Electronically Filed

Rye Development

100 S. Olive Street, West Palm Beach, FL 33401

October 21, 2022

VIA E-FILING

Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Subject: Lewis Ridge Pumped Storage, LLC
Lewis Ridge Pumped Storage Project, FERC Project No. 15249
Notice of Intent, Pre-Application Document, and Request to Use Traditional Licensing Process for the Lewis Ridge Pumped Storage Project

Dear Secretary Bose:

Lewis Ridge Pumped Storage, LLC (LRPS), in accordance with the requirements of 18 Code of Federal Regulation (CFR) Section 5, herein electronically files with the Federal Energy Regulatory Commission (Commission or FERC) the Notice of Intent (NOI) and Pre-Application Document (PAD) for the licensing of the Lewis Ridge Pumped Storage Project (Project) (FERC No. 15249). The preliminary permit, issued by the Commission to Lewis Ridge Pumped Storage, LLC on March 3, 2022 (effective March 1, 2022), will expire either 48 months from the effective date (March 1, 2026) or on the date that a development application submitted by the Lewis Ridge Pumped Storage, LLC has been accepted for filing, whichever occurs first.

The unconstructed Project is located in the Upper Cumberland River Basin in Bell County, Kentucky near the borders of Tennessee and Virginia. The Project would be a closed loop pumped storage hydroelectric generating facility located at a site historically used for mining. The Project is anticipated to provide 287 megawatts (MW) of generation capacity.

Pursuant to 18 CFR §4.38, §5.5(c), and §5.6(a), the NOI and PAD are being distributed electronically to the relevant resource agencies, Native American tribes, non-governmental organizations, and other potential interested parties included on the attached distribution list.

LRPS requests Commission approval to use the Traditional Licensing Process (TLP) for the relicensing of the Project (Attachment A). As provided in 18 CFR §5.3(d)(1), we note that comments on the request to use the TLP must be filed with the Commission within 30 days of this letter. Pursuant to 18 CFR §5.3(d)(2), LRPS has published notice of the request to use the TLP in a daily newspaper of general circulation in the one county in which the Project is located (Bell County, Kentucky); the notice contains the information required by that section.

In accordance with 18 CFR §5.5(e), Section 7 of the Endangered Species Act and the joint agency regulations at 50 CFR part 402, Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act, and the implementing regulations at 50 CFR 600.920, LRPS hereby requests to be designated as the Commission's non-federal representative for the purposes of consultation under Section 7 of the Endangered Species Act. LRPS requests authorization to initiate consultation under Section 106 of the National Historic Preservation Act and to implement regulations at 36 CFR Section 8000.2(c)(4).

Should the Commission approve the use of the TLP, LRPS proposes to host a joint agency and public meeting (JAM) of the Project in accordance with 18 CFR §4.38 no earlier than 30 days, but no later than 60 days, from the Commission's TLP approval.

Currently, LRPS proposes to hold the JAM in Pineville, Kentucky on January 25, 2023. The date and location of the meeting may be altered after consultation with jurisdictional agencies and other licensing participants and pending FERC's decision regarding the LRPS request to use the TLP. If FERC requires that LRPS use the Integrated Licensing Process (ILP), then FERC will hold a scoping meeting in accordance with the regulations at CFR §5.8.

Please direct any questions pertaining to the Project or process to Sandy Slayton by phone at (206) 919-3976 or email at sandy@ryedevelopment.com.

Sincerely,

Erik Steimle
Vice President
Lewis Ridge Pumped Storage, LLC

Attachments: Distribution List
Request for Use of Traditional Licensing Process
Notice of Intent
Pre-Application Document

Lewis Ridge Pumped Storage Project (P-15249)

Distribution List

Elected Officials

Office of Senator Mitch McConnell
Lexington Office
771 Corporate Drive, Suite 108
Lexington, Kentucky 40503

Office of Senator Rand Paul
Lexington Office
771 Corporate Drive, Suite 105
Lexington, Kentucky 40503

Office of Representative Harold "Hal" Rogers
Somerset Office
551 Clifty Street
Somerset, Kentucky 42503

Johnnie Turner
Kentucky State Senator (29^{th} District)
P.O. Box 351
Harlan, Kentucky 40831

Adam Bowling
Kentucky House of Representatives (87^{th} District)
P.O. Box 2928
Middlesboro, Kentucky 40965

Federal Agencies

Director
Bureau of Indian Affairs
U.S. Department of the Interior
MS - 4606
1849 C Street NW
Washington, DC 20240

Kim Amendola
Deputy Regional Administrator
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-01930

Commanding Officer
United States Coast Guard
95 Peyton Street
Barboursville, West Virginia 25504

Mso Paducah
United States Coast Guard
225 Tully Street
Paducah, Kentucky 42003-0170

Hydropower Coordinator
U.S. Army Corps of Engineers
Nashville District
110 9^{th} Ave S
Nashville, Tennessee 37203

U.S. Army Corps of Engineers
Eastern Regulatory Division
Nashville District
501 Adesa Parkway, Suite B 250
Lenoir City, Tennessee 37771

U.S. Department of Energy
P.O. Box 10940
Pittsburgh, Pennsylvania 15236-0940

Andrew L. Raddant
Regional Environmental Officer
U.S. Department of the Interior
Office of Environmental Policy and Compliance
15th State Street, 8th Floor
Boston, Massachusetts 02109

Daniel Blackman
Regional Administrator
U.S. Environmental Protection Agency
Region IV
61 Forysth Street, S.W.
Atlanta, Georgia 30303

Leopoldo "Leo" Miranda-Castro
Regional Director, Southeast Region
U.S. Fish and Wildlife Service
Ecological Services
1875 Century Boulevard
Atlanta, Georgia 30345

John Faustini
Regional Hydrologist and FERC Hydropower Coordinator, Southeast Region
U.S. Fish and Wildlife Service
Ecological Services
1875 Century Boulevard
Atlanta, Georgia 30345

Lee Andrews
Field Supervisor
U.S. Fish and Wildlife Service
Kentucky Field Office
Interior Region 2 - South Atlantic-Gulf
330 West Broadway, Room 265
Frankfort, Kentucky 40601

Jeff Duncan
Regional Hydropower Coordinator
U.S. National Park Service
Southeast Region
1924 Building
100 Alabama Street SW
Atlanta, Georgia 30303

Tribes

Tim "Healing Spirit" Jordan
Chief
Southern Cherokee Nation of Kentucky
P.O. Box 1750
Henderson, Kentucky 42419

Richard Sneed
Principal Chief
Eastern Band of Cherokee Indians
Qualla Boundary
P.O. Box 455
Cherokee, North Carolina 28719

Craig Harper
Chief
Peoria Tribe of Indians of Oklahoma
118 South Eight Tribes Trail
Miami, Oklahoma 74355

Deborah Dotson
President
Delaware Nation
P.O. Box 825
Anadarko, Oklahoma 73005

Douglas Lankford
Chief
Miami Tribe of Oklahoma
P.O. Box 1326
Miami, Oklahoma 74355-1326

State Agencies

Director
Kentucky Department for Environmental Protection
300 Fair Oaks Lane
Frankfort, Kentucky 40601

Robert Miller
Kentucky Department for Environmental Protection
Division of Water
London Regional Office
875 S Main Street
London, Kentucky 40741

Gordon R. Stone
Commissioner
Kentucky Department for Natural Resources
300 Sower Boulevard, 2nd Floor
Frankfort, Kentucky 40601

Lonis Morgan, Environmental Control Manager
Kentucky Division of Mine Reclamation and Enforcement
1804 E Cumberland Avenue
Middlesboro, Kentucky 40965

Matthew Catron
Regional Biologist
Kentucky Department of Fish & Wildlife Resources
#1 Sportsman's Lane
Frankfort, Kentucky 40601

Kentucky Department of Fish & Wildlife Resources
Arnold Mitchell Building
#1 Game Farm Road
Frankfort, Kentucky 40601

Craig Potts
Executive Director and State Historic Preservation Officer
Kentucky Heritage Council
The Barstow House
410 High Street
Frankfort, Kentucky 40601

Kentucky Tourism, Arts, and Heritage Cabinet
500 Mero Street, Fifth Floor
Frankfort, Kentucky 40601

Kenya Stump
Executive Director
Kentucky Office of Energy Policy
300 Sower Boulevard
Frankfort, Kentucky 40601

Kentucky Chamber of Commerce
464 Chenault Road
Frankfort, Kentucky 40601

Kentucky Coal & Marketing & Export Council
Cabinet for Economic Development
300 West Broadway
Frankfort, Kentucky 40601

Kentucky Public Service Commission
211 Sower Boulevard
P.O. Box 615
Frankfort, Kentucky 40602

Patrick Morrisey
Attorney General
West Virginia Office of Attorney General
Building 1, Room E-26
State Capitol Complex
1900 Kanawha Boulevard E
Charleston, West Virginia 25305

Daniel Cameron
Attorney General
Office of the Attorney General
700 Capital Avenue, Suite 118
Frankfort, Kentucky 40601-3449

Local Governments

Debbie Gambrel
County Clerk
Bell County
101 Courthouse Square
P.O. Box 157
Pineville, Kentucky 40977

Sandra Wilson
City Clerk
City of Middlesboro City Hall
221 N. 21st Street
Middlesboro, Kentucky 40965

Albey Brock
Bell County Judge Executive
101 Courthouse Square
P.O. Box 339
Pineville, Kentucky 40977

Non-Governmental Organizations

Ashley Wilmes
Director
Kentucky Resource Council
P.O. Box 1070
Frankfort, Kentucky 40602

Tom Fitzgerald
Kentucky Resource Council
P.O. Box 1070
Frankfort, Kentucky 40602

Licensee

Sandy Slayton
Vice President
Lewis Ridge Pumped Storage, LLC
830 NE Holladay Street
Portland, Oregon 97232

Erik Steimle
Vice President
Rye Development
100 S. Olive Street
West Palm Beach, Florida 33401

Lesley Brotkowski
Senior Licensing Coordinator
Kleinschmidt Associates
233403 Stettin Ridge Court
Wausau, Wisconsin 54401

Lewis Ridge Pumped Storage Project
FERC Project No. 15249

Request to Use the Traditional Licensing Process

Lewis Ridge Pumped Storage, LLC (LRPS, Permittee, or potential applicant) is including in this filing to use the Federal Energy Regulatory Commission's (FERC or Commission) Traditional Licensing Process (TLP) for the licensing of the Lewis Ridge Pumped Storage Project (Project). The following sections outline how use of the TLP will: a) comply with the criteria outlined in 18 CFR Section 5.3 (C)(1)(ii)(A-F); b) benefit the participants to the process, and c) provide FERC with the information it needs to complete its licensing obligations. Any comments on this request to use the TLP must be filed with the Commission within 30 days of the filing date of this request with FERC, or by November 20, 2022.

A. Likelihood of Timely License Issuance [18 CFR § 5.3(c)(1)(ii)(A)]

Through use of the TLP, LRPS anticipates the timely issuance of an original license for the Project. The TLP will provide agencies and stakeholder with manageable timeframes while also allowing flexibility in scheduling and a collaborative process. Section 2.0 of the Pre-Application Document (PAD) outlines a Process Plan and Schedule following the TLP which, if approved, will ultimately assist the Commission in achieving its goal of issuing a timely license for this Project.

B. Complexity of the Resource Issues [18 CFR § 5.3(c)(1)(ii)(B)]

LRPS does not anticipate complex resource issues at the Project that would require use of the FERC's Integrated Licensing Process (ILP). LRPS has developed a preliminary listing of resource issues and informational needs in Section 6.0 of the PAD. LRPS believes that additional remaining resource issues will be identified through the Joint Agency and Public Meeting anticipated to be held on January 25, 2023, and subsequent site visit and consultation activities. It is LRPS' belief that the resource issues at the Project are relatively simple, as compared to other Projects of this size, and can be adequately addressed, studied, and/or mitigated.

The unconstructed Project is located in Bell County, Kentucky on private land. No federal or tribal lands are in the preliminary Project Boundary. With the exception of the interconnection line, which runs along existing roads, the Project is located in an area historically used for mining. The land on which the Project features are to be located has been previously disturbed for the mining operations or roads. LRPS believes that the Project location is advantageous in utilizing previously disturbed area to minimize resource impacts. The Project will be closed loop, which further limits scope of operational impacts to resource issues due to not having an ongoing hydrologic connection to a natural body of water for the purpose of water storage.

LRPS is committed to public health and safety and will take all necessary steps to ensure that this Project is engineered and designed to ensure a stable, lasting, and safe Project. LRPS will confirm site stability throughout the design phase of the Project, in geotechnical evaluations, engineering, and Project design. The Project engineering and design process as it pertains to site feasibility does not involve complex coordination of resource agencies or stakeholders that would lend itself to requiring the use of the ILP.

C. Level of Anticipated Controversy [18 CFR § 5.3(c)(1)(ii)(C)]

LRPS expects limited controversy associated with the licensing of the Project. LRPS has initiated consultation with resource agencies and stakeholders, as further described in Appendix A of the PAD. LRPS has also evaluated readily available information on the existing environment surrounding the Project and identified where additional information is needed, as detailed in Sections 5.0 and 6.0 of the PAD. Based on the discussions during initial outreach, the limited responses to initial consultation, and the anticipated low complexity of issues identified to date, it is not anticipated at the Project will result in controversy that cannot be resolved within the TLP. Use of the TLP will enable LRPS to reach agreement with the resource agencies and stakeholders on protection, mitigation, & enhancement measures for the Project, as may be determined necessary.

D. Relative Cost of the Traditional Licensing Process Compared to the Integrated Licensing Process [18 CFR § 5.3(c)(1)(ii)(D)]

LRPS fully expects that for all participants of this licensing, the TLP would be more economical than the ILP. The use of the TLP would allow for the potential of a shorter period of pre-application activity, minimize the preparation of formal documents and filings, and further reduce reviews associated with such filings, which would all have the potential to benefit all participants, including resource agencies and stakeholders.

The TLP is also likely to be more efficient for the agencies and stakeholders expected to participate. The timelines and more flexible nature of the TLP will provide the stakeholders and LRPS more options to schedule meetings and develop pre-filing documentation. This flexibility will better allow for the licensing parties to perform such activities in coordination with other ongoing relicensing and routine activities. This schedule will help reduce the overall cost of the licensing effort for LRPS, and the licensing participants.

E. The Amount of Available Information and Potential for Significant Disputes Over Studies [18 CFR § 5.3(c)(1)(ii)(E)]

As presented in the attached PAD, baseline information exists for environmental resources at the Project. To address information gaps, LRPS will work with the resource agencies and stakeholders on needed data collection efforts to address potential resource concerns associated with the Project. LRPS does not anticipate any significant resource concerns or disputes over studies. LRPS has initiated pre-PAD consultation with the agencies and stakeholders, offering to meet with those interested in learning more about the Project and FERC licensing process. Meetings have been held with the U.S. Fish and Wildlife Service, Kentucky Cabinet for Economic Development, and Kentucky Resources Council. This early consultation has allowed LRPS to identify areas where additional resource information is needed to characterize the existing environment and evaluate potential Project effects. LRPS has identified several studies that will be conducted. Through the Joint Agency and Public Meeting and subsequent site visit and consultation activities, LRPS anticipates that remaining information needs or resource issues will be identified. LRPS plans to work with the interested parties during the development of the study plans to allow for collaborative study plan development. The success of these early efforts in advancing study plan development diminishes the potential for significant disputes over studies. Should a significant dispute arise, LRPS would initiate FERC's dispute resolution process outlined in 18CFR §4.38(b)(6)(i).

F. Other Pertinent Factors [18 CFR § 5.3(c)(1)(ii)(F)]

LRPS plans to collaboratively work with the agencies and stakeholders to develop appropriate study scopes to analyze identified issues. The Applicant is committed to conducting necessary studies to effectively evaluate the issues and anticipates no significant disputes over studies. LRPS believes that the TLP is the most efficient, effective, least burdensome, and most appropriate means to obtain an original license for the Project. For all of the foregoing reasons, LRPS respectfully requests that the Commission grant this request and authorize the LRPS to use the TLP for the licensing of the Project.

As required by 18 CFR § 5.3(d)(1), LRPS is concurrently providing copies of this request to all affected resource agencies, Native American tribes, and potentially interested parties. As required by 18 CFR § 5.3(d)(2), the LRPS is publishing notice of this request simultaneously with the publication of notice of availability of the NOI and PAD in Middlesboro Daily News, a newspaper of general circulation in Bell County, Kentucky.

By this notice, the LRPS is notifying the resource agencies, Native American tribes, and potentially interested parties that comments on this application must be provided to the Commission and the LRPS no later than 30 days following the filing date of this document. All comments should reference **Project No. 15249-000 — Lewis Ridge Pumped Storage Project**, and they should address, as appropriate to the circumstances of the request, the following topics:

- Likelihood of timely license issuance;
- Complexity of the resource issues;

- Level of anticipated controversy;
- Relative cost of the TLP compared to the ILP;
- The amount of available information and potential for significant disputes overstudies; and
- Other factors believed by the commenter to be pertinent.

United States of America
Federal Energy Regulatory Commission

Lewis Ridge Pumped Storage, LLC Project No. 15249

Notice of Intent of Lewis Ridge Pumped Storage, LLC to
File an Application for an Original License for the
Lewis Ridge Pumped Storage Project (FERC P-15249)

Pursuant to 18 C.F.R. Section 5.5 of the Federal Energy Regulatory Commission's (Commission or FERC) regulations, Lewis Ridge Pumped Storage, LLC (Permittee, potential applicant, or LRPS) hereby gives notice and declares its intent to apply for an original license for the proposed Lewis Ridge Pumped Storage Project (FERC P-15249) (Project).

Simultaneously, the Permittee is filing its Pre-Application Document (PAD) with the Commission and proposes to conduct pre-filing activities utilizing the Traditional License Process (TLP).

1. The potential applicant's name and address:

Lewis Ridge Pumped Storage, LLC
100 S. Olive Street
West Palm Beach, FL 33401

The Permittee requests that all correspondence and service of documents related to this notification and subsequent proceedings be addressed to:

Sandy Slayton
Vice President
Lewis Ridge Pumped Storage, LLC
830 NE Holladay Steet
Portland, OR 97232
Phone: (206) 919-3976
Email: sandy@ryedevelopment.com

2. Project number:

P-15249

3. The license expiration date, if any:

Not applicable. The Project does not possess a FERC license and involves the construction of new facilities.

4. An unequivocal statement of the potential applicant's intention to file an application for an original license:

Lewis Ridge Pumped Storage, LLC unequivocally declares its intent to file an application for an original license for the Lewis Ridge Pumped Storage Project, P-15249.

5. The type of principal project works licensed, if any, such as dam and reservoir, powerhouse or transmission lines:

This is a Notice of Intent (NOI) for an unconstructed project.

Preliminary Project Description:

As proposed, the Project would consist of the following: (1) a 5,450-foot-long, 135-foot-high roller compacted concrete dam for the upper reservoir with an integrated overflow spillway; (2) an upper reservoir with a surface area of 24 acres and a storage capacity of 2,300 acre-feet; (3) a 3,850-foot-long steel penstock with the upper section likely being 16 feet in diameter and the lower extent bifurcating into two 12 foot diameter steel sections; (4) a steel surge tower or set of energy-dissipating pressure relief valves; (5) a 420-foot-long, 80-foot-wide powerhouse containing two 143.5-megawatt (MW) reversible pump-turbines with a total installed capacity of 287 MW; (6) a 830-foot-long, 80-foot-high roller compacted concrete dam at the lower reservoir with an integrated overflow spillway (7) a 47 acre lower reservoir with a storage capacity of 2,300 acre-feet; and (8) a 2.3-mile-long, 161 kilovolt overhead transmission line. The proposed Project would have an estimated annual generation of 671,700 megawatt-hours (Mwh) and a daily energy storage of 2,165 Mwh. The proposed Project would have a storage time of 8 hours at full discharge capacity.

6. The location of the project by state, county, and stream, and, when appropriate, by city or nearby city:

State: Kentucky
County: Bell
Stream or body of water: To be determined[1]
Nearby cities or towns: Blackmont, Tejay, Balkan, and Callaway

[1] The preliminary Project design is a closed loop pumped storage project, with recharge water from Tom Fork, a tributary of the Cumberland River located at the Lower Reservoir site. As described in detail in Section 4 of the PAD, the source for the initial fill of water at the Project has not yet been determined.

7. The installed plant capacity:

The proposed installed generation capacity is 287 megawatts (MW).

8. The names and mailing address of:

a. Every county in which any part of the project is located, and in which any Federal facility that is used or to be used by the project is located:

County Clerk
Bell County, Kentucky
101 Courthouse Square
P.O. Box 157
Pineville, Kentucky 40977

b. Every city, town, or similar political subdivision in which any part of the project is or is to be located and any Federal facility that is or is to be used by the project is located:

The proposed Project is located near the unincorporated communities of Blackmont, Tejay, Balkan, and Callaway, Kentucky, which fall under the jurisdiction of the Bell County.

Every city, town, or similar political subdivision that has a population of 5,000 or more people and is located within 15 miles of the proposed project:

City of Middlesboro
City Hall
221 N. 21st Street
Middlesboro, Kentucky 40965

c. Every irrigation district, drainage district, or similar special purpose political subdivision (A) In which any part of the project is or is proposed to be located and any Federal facility that is or is proposed to be used by the project is located; or (B) That owns, operates, maintains, or uses any project facility or any Federal facility that is or is proposed to be used by the project:

There is no irrigation district, drainage district, or similar special purpose political subdivision in which any part of the Project is located or that owns, operates, maintains, or uses any Project facility.

The Project uses no Federal facilities and occupies no Federal lands.

d. Every other political subdivision in the general area of the Project or proposed Project that there is reason to believe would be likely to be interested in, or affected by, the notification:

There are no other political districts or subdivisions that are likely to be interested in or affected by the notification.

e. Affected Native American Tribes:

The Permittee is not aware that the proposed Project affects any Native American tribe. The following is a listing of Native American tribes that may have some level of interest in the area surrounding the Project and have been included on the Project licensing Distribution List:

Southern Cherokee Nation of Kentucky
P.O. Box 1750
Henderson, Kentucky 42419

Eastern Band of Cherokee Indians
Qualla Boundary
P.O. Box 455
Cherokee, North Carolina 28719

Peoria Tribe of Indians of Oklahoma
118 South Eight Tribes Trail
Miami, Oklahoma 74355

Delaware Nation
P.O. Box 825
Anadarko, Oklahoma 73005

Miami Tribe of Oklahoma
P.O. Box 1326
Miami, Oklahoma 74355-1326

PRE-APPLICATION DOCUMENT

LEWIS RIDGE PUMPED STORAGE PROJECT
FERC NO. 15249

Prepared for:
Lewis Ridge Pumped Storage, LLC

Prepared by:
Kleinschmidt Associates

October 2022

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

DEFINITIONS OF TERMS, ACRONYMS, AND ABBREVIATIONS

°C	degrees Celsius
CEII	Critical Energy Infrastructure Information
CFR	Code of Federal Regulations
cfs	cubic feet per second
CFU	colony-forming unit
cm	centimeter
CPUE	catch per unit effort
Commission	Federal Energy Regulatory Commission
DLA	Draft License Application
DO	dissolved oxygen
DOI	U.S. Department of Interior
EFH	Essential Fish Habitat
EJ	Environmental justice
EJScreen	Environmental Justice Screening and Mapping Tool
EL	Elevation
ESA	Endangered Species Act
°F	Fahrenheit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
FOIA	Freedom of Information Act
FPA	Federal Power Act
Installed Capacity	The nameplate MW rating of a generator or group of generators
Interested Parties	The broad group of individuals and entities that have an interest in a proceeding
IPaC	Information, Planning, and Conservation
Kentucky DFWR	Kentucky Department of Fish and Wildlife Resources
L	liter
LRPS	Lewis Ridge Pumped Storage, LLC
MBI	Macroinvertebrate Bioassessment Index
mg	milligrams
mg/L	milligrams per liter
mi^2	square-miles
ml	milliliter
MLRA	Major Land Resource Area
msl	mean sea level

MW	megawatt
MWh	megawatt hours
NCLD	National Land Cover Database
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act
NGO	Non-governmental organization
NPS	National Park Service
NOI	Notice of Intent
NWI	National Wetlands Inventory
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Units
OKNP	Office of Kentucky Nature Preserves
PAD	Pre-Application Document
PDF	Portable Document Format
Permittee	Lewis Ridge Pumped Storage, LLC
Potential applicant	Lewis Ridge Pumped Storage, LLC
Project	Lewis Ridge Pumped Storage Project P-15249
Project Vicinity	The general geographic area in which the proposed Project would be located, as indicated on the Project Vicinity figures
RCC	Roller Compacted Concrete
RM	river mile
RTE	rare, threatened, and endangered species
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SHPO	State Historic Preservation Office
TBD	To be determined
TLP	Traditional Licensing Process
TMDL	total maximum daily load
TNS	terrestrial nuisance species
µS	microsiemens
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1.0 INTRODUCTION

Lewis Ridge Pumped Storage, LLC (Permittee, potential applicant, or LRPS) is filing with the Federal Energy Regulatory Commission (FERC or Commission) its Notification of Intent (NOI) to file an application for an original license and the Pre-Application Document (PAD) for the unconstructed Lewis Ridge Pumped Storage Project (FERC No. 15249) (Project). LRPS received a Preliminary Permit for the Project from the FERC on March 3, 2022. The Project would be located in Bell County, Kentucky near the communities of Blackmont, Tejay, Balkan, and Callaway (Figure 1-1). The Project would be a closed loop pumped storage hydroelectric generating facility located at a site historically used for mining. The Project is anticipated to provide 287 megawatts (MW) of generation capacity.

The Permittee provides this PAD as required by Title 18 § 5.6 of the U.S. Code of Federal Regulations (CFR). This PAD accompanies the Permittee's NOI to seek an original license for the Project. The Permittee distributed this PAD and NOI simultaneously to federal and state resource agencies, local governments, Native American tribes, members of the public, and others identified as potentially interested in the licensing proceeding, as listed in the Distribution List. This PAD includes existing, relevant, and reasonably available information related to the Project. The information presented in this PAD provides participants in this licensing the information necessary to identify issues and related information needs.

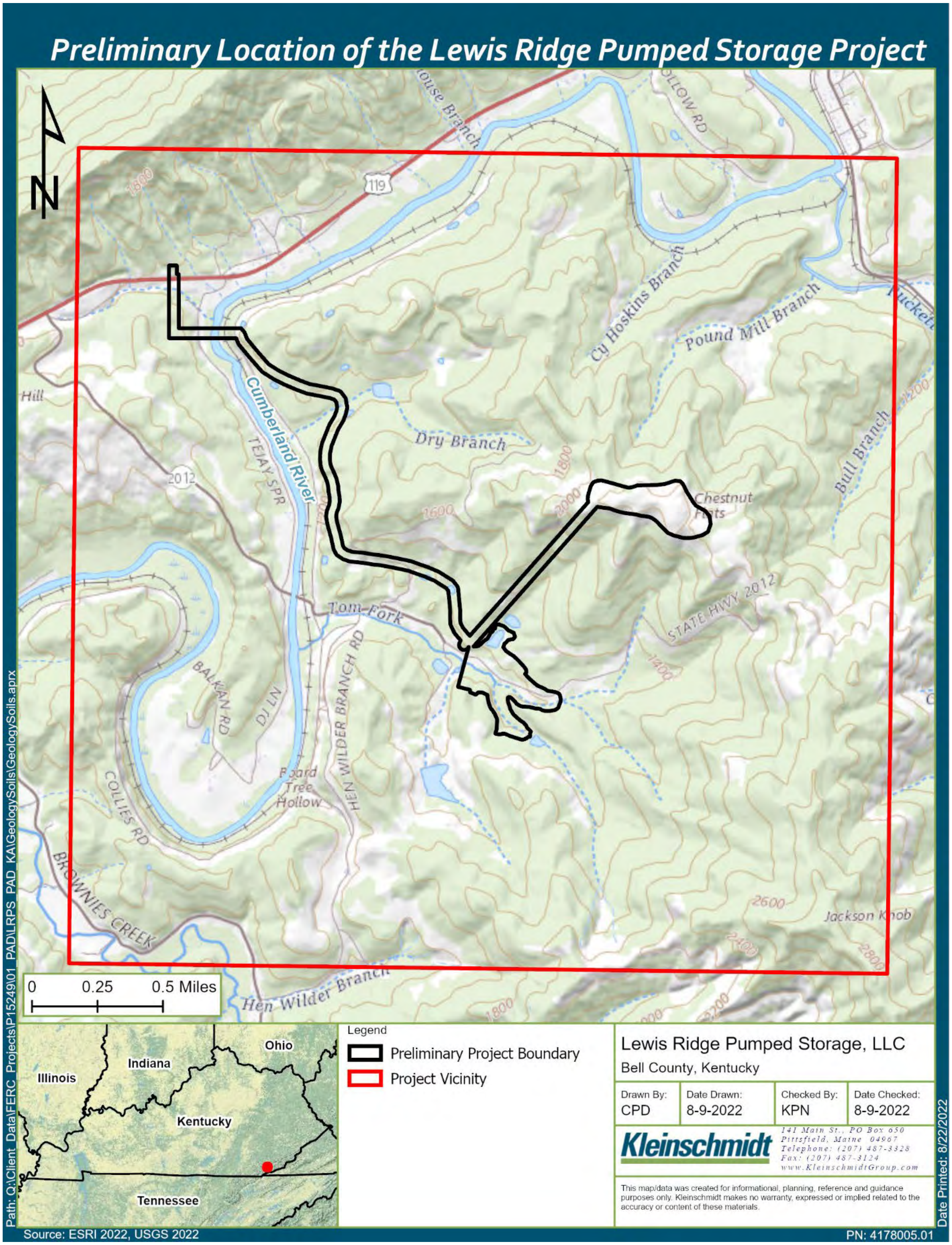


Figure 1-1: Preliminary Location of the Lewis Ridge Pumped Storage Project

1.1 Authorized Agents

The following person is authorized to act as agent for the Permittee pursuant to 18 CFR § 5.6(d)(2)(i):

Sandy Slayton
Vice President
Lewis Ridge Pumped Storage, LLC
830 NE Holladay Street
Portland, Oregon 97232
Phone: (206) 919-3976
Email: sandy@ryedevelopment.com

1.2 PAD Content

This PAD follows the content and form requirements of 18 CFR § 5.6 (c) and (d), with minor changes in form for enhanced readability. This PAD is organized into two volumes. Volume I contains the public information required by 18 CFR § 5.6 (c) and (d) for distribution to Federal and state resource agencies, local governments, Native American Tribes, members of the public, and others likely to be interested in the relicensing proceeding. Volume 2 contains drawings of Project works that meet the definition of Critical Energy Infrastructure Information (CEII) pursuant to FERC's June 23, 2003 Order No. 630-A. Consistent with that order, the Licensee is distributing Volume II only to FERC.

Volume I (Public) of the PAD is organized as follows:

- Table of Contents; List of Tables; List of Figures; List of Appendices; and Definitions of Terms, Acronyms, and Abbreviations.
- Section 1.0 – Introduction
- Section 2.0 – Process Plan and Schedule, Communications Protocol, and Traditional Licensing Process (TLP) Flow Chart, per 18 CFR § 5.6(d)(1).
- Section 3.0 – General Description of the River Basin, per 18 CFR § 5.6(d)(3)(xiii).
- Section 4.0 – Description of Preliminary Project Location, Facilities, and Operation, per 18 CFR § 5.6(d)(2).
- Section 5.0 – Description of the Existing Environment by Resource Area, per 18 CFR § 5.6(d)(3)(ii-xii).
- Section 6.0 – Preliminary Listing of Potential Issues, Informational Needs, and Mitigation by Resource, per 18 CFR § 5.6(d)(4)(i-ii).
- Section 7.0 – Relevant Resource Management Plans, per 18 CFR § 5.6(d)(4)(iii-iv).

- Appendices:
  - Appendix A – Summary of Contacts and Correspondence Made in Preparing the PAD 18 CFR § 5.6 (d)(5)
  - Appendix B – Geologic Maps
  - Appendix C – Mining Map
  - Appendix D – USDA NRCS Physical Soil Properties of Bell and Harlan Counties, Kentucky
  - Appendix E – Rare Species Information
  - Appendix F – EJScreen Reports (Version 2.0) for Census Tract 9604, Block Groups 1 and 2

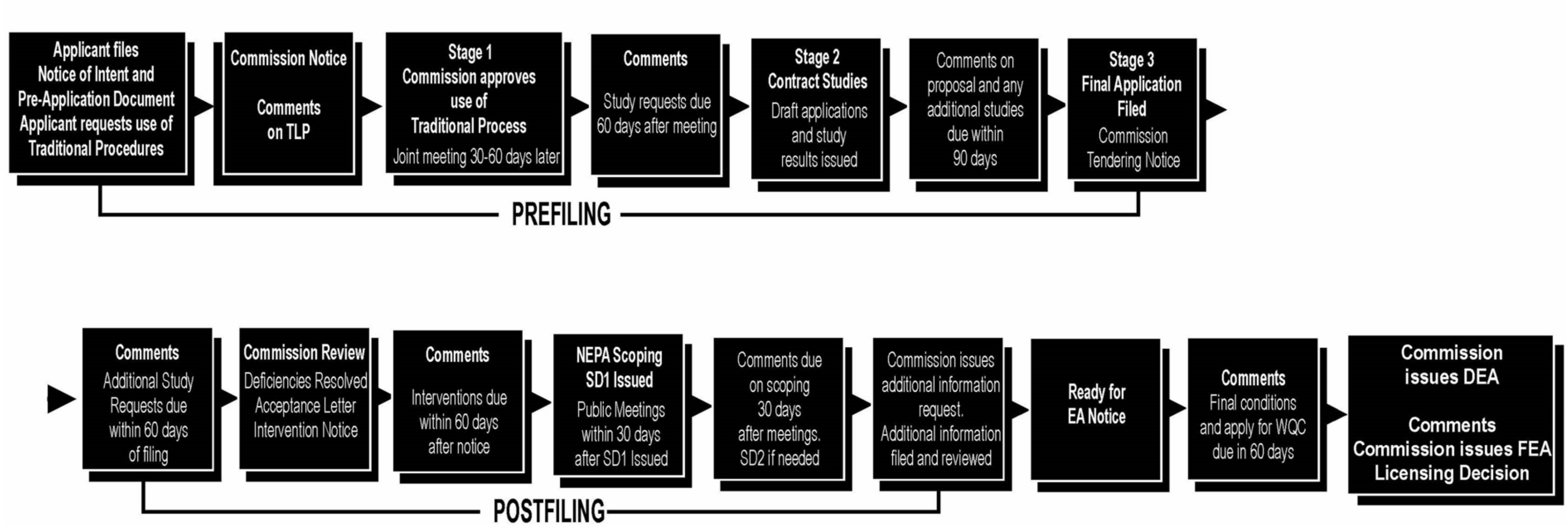
Volume II (CEII) of the PAD is organized as follows:

- Single-line Diagram for the Project

2.0 PLANS, SCHEDULE, AND PROTOCOLS

18 CFR 5.6(d)(1) requires "The pre-application document must include a plan and schedule for all pre-application activity that incorporates the time frames for pre-filing consultation, information gathering, and studies set forth in this part. The plan and schedule must include a proposed location and date for the scoping meeting and site visit required by §5.8(b)(3)(viii)."

Pursuant to 18 CFR § 5.3(b) and (c), the Permittee is requesting FERC's approval to use the Traditional Licensing Process (TLP) for the Project. The Permittee is submitting this request to FERC concurrently with the submittal of the NOI and PAD. Under the TLP, the three-stage pre-filing consultation process described in 18 CFR § 4.38 would be completed and documented. The first stage includes coordination between the Permittee, resource agencies, affected Native American tribes, stakeholders, and the public and includes initial information gathering, notification of interested parties, and study planning and implementation. The second stage involves study implementation and additional data gathering as well as development of a Draft License Application (DLA) and review of the DLA by resource agencies and optionally, FERC. The third stage commences with the filing the Final License Application (FLA), whereby FERC initiates its own review and public comment process, ultimately issuing a license for the Project. Figure 2-1 depicts the regulatory milestones of the TLP.



Source: FERC 2004

Figure 2-1: FERC Traditional Licensing Process Chart

2.1 Process Plan and Schedule through Filling of License Application

Table 2-1 provides the Process Plan and Schedule for the Project, which outlines actions by FERC, LRPS, and other participants in the licensing process through filing of the FLA. This Process Plan and Schedule for the Project assumes FERC approval of the TLP and is based upon the NOI/PAD filing date of October 21, 2022 and all subsequent dates are derived from the NOI/PAD filing date. The Process Plan and Schedule is subject to change throughout the licensing process; however, regulatory timeframes in 18 CFR Part 16 will be respected.

Table 2-1: Pre-Filing Process Plan and Schedule

Responsible Party	Pre-Filing Milestone	Tentative Date	Regulatory Reference
First Stage Consultation			
LRPS	File NOI/PAD with FERC	10/21/2022	18 CFR § 5.5, 5.6
LRPS	Submit TLP request	10/21/2022	18 CFR § 5.5, 5.3(d)(1)
LRPS	Publish notice of NOI/PAD and TLP request in daily or weekly newspaper	10/21/2022	18 CFR § 5.3(d)(2)
LRPS	Request FERC name licensee as non-federal representative for consultation regarding ER and Section 106 (formally allows licensee to consult with U.S. Fish and Wildlife Service [USFWS], Native American tribes, and State Historic Preservation Officer (SHPO)	10/21/2022	18 CFR § 5.5(e); Federal Endangered Species Act (ESA): 50 CFR; National Historic Preservation Act (NHPA): 36 CFR § 800.2
Participants	Comments on the request to use TLP due to FERC	11/21/2022 (30 days after TLP request submittal)	18 CFR § 5.3
FERC	Notice of Commencement of Proceeding and action on use of TLP	12/20/2022 (Within 60 days of PAD/NOI filing)	18 CFR § 5.8
LRPS	Notify FERC, public of Joint Meeting and Site Visit	15 days before scheduled Joint Meeting	18 CFR § 4.38(b)(3)(ii)
LRPS	Publish notice of Joint Meeting and Site Visit	14 days before Joint Meeting	18 CFR § 4.38(g)
LRPS. Public meeting at which all Participants are invited to attend.	Hold Joint Meeting and Site Visit for consultation with agencies, Native American tribes, and public. Location to be in Pineville, KY. Location and date indicated are tentative.	1/25/2023 (30 to 60 days from FERC approval to use TLP)	18 CFR § 4.38(b)
LRPS	File copy of Joint Meeting record with FERC. Provide to any resource agency, Native American tribe, or member of the public upon request.	Promptly following the Joint Meeting, as available.	18 CFR § 4.38(b)
Participants	Interested resource agencies, Native American tribes and members of the public provide written comments/study requests	No later than 60 days after the Joint Meeting. (A 60-day extension may be requested)	18 CFR § 4.38(b)

Responsible Party	Pre-Filing Milestone	Tentative Date	Regulatory Reference
Second Stage Consultation			
LRPS	Complete studies	Year 1 studies: 2022 Year 2 studies: 2023	18 CFR § 4.38(c)
LRPS	Distribute DLA to resource agencies, Native American tribes and interested parties with written request for review and comment	To be determined. At least 6 months prior to filing the FLA.	18 CFR § 4.38(c)
Participants	Comments on DLA	90-day comment period	18 CFR § 4.38(c)(5), 16.8(c)(5)
LRPS	If written comments show a substantive disagreement with conclusions on resource impacts, proposed protection or enhancement measures the licensee must hold a Joint Meeting with disagreeing party	Within 60 days of receiving comments 15-day notice of meeting to FERC	18 CFR § 4.38(c)(6)
Third Stage Consultation			
LRPS	File FLA with FERC	To be determined. Prior to preliminary permit expiration on 3/03/2026.	18 CFR § 5.17, 4.38(d)

2.2 Proposed Communications Protocols

Effective communication is essential for meeting the TLP consultation requirements. The Permittee anticipates that the means of communication will be email, meetings, documents, and telephone. The licensing process for the Project is open to the general public and interested individuals and organizations are encouraged to participate. FERC provides additional information on participation at https://www.ferc.gov/industries-data/resources/how-get-involved. Additional information on the proposed communication protocols, as well as information on how to be added to the Permittee's Project Distribution List is provided below.

2.2.1 Parties to the Licensing

In general, there are two categories of participation in a FERC licensing – Interested Parties and Licensing Participants. Interested Parties are a broad group of individuals, agencies, and non-governmental organizations (NGO) that have an interest in the licensing. Sometimes this group is referred to as "stakeholders." Licensing Participants are a subset of Interested Parties. Licensing Participants are the individuals and entities that actively participate in the licensing process. Any Interested Party may elect to be a Licensing Participant. Licensing Participants generally have a specific interest in the licensing and may receive communications related to their specific interest.

2.2.2 General Communications

The Permittee's goal is to keep open communications during the licensing process and provide all Interested Parties with easy access to licensing information. The Permittee will use electronic communications, such as email, as a primary means of providing information during the licensing process. Communications include written correspondence, emails, and notes from individual and conference telephone calls.

2.2.3 Meetings

The Permittee recognizes a number of Native American tribes, agencies, groups, and individuals may want to participate in the licensing process. The Permittee will work with Licensing Participants to develop meeting schedules that include practical locations and times to accommodate the majority of participants. In general, the Permittee will schedule meetings between the hours of 9:00 a.m. and 3:00 p.m. Meetings may be in-person or by conference call. The Permittee will endeavor to begin and end meetings in a timely manner.

To the extent possible, the Permittee will notify Licensing Participants at least two weeks in advance of the next planned public meeting. At that time, the Permittee will provide a meeting agenda via email and/or by mail. The Permittee will also distribute any documents or other information that will be the subject of meeting discussions.

2.2.4 Documents

The Permittee will maintain copies of all public information including Distribution Lists, announcements, notices, communications, and other documents related to the licensing of the Project. Information may be obtained by contacting LRPS at info@lewisridgeproject.com. Key documents will also be available on the Project website: www.lewisridgeproject.com. The Permittee prefers to receive all documents electronically in either portable document format (PDF) or an appropriate MS Office format. Email electronic documents to LRPS at the following email address: info@lewisridgeproject.com. Hard copy documents may be mailed to Rye Development, Lewis Ridge Project, 830 NE Holladay Street, Portland, Oregon 97232.

All applicable documents received will be incorporated into the consultation record for the licensing and made available for distribution to the public.

Documents submitted to and issued by the FERC for the Project are available through FERC's eLibrary under Docket P-15249 (https://www.ferc.gov/ferc-online/elibrary). In addition, all materials filed with or issued by FERC will be available for review and copying at the FERC offices in Washington, DC:

Federal Energy Regulatory Commission
Public Reference Room, Room 2-A
Attn: Secretary
888 First Street, N.E.
Washington, DC 20426

The Permittee will maintain a hard copy of the NOI and PAD at the Bell County Public Library, Pineville Branch, which is located at 214 Walnut Street, Pineville, Kentucky 40977. The background reference material is available via special request by contacting LRPS via email at info@lewisridgeproject.com or via mail at the following address: Rye Development, Lewis Ridge Project, 830 NE Holladay Street, Portland, Oregon 97232.

2.2.4.1 Restricted Documents

Certain Project-related documents may be restricted from public viewing for regulatory and statutory reasons. Critical Energy Infrastructure Information (CEII) (18 CFR § 388.113) relates to the design and safety of dams and appurtenant facilities. Access to CEII documents is restricted to protect national security and public safety. Anyone seeking CEII information from FERC must file a CEII request. FERC's website at https://www.ferc.gov/ceii-filing-guide contains additional details related to CEII.

Information related to protecting sensitive information is also restricted from public viewing. Archaeological or other culturally important information is restricted under Section 106 of the NHPA. Endangered and threatened species are protected by the federal Endangered Species Act of 1973 (16 USCA §§ 1531-1543, P.L. 93-205) and Kentucky endangered species laws. While migratory birds are protected by the Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703-712, July 3, 1918, as amended) and eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d, 54 Stat. 250, as amended), specific species locations are not restricted. Anyone seeking this information from FERC must file a Freedom of Information Act (FOIA) request. Instructions for FOIA are available on FERC's website at https://www.ferc.gov/foia.

2.2.4.2 Study Requests

In developing the PAD, the Permittee has collected and summarized readily available information regarding the proposed Project and potential effects on the human and natural environments. The PAD, however, may also indicate areas where there is limited information related to areas of potential concern regarding the Project’s operation. In those cases, any party may request additional studies or investigations, as detailed below.

The TLP requires specific information from parties requesting studies related to the licensing. Study requests must be submitted no later than 60 days after the Joint Meeting. Each interested resource agency, Native American tribe, organization and members of the public must provide the Permittee with written comments and study requests that conform with the regulatory requirements contained in 18 CFR § 16.8.

As specified by 18 CFR § 16.8 (b)(4) of FERC's regulations, any study request must:

- Identify its determination of necessary studies to be performed or information to be provided by the potential applicant;
- Identify the basis for its determination;
- Discuss its understanding of the resource issues involved, and its goals objectives for these resources;
- Explain why each study methodology recommended is more appropriate than any other available methodology alternatives, including those identified by the potential applicant pursuant to paragraph (b)(2)(vi) of this section;
- Document that the use of each study methodology recommended is a generally accepted practice; and
- Explain how the studies and information requested will be useful to the agency, Native American tribe, or member of the public in furthering its resource goals and objectives.

Parties submitting requests should also describe any available cost-share funds or in-kind services that the sponsor of the request may contribute towards the study effort. It is preferred that requests are formatted in MS Word or PDF format and sent via email to ensure timely receipt.

Study requests can be sent to LRPS at info@lewisridgeproject.com.

2.2.4.3 Document Distribution

The Permittee will distribute, whenever possible, all documents electronically in standard MS Word format or PDF. Some documents may be distributed in hard copy for convenience or by request. Distribution of information will follow the guidelines presented in Table 2-2.

Table 2-2: Document Distribution for the Lewis Ridge Pumped Storage Project

Document	Method	Distribution
Public Meeting Notices	Email, U.S. Mail*, and Newspapers	Public and all Potential Interested Parties
Meeting Agendas	Email or U.S. Mail*	Interested Parties
Meeting Summaries	Email or U.S. Mail*	On Request
Process Plan & Schedule	Email or U.S. Mail*	On Request
Major Documents: Notice of Intent, Pre-Application Document, Proposed Study Plans, Study Reports, Draft License Application, Final License Application, etc.	Email or U.S. Mail	Notice of availability by U.S. Mail or Email to Interested Parties; all documents will be distributed electronically whenever possible.
PAD support documents	Lewis Ridge Pumped Storage, LLC corporate office	On Request

* U.S. Mail service by special request.

2.2.4.4 Mailing Lists

LRPS will maintain a Distribution List of all Interested Parties including Licensing Participants. Any interested entity or individual may request to be added to the Permittee's Distribution List by emailing info@lewisridgeproject.com. The list will include standard U.S. Post Office addresses for distributing notices and documents for public review.

After the Permittee files the FLA, FERC will establish an official Service List for parties who formally intervene in the proceeding. Intervention is a formal legal process in the FERC regulations. Additional information may be found on FERC's website at http://ferc.gov/resources/guides/how-to/intervene.asp. Once FERC establishes a Service List, any written documents filed with FERC must also be sent by the originator to the Service List. A Certificate of Service must be included with documents filed with FERC.

Table 2-3: Mailing Lists for the Lewis Ridge Pumped Storage Project

Entity	Type	Description
Lewis Ridge Pumped Storage, LLC	Project No. 15249 Distribution List	A list of Interested Parties prepared by the potential applicant in anticipation of the Project licensing proceeding.
FERC	Project No. 15249 Mailing List	A mailing list of Interested Parties prepared and maintained by FERC throughout the Project licensing proceeding.
FERC	Project No. 15249 Service List	A mailing list of parties that have formally intervened in the licensing proceeding, prepared and maintained by FERC after it accepts the License Application.

2.2.5 Telephone

After the Joint Meeting, the Permittee may hold additional meetings via conference call. These and any other routine telephone calls among Licensing Participants that pertain to the Project will be documented as part of consultation.

After the License Application is filed, it is anticipated that FERC will provide public notice of any decisional telephone calls in which it participates prior to acceptance of the License Application. FERC will provide prior public notice of any decisional telephone calls in which it participates after the Commission formally accepts the License Application.

2.3 References

Federal Energy Regulatory Commission (FERC). 2004. Handbook for Hydroelectric Project Licensing and 5 MW Exemptions from Licensing. Available online: https://www.ferc.gov/sites/default/files/2020-04/licensing-handbook.pdf. Accessed: June 2022.

3.0 GENERAL DESCRIPTION OF RIVER BASIN

18 CFR 5.6(d)(3)(xiii) requires "A general description of the river basin or sub-basin, as appropriate, in which the proposed project is located, including information on: (A) the area of the river basin or sub-basin and length of stream reaches therein; (B) Major land and water uses in the project area; (C) all dams and diversion structures in the basin or sub-basin, regardless of function; and (D) Tributary rivers and streams, the resources of which are or may be affected by project operations."

3.1 River Basin and Sub-Basins Description

The Project is a closed loop pumped storage project, located in the Upper Cumberland River Basin, in southeast Kentucky near the borders of Tennessee and Virginia. The nearest major river is the Cumberland, located just over a half a mile from the Lower Reservoir at approximately river mile (RM) 659. The Cumberland River flows in a western direction for approximately 688 miles from the Appalachian Mountains to the confluence with the Ohio River and the mouth of the Tennessee River (Olson 2021). The Project is located within the Upper Cumberland River Watershed (HUC8 05130101), which is part of the Upper Cumberland River Basin (HUC6 051301), which is part of the larger Cumberland River Basin (HUC4 0513) (USGS 2022). These river basins and sub-basins are shown on Figure 3-1.

The drainage area of the Cumberland River Basin (HUC4 0513) is approximately 18,000 square miles (Olson 2021). The Cumberland River Basin (HUC4 0513) stretches across 70 Kentucky and Tennessee counties (Cumberland River Compact 2022a). The drainage area of the Upper Cumberland River Basin (HUC6 051301) is approximately 10,688 square miles. The drainage area of the Upper Cumberland River Watershed (HUC8 05130101) is 2336 square miles. The Upper Cumberland River Watershed (HUC8 05130101) crosses Bell, Clay, Harlan, Knox, Laurel, Leslie, Letcher, McCreary, and Whitley Counties in Kentucky, and Campbell, Claiborne, and Scott Counties in Tennessee (Cumberland River Compact 2022b).

Figure 3-1: Cumberland River Basin and Sub-Basins

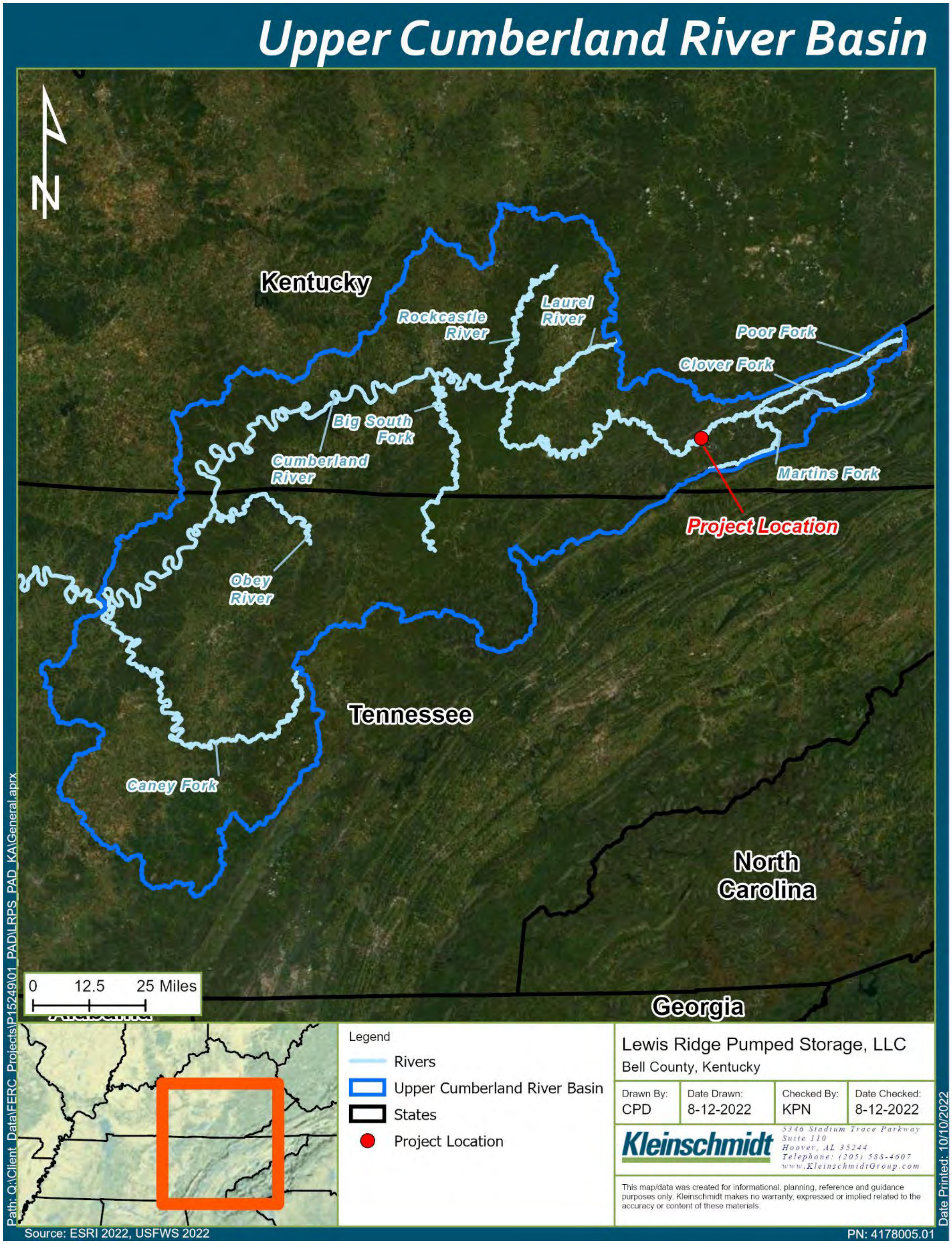


Figure 3-2: Upper Cumberland River Basin

3.2 River Basin Tributaries and Dams

The Cumberland River Basin (HUC4 0513) includes over 22,000 miles of streams and rivers (Cumberland River Compact 2022a). The mainstem of the Cumberland River flows in a westerly direction with its tributaries draining from the north or south (Kentucky EEC 1998). Clover Fork, Martin’s Fork, and Poor Fork form the headwaters of the Cumberland River in southeast Kentucky in the city of Harlan (Olson 2021). Between Harlan, Kentucky and Celina, Tennessee, the Cumberland River flows 310 miles and drains 6,400 square miles from over 7,900 miles of tributaries and streams (Cumberland River Compact 2019). Along this stretch, the Cumberland River receives water from streams and creeks such as Rockcastle, Laurel, Big South Fork, Caney Fork, and Obey River (World Atlas 2022). The Cumberland River flows naturally for 135 miles before reaching Lake Cumberland (formed by Wolf Creek Dam). Near Celina, Tennessee, Caney Fork and Obey River join the Cumberland River and it continues through Nashville, Tennessee where the river is dammed to form Old Hickory Lake and Cordell Hull Lake (World Atlas 2022).

The U.S. Army Corps of Engineers (USACE) operates eight dams on the Cumberland River (Wolf Creek Dam, Dale Hollow Dam, Center Hill Dam, Cordell Hull Dam, Old Hickory Dam, J. Percy Priest Dam, Cheatham Dam, and Barkley Dam) and two dams on its tributaries (Martin’s Fork Dam and Laurel River Dam) (USACE 2022; Olson 2021). The locations of these dams are shown on Figure 3-3. Major impoundments in the Upper Cumberland Watershed include Lake Cumberland on the mainstem of the Cumberland River, Laurel River Lake, Martins Fork Lake, Cranks Creek Reservoir, Wood Creek Lake, Lake Linville, and Cannon Creek Reservoir (Kentucky EEC 2000).

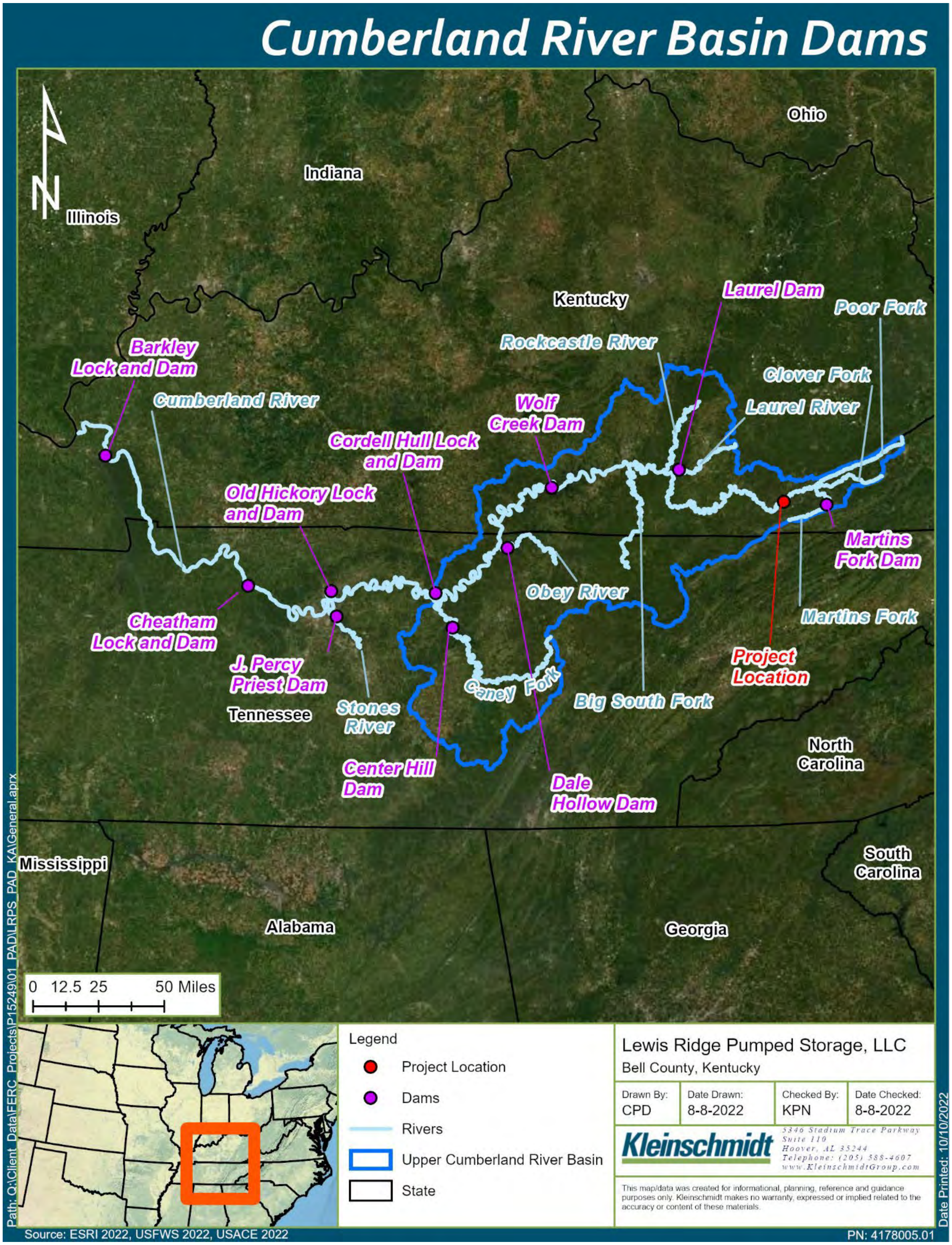


Figure 3-3: USACE Dams on the Cumberland River

3.3 Major Land Uses

The proposed Project is in the Cumberland Plateau Major Land Resource Area (MLRA) 125. The area's general topography is characterized by long, steep side slopes between narrow ridgetops and narrow stream floodplains. Major land uses in the Cumberland Plateau MLRA include commercial timber production and farming (corn, hay, tobacco, and vegetable production). Extensive acreage of forested areas exists in national forests, wildlife management areas, state parks, and privately owned tracts by coal and timber companies within the Cumberland Plateau MLRA. (NRCS 2006).

3.4 Major Water Uses

Public supply, livestock, and irrigation are the major water uses within the Cumberland Plateau MLRA. Total withdrawals average 915 million gallons per day with 84 percent sourced by surface water (from precipitation and perennial streams). Reservoirs within the Cumberland Plateau MLRA provide water for municipal and industrial users, while springs provide for domestic use and livestock. (NRCS 2006).

3.5 Climate

Average annual precipitation for the Cumberland Plateau MLRA is 45-60 inches, and as high as 75 inches in higher elevation areas. Most of the rainfall occurs during summer thunderstorms with half of the annual precipitation occurring during the growing season. Annual temperatures average 50-60 degrees Fahrenheit (°F) and the freeze-free period averages 200 days. (NRCS 2006).

3.6 References

Cumberland River Compact. 2019. Our Cumberland River Basin. Available online: https://cumberlandrivercompact.org/wp-content/uploads/2019/11/OurCumberlandRiverBasin_PartOne.pdf. Accessed: May 2022.

Cumberland River Compact. 2022a. Cumberland River Basin. Available online: https://cumberlandriverbasin.org/about/ Accessed: August 2022.

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Kentucky Environmental and Energy Cabinet (EEC). Kentucky Division of Water. 1998. Removing Fecal Pollution from the Upper Cumberland River Drainage. Available online: https://eec.ky.gov/Environmental-Protection/Water/Protection/TMDL/Approved%20TMDLs/TMDL-UpperCumberlandandTributariesPathogens.pdf. Accessed: May 2022.

Natural Resources Conservation Service (NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. Available online: https://www.rosemonteis.us/sites/default/files/references/nrcs-2006.pdf. Accessed: May 2022.

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U.S. Geological Survey (USGS). 2022. Science in Your Watershed - 051301 Upper Cumberland. Available online: https://water.usgs.gov/wsc/a_api/wbd/basin05/051301.html. Accessed: August 2022.

World Atlas. 2022. Cumberland River. Available online: https://www.worldatlas.com/rivers/cumberland-river.html. Accessed: May 2022.

4.0 PRELIMINARY PROJECT LOCATION, FACILITIES, AND OPERATIONS

4.1 Overview

The Project is an unconstructed pumped storage hydroelectric generating facility, which will involve the construction of new water storage, water conveyance, and generation facilities at off-channel locations where no such facilities exist at this time. The proposed Project concept is based on traditional pumped storage technologies of "storing" electric energy in the form of hydraulic potential, by pumping water to Upper Reservoir during off-peak times and allowing it to flow back through hydroelectric turbines when electric demand is peaking. The proposed Project is a closed loop pumped storage project that seeks to derive the benefits of traditional pumped storage, essentially increasing off-peak load and increasing generating capacity during peak demand periods, but in an improved manner that reduces and avoids many of the environmental impacts of the traditional pumped storage facility design. The existing Project site features topography beneficial to a closed loop system. Water will be circulated between a Lower and Upper Reservoir to store/generate power.

The Project is currently in the initial stages of design, permitting, and licensing and exact Project specifications and site-specific locations of the Project features have not been finalized. The specifications associated with the Project as described herein are considered preliminary and may change for reasons such as engineering and geotechnical feasibility, environmental concerns, or site agreements and contracts.

4.2 Project Location

The proposed Project site is located in Bell County, Kentucky, which is in southeast Kentucky near the borders of Tennessee and Virginia. The Project site is located near the communities of Blackmont, Tejay, Balkan, and Callaway and near RM 659 of the Cumberland River.

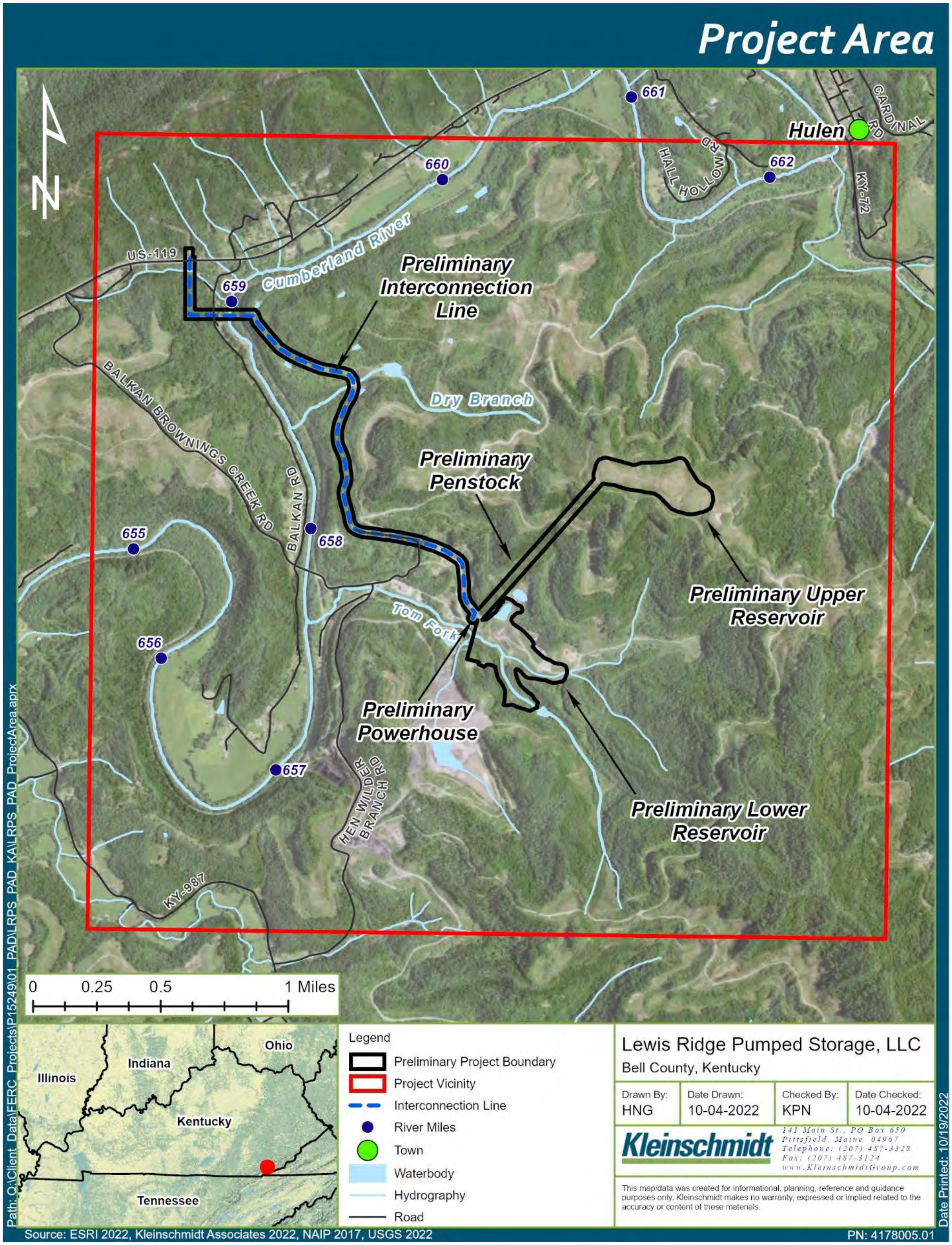

Figure 4-1: Preliminary Project Boundary and Project Vicinity

4.2.1 Preliminary FERC Project Boundary

A preliminary FERC Project Boundary for the proposed Project is shown in Figure 4-1.[1] This preliminary Project Boundary depicts the geographic extent that is anticipated to encompass all land necessary to operate the Project, once construction is completed. The preliminary Project Boundary encompasses approximately 158 acres. The Project is located entirely on private land. There are no lands of the United States in the Project Boundary.

As shown in Figure 4-1 a "Project Vicinity" has been defined for the purpose of this PAD. The Project is unconstructed and in the initial stages of site layout review and design. The Project Boundary in this PAD is considered preliminary. For the purpose of this PAD, environmental resources were described for the area within the Project Vicinity to allow for a broader geographic context of the immediate surrounding area to the Project. It is anticipated that the construction limits of disturbance and any potential changes to the Project Boundary are likely to be located within the defined Project Vicinity.

4.2.2 Project Land Ownership

The preliminary Project Boundary is on private land. There are no Federal or Tribal lands associated with the Project. The site at which the proposed Project facilities are located, with the exception of the Project interconnection line, are located on a site historically used for mining. The key Project features, with the exception of the interconnection line, are located at a site owned largely by Asher Land and Mineral, LLLP. The preliminary location of the Project interconnection line runs adjacent to existing roads across private land.

4.3 Proposed Project Facilities

As proposed, the Project would consist of the following: (1) a 5,450-foot-long, 135-foot-high roller compacted concrete dam for the Upper Reservoir with an integrated overflow spillway; (2) an Upper Reservoir with a surface area of 24 acres and a useable storage capacity of 2,300 acre-feet; (3) a 3,850-foot-long steel penstock with the upper section likely being 16 feet in diameter and the lower extent bifurcating into two 12 foot diameter steel sections; (4) a steel surge tower or set of energy-dissipating pressure relief valves; (5) a 420-foot-long, 80-foot-wide powerhouse containing two 143.5- MW reversible pump-turbines with a total installed capacity of 287 MW; (6) a 830-foot-long, 80-foot-high roller compacted concrete dam at the Lower Reservoir with an integrated overflow spillway; (7) a 47 acre Lower Reservoir with a storage capacity of 2,300 acre-feet; and (8) a 2.3-mile-long, 161 kilovolt overhead interconnection line. The proposed Project would have an estimated annual generation of 671,700 megawatt-hours (MWh) and a daily energy

[1] Kentucky does not use the Public Land Survey System in this part of the state, thus township, range, and section are not applicable to the Project Vicinity and not depicted on this figure.

storage of 2,165 MWh. The proposed Project would have a storage time of 8 hours at full discharge capacity. The preliminary Project specifications are provided in Table 4-1.

Table 4-1: Preliminary Project Specifications

Project Description	Specification
General Information	
FERC Number	P-15249
Operation Type	Closed Loop Pumped Storage Project
Project Location	Bell County, Kentucky
Usable Storage Capacity	2,300 acre-feet
Gross Storage Capacity	2,600 acre-feet
Storage Time	8 hours (at full discharge capacity)
Maximum Gross Head	1,125 feet
Minimum Gross Head	955 feet
Average Gross Head	1,038 feet
Project Generation	
Installed Capacity	287 MW (full reservoir & total for 2 units)
Average Annual Generation	671,700 MWh
Average Monthly Generation	55,975 MWh
Upper Reservoir	
Structure Type	Roller Compacted Concrete (RCC)
Location	36.770072 Latitude, 83.541272 Longitude
Minimum Water Surface	Approximately elevation 2,180 feet mean sea level (msl)
Maximum Water Surface	Approximately elevation 2,300 feet msl
Surface Area (at normal high water surface elevation 2300 feet MSL)	24 acres
Dam Height	135 feet (crest at 2,305 feet msl elevation)
Dam Length	5,450 feet
Overflow Spillway	Integrated, sized for probable maximum precipitation event and maximum pumping flow
Water Conduits	
Number of penstocks	1 for upper reach bifurcating to 2 at lower extents
Diameter of penstocks	16 feet and 12 feet respectively
Length of penstock	3,850 feet
Lower Reservoir	
Structure Type	Roller Compacted Concrete (RCC)
Location	36.760058 Latitude, 83.549833 Longitude
Minimum Water Surface	Approximately elevation 1,175 feet msl
Maximum Water Surface	Approximately elevation 1,225 feet msl

Project Description	Specification
Surface Area (at normal high water surface elevation 1,225 feet MSL)	47 acres
Dam Height	80 feet (crest at 1,230 feet msl elevation)
Dam Length	830 feet
Overflow Spillway	Integrated, specifications TBD, sized for probable maximum precipitation event after completion of generation cycle (lower reservoir filled)
Powerhouse	
Location	Attached to Lower Reservoir dam
Dimensions	420-foot-long, 80-foot-wide
Pump Turbine-Generators	Two (2) 143.5- MW reversible pump-turbine units
Rated Flow	3,480 cubic feet per second (cfs) total station flow
Transformers and Interconnection Lines	
Number of Interconnection Lines	1
Length of Interconnection Line	2.3 miles
Interconnection Line Voltage	161 kilovolt
Number of Transformers	2
Water Recharge Conveyance System	
Type	Gravity fed from Tom Fork stream diversion
Access Roads	
Length of Permanent Access Roads	TBD
Length of Temporary Access Roads	TBD

4.4 Proposed Project Operations

The Project would operate as a closed-loop pumped storage project. The Project would pump water from the Lower Reservoir to the Upper Reservoir at times when energy is in excess or in low demand. To generate energy, water would be released from the Upper Reservoir through the penstock to the powerhouse containing two reversible 143.5-MW pump-generator units. This would occur to provide ancillary power services and supplement power generation based on on-peak/off-peak power needs. The Project would have the capacity to generate for 8 hours a day of full discharge, at a maximum of 287 MW, and pump water from the Lower Reservoir to the Upper Reservoir in about 12 hours.

4.5 Initial Fill

As the Project is still in the initial design phase at the time of this PAD, the source for the initial fill of water at the Project has not yet been determined. The preliminary design concept includes a diversion structure in Tom Fork near the Lower Reservoir, which will be used for recharge water, as described in Section 4.6. It has not yet been determined if initial fill from the drainage basin at the Lower Reservoir will be sufficient, or if temporary pumping from the Cumberland River will be needed to supplement the initial fill of the Project.

LRPS conducted a preliminary hydrologic assessment to gather information on the Lower Reservoir's drainage basin and to estimate the potential evaporation rate at the Project, filling time, and the maximum storm inflow in the drainage basin at the preliminary Lower Reservoir. It was determined that the drainage area of the preliminary Lower Reservoir is 1.82 square miles and that the average annual inflow rate into the Lower Reservoir's drainage basin is 3.3 cfs (or 8,553,600 cubic feet per month). Based on preliminary Project specifications, it was estimated that the Project initial fill duration would be approximately 380 days if 100% diversion of Tom Fork was used.

4.6 Recharge Water

The Project recharge water will be sourced Tom Fork and the associated drainage basin at the Lower Reservoir. The Project is in the initial stages of design, and specifications have not yet been finalized. It is currently envisioned that a new diversion structure across Tom Fork will act as a small dam that can redirect flow by gravity to the Lower Reservoir. A small impoundment of sufficient depth would be created. A small offtake structure would withdraw, by gravity, evaporation and seepage makeup water directly into the Lower Reservoir. When not recharging the system, the gate to the Lower Reservoir would close and water would continue to flow down through the Tom Fork streambed.

Monthly reservoir evaporation volumes (upper and lower individually) range from approximately 131,700 cubic feet to 377,000 cubic feet. The average inflow (annually) is approximately 3.3 cubic feet per second or 8,553,600 cubic feet per month. Therefore, the highest evaporation rate for the combined two reservoirs is only 8% (approximately) of the average monthly stream flow. Seepage losses have not been computed yet given the requirement for further geotechnical investigation.

4.7 One-Line Diagram

The single-line diagram for the Project is considered CEII and is provided in Volume II of this PAD.

4.8 References

Kleinschmidt Associates (Kleinschmidt). 2022, September 22. Lewis Ridge Lower Reservoir Hydrology Memorandum. Document No. 4178005.01_004ME.

5.0 DESCRIPTION OF EXISTING ENVIRONMENT

5.1 Geology and Soils

18 CFR 5.6(d)(3)(ii) requires "Descriptions and maps showing the existing geology, topography, and soils of the proposed project and surrounding area. Components of the description must include: (A) A description of geological features, including bedrock lithology, stratigraphy, structural features, glacial features, unconsolidated deposits, and mineral resources at the project site; (B) A description of the soils, including the types, occurrence, physical and chemical characteristics, erodability and potential for mass soil movement; (C) A description of reservoir shorelines and streambanks, including: (1) Steepness, composition (bedrock and unconsolidated deposits), and vegetative cover; and (2) Existing erosion, mass soil movement, slumping, or other forms of instability, including identification of project facilities or operations that are known to or may cause these conditions."

5.1.1 Overview

The unconstructed Project is located in Bell County of the Balkan Quadrangle of Kentucky. The area within the majority of the preliminary Project Boundary and Project Vicinity has a history of coal mining, including surface and underground mining methods. Presently, there are active mining permits in the Project Vicinity.

5.1.2 Topography

Figure 5-1 depicts the general topography in the Project Vicinity. The existing ground surface elevations at the Project range from approximately 1,200 to 2,300 feet msl.

The Project is located in an area of southeastern Kentucky with mountainous topography, south of the Pine Mountain Overthrust Fault (USGS and Kentucky Geologic Survey 1988) (Figure B-1 in Appendix B). The Project is located in the level IV ecoregion known as Cumberland Mountain Thrust Block (ecoregion 69e) within the level III Central Appalachians ecoregion (ecoregion 69), which consists of high, steep ridges, hills, coves, narrow valleys (Woods et al. 2002). The Cumberland Mountain Thrust Block is underlain by Pennsylvania shale, siltstone, sandstone, conglomerate, and coal (Woods et al 2002). The sides of many of the mountain peaks and ridges are quite steep. Local relief may be as great as 1,500 feet over a horizontal distance of ½ mile in the area south of the Pine Mountain Overthrust Fault (McGrain and Currens 1978). South of the Pine Mountain Overthrust Fault the rocks of the Breathitt Formation underlie the narrow valleys and form high, rugged hills. The tops of hills and ridges are commonly capped by sandstone. Shales form wide valleys and moderate or gentle slopes on hills (Kilburn et al. 1962).

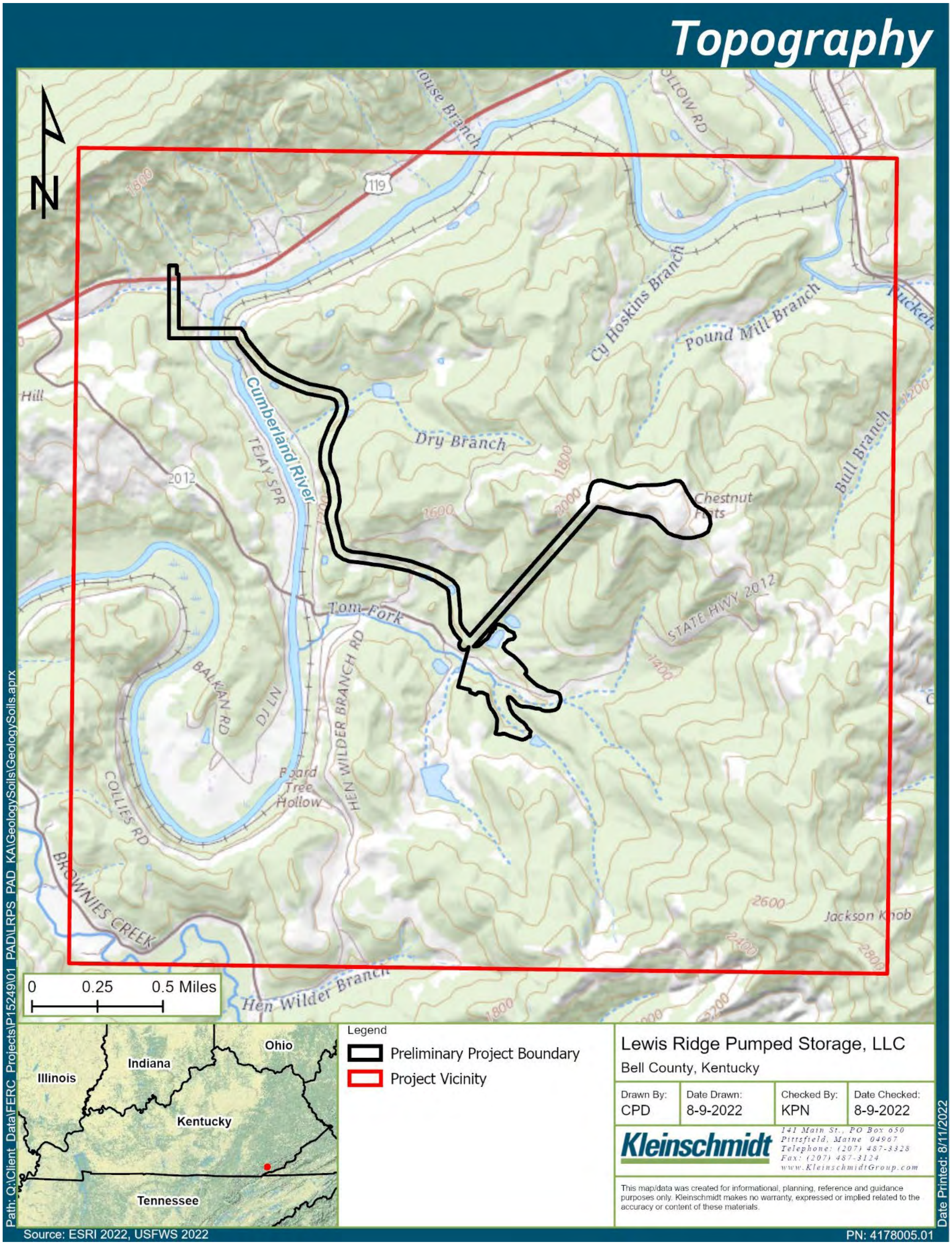

Figure 5-1: Topography in the Project Vicinity

5.1.3 Surficial and Bedrock Geology

The surficial geology of the proposed Project Vicinity consists of sandstone and shale clast loamy colluvium (USGS 1991). The sandstone- and shale-clast loamy colluvium is described as light-gray, brownish-gray, or yellowish-gray, sandy loam to clay loam; poorly sorted and unstratified. It contains angular to subrounded pebble- to boulder-size fragments of sandstone, conglomeratic sandstone, and chips of shale. On steep slopes, the clayey material tends to be unstable, and commonly is associated with instabilities including soil creep and landslides. Mapped areas of colluvium include rock exposures on steep slopes and minor alluvium along streams. Thickness is generally 2 to 7 meters (6.5 to 23 feet), and as much as 25 meters (82 feet) at the foot of some steep slopes.

A geologic map of Kentucky is included in Appendix B as Figure B-1 (USGS and the Kentucky Geologic Survey 1988) and a geologic map of the Balkan Quadrangle, Bell, and Harlan Counties, Kentucky is included in Appendix B as Figure B-2 (Froelich and Tazelaar 1973). The bedrock in the Project Vicinity is mapped primarily as the Breathitt Formation (Froelich and Tazelaar 1973).

Figure 5-2 shows the bedrock geology in the general Project region and Figure 5-3 shows the bedrock geology in the Project Vicinity. As shown, shale is the most common top mapped layer in the Project Vicinity. The U.S. Geological Survey (USGS) and Kentucky Geologic Survey's Geologic Map of Kentucky (1988) confirms the presence of the upper, middle, and lower parts of the Breathitt Formation. The Breathitt Formation (of Pottsville group) consists of sandy shale and coarse ferruginous sandstone with occasional coal seams, with the Pittsburg (Kentucky) coal lying at base. Members of the Hance Formation and the Mingo Formation are located within the Breathitt Formation. Members of the Mingo Formation identified in the Project Vicinity include the Darby coal bed, the Kellioka coal bed, and the Harlan coal bed. Members of the Hance Formation identified in the Project Vicinity include the Mason coal bed, the Mason Rider coal bed, coal beds in the Path Fork coal zone, and coal beds in the Hance coal zone. The Hance Formation is described as mainly shale, some sandstone and coal. The Mingo Formation is described as shales, sandstones, and coals (contains Sandstone Parting, Mingo, and Kellioka coals). At the bottom is the Harlan coal in the east, the Hance coal at the center, and the Bennett Fork coal in the west. (USGS N.d).

A general stratigraphic section includes the Mingo formation, underlain by the Hance and Lee formations. The lithology surrounding the coal seams historically partially mined consists of sandstone, siltstone, and shale. The shale and siltstone are generally medium to dark gray, locally dark gray to black with ironstone nodules common in the lowest third of the unit, interbedded with thin silty sandstone beds. Sandstones are generally light to medium gray, fine to coarse grained, poorly sorted, and generally cross bedded. (Nally & Hamilton Enterprises, Inc. 2007).

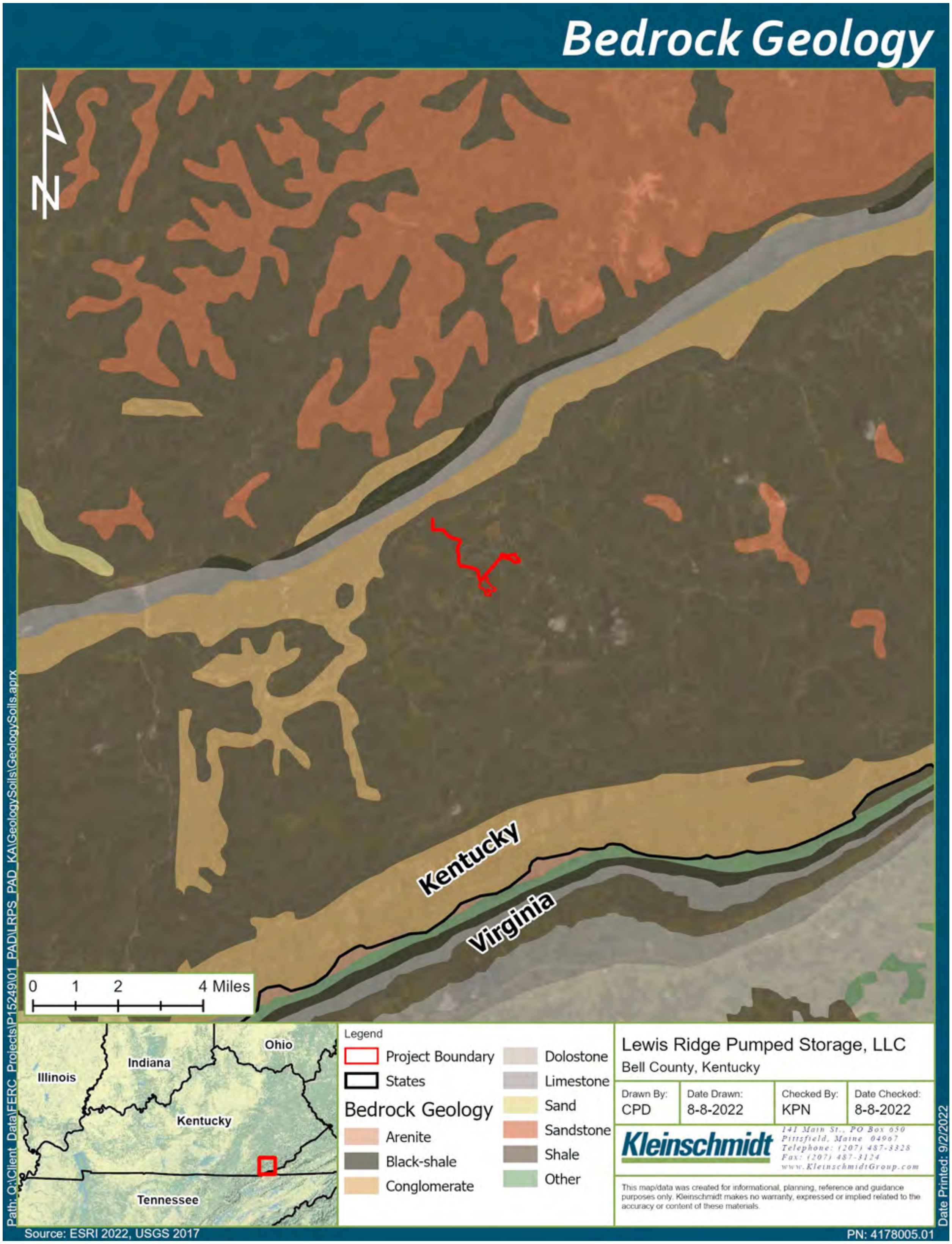

Figure 5-2: Bedrock Geology in the Region

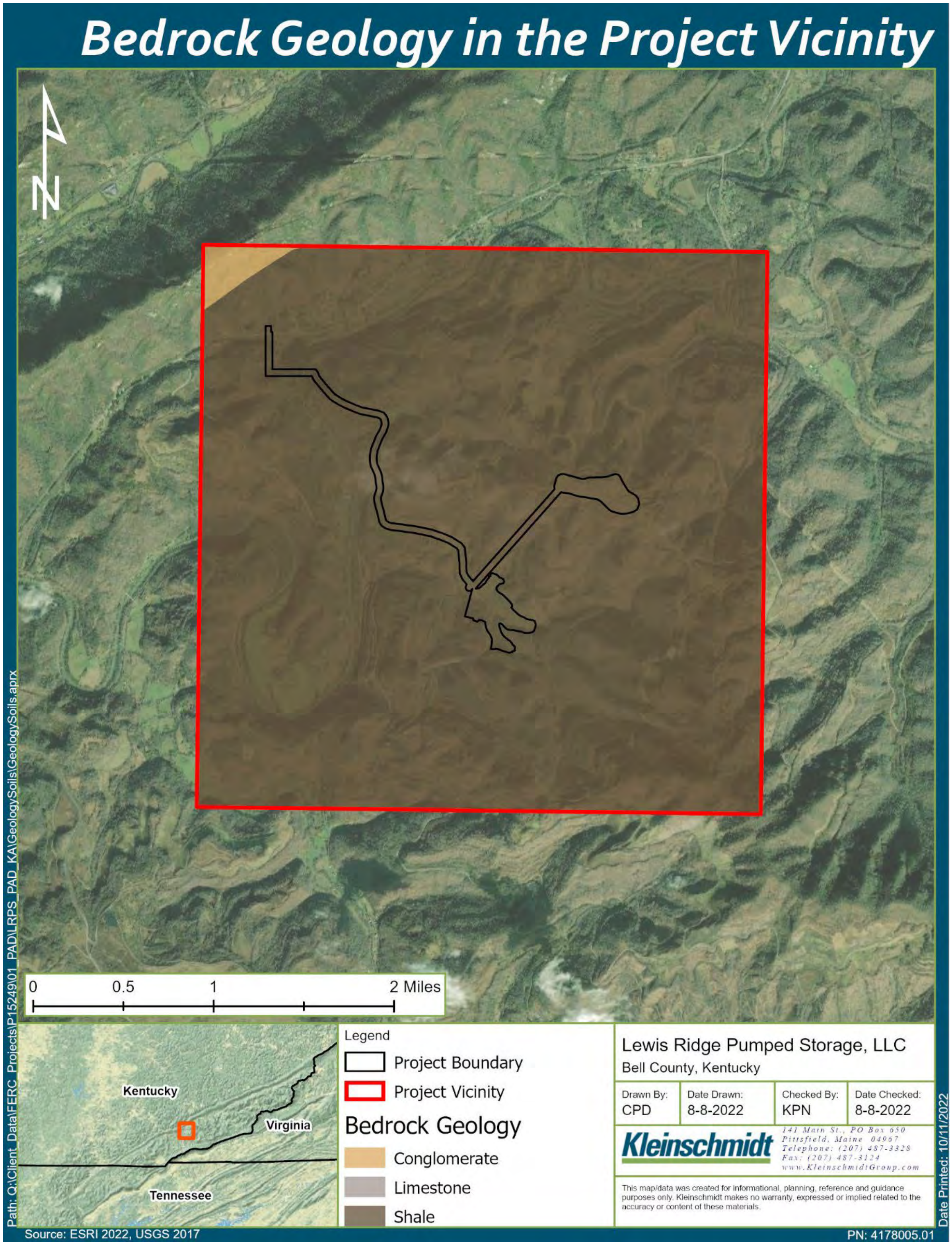

Figure 5-3: Bedrock Geology in the Project Vicinity [2]

[2] Limestone is shown on the legend because a small area (0.1 acres) in the northeastern corner of the Project Vicinity is mapped as limestone, which is not visible at the scale shown.

5.1.4 Soils

The soil types according to the United States Department of Agriculture (USDA) National Resource Conservation Service (NRCS) in the preliminary Project Boundary and Project Vicinity are tabulated in Table 5-1 and Table 5-2, respectively. Soil types in the preliminary Project Boundary and Project Vicinity are depicted on Figure 5-4 and Figure 5-5, respectively (USDA NRCS 2022). Available in Appendix D is the Physical Soil Properties of Bell and Harlan Counties, Kentucky table, which provides a description of physical characteristics, erodibility, and erosion factors associated with each soil type.

Table 5-1: NRCS Mapped Soils in the Preliminary Project Boundary

Map Symbol	Soil Type	Acres	% of Preliminary Project Boundary
ShF	Shelocta-Highsplint-Gilpin complex, 20 to 70 percent slopes, very stony	60.8	39%
FbF	Fairpoint and Bethesda soils, 20 to 70 percent slopes, stony	52.4	33%
GtF	Gilpin-Rayne-Sequoia complex, 25 to 55 percent slopes, very stoney	23.0	15%
GsD	Gilpin-Shelocta silt loams, 12 to 20 percent slopes	12.7	8%
Cr	Craigsville-Philo complex, occasionally flooded	2.8	2%
W	Water	2.5	2%
UrE	Udorthents-Urban land complex, 15 to 35 percent slopes	2.2	1%
Sb	Shelbiana loam, occasionally flooded	1.1	1%
HeF	Helechawa-Varilla-Jefferson complex, 35 to 75 percent slopes, very rocky	0.1	<1%
VrD	Varilla very stony loam, 5 to 20 percent slopes, extremely bouldery	0.1	<1%
	Total	**157.6**	

Source: USDA NRCS 2022

Table 5-2: NRCS Mapped Soils in the Project Vicinity

Map Symbol	Soil Type	Acres	% of Project Vicinity
SkF	Shelocta-Kimper-Cloverlick complex, 20 to 80 percent slopes, very stony	1,575.1	25%
ShF	Shelocta-Highsplint-Gilpin complex, 20 to 70 percent slopes, very stony	1,199.3	19%
GtF	Gilpin-Rayne-Sequoia complex, 25 to 55 percent slopes, very stony	773.9	12%
FbF	Fairpoint and Bethesda soils, 20 to 70 percent slopes, stony	761.9	12%
HsF	Highsplint-Cloverlick-Guyandotte comples, 35 to 75 percent slopes, very stony	368.7	6%
Sb	Shelbiana loam, occasionally flooded	347.2	6%
SmF	Shelocta-Kimper-Cutshin complex, 20 to 55 percent slopes, very stony	325.5	5%
HeF	Gilpin-Rayne-Sequoia complex, 25 to 55 percent slopes, very stony	187.0	3%
W	Water	127.5	2%
SgE	Shelocta-Gilpin silt loams, 20 to 35 percent slopes	77.6	1%
CgF	Cloverlick-Guyandotte-Highsplint complex, 20 to 80 percent slopes, very stony	70.2	1%
AtF	Alticrest-Totz-Helechawa complex, rocky, 20 to 55 percent slopes	68.4	1%
AgB	Allegheny loam, 2 to 6 percent slopes	63.9	1%
VrD	Varilla very stony loam, 5 to 20 percent slopes, extremely bouldery	59.6	1%
Po	Pope fine sandy loam, occasionally flooded	57.5	1%
Du	Dumps, Mine; tailings; and Tipples	52.9	1%
FbC	Fairpoint and Bethesda soils, 2 to 20 percent slopes	48.7	1%
GsD	Gilpin-Shelocta silt loams, 12 to 20 percent slopes	27.3	<1%
UrE	Udorthents-Urban land complex, 15 to 35 percent slopes	20.6	<1%
HeF	Helechawa-Varilla-Jefferson complex, 35 to 75 percent slopes, very rocky	13.1	<1%
Ud	Udorthents-Urban land complex, occasionally flooded	3.1	<1%
Cr	Craigsville-Philo complex, occasionally flooded	2.8	<1%
	Total	**6,231.8**	

Source: USDA NRCS 2022

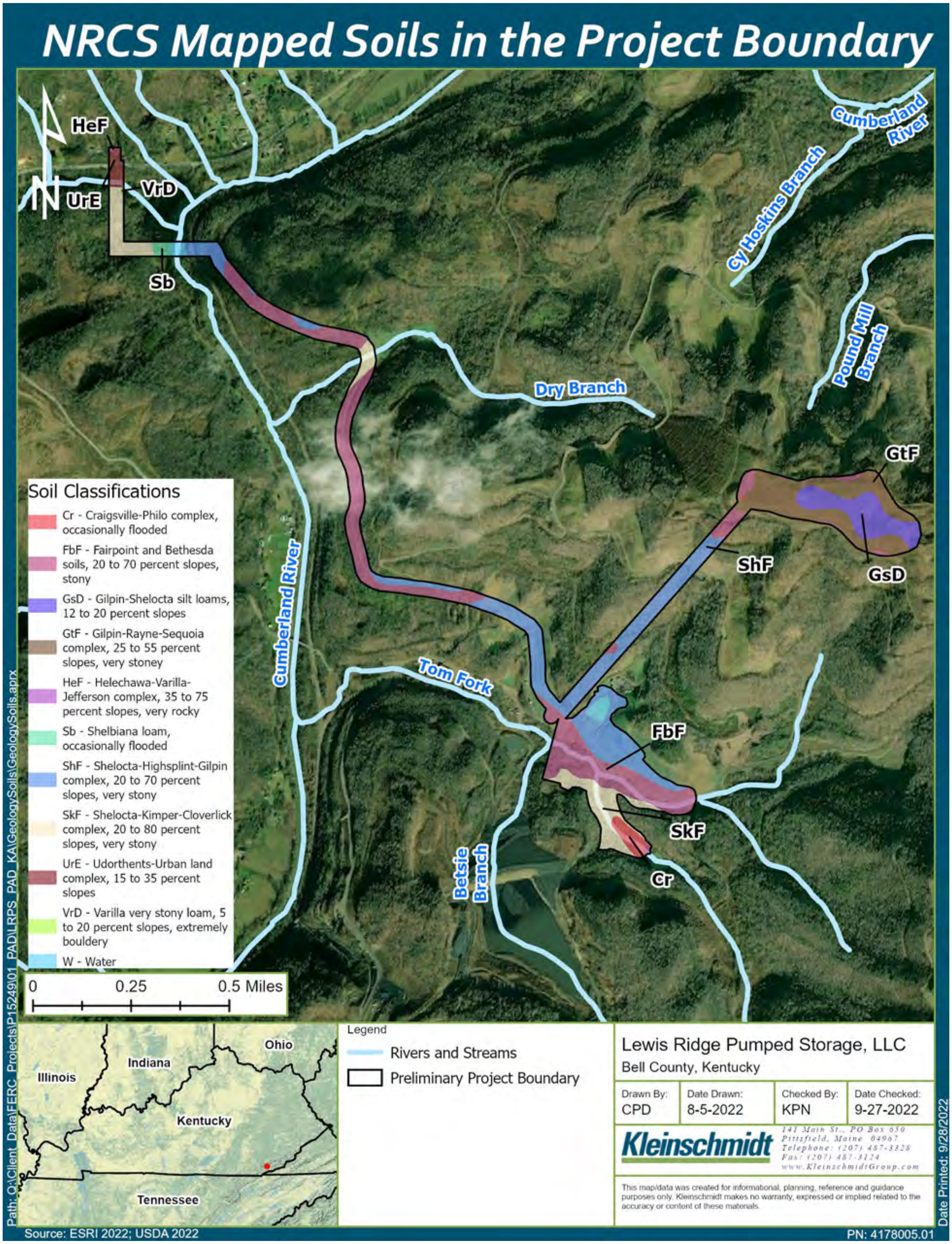

Figure 5-4: NRCS Mapped Soils in the Preliminary Project Boundary

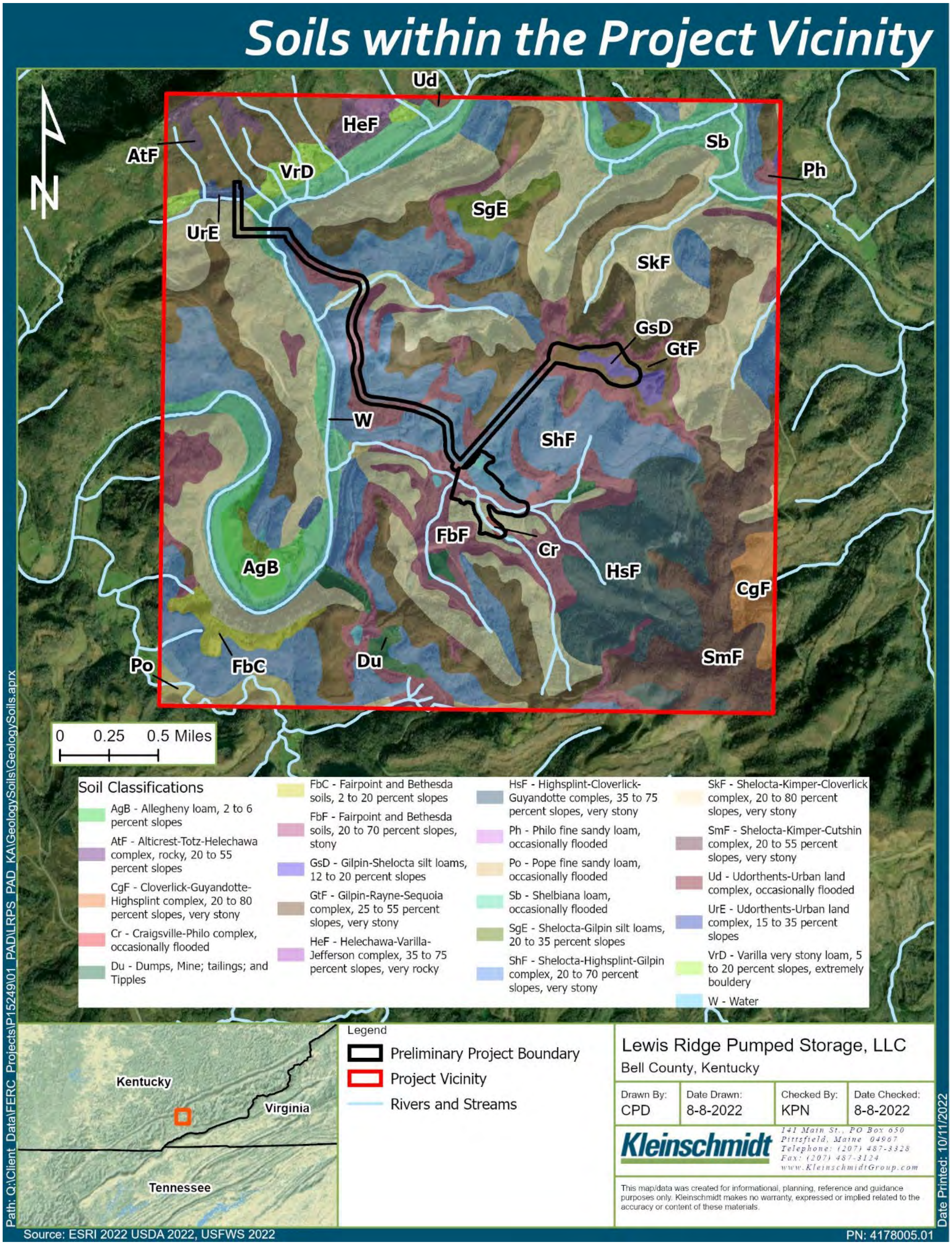

Figure 5-5: NRCS Mapped Soils in the Project Vicinity

5.1.5 Seismic Hazards

Per the USGS Earthquake Hazards Map 2014, the Project is located in a seismic area with a ground peak acceleration of approximately 0.25g, with a 2 percent probability of exceedance in 50 years (2,475-year recurrence interval). Using the U.S. Geological Survey - Earthquake Hazards Program Search Earthquake Catalog, there were no results for earthquakes greater than 2.5 in magnitude within 500 kilometers of the Project location since 1900.

5.1.6 Mining Activities

The Project is located on a property that has historically been used for coal mining. Appendix C contains a map that shows documented mined areas in the Project Boundary. There are active mining permits in the Project Vicinity and many areas have been reclaimed. All historically mined areas on which Project features will be located will be reclaimed.

There are six identified coal seams in the Project Vicinity. From highest to lowest elevation, the seams are Darby, Kellioka, Harlan, Upper Path Fork, Hance, and Mason.

Besides the mining activities in the Project Vicinity, LRPS is not aware of any existing erosion, mass soil movement, slumping, or other forms of instability at the Project location.

5.1.7 References

Albert J. Froelich and James F. Tazelaar. 1973. Geologic Map of the Balkan Quadrangle, Bell, and Harlan Counties, Kentucky.[3]

Chabot Kilburn, W.E. Price, Jr., and D.S. Mull. 1962. Availability of Groundwater in Bell, Clay, Jackson, Knox, Laurel, Leslie, McCreary, Owsley, Rockcastle, and Whitley Counties, Kentucky. Published by the U.S. Geological Survey.

McGrain, P., and Currens, J.C. 1978. Topography of Kentucky: Kentucky Geological Survey, ser. 11, Special Publication 25, 76 p.

Nally & Hamilton Enterprises, Inc., 2007, Permit 807-0333 Application.

RESPEC Company, LLC (RESPEC). 2022. Lewis Ridge Project Status Report, External Memorandum.

United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). 2022. Web Soil Survey. Available online: https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx Accessed: August 2022.

[3] Available as Figure B-2 in Appendix B.

U.S. Geologic Survey (USGS). 1991. Quaternary Geologic Map of the Blue Ridge 4° x 6° Quadrangle, United States.[4]

U.S. Geologic Survey (USGS) and the Kentucky Geologic Survey. 1988. Geologic Map of Kentucky, Sesquicentennial Edition of the Kentucky Geologic Survey.[5]

U.S. Geologic Survey (USGS). N.d. A Geologic Map of a Part of the Cumberland Gap Coal Field, Western Sheet.[6]

Woods, A.J., J.M. Omernik, W.H. Martin, G.J. Pond, W.M. Andrews, S.M. Call, J.A. Comstock, and D.D. Taylor. 2002. Ecoregions of Kentucky (color poster with map, descriptive text, summary tables, and photographs): Reston, VA, U.S. Geological Survey (map scales 1:1,000,000).

[4] Available as Figure B-3 in Appendix B.

[5] Available as Figure B-1 in Appendix B.

[6] Available as Figure B-4 in Appendix B.

5.2 Water Resources

18 CFR 5.6(d)(3)(iii) requires "A description of the water resources of the proposed project and surrounding area. This must address the quantity and quality (chemical/physical parameters) of all waters affected by the project, including but not limited to the project reservoir(s) and tributaries thereto, bypassed reach, and tailrace. Components of the description must include: A) Drainage area; (B) The monthly minimum, mean, and maximum recorded flows in cubic feet per second of the stream or other body of water at the powerplant intake or point of diversion, specifying any adjustments made for evaporation, leakage, minimum flow releases, or other reductions in available flow; (C) A monthly flow duration curve indicating the period of record and the location of gauging station(s), including identification number(s), used in deriving the curve; and a specification of the critical streamflow used to determine the project's dependable capacity; (D) Existing and proposed uses of project waters for irrigation, domestic water supply, industrial and other purposes, including any upstream or downstream requirements or constraints to accommodate those purposes; (E) Existing instream flow uses of streams in the project area that would be affected by project construction and operation; information on existing water rights and water rights applications potentially affecting or affected by the project; (F) Any federally-approved water quality standards applicable to project waters; (G) Seasonal variation of existing water quality data for any stream, lake, or reservoir that would be affected by the proposed project, including information on: (1) Water temperature and dissolved oxygen, including seasonal vertical profiles in the reservoir; (2) Other physical and chemical parameters to include, as appropriate for the project; total dissolved gas, pH, total hardness, specific conductance, chlorophyll a, suspended sediment concentrations, total nitrogen (mg/L as N), total phosphorus (mg/L as P), and fecal coliform (E. Coli) concentrations; (H) The following data with respect to any existing or proposed lake or reservoir associated with the proposed project; surface area, volume, maximum depth, mean depth, flushing rate, shoreline length, substrate composition; and (I) Gradient for downstream reaches directly affected by the proposed project."

5.2.1 Overview

Within the preliminary Project Boundary are the Cumberland River and two known tributaries, Tom Fork and Dry Branch (Figure 5-6). Tom Fork is located at the preliminary Lower Reservoir location. Tom Fork flows from east-to-west to its confluence with the Cumberland River. The preliminary interconnection line crosses Dry Branch in a single span. Dry Branch flows from east-to-west across the preliminary interconnection line to its confluence with the Cumberland River. The preliminary interconnection line also crosses the Cumberland River in a single span.

Water resources in the Project Vicinity are also discussed below. This includes a discussion of the Cumberland River, which is in the Project Vicinity and crossed by the interconnection line.

Figure 5-6 depicts the National Hydrography Dataset (NHD) mapped features within the Project Vicinity. The Cumberland River is mapped on the NHD as a stream/river, Dry Branch is mapped as an intermittent stream, and Tom Fork is mapped as a perennial stream below the preliminary Lower Reservoir location and as an intermittent stream above the Lower Reservoir location.

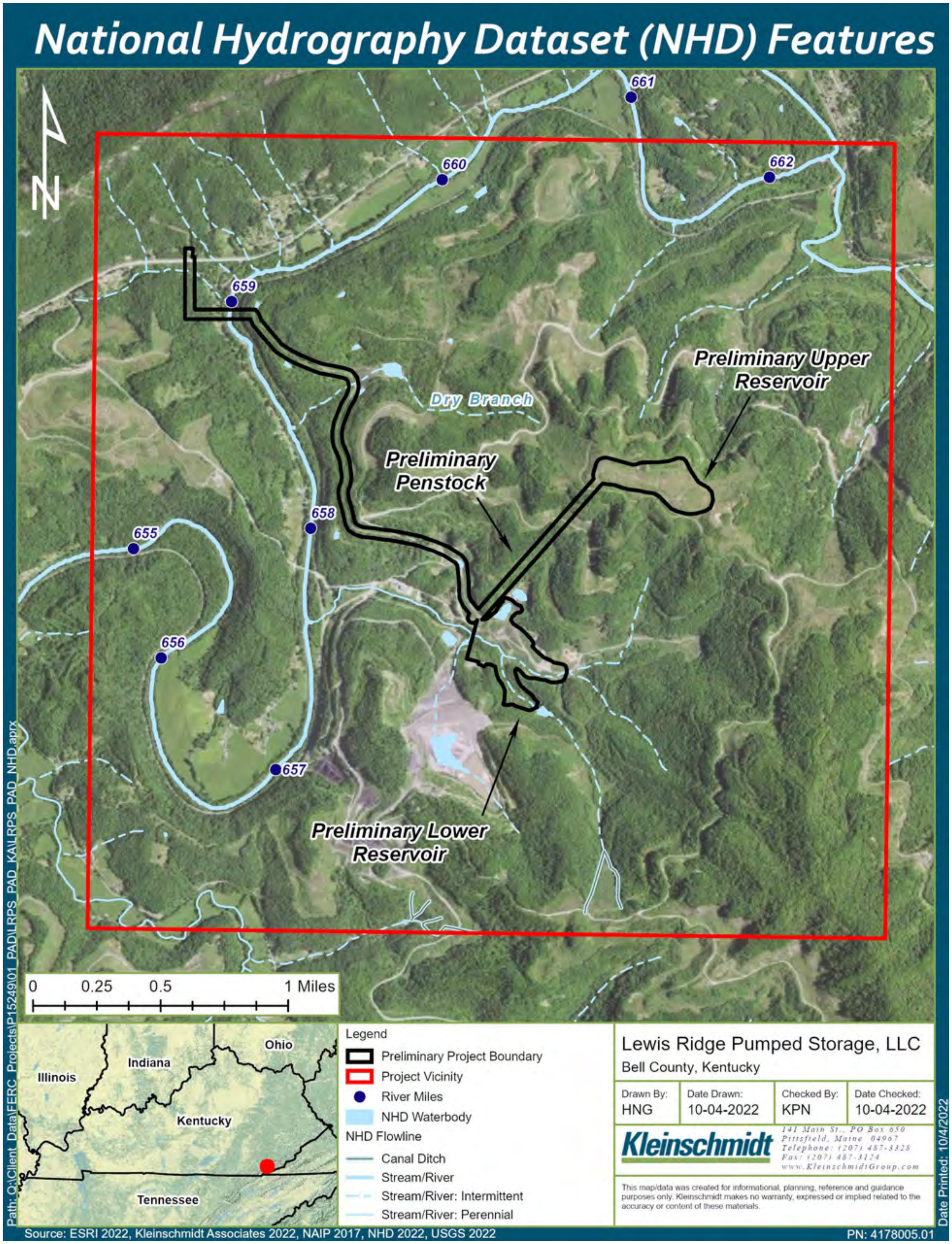

Figure 5-6: National Hydrography Dataset (NHD) Mapped Features in the Project Vicinity

5.2.2 Drainage Area

The drainage area of the Cumberland River near the Project is approximately 468 square miles, and the drainage area of the river basin is described in Section 3.1.

At the Project, the drainage area of the Upper Reservoir is simply the size of the proposed reservoir, which is approximately 24 acres.

The drainage area of the Lower Reservoir is approximately 1.82 square miles (Kleinschmidt 2022). This drainage area of the Lower Reservoir is shown in Figure 5-7. To calculate this drainage area and develop the figure, USACE HEC-HMS v4.10 software was used to delineate the drainage area of the basin containing the Lower Reservoir. The terrain data used to delineate the watershed was KyFromAbove's 5-foot digital elevation model, which was obtained from the Kentucky Division of Geographic Information's website.

Figure 5-7: Drainage Area of Preliminary Lower Reservoir

5.2.3 Streamflow, Gage Data, and Flow Statistics

The following information pertains to the Cumberland River[7], which is located in the Project Vicinity. Table 5-3 provides information about two USGS gage sites on the Cumberland River located in close proximity to the Project Vicinity. USGS gage number 03401000 (Harlan gage) is located approximately 20 miles upstream of the Project Vicinity and USGS gage number 03402900 (Pineville gage) is located approximately 15 miles downstream of the Project Vicinity. Streamflows are highest in the winter months of January through March and lowest in the summer and early fall between August and October. Monthly average and median streamflows at the Harlan gage are provided in Table 5-4.

There is no historical gauged streamflow data available for the two small tributaries that are in the preliminary Project Boundary, Tom Fork and Dry Branch. LRPS conducted preliminary hydrologic assessment of the drainage basin at the Lower Reservoir, which is on Tom Fork (Kleinschmidt 2022). As described in Section 4.6, the Project recharge water will be sourced from the drainage basin in which the Lower Reservoir is located. This preliminary hydrologic assessment estimated that the average annual inflow rate into the Lower Reservoir's drainage basin is 3.3 cfs (or 8,553,600 cubic feet per month) (Kleinschmidt 2022).

Table 5-3: Cumberland River USGS Gage Sites near the Project Vicinity

USGS Gage Number	Description	Drainage Area Square Miles (mi^2)	Period of Record
03401000	Cumberland River near Harlan, Kentucky (approximately 20 miles upstream of Project Vicinity)	374	April 1940-Present
03402900	Cumberland River at Pine St Bridge at Pineville, Kentucky (approximately 15 miles downstream of Project Vicinity)	770	1991-Present

Sources: USGS 2022a, USGS 2022b

[7] As described in Section 4.5, the Project is still in the initial design phase and the source for the initial fill of water at the Project has not yet been determined.

Table 5-4: Monthly Minimum, Average, Median, and Maximum Flows for the Cumberland River at the Harlan Gage (USGS Gage 03401000) for Water Years 1941-2021

Month	Minimum Flow (cfs)	Average Flow (cfs)	Median Flow (cfs)	Maximum Flow (cfs)
January	64	1,143	722	2,767
February	105	1,374	863	3,692
March	334	1,453	960	4,148
April	211	1,099	728	2,986
May	119	758	486	2,003
June	76	390	242	1,224
July	21	312	170	1,414
August	40	246	134	1,202
September	14	153	82	1,018
October	9	201	92	1,129
November	26	466	224	2,004
December	44	944	573	2,704

Source: USGS 2022a

5.2.4 Flow Duration Curves

Provided in Figure 5-8 and Figure 5-9 are monthly flow duration curves for the Cumberland River, using flow data obtained from the Harlan gage (USGS gage 03401000) for the period October 1, 1940 to September 30, 2021 (i.e., water years 1941-2021). Peak flows typically occur in January through May and have historically exceeded 20,000 cfs. Low flows typically occur during the late summer and fall months and are frequently less than 100 cfs. Flow duration curves are not included for Tom Fork or Dry Branch as these data do not exist.

As the unconstructed Project is a closed loop pumped storage facility, streamflow does not impact the Project's dependable capacity.

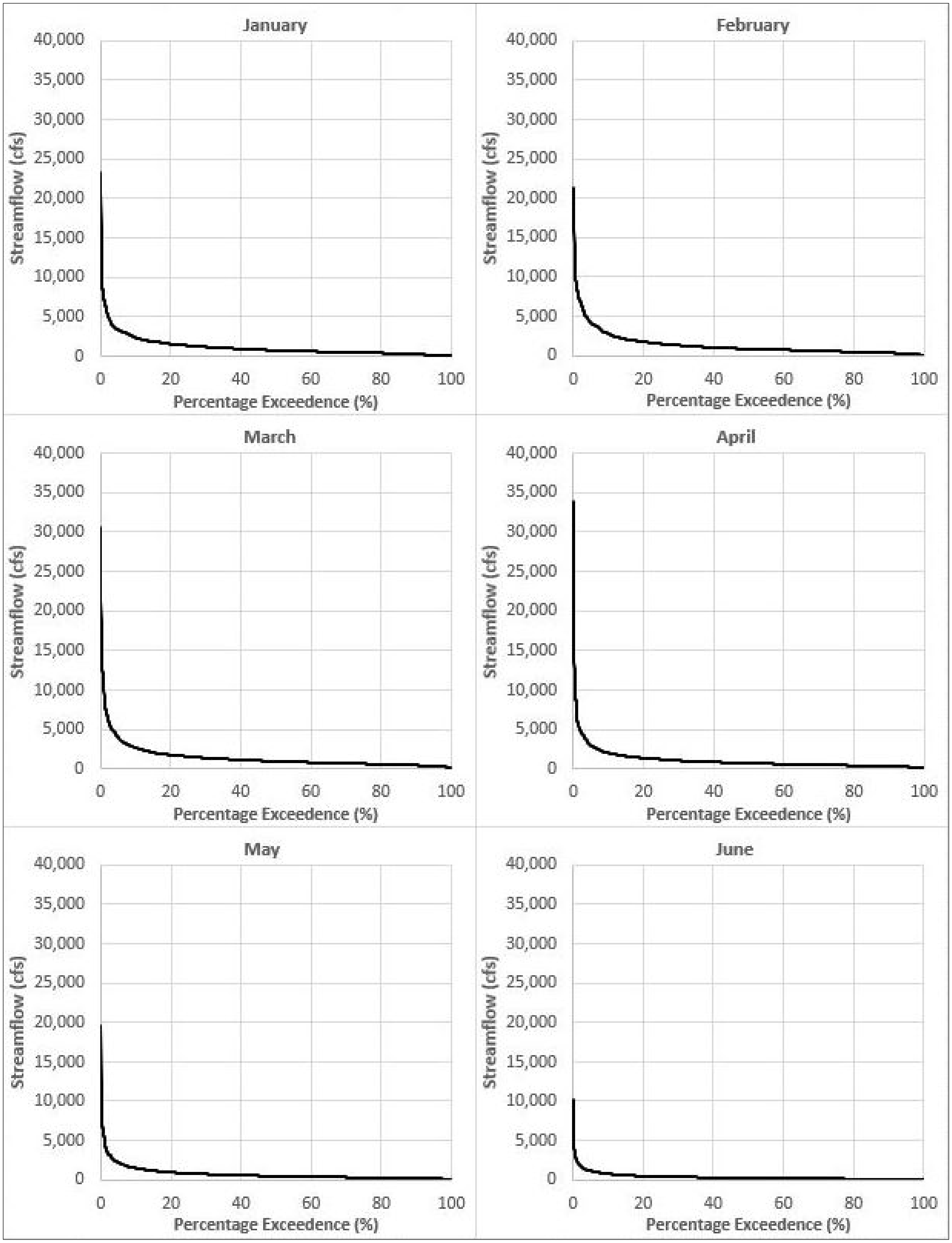

Figure 5-8: January through June Flow Duration Curves for the Cumberland River at the Harlan Gage

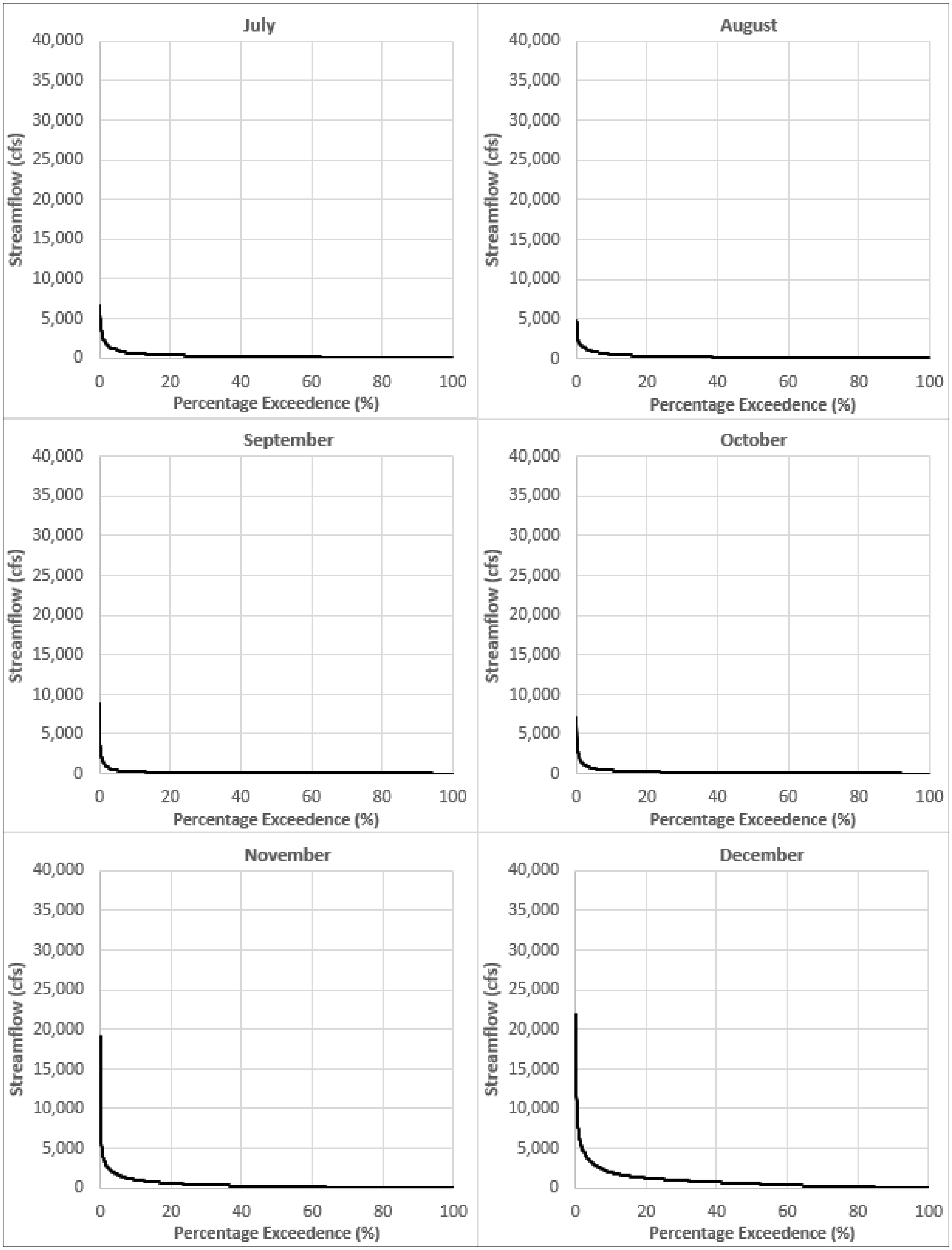

Figure 5-9: July through December Flow Duration Curves for the Cumberland River at the Harlan Gage

5.2.5 Existing and Proposed Uses of Waters

The proposed Project consists of construction of an upper and lower reservoir to store water for the purpose of electric power generation. Reservoir recharge water will be sourced from Tom Fork to account for evaporative water loss and minimal quantities of seepage.

5.2.6 Existing Instream Flow Uses

The Cumberland River in the Project Vicinity is designated for both warm water aquatic habitat and primary contact recreation (KAR 2020). Per the Kentucky Division of Water, Water Maps Portal Source Water Protection Viewer (Kentucky Division of Water 2022), there are no permitted water withdrawals from the Cumberland River or its tributaries within the Project Vicinity.

5.2.7 Federally-Approved Water Quality Standards

Applicable water quality standards for the Cumberland River and its tributaries (i.e., Tom Fork and Dry Branch) in the Project Vicinity are summarized in Table 5-5. This table outlines the warm water aquatic habitat water quality standards.

Primary Contact Recreation standards are also applicable to the Cumberland River in the Project Vicinity between May 1st through October 31st. These standards state that the *E. coli* content shall not exceed 130 colonies per 100 milliliters (ml) as a geometric mean based on not less than five samples taken during a thirty-day period. The *E. coli* content also shall not exceed 240 colonies per 100 ml in twenty percent or more of all samples taken during a thirty-day period. Fecal coliform criteria applies during the remainder of the year and shall not exceed 1,000 colonies per 100 ml as a thirty-day geometric mean based on not less than five samples nor exceed 2,000 colonies per 100 ml in twenty percent or more of all samples taken during a thirty-day period. pH shall be between six to nine and shall not change more than one pH unit within this range over a period of 24 hours.

Table 5-5: Summary of the Warm Water Aquatic Habitat Water Quality Standards Applicable to the Cumberland River in the Project Vicinity

Parameter	Warm Water Aquatic Habitat Water Quality Standard
pH	6-9
Temperature Celsius (°C)	<31.7
Dissolved Oxygen (DO) milligrams per liter (mg/L)	5
Total Dissolved Solids or Specific Conductance	Shall not be changed to the extent that the indigenous aquatic community is adversely affected
Settleable Solids	The addition of settleable solids that may alter the stream bottom so as to adversely affect productive aquatic communities shall be prohibited
Ammonia Un-ionized (mg/L)	<0.05 mg/L

Source: KAR 2020

5.2.8 Water Quality Data

The Cumberland River in the Project Vicinity is not listed on the 303d list for impaired water bodies. Two reaches of the Cumberland River upstream of the Project are listed on the 303d list for impaired water bodies. The stretch from RM 677 to 688.9 is listed for *E. coli* as Category 5, which means the parameter does not meet water quality standard(s), and that parameter is a pollutant with a total maximum daily load (TMDL) required. This listed stretch and parameter have been identified as a high priority. (Kentucky EEC 2022). The stretch from RM 668.3 to 675.80 is listed for specific conductivity as Category 5, with a TMDL required. This listed stretch and parameter have been identified as a low priority. (Kentucky EEC 2022).

Water quality data for the Cumberland River near the Project area are available about 20 miles upstream of the Project Vicinity at the town of Harlan (21KY_WQX-CRW022) and about 8 miles downstream at the State Highway 1344 Bridge (21KY_WQX-PRI086). The ranges of water quality data collected for select parameters are summarized in Table 5-6. Water quality data are not available for Tom Fork or Dry Branch.

Table 5-6: Water Quality Data for Select Parameters at Two Locations in the Cumberland River

Parameter	Cumberland River at Harlan (21KY_WQX-CRW022)	Cumberland River at 1344 Bridge (21KY_WQX-PRI086)
Period of Record Range	2010-2016	2008-2016
Dissolved Oxygen	4.9-15.3 mg/L	4.8-14.8
Conductivity	176-615 microsiemens per centimeter (µS/cm)	50-811 uS/cm
pH	6.78-8.24	6.95-8.75
Temperature	0.6-24.1 degrees °C	2.4-27.9 °C
Total suspended solids	4-1,110 mg/L	2-890 mg/L
Turbidity	2.9-24.1 Nephelometric Turbidity Units (NTU)	0.1-260 NTU
E. coli	69.7-416 colony-forming unit (CFU)	4-1,986 CFU

Source: National Water Quality Monitoring Council 2022

5.2.9 Proposed Project Reservoirs

The preliminary specifications of the Project reservoirs are provided in Section 4.3.

5.2.10 Gradient of Downstream Reaches

The gradient of the Cumberland River in the Project Vicinity is approximately 0.057% between river mile 674 and 675 and approximately 0.076% between river mile 675 and 676. The average gradient of Tom Fork downstream of the preliminary Lower Reservoir to the confluence with the Cumberland River is approximately 5%.

5.2.11 Groundwater

The Breathitt Formation (previously described in Section 5.1) in Bell County yields more than 500 gallons per day to more than three-quarters of the wells drilled in valley bottoms, more than 500 gallons per day to about three-quarters of the wells on hillsides, and more than 100 gallons per day to nearly all wells on ridges. Sandstones yield water to most wells. Shales also yield water to many wells, and coal yields water to few. Near-vertical joints and openings along bedding planes yield most of the water to wells. (Kilburn et al. 1962).

Groundwater flow in the Project region occurs primarily through fractures and openings along bedding planes, which permits more rapid movement of water than water flowing through the pore spaces of predominantly sandstone bedrock. The sandstone zones are sometimes associated with impermeable claystone units that occur near coal seams and shales that limit the vertical movement of water. These strata cause the water being transmitted by the sandstone and/or fractures to move laterally to the hillsides where the water flows to the surface or until it can move vertically downward again when it encounters a fracture penetrating a confining bed. Mining activities break up the strata over and under the coal seams by blasting operations and increase the permeability of the material, allowing for faster movement of groundwater. Groundwater movement is characterized by stepping movement from the ridge tops to the valley bottoms. Also, wells are generally recharged by direct connection to infiltration from the surface areas directly above and near the wells. (Nally & Hamilton Enterprises, Inc. 2007).

Surface and ground water quality sampling results indicated that there were no adverse effects to the water quality of surface and groundwater systems prior to the permit 807-0372 mining operation and that there had been no adverse effects from previous surface or deep mining. (Nally & Hamilton Enterprises, Inc. 2010).

5.2.12 References

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5.3 Fish and Aquatic Resources

18 CFR 5.6(d)(3)(iv) requires "A description of the fish and other aquatic resources, including invasive species, in the project vicinity. This section must discuss the existing fish and macroinvertebrate communities, including the presence or absence of anadromous, catadromous, or migratory fish, and any known or potential upstream or downstream impacts of the project on the aquatic community. Components of the description must include: (A) Identification of existing fish and aquatic communities; (B) Identification of any essential fish habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act and established by the National Marine Fisheries Service; and (C) Temporal and spatial distribution of fish and aquatic communities and any associated trends with respect to: (1) Species and life stage composition; (2) Standing crop; (3) Age and growth data; (4) Spawning run timing; and (5) The extent and location of spawning, rearing, feeding, and wintering habitat."

5.3.1 Existing Fish and Aquatic Communities

The Project Vicinity includes the Upper Cumberland River, approximately 659 river miles upstream of its confluence with the Ohio River. Habitat in this Upper Cumberland River consists mainly of riffles and runs with cobble, boulder, and bedrock substrates (Kentucky Department of Fish and Wildlife Resources [Kentucky DFWR] 2022b).

Within the Upper Cumberland River Basin, 58 species of fish currently or historically occur (Table 5-7). No information describing the fish community within the Project Vicinity (including Cumberland River/Tom Fork) was available. However, in 2017, Kentucky DFWR conducted an electrofishing survey in the Cumberland River approximately 37 miles downstream of the proposed Project location. The survey, which targeted sportfish species, yield 66 fish during 1.5 hours of effort. Overall catch per unit effort (CPUE) was 44 fish/hour. The most abundant species captured were channel catfish, flathead catfish, and spotted bass (Kentucky DFWR 2018). Table 5-8 presents the results of the 2017 survey (Kentucky DFWR 2018). Due to its proximity, the sportfish community in the Cumberland River within the Project Vicinity is expected to be relatively similar to that which Kentucky DFWR found in its survey downstream.

The Kentucky DFWR established a conservation and management plan to conserve and enhance existing native walleye populations in Kentucky (Kentucky DFWR 2014). Between 2014 and 2020, Kentucky DFWR has stocked an average of approximately 26,000 fingerling native strain walleye in the Upper Cumberland River as part of these conservation and management efforts (Kentucky DFWR 2014, 2015, 2016, 2017, 2018, 2019, 2020).

Table 5-7: List of Fish Occurring in the Upper Cumberland River Basin

Family	Common Name	Scientific Name
Petromyzontidae	least brook lamprey	*Lampetra aepyptera*
Acipenseridae	lake sturgeon	*Acipenser fulvescens*
Atherinopsidae	brook silverside	*Labidesthes sicculus*
Clupeidae	gizzard shad	*Dorosoma cepedianum*
Cyprinidae	blackside dace	*Chrosomus cumberlandensis*
	bluntnose minnow	*Pimephales notatus*
	creek chub	*Semotilus atromaculatus*
	central stoneroller	*Campostoma anomalum*
	fathead minnow	*Pimephales promelas*
	flame chub	*Hemitremia flammea*
	highland shiner	*Notropis micropteryx*
	mimic shiner	*Notropis volucellus*
	river chub	*Nocomis micropogon*
	rosyface shiner	*Notropis rubellus*
	sawfin shiner	*Notropis sp. 4*
	scarlet shiner	*Lythrurus fasciolaris*
	silverjaw minnow	*Notropis buccatus*
	southern redbelly dace	*Chrosomus erythrogaster*
	spotfin shiner	*Cyprinella spiloptera*
	steelcolor shiner	*Cyprinella whipplei*
	striped shiner	*Luxilus chrysocephalus*
	warpaint shiner	*Luxilus coccogenis*
	western blacknose dace	*Rhinichthys obtusus*
	whitetail shiner	*Cyprinella galactura*
Catostomidae	black redhorse	*Moxostoma duquesnei*
	golden redhorse	*Moxostoma erythrurum*
	northern hog sucker	*Hypentelium nigricans*
	white sucker	*Catostomus commersonii*
Ictaluridae	black bullhead	*Ameiurus melas*
	brindled madtom	*Noturus miurus*
	yellow bullhead	*Ameiurus natalis*
	channel catfish	*Ictalurus punctatus*
	flathead catfish	*Pylodictis olivaris*
Poeciliidae	western mosquitofish	*Gambusia affinis*
Cottidae	banded sculpin	*Cottus carolinae*
Moronidae	white bass	*Morone chrysops*
Centrarchidae	bluegill	*Lepomis macrochirus*
	green sunfish	*Lepomis cyanellus*
	largemouth bass	*Micropterus salmoides*

Family	Common Name	Scientific Name
	longear sunfish	*Lepomis megalotis*
	redear sunfish	*Lepomis microlophus*
	rock bass	*Ambloplites rupestris*
	smallmouth bass	*Micropterus dolomieu*
	spotted bass	*Micropterus punctulatus*
	warmouth	*Lepomis gulosus*
	white crappie	*Pomoxis annularis*
Percidae	arrow darter	*Etheostoma sagitta*
	blackside darter	*Percina maculata*
	Cumberland darter	*Etheostoma susanae*
	emerald darter	*Etheostoma baileyi*
	greenside darter	*Etheostoma blennioides*
	logperch	*Percina caprodes*
	olive darter	*Percina squamata*
	rainbow darter	*Etheostoma caeruleum*
	redline darter	*Etheostoma rufilineatum*
	snubnose darter	*Etheostoma simoterum*
	stripetail darter	*Etheostoma kennicotti*
	walleye	*Sander vitreus*

Source: Natureserve 2010

Table 5-8: Fish Captured During 2017 Survey on the Upper Cumberland River at Barbourville, Kentucky

Common Name	Number Captured	CPUE (fish/hr)
smallmouth bass	3	2.0
spotted bass	11	7.3
bluegill	1	0.7
longear sunfish	4	2.7
redbreast sunfish	1	0.7
green sunfish	1	0.7
black crappie	1	0.7
walleye	6	4.0
channel catfish	27	18.0
flathead catfish	11	7.3
Total	**66**	**44.1**

Source: Kentucky DFWR 2018

5.3.2 Temporal and Spatial Distribution of Aquatic Communities

Most seasonal movement of fish are associated with spawning activities and correlations with water temperatures and available seasonal refugia. Although there are no diadromous fish species present in the upper Cumberland River, some fish species present may exhibit seasonal movements or migrations within the river to locate foraging or spawning habitat. Examples of such species include white sucker and walleye (Jenkins and Burkhead 1993, Etnier and Starnes 1993).

Cumberland River habitat near the proposed Project appears to be relatively homogenous (i.e., shallow, flowing riffles/runs over cobble, boulder, and bedrock) (Kentucky DFWR 2022b). Accordingly, the fish assemblage present would be expected to consist of smaller individuals and lotic species that prefer those habitats, such as minnows, suckers, and darters. Further downstream of the Project Vicinity on the Cumberland River, as habitat becomes more diverse with deeper water and the presence of pools, a more diverse range of fish species and sizes would be expected, including an increased prevalence of habitat generalist and more lentic species (Jenkins and Burkhead 1993).

5.3.3 Invasive and Nonindigenous Fish and Aquatic Species

The nonindigenous aquatic species known to occur in Upper Cumberland River Basin (HUC6 051301) are listed in Table 5-9. Nonindigenous aquatic species are defined as an aquatic species that has entered a body of water or aquatic ecosystem outside of its historic or native range. Invasive carp are known to occur in the Cumberland River downstream of the Project (Kentucky DFWR 2022a).

Table 5-9: Nonindigenous Aquatic Species known to occur in Upper Cumberland River Basin

Scientific Name	Common Name	Species Origin[1]	Native Habitat
Coelenterates-Hydrozoans			
Craspedacusta sowerbyi	freshwater jellyfish	Exotic	Freshwater
Crustaceans-Crayfish			
Cambarellus shufeldtii	Cajun dwarf crayfish	Native	Freshwater
Cambarus cumberlandensis	Cumberland crayfish	Native	Freshwater
Faxonius rusticus	rusty crayfish	Native	Freshwater
Fishes			
Alosa chrysochloris	skipjack herring	Native	Freshwater-Marine
Alosa pseudoharengus	alewife	Native	Freshwater-Marine
Carassius auratus	goldfish	Exotic	Freshwater
Culaea inconstans	brook Stickleback	Native	Freshwater
Cyprinus carpio	common carp	Exotic	Freshwater
Dorosoma cepedianum	gizzard shad	Native	Freshwater-Marine
Dorosoma petenense	threadfin shad	Native	Freshwater-Marine
Esox masquinongy	muskellunge	Native	Freshwater

Scientific Name	Common Name	Species Origin[1]	Native Habitat
Fundulus catenatus	northern studfish	Native	Freshwater
Gambusia affinis	western mosquitofish	Native	Freshwater
Lepomis auritus	redbreast sunfish	Native	Freshwater
Lepomis gibbosus	pumpkinseed	Native	Freshwater
Lepomis gulosus	warmouth	Native	Freshwater
Lepomis microlophus	redear sunfish	Native	Freshwater
Lepomis miniatus	redspotted sunfish	Native	Freshwater
Micropterus coosae	redeye bass (sensu lato)	Native	Freshwater
Micropterus dolomieu	smallmouth bass	Native	Freshwater
Micropterus punctulatus	spotted bass	Native	Freshwater
Micropterus salmoides	largemouth bass	Native	Freshwater
Morone saxatilis	striped bass	Native	Freshwater-Marine
Moxostoma lachneri	greater jumprock	Native	Freshwater
Notemigonus crysoleucas	golden shiner	Native	Freshwater
Oncorhynchus clarkii	cutthroat trout	Native	Freshwater
Oncorhynchus kisutch	coho salmon	Native	Freshwater-Marine
Oncorhynchus mykiss	rainbow trout	Native	Freshwater-Marine
Perca flavescens	yellow perch	Native	Freshwater
Piaractus brachypomus	pirapitinga, red-bellied pacu	Exotic	Freshwater
Pimephales promelas	fathead minnow	Native	Freshwater
Pomoxis annularis	white crappie	Native	Freshwater
Pomoxis nigromaculatus	black crappie	Native	Freshwater
Salmo trutta	brown trout	Exotic	Freshwater
Salvelinus fontinalis	brook trout	Native	Freshwater
Salvelinus namaycush	lake trout	Native	Freshwater
Sander canadensis Ã— vitreus	saugeye	Native Hybrid	Freshwater
Sander vitreus	walleye	Native	Freshwater
Tinca tinca	tench	Exotic	Freshwater
Mollusks-Bivalves			
Corbicula fluminea	Asian clam	Exotic	Freshwater
Dreissena polymorpha	zebra mussel	Exotic	Freshwater
Plants			
Acorus calamus	single-vein sweetflag	Exotic	Freshwater
Alternanthera philoxeroides	alligatorweed	Exotic	Freshwater
Egeria densa	Brazilian waterweed	Exotic	Freshwater
Lythrum salicaria	purple loosestrife	Exotic	Freshwater
Murdannia keisak	marsh dewflower	Exotic	Freshwater
Myriophyllum aquaticum	parrot feather	Exotic	Freshwater
Myriophyllum spicatum	Eurasian watermilfoil	Exotic	Freshwater-Brackish
Najas minor	brittle waternymph	Exotic	Freshwater
Nasturtium officinale	water-cress	Exotic	Freshwater
Potamogeton crispus	curly-leaf pondweed	Exotic	Freshwater
Reptiles			
Alligator mississippiensis	American alligator	Native	Freshwater
Trachemys scripta troostii	Cumberland Slider	Native	Freshwater

Source: USGS 2022

[1] Native = native to the United States
Exotic = not native to the United States.
Native Hybrid = hybrid of two species native to the United States.

5.3.4 Benthic Macroinvertebrates and Freshwater Mussels

A distribution checklist of Kentucky mussels (Cicerello et al. 1991) indicated that 11 mussel species have been documented within the Upper Cumberland River Basin upstream of Cumberland Falls. Cumberland Falls is located at approximately RM 548 of the Cumberland River, or approximately 111 river miles below the Project. Table 5-10 provides a list of these species.

The Kentucky Department of Environmental Protection (Kentucky DEP) Division of Water monitors physical, chemical and biological elements of waterbodies to assess the quality of the aquatic environment of waterbodies across the state. Kentucky DEP uses combinations of algal, macroinvertebrate and fish community structure as indicators of waterbody health. Macroinvertebrate assemblages have proven to be useful in detecting even subtle changes in habitat and water quality. Table 5-11 presents the top 15 genera collected from reference wadeable streams in the mountain bioregion. (Pond et al. 2003).

Table 5-10: Mussel Species Known to Occur in the Upper Cumberland River Basin Upstream of Cumberland Falls

Scientific Name	Common Name
Alasmidonta atropurpurea	Cumberland elktoe
Alasmidonta marginata	elktoe
Alasmidonta viridis	slippershell mussel
Anodontoides ferussacianius	cylindrical papershell
Elliptio dilatate	spike
Lampsilis cardium	plain pocketbook
Lampsilis fasciola	wavy-rayed lampmussel
Lampsilis ovata	pocketbook
Ortmanniana pectorosa	pheasantshell
Strophitus undulatus	squawfoot
Toxolasma parvum	lilliput

Source: Cicerello et al. 1991

Table 5-11: Top 15 Genera Collected from Reference Wadeable Streams in the Mountain Bioregion

Genus	Relative Abundance	Relative Frequency	Relative Importance*
Stenonema (5 spp.)	9.3	97.3	106.6
Isonychia sp.	10.7	89.2	99.9
Cheumatopsyche sp.	7.5	91.9	99.4
Acroneuria (3 spp.)	4.4	83.8	88.2
Optioservus (2 spp.)	4.0	81.1	85.1
Nigronia (2 spp.)	3.5	75.7	79.2
Ceratopsyche (3 spp.)	4.8	73.0	77.8
Baetis (4 spp.)	2.6	67.6	70.2
Leuctra sp.	2.4	62.2	64.6
Polypedilum (4 spp.)	2.2	62.2	64.4
Psephenus herricki	3.2	59.5	62.6
Chimarra (2 spp.)	5.5	56.8	62.2
Atherix sp.	2.5	54.1	56.5
Acentrella (spp.)	1.1	51.4	52.5
Hydropsyche (3 spp.)	1.7	43.2	44.9

Source: Pond et al. 2003

* Mean relative abundance + relative frequency = relative importance

5.3.5 Essential Fish Habitat

There are no federal fishery management plans for diadromous fish species that occupy the freshwater, inland regions of Kentucky/Tennessee; therefore, there is no designated Essential Fish Habitat (EFH) near the proposed Project.

5.3.6 References

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5.4 Terrestrial Wildlife and Botanical Resources

18 CFR 5.6(d)(3)(v) requires "A description of the wildlife and botanical resources, including invasive species, in the project vicinity. Components of this description must include: (A) Upland habitat(s) in the project vicinity, including the project's transmission line corridor or right-of-way and a listing of plant and animal species that use the habitat(s); and (B) Temporal or spatial distribution of species considered important because of their commercial, recreational, or cultural value."

5.4.1 Terrestrial Habitats in the Project Vicinity

The Project is located in the Cumberland Mountain Thrust Block (Level IV ecoregion 69e) within the Central Appalachians ecoregion (Level III ecoregion 69), which consists of primarily forested high, steep ridges, hills, coves, narrow valleys, and the Pine Mountain Overthrust Fault (Woods et al. 2002). In general, maximum elevations are greater in this ecoregion than elsewhere in Kentucky. Forest composition is highly variable and is influenced by local aspect, slope position and gradient, topographic shading, soil moisture, and past land usage.

Because of this variation in local landscapes and variety of land uses throughout the area (i.e., extensive surface and underground coal mining, logging, and conversion to pastureland), the composition of vegetative communities is highly variable on a broad scale. In general, the ecoregion was formerly dominated by American chestnut on drier sites. Following logging and the disappearance of chestnut, second-growth forest typically contain white oak (*Quercus alba*), black oak (*Quercus velutina*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), yellow poplar (*Liriodendron tulipifera*), black walnut (*Juglans nigra*), black locust (*Robinia pseudoacacia*), hickory (*Carya spp*), white ash (*Fraxinus americana*), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), buckeye (*Aesculus spp*), Eastern hemlock (*Tsuga canadensis*), and American basswood (*Tilia americana*) (Woods et al. 2002). On mesic sites, forests are mixed; dominated by American beech, yellow poplar, sugar maple, and white oak, with co-dominants of ash, black walnut, buckeye, basswood, northern red oak (*Quercus rubra*), and others. On drier sites, white oak and hickories dominate the landscape. Pines (*Pinus spp*) tend to dominate areas with shallow, sandy soils on steep-dipping sandstone. Species composition within shady gorges feature eastern hemlock and various magnolias (*Magnolia spp*) with an understory of rhododendrons (*Rhododendron spp*) (Woods et al. 2002).

Conversely, areas heavily impacted by anthropogenic disturbances (i.e., mining), are often dominated by invasive shrubs, forbs, grasses, and early-successional tree species (Kentucky EEC 2022). Invasive species are discussed in Section 5.4.3. Common forbs on previously disturbed sites include narrow-leaf pinweed (*Lechea tenuifolia*), Ozark tickseed sunflower (*bidens polylepis*), and Pennsylvania smartweed (polygonum pensylvanicum). Common grasses include fescues (*Festuca spp.*) and oatgrass (*Danthonia spp*). Common early-successional tree species include Virginia pine (*Pinus virginiana*) and black tupelo (*Nyssa sylvatica*). (Reiss 1986)

Botanical species observed during a site visit in May 2022, are included in Table 5-12 below.

Table 5-12: Botanical Species Observed in Project Vicinity

Scientific Name	Common Name	Native and/or Invasive
Acer negundo	box elder	Native
Ailanthus altissima	tree-of-heaven	Non-native
Arctium minus	burdock	Non-native
Catalpa speciosa	northern catalpa	Native
Cercis canadensis	redbud	Native
Dactylis glomerata	orchardgrass	Non-native
Elaeagnus umbellata	autumn olive	Non-native
Festuca spp.	Festuca	Both
Juniperus virginiana	eastern red cedar	Native
Lespedeza spp.	Lespedeza	Both
Leucanthemum vulgare	oxeye daisy	Non-native
Liquidambar styraciflua	sweetgum	Native
Lonicera spp.	Honeysuckle	Both
Melilotus officinalis	yellow sweet clover	Non-native
Penstemon spp.	Penstemon	Both
Platanus occidentalis	American sycamore	Native
Pueraria lobata	kudzu	Non-native
Quercus alba	white oak	Native
Robinia pseudoacacia	black locust	Native
Rosa multiflora	multiflora rose	Non-native
Trifolium pratense	red clover	Non-native
Toxicodendron radicans	poison ivy	Native

Source: Kleinschmidt Associates 2022. This list is based on observations from a May 2022 site visit, not a formal botanical survey.

5.4.2 Terrestrial Wildlife Resources in the Project Vicinity

According to the Kentucky DFWR, wildlife with known occurrences within Bell County includes 178 birds, 47 mammals, 31 reptiles, and 33 amphibians. Similar to vegetative communities, wildlife occurrence and distribution varies by habitat, local aspect, and elevation. Reptile species occurring within Bell County include various turtles, snakes, skinks, and lizards. Amphibians include a variety of frogs, toads, and salamanders. Mammal species within Bell County include small mammals such as shrews, voles, mice, rabbits and bats; medium mammals such as red fox, gray fox, river otter, and beaver; and large mammals such as black bear, white-tailed deer, and elk. (Kentucky DWFR 2022).

Bell County is within the Kentucky Elk Restoration Zone, which encompasses 16 counties in the Cumberland Plateau physiographic ecoregion (Kentucky DFWR 2015). Initial research following the elk reintroduction in Kentucky demonstrated that elk favored the food resources on recently reclaimed mines sites and used the adjacent forests for cover and refuge (Larkin et al. 2001, Wichrowski et al. 2005, Schneider et al. 2006, Olsson et al. 2007). However, as grassland reclamation progresses, forage quality generally degrades over time as the newly planted wheat, rye, and clover transition to less-nutritious, competitive, or invasive species like lespedeza or fescue (Kentucky DFWR 2015).

Wild pigs (*Sus scrofa*) are a non-native invasive species known to Kentucky and have the potential to occur in the Project Vicinity. Wild pigs in Kentucky are the result of released domestic pigs and hybrids of domestic and Eurasian boar. They are highly adaptable to a variety of habitats and have a high reproductive potential, making population control difficult (Kentucky DFWR 2022).

5.4.3 Invasive Plants Species

Lands in the Central Appalachians ecoregion have been subject to disturbance by activities such as mining, logging, and fire, loss of American chestnut, and invasion of southern pine beetles, which have allowed for the spread of invasive species. These previously-disturbed landscapes exhibit altered vegetative communities, which are dominated by introduced species, like multiflora rose (*Rosa multiflora*), autumn olive (*Elaeagnus umbellata*), princess tree (*Paulownia tomentosa*), and early-successional native species such as black locust and red maple (Kentucky EEC 2022).

In 2008, the Kentucky DFWR developed a Terrestrial Nuisance Species Management Plan. As described in the plan, terrestrial nuisance species (TNS) are non-native species that threaten the diversity or abundance of native terrestrial species or the ecological stability of ecosystems, or commercial, agricultural, or recreational activities dependent on such ecosystems. Kentucky DFWR produced a list of the most problematic TNS in Kentucky, which included six microorganisms, four insects, two birds, one mammal, and 39 plant species (Kentucky DFWR 2008).

In 2000, the Kentucky Invasive Plant Council was established as a state chapter of the Southeast Exotic Pest Plant Council and works to serve as a technical support resource on invasive species in Kentucky, facilitate the exchange of information concerning the management and control of exotic invasive plant species, and support research and monitoring of those species (Kentucky IPC 2019). A list of exotic invasive plant species of Kentucky and associated threat category is provided in Table 5-13.

Table 5-13: Threat Category[1] of Exotic Invasive Plants Species Known to Occur in Kentucky

Scientific Name	Common Name	Terrestrial Nuisance Species?
Category 1 – Severe Threat		
Achyranthes japonica	Japanese chaff flower	
Ailanthus altissima	tree-of-heaven	Yes
Alliaria petiolata	garlic mustard	Yes
Ampelopsis brevipedunculata	Porcelain berry	
Arthraxon hispidus	hairy jointgrass	
Carduus nutans	musk thistle	Yes
Celastrus orbiculatus	oriental bittersweet	Yes
Cirsium arvense	Canada thistle	
Clematis terniflora	leatherleaf clematis	
Conium maculatum	poison hemlock	Yes
Coronilla varia	crown vetch	Yes
Dioscorea oppositifolia	Chinese yam	Yes
Elaeagnus umbellata	autumn olive	Yes
Euonymus alatus	winged euonymus, burning bush	Yes
Euonymus fortunei	winter creeper	Yes
Festuca arundinacea (=Lolium arundinaceum)	Kentucky 31 fescue	Yes
Glechoma hederacea	ground ivy	
Lespedeza cuneata	sericea lespedeza	Yes
Lespedeza stipulacea (=Kummerowia)	Korean lespedeza	Yes
Ligustrum sinense, L. vulgare	Chinese privet, European privet	Yes
Lonicera japonica	Japanese honeysuckle	Yes
Lonicera maackii, L. fragrantissima, L. standishii	bush honeysuckles	Yes
Lysimachia nummularia	moneywort	
Lythrum salicaria	purple loosestrife	
Melilotus alba	white sweet clover	Yes
Melilotus officinalis	yellow sweet clover	Yes
Microstegium vimineum	Japanese stiltgrass	
Miscanthus sinensis	Chinese silver grass	Yes
Paulownia tomentosa	Princess tree	Yes
Phragmites australis	common reed	
Polygonum cuspidatum	Japanese knotweed	
Pueraria lobata	kudzu	Yes
Pyrus calleryana	callery pear	Yes
Ranunculus ficaria	lesser celandine	Yes
Rhamnus cathartica	European buckthorn	

Scientific Name	Common Name	Terrestrial Nuisance Species?
Rosa multiflora	multiflora rose	Yes
Sorghum halepense	Johnson grass	Yes
Stellaria media	chickweed	Yes
Category 2 – Significant Threat		
Agrostis stolonifera	weeping love grass	
Akebia quinata	akebia	
Albizia julibrissin	mimosa	
Alternanthera philoxeroides	alligatorweed	
Berberis thunbergii	Japanese barberry	
Bromus inermis	smooth bromegrass	Yes
Bromus tectorum, B. japonicus	cheatgrass	Yes
Cardiospermum halicacabum	balloon vine	
Centaurea biebersteinii	spotted knapweed	Yes
Chrysanthemum leucanthemum	ox-eye daisy	
Cirsium vulgare	bull thistle	
Daucus carota	Queen Anne's lace	Yes
Dipsacus sylvestris, D. laciniata	common teasel, cutleaf teasel	
Echinochloa crus-galli	barnyard grass	
Eleusine indica	goose grass	
Galium pedemontanum	cleavers	
Hedera helix	English ivy	
Hemerocallis fulva	day lily	
Humulus japonicus	Japanese hops	
Hydrilla verticillata	hydrilla	
Lespedeza bicolor, L. thunbergii	bicolor lespedeza, shrubby lespedeza	Yes
Lespedeza striata (= Kummerowia)	Japanese clover/Kobe lespedeza	Yes
Medicago lupulina	black medic	
Mentha x piperata	peppermint	
Morus alba	white mulberry	
Mosla dianthera	miniature beefsteak	
Najas minor	water nymph	
Ornithogalum umbellatum	star-of-Bethlehem	
Pastinaca sativa	wild parsnip	
Perilla frutescens	beefsteak	
Poa compressa	Canada bluegrass	
Poa pratensis	Kentucky bluegrass	
Polygonum cespitosum	bunchy knotweed	

Scientific Name	Common Name	Terrestrial Nuisance Species?
Polygonum persicaria	lady's thumb	
Populus alba	white poplar	
Potamogeton crispus	curlyleaf pondweed	
Rhodotyps scandens	Jetbead	
Rorrippa nasturtium-aquaticum	water-cress	
Rubus phoenicolasius	wineberry	
Schedonorus pratensis	meadow fescue	
Setaria faberi	giant foxtail	
Setaria viridis	green foxtail	
Spiraea japonica	Japanese spiraea	
Thlaspi alliaceum	garlic peppergrass	
Tussilago farfara	coltsfoot	
Typha xglacua	cattail	
Ulmus pumila	Siberian elm	
Verbascum thapsus	common mullein	
Vinca minor	lesser periwinkle	
Category 3 – Moderate Threat		
Argopyron repens	quack grass	
Allium vineale	field garlic	
Arctium minus	common burdock	
Arenaria serpyllifolia	thyme-leaf sandwort	
Barbarea vulgaris	yellow rocket	
Bromus arvensis, B. catharcticus,B. hordeaceus, B. racemosus	field bromes	
Buddleja davidii	orange-eye butterfly bush	
Carduus acathoides	spiny plumeless thistle	
Chenopodium album	lamb's quarters	
Cichorium intybus	chicory	
Commelina communis	dayflower	
Convolvulus arvensis	field bindweed	
Duchesnea indica	Indian strawberry	
Duetzia scabra	fuzzy deutzia	
Elaeagnus angustifolia	Russian olive	
Eleusine indica	goose grass	
Fatoua villosa	hairy crabweed	
Hesperis matronalis	dame's rocket	
Holcus lanatus	velvet grass	
Hypericum perforatum	common St. John's-wort	

Scientific Name	Common Name	Terrestrial Nuisance Species?
Ipomoea hederacea	ivy-leafed morning-glory	
Ipomoea purpurea	purple morning-glory	
Iris pseudoacorus	pale yellow iris	
Lamium purpureum	purple deadnettle	
Lamium amplexicaule	henbit	
Lithospermum arvense	corn-gromwell	
Lolium multiflorum	Italian rye	
Lonicera x bella, L. morrowii, L. tartarica	bush honeysuckles	Yes
Lotus corniculatus	birdsfoot trefoil	
Mohonia bealei	leatherleaf mahonia	
Mentha spicata	spearmint	
Nepeta cataria	catnip	
Oxalis stricta (= O. europea)	common yellow wood-sorrel	
Paspalum dilatatum	dallisgrass	
Phyllostachys aura	golden bamboo	
Poa annua	speargrass	
Potentilla recta	sulphur five-fingers	
Prunus mahalab	mahalab cherry	
Ranunculus bulbosus	bulbous buttercup	
Rumex acetosella	dock, sheep sorrel	
Solanum dulcamara	bitter nightshade	
Thlaspi perfoliatum	field cress	
Torillis arvensis, T. japonica	hedge parsley	
Wisteria sinensis, W. floribunda, W. x formosa	exotic wisterias	

[1] Threat Categories and Descriptions (Kentucky EPPC 2013)

- Category 1 – Severe Threat: Exotic plant species which possess characteristics of invasive species and spread easily into native plant communities and displace native vegetation; includes species which are or could become widespread in Kentucky.
- Category 2 – Significant Threat: Exotic plant species which possess some invasive characteristics but have less impact of native plant communities; may have the capacity to invade natural communities along disturbance corridors, or to spread from stands in disturbed sites in undisturbed areas but have fewer characteristics of invasive species than Category 1.
- Category 3 – Moderate Threat: Exotic plant species which seem to principally spread and remain in disturbed corridors, not readily invading natural areas; also some agronomic weeds.

5.4.4 References

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5.5 Wetlands, Riparian, and Littoral Habitat

18 CFR 5.6(d)(3)(vi) requires "Description of floodplains, wetlands, riparian, and littoral habitat (1) List of plant and animal species using the habitat (2) Map of wetlands, riparian and littoral habitat (3) Acreage estimate for each type of land including variability connected to project operations."

5.5.1 Overview

The U.S. Fish and Wildlife Service (USFWS) classification scheme for wetlands serves as the national standard for wetland classification and has been used to classify wetlands appearing in the National Wetlands Inventory (NWI) (USFWS 2022). The NWI coverage is developed from aerial photography. USFWS defines wetlands as: "*...lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. For the purpose of the classification, wetlands must have one or more of these three attributes: (1) at least periodically, the land must support predominantly wetland plants; (2) the substrate is predominantly undrained hydric soil; and (3) rocky, gravelly, or sandy areas that are saturated with or covered by shallow water at some time during the growing season.*"

Information regarding the location and spatial extent of wetland resources in the Project Vicinity and Preliminary Project Boundary was obtained from the NWI. The mapped NWI features in the Project Vicinity are presented in Figure 5-10 and are listed in Table 5-14. Information regarding floodplains in the Project Vicinity was obtained using Federal Emergency Management Agency (FEMA) flood mapping, as shown in Figure 5-11. As shown, FEMA mapped floodways in the Project Vicinity are primarily associated with the Cumberland River. At the preliminary Lower Reservoir, there is a narrow section closely along Tom Fork that is mapped as a 1% annual chance flood hazard.

Table 5-14: USFWS NWI Mapped Wetlands in the Project Vicinity and Preliminary Project Boundary

NWI Wetland Type	Acres in the Project Vicinity	Acres in the Preliminary Project Boundary
Freshwater Emergent Wetland	3.9	0
Freshwater Forested/Shrub Wetland	30.5	0
Freshwater Pond	19.7	1.8
Riverine	139.3	2.5

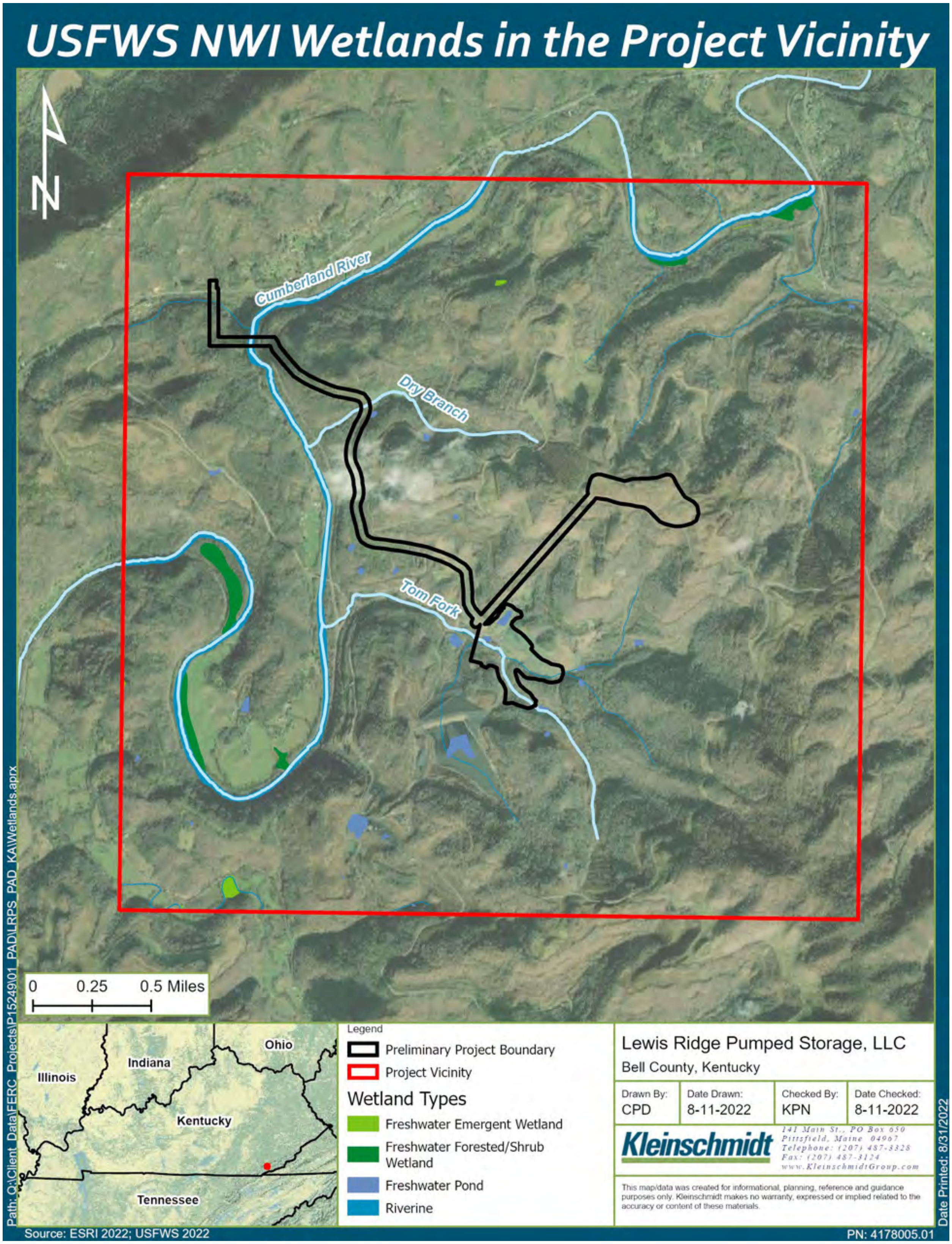

Figure 5-10: USFWS NWI Wetlands in the Project Vicinity

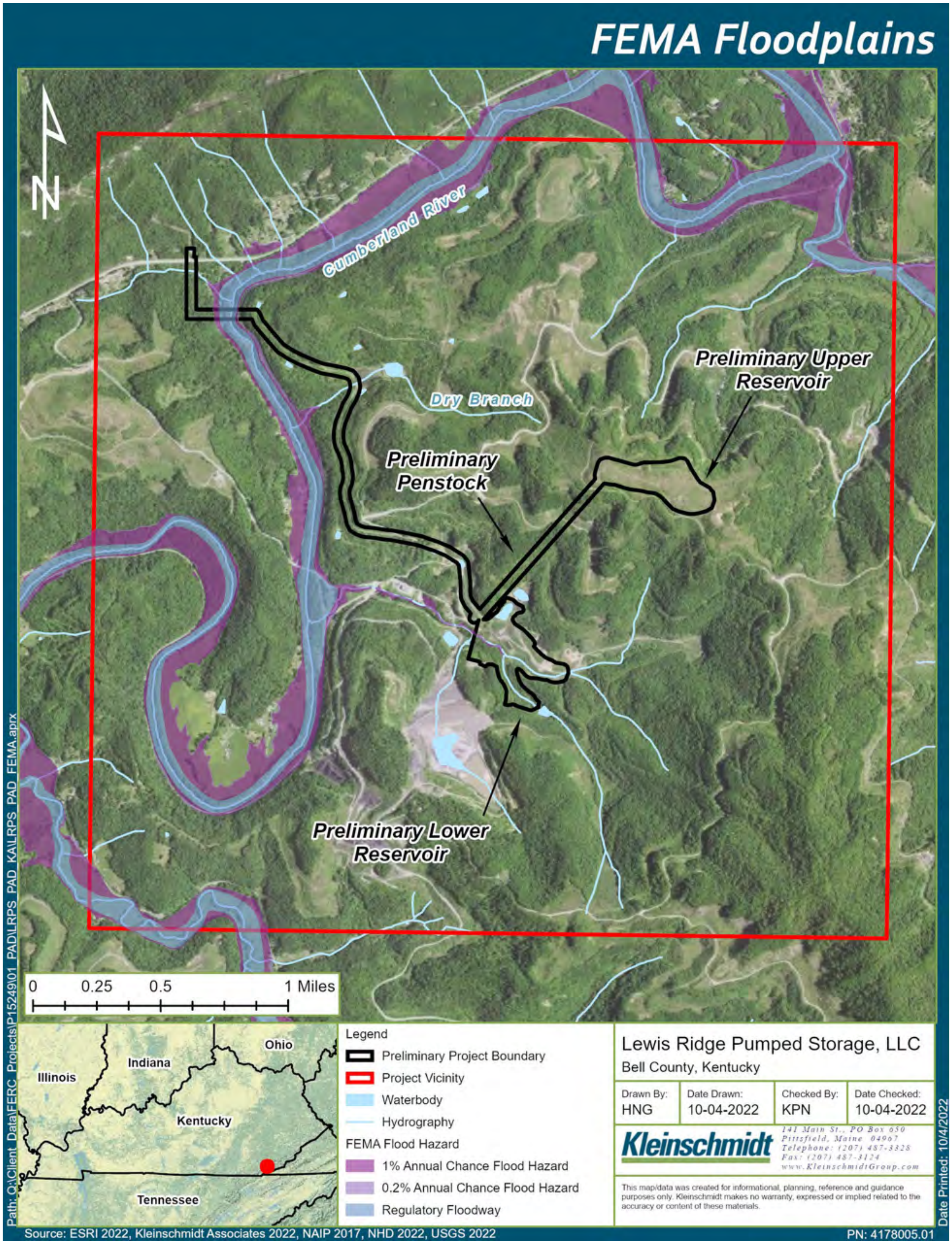

Figure 5-11: FEMA Mapped Floodplain Areas in the Project Vicinity

5.5.2 Riparian and Littoral Habitat

Riparian habitat is located along streams, rivers, and lakes, and provides important ecosystem functions related to hydrology and flooding, nutrient cycling, and plant and wildlife habitat (Mitsch and Gosselink 2000). The littoral zone acts as an interface between the open water aquatic environment and the terrestrial environment (Wetzel 2001). The size and extent of the littoral zone within a waterbody varies depending upon geomorphology and sedimentation within the aquatic system (Wetzel 2001). Riparian habitat in the Project Vicinity includes land adjacent to the Cumberland River as well as several associated tributaries. These riparian habitats are found in the floodplains of the river and associated tributaries. There are two tributaries in the Preliminary Project Boundary that are mapped on the NWI. At the preliminary Lower Reservoir location, there is one tributary named Tom Fork. Additionally, the preliminary interconnection line crosses Dry Branch. Dry Branch flows from east-to-west across the preliminary interconnection line to its confluence with the Cumberland River. Both Dry Branch and Tom Fork are classified on the NWI as R4SBC, which indicates that the system is riverine, subsystem is intermittent, class is streambed, and water regime is seasonally flooded.

5.5.3 Wetland Habitat

Wetlands have the potential to provide a variety of ecological functions including groundwater discharge and recharge, floodflow alteration, fish and shellfish habitat, sediment, toxicant, and pathogen retention, nutrient removal, retention, and transformation, production export, sediment and shoreline stabilization, and wildlife habitat. Wetlands also support human-defined values such as recreation, educational and scientific use, uniqueness and heritage, visual quality, and threatened and endangered species habitat (USACE 1999). Understanding the distribution and characteristics of wetlands on the landscape is therefore useful for land use planning and management. Within the Project Vicinity, there are approximately 3.9 acres mapped on the NWI as freshwater emergent wetland, 30.5 acres mapped as freshwater forested/shrub wetland, and 19.7 mapped as freshwater pond. Within the Preliminary Project Boundary, there are no areas mapped as freshwater wetland and approximately 1.8 acres mapped on the NWI as freshwater pond. This 1.8 acres includes two areas classified on the NWI as PUBHh located in the Preliminary Lower Reservoir location. These areas are both classified as a permanently flooded and diked/impounded.

5.5.4 Wetland, Riparian, and Littoral Plant and Animal Species

LRPS is conducting a wetland and waterway delineation, which will provide detail on plant species within the Project Boundary. See Section 6 for more detail. It is anticipated that a variety of animal species, including birds, insects, mammals, snakes, turtles, and amphibians such as frogs, toads, and salamanders may use the wetland, riparian, and littoral habitat.

5.5.5 References

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5.6 Rare, Threatened, and Endangered Species

18 CFR 5.6(d)(3)(vii) requires "A description of any listed rare, threatened and endangered, candidate, or special status species that may be present in the project vicinity. Components of this description must include: (A) A list of Federal- and state-listed, or proposed to be listed, threatened and endangered species known to be present in the project vicinity; (B) Identification of habitat requirements; (C) References to any known biological opinion, status reports, or recovery plan pertaining to a listed species; (D) Extent and location of any federally- designated critical habitat, or other habitat for listed species in the project area; and I Temporal and spatial distribution of the listed species within the project vicinity."

5.6.1 Overview

Information on rare, threatened, and endangered (RTE) species potentially occurring in Bell County, Kentucky was obtained from rare species databases maintained by the USFWS Information, Planning, and Conservation (IPaC), the Kentucky Department of Fish and Wildlife Resources (Kentucky DFWR) list of State Threatened, Endangered, and Special Concern Species, and the Office of Kentucky Nature Preserves (OKNP) Kentucky Rare Plant Database.

5.6.2 Rare, Threatened, and Endangered Wildlife Resources

According to the USFWS IPaC list and letter from USFWS dated August 23, 2022 (Appendix E), four federally listed species potentially occur within the Project Vicinity: gray bat (*Myotis grisescens*, endangered), Indiana bat (*Myotis sodalist*, endangered), northern long-eared bat (*Myotis septentrionalis*, threatened), and monarch butterfly (*Danaus plexippus*, candidate) (USFWS 2022a). The Kentucky DFWR list of species classified as state endangered, threatened, or species of concern in Bell County, Kentucky includes insects, crayfish, mussels, reptiles, amphibians, fish, and mammals (Table 5-15, Kentucky DFWR 2022a). This list includes two species of fish with federal protection status, blackside dace (*Chrosomus cumberlandensis*; threatened) and Cumberland arrow darter (*Etheostoma sagitta*; candidate), which were not included in the USFWS list (Kentucky DFWR 2022a, USFWS 2022a). In August 2022, the yellow-spotted woodland salamander (*Plethodon pauleyi*) was petitioned to be listed under the ESA as an endangered or threatened species and to concurrently designate critical habitat (Center for Biological Diversity 2022). The federally listed and petitioned species are discussed in detail below. There is no proposed or designated Critical Habitat for any protected species within the Project Vicinity.

Table 5-15: Rare, Threatened, and Endangered Wildlife Species with Known Records of Occurrence in Bell County, Kentucky[a]

Scientific Name	Common Name	Federal Status[b]	KY Status[c]	Global & State Rank[d]
Insects				
Callophrys irus	frosted elfin	-	E	G3; S1
Callophrys dimidiata	sparkling jewelwing	-	E	G5; S1S2
Cheumatopsyche helma	helma's net-spinning caddisfly	-	H	G3; SH
Danaus plexippus	monarch butterfly	C	-	G4; S4
Lytrosis permagnaria	a geometrid moth	-	E	G3G4; S1S2
Manoplylax butleri	bottle cap caddisfly	-	S	G2; S2
Polygonia faunus	green comma	-	H	G5; SH
Pseudanophthalmus frigidus	icebox cave beetle	-	E	G1; S1
Stylurus notatus	elusive clubtail	-	E	G3; S1
Mussels				
Anodontoides denigrata	Cumberland papershell	-	E	G1; S1
Fumonelix wetherbyi	clifty covert	-	S	G2G3; S2
Lampsilis ovata	pocketbook	-	E	G5; S1
Crayfish				
Cambarus buntingi	longclaw crayfish	-	T	G4Q; S2S3
Cambarus guenteri	redbird crayfish	-	S	GNR; S3
Cambarus parvoculus	mountain midget crayfish	-	S	G5; S2
Fish				
Chrosomus cumberlandensis	blackside dace	LT	T	G2; S2
Etheostoma sagitta	Cumberland arrow darter	C	S	G3; S3
Amphibians				
Cryptobranchus alleganienses alleganienses	east hellbender	-	S	G3T2; S2S3
Reptiles				
Cemophora coccinea	scarletsnake	-	S	G5; S3
Ophisaurus 5-46odalist5-46s longicaudus	Eastern slender glass lizard	-	T	G5T5; S2
Plestiodon anthracinus	coal skink	-	E	G5; S1
Plestiodon inexpectatus	Southeastern five-lined skink	-	S	G5; S2S3
Birds				
Accipiter striatus	sharp-shinned hawk	-	S	G5; S3B, S4N
Cardellina canadensis	Canada warbler	-	S	G5; S3B
Centronyx henslowii	Henslow's sparrow	-	S	G4; S3B
Certhia americana	brown creeper	-	T	G5; S1S2B, S4N
Circus hudsonius	Northern harrier	-	T	G5; S1S2B, S4N
Corvus corax	common raven	-	T	G5; S1S2
Empidonax minimus	least flycatcher	-	E	G5; S1B
Falco peregrinus	peregrine falcon	-	E	G4; S1B
Haliaeetus leucocaphalus	bald eagle	-	S	G5; S3B, S3S4N
Junco hyemalis	dark-eyed junco	-	S	G5; S2S3B, S5N
Peucaea aestivalis	Bachman's sparrow	-	E	G3; S1B

Scientific Name	Common Name	Federal Status[b]	KY Status[c]	Global & State Rank[d]
Phalacrocorax auratus	double-crested cormorant	-	S	G5; S2B
Podilymbus Podiceps	rose-breasted grosbeak	-	S	G5; S3S4B
Polygonia faunus	pied-billed grebe	-	E	G5; S1B, S4N
Setophaga fusca	blackburnian warbler	-	T	G5; S1S2B
Sitta canadensis	red-breasted nuthatch	-	E	G5; S1B
Spatula discors	blue-winged teal	-	T	G5; S1S2B
Tyto alba	barn owl	-	S	G5; S3
Vermivora chrysoptera	golden-winged warbler	-	E	G4; S1B
Mammals				
Myodes gapperi maurus	Kentucky red-backed vole	-	S	G5T3T4; S3
Myotis grisescens	gray bat	LE	E	G4
Myotis leibii	Eastern small-footed bat	-	T	G4; S2
Myotis lucifugus	little brown bat	-	T	G3; S2
Myotis sodalis	Indiana bat	LE	E	G2; S1S2
Myotis septentrionalis	northern long-eared bat	LT	E	G1G2
Perimyotis subflavus	tricolored bat	-	T	G2G3; S2
Sorex cinereus	cinereus shrew	-	S	G5; S3
Spilogale putorius	Eastern spotted skunk	-	S	G4; S2S3

[a] Source: Kentucky DFWR 2022a

[b] Federal status: LE = listed endangered; LT = listed threatened; C = candidate species, not yet listed or proposed for listing.

[c] Kentucky state status: E = endangered; T = threatened; S = special concern; H=historic.

[d] Global ranks: G1 = critically imperiled, at very high risk of extinction due to extreme rarity; G2 = imperiled, at high risk of extinction due to very restricted range; G3 = vulnerable, at moderate risk of extinction due to restricted range; G4 = apparently secure, uncommon but not rare; G5 = secure – common, widespread, abundant.

State ranks: S1 = critically imperiled, at very high risk of extinction due to extreme rarity; S2 = imperiled, at high risk of extinction due to very restricted range; S3 = vulnerable, at moderate risk of extinction due to restricted range; S4 = apparently secure, uncommon but not rare; S5 = secure – common, widespread, abundant.

Gray Bat

The gray bat is a highly colonial species in eastern North America distinguished from other species of the genus *Myotis* by its larger size and the uniformly gray fur on its back. The primary range of the species is centered on the cave regions of Alabama, Missouri, Arkansas, Kentucky, and Tennessee, with smaller populations found in adjacent states (USFWS 2009, Ozier et al. 2020). Gray bats inhabit caves year-round, occupying cold hibernating caves or mines in winter and dispersing to warmer maternity and bachelor caves during summer. Mating occurs in the fall prior to hibernation, and females deliver a single pup after arriving at the maternity cave in late May or early June. The summer caves are almost always near a river or reservoir, where gray bats feed on night-flying aquatic and terrestrial insects. Most foraging occurs over open water near a forested shoreline, and bats forage up to 12 miles or more from roost sites. A primary threat to the gray bat is anthropogenic disturbance to their caves. Infection of gray bats by the fungus causing white-nose syndrome, a disease that infects the skin of hibernating bats and has devastated populations of other bat species, is also a possible threat. (Ozier et al. 2020). The gray bat has an approved recovery plan from 1982 (USFWS 1982).

Indiana Bat

The Indiana bat is a nocturnal insectivore, emerging from roosts shortly after sunset, and feeding almost exclusively on flying insects, but will consume terrestrial prey on occasion (USFWS 2007). Summer roost habitats are underneath exfoliating bark in mature trees that receive direct sunlight for more than half a day. Foraging typically occurs in semi-open to closed forested habitats with an open understory, forested edges, or riparian or wetland areas. During the winter, Indiana bats are restricted to suitable underground hibernacula. Hibernacula are predominantly caves but can include other cave-like structures such as mines and shafts. Typical hibernacula are high in volume and complexity, where variable vertical relief provides a range of temperatures and microclimates during the winter months (USFWS 2007). Threats to Indiana bat include human disturbance of hibernating bats, loss of summer habitat, pesticides and other contaminants, and white-nose syndrome (USFWS 2022b). The Indiana bat has a draft recovery plan from 2007 (USFWS 2007).

In association with the mining facility's permitting process, mist netting, acoustic monitoring, and habitat assessments were performed for the Indiana bat near the preliminary Lower Reservoir location in 2010. The report concluded that the Indiana bats were not using the then proposed permit area as summer roost or forage habitat and no portals were located that would provide potential winter habitat to bats (Biological Systems 2010).

Northern Long-eared Bat

The northern long-eared bat, distinguished from other species of *Myotis* by its long ears, is a wide-ranging species found in a variety of forested habitats in summer and hibernates in caves in winter (USFWS 2016). The species is found across eastern and north-central U.S. and southern Canada and is generally associated with old-growth forests (NatureServe 2021). Northern long-eared bats overwinter in hibernacula that include caves and abandoned mines (USFWS 2016). Rarely are there more than 100 individuals per hibernation colony (NatureServe 2021). Mating occurs in late summer or fall prior to hibernation, and each female delivers a single pup in June or early July. In summer, the bats generally are colonial but tend to be more solitary than other *Myotis* species, often roosting alone in deep cracks and crevices, under bark, or in hollows of live and dead trees. Foraging occurs within forests, along forest edges and clearings, and occasionally over ponds. Principal threats to the species include human disturbance of hibernating bats and mortality due to white-nose syndrome (USFWS 2016).

Monarch Butterfly

Monarch butterfly is a candidate species not yet proposed for listing under the Endangered Species Act of 1973 (USFWS 2020). The species is a large and conspicuous butterfly that exhibits long-distance migration and overwinters as adults at forested locations in Mexico and California. Adult monarch butterflies feed on nectar from a wide variety of flowers. Reproduction is dependent on the presence of milkweed, the sole food source for larvae. Larvae develop and feed on the milkweed plant, sequestering chemicals as a defense against predators. Adults live up to six to nine months, and multiple generations are produced over the course of the breeding season. Monarch butterflies occur across the continental U.S., but populations have been declining over the past 20 years. Primary threats to the species include the loss and degradation of habitat from conversion of grasslands to agriculture, widespread use of herbicides, exposure to insecticides, land-clearing activities in overwintering sites, urban development, and general loss of milkweed and nectar sources across the species' range from various land development activities (USFWS 2020).

Blackside Dace

Reaching a maximum length of three inches, the blackside dace is a small minnow endemic to the upper Cumberland River drainage in southeastern Kentucky and northeastern Tennessee. The blackside dace has a pointed snout, a wide, black lateral stripe on its side, with an olive to gold-colored back. The blackside dace is found in small, cool, upland streams with moderate flows and minimal silt. Habitat consists of streams with good canopy and instream cover such as submerged root wads, undercut banks, woody debris, and large rocks. (Floyd 2016). The spawning period is from April to July, with the most observations of spawning activity occurring from May to June (USFWS 2015). Spawning males are brightly colored, with bright yellow dorsal fins and scarlet on the lower head, nape, and belly (NatureServe 2022a). Principal threats to the species include siltation related to coal mining, silviculture, agriculture, and road construction (National Geographic 2022). The blackside dace has an approved recovery plan from 1988 (USFWS 1988).

Cumberland Arrow Darter

The Cumberland arrow darter occurs in the upper Kentucky and Cumberland River drainages. The species is currently stable in the Cumberland drainage and considered of conservation concern in the Kentucky River drainage. Habitat includes rocky riffles and pools of headwaters, creeks, and small rivers. Juveniles and sometimes adults are found in larger streams such as the main channel of Cumberland River in Kentucky. Spawning occurs in riffles in water approximately 5-15 centimeters deep or under or near rocks. Spawning peaks in April and the age range of breeding females is 2-4 years. (Nature Serve 2022b). Principal threats are point and non-point source pollution related to acid mine drainage and siltation related to coal mining (Kentucky DFWR 2022b).

Yellow-spotted Woodland Salamander

The petitioned yellow-spotted woodland salamander occurs on shale and sandstone outcrops from West Virginia to east Tennessee. Yellow-spotted woodland salamanders are large and slender, with gray-brown bodies and two rows of yellow spots along their dorsum. Adults range from 100-170 millimeters from head to tail with males being slightly smaller than females. Forage for prey occurs during the day on rock outcrops, trees, and the forest floor. The salamanders hibernate from October to March, with higher elevation individuals hibernating from September to April. Females reach sexual maturity at age five and nest in underground cavities or rock outcrop crevices. Principal threats are the present or threatened loss or modification of habitat related to mining, logging, and deforestation. (Center for Biological Diversity 2022).

5.6.3 Rare, Threatened, and Endangered Botanical Resources

There are no federally listed plant species that potentially occur within the Project Vicinity according to the USFWS IPaC list and letter from USFWS dated August 23, 2022 (Appendix E) (USFWS 2022a). According to the OKNP Rare Plant Database, and Endangered, Threatened, and Special Concern Plants, Animals and Natural Communities of Kentucky (OKNP 2019), there are 29 rare plant species with known occurrences within Bell County (Table 5-16).

Table 5-16: Rare, Threatened, and Endangered Plant Species with Known Records of Occurrence in Bell County, Kentucky

Scientific Name	Common Name	Federal Status[a]	KY Status[b]	Global Rank, State Rank[c]	Habitat[d]
Adlumia fungosa	Allegheny-vine	-	H	G4, SH	Cliffs, talus, rocky slopes, rich stream-bottom forests, cool rocky forests; well-drained sunny openings, rocky and sandy slopes. Can invade following fire and logging.
Amianthium muscitoxicum	Fly poison	-	T	G4G5, S1	Sandy soil, lowlands, bogs, and open woods. Reported from pine-oak woods and sandstone outcrops.
Baptisia tinctoria	Yellow wild indigo	-	T	G5, S1S2	Sandhills, pine flatwoods, xeric woodlands, ridges, woodland edges, and road banks.
Boykinia aconitifolia	Brook saxifrage	-	T	G4, S2	Streambanks, riverbanks, crevices in spray cliffs around waterfalls, seepages.
Calamagrostis odali ssp. Porteri	Porter's reedgrass	-	T	G4T4, S2S3	Dry, rocky woods on mountain summits.
Calopogon tuberosus var. tuberosus	Tuberosus grass pink	-	E	G5T5, S1	Sphagnum bogs, fens, savannas, and wet shores. Dry, sandy pine and pine-oak woods and swamps.
Capnoides/Corydalis sempervirens	Rock harlequin	-	S	G5, S3?	Dry rocky woods. Usually associated with rock outcrops and ridge summits.
Carex austrocaroliniana	Tarheel sedge	-	S	G4, S3	Mesophytic ravine forests.
Castanea pumila	Allegheny chinkapin	-	T	G5, S2	Xeric forests and woodlands. Generally, in fire-maintained habitats. Dry or moist acidic soils.
Chelone obliqua var. obliqua	Red turtlehead	-	E	G4T3T4Q, S1	Streambanks, swamp forests. Alluvial swamps and wet woods.
Chrysosplenium americanum	American golden-saxifrage	-	T	G5, S2?	Springs or muddy soils; springheads, open wooded seeps, seepage banks of spring-fed streams, seasonally wet sandstone rocks, rills, cool wet areas. Usually in shade.
Convallaria montana	American lily-of-the-valley	-	E	G4?, S1	Rocky or dry-mesic mixed hardwood forested slopes.
Deschampsia/Avenella flexuosa	Crinkled hairgrass	-	T	G5, S2	Dry, open or partially shaded sandy or rocky soil in mesic forests. Cracks in sandstone cliffs and cliff bases.
Gentiana decora	Showy gentian	-	S	G4?, S3	Moist woods and openings in canopy on mountain summits.
Houstonia serpyllifolia	Michaux's bluets	-	E	G4?, S1	Streambanks, grassy balds, moist forests, seepy rock outcrops, spray cliffs, and moist disturbed areas. Moist soils in the mountains.
Lathyrus venosus	Smooth veiny peavine	-	S	G5, S2S3	Dry to mesic slopes, especially in basic soils.
Liparis loeselii	Loesel's twaybay	-	T	G5, S2S3	Bogs, peaty meadows, and damp or seeping thickets or mesic slopes. Has been found on abandoned strip mines.

Scientific Name	Common Name	Federal Status[a]	KY Status[b]	Global Rank, State Rank[c]	Habitat[d]
Listera smallii	Kidney-leaf twaybay	-	T	G4, S2	Humus of damp woods and tickets, bogs or shaded weed-free humus below rhododendron on mountain slopes and stream heads.
Melampyrum lineare var. latifolium	American cowwheat	-	T	G5T5, S2	Dry, open sandstone ridgetops, including dry to dry-mesic second growth woods, road edges, and rock outcrops.
Monotropsis odorata	Sweet pinesap	-	T	G3, S2	Sandstone ridgetops. Chiefly pine woods but also mesophytic woods.
Polytrichum pallidisetum	A hair cap moss	-	T	G5, S2?	Soil humus and rocks in moist conditions or hardwood forests.
Prosartes maculata	Nodding mandarin	-	S	G4, S3?	Rich mesic forests.
Salvia urticifolia	Nettle-leaf sedge	-	E	G5, S1	Woods, thickets, and glades.
Silene ovata	Ovate catchyfly	-	E	G3, S1	Dry, mesic forests and mountain summits. Has been found in calcareous sandstone woods and exposures on the side slopes below a cap of sandstone.
Solidago curtisii	Curtis' goldenrod	-	T	GNR, S3	Mountain woods.
Solidago puberula	Downy goldenrod	-	S	G5, S2	Dry woods.
Solidago roanensis	Roan Mountain goldenrod	-	T	G4G5, S1S2	Forests on mountain summits and openings, including roadbanks.
Trillium undulatum	Painted trillium	-	T	G5, S2	Mesic ravine forests, upper elevation mesic hemlock forests. Seeps in mesic forests and oak-chestnut forests.
Veratrum parviflorum	Appalachian bunchflower	-	E	G4?, S1	Moist wooded slopes in the mountains.

[a] Federal status: LE = listed endangered; LT = listed threatened; C = candidate species, not yet listed or proposed for listing; SOMC = Species of Management Concern.

[b] Kentucky state status: E = endangered; T = threatened; S = special concern; H=historic.

[c] Global ranks: G1 = critically imperiled, at very high risk of extinction due to extreme rarity; G2 = imperiled, at high risk of extinction due to very restricted range; G3 = vulnerable, at moderate risk of extinction due to restricted range; G4 = apparently secure, uncommon but not rare; G5 = secure – common, widespread, abundant; G#? = denotes inexact numeric rank; GNR = unranked, conservation status not yet assessed; G#Q = questionable taxonomy that may reduce conservation priority; G#T# = T denotes rarity of a subspecies.

State ranks: S1 = critically imperiled, at very high risk of extinction due to extreme rarity; S2 = imperiled, at high risk of extinction due to very restricted range; S3 = vulnerable, at moderate risk of extinction due to restricted range; S4 = apparently secure, uncommon but not rare; S5 = secure – common, widespread, abundant; S#? = denotes inexact numeric rank; S#B = refers to breeding population in Kentucky; S#N = refers to non-breeding population in Kentucky.

[d] Habitat descriptions for plants from OKNP Rare Plant Database (OKNP 2019).

Source: OKNP 2019

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5.7 Recreation and Land Use

18 CFR 5.6(d)(3)(viii) requires "A description of the existing recreational and land uses and opportunities within the project boundary. The components of this description include: (A) Text description illustrated by maps of existing recreational facilities, type of activity supported, location, capacity, ownership and management; (B) Current recreational use of project lands and waters compared to facility or resource capacity; (C) Existing shoreline buffer zones within the project boundary; (D) Current and future recreation needs identified in current State Comprehensive Outdoor Recreation Plans, other applicable plans on file with the Commission, or other relevant local, state, or regional conservation and recreation plans; I If the potential applicant is an existing licensee, its current shoreline management plan or policy, if any, with regard to permitting development of piers, boat docks and landings, bulkheads, and other shoreline facilities on project lands and waters; (F) A discussion of whether the project is located within or adjacent to a: (1) River segment that is designated as part of, or under study for inclusion in, the National Wild and Scenic River System; or (2) State-protected river segment; (G) Whether any project lands are under study for inclusion in the National Trails System or designated as, or under study for inclusion as, a Wilderness Area. (H) Any regionally or nationally important recreation areas in the project vicinity; (I) Non-recreational land use and management within the project boundary; and (J) Recreational and non-recreational land use and management adjacent to the project boundary."

5.7.1 Recreation

5.7.1.1 Recreation in the Preliminary Project Boundary and Project Vicinity

The preliminary Project Boundary and much of the Project Vicinity includes land used historically for mining. Recreation is not permitted on the private property with active and reclaimed mining operations; due to the industrial nature of this land, public access is restricted for public safety. There are no existing recreation sites in the preliminary Project Boundary and there are no public recreation sites in the Project Vicinity.

The Upper Cumberland River supports recreational water activities including fishing, canoeing, and kayaking. There is an Upper Cumberland River public access site called the Varilla Ramp located just downstream from the Project Vicinity, approximately 3 miles from the Project. The Varilla Ramp includes a boat ramp and a small, gravel parking area for approximately 8 vehicles. The Varilla Ramp is used for bank anglers, wade fishing, and as a put-in for canoes and kayaks. The Varilla Ramp is managed by the Kentucky DFWR. The Kentucky DFWR lists a river mile stretch of 13.8 miles of the Upper Cumberland River with the Varilla Ramp being the put-in access point, and the 4 Mile Ramp located just north of Pineville being the take-out location. The Kentucky DFWR does not list any boating sections on the Upper Cumberland River further upstream of the Project Vicinity. The Varilla Ramp is shown in Figure 5-12. (Kentucky DFWR 2022).

Figure 5-12: Varilla Ramp

Source: Kentucky DFWR 2022

5.7.1.2 Regional Recreation Opportunities

There are numerous recreational opportunities in Eastern Kentucky in the region surrounding the Project. Key regional parks include Cumberland Gap National Historic Park, Kentucky Ridge State Forest and Wildlife Management Area, Daniel Boone National Forest, and Cumberland Falls State Resort Park.

Cumberland Gap National Historic Park is located approximately 10 miles from the Project. The park is at the borders of Kentucky, Tennessee, and Virginia. The park consists of approximately 24,000 acres and offers 85 miles of hiking trails, camping, scenic views, unique geologic sandstone formations, and underground caverns. Cumberland Gap National Historic Park is managed by the National Park Service (NPS). (NPS 2022a).

Kentucky Ridge State Forest, located approximately 15 miles from the Project, consists of over 15,000 acres and contains the Pine Mountain State Resort Park. Kentucky Ridge State Forest is located on the south side of Pine Mountain and the north side of Log Mountain, encompassing Little Clear Creek Valley as well as Chenoa Lake. The forest is open to public hunting fishing, primitive camping, and hiking, and is managed by the state. (Kentucky EEC 2022a).

Daniel Boone National Forest, located approximately 40 miles from the Project, consists of more than 708,000 acres of national forest system lands across 21 counties in eastern Kentucky. Daniel Boone National Forest has over 600 miles of trails and is home to two federally recognized wildernesses and more than 250 recreation sites. Recreation activities include hiking, hunting, camping, picnicking, off-highway vehicle riding, and fishing. Daniel Boone National Forest is managed by the USDA United States Forest Service (USFS). (USDA USFS 2022).

Cumberland Falls State Resort Park is located approximately 45 miles from the Project in Corbin, Kentucky. The park is managed by Kentucky State Parks. Within the park is Cumberland Falls, a 125-foot-wide waterfall on the Cumberland River. In addition to camping, there is lodging available at the park. The park provides opportunities for recreation including hiking, fishing, canoeing, and picnicking. (Kentucky State Parks 2022).

5.7.1.3 Recreation Needs Identified in Management Plans

Kentucky has a Statewide Comprehensive Outdoor Recreation Plan (SCORP), which was prepared by the Kentucky Department for Local Government (2019). This is a five-year plan which covers 2020-2025 and outlines strategies and recommendations for addressing outdoor recreation in the state. The SCORP permits the state to remain eligible to receive federal Land and Water Conservation Funds for outdoor recreational projects. The SCORP was developed with extensive input from Kentucky's fifteen area development districts, several federal, state and local government agencies, and community recreational-user groups. (Kentucky Department for Local Government 2019).

The Kentucky SCORP contained ten strategic goals to work on through 2025:

Goal 1: Expand and improve the quantity and variety of outdoor recreation opportunities, with emphasis on areas and population segments where these are most lacking.

Goal 2: Develop and promote the recreational opportunities that are associated with tourism.

Goal 3: Implement an integrated strategy of trail development utilizing the funding resources and selection criteria of the Recreational Trails Program Fund, Land and Water Conservation Fund, Transportation Enhancement funds, and other sources.

Goal 4: Facilitate the public's awareness and Statewide Outdoor Recreation Goals/use of Kentucky's outdoor recreation resources, facilities, programs, and promote the social and health benefits of their use.

Goal 5: Preserve the state's natural, environmental, historical, and cultural assets.

Goal 6: Establish and maintain a strong element of public participation in the planning, development, and management of outdoor recreation facilities and programs.

Goal 7: Increase and promote coordination and definition of roles among the various federal, state, regional, local, and private agencies that are responsible for the planning, programming, and implementation of recreation facilities and opportunities.

Goal 8: Make the most efficient use of existing recreation facilities and resources.

Goal 9: Fully exploit all existing funding resources for recreation and seek to develop other funding possibilities.

Goal 10: Promote the use of SCORP as a planning tool and the progressive implementation of its identified objectives

Regarding current and future recreation needs, Strategic Goal 1 of the Kentucky 2020-2025 SCORP is further detailed. An objective under Strategic Goal 1 is, to "*Develop additional local park and recreation facilities that are based on a careful assessment of community needs. Through technical assistance and planning incentives from state and regional agencies, educate and encourage local park departments of techniques for conducting needs surveys, developing community recreation plans, and incorporating public input into the need assessment.*" (Kentucky Department for Local Government 2019).

A quantitative statewide survey regarding the demand for recreation facilities and resources was completed and detailed in the SCORP (2019). In the survey, most respondents said that parks somewhat met their needs while approximately one third of participants indicated that parks completely met their needs. Less than 10% of respondents said that their needs were not at all met. The SCORP concluded that although there is room for improvement, the survey indicates that Kentuckians are largely satisfied with their parks. It was also stated that paved trails were reported as the most urgent need facing recreational facilities (19.2%) with playgrounds (17.2%), and picnic shelters (15.8%) following. (Kentucky Department for Local Government 2019).

5.7.2 Land Use

The area within the preliminary Project Boundary has historically been used for coal mining and is considered an industrial site. The area within the preliminary Project Boundary is privately owned and managed. There are still active mining permits in the Project Vicinity. The preliminary Upper and Lower Reservoirs are located at reclaimed mine sites and the preliminary interconnection line runs along existing roads. Photos of the Project Vicinity are provided in Section 5.8. Overall, the Project Vicinity includes lands generally considered as rural lands. The Project Vicinity includes lands which have been used historically for mining. Additionally, the Project Vicinity includes forested lands and low-density residential areas.

The major land use categories as mapped by the National Land Cover Database (NLCD) for the preliminary Project Boundary and Project Vicinity are presented in Table 5-17 and depicted on

Figure 5-13. As shown, the major land use identified in the NLCD for the preliminary Project Boundary and Project Vicinity include undeveloped land, largely consisting of deciduous forest, shrub/scrub, and herbaceous land.

Table 5-17: Major Land Use Categories in the Preliminary Project Boundary and Vicinity

Major Land Use	Project Boundary Acres	Project Vicinity Acres
Deciduous Forest	73.4	4,230.1
Shrub/Scrub	40.2	787.9
Herbaceous	19.5	323.8
Developed, Open Space	10.1	134.1
Developed, Low Intensity	9.4	88.3
Developed, Medium Intensity	2.0	49.1
Open Water	1.3	108.7
Hay/Pasture	0.7	183.5
Developed, High Intensity	0.7	10.7
Mixed Forest	0.4	218.4
Barren Land	0.1	87.0
Emergent Herbaceous Wetlands	-	6.4
Evergreen Forest	-	2.0
Woody Wetlands	-	1.3
Total*	**157.6**	**6,231.4**

* Due to rounding, the sum of the addends may not equal the total.

Source: Dewitz 2021, USGS 2021

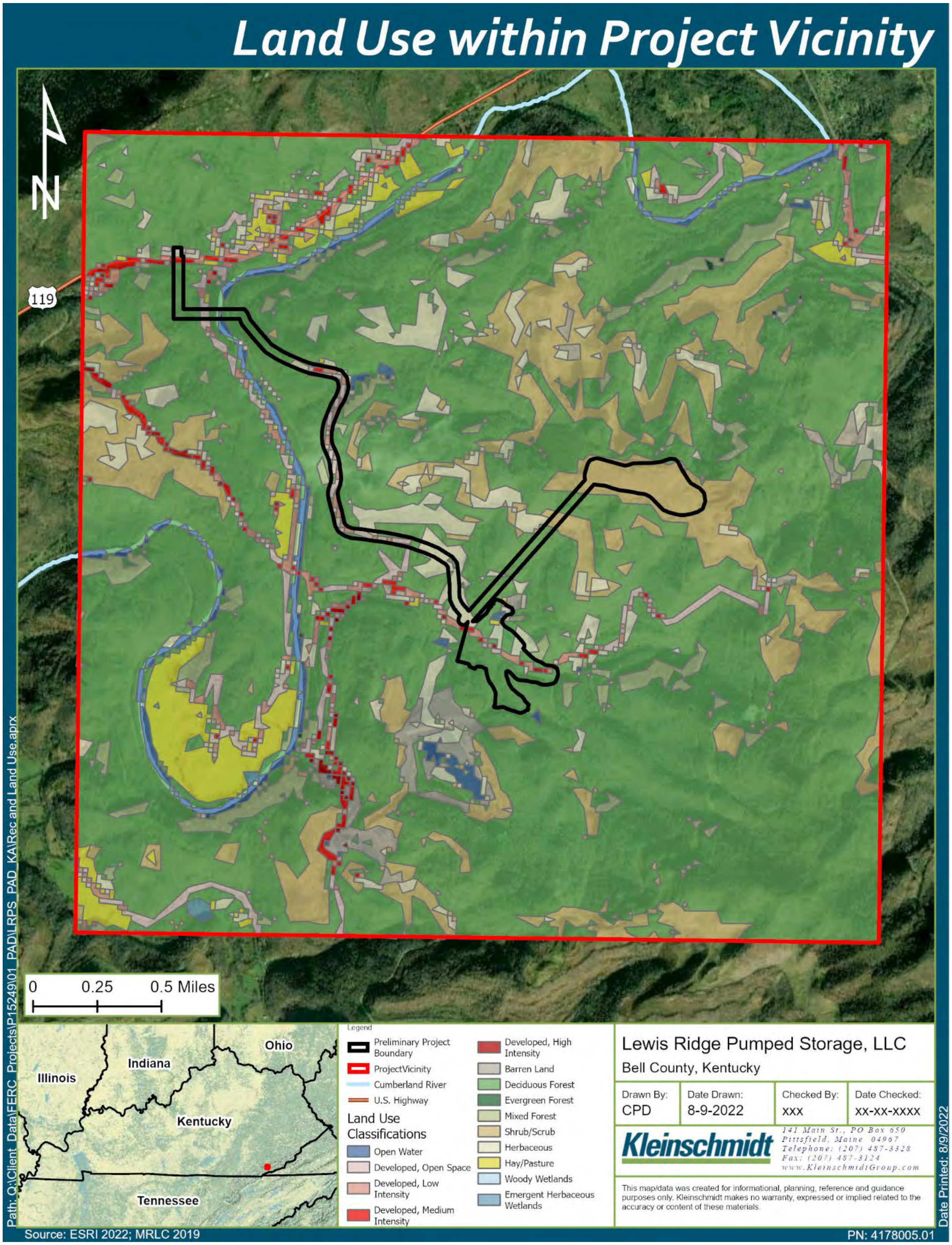

Figure 5-13: Land Use in the Project Vicinity

5.7.3 Protected River Segments

There are no rivers within the Project Vicinity that have been designated for inclusion in the National Wild and Scenic River System (NPS 2022b).

Kentucky has a Wild Rivers Program which was established by the Kentucky Wild Rivers Act of 1972 and is administered by the Office of Kentucky Nature Preserves. Located approximately 84 miles downstream from the Project, the Cumberland River has been designated a Wild River from Summer Shoals to the backwaters of Lake Cumberland (Kentucky EEC 2022b). This segment is 16.1 miles long and is over 40 miles from the Project Vicinity (Kentucky EEC 2022b). There are no state-protected river segments in the Project Vicinity.

5.7.4 National Trails System and Wilderness Areas

In the Project Vicinity, there are no lands included in the National Trails System, nor are there lands designated as, or under study for inclusion as, a Wilderness Area (NPS 2022c, Southern Appalachian Wilderness Stewards 2022).

5.7.5 References

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5.8 Aesthetic Resources

18 CFR 5.6(d)(3)(ix) requires "A description of the visual characteristics of the lands and waters affected by the project. Components of this description include a description of the dam, natural water features, and other scenic attractions of the project and surrounding vicinity. Potential applicants are encouraged to supplement the text description with visual aids."

5.8.1 Bell County, Kentucky

Bell County's 361-acres include two scenic Appalachian Mountain ridges, the Pine and Cumberland Mountains, which are densely forested with picturesque streams flowing through deep valleys (Commonwealth 2017). The Pine Mountain ridge extends west/east over 120 miles from Tennessee to Elkhorn City, Kentucky and is approximately 3 miles north of the Project Vicinity (Commonwealth 2022). The Cumberland Mountain ridge extends west/east and is approximately 6 miles south of the Project Vicinity. Bell County is home to Kentucky's first state park (Pine Mountain State Resort Park) and the country's largest national historical park (Cumberland Gap National Historical Park). Chained Rock on Pine Mountain provides views of the city of Pineville and its surrounding mountain forests. (KY Dept of Tourism 2022).

The Pine Mountain State Scenic Trail is currently being developed and once completed, will traverse 120-miles from the Breaks Interstate Park to the Cumberland Gap National Historical Park. The nearby Cumberland Gap National Historical Park offers diverse views of mountain scenery and includes scenic vistas of the Appalachian Mountains, waterfalls, unique rock formations, and lush forests as depicted in Figure 5-14 through Figure 5-16 (NPS 2021a; NPS 2021b). The Pine Mountain State Scenic Trail will pass through several scenic nature preserves, including one containing the largest old growth forest in Kentucky. (Commonwealth 2022).

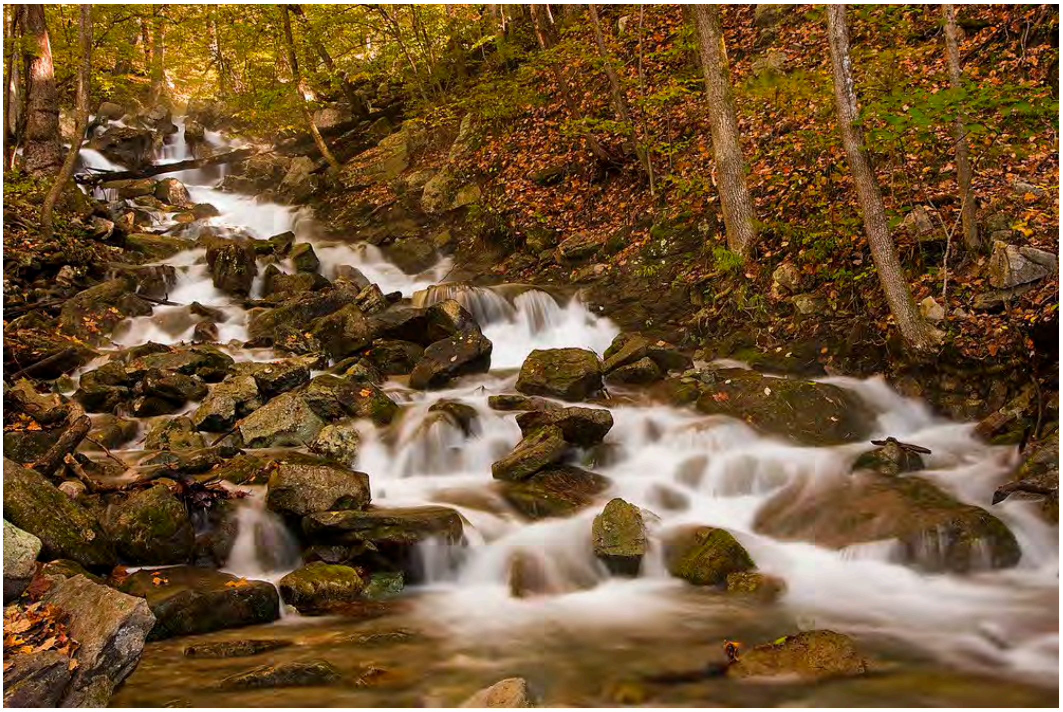

Figure 5-14: Gap Greek at Cumberland National Historical Park

Source: NPS 2021b

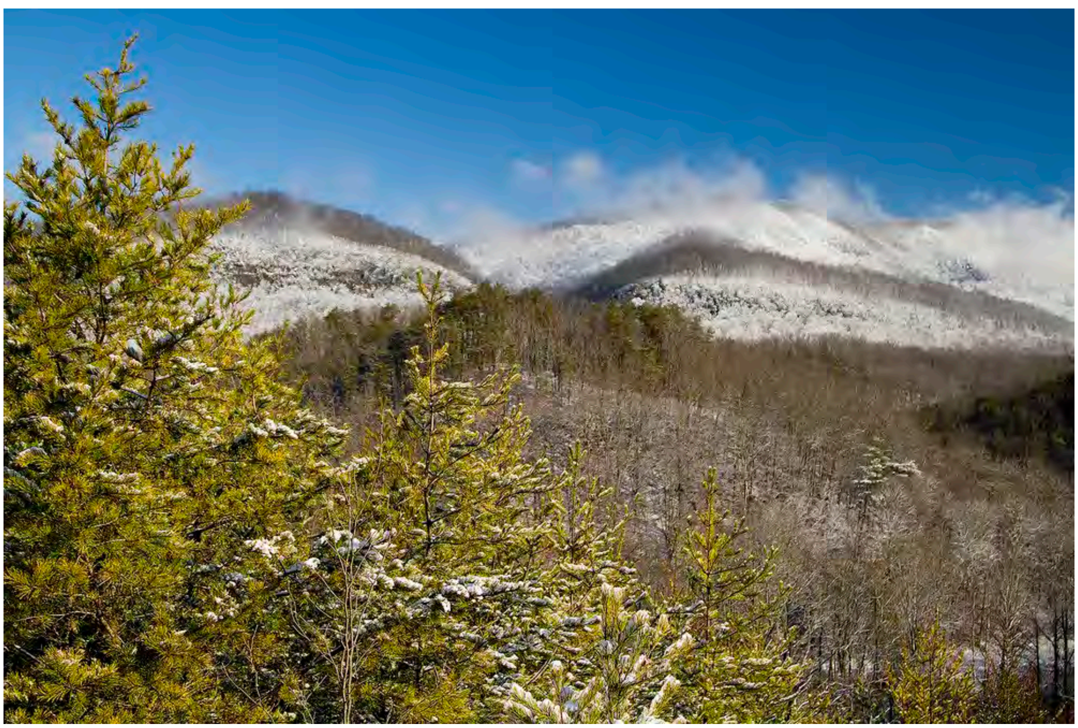

Figure 5-15: Poor Valley Ridge and Cumberland Mountain

Source: NPS 2021b

Figure 5-16: The Cumberland Gap

Source: NPS 2021b

5.8.2 Lewis Ridge Project Site

Aesthetics in the Project Vicinity consists of previously disturbed lands (including previous and active mining facilities) and surrounding forests. Photos taken within the Project Vicinity are provided as Figure 5-17 through Figure 5-24.

Figure 5-17: Preliminary Upper Reservoir Site

Figure 5-18: View from the Preliminary Upper Reservoir Site, facing northwest

Figure 5-19: Preliminary Lower Reservoir Site

Figure 5-20: View of Tom Fork Downstream of Preliminary Lower Reservoir Site

Figure 5-21: View of Dry Branch near Preliminary Interconnection Line Crossing

Figure 5-22: View of Reclaimed Mining Area in Project Vicinity

Figure 5-23: View of Pond in Project Vicinity

Figure 5-24: Closed High Wall Mining Operation in Project Vicinity

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5.9 Cultural Resources

18 CFR 5.6(d)(3)(x) requires "A description of the known cultural or historical resources of the proposed project and surrounding area. Components of this description include: (A) Identification of any historic or archaeological site in the proposed project vicinity, with particular emphasis on sites or properties either listed in, or recommended by the State Historic Preservation Officer or Tribal Historic Preservation Officer for inclusion in, the National Register of Historic Places; (B) Existing discovery measures, such as surveys, inventories, and limited subsurface testing work, for the purpose of locating, identifying, and assessing the significance of historic and archaeological resources that have been undertaken within or adjacent to the project boundary; and (C) Identification of Indian tribes that may attach religious and cultural significance to historic properties within the project boundary or in the project vicinity; as well as available information on Indian traditional cultural and religious properties, whether on or off of any federally-recognized Indian reservation (A potential applicant must delete from any information made available under this section specific site or property locations, the disclosure of which would create a risk of harm, theft, or destruction of archaeological or Native American cultural resources or to the site at which the resources are located, or would violate any Federal law, including the Archaeological Resources Protection Act of 1979, 16 U.S.C. 470w-3, and the National Historic Preservation Act of 1966, 16 U.S.C. 470hh)."

5.9.1 Prehistoric Context

The Project is situated in southeast Kentucky near the borders of Tennessee and Virginia. Archaeological evidence suggests that humans have occupied the region for more than 12,000 years (KY Heritage Council 2022a).

The earliest evidence of human occupation in the southeastern United States is identified as the Paleoindian Stage, which began approximately 12,000 B.C. and continued to approximately 8,000 B.C. The climate in Kentucky was much colder and wetter upon the estimated first arrival at the end of the last ice age at least 12,000 years ago. Mammoth, mastodon, and bison provided meat and hides were used for temporary shelters and clothing. In this time frame, people lived in small groups and migrated frequently. The Paleoindian toolkit consisted of well-crafted spear points of stone. It is likely Paleoindians also made tools from wood and animal bones (KY Heritage Council 2022a).

During the Archaic period (8,000 to 1,000 B.C.), the region's climate gradually trended toward that of modern weather patterns, which led to the extinction of large animals such as the mastodon and giant bison. Hunting shifted to smaller game animals such as deer, turkey, and rabbit. Archaic groups collected wild plants for food and medicine and made baskets for collecting, transporting, and storing their food. Sedentism increased during this period compared to the Paleoindian period, but groups still migrated every few months. Archaic hunters used notched and stemmed (not fluted) stone spearpoints and used a spearthrower (atlatl) to improve velocity and accuracy. By 1,000 B.C., some Archaic groups began experimenting with growing food (KY Heritage Council 2022a).

The Woodland period (1,000 B.C. to A.D. 1,000) is marked by the introduction of pottery, which was used for cooking and food storage. During this period, gardening and cultivating plants increased and groups tended to live in larger communities. Large earthen enclosures were used in religious ceremonies and burial mounds were constructed over decades. Evidence from this period suggests that long-distance exchange networks appeared and people began to explore caves (such as Mammoth Cave in Kentucky). The bow and arrow were invented late in this period and spearpoints were replaced with arrowheads. The use of groundstone tools continued and were used for processing corn. (KY Heritage Council 2022a).

The Late Prehistoric period (A.D. 1000-1750) represents the last pre-contact cultural traditions prior to the introduction of European settlers and the introduction of diseases that decimated native populations. Late Prehistoric groups focused on planting, growing, and harvesting corn and beans. The toolkit was expanded to include the hoe for agricultural fields. New forms of pottery such as jars, bowls, plates, bottles, and colanders were developed. People lived in large year-round settlements and constructed rectangular houses. Communities were ruled by hereditary chiefs who lived on larger mounds near the center of the settlement. Religious and ceremonial life is depicted by the figures engraved on shell gorgets (necklace pendants) and placement of ceramic vessels with shell spoons, pipes, and shell necklaces with the deceased. (KY Heritage Council 2022a).

Several Native American tribes once called Kentucky home, including the Cherokee, the Chickasaw, and the Shawnee (VisitLex 2022). From around 1650 to 1750, Native American wars ensued over control of Kentucky, or the “Great Meadow,” between the Shawnee tribes located north of the Ohio River and the Cherokee and Chickasaw tribes located south of the Cumberland River (KY Dept of Tourism 2022). By the 1680s or 1690s, the Shawnee had one or more villages on the upper Cumberland River; however, the Cherokee claimed the upper Cumberland River as their hunting grounds (Henderson and Pollack 2012). The Cherokee forced the Shawnee out of the area around 1714 (Henderson and Pollack 2012).

5.9.2 Historic Context

Dr. Thomas Walker and Christopher Gist first explored Kentucky in 1750 and 1751, but outbreaks of conflict between the British and Native Americans delayed further exploration for over a decade (KY Dept of Tourism 2022). By the late 1700s the newly formed United States began to put settlement pressure on the region (KY Dept of Tourism 2022). European settlement in the area was slower than along the East Coast of the modern United States due to the barrier of the Appalachian Mountains (VisitLex 2022). After 1775, Kentucky experienced rapid growth as the first settlements west of the Appalachian Mountains were founded with settlers primarily from Virginia, North Carolina, and Pennsylvania (accessing the area by the Cumberland and Ohio Rivers). Daniel Boone first explored Kentucky in 1767 and returned in 1769 for a two-year exploration of the area

(KY Dept of Tourism 2022). In 1772, the Cherokee surrendered their claim to Kentucky to the colony of Virginia (VisitLex 2022). During the American Revolutionary War, indigenous Native American tribes fought with the British against American colonists. Several conflicts took place in Kentucky, including the siege of Boonesboro, attacks on Martin's and Ruddle's Station, and the Battle of Blue Licks in 1782 (VisitLex 2022). The Battle of Blue Licks was one of the last Native American battles in Kentucky, although smaller conflicts occurred until 1813 (KY Dept of Tourism 2022). Kentucky became a state in 1792 and the westernmost region was annexed following its purchase from the Chickasaw Indians in 1818 (KY Dept of Tourism 2022). With passage of the "Indian Removal Act" in 1830, American Indians living east of the Mississippi River were required to move west to Indian Territory. However, Kentucky's Indian removal had taken place much earlier, first in response to the events of the French and Indian War, then the American Revolution, and finally, the War of 1812 (Henderson and Pollack 2012). In addition to aiding in immigration to the area, the Cumberland Gap had strategic value during the Civil War as whoever occupied the pass controlled the railroad from Virginia to Tennessee.

The logging Industry in Bell County began after the Civil War ended in 1865, with its most active years continuing until around 1900. The coal industry in Bell County started around 1888, after the Louisville and Nashville Railroad Company built a railroad along the Cumberland River (Fusan 1939). The coal fields in eastern Kentucky peaked in 1928-1930 and maintained those production levels until the second World War (Kentucky Foundation 2007).

5.9.3 Architectural Review

A Phase I archaeological reconnaissance was performed in 2007 in association with the permit submitted to the Division of Mines for a mining facility in the area of the preliminary Lower Reservoir location. The survey identified four previously unrecorded sites: two historic cemeteries (further discussed in Section 5.9.4), remains of a coal camp house, and remains of a historic coal mining operation (McGraw 2007). Although not eligible for the NRHP individually, the Kentucky State Historic Preservation Office (SHPO) and the Division of Mines recommended Phase II investigations of the sites in the form of archival research to determine if they were eligible as a district. Due to extensive disturbance from coal mining operations and surface mining, the district was found ineligible for the NRHP.

A preliminary historic resources site check of the Project Vicinity was submitted to the Kentucky Heritage Council to identify previously recorded sites and any properties or sites already listed on or determined eligible for the National Register of Historic Places (NRHP). The site check identified 10 historic houses along public roadways (1 of which meets NRHP criteria) and the Balkan School (meets NRHP criteria) (Figure 5-25) within the Project Vicinity (Kentucky Heritage Council 2022b).

Figure 5-25: Balkan School

5.9.4 Archaeological Review

A preliminary records review for archaeological sites was submitted to the University of Kentucky to determine whether there are previously recorded archaeological sites near the Project, and if present, their NRHP status. The review identified 5 sites within a 30-meter buffer of the Project Boundary and includes the two cemeteries identified in the 2007 Phase 1 reconnaissance. Three of the sites do not meet NRHP eligibility criteria and the two cemeteries' NRHP status have not been assessed (University of Kentucky 2022). The previous mining facility did not impact the cemeteries by providing a 100-foot buffer zone.

5.9.5 References

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5.10 Socioeconomic Resources and Environmental Justice

18 CFR 5.6(d)(3)(xi) requires "A general description of socio-economic conditions in the vicinity of the project. Components of this description include general land use patterns (e.g., urban, agricultural, forested), population patterns, and sources of employment in the project vicinity."

5.10.1 Overview

The unconstructed Project is located in Bell County, near the communities of Blackmont, Tejay, Balkan, and Callaway in southeast Kentucky. The following sections describe socioeconomic conditions in the Project region, including Bell County and the Commonwealth of Kentucky, to provide context.

5.10.2 General Land Use Patterns

Compared to other counties in Kentucky, Bell County, Kentucky has a high number of mining, quarrying, oil & gas extraction, utilities, and agriculture, forestry, fishing & hunting industries (Data USA 2019). Bell County, Kentucky produced 302 million tons of coal from 1879 to 2004, with 108 million tons extracted by surface mining (Carey 2007). General land use in the Project Vicinity is further described in Section 5.7.

5.10.3 Population Patterns

Figure 5-18 summarizes the population estimates for Bell County, Kentucky and the Commonwealth of Kentucky as reported in the 2010 and 2020 U.S. Census, and as estimated by the United States Census Bureau for 2021.

Table 5-18: Estimated Population of Bell County, Kentucky and the Commonwealth of Kentucky

County/State	2010 Census	2020 Census	Percent Change 2010-2020	2021 Estimates	Percent Change 2020-2021
Bell County, Kentucky	28,691	24,097	-16.01%	23,858	-0.99%
Kentucky	4,339,367	4,505,836	3.84%	4,509,394	0.08%

Source: U.S. Census Bureau 2022

Census tract 9604 (Figure 5-26) is approximately 53 square-miles and includes the communities of Tejay, Balkan, and Callaway. The tract had an estimated population of 1,292 with a population density of 24.4 people per square-mile (U.S. Census 2020). Based on 2020 data, Bell County is approximately 359 square-miles and had a population density of 67.1 people per square-mile; both of which are lower than the state average density of 114.1 people per square-mile. (U.S. Census Bureau 2022).

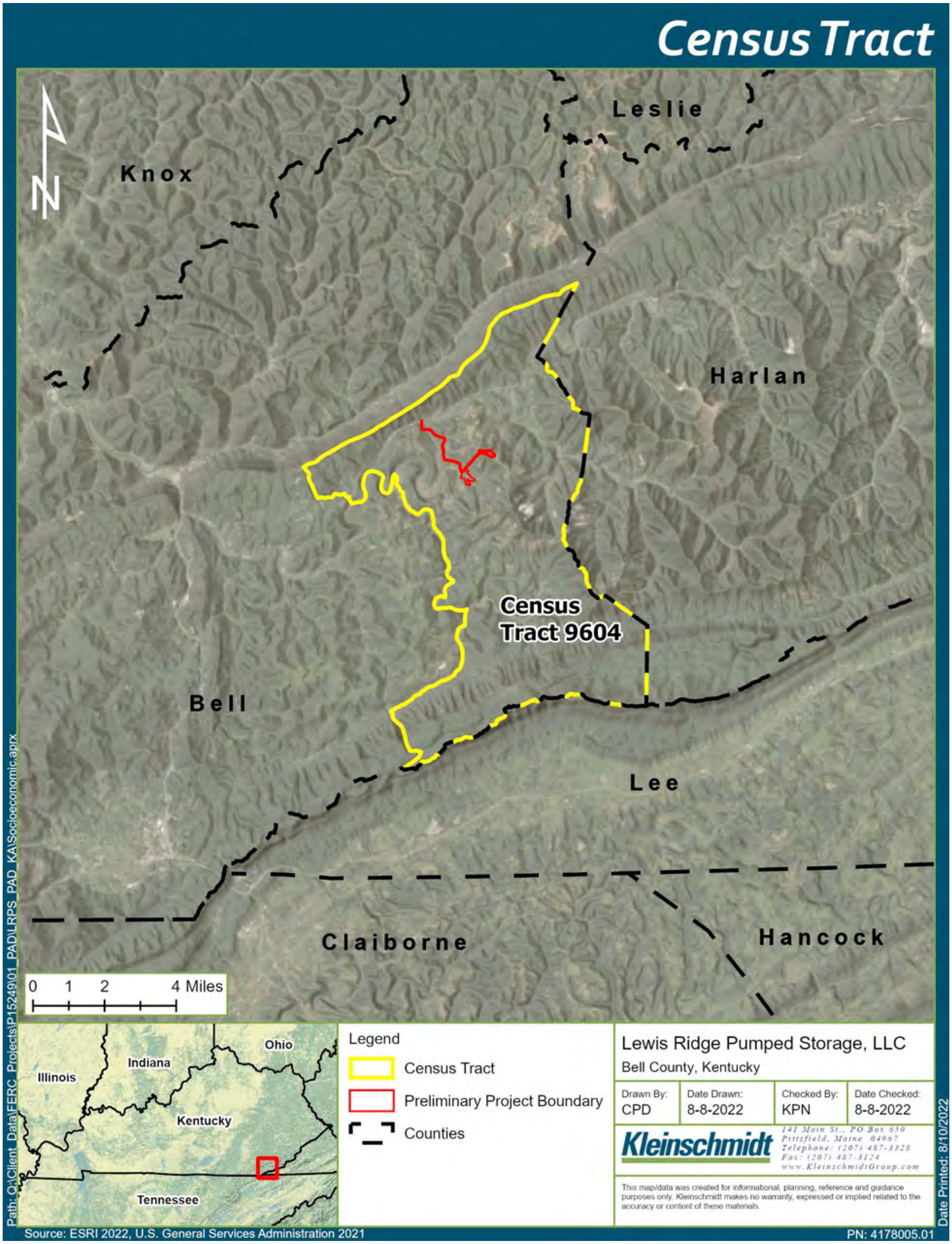

Figure 5-26: Location of Census Tract 9604

5.10.4 Economic Indicators and Employment

The 2016-2020 estimated median household income for Bell County was $28,442 in 2020 dollars with a poverty rate of 29.8 percent, compared to 14.9 percent in Kentucky (U.S. Census Bureau 2022). Table 5-19 provides the household and family distribution and income for Bell County, Kentucky. In 2019, Census tract 9604 had an estimated median household income of $30,978, the second highest median household income of the census tracts in Bell County, Kentucky (Data USA 2019).

Table 5-19: Household Incomes and Distributions for Bell County, Kentucky

	Bell County
2016-2020 Households	10,504
2016-2020 Approximate Number of Persons per Household	2.43
2016-2020 Percentage of Population in Civilian Labor Force	38.4%
2020 Population Below Poverty Level	29.8%

Source: U.S. Census Bureau 2022

The largest industries in Bell County, Kentucky in 2019 were Health Care & Social Assistance, Manufacturing, and Retail Trade. The highest paying industries were Mining, Quarrying, & Oil & Gas Extraction ($62,604), Agriculture, Forestry, Fishing & Hunting, & Mining ($46,513), and Wholesale Trade ($45,472). (Data USA 2019).

5.10.5 Environmental Justice

Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, and Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, as amended, require federal agencies to consider if impacts on human health or the environment would be disproportionately high and adverse for minority and low-income populations in the surrounding community resulting from the programs, policies, or activities of federal agencies. The thresholds used for populations meeting environmental justice (EJ) status are as follows:

- For minority populations, the meaningfully greater analysis method was used, where the minority population in a block group is at least 10 percent greater than that of the same population for the county:
  - (County population) x (1.10) = threshold above which a minority population must be for inclusion as an environmental justice community
- The “low-income threshold criteria” was used to identify environmental justice communities based on income level, where the block group must have a higher percentage of low-income households than the county.

Figure 5-27 depicts the census blocks groups screened for environmental justice within census tract 9604. Table 5-20 provides associated race and ethnicity data, as well as data on households in poverty. Ethnicity data did not identify any EJ communities within the census tract, however, both block groups within the census tract meet EJ status due to income levels below the poverty level.

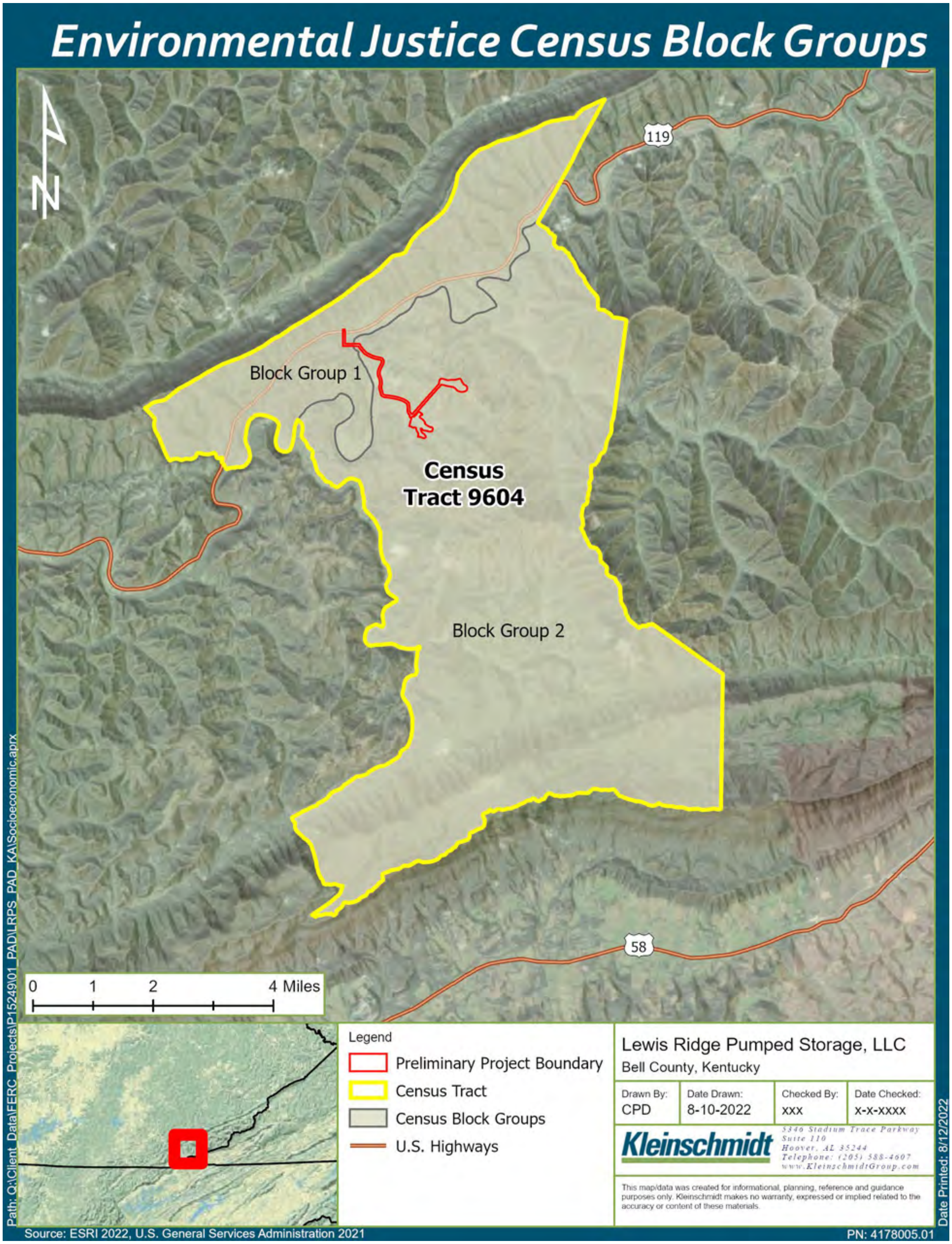

Figure 5-27: Block Groups within Census Tract 9604 Screened for Environmental Justice

Table 5-20: Environmental Justice Data

Geography	Race and Ethnicity Data									Low-Income Data
	Total Population (count)	White Alone Not Hispanic (count)	African American (count)	Native American/ Alaska Native (count)	Asian (count)	Native Hawaiian & Other Pacific Islander (count)	Some Other Race (count)	Two or More Races (count)	Total Minority (%)*	Households in Poverty (%)
Kentucky	4,449,052	3,868,479	358,928	9,386	65,191	3,182	43,601	100,285	13	16.7
Bell County, Kentucky	26,791	25,531	742	60	45	-	36	377	4.7	31.7
Census Tract 9604, Block Group 1	856	856	-	-	-	-	-	-	0	52.1
Census Tract 9604, Block Group 2	1060	1060	-	-	-	-	-	-	0	34

*Calculated the percent total minority population by subtracting the percentage of "White Alone Not Hispanic" from 100 percent for any given area.

*Blue shaded cells indicate EJ community

Source: American Community Survey 2019, 2020

The EPA's Environmental Justice Screening and Mapping Tool (EJScreen) (Version 2.0) was used to review environmental and demographic indicators of Block Group 1 and 2 of Census Tract 9604. Block Group 1 had an approximate population of 856 and covered approximately 11 square-miles, and Block Group 2 had an approximate population of 1,060 and covered approximately 42 square-miles. The percentiles in Table 5-21 (Block Group 1) and in Table 5-22 (Block Group 2) provide perspective on how the block groups compare to the entire Commonwealth of Kentucky, the EPA region (4), and the United States for each EJ index. EJScreen is not used by EPA to identify EJ communities or to quantify specific risk values for a selected area. Instead, the tool is a screening level for identifying geographic areas that may warrant further consideration, analysis, or outreach. The complete EJScreen Reports (Version 2.0) for Block Groups 1 and 2 of Census Tract 9604 are provided in Appendix F.

Table 5-21: Pollution and Sources and Socioeconomic Indicators for Block Group 1 of Census Tract 9604

Selected Variables	Value	State		EPA Region		USA	
		Avg.	%tile	Avg.	%tile	Avg.	%tile
Pollution and Sources							
Particulate Matter 2.5 (µg/m^3)	7.64	8.9	5	8.18	27	8.74	24
Ozone (ppb)	40.3	42.4	16	37.9	59	42.6	33
2017 Diesel Particulate Matter* (µg/m^3)	0.0706	0.226	0	0.261	<50	0.295	<50
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	29	99	31	80-90	29	80-90
2017 Air Toxics Respiratory HI*	0.3	0.36	46	0.4	<50	0.36	<50
Traffic Proximity (daily traffic count/distance to road)	43	380	30	430	28	710	21
Lead Paint (% Pre-1960 Housing)	0.25	0.23	69	0.15	81	0.28	59
Superfund Proximity (site count/km distance)	0.052	0.039	80	0.083	60	0.13	43
RMP Facility Proximity (facility count/km distance)	0.043	0.67	6	0.6	3	0.75	3
Hazardous Waste Proximity (facility count/km distance)	0.03	0.77	11	0.62	3	2.2	3
Underground Storage Tanks (count/km^2)	0	1.1	16	3.5	10	3.9	16
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00025	1.3	45	0.45	50	12	38
Socioeconomic Indicators							
Demographic Index	33%	26%	73	37%	50	36%	54
People of Color	0%	15%	8	39%	1	40%	1
Low Income	65%	37%	90	35%	91	31%	92
Unemployment Rate	11%	6%	85	6%	86	5%	87
Linguistically Isolated	0%	1%	73	3%	51	5%	45
Less Than High School Education	32%	14%	94	13%	94	12%	92
Under Age 5	7%	6%	68	6%	71	6%	68
Over Age 64	14%	16%	43	17%	46	16%	50

Source: EPA 2022a

Table 5-22: Pollution and Sources and Socioeconomic Indicators for Block Group 2 of Census Tract 9604

Selected Variables	Value	State		EPA Region		USA	
		Avg.	%tile	Avg.	%tile	Avg.	%tile
Pollution and Sources							
Particulate Matter 2.5 (μg/m^3)	7.64	8.9	5	8.18	27	8.74	24
Ozone (ppb)	40.3	42.4	16	37.9	59	42.6	33
2017 Diesel Particulate Matter* (μg/m^3)	0.0706	0.226	0	0.261	<50	0.295	<50
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	29	99	31	80-90	29	80-90
2017 Air Toxics Respiratory HI*	0.3	0.36	46	0.4	<50	0.36	<50
Traffic Proximity (daily traffic count/distance to road)	6.2	380	11	430	8	710	5
Lead Paint (% Pre-1960 Housing)	0.35	0.23	80	0.15	87	0.28	67
Superfund Proximity (site count/km distance)	0.059	0.039	84	0.083	64	0.13	48
RMP Facility Proximity (facility count/km distance)	0.043	0.67	6	0.6	3	0.75	3
Hazardous Waste Proximity (facility count/km distance)	0.035	0.77	13	0.62	5	2.2	4
Underground Storage Tanks (count/km^2)	0	1.1	16	3.5	10	3.9	16
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00016	1.3	41	0.45	46	12	34
Socioeconomic Indicators							
Demographic Index	34%	26%	75	37%	52	36%	55
People of Color	1%	15%	14	39%	3	40%	3
Low Income	66%	37%	90	35%	92	31%	92
Unemployment Rate	2%	6%	31	6%	28	5%	30
Linguistically Isolated	2%	1%	80	3%	62	5%	55
Less Than High School Education	24%	14%	85	13%	86	12%	85
Under Age 5	2%	6%	11	6%	14	6%	13
Over Age 64	15%	16%	44	17%	48	16%	51

Source: EPA 2022b

5.10.6 References

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5.11 Tribal Resources

18 CFR 5.6(d)(3)(xii) requires "A description of Indian tribes, tribal lands, and interests that may be affected by the project. Components of this description include: (A) Identification of information on resources specified in paragraphs (d)(2)(ii)–(xi) of this section to the extent that existing project construction and operation affecting those resources may impact tribal cultural or economic interests, e.g., impacts of project-induced soil erosion on tribal cultural sites; and (B) Identification of impacts on Indian tribes of existing project construction and operation that may affect tribal interests not necessarily associated with resources specified in paragraphs (d)(3)(ii)–(xi) of this Section, e.g., tribal fishing practices or agreements between the Indian tribe and other entities other than the potential applicant that have a connection to project construction and operation."

There are no Tribal lands in the Project Vicinity. The Permittee has identified the Native American tribes listed in Table 5-23 as having the potential to have interest in the Project and are included in the Distribution List for the Project licensing process.

Table 5-23: Native American Tribes included in Project Distribution List

Native American Tribe
Southern Cherokee Nation of Kentucky
Eastern Band of Cherokee Indians
Peoria Tribe of Indians of Oklahoma
Delaware Nation
Miami Tribe of Oklahoma

6.0 PRELIMINARY LISTING OF POTENTIAL ISSUES, INFORMATIONAL NEEDS, AND MITIGATION BY RESOURCE

18 CFR 5.6(d)(4) requires "Based on the resource description and impacts discussion required by paragraph (d)(3) of this section; the pre-application document must include with respect to each resource area identified above, a list of: (i) Issues pertaining to the identified resources; (ii) Potential studies or information gathering requirements associated with the identified issues; (iii) Relevant qualifying Federal and state or tribal comprehensive waterway plans; and (iv) Relevant resource management plans."

6.1 Geology and Soils

The Project is located at a site on a property that has historically been used for coal mining. Information regarding baseline conditions of the geology and soils of the Project Vicinity and previously conducted mining activities is readily available. Due to the placement of Project features on reclaimed mining areas, site stability has potential to be an issue that will need to be confirmed throughout the design phase of the Project, in geotechnical evaluations, engineering, and design of the Project. LRPS is committed to public health and safety and will take all necessary steps to ensure that this Project is engineered and designed to ensure a stable, lasting, and safe Project.

LRPS is proposing to conduct a phased geotechnical investigation approach to obtaining the geotechnical data/information needed to support the design as it progresses. LRPS proposes to conduct a preliminary geotechnical investigation which will include a geophysical survey at the Upper and Lower Reservoirs and a limited number of widely spaced geotechnical borings (i.e., one to two at each primary Project feature). The purpose of the proposed preliminary geotechnical investigation is to provide a general characterization of subsurface conditions at the preliminary locations of each primary Project feature, including the thickness of overburden soil, top of bedrock depth/elevation contours, presence of subsurface voids, and ease/difficulty of rock excavation.

As the design progresses, additional phase(s) of geotechnical investigation and evaluation of subsurface conditions may be required. LRPS proposes that the results of the preliminary geotechnical investigation be obtained first, and additional phases of geotechnical investigation are developed based on the results of the preliminary investigation and Project engineering and design needs. Additional phases of geotechnical investigation will be conducted as needed, and may include additional geophysical survey in additional areas, more closely spaced geophysical lines to improve/enhance data resolution, and/or a more rigorous geotechnical drilling plan with several borings at each primary Project feature. During drilling of borings in subsequent investigation phases, a down-hole televiewer (or similar equipment) may be used in some borings to evaluate the presence of voids or to map fractures at elevations of interest to the Project and/or packer testing may be completed at elevations of interest to estimate the hydraulic conductivity of the rock mass. Additionally, some of the subsequent borings could be converted to temporary observation wells to measure the groundwater elevations and conditions in the Project Vicinity.

6.2 Water Resources

The Project would involve a one-time withdrawal of water for initial fill and routine smaller withdrawals for makeup water due to evaporation and seepage at the reservoirs. At this time, the water source for the initial fill and recharge is anticipated to be Tom Fork, which is located at the Lower Reservoir. It has not yet been determined if supplementation will be required from the Cumberland River for the initial fill. LRPS conducted a preliminary hydrologic assessment to estimate the evaporation rate at the Project, filling time, and the maximum storm inflow in the drainage basin at the preliminary Lower Reservoir. Based on preliminary Project specifications, a drainage area of 1.82 square miles at the preliminary Lower Reservoir, and an average annual inflow rate into that drainage basin of 3.30 cfs (or 8,553,600 ft^3 per month), it is anticipated that the Project initial fill duration would be approximately 380 days, if 100% diversion of Tom Fork was used.

It is anticipated that the Project will require routine maintenance recharge fill to make up water lost due to evaporation. In the preliminary hydrologic assessment of the Project, it was estimated that the average percent of diversion of Tom Fork flow required for recharge water would be approximately 8%. Due to the anticipated evaporation rate and inflow anticipated at Tom Fork, it is anticipated that pumping from the Cumberland River will not be necessary for routine maintenance recharge fill.

As the Project is proposed to be closed loop, it is not anticipated that the Project will impact water quality in Tom Fork. The preliminary Project Boundary crosses both Dry Branch and the Cumberland River. These crossings are of the preliminary interconnection line only and no water resource impacts are anticipated at those crossings.

Best management practices will be used during construction for the protection of water resources and will be outlined in an appropriate construction plan which will address erosion and sedimentation associated with construction.

LRPS proposes to conduct baseline water quality sampling in Tom Fork, including parameters such as dissolved oxygen, temperature, and conductivity. As part of the licensing process, LRPS will consult with Kentucky DEP and the appropriate agencies to determine permit application needs and appropriate monitoring and mitigation measures in accordance with the requirements of the CWA and associated regulations.

The objectives and methodology associated with the proposed wetland and waterway delineation and water quality sampling of Tom Fork will be detailed in a Draft Proposed Study Plan, which LRPS will make available to the interested agencies and stakeholders for review and comment.

6.3 Fish and Aquatic Resources

As described in Section 5.3, there is available information about fish and aquatic resources in the Cumberland River, and limited information on fish and aquatic resources in the tributaries in the Project Vicinity, including Tom Fork. The interconnection line will cross the Cumberland River and Dry Branch each in a single span, with no anticipated impacts to aquatic habitat or fisheries.

It is anticipated the Project has the potential to cause temporary and permanent impacts to fish and aquatic resources at Tom Fork. The preliminary Lower Reservoir location is located on Tom Fork and the initial fill would require the diversion at the preliminary Lower Reservoir to obtain water to fill the Project. It has not yet been determined the rate of initial fill, although it was estimated that at 100% diversion, it would take approximately 380 days to fill the Project, based on the preliminary Project specifications and historical regional flow data. The diversion for initial fill is anticipated to temporarily impact water quantity at Tom Fork between the Lower Reservoir and the confluence with the Cumberland River. It was estimated that the average percent of diversion of Tom Fork flow required for recharge water would be approximately 8%. The diversion for recharge fill is anticipated to permanently impact water quantity at Tom Fork between the Lower Reservoir and the confluence with the Cumberland River. These impacts to water resources have the potential to impact fish and aquatic habitat in Tom Fork.

LRPS is proposing two studies that would provide information about fish and aquatic species habitat in Tom Fork. LRPS is proposing to conduct a wetland and waterbody delineation in the preliminary Project Boundary. This will include obtaining some information about the physical habitat in Tom Fork, including substrate. LRPS is also proposing to conduct baseline water quality sampling in Tom Fork which will also inform fish and aquatic species habitat. The collected information will help in understanding the existing conditions in Tom Fork to inform fish and aquatic species habitat.

6.4 Terrestrial Wildlife and Botanical Resources

The Project is located at an existing highly disturbed area historically used for mining. The Project features will primarily be located in this previously disturbed area or along existing access roads. The wildlife and botanical resources in the region are well understood. Both native and non-native vegetation cover the Project Vicinity, and it is expected that common terrestrial wildlife inhabit or use the Project Vicinity, including small and large mammals, birds, reptiles, and amphibians. The Project has the potential to impact the terrestrial wildlife and botanical resources temporarily and permanently within the limits of disturbance during and after construction. Noise and human presence during construction activities has the potential to temporarily disturb wildlife. The Project will permanently alter the habitat within the Project Boundary and is anticipated to displace terrestrial wildlife and vegetation due to the alteration of habitat within the Project Boundary. Although permanent vegetation disruption is anticipated, it is not anticipated that the Project will have long-term effects on plant communities within the Project Vicinity.

At this time, as terrestrial wildlife and botanical resources are well understood, LRPS is not proposing studies specific to common terrestrial wildlife and botanical resources. LRPS work with the appropriate state and federal resource agencies to develop Project construction and operation plans that address noxious weed control and vegetation management.

6.5 Wetlands, Riparian, and Littoral Habitat

Readily available information on wetlands in the Project Vicinity was obtained from the USFWS NWI. LRPS proposes to conduct a wetland and waterway delineation in and directly adjacent to the preliminary Project Boundary. This will be a field survey to identify and delineate jurisdictional waters of the United States and will determine the extent of waters so that any potential disturbances to those waters are understood and permitted with the USACE, as appropriate. The objectives and methodology associated with the proposed wetland and waterway delineation will be detailed in a Draft Proposed Study Plan, which LRPS will make available to the interested agencies and stakeholders for review and comment.

6.6 Rare, Threatened, and Endangered Species

As described in further detail in Section 5.6, federally-protected (or petitioned to be federally-protected) species with the potential to occur in the Project Vicinity include: gray bat, Indiana bat, northern long-eared bat, monarch butterfly, and the yellow-spotted woodland salamander. Several state-protected species were identified as having known occurrences in Bell County, Kentucky, including two fish species: blackside dace and Cumberland arrow darter.

The proposed Project has the potential to impact fish and aquatic species, including RTE fish species, if present, in Tom Fork, due to the proposed water withdrawal for initial fill and routine recharge. LRPS proposes to conduct baseline water quality sampling in Tom Fork, including parameters such as dissolved oxygen, temperature, and conductivity. LRPS also proposes to conduct a wetland and waterbody delineation in the preliminary Project Boundary which will include obtaining some information about the physical habitat at Tom Fork, including substrate. The information collected in these studies are anticipated to provide information to determine if the existing conditions at Tom Fork provide suitable habitat for blackside dace or Cumberland arrow darter. Detailed study objectives and methodology will be provided in the Draft Proposed Study Plan.

To avoid potential impacts to tree roosting bats, LRPS proposes to avoid tree-clearing during between June 1 and August 15. If avoidance is not possible, a survey will be conducted.

6.7 Recreation and Land Use

The preliminary Project Boundary and much of the Project Vicinity includes land used historically for mining. There are no existing recreation sites in the preliminary Project Boundary and there are no public recreation sites in the Project Vicinity. Recreation is not permitted in the preliminary Project Boundary as it is private property with active and reclaimed mining operations and public access is restricted for public safety due to the industrial nature of this land. As there is no recreation in the Project Boundary, it is not anticipated that the Project will temporarily or permanently impact recreation resources. Due to the existing and proposed industrial land use of the area, it is also anticipated that there will be no notable changes in land use. As recreation resources and land use in the Project Vicinity are well understood, and no issues have been identified, no studies or protection, mitigation, and enhancement (PME) measures relative to recreation and land use resources are proposed.

6.8 Aesthetic Resources

The Project involves the development of the features described in Section 4.0, including the development of an upper and lower reservoir, penstock, and interconnection line. Project specifications are considered preliminary, as LRPS is still in the initial design phase. At this time, it has not been determined if the penstock will be entirely above-ground or buried. At this time, LRPS anticipates that the interconnection line will run primarily along existing roads, thus minimizing disturbance and alteration of the area. Due to the history of mining in the majority of the area within the preliminary Project Boundary, much of the area has been previously disturbed and the Project is not anticipated to have notable alteration of the use of the land. Additionally, vegetation and topography limits the visibility of the area. No issues have been identified relative to aesthetic resources and no studies or PME measures are proposed.

6.9 Cultural Resources

The Project construction has the potential to impact historic architectural and archaeological resources, if there are any, within the Project area of potential effects, which would likely include the Project Boundary and the Project construction limits of disturbance. As described in Section 5.9, based on preliminary desktop historic architectural review, there are several historic properties in the Project Vicinity. LRPS proposes to consult with Kentucky SHPO to determine if any historic properties would be in the Project area of potential effects in accordance with Section 106 of the National Historic Preservation Act (NHPA) of 1966. In addition to the preliminary archaeological records review that was completed and discussed in Section 5.9.1.4, LRPS proposes to conduct additional desktop archaeological review of the Project area of potential effects. This additional review will be conducted by a certified archaeologist, as required by Kentucky SHPO, and will result in detailed information on previously recorded sites and survey areas in the specified area. The additional review is intended to meet the Kentucky SHPO's specifications to verify known sites in a project area and provide information that is critical to the review of projects subject to Section 106 consultation. Following the results of the additional archaeological review, LRPS will consult with the Kentucky SHPO, and Native American tribes to determine if field survey is required.

6.10 Socioeconomic Resources and Environmental Justice

The region surrounding the Project support various employment industries including health care and social assistance, manufacturing, and retail trade. Environmental justice communities were identified in the Project Vicinity based on the low-income threshold criteria. LRPS anticipates that the Project would have a positive economic impact on the region and has the potential to benefit the identified EJ communities through the creation of jobs and additional tax revenue. LRPS is proposing to conduct a socioeconomic study that examines the short-term and long-term economic impacts to the Project region.

6.11 Tribal Resources

There are no Tribal lands in the Project Vicinity and LRPS does not anticipate that the Project will impact Tribal resources. LRPS has identified five Native American tribes that could have potential interest in the Project, and have included these Native American tribes on the Project Distribution List.

The Project Boundary primarily includes land previously disturbed due to the historical mining activities and associated access roads. As described in further detail in Section 6.9, LRPS proposes to conduct an additional desktop archaeological review of the Project area of potential effects. This archaeological review will be conducted by a certified archaeologist and will result in detailed information on previously recorded sites and survey areas in the specified area. LRPS will consult with the Kentucky SHPO and the Native American tribes to determine if undisturbed areas within the Project area of potential effects of Project limits of disturbance have a potential for archaeological sites, and if determined necessary, will complete a field survey of the area.

7.0 RELEVANT RESOURCE MANAGEMENT PLANS

7.1 Relevant Qualifying Federal and State or Comprehensive Waterway Plans

Section 10(a)(2)(A) of the Federal Power Act (FPA), 16 U.S.C § 803(a)(2)(A), requires FERC to consider the extent to which a Project is consistent with Federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways potentially affected by the proposed Project. On April 27, 1988, FERC issued Order No. 481-A revising order No. 481, issued October 26, 1987, establishing that FERC will accord FPA Section 10(a)(2)(A) comprehensive plan status to any Federal or state plan that:

- Is a comprehensive study of one or more of the beneficial uses of a waterway or waterways;
- Specifies the standards, the data, and the methodology used; and
- Is filed with the Secretary of the Commission.

FERC currently lists 18 comprehensive plans for the Commonwealth of Kentucky (FERC 2022). Of these listed plans, seven (7) are potentially relevant to the Project, as listed below (Table 7-1). These plans may be useful in the licensing proceeding for characterizing desired conditions.

Table 7-1: List of Qualifying Comprehensive Plans Potentially Relevant to the Project

Resource	Comprehensive Plan
Recreation Resources	Kentucky Department for Local Government. Kentucky Statewide Comprehensive Outdoor Recreation Plan (SCORP). Frankfort, Kentucky. October 2008.
Water Resources	Kentucky Department for Natural Resources and Environmental Protection. 1979. Kentucky wild rivers statewide management plan. Frankfort, Kentucky. June 1979.
Water Resources	Kentucky Department for Natural Resources and Environmental Protection. 1980. Kentucky wild rivers: Cumberland River management plan. Frankfort, Kentucky. June 1980.
Water Resources	Kentucky Division of Water. National Park Service. 1992. Kentucky rivers assessment. Department of the Interior, Atlanta, Georgia.
Water Resources	Kentucky Department for Natural Resources and Environmental Protection. 1980. Kentucky wild rivers: Martins Fork management plan. Frankfort, Kentucky. June 1980.
Water Resources	National Park Service. 1993. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C.
Fish and Aquatic Resources	U.S. Fish and Wildlife Service. n.d. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.

Source: FERC 2022

7.2 References

Federal Energy Regulatory Commission (FERC). 2022, August. List of Comprehensive Plans. Office of Energy Projects, 20426. Washington, D.C. Available online: https://cms.ferc.gov/media/list-comprehensive-plans Accessed: August 2022.

APPENDIX A

SUMMARY OF CONTACTS AND CORRESPONDENCE MADE IN PREPARING THE PAD
18 CFR § 5.6 (D)(5)

From:	Nathan Sandvig
To:	Chandler, Kent (PSC)
Cc:	Sandy Slayton; Michael Gambrel; Lesley Brotkowski; Michael Ricci; Matt Dunlap; Elizabeth Krchnavek
Subject:	Lewis Ridge Pumped Storage Hydropower Project Update
Date:	Thursday, July 21, 2022 3:46:45 PM
Attachments:	image001.png

Chairman Chandler,

Hope all is well and you stayed tick-free and relatively dry at the Kentucky Mountain Laurel Festival back in May.

Following-up, thanks for taking the time to meet with Rye Development and our team (copied) on site of the proposed 216-MW Lewis Ridge Pumped Storage Project. The project is anticipated to have 8 hours or 2,165 MWh of cost-competitive energy storage.

Rye has initiated site evaluations and is in the process of developing documents required for a license application to FERC. We wanted to let you know that Rye and our consultants Kleinschmidt are initiating consultation and setting up meetings with resource agencies and stakeholders to introduce the proposed Lewis Ridge Project.

Lastly, we plan on submitting a non-conforming proposal letter in response to LG&E/KU's capacity/energy RFP. We are going to suggest opening a dialog to explore interest, conduct due diligence, discuss commercial structuring, etc. in this RFP process or preferably in a separate track given the unique nature of this superior asset class that is on par and competitive Li-ion batteries. We believe this ultra-flexible project is ideal for cost-effective firm peaking, firm dispatchable baseload and/or load-following capacity and energy to optimize the clean energy generation portfolio for the future.

Please reach out if you have any questions, comments, concerns, etc. We look forward to working with you on the proposed Lewis Ridge Project.

Regards,

Rye Development

Nate Sandvig
Vice President
830 NE Holladay St.
Portland, OR 97232
(503) 309-2496
nathan@ryedevelopment.com
www.ryedevelopment.com

From:	Nathan Sandvig
To:	Stump, Kenya K (EEC); Johnson, Kari (EEC); Slone, Gordon (EEC); Johnson, Carey M (EEC)
Cc:	Sandy Slayton; Michael Gambrel; Lesley Brotkowski; Michael Ricci; Elizabeth Krchnavek
Subject:	Lewis Ridge Pumped Storage Hydropower Project Update
Date:	Thursday, July 21, 2022 3:53:33 PM
Attachments:	image001.png

Kenya et al,

Hope all is well. It was great meeting back in May. Very much appreciated your time and initial input.

As you know, Rye Development is proposing to develop the 216-MW Lewis Ridge Pumped Storage Project on reclaimed mine land in Bell County. Rye has initiated site evaluations and is in the process of developing documents required for a license application to the Federal Energy Regulatory Commission (FERC). We wanted to let you know that Rye is initiating consultation and setting up meetings with resource agencies and stakeholders to introduce the proposed Lewis Ridge Project. Copied is our leadership team and consultants who will be involved in this effort.

Please reach out if you have any questions, comments, concerns, etc. We look forward to working with you on the proposed Lewis Ridge Project.

Regards,

Rye Development

Nate Sandvig
Vice President
830 NE Holladay St.
Portland, OR 97232
(503) 309-2496
nathan@ryedevelopment.com
www.ryedevelopment.com

In August 2022, Lewis Ridge Pumped Storage, LLC initiated consultation with the following entities by sending an outreach email and information sheet (both provided below this list):

- Albey Brock, Bell County Judge Executive
- Craig Potts, Kentucky Heritage Council
- Matthew Catron, Kentucky Department of Fish & Wildlife Resources
- Lonis Morgan, Kentucky Division of Mine Reclamation and Enforcement
- Gordon R. Slone, Kentucky Department for Natural Resources
- Robert Miller, Kentucky Department for Environmental Protection, Division of Water, London Regional Office
- Deborah Dotson, Delaware Nation
- Chief Harper, Peoria Tribe of Indians of Oklahoma
- Richard Sneed, Eastern Band of Cherokee Indians, Qualla Boundary
- Tim “Healing Spirit” Jordan, Southern Cherokee Nation of Kentucky
- Douglas Lankford, Miami Tribe of Oklahoma
- Jeff Duncan, U.S. National Park Service, Southeast Region
- Daniel Blackman, U.S. Environmental Protection Agency, Region IV
- Andrew Raddant, U.S. Department of the Interior, Office of Environmental Policy and Compliance
- Leopoldo “Leo” Miranda-Castro, U.S. Fish and Wildlife Service
- Kim Amendola, National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service, Southeast Regional Office
- Tucker Davis, Kentucky Coal Association
- Kentucky Cabinet for Economic Development
- Tom Fitzgerald, Kentucky Resource Council
- Kentucky Chamber of Commerce

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Wednesday, August 24, 2022
To: (see list abovc)
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>
Subject: Lewis Ridge Pumped Storage Project, Bell County, KY
Attachment: Lewis Ridge PSP Preliminary Info Sheet 08172022

Hello,

Rye Development (Rye) is proposing to develop the Lewis Ridge Pumped Storage Project (Lewis Ridge Project) on reclaimed mine land in Bell County, Kentucky. Rye has initiated site evaluations and is in the process of developing documents required for a license application to the Federal Energy Regulatory Commission (FERC). We would like to set up a meeting with you to introduce the proposed Lewis Ridge Project and FERC licensing process. A preliminary description of the proposed project is attached. Rye wants to learn about available resource information and discuss potential resource concerns, information gaps, and proposed studies. If you would like to talk with us to learn more about the project or discuss existing information about the site, please let me know your availability on September 7, 8, or 9 for a virtual meeting.

Thank you for your consideration. We look forward to working with you on the proposed Lewis Ridge Project.

Sincerely,
Sandy

Rye Development
Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

Lewis Ridge Pumped Storage Project, FERC No. P-15249
Information Sheet

The Lewis Ridge Pumped Storage Project (Project) (Federal Energy Regulatory Commission [FERC or Commission] Project No. 15249) is an unconstructed closed loop pumped storage hydroelectric generating facility in Bell County, Kentucky. Lewis Ridge Pumped Storage, LLC (Permittee, potential applicant, or LRPS) received a Preliminary Permit for the Project from the FERC on March 3, 2022. LRPS is currently preparing a Notification of Intent (NOI) to file an application for an original FERC license for the Project, as well as a Pre-Application Document (PAD) and a request to use the Traditional Licensing Process (TLP) for FERC licensing of this Project. Under the TLP, the three-stage pre-filing consultation process described in 18 CFR § 4.38 would be completed and documented.

The Project is currently in the initial stages of design, permitting, and licensing and exact Project specifications and site-specific locations of the Project features have not been finalized. Figure 1 depicts the approximate preliminary locations of the Project features. The Project would be located at a site historically used for mining. The Project is anticipated to provide 287 megawatts (MW) of generation capacity. It is anticipated that the Project would use two pump turbine units with power generated through a closed loop pumped storage project. The Project seeks to derive the benefits of traditional pumped storage, essentially increasing off-peak load and increasing generating capacity during peak demand periods, but in an improved manner that reduces and avoids many of the environmental impacts of the traditional pumped storage facility design. The closed loop pumped storage project would utilize the site topography to circulate water between a lower and upper reservoir to store and generate power. The primary drainage basin for the Project is the Cumberland River Basin. The source of water for the initial fill of the Project is dependent on site-specific information not yet available, but preliminary review indicates that the initial fill water source may be the natural flow from the unnamed tributary at which the Lower Reservoir would be located with potential supplementation from the Cumberland River. It is anticipated that recharge water would be sourced from the unnamed tributary at which the Lower Reservoir would be located. A key benefit to the preliminary Project site is that the area at which the Project facilities would be located would be a reclaimed mine site, meaning that the area is largely disturbed.

The preliminary Project features include the following: (1) a 5,450-foot-long, 135-foot-high roller compacted concrete dam for the upper reservoir with an integrated overflow spillway; (2) an upper reservoir with a surface area of 24 acres and a storage capacity of 2,300 acre-feet; (3) a 3,850-foot-long steel penstock with the upper section likely being 16 feet in diameter and the lower extent bifurcating into two 12 foot diameter steel sections; (4) a steel surge tower or set of energy-dissipating pressure relief valves; (5) a 420-foot-long, 80-foot-wide powerhouse containing two 143.5-megawatt (MW) reversible pump-turbines with a total installed capacity of 287 MW; (6) a 830-foot-long, 75-foot-high roller compacted concrete dam at the lower reservoir with an integrated overflow spillway; (7) a 47 acre lower reservoir with a storage capacity of 2,300 acre-feet; and (8) a 2.3-mile-long, 161 kilovolt overhead transmission line. The Project would have an estimated annual generation of 605,000 megawatt-hours (Mwh) and energy storage of 2,165 Mwh. The Project would have a storage time of 8 hours at full discharge capacity.

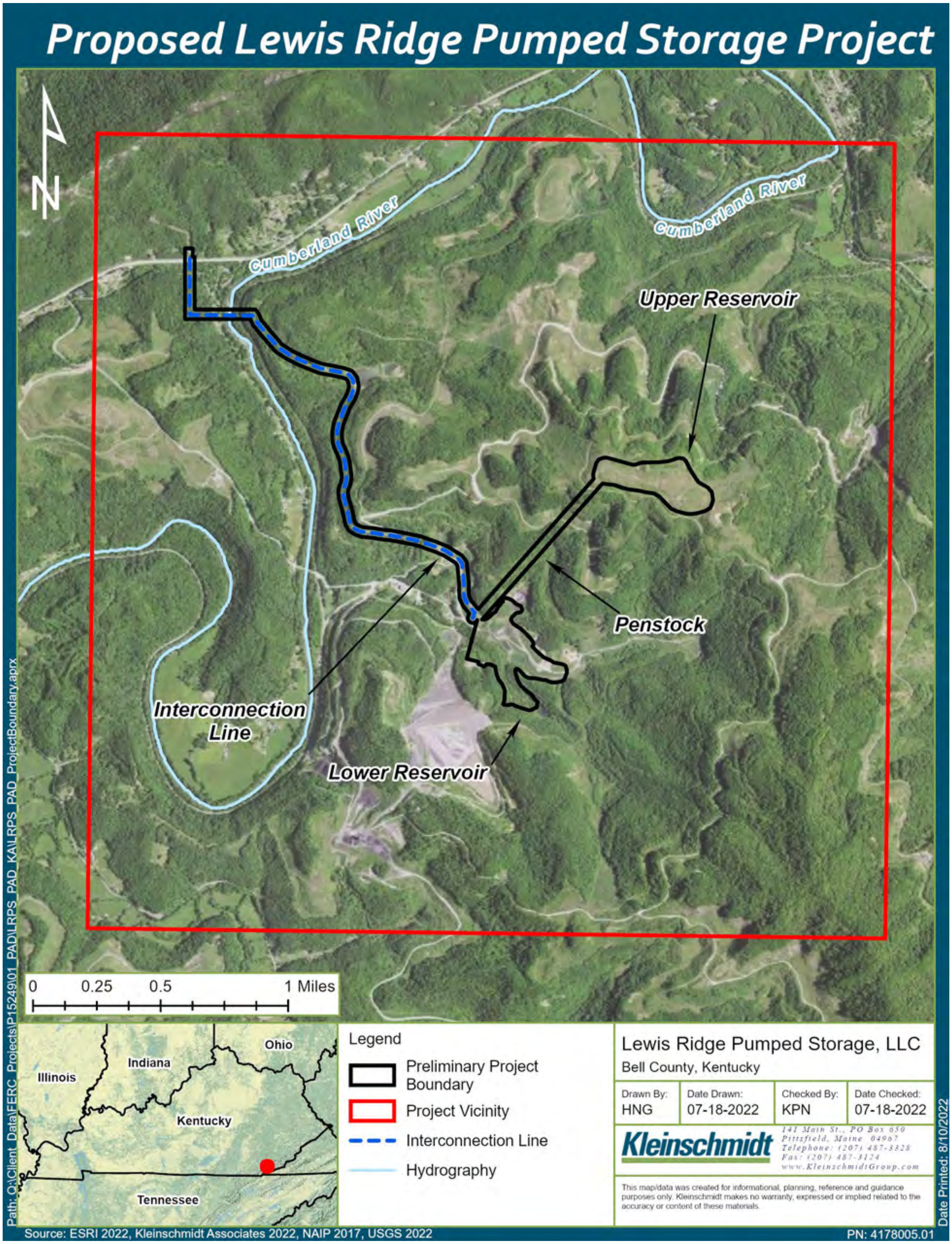


Figure 1. Proposed Lewis Ridge Pumped Storage Project

Lewis Ridge Pumped Storage, LLC conducted meetings with the U.S. Fish and Wildlife Service and the Kentucky Cabinet for Economic Development on September 9th, 2022, and with the Kentucky Resource Council on September 13th, 2022. Meeting summaries and the associated PowerPoint presentation are provided below. Following the meeting summaries and PowerPoint presentation is additional email correspondence associated with the Lewis Ridge Pumped Storage Project licensing.

Lewis Ridge Pumped Storage Project

Meeting Summary

9/9/2022 10:00 AM

Attendees:

John Faustini, U.S. Fish and Wildlife Service (USFWS)
Lee Andrews, U.S. Fish and Wildlife Service
Jennifer Garland, U.S. Fish and Wildlife Service
Sandy Slayton, Lewis Ridge Pumped Storage, LLC (LRPS)
Lesley Brotkowski, Kleinschmidt Associates
Elizabeth Krchnavek, Kleinschmidt Associates

Purpose:

Initial agency meeting with U.S. Fish and Wildlife Service. Provide an overview of the Lewis Ridge Pumped Storage Project (Project) and request input and available resource information.

Summary:

- Sandy opened the call, and initiated introductions of all on the call.
- Sandy provided the meeting agenda and described meeting purpose.
- Sandy gave an overview of pumped storage and the purpose of the Project.
- Sandy provided an overview of the Project. Sandy described the preliminary Project Boundary and Project Vicinity. In response to questions from John and Lee, Sandy described that for the initial fill it has not yet been determined if supplementation from the Cumberland River will be required.
- Sandy described the preliminary Project specifications.
- Sandy described the current status of the Project in the Federal Energy Regulatory Commission (FERC) Licensing Process
    - Received Preliminary Permit 3/3/2022.
    - Requesting to follow the Traditional Licensing Process (TLP).
    - Planning to file the Pre-Application Document (PAD) in October.
- Sandy asked USFWS for available resource information or resource concerns and described the anticipated studies, which include a wetland and waterway delineation, bat survey (if needed), cultural resources study, and socioeconomic assessment.
- Lesley described the species that were listed in the USFWS Information for Planning and Consultation (IPaC) report.
- Lee discussed the following resources:
    - Bats:
        - Stated that it is likely that either LRPS will either need to assume bat presence or conduct a survey. Can either do a survey or assume presence.
        - Stated that it will need to be determined if the Project will impact any caves.
        - Stated that the tri-colored bat is under review to be listed as endangered under the Endangered Species Act (ESA).
    - Blackside dace

        - Stated that records will need to be checked to see if blackside dace occurs in Tom Fork. Added that it is possible that the water quality is not very good and that the conductivity may be too high to provide habitat for blackside dace.
    - Yellow-spotted salamander
        - Stated that the yellow-spotted salamander was recently petitioned for protection under the ESA. It is not currently listed. The species is very rare with very few occurrences.
    - Monarch butterfly
        - Stated that there may be opportunities for habitat enhancement.
    - Cumberland arrow darter
        - Not listed federally.
- Sandy closed by thanking USFWS for their participation.
- John noted that Carrie Allison is no longer with USFWS and the distribution list should be updated to reflect that change.

Lewis Ridge Pumped Storage Project

Meeting Summary

9/9/2022 11:00AM

Attendees:

Andy Luttner, Kentucky Cabinet for Economic Development
Sandy Slayton, Lewis Ridge Pumped Storage, LLC (LRPS)
Lesley Brotkowski, Kleinschmidt Associates
Elizabeth Krchnavek, Kleinschmidt Associates

Purpose:

Initial agency meeting with KY Cabinet for Economic Development. Provide an overview of the Lewis Ridge Pumped Storage Project (Project) and request input.

Summary:

- Sandy opened the call, and initiated introductions of all on the call.
- Sandy provided the meeting agenda and described meeting purpose.
- Sandy gave an overview of pumped storage and the purpose of the Project.
- Andy Luttner described the objectives of Kentucky Cabinet for Economic Development and explained that there is a lot of interest in development in Kentucky and need for green energy.
- Andy asked about distribution. Sandy explained that they will be selling independently to the grid LG&E and KU Energy.
- Sandy discussed the Project specifications, benefits of the Project, reasoning behind the site selection.
- Andy asked the economic impact of the Project. Sandy stated that LRPS will be conducting an economic study, but there will be permanent jobs, as well as construction jobs.
- Andy asked about timeline. Sandy explained that the final Federal Energy Regulatory Commission (FERC) application is anticipated to be filed in early 2024, then FERC initiates their National Environmental Policy Act (NEPA) process, and then construction could occur. Soonest operation would be approximately 2030-2031.
- Andy offered support of the Project and stated that if LRPS has any requests, to let him know.
- Sandy closed by thanking Andy for his participation.

Lewis Ridge Pumped Storage Project

Meeting Summary

9/13/2022 2:30PM

Attendees:

Ashley Wilmes, Kentucky Resource Council (KYRC)
Tom FitzGerald, KYRC
Sandy Slayton, Lewis Ridge Pumped Storage, LLC (LRPS)
Lesley Brotkowski, Kleinschmidt Associates
Elizabeth Krchnavek, Kleinschmidt Associates

Purpose:

Initial agency meeting with KYRC. Provide an overview of the Lewis Ridge Pumped Storage Project (Project) and request input and available resource information.

Summary:

- Sandy opened the call, and initiated introductions of all on the call.
- Sandy provided the meeting agenda and described meeting purpose.
- Sandy gave an overview of pumped storage and the purpose of the Project.
- Sandy provided an overview of the Project. Sandy described the preliminary Project Boundary and Project Vicinity. Sandy described the preliminary Project specifications.
- Tom FitzGerald initiated discussion. He asked questions about the ownership of the site. Sandy responded that Asher Land and Company owns the site. Tom FitzGerald asked about water conveyance. Sandy stated that it would be a penstock. Tom FitzGerald asked about Project specifications, hazard classifications, and if the Project will be located on fill. Tom Fitzgerald expressed concerns of site stability.
- Sandy described the anticipated studies: cultural resources, wetland and waterway delineation, bat survey, and a socioeconomic assessment, along with geotechnical evaluations.
- Tom Fitzgerald provided recommendations regarding Project feature location, as it relates to site stability. Tom Fitzgerald cautioned that the Project not be placed on fill, as he states there are concerns about fill compaction.
- Tom Fitzgerald asked about distribution. Sandy explained that they will be selling independently to the grid LG&E and KU Energy.
- Tom Fitzgerald suggested that additional non-governmental organizations, including Earthjustice, may be interested in the Project. Ashley Wilmes requested that LRPS share the slide deck and a quick introductory email so that they can send to their clients. Sandy replied that the Project website just went live and that she can send the PowerPoint.
- Sandy closed by thanking KYRC for their participation.

Lewis Ridge Pumped Storage Project

FERC P-15249

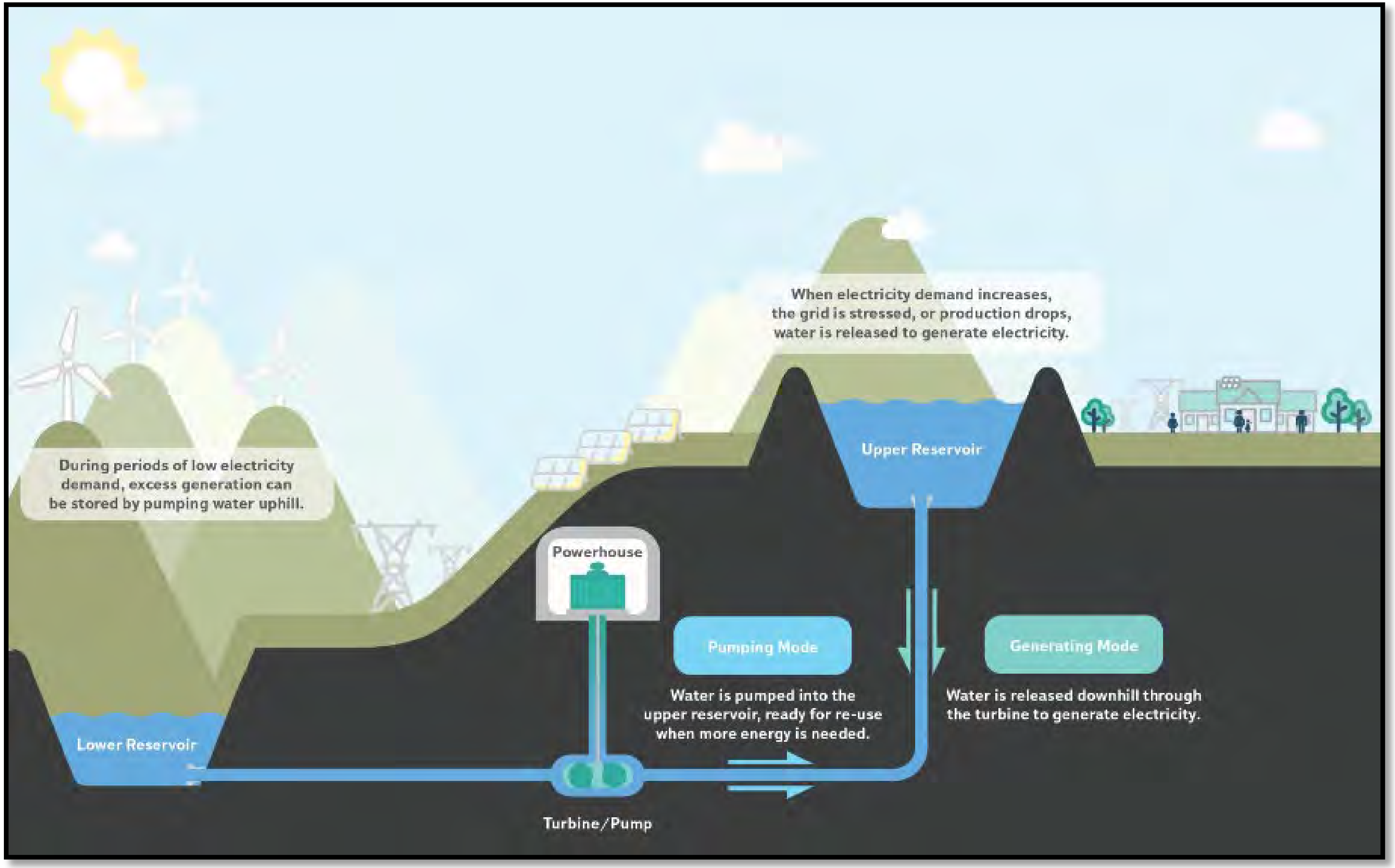
Agenda

1) Introductions
2) Meeting Purpose
3) Pumped Storage Overview
4) Project Overview
5) FERC Licensing Process
6) Resources and Proposed Studies
7) Discussion

Meeting Purpose

1) Provide an overview of the proposed Lewis Ridge Pumped Storage Project
2) Provide information about the FERC licensing process
3) Receive input and feedback regarding the information presented

Pumped Storage Overview



Why Pumped Storage in KY?

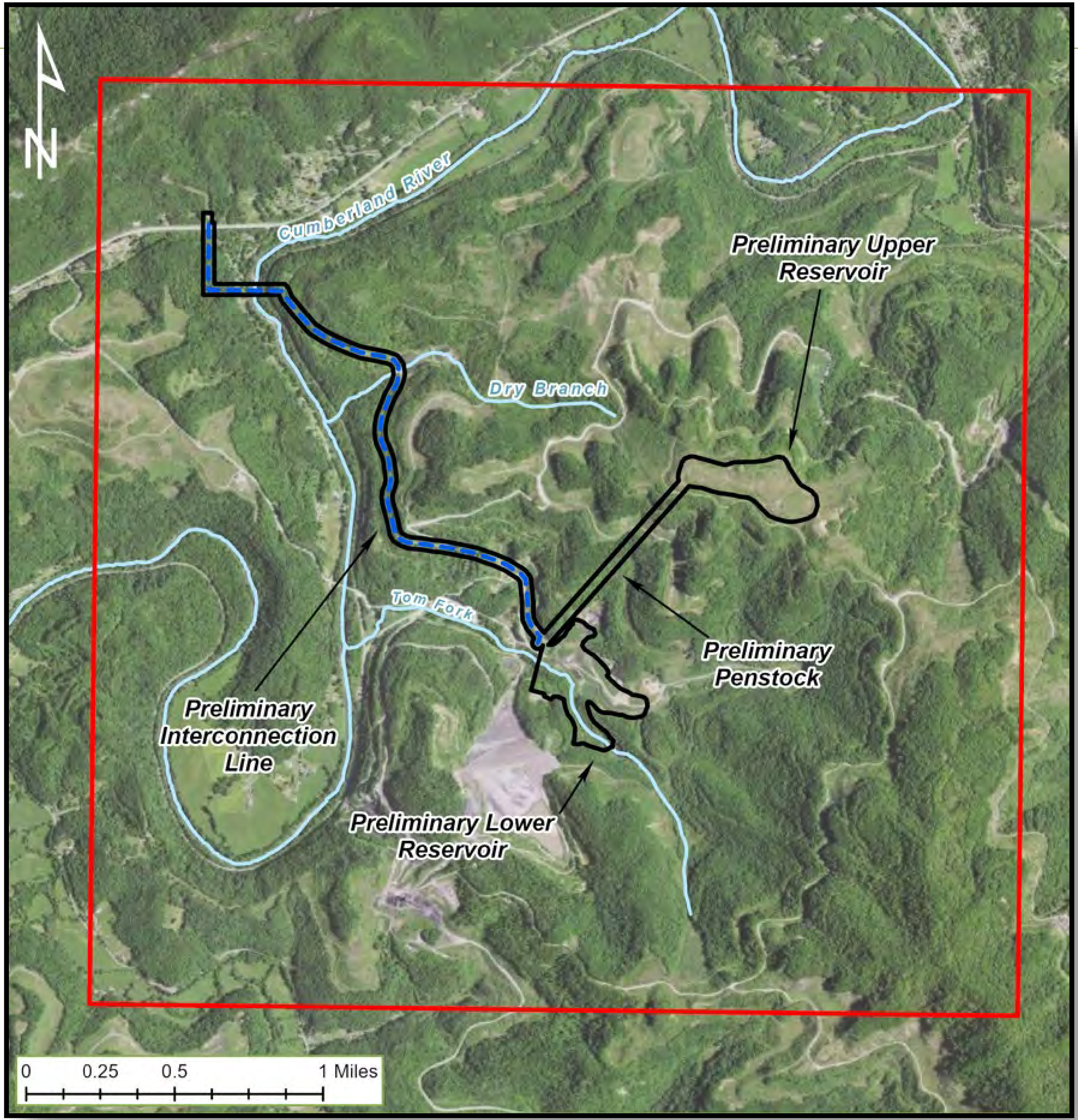
- ❖ Pumped storage provides reliable and dependable generation during periods of high energy use.

- ❖ Pumped storage projects support a grid in transition, providing energy certainty during weather and blackout events, and capacity for variable generation sources.

Project Overview

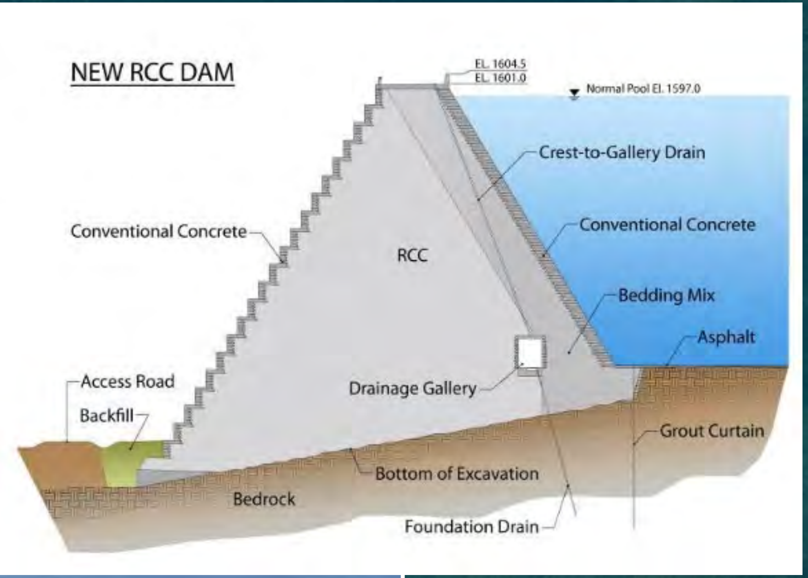
- Initial stages of design
- Unconstructed 287 MW closed-loop pumped storage hydroelectric generating facility
- Provide 8 hours or 2,165 MWh (671,700 MWh annually) of cost-competitive energy storage
- Location in Bell County, in Southeastern Kentucky
- Reclaimed coal mine site

Preliminary Project Boundary and Project Vicinity



Preliminary Project Specifications

- ❖ Structure type of Upper and Lower Reservoir – Roller Compacted Concrete
- ❖ Two 143.5 MW reversible pump-turbine units
- ❖ 3,850-foot-long steel penstock
- ❖ 2.3 mile transmission line



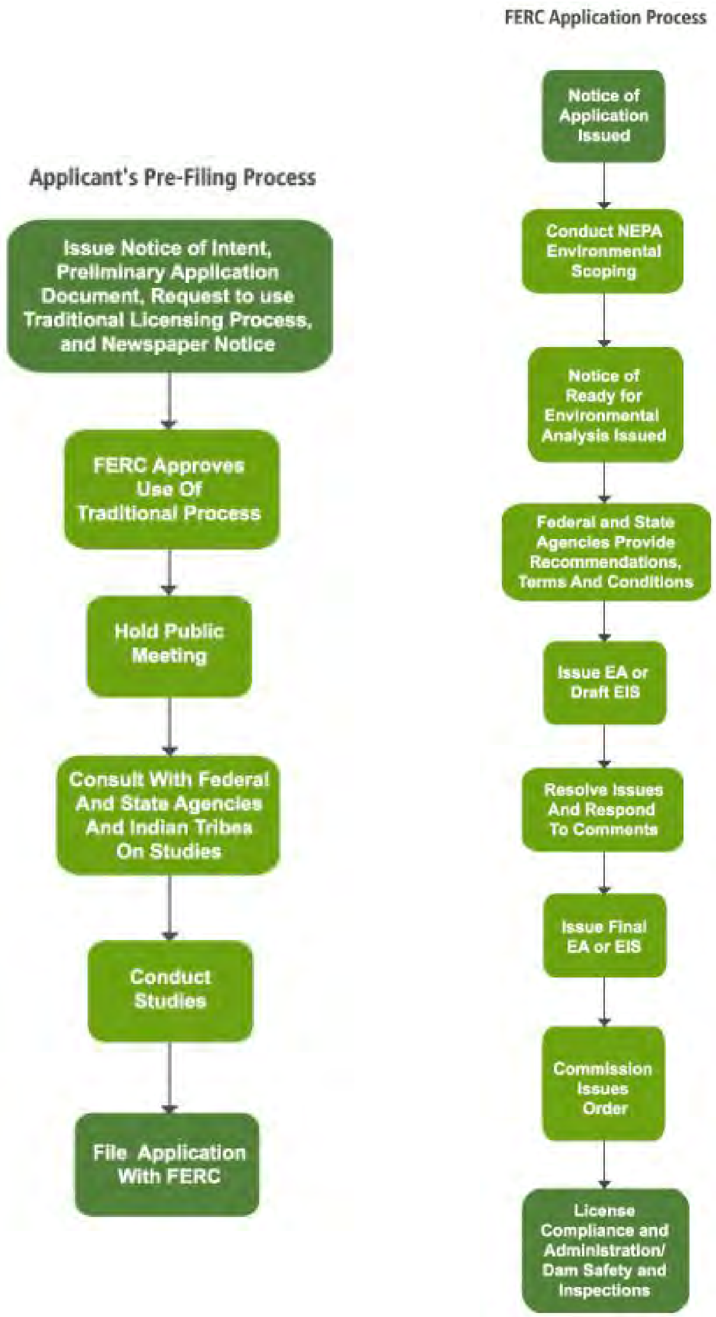
Comparable Upper Reservoir Construction Example – Taum Sauk

Preliminary Project Operations

- Closed-loop pumped storage project
  - Pump water from the Lower Reservoir to the Upper Reservoir at times when energy is in excess or in low demand. To generate energy, water would be released from the Upper Reservoir through the penstock to the powerhouse.
- Recharge Fill
  - Diversion structure at Tom Fork located at Lower Reservoir.
- Initial Fill
  - TBD. Hydrology evaluation to be conducted to determine if supplementation from the Cumberland River will be needed.

FERC Licensing Process

- ❖ FERC Preliminary Permit issued on March 3, 2022.
  - Term of 48 months.
- ❖ Requesting to follow the Traditional Licensing Process (TLP).



Resources and Proposed Studies

- Environmental Resources
  - Available resource information?
  - Resource concerns?

- Anticipated Studies
  - Wetland and waterway delineation
  - Bat survey
  - Cultural resources study
  - Socioeconomic assessment

Questions and Discussion

Sandy Slayton
Vice President, Environmental
Rye Development
P: 206-919-3976
E: sandy@ryedevelopment.com

Lesley Brotkowski
Senior Licensing Coordinator
Kleinschmidt Associates
P: 715-318-3729
E: Lesley.Brotkowski@kleinschmidtgroup.com

From: Karla Reece - NOAA Federal <karla.reece@noaa.gov>
Sent: Friday, August 26, 2022 11:15 AM
To: Sandy Slayton <sandy@ryedevelopment.com>
Subject: Re: Lewis Ridge Pumped Storage Project, Bell County, KY

Hello Ms Slayton,

It seems to me that your project is well away from the habitats where NMFS ESA-listed species might be present. You can find information about ESA-listed species under NMFS purview along with a host of other information about the consultation process on our website, here: https://www.fisheries.noaa.gov/southeast/endangered-species-conservation/esa-section-7-interagency-consultation-southeast-united-states

A list of Species and Critical Habitat found in the Southeast Region is provided here: https://www.fisheries.noaa.gov/southeast/endangered-species-conservation/esa-section-7-interagency-consultation-southeast-united-states

Thank you,

Karla

I am 100% Teleworking due to Covid-19. Please email any questions or concerns for the most efficient response.

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Karla Reece- *(she/her)*
Section 7 Team Lead
Interagency Cooperation Branch
Protected Resources
NOAA Fisheries | U.S. Department of Commerce
Southeast Regional Office
National Marine Fisheries Service
email: karla.reece@noaa.gov

Section 7 Guidance Webpage - UPDATED URL
Updated Construction Conditions, (May 2021)

From:	Andrews, Lee
To:	Sandy Slayton; Garland, Jennifer; Putnam, Christopher; Faustini, John
Cc:	Lesley Brotkowski; Elizabeth Krchnavek
Subject:	Re: Fw: [EXTERNAL] Lewis Ridge Pumped Storage Project (Rye/FWS)
Date:	Friday, September 9, 2022 12:39:19 PM
Attachments:	image001.png

You can address anything on this project to me at the address listed below. For anything you send via email, just send it to our office email address, which is:

KentuckyES@fws.gov

Thanks.

Lee Andrews
Field Supervisor
U.S. Fish and Wildlife Service
Kentucky Field Office

Interior Region 2 -- South Atlantic-Gulf
330 West Broadway, Room 265
Frankfort, KY 40601

502/695-0468 x108
502/695-1024 fax
502/229-4616 cell

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Friday, September 9, 2022 12:27 PM
To: Garland, Jennifer <jennifer_garland@fws.gov>; Putnam, Christopher <christopher_putnam@fws.gov>; Faustini, John <john_faustini@fws.gov>; Andrews, Lee <lee_andrews@fws.gov>
Cc: Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Subject: RE: Fw: [EXTERNAL] Lewis Ridge Pumped Storage Project (Rye/FWS)

Hi All,

Thank you for the call this morning. Christopher, I'm sorry we missed you. Attached is the presentation we went through on the call. We are really happy to have you all engaged. Please let us know if any questions or comments come up, and Chris, we'd be happy to talk with you sometime if you'd like.

To update our records, as we had Carrie Allison as the main contact, who from this group should we specifically have on our distribution list in her place?

Have a great weekend.

From:	Ashley Wilmes
To:	Sandy Slayton
Cc:	fitzkrc@aol.com; Lesley Brotkowski; Elizabeth Krchnavek; Nathan Sandvig
Subject:	Re: Lewis Ridge Pumped Storage Project (Rye/KYRC)
Date:	Tuesday, September 13, 2022 3:12:45 PM

The comments of the Joint Intervenors in the LGE/KU IRP case, and other filings, can be accessed here: https://psc.ky.gov/Case/ViewCaseFilings/2021-00393

The video of the two days of hearing can be accessed through the PSC website here: https://psc.ky.gov/Case/ViewCaseFilings/2021-00393/Hearings

--

Ashley Wilmes | Director (*she/her/hers*)

Kentucky Resources Council
www.kyrc.org | 502-875-2428

From:	Sandy Slayton
To:	Ashley Wilmes; fitzkrc@aol.com
Cc:	Lesley Brotkowski; Elizabeth Krchnavek; Nathan Sandvig
Subject:	RE: Lewis Ridge Pumped Storage Project (Rye/KYRC)
Date:	Tuesday, September 13, 2022 3:46:52 PM
Attachments:	image001.png Lewis Ridge PSP Preliminary Info Sheet 08172022.docx Lewis Ridge PSP Preliminary Info Overview (1).pptx

Thank you Ashley. We appreciate talking with you both today, and appreciate you sending that information over. We will definitely review it.

Attached is some project information that we would be happy for you to share with the other NGOs you mentioned. We also just went live with a project website: https://www.lewisridgeproject.com/

If you have other thoughts, ideas, concerns that come up, please let us know. We'll keep you in the loop as we move forward.

Sandy

Rye Development

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From:	Sandy Slayton
To:	Duncan, Jeffrey R
Cc:	Nathan Sandvig; Lesley Brotkowski; Elizabeth Krchnavek
Subject:	RE: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY
Date:	Thursday, October 6, 2022 2:22:05 PM
Attachments:	image001.png

Hi Jeff,

Sorry we missed you again. Feel free to call me any time if you want to just try and connect that way.

Sandy

Rye Development
Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Duncan, Jeffrey R <Jeff_Duncan@nps.gov>
Sent: Tuesday, October 4, 2022 11:41 AM
To: Sandy Slayton <sandy@ryedevelopment.com>
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Subject: Re: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY

Let's do 2-230 Thurs. Thanks!

Jeffrey R. Duncan, PhD.
Regional Aquatic Ecologist

Science and Natural Resources Management

Wild and Scenic Rivers
Fisheries and Aquatic Resources

National Park Service, Interior Region 2 - South Atlantic Gulf

100 West Martin Luther King, Jr. Blvd. Suite 215

Chattanooga, TN 37402

Ph: (423) 987-6127

I'm a proud graduate of the NPS GOAL Leadership Academy. Ask me about the program!

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Tuesday, October 4, 2022 11:19 AM
To: Duncan, Jeffrey R <Jeff_Duncan@nps.gov>
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Subject: RE: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY

Hi Jeff,

How about Thursday 2-2:30 or 2:30-3 eastern time? Let me know if either works and I'll send us a calendar appointment.

Thanks!

Sandy

From: Duncan, Jeffrey R <Jeff_Duncan@nps.gov>
Sent: Monday, October 3, 2022 10:01 AM
To: Sandy Slayton <sandy@ryedevelopment.com>
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Subject: Re: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY

Hi Sandy-

I'm actually pretty flexible tomorrow (Tues) and Wed. Alternatively, my Thursday afternoon is currently open too.

Thanks, Jeff

Jeffrey R. Duncan, PhD.
Regional Aquatic Ecologist

Science and Natural Resources Management

Wild and Scenic Rivers
Fisheries and Aquatic Resources

National Park Service, Interior Region 2 - South Atlantic Gulf

100 West Martin Luther King, Jr. Blvd. Suite 215

Chattanooga, TN 37402

Ph: (423) 987-6127

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From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Friday, September 30, 2022 4:31 PM
To: Duncan, Jeffrey R <Jeff_Duncan@nps.gov>
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Subject: RE: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY

Hi Jeff,

I apologize for not getting our rescheduled meeting on our calendars regarding the Lewis Ridge Pumped Storage Project. Is there a time next week (week of Oct 3) that works for you?

Thanks! Have a great weekend.

Sandy

From: Duncan, Jeffrey R <Jeff_Duncan@nps.gov>
Sent: Thursday, September 8, 2022 6:15 PM
To: Sandy Slayton <sandy@ryedevelopment.com>
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Subject: Re: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY

I'm not in tomorrow (Friday). Next week Tues or Wed mornings or anytime Friday all look good. Thanks!

Jeffrey R. Duncan, PhD.
Regional Aquatic Ecologist

Science and Natural Resources Management

Wild and Scenic Rivers
Fisheries and Aquatic Resources

National Park Service, Interior Region 2 - South Atlantic Gulf

100 West Martin Luther King, Jr. Blvd. Suite 215

Chattanooga, TN 37402

Ph: (423) 987-6127

I'm a proud graduate of the NPS GOAL Leadership Academy. Ask me about the program!

From: Sandy Slayton <sandy@ryedevelopment.com>

Sent: Thursday, September 8, 2022 8:02 PM
To: Duncan, Jeffrey R <Jeff_Duncan@nps.gov>
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Subject: RE: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY

No problem, Jeff! I totally understand. If you happen to be available tomorrow, Friday 9/9 between 11-12:30 eastern, I know we have a window then. If that doesn't work, we can find a time next week – maybe let me know which day(s) work best.

Thanks!

Sandy

From: Duncan, Jeffrey R <Jeff_Duncan@nps.gov>
Sent: Thursday, September 8, 2022 12:13 PM
To: Sandy Slayton <sandy@ryedevelopment.com>
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Subject: Re: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY

My sincere apologies. My day has been wall to wall meetings, including one or two that ran over...but that's no excuse. Apparently I neglected to accept the invitation for this one, so it wasn't highlighted on calendar. More than happy to reschedule at your convenience. Just let me know.

Again, my apologies....

Jeffrey R. Duncan, PhD.
Regional Aquatic Ecologist

Science and Natural Resources Management

Wild and Scenic Rivers
Fisheries and Aquatic Resources

National Park Service, Interior Region 2 - South Atlantic Gulf

100 West Martin Luther King, Jr. Blvd. Suite 215

Chattanooga, TN 37402

Ph: (423) 987-6127

I'm a proud graduate of the NPS GOAL Leadership Academy. Ask me about the program!

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Thursday, September 8, 2022 2:09 PM
To: Duncan, Jeffrey R <Jeff_Duncan@nps.gov>
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Subject: RE: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY

Hi Jeff,

Sorry we missed you today. Please let us know if there is a good time to reschedule.

Thanks!

Sandy

From: Sandy Slayton
Sent: Thursday, August 25, 2022 5:29 PM
To: 'Duncan, Jeffrey R' <Jeff_Duncan@nps.gov>
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>
Subject: RE: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY

Thanks for the reply, Jeff. We're looking forward to talking with you. I'll send out an invitation for 2pm on 9/8; please feel free to suggest an alternative time.

Sandy

From: Duncan, Jeffrey R <Jeff_Duncan@nps.gov>
Sent: Wednesday, August 24, 2022 4:51 PM
To: Sandy Slayton <sandy@ryedevelopment.com>

Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>
Subject: Re: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY

Hi Sandy- Thanks for reaching out. I'm currently in the afternoons of 9/7 and 9/8. I look forward to speaking with you and learning about the project.

Best, Jeff

Jeffrey R. Duncan, PhD.
Regional Aquatic Ecologist

Science and Natural Resources Management

Wild and Scenic Rivers
Fisheries and Aquatic Resources

National Park Service, Interior Region 2 - South Atlantic Gulf

100 West Martin Luther King, Jr. Blvd. Suite 215

Chattanooga, TN 37402

Ph: (423) 987-6127

I'm a proud graduate of the NPS GOAL Leadership Academy. Ask me about the program!

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Wednesday, August 24, 2022 7:41 PM
To: Duncan, Jeffrey R <Jeff_Duncan@nps.gov>
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>
Subject: [EXTERNAL] Lewis Ridge Pumped Storage Project, Bell County, KY

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Mr. Duncan,

Rye Development (Rye) is proposing to develop the Lewis Ridge Pumped Storage Project (Lewis Ridge Project) on reclaimed mine land in Bell County, Kentucky. Rye has initiated site evaluations and is in the process of developing documents required for a license application to the Federal Energy Regulatory Commission (FERC). We would like to set up a meeting with you to introduce the proposed Lewis Ridge Project and FERC licensing process. A preliminary description of the proposed project is attached. Rye wants to learn about available resource information and discuss potential resource concerns, information gaps, and proposed studies. If you would like to talk with us to learn more about the project or discuss existing information about the site, please let me know your availability on September 7, 8, or 9 for a virtual meeting.

Thank you for your consideration. We look forward to working with you on the proposed Lewis Ridge Project.

Sincerely,
Sandy

Rye Development
Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

APPENDIX B

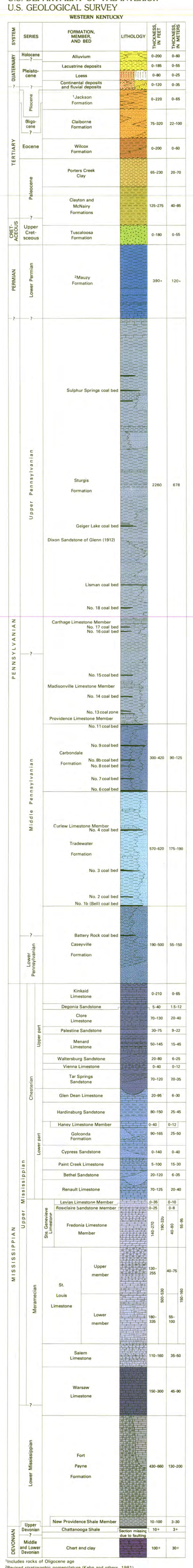
GEOLOGIC MAPS

GEOLOGIC MAP OF KENTUCKY

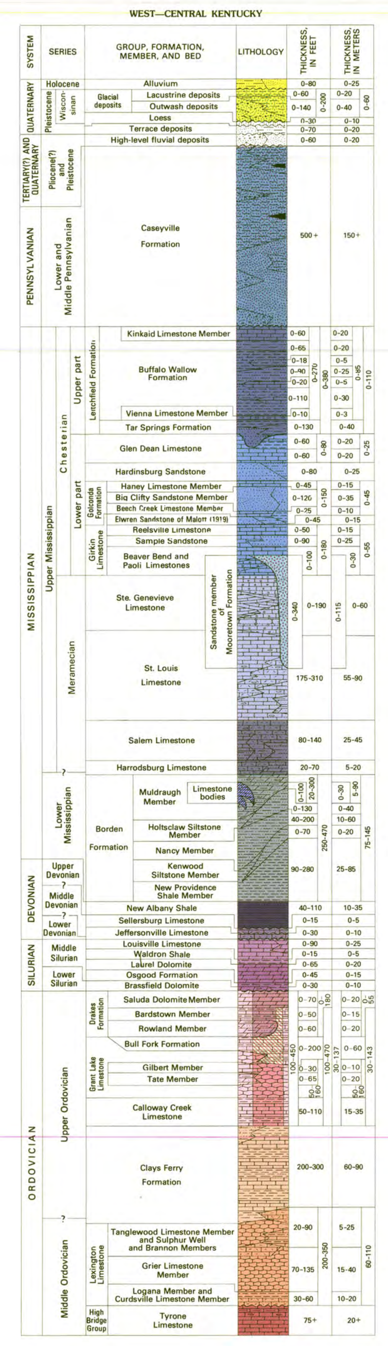
Sesquicentennial Edition of the Kentucky Geological Survey

By the
U.S. GEOLOGICAL SURVEY
Dallas L. Peck, Director
In cooperation with the
KENTUCKY GEOLOGICAL SURVEY
Donald C. Haney, State Geologist and Director
1988
Compiled by Martin C. Noger, Kentucky Geological Survey,
from the
Geologic Map of Kentucky (Scale 1:250,000), 1981
by
Robert C. McDowell, George J. Grabowski, Jr., and Samuel L. Moore, U.S. Geological Survey

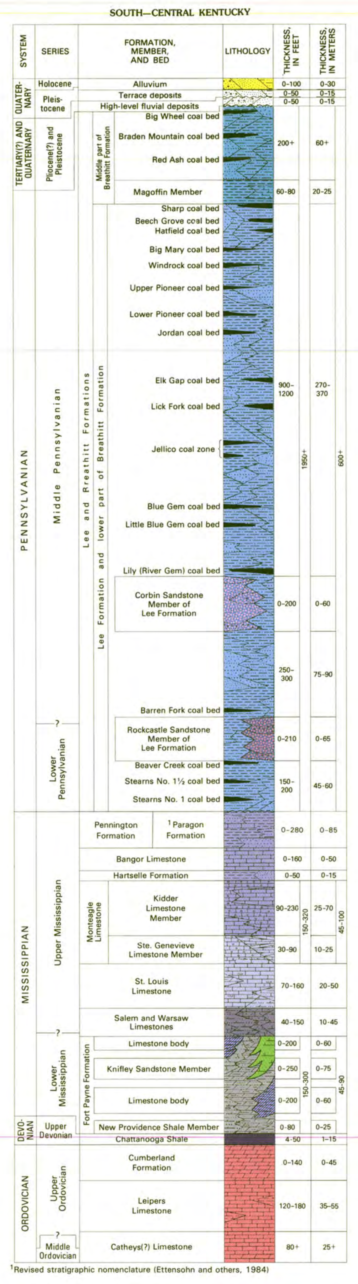
WESTERN KENTUCKY



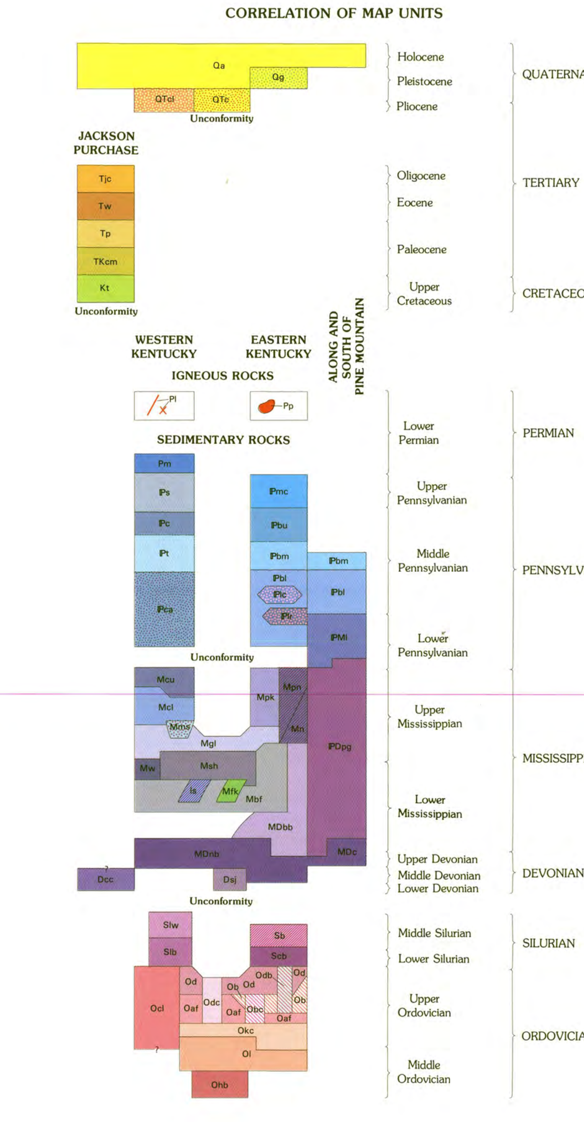
WEST-CENTRAL KENTUCKY



SOUTH-CENTRAL KENTUCKY

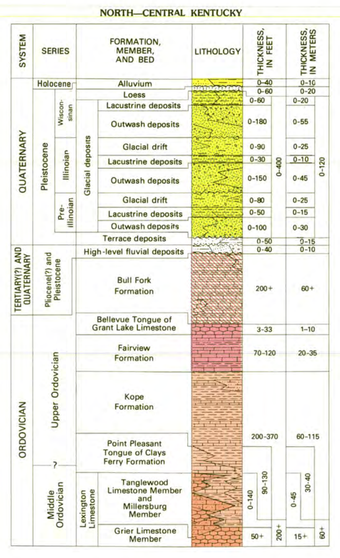


CORRELATION OF MAP UNITS

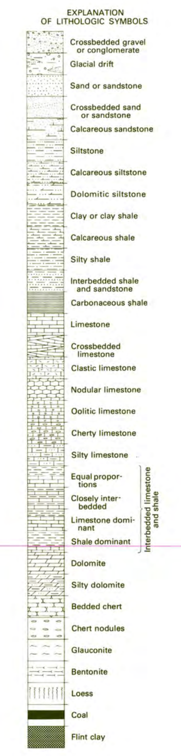


DESCRIPTION OF MAP UNITS

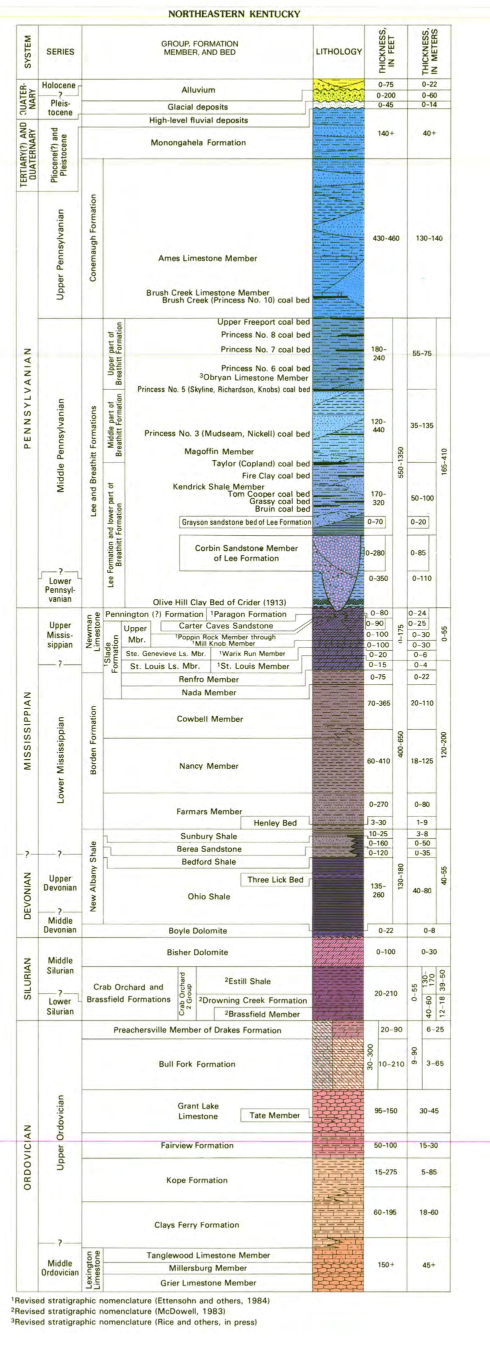
NORTH-CENTRAL KENTUCKY



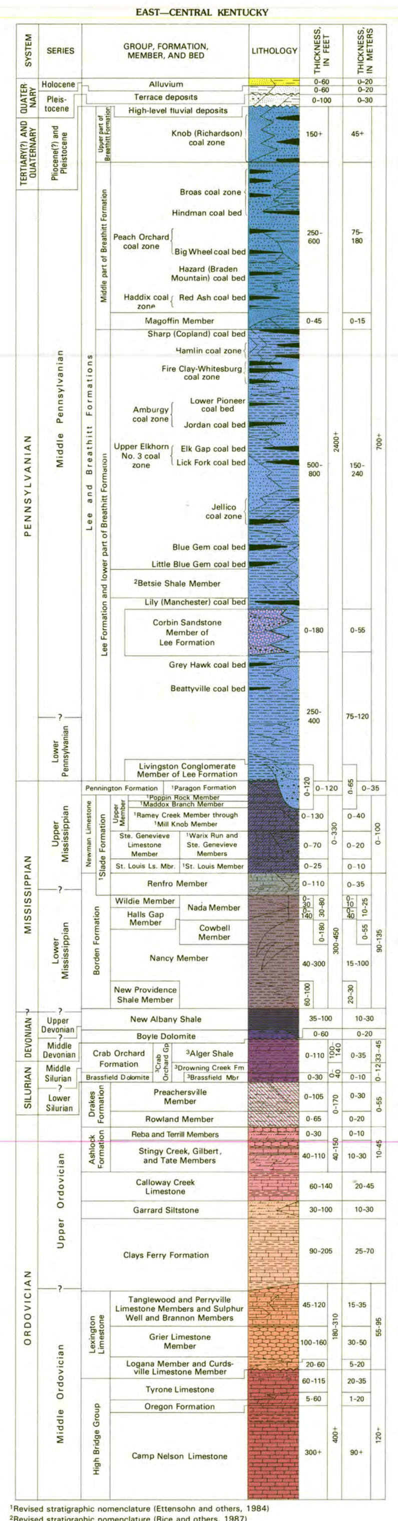
EXPLANATION OF LITHOLOGIC SYMBOLS



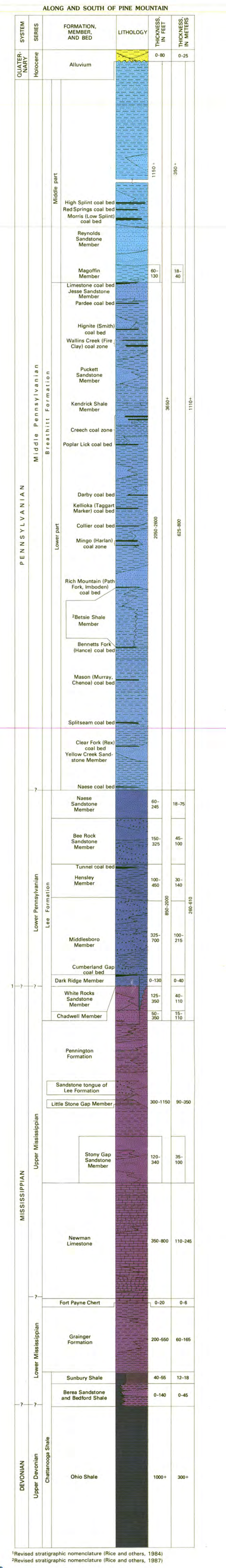
NORTHEASTERN KENTUCKY



EAST-CENTRAL KENTUCKY



ALONG AND SOUTH OF PINE MOUNTAIN



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Rice, C.L., Kosanke, R.M., and Henry, T.W., [in Press], Revision of nomenclature and correlations of some Middle Pennsylvanian units in the northwestern part of the Appalachian basin, Kentucky, Ohio, and West Virginia: GSA Special Paper.

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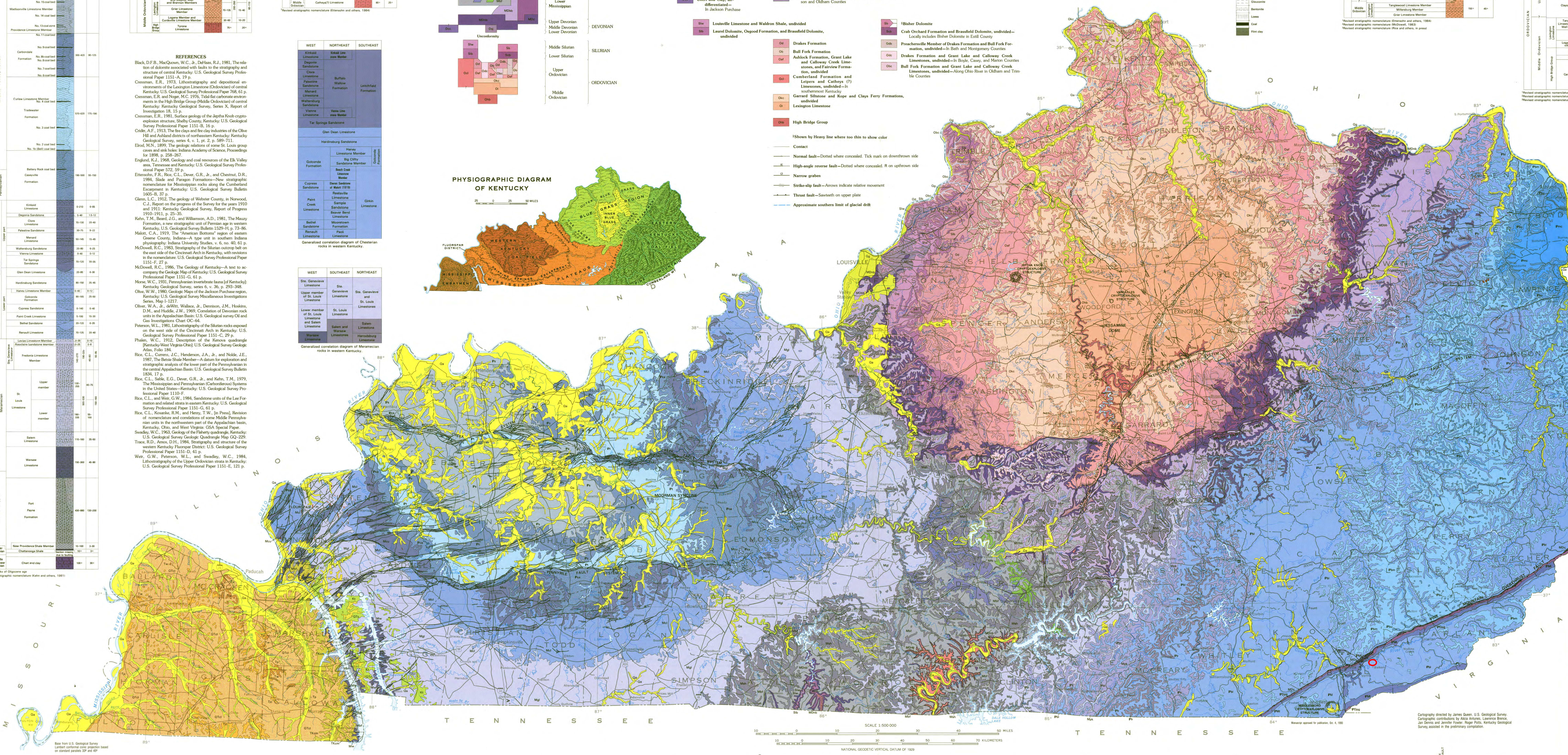
Generalized correlation diagram of Chesterian rocks in western Kentucky

Generalized correlation diagram of Meramecian rocks in western Kentucky

PHYSIOGRAPHIC DIAGRAM OF KENTUCKY

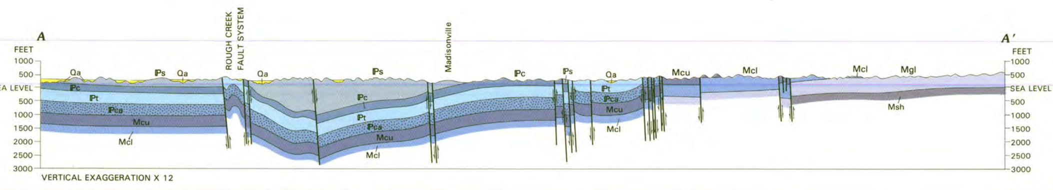


Base from U.S. Geological Survey
Lambert conformal conic projection based on standard parallels 33° and 45°

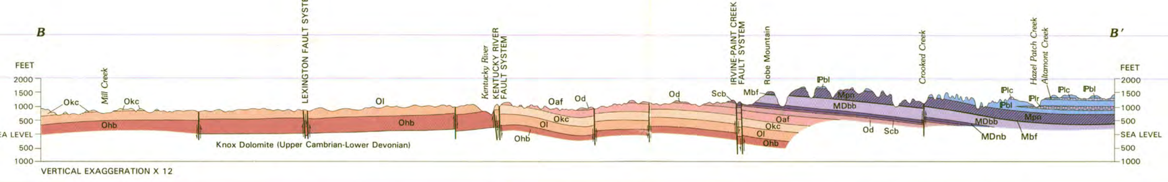
SCALE 1:500,000

NATIONAL GEODETIC VERTICAL DATUM OF 1929

Cartography directed by James Queen, U.S. Geological Survey. Cartographic contributions by Alicia Antunes, Lawrence Brence, Jan Dennis and Jennifer Fowler. Roger Potts, Kentucky Geological Survey, assisted in the preliminary compilation.



VERTICAL EXAGGERATION X 12



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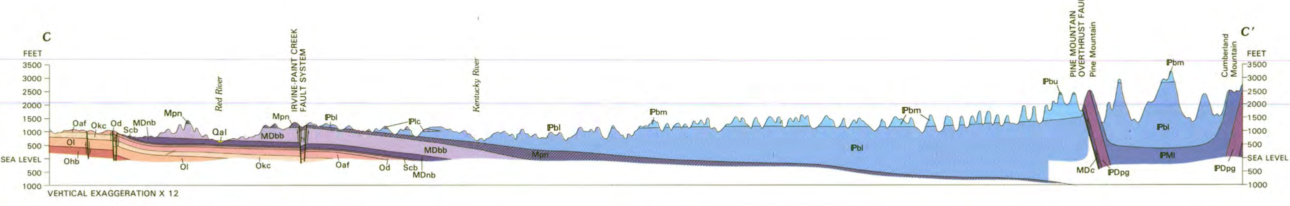
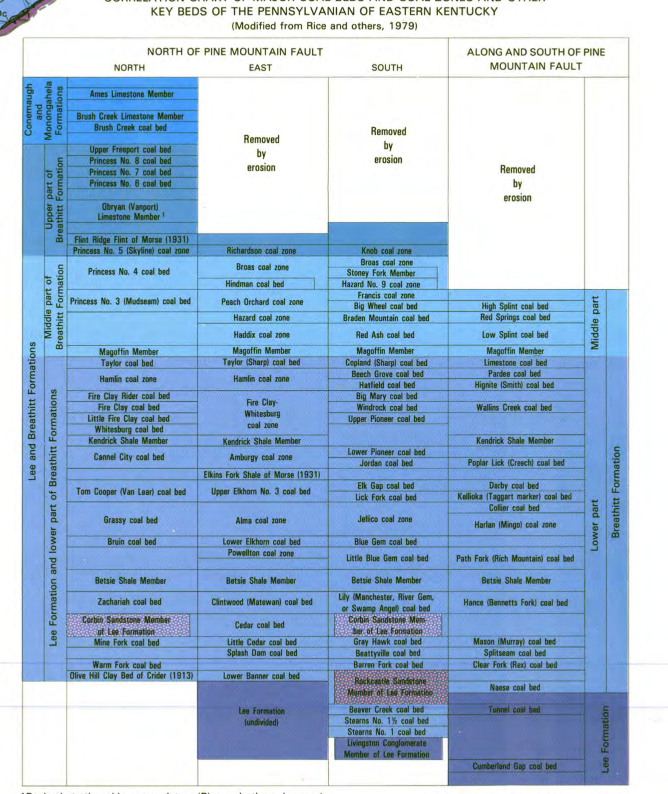


VERTICAL EXAGGERATION X 12

CORRELATION CHART OF MAJOR COAL BEDS AND COAL ZONES AND OTHER KEY BEDS OF THE PENNSYLVANIAN OF EASTERN KENTUCKY



[1] Revised stratigraphic nomenclature (Rice and others, in press)

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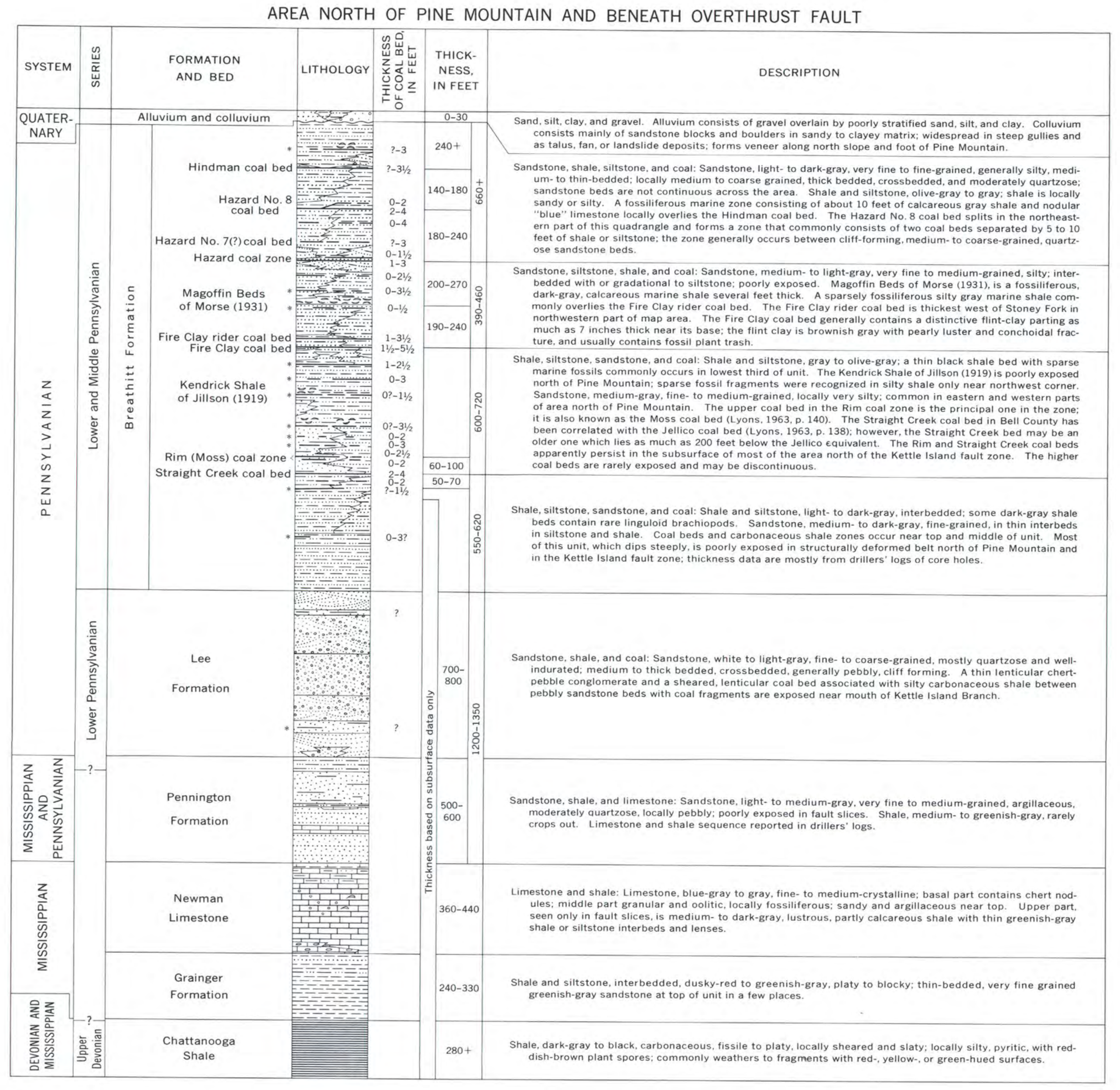
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
V. E. McKELVEY, DIRECTOR

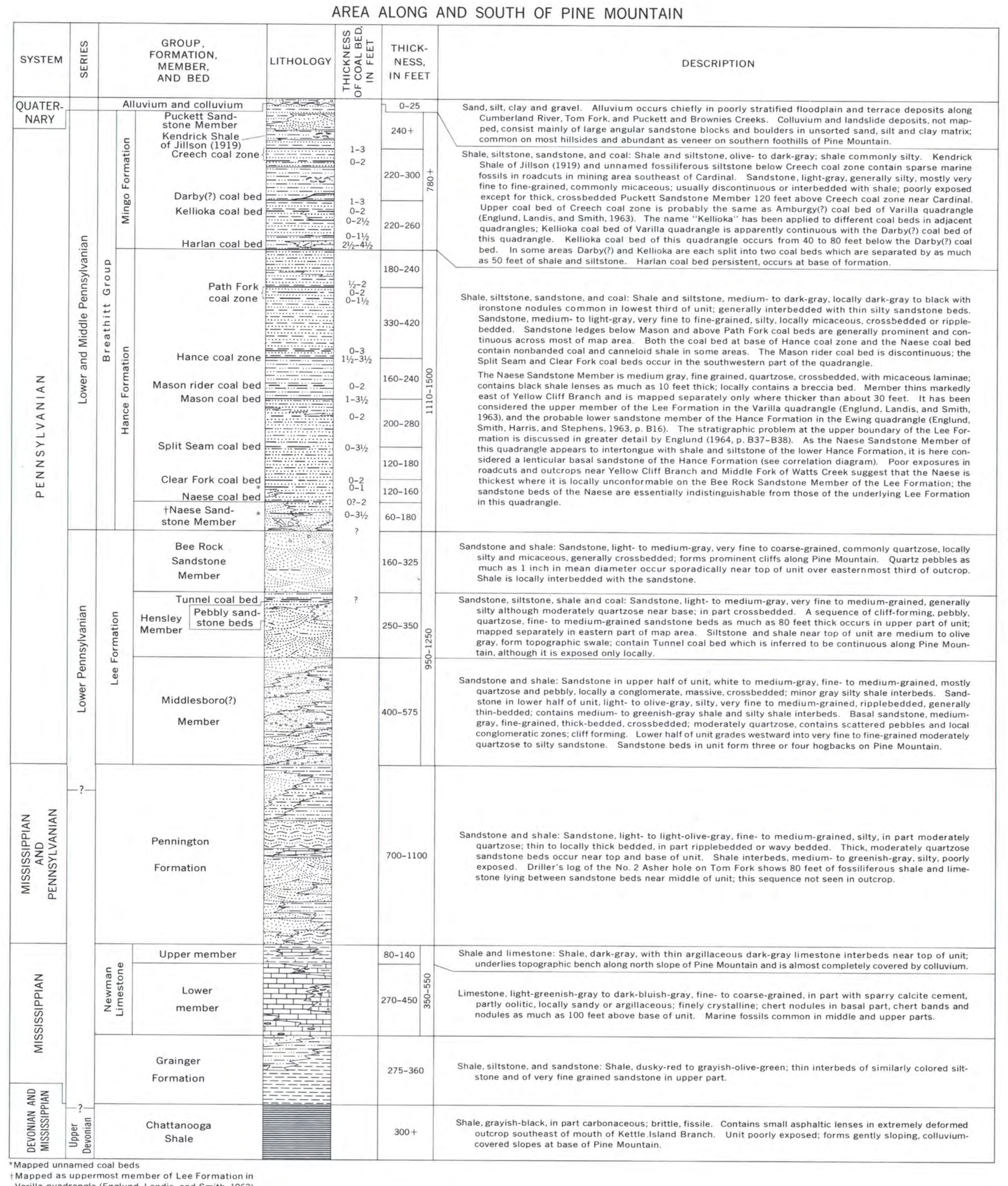
PREPARED IN COOPERATION WITH
THE COMMONWEALTH OF KENTUCKY, UNIVERSITY OF KENTUCKY
KENTUCKY GEOLOGICAL SURVEY
WALLACE W. HAGAN, DIRECTOR AND STATE GEOLOGIST

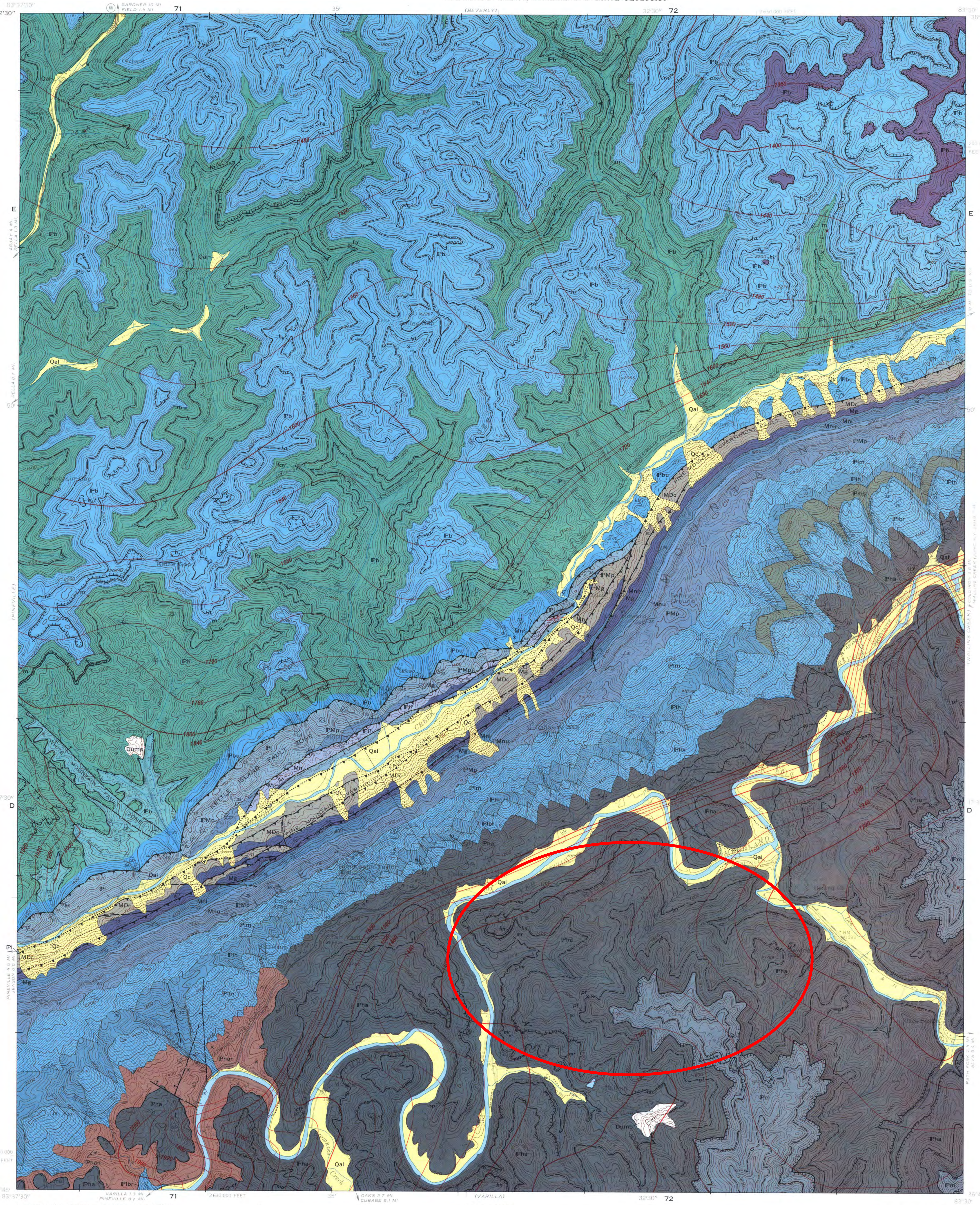
GEOLOGIC QUADRANGLE MAP
BALKAN QUADRANGLE, KENTUCKY
GQ-1127

AREA NORTH OF PINE MOUNTAIN AND BENEATH OVERTHRUST FAULT

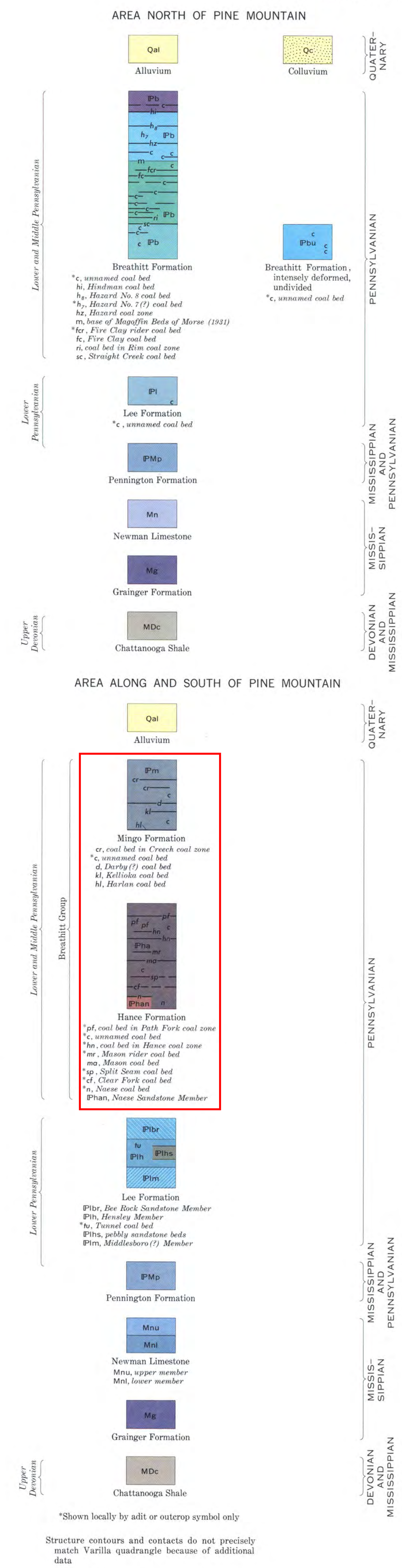


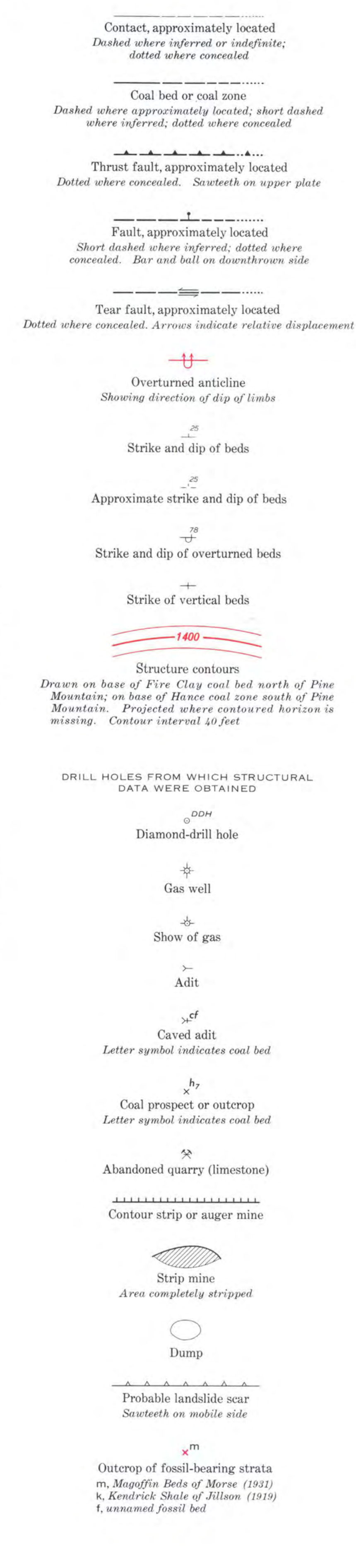
AREA ALONG AND SOUTH OF PINE MOUNTAIN





EXPLANATION





ECONOMIC GEOLOGY

Coal, gas, oil, and limestone are the principal mineral resources known in the quadrangle. Gas and oil accumulations are present mostly in pre-Pennsylvanian strata north of Pine Mountain. Thick Mississippian limestone beds on the northern slope of Pine Mountain are a potential source of large amounts of crushed limestone.

Coal beds north of Pine Mountain: A general study of coal resources in the region was made by Lyons (1963). All production from this area has been common banded high-volatile A or B rank bituminous coal from the Breathitt Formation.

The Straight Creek coal bed has been mined extensively in the Kettle Island area; it may contain large subsurface coal reserves elsewhere in the quadrangle. The coal bed averages 3 feet in thickness and locally has a very thin shale parting. At mines near Kettle Island the coal is reportedly scoured and overlain by channel-fill sandstone (E. Dean, oral communication, 1968). Lyons (1963, p. 140) has included Straight Creek coal reserves with those of the Jellico coal bed.

Little is known regarding the Rim (or Moss) coal zone and the unnamed coal beds between the Rim and Fire Clay coal beds in this quadrangle. The principal coal bed of the Rim coal zone is mined extensively to the west of the map area; mineable reserves may be present in the subsurface north of Kettle Island. A persistent coal bed, locally called the Vanderpool coal bed, occurs about 100 feet below the Fire Clay coal bed; it has been extensively mined by local residents for house coal.

The Fire Clay coal bed, known locally as the Hazard No. 4, Crockett, or Dean seam, has been mined extensively in the western part of the area where it averages 2½ feet thick. It varies in thickness, is split by shale partings, and has not been mined elsewhere in the quadrangle.

The Fire Clay rider coal bed, locally called the McGuire seam, commonly is thicker than the Fire Clay coal bed in the eastern part of the area and is the principal mined coal bed in the northwestern part of the quadrangle.

The principal coal bed above the Magoffin Beds of Morse (1931) is locally called the Hazard No. 7, although the latter coal occurs about 80 feet above the Hazard coal zone. Both of these coal beds are thickest east of Stoney Fork and in the stripped area north of Kettle Island.

The Hazard No. 8 coal bed is thickest and has been extensively stripped and augered east of Stoney Fork. The coal is split into a zone in this area, and the main coal bed averages 25 inches thick in a 6-foot zone of carbonaceous shale and thin coal beds. An unmapped coal bed about 50 feet below the Hazard No. 8 is locally as much as 4 feet thick in the northeastern part of the quadrangle.

The Hindman coal bed, known locally as the Hazard No. 9, has been extensively augered in the northeastern part of the map area. Locally an overlying calcareous siltstone is in contact with this coal; operators report that where limy rocks directly overlie this coal bed its quality is low.

Coal beds along and south of Pine Mountain: Several collapsed openings in the Tunnel coal bed of the Lee Formation were found north and west of Callaway. The extent and thickness of this bed in the Balkan quadrangle are not known. The coal was 3½ to 5 feet thick where mined a few miles to the east in the Wallins Creek quadrangle (Froelich, 1972).

A general description of the coal resources of the Breathitt Group in this region is given by Smith (1963). All commercial production from this area has been common banded bituminous coal of A or B rank from the Breathitt Group.

Several coals beds were stripped, augered, and mined underground south and southwest of Cardinal in the late 1960's. However, the only active operation at the time of mapping was a small truck mine in the Mason coal bed on Tom Fork. The Mason thickens from an average of 2 feet just south of Pine Mountain to about 3 feet near the southern boundary of the quadrangle.

The Split Seam, Clear Fork, Naese, and possibly coal beds in the Path Fork coal zone are locally thicker than 2 feet; however, they commonly are irregular in thickness, or are impure, or occur in steeply dipping strata.

Two coal beds more than 30 inches thick in the Hance coal zone probably contain the largest reserves in the area. The Hance has been mined underground only locally; because of unreliable roof conditions, it is more safely and readily recovered by stripping or augering.

The Harlan coal bed has been intensively mined and augered in the southeastern part of the quadrangle, and reserves are essentially depleted. The Kellioka and Darby(?) coal beds rarely exceed 2 feet in thickness; only the Kellioka has been locally mined and augered. Coal beds of the Creech coal zone are irregular in thickness and quality, and commonly are less than 2 feet thick.

Of the 21 test holes drilled for oil and gas north of Pine Mountain, about half produce gas. The main producing formations are the Newman Limestone ("Big Lime"), Chattanooga Shale, and Hancock Dolomite ("Lockport" or "Corniferous") of Silurian age, with minor production from sandstone ("Maxton") of the Pennington Formation and sandstone ("Salt") of the Lee Formation. The only exploratory hole drilled south of Pine Mountain was abandoned, but it had gas shows in the lower member of the Newman Limestone and in the Chattanooga Shale.

An abandoned quarry is in the Newman Limestone north of Straight Creek; the limestone is in a fault slice of the Kettle Island fault zone. This limestone deposit is accessible but limited in extent and quality varies from good to poor along the strike. Large limestone reserves are present in the lower member of the Newman Limestone on the north slope of Pine Mountain; however, access is steep and difficult as the bed lies 400 to 800 feet above the railroad spur line along Straight Creek.

One of three reported cave openings in the lower part of the Newman Limestone is on the north side of Pine Mountain east of Laurel Ford. This cave and the nearby park-like Salting Ground are potential recreational sites; however, access in 1970 was difficult.

Availability of ground water in the quadrangle and in surrounding areas is discussed by Price and others (1962) and by Kilburn and others (1962). They indicate that most of the drilled wells in Lee and Breathitt strata yield water at rates adequate for modern domestic supplies. The water comes mainly from joints and bedding plane openings in sandstone, shale, and coal and is soft to moderately hard, with noticeable amounts of iron. The lower member of the Newman Limestone at places produces good flows from Pine Mountain, and some springs yield prolifically from solution cavities and joints.

The most favorable sites for construction are on the flood plain and terraces along Straight Creek, which are the only well-drained level surfaces north of Pine Mountain; similar alluviated areas south of Pine Mountain are present along Cumberland River, Tom Fork, and Puckett and Brownies Creeks; all are prone to periodic flooding.

Rock falls, creep, and landslides have caused engineering design and maintenance problems in new highway and railroad cuts north and south of Pine Mountain. Failure has occurred in unconsolidated colluvial deposits and in dipping bedrock; landslide scars are locally prominent on the south slope of Pine Mountain east of Green Howard Branch. Bedding-plane landslides have repeatedly occurred in jointed rocks of the south-dipping Hance Formation north of Cumberland River (Froelich, 1970).

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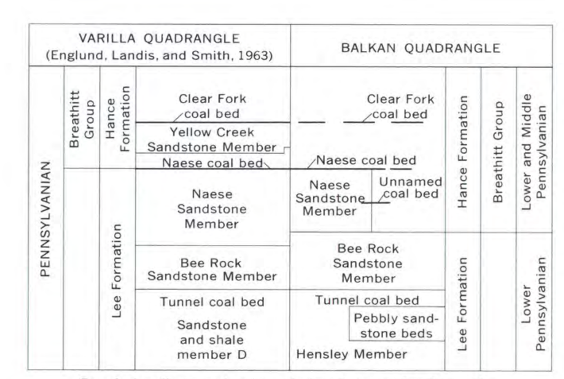


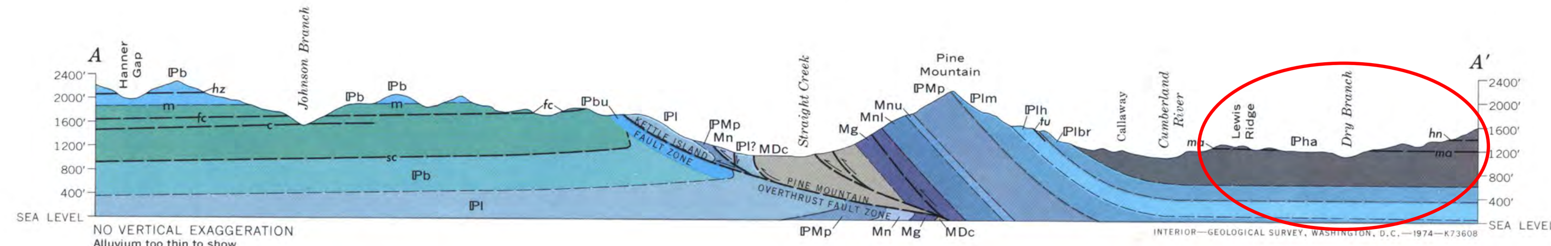
Correlation diagram showing relations between Lee Formation and Breathitt Group in Varilla and Balkan quadrangles

Base from U.S. Geological Survey, 1954. Revised 1973

SCALE 1:24000

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Geology mapped in 1967–71



GEOLOGIC MAP OF THE BALKAN QUADRANGLE, BELL AND HARLAN COUNTIES, KENTUCKY

By
Albert J. Froelich and James F. Tazelaar

1973

Price $1.00

PREPARED IN COOPERATION WITH THE
DEPARTMENT OF ENVIRONMENTAL SCIENCE, UNIVERSITY OF VIRGINIA,
DEPARTMENT OF GEOLOGY AND GEOGRAPHY, UNIVERSITY OF WEST VIRGINIA,
DEPARTMENT OF GEOLOGY, UNIVERSITY OF NORTH CAROLINA
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PENNSYLVANIA BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY, DEPARTMENT OF ENVIRONMENTAL RESOURCES,
AND TENNESSEE DIVISION OF GEOLOGY, DEPARTMENT OF CONSERVATION

LIST OF MAP UNITS

HOLOCENE AND LATE WISCONSIN

- agg ALLUVIAL SANDY GRAVEL
- al ALLUVIUM

HOLOCENE AND WISCONSIN

- cba GRANITIC-BOULDER COLLUVIUM
- cbb QUARTZITE-BLOCK LOAMY COLLUVIUM
- cbc CARBONATE-BOULDER CLAYEY COLLUVIUM
- cbd MAFIC-BOULDER LOAMY COLLUVIUM
- csa SANDY SILTY COLLUVIUM
- csb COLLUVIUM WITH HUGE BLOCKS
- csh SANDY SHALY COLLUVIUM
- cl LOAMY COLLUVIUM
- cla SANDSTONE- AND SHALE-CLAST LOAMY COLLUVIUM
- LANDSLIDE DEPOSITS AND LOAMY COLLUVIUM
  - jla Abundant landslide deposits
  - jlb Scattered landslide deposits
- clc LOAMY COLLUVIUM WITH ERRATICS
- cle CALCAREOUS SHALE-CHIP LOAMY COLLUVIUM
- clf ACID SHALE-CHIP LOAMY COLLUVIUM
- clh GRANITIC- TO DIORITIC-CLAST LOAMY COLLUVIUM
- cca SHALE-CHIP LOAMY COLLUVIUM
- ccb CARBONATE-CLAST LOAMY COLLUVIUM
- ccc STONY SILTY CLAYEY COLLUVIUM
- cch SHALE-CHIP CLAYEY LOAM COLLUVIUM WITH QUARTZITE-CLAST MANTLE

WISCONSIN

- lca LAKE CLAY AND SILT
- lla SLACKWATER LAKE CLAY, SILT, AND SAND
- gg OUTWASH SAND AND GRAVEL
- kg ICE-CONTACT SAND AND GRAVEL
- LOAMY TILL
  - tl Ground moraine
  - tl End moraine
- LOAMY TILL
  - tld Ground moraine
  - tld Stagnation moraine
  - tld End moraine
- LOAMY TILL
  - tlg Ground moraine
  - tlg Stagnation moraine
  - tlg End moraine
- LOAMY TILL
  - tlh Ground moraine
  - tlh End moraine

ILLINOIAN

- lci LAKE CLAY AND SILT
- llb SLACKWATER LAKE SILT AND SAND
- ggi OUTWASH SAND AND GRAVEL
- kgi ICE-CONTACT SAND AND GRAVEL
- LOAMY TILL
  - tli Ground moraine
  - tli Attenuated drift

PRE-WISCONSIN

- agn ALLUVIAL SAND AND GRAVEL
- cci DEEPLY WEATHERED FELSIC- AND MAFIC-BOULDER COLLUVIUM AND ALLUVIUM

EARLY PLEISTOCENE

- llc LAKE AND SLACKWATER CLAY, SILT, AND SAND

QUATERNARY AND TERTIARY

- zgc CLAYEY SANDY GRAVEL DECOMPOSITION RESIDUUM
- zsn SANDY SHALY DECOMPOSITION RESIDUUM
- zla LOAMY DECOMPOSITION RESIDUUM
- zlb LOAMY DECOMPOSITION RESIDUUM
- zlc RED SILTY SAND TO SILTY CLAY DECOMPOSITION RESIDUUM
- zrb CHERTY CLAY SOLUTION RESIDUUM, SANDY CLAY DECOMPOSITION RESIDUUM, AND SILTY CLAY DECOMPOSITION RESIDUUM
- rcc CHERTY CLAY SOLUTION RESIDUUM
- rch CLAY LOAM SOLUTION RESIDUUM
- rci LOAMY TO CLAYEY SOLUTION RESIDUUM
- rcj RED CLAY SOLUTION RESIDUUM
- sga SANDY CLAYEY SAPROLITIZED GRAVEL
- sgb CLAYEY SAPROLITIZED GRAVEL
- ssa SILTY TO CLAYEY SANDY SAPROLITE, ROCK TORS, AND JOINT-BLOCK CORE BOULDERS
- ssb SILTY TO CLAYEY SANDY SAPROLITE
- ssd SANDY CLAY SAPROLITE
- sse QUARTZ-RICH SAPROLITE
- sla CLAYEY SAPROLITE
- slb MICACEOUS SAPROLITE
- slc SILTY TO CLAYEY SAPROLITE
- slf THIN SILTY CLAY SAPROLITE ON SERPENTINITE
- slg CLAYEY SAPROLITE, ROCK TORS, AND BLOCK-JOINT CORE BOULDERS
- scb RED CLAY TO SILTY CLAY SAPROLITE

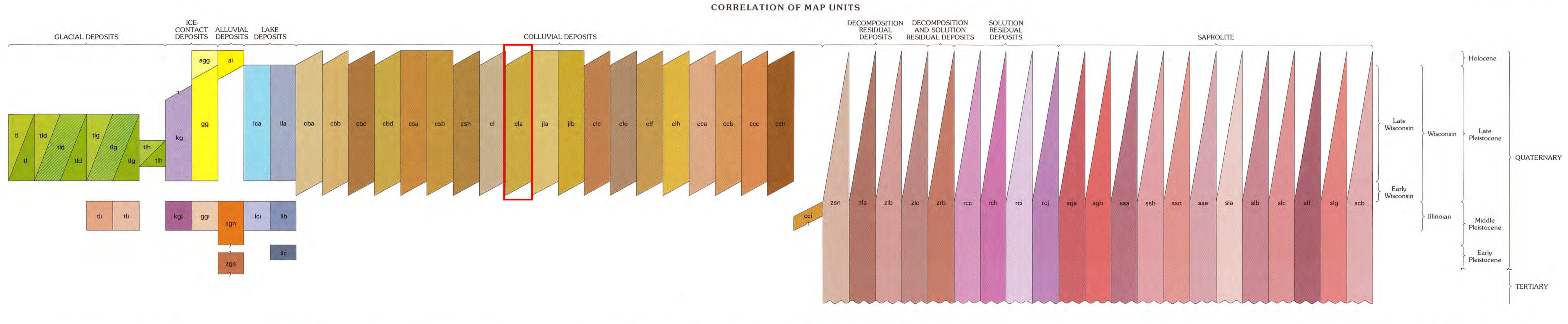
CONTACT—Dashed where inferred

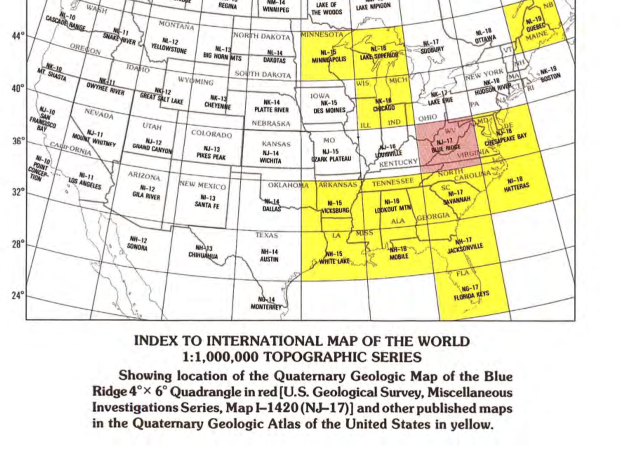
MELTWATER CHANNEL

ESKER

DIRECTION OF ICE MOVEMENT INDICATED BY STRIATIONS

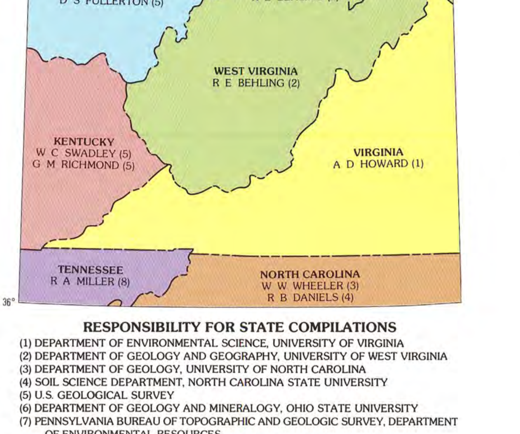
CORRELATION OF MAP UNITS





INDEX TO INTERNATIONAL MAP OF THE WORLD 1:1,000,000 TOPOGRAPHIC SERIES

Showing location of the Quaternary Geologic Map of the Blue Ridge 4° × 6° Quadrangle in red [U.S. Geological Survey, Miscellaneous Investigations Series, Map I–1420 (NJ–17)] and other published maps in the Quaternary Geologic Atlas of the United States in yellow.



RESPONSIBILITY FOR STATE COMPILATIONS

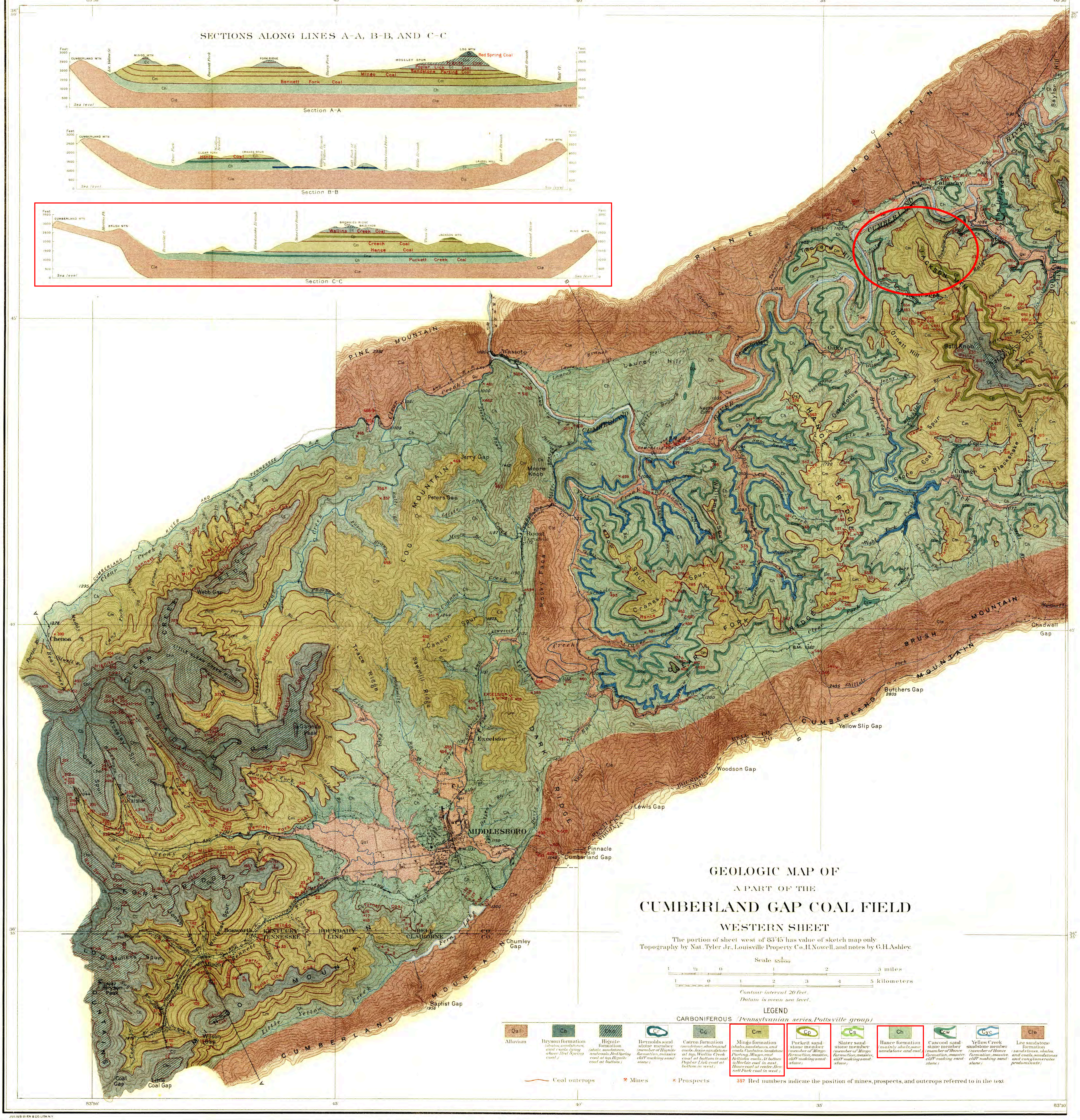
QUATERNARY GEOLOGIC MAP OF THE BLUE RIDGE 4° × 6° QUADRANGLE, UNITED STATES

State compilations by
Alan D. Howard, Robert E. Behling, Walter H. Wheeler, Raymond B. Daniels,
W C Swadley, Gerald M. Richmond, Richard P. Goldthwait, David S. Fullerton,
William D. Sevon, and Robert A. Miller

Edited and integrated by
Gerald M. Richmond, David S. Fullerton, and Ann Coe Christiansen

1991

QUATERNARY GEOLOGIC ATLAS OF THE UNITED STATES


SECTIONS ALONG LINES A-A, B-B, AND C-C
Section A-A
Section B-B
Section C-C
GEOLOGIC MAP OF
A PART OF THE
CUMBERLAND GAP COAL FIELD
WESTERN SHEET
The portion of sheet west of 83°45′ has value of sketch map only.
Topography by Nat. Tyler Jr., Louisville Property Co., H. Nowell, and notes by G. H. Ashley.
Scale 1/45000
3 miles
5 kilometers
Contour interval 20 feet.
Datum is mean sea level.
LEGEND
CARBONIFEROUS (Pennsylvanian series, Pottsville group)
Alluvium
Bryson formation
Hignite formation
Reynolds sandstone member (member of Hignite formation, massive cliff-making sandstone)
Catron formation (sandstone, shales, and coals. Jesse sandstone at top, Wallin Creek coal at bottom in east, Poplar Lick coal at bottom in west)
Mingo formation (shales, sandstones, and coals. Contains Sandstone Parting, Mingo, and Kellioka coals. At bottom is Harlan coal in east, Hance coal at center, Bennett Fork coal in west)
Puckett sandstone member (member of Mingo formation; massive, cliff-making sandstone)
Slater sandstone member (member of Mingo formation; massive, cliff-making sandstone)
Hance formation (mainly shale, some sandstone and coal)
Cawood sandstone member (member of Hance formation; massive cliff-making sandstone)
Yellow Creek sandstone member (member of Hance formation; massive cliff-making sandstone)
Lee sandstone formation (sandstones, shales, and coals; sandstones and conglomerates predominate)
Coal outcrops
Mines
Prospects
357 Red numbers indicate the position of mines, prospects, and outcrops referred to in the text
MIDDLESBORO
Cumberland Gap
Chenoa
Excelsior
Wasioto
PINE MOUNTAIN
CUMBERLAND MOUNTAIN
BRUSH MOUNTAIN

Appendix C

Mining Map

24x36 = FULL SCALE

LEGEND

- ROADS
- RR TRACKS (ACTIVE CSXT)
- WATERLINE
- PRELIMINARY PROJECT BOUNDARY
- SURFACE MINING AREA
- DEEP MINING AREA
- AUGER MINING AREA

NOTES:
1. ALL ELEVATIONS IN NAV'D 1988 DATUM. HORIZONTAL CONTROL BASED ON NAD83 KENTUCKY STATE PLANE SINGLE ZONE SPCS, US FEET.

NOT FOR CONSTRUCTION

RYE DEVELOPMENT, LLC

LEWIS RIDGE PUMPED STORAGE PROJECT

EXISTING SITE PLAN
MINING AREAS

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888-224-5942
KleinschmidtGroup.com

No.	Revision	Date	Drawn	Checked
-	-	-	-	-

Designed	Drawn	Checked	Project No.	Date Revised	Drawing No.
MLD	RL	-	4178-005	09-20-22	Figure 5

PRINTED: Sep. 20, 2022 - 3:33 PM J:\4178\005\Drawings\CAD\4178005 Figure 2 (Mining Areas).dwg

Appendix D

USDA NRCS Physical Soil Properties of Bell and Harlan Counties, Kentucky

Physical Soil Properties

Bell and Harlan Counties, Kentucky

[Entries under "Erosion Factors--T" apply to the entire profile. Entries under "Wind Erodibility Group" and "Wind Erodibility Index" apply only to the surface layer. Absence of an entry indicates that data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
AgB:														
Allegheny	0-8	20-52	28-65	10-27	1.43-1.48	4.00-14.00	0.17-0.21	0.4-1.4	1.0-4.0	.32	.32	5	5	56
	8-33	20-60	20-65	12-35	1.44-1.63	4.00-14.00	0.15-0.19	0.5-2.5	0.0-0.5	.37	.37			
	33-42	30-70	15-60	5-35	1.61-1.65	4.00-14.00	0.11-0.15	0.2-2.5	0.0-0.5	.32	.32			
	42-72	30-70	15-50	5-35	1.44-1.62	4.00-14.00	0.11-0.15	0.1-2.5	0.0-0.5	.37	.37			
	72-82	35-75	10-50	5-35	1.49-1.68	4.00-14.00	0.10-0.15	0.1-2.5	0.0-0.5	.32	.32			
AtF:														
Alticrest	0-2	---	---	8-18	1.40-1.55	14.00-42.00	0.12-0.18	0.0-2.9	1.0-3.0	.17	.17	2	3	86
	2-33	---	---	8-18	1.40-1.55	14.00-42.00	0.10-0.16	0.0-2.9	0.0-0.5	.24	.37			
	33-43	---	---	---	---	---	---	---	---	---	---			
Helechawa	0-5	---	---	4-15	1.10-1.40	14.00-42.00	0.10-0.18	0.0-2.9	2.0-10	.15	.15	5	3	86
	5-49	---	---	7-18	1.35-1.70	14.00-42.00	0.08-0.14	0.0-2.9	0.8-1.5	.24	.24			
	49-63	---	---	5-15	1.50-1.70	14.00-42.00	0.08-0.13	0.0-2.9	0.3-0.8	.28	.28			
	63-73	---	---	---	---	---	---	---	---	---	---			
Totz	0-7	---	---	3-12	1.15-1.35	42.00-141.00	0.07-0.12	0.0-2.9	1.0-5.0	.32	.32	1	3	86
	7-18	---	---	3-12	1.50-1.70	42.00-141.00	0.05-0.11	0.0-2.9	0.0-0.8	.37	.37			
	18-28	---	---	---	---	---	---	---	---	---	---			
CgF:														
Cloverlick	0-2	---	---	---	0.05-0.10	42.00-141.00	0.15-0.45	---	61-78	---	---	5	7	38
	2-8	23-52	28-50	7-27	1.05-1.52	14.11-42.34	0.11-0.15	0.2-1.7	0.5-3.0	.10	.20			
	8-24	18-45	28-65	7-27	1.25-1.52	4.23-42.34	0.12-0.16	0.1-1.7	0.3-0.7	.24	.37			
	24-43	20-52	28-65	7-27	1.25-1.52	14.11-42.34	0.07-0.11	0.1-2.1	0.0-1.0	.15	.43			
	43-80	28-60	28-60	5-35	1.00-1.50	4.23-42.34	0.05-0.09	0.0-2.1	0.3-0.7	.10	.37			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
CgF:														
Guyandotte	0-2	---	---	---	0.20-0.35	42.00-141.00	0.15-0.39	---	30-90	---	---	5	6	48
	2-5	---	---	---	0.26-0.35	42.00-141.00	0.15-0.38	---	30-90	---	---			
	5-15	52-75	8-35	5-20	1.08-1.53	4.00-42.00	0.07-0.11	0.1-0.7	2.0-10	.02	.05			
	15-67	30-70	15-55	3-20	1.35-1.60	4.00-42.00	0.03-0.07	0.0-1.0	0.2-1.5	.05	.24			
Highsplint	0-1	---	---	---	0.05-0.10	42.00-141.00	0.15-0.43	---	61-78	---	---	5	8	0
	1-4	15-35	50-65	10-27	1.22-1.46	4.23-42.34	0.08-0.12	0.2-1.3	0.5-5.0	.10	.32			
	4-11	15-35	40-65	18-34	1.39-1.48	4.23-42.34	0.07-0.11	0.4-2.0	0.3-0.7	.10	.37			
	11-28	15-35	40-65	18-34	1.39-1.53	4.23-42.34	0.07-0.11	0.4-2.0	0.3-0.7	.10	.37			
	28-48	15-40	35-60	18-34	1.39-1.44	4.23-42.34	0.07-0.11	0.4-2.0	0.3-0.7	.10	.37			
	48-85	15-50	28-50	7-40	1.40-1.58	1.41-14.11	0.07-0.11	0.1-2.7	0.2-0.7	.10	.43			
Cr:														
Craigsville, occasionally flooded	0-9	---	---	5-15	1.20-1.40	14.11-141.14	0.07-0.15	0.0-2.9	1.0-5.0	.10	.17	3	5	56
	9-20	---	---	5-15	1.30-1.60	14.11-141.14	0.06-0.15	0.0-2.9	0.5-1.0	.15	.28			
	20-60	---	---	5-10	1.35-1.55	42.34-141.14	0.04-0.09	0.0-2.9	0.5-1.0	.05	.24			
Philo, occasionally flooded	0-9	---	---	10-18	1.20-1.40	14.11-42.34	0.10-0.14	0.0-2.9	2.0-4.0	.17	.17	5	3	86
	9-60	---	---	5-18	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.55	.55			
Du:														
Dumps, mine (tailings & tipples)	---	---	---	---	---	---	---	---	---	---	---	---	---	---
FbC:														
Fairpoint, unstable fill	0-3	---	---	18-27	1.40-1.55	4.23-14.11	0.09-0.18	0.0-2.9	0.0-0.5	.20	.43	5	7	38
	3-60	---	---	18-35	1.60-1.80	1.41-4.23	0.03-0.10	3.0-5.9	0.0-0.5	.05	.49			
Bethesda, unstable fill	0-7	---	---	18-27	1.40-1.55	4.23-14.11	0.10-0.16	0.0-2.9	0.0-0.5	.15	.37	5	8	0
	7-60	---	---	18-35	1.60-1.90	1.41-4.23	0.04-0.13	0.0-2.9	0.0-0.5	.10	.37			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
FbF:														
Fairpoint, unstable fill	0-11	24-52	28-50	7-27	1.35-1.50	4.23-14.11	0.14-0.20	0.3-2.3	0.5-2.0	.20	.37	3	7	38
	11-32	10-52	28-60	7-40	1.60-1.80	1.40-4.00	0.03-0.10	0.2-2.9	0.0-0.3	.10	.43			
	32-41	20-52	28-60	7-27	1.60-1.80	1.40-4.00	0.00-0.10	0.0-1.7	0.0-0.3	.10	.43			
	41-51	20-52	28-60	7-27	1.60-1.80	1.40-4.00	0.01-0.10	0.0-1.0	0.0-0.3	.05	.43			
	51-58	20-52	28-60	7-27	1.60-1.80	1.40-4.00	0.01-0.10	0.0-1.0	0.0-0.3	.10	.49			
	58-72	20-52	28-60	7-27	1.60-1.80	1.40-4.00	0.01-0.10	0.0-1.0	0.0-0.3	.05	.43			
Bethesda, unstable fill	0-12	18-52	28-60	7-40	1.35-1.50	4.23-14.11	0.14-0.20	0.3-4.0	0.5-5.0	.20	.37	5	7	38
	12-36	10-52	28-60	7-40	1.60-1.80	1.40-4.00	0.03-0.10	0.1-3.2	0.0-5.0	.15	.37			
	36-58	10-52	28-60	7-35	1.60-1.80	1.40-4.00	0.03-0.10	0.1-2.5	0.0-5.0	.15	.37			
	58-72	20-52	28-60	7-35	1.60-1.80	1.40-4.00	0.01-0.10	0.0-2.5	0.0-5.0	.10	.28			
GsD:														
Gilpin	0-6	---	---	15-27	1.20-1.40	4.23-14.11	0.18-0.22	0.0-2.9	1.0-3.0	.32	.32	3	6	48
	6-28	---	---	20-35	1.20-1.45	4.23-14.11	0.08-0.16	0.0-2.9	0.0-0.5	.24	.43			
	28-38	---	---	---	---	---	---	---	---	---	---			
Shelocta	0-12	---	---	10-27	1.15-1.30	4.00-14.00	0.16-0.22	0.0-2.9	0.5-5.0	.32	.32	3	5	56
	12-48	---	---	18-45	1.30-1.55	4.00-14.00	0.10-0.20	0.0-2.9	0.0-0.5	.43	.43			
	48-58	---	---	---	---	---	---	---	---	---	---			
GtF:														
Gilpin, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.00-0.30	---	52-86	---	---	2	5	56
	1-5	10-43	30-70	7-27	1.01-1.45	4.00-14.00	0.12-0.18	0.2-1.7	2.0-4.0	.24	.37			
	5-11	10-52	28-70	18-27	1.20-1.61	4.00-14.00	0.08-0.12	0.7-1.8	1.0-2.0	.28	.49			
	11-20	10-45	28-65	18-35	1.20-1.80	4.00-14.00	0.08-0.12	0.7-3.1	0.3-1.0	.32	.55			
	20-28	10-45	28-65	15-35	1.20-1.80	4.00-14.00	0.08-0.12	0.6-3.8	0.0-0.5	.24	.49			
	28-38	---	---	---	---	0.01-0.10	---	---	---	---	---			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
GtF:														
Rayne, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.00-0.30	---	52-86	---	---	4	5	56
	1-2	10-45	45-70	10-27	0.50-1.00	4.00-14.00	0.16-0.22	0.4-1.7	1.0-4.0	.37	.37			
	2-7	10-45	28-65	10-27	1.30-1.60	4.00-14.00	0.10-0.20	0.4-1.9	0.5-3.0	.43	.43			
	7-17	10-45	28-62	15-35	1.30-1.50	4.00-14.00	0.08-0.16	0.5-2.0	0.3-0.8	.49	.49			
	17-24	10-45	28-65	18-35	1.40-1.80	4.00-14.00	0.08-0.16	0.3-1.9	0.3-0.8	.49	.49			
	24-31	10-45	28-65	18-35	1.40-1.80	4.00-14.00	0.08-0.16	0.3-2.1	0.0-0.8	.24	.43			
	31-44	10-32	41-70	18-27	1.35-1.46	4.00-14.00	0.08-0.16	0.4-1.0	0.0-0.3	.17	.49			
	44-54	---	---	---	---	0.00-0.01	---	---	---	---	---			
Sequoia, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.00-0.30	---	52-86	---	---	3	5	56
	1-5	6-39	34-72	15-27	1.00-1.42	4.23-14.11	0.17-0.20	0.0-2.9	0.5-2.0	.49	.49			
	5-12	6-39	16-55	27-45	1.31-1.50	1.41-4.23	0.08-0.16	0.0-5.9	0.0-0.5	.43	.43			
	12-20	6-39	6-45	35-55	1.31-1.45	1.41-4.23	0.08-0.16	0.0-5.9	0.0-0.5	.28	.28			
	20-34	6-39	6-45	35-55	1.31-1.45	1.41-4.23	0.08-0.16	0.0-5.9	0.0-0.5	.28	.28			
	34-44	---	---	---	---	0.00-1.41	---	---	---	---	---			
HeF:														
Helechawa	0-1	---	---	---	0.22-0.27	42.00-141.00	0.15-0.45	---	61-78	---	---	5	2	134
	1-3	40-90	2-50	4-15	0.70-1.43	14.00-42.00	0.10-0.14	0.1-0.9	4.0-20	.05	.05			
	3-12	40-90	2-50	4-15	1.40-1.53	14.00-42.00	0.13-0.17	0.1-0.7	1.3-4.0	.15	.15			
	12-45	40-85	2-50	4-17	1.43-1.67	14.00-42.00	0.11-0.15	0.1-0.9	0.1-1.3	.28	.28			
	45-80	40-90	2-50	4-27	1.45-1.64	14.00-42.00	0.10-0.14	0.1-1.4	0.1-1.0	.17	.17			
Varilla	0-2	---	---	---	0.22-0.27	42.00-141.00	0.15-0.45	---	61-78	---	---	3	5	56
	2-5	30-70	20-67	2-27	1.29-1.48	14.00-42.00	0.10-0.14	0.0-1.2	0.7-6.0	.10	.20			
	5-12	30-70	28-67	2-27	1.48-1.60	14.00-42.00	0.09-0.13	0.0-1.1	0.5-2.0	.17	.32			
	12-22	30-70	28-64	2-27	1.48-1.63	14.00-42.00	0.06-0.10	0.0-0.9	0.1-1.0	.15	.37			
	22-36	30-70	21-64	2-27	1.43-1.60	14.00-42.00	0.05-0.09	0.0-0.9	0.1-1.0	.10	.37			
	36-47	40-76	21-50	3-18	1.43-1.60	14.00-42.00	0.03-0.07	0.0-0.6	0.1-0.5	.05	.28			
	47-66	43-90	5-50	2-18	1.43-1.60	14.00-141.00	0.01-0.03	0.0-0.6	0.1-0.5	.02	.17			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
HeF:														
Jefferson	0-1	---	---	---	0.22-0.27	42.00-141.00	0.15-0.45	---	61-78	---	---	5	6	48
	1-10	24-70	10-65	10-20	1.34-1.47	14.11-42.34	0.14-0.18	0.3-0.9	0.8-5.0	.20	.32			
	10-24	21-70	10-53	10-27	1.48-1.55	14.11-42.34	0.13-0.17	0.3-1.3	0.4-0.8	.43	.43			
	24-41	21-70	10-53	10-27	1.54-1.64	14.11-42.34	0.13-0.17	0.3-1.3	0.2-0.4	.43	.43			
	41-81	28-75	20-50	5-30	1.50-1.58	14.11-42.34	0.08-0.12	0.1-1.2	0.1-0.2	.15	.37			
HsF:														
Highsplint	0-4	---	---	15-27	1.10-1.30	4.23-42.34	0.07-0.15	0.0-2.9	0.5-5.0	.10	.32	5	8	0
	4-48	---	---	18-34	1.30-1.55	4.23-42.34	0.07-0.13	0.0-2.9	0.3-0.7	.10	.43			
	48-60	---	---	18-34	1.55-1.70	1.41-14.11	0.05-0.11	0.0-2.9	0.2-0.7	.15	.43			
Cloverlick	0-11	---	---	18-27	1.00-1.20	4.00-14.00	0.20-0.24	0.0-2.9	5.0-15	.10	.20	5	8	0
	11-45	---	---	15-30	1.30-1.50	4.00-14.00	0.12-0.20	0.0-2.9	0.3-0.8	.10	.37			
	45-60	---	---	15-30	1.30-1.60	4.00-14.00	0.05-0.12	0.0-2.9	0.0-0.5	.10	.37			
Guyandotte	0-13	---	---	5-27	1.00-1.30	4.00-14.00	0.10-0.16	0.0-2.9	2.0-10	.10	.37	5	8	0
	13-60	---	---	5-27	1.30-1.60	4.00-14.00	0.05-0.15	0.0-2.9	0.3-0.8	.10	.43			
Ph:														
Philo, occasionally flooded	0-9	---	---	10-18	1.20-1.40	14.11-42.34	0.10-0.14	0.0-2.9	2.0-4.0	.17	.17	3	3	86
	9-37	---	---	10-18	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.28	.28			
	37-60	---	---	5-18	1.20-1.40	14.00-42.00	0.06-0.10	0.0-2.9	0.0-0.5	.05	.32			
Po:														
Pope, occasionally flooded	0-4	---	---	5-15	1.20-1.40	14.00-42.00	0.10-0.16	0.0-2.9	1.0-4.0	.20	.20	4	3	86
	4-23	---	---	5-18	1.30-1.60	4.00-42.00	0.10-0.18	0.0-2.9	0.3-0.8	.32	.32			
	23-59	---	---	5-20	1.30-1.60	4.00-42.00	0.10-0.18	0.0-2.9	0.0-0.5	.20	.20			
	59-62	---	---	5-20	1.30-1.60	4.00-42.00	0.10-0.18	0.0-2.9	0.0-0.5	.02	.10			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
Sb:														
Shelbiana, occasionally flooded	0-15	---	---	10-27	1.20-1.40	4.23-14.11	0.12-0.22	0.0-2.9	2.0-6.0	.32	.32	5	5	56
	15-70	---	---	18-34	1.20-1.50	4.23-14.11	0.12-0.22	0.0-2.9	0.3-0.8	.43	.43			
SgE:														
Shelocta	0-6	---	---	10-27	1.15-1.30	4.23-14.11	0.16-0.22	0.0-2.9	0.5-5.0	.32	.32	3	5	56
	6-33	---	---	20-34	1.30-1.55	4.23-14.11	0.10-0.20	0.0-2.9	0.5-2.0	.43	.43			
	33-58	---	---	15-45	1.30-1.55	4.23-42.34	0.08-0.16	0.0-2.9	0.0-0.5	.24	.43			
	58-68	---	---	---	---	---	---	---	---	---	---			
Gilpin	0-6	---	---	15-27	1.20-1.40	4.23-14.11	0.18-0.22	0.0-2.9	1.0-3.0	.32	.32	3	6	48
	6-26	---	---	18-35	1.20-1.45	4.23-14.11	0.08-0.16	0.0-2.9	0.0-0.5	.43	.43			
	26-36	---	---	---	---	---	---	---	---	---	---			
ShF:														
Shelocta, very stony	0-1	---	---	---	0.15-0.30	42.00-141.00	0.27-0.38	---	52-86	---	---	4	5	56
	1-3	10-35	50-70	10-27	1.26-1.39	4.00-14.00	0.12-0.22	0.6-2.9	1.0-10	.32	.32			
	3-7	10-45	28-65	10-27	1.31-1.42	4.00-14.00	0.11-0.17	0.5-2.8	0.5-3.0	.37	.37			
	7-23	20-45	28-62	18-35	1.34-1.50	4.00-14.00	0.11-0.19	0.7-2.6	0.3-1.0	.32	.43			
	23-34	10-45	28-65	18-35	1.42-1.53	4.00-14.00	0.07-0.19	0.4-2.7	0.3-0.8	.28	.49			
	34-45	10-45	28-65	18-35	1.42-1.53	4.00-14.00	0.08-0.20	0.4-2.9	0.1-0.5	.17	.43			
	45-59	10-32	50-70	18-27	1.35-1.46	4.00-14.00	0.00-0.18	0.5-1.7	0.0-0.3	.64	.64			
	59-69	---	---	---	---	0.00-0.01	---	---	---	---	---			
Highsplint, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.14-0.26	---	61-78	---	---	5	8	0
	1-4	13-32	50-64	7-27	1.22-1.46	4.23-42.34	0.07-0.14	0.2-1.3	0.5-5.0	.10	.32			
	4-11	13-40	35-64	18-34	1.39-1.48	4.23-42.34	0.07-0.14	0.4-2.0	0.3-0.7	.10	.37			
	11-28	13-35	42-62	18-34	1.39-1.53	4.23-42.34	0.07-0.13	0.4-2.0	0.3-0.7	.10	.37			
	28-48	18-40	40-62	18-34	1.39-1.44	4.23-42.34	0.07-0.15	0.4-2.0	0.3-0.7	.10	.37			
	48-85	18-40	40-62	18-34	1.40-1.58	1.41-14.11	0.07-0.15	0.4-2.0	0.2-0.7	.10	.43			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
ShF:														
Gilpin, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.25-0.34	---	52-86	---	---	2	6	48
	1-5	10-40	50-70	7-27	1.01-1.45	4.00-14.00	0.11-0.17	0.1-1.5	2.0-4.0	.24	.37			
	5-11	10-50	30-70	18-27	1.20-1.61	4.00-14.00	0.10-0.20	0.7-1.8	1.0-2.0	.28	.49			
	11-20	10-45	24-70	18-35	1.20-1.80	4.00-14.00	0.10-0.23	0.7-3.1	0.3-1.0	.32	.55			
	20-28	10-45	28-70	15-40	1.20-1.80	4.00-14.00	0.00-0.23	0.6-4.8	0.0-0.5	.24	.49			
	28-38	---	---	---	---	0.01-0.10	---	---	---	---	---			
SkF:														
Shelocta, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.00-0.30	---	52-86	---	---	4	5	56
	1-3	10-45	45-70	10-27	0.50-1.00	4.00-14.00	0.16-0.22	0.3-2.6	2.0-12	.32	.32			
	3-7	10-45	28-65	10-27	1.30-1.60	4.00-14.00	0.10-0.20	0.4-1.9	1.5-5.0	.32	.32			
	7-23	20-45	28-62	18-35	1.30-1.50	4.00-14.00	0.08-0.16	0.5-2.0	1.0-2.0	.28	.43			
	23-34	10-45	28-65	18-35	1.40-1.80	4.00-14.00	0.08-0.16	0.3-1.9	0.3-0.8	.28	.49			
	34-45	10-45	28-65	18-35	1.40-1.80	4.00-14.00	0.08-0.16	0.3-2.1	0.0-0.8	.17	.43			
	45-59	8-32	50-70	18-27	1.35-1.46	4.00-14.00	0.08-0.16	0.4-1.0	0.0-0.3	.64	.64			
	59-69	---	---	---	---	0.00-0.01	---	---	---	---	---			
Kimper, very stony	0-2	---	---	---	0.05-0.10	42.00-141.00	0.00-0.03	---	61-78	---	---	5	7	38
	2-8	23-52	28-50	8-27	1.00-1.50	14.11-42.34	0.09-0.15	0.2-1.9	0.5-3.0	.10	.24			
	8-13	20-65	20-70	8-27	1.00-1.50	14.11-42.34	0.09-0.15	0.2-1.3	0.5-1.8	.17	.37			
	13-27	20-65	20-65	8-27	1.25-1.60	14.11-42.34	0.07-0.15	0.2-1.5	0.0-1.0	.24	.43			
	27-41	20-65	20-65	8-27	1.25-1.50	14.11-42.34	0.07-0.15	0.3-1.9	0.0-1.0	.20	.37			
	41-52	20-65	20-65	8-35	1.25-1.50	14.11-42.34	0.07-0.15	0.2-2.7	0.0-1.0	.15	.37			
	52-64	20-65	20-70	8-35	1.25-1.60	14.11-42.34	0.07-0.15	0.2-2.7	0.0-1.0	.15	.37			
	64-75	20-65	20-70	8-35	1.25-1.50	14.11-42.34	0.07-0.15	0.2-2.7	0.0-1.0	.15	.49			
	75-85	---	---	---	---	0.42-1.40	---	---	---	---	---			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
SkF:														
Cloverlick, very stony	0-2	---	---	---	0.05-0.10	42.00-141.00	0.00-0.03	---	61-78	---	---	5	7	38
	2-8	23-52	28-50	8-27	1.00-1.50	14.11-42.34	0.09-0.15	0.2-1.7	0.5-3.0	.10	.20			
	8-24	18-45	28-65	8-27	1.00-1.50	4.23-42.34	0.07-0.13	0.2-3.0	0.3-0.7	.24	.37			
	24-43	20-52	28-65	8-27	1.00-1.50	14.11-42.34	0.07-0.15	0.0-1.6	0.0-1.0	.15	.43			
	43-80	40-60	8-52	8-35	1.00-1.50	4.23-42.34	0.03-0.13	0.0-2.1	0.3-0.7	.10	.37			
SmF:														
Shelocta	0-8	---	---	10-25	1.15-1.30	4.00-14.00	0.16-0.22	0.0-2.9	0.5-5.0	.32	.32	3	5	56
	8-31	---	---	18-34	1.30-1.55	4.00-14.00	0.10-0.20	0.0-2.9	0.3-0.8	.28	.43			
	31-55	---	---	15-34	1.30-1.55	4.00-14.00	0.08-0.16	0.0-2.9	0.0-0.5	.24	.43			
	55-65	---	---	---	---	---	---	---	---	---	---			
Kimper	0-7	---	---	12-27	1.00-1.40	4.23-42.34	0.13-0.20	0.0-2.9	2.0-15	.15	.28	5	6	48
	7-48	---	---	18-30	1.20-1.70	4.23-14.11	0.13-0.20	0.0-2.9	0.5-2.0	.24	.43			
	48-62	---	---	12-20	1.20-1.70	4.23-42.34	0.10-0.16	0.0-2.9	0.0-0.5	.37	.64			
	62-72	---	---	---	---	---	---	---	---	---	---			
Cutshin	0-17	---	---	12-27	1.20-1.40	4.23-14.11	0.08-0.16	0.0-2.9	3.0-7.0	.28	.28	3	5	56
	17-60	---	---	12-27	1.20-1.40	4.23-14.11	0.08-0.16	0.0-2.9	0.5-2.0	.15	.37			
Ud:														
Udorthents, unstable fill	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Urban land	---	---	---	---	---	---	---	---	---	---	---	---	---	---
UrE:														
Udorthents, unstable fill	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Urban land	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
VrD:														
Varilla	0-5	---	---	3-20	1.00-1.40	14.11-42.34	0.10-0.13	0.0-2.9	1.0-6.0	.05	.15	5	7	38
	5-31	---	---	3-20	1.45-1.65	14.11-42.34	0.05-0.10	0.0-2.9	0.5-1.5	.10	.32			
	31-60	---	---	3-20	1.45-1.65	14.11-141.14	0.01-0.05	0.0-2.9	0.0-0.5	.05	.24			
W:														
Water	---	---	---	---	---	---	---	---	---	---	---	---	---	---

APPENDIX E

RARE SPECIES INFORMATION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kentucky Ecological Services Field Office
J C Watts Federal Building, Room 265
330 West Broadway
Frankfort, KY 40601-8670
Phone: (502) 695-0468 Fax: (502) 695-1024

In Reply Refer To: August 23, 2022
Project Code: 2022-0077606
Project Name: Lewis Ridge Pumped Storage Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Kentucky Ecological Services Field Office
J C Watts Federal Building, Room 265
330 West Broadway
Frankfort, KY 40601-8670
(502) 695-0468

Project Summary

Project Code: 2022-0077606
Project Name: Lewis Ridge Pumped Storage Project
Project Type: Dam - New Construction
Project Description: The project is located within the communities of Blackmont, Tejay, Balkan, and Callaway, Kentucky adjacent to the Cumberland River in Bell County, Kentucky. The project is a proposed pumped storage hydroelectric generating facility, which will involve the construction of new water storage, water conveyance, and generation facilities at off-channel locations where no such facilities exist at this time.
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@36.7659582,-83.54975996325211,14z

Counties: Bell County, Kentucky

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 3 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS

Gray Bat *Myotis grisescens* — Endangered

No critical habitat has been designated for this species.
This species only needs to be considered under the following conditions:

- The project area includes potential gray bat habitat.

Species profile: https://ecos.fws.gov/ecp/species/6329
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KFABX7SDJVCNXEIUNJI4GRMDMI/documents/generated/6422.pdf

Indiana Bat *Myotis sodalis* — Endangered

There is **final** critical habitat for this species. The location of the critical habitat is not available.
This species only needs to be considered under the following conditions:

- The project area includes 'potential' habitat. All activities in this location should consider possible effects to this species.
- The project area includes known 'swarming 1' habitat.

Species profile: https://ecos.fws.gov/ecp/species/5949
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KFABX7SDJVCNXEIUNJI4GRMDMI/documents/generated/6422.pdf

Northern Long-eared Bat *Myotis septentrionalis* — Threatened

No critical habitat has been designated for this species.
This species only needs to be considered under the following conditions:

- The specified area includes areas in which incidental take would not be prohibited under the 4(d) rule. For reporting purposes, please use the "streamlined consultation form," linked to in the "general project design guidelines" for the species.

Species profile: https://ecos.fws.gov/ecp/species/9045
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KFABX7SDJVCNXEIUNJI4GRMDMI/documents/generated/6422.pdf

Insects

NAME	STATUS

Monarch Butterfly *Danaus plexippus* — Candidate

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/9743

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

IPaC User Contact Information

Agency: RESPEC
Name: Michael Ricci
Address: 146 E 3rd St
City: Lexington
State: KY
Zip: 40508
Email michael.ricci@respec.com
Phone: 8593614540

Lead Agency Contact Information

Lead Agency: Army Corps of Engineers

Species Information

State Threatened, Endangered, and Special Concern Species observations for selected counties

Linked life history provided courtesy of NatureServe Explorer .
Records may include both recent and historical observations.
US Status Definitions Kentucky Status Definitions

List State Threatened, Endangered, and Special Concern Species observations in 1 selected county.
Selected county is: Bell.

Scientific Name and Life History	Common Name and Pictures	Class	County	US Status	KY Status	WAP	Reference
Accipiter striatus	Sharp-shinned Hawk	Aves	Bell	N	S	Yes	Reference
Anguispira rugoderma	Pine Mountain Disc	Gastropoda	Bell	N	E		Reference
Anodontoides denigrata	Cumberland Papershell	Bivalvia	Bell	N	E	Yes	Reference
Callophrys irus	Frosted Elfin	Insecta	Bell	N	E		Reference
Calopteryx dimidiata	Sparkling Jewelwing	Insecta	Bell	N	E		Reference
Cambarus buntingi	Longclaw Crayfish	Malacostraca	Bell	N	T	Yes	Reference
Cambarus guenteri	Redbird Crayfish	Malacostraca	Bell	N	S		Reference
Cambarus parvoculus	Mountain Midget Crayfish	Malacostraca	Bell	N	S	Yes	Reference
Cardellina canadensis	Canada Warbler	Aves	Bell	N	S	Yes	Reference
Cemophora coccinea	Scarletsnake	Reptilia	Bell	N	S	Yes	Reference
Centronyx henslowii	Henslow's Sparrow	Aves	Bell	N	S	Yes	Reference
Certhia americana	Brown Creeper	Aves	Bell	N	T		Reference
Cheumatopsyche helma	Helma's Net-spinning Caddisfly	Insecta	Bell	N	H		Reference
Chrosomus cumberlandensis	Blackside Dace	Actinopterygii	Bell	T	T	Yes	Reference

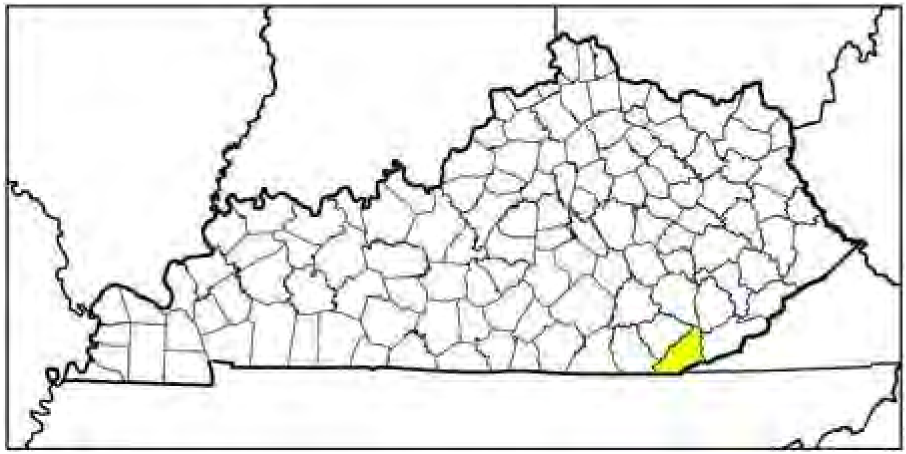
Circus hudsonius	Northern Harrier	Aves	Bell	N	T	Yes	Reference
Corvus corax	Common Raven	Aves	Bell	N	T	Yes	Reference
Cryptobranchus alleganiensis alleganiensis	Eastern Hellbender	Amphibia	Bell	N	S	Yes	Reference
Empidonax minimus	Least Flycatcher	Aves	Bell	N	E	Yes	Reference
Etheostoma sagitta	Cumberland Arrow Darter	Actinopterygii	Bell	C	S	Yes	Reference
Falco peregrinus	Peregrine Falcon	Aves	Bell	N	E	Yes	Reference
Fumonelix wetherbyi	Clifty Covert	Gastropoda	Bell	N	S		Reference
Haliaeetus leucocephalus	Bald Eagle	Aves	Bell	N	S	Yes	Reference
Junco hyemalis	Dark-eyed Junco	Aves	Bell	N	S		Reference
Lampsilis ovata	Pocketbook	Bivalvia	Bell	N	E	Yes	Reference
Lophodytes cucullatus	Hooded Merganser	Aves	Bell	N	T	Yes	Reference
Lytrosis permagnaria	A Geometrid Moth	Insecta	Bell	N	E		Reference
Manophylax butleri	A Limnephilid Caddisfly	Insecta	Bell	N	S		Reference
Myodes gapperi maurus	Kentucky Red-backed Vole	Mammalia	Bell	N	S	Yes	Reference
Myotis grisescens	Gray Myotis	Mammalia	Bell	E	T	Yes	Reference
Myotis leibii	Eastern Small-footed Myotis	Mammalia	Bell	N	T	Yes	Reference
Myotis lucifugus	Little Brown Bat	Mammalia	Bell	N	T	Yes	Reference
Myotis septentrionalis	Northern Myotis	Mammalia	Bell	T	E	Yes	Reference
Ophisaurus attenuatus longicaudus	Eastern Slender Glass Lizard	Reptilia	Bell	N	T	Yes	Reference
Pandion haliaetus	Osprey	Aves	Bell	N	S	Yes	Reference
Passerculus sandwichensis	Savannah Sparrow	Aves	Bell	N	S	Yes	Reference
Patera panselenus	Virginia Bladetooth	Gastropoda	Bell	N	S		Reference
Perimyotis subflavus	Eastern Pipistrelle	Mammalia	Bell	N	T	Yes	Reference

Peucaea aestivalis	Bachman's Sparrow	Aves	Bell	N	E	Yes	Reference
Phalacrocorax auritus	Double-crested Cormorant	Aves	Bell	N	S		Reference
Pheucticus ludovicianus	Rose-breasted Grosbeak	Aves	Bell	N	S		Reference
Plestiodon anthracinus	Coal Skink	Reptilia	Bell	N	E	Yes	Reference
Plestiodon inexpectatus	Southeastern Five-lined Skink	Reptilia	Bell	N	S	Yes	Reference
Plethodon pauleyi	Yellow-spotted Woodland Salamander	Amphibia	Bell	N	E	Yes	Reference
Podilymbus podiceps	Pied-billed Grebe	Aves	Bell	N	E	Yes	Reference
Polygonia faunus	Green Comma	Insecta	Bell	N	H		Reference
Pseudanophthalmus frigidus	Icebox Cave Beetle	Insecta	Bell	C	E		Reference
Setophaga fusca	Blackburnian Warbler	Aves	Bell	N	T		Reference
Sitta canadensis	Red-breasted Nuthatch	Aves	Bell	N	E		Reference
Sorex cinereus	Cinereus Shrew	Mammalia	Bell	N	S	Yes	Reference
Spatula discors	Blue-winged Teal	Aves	Bell	N	T		Reference
Spilogale putorius	Eastern Spotted Skunk	Mammalia	Bell	N	S	Yes	Reference
Stylurus notatus	Elusive Clubtail	Insecta	Bell	N	E		Reference
Tyto alba	Barn Owl	Aves	Bell	N	S	Yes	Reference
Vermivora chrysoptera	Golden-winged Warbler	Aves	Bell	N	E	Yes	Reference

54 species are listed

KY Office of Kentucky Nature Preserves

Search Results : Bell County



Adlumia fungosa - Allegheny-vine
Amianthium muscitoxicum - Fly Poison
Baptisia tinctoria - Yellow Wild Indigo
Boykinia aconitifolia - Brook Saxifrage
Calamagrostis porteri ssp. porteri - Porter's Reedgrass
Calopogon tuberosus - Grass Pink
Carex austrocaroliniana - Tarheel Sedge
Castanea pumila - Allegheny Chinkapin
Chelone obliqua var. obliqua - Red Turtlehead
Chrysosplenium americanum - American Golden-saxifrage
Convallaria montana - American Lily-of-the-valley
Corydalis sempervirens - Rock Harlequin
Deschampsia flexuosa - Crinkled Hairgrass
Gentiana decora - Showy Gentian
Houstonia serpyllifolia - Michaux's Bluets
Lathyrus venosus - Smooth Veiny Peavine
Liparis loeselii - Loesel's Twayblade
Listera smallii - Kidney-leaf Twayblade
Melampyrum lineare var. latifolium - American Cowwheat
Monotropsis odorata - Sweet Pinesap
Polytrichum pallidisetum - A Hair Cap Moss
Prosartes maculata - Nodding Mandarin
Salvia urticifolia - Nettle-leaf Sage
Silene ovata - Ovate Catchfly
Solidago curtisii - Curtis' Goldenrod
Solidago puberula - Downy Goldenrod
Solidago roanensis - Roan Mountain Goldenrod
Trillium undulatum - Painted Trillium
Veratrum parviflorum - Appalachian Bunchflower

Note: To print pages from this site change Page Setup to Landscape
Data Last Updated: November 2018

Office of Kentucky Nature Preserves
300 Sower Blvd
Frankfort,KY 40601
Phone: (502) 573-2886
Email: naturepreserves@ky.gov

APPENDIX F

EJSCREEN REPORTS (VERSION 2.0) FOR CENSUS TRACT 9604, BLOCK GROUPS 1 AND 2

Save as PDF

EJScreen Report (Version 2.0)

Blockgroup: 210139604001

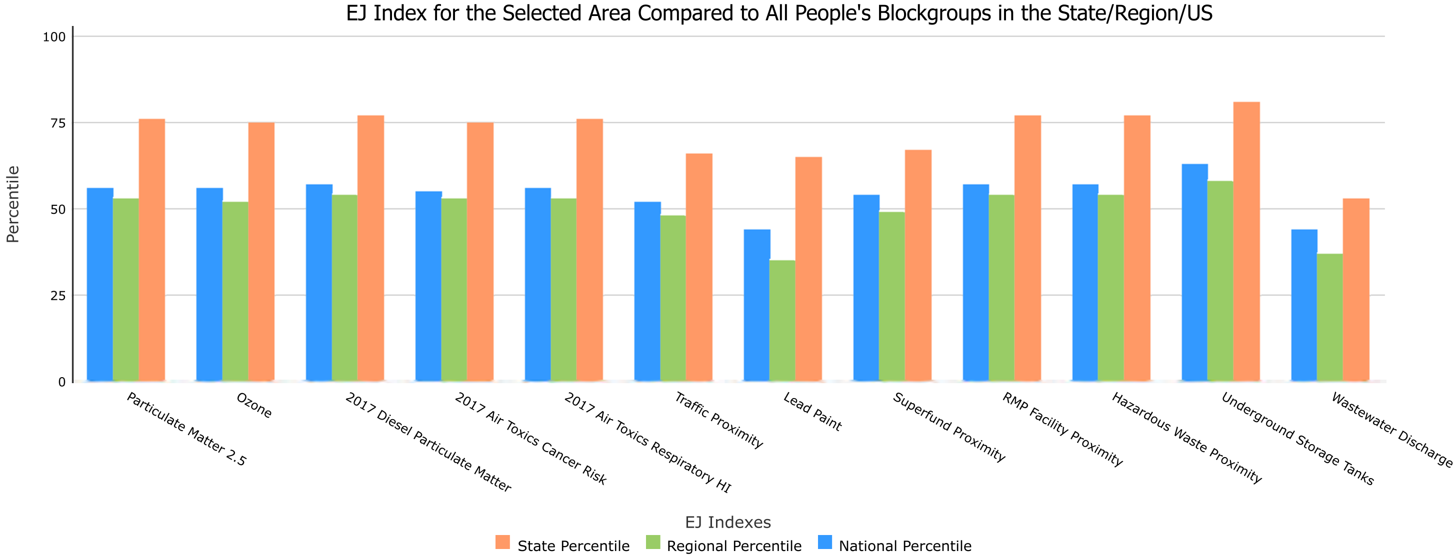
KENTUCKY, EPA Region 4

Approximate Population: 856

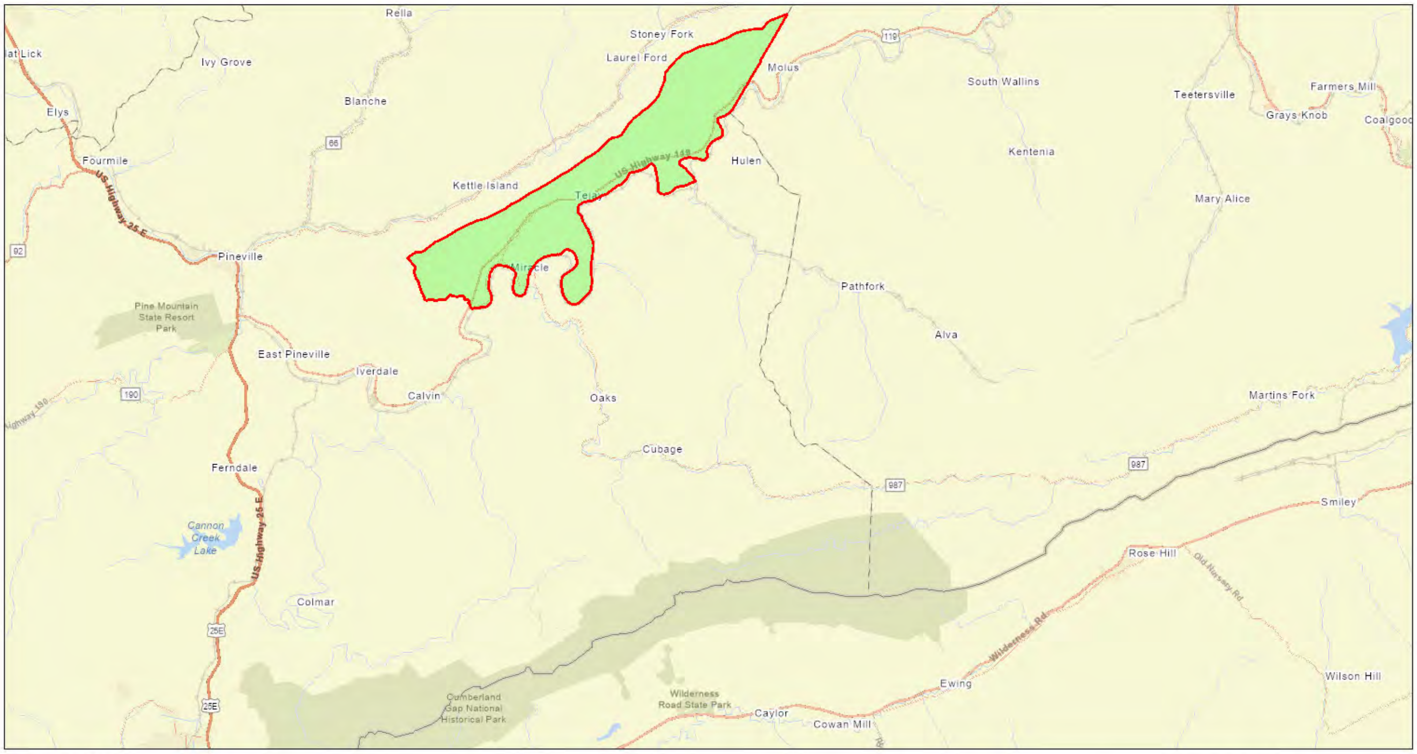
Input Area (sq. miles): 11.31

Selected Variables	Percentile in State	Percentile in EPA Region	Percentile in USA
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	76	53	56
EJ Index for Ozone	75	52	56
EJ Index for 2017 Diesel Particulate Matter*	77	54	57
EJ Index for 2017 Air Toxics Cancer Risk*	75	53	55
EJ Index for 2017 Air Toxics Respiratory HI*	76	53	56
EJ Index for Traffic Proximity	66	48	52
EJ Index for Lead Paint	65	35	44
EJ Index for Superfund Proximity	67	49	54
EJ Index for RMP Facility Proximity	77	54	57
EJ Index for Hazardous Waste Proximity	77	54	57
EJ Index for Underground Storage Tanks	81	58	63
EJ Index for Wastewater Discharge	53	37	44

EJ Index for the Selected Area Compared to All People's Blockgroups in the State/Region/US



This report shows the values for environmental and demographic indicators and EJScreen indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJScreen documentation for discussion of these issues before using reports.



August 19, 2022

Project 1

1:144,448

0 1.5 3 6 mi

0 2.25 4.5 9 km

VGIN, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, EPA, NPS, USDA

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

Selected Variables	Value	State		EPA Region		USA	
		Avg.	%tile	Avg.	%tile	Avg.	%tile
Pollution and Sources							
Particulate Matter 2.5 (μg/m³)	7.64	8.9	5	8.18	27	8.74	24
Ozone (ppb)	40.3	42.4	16	37.9	59	42.6	33
2017 Diesel Particulate Matter* (μg/m³)	0.0706	0.226	0	0.261	<50th	0.295	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	29	99	31	80-90th	29	80-90th
2017 Air Toxics Respiratory HI*	0.3	0.36	46	0.4	<50th	0.36	<50th
Traffic Proximity (daily traffic count/distance to road)	43	380	30	430	28	710	21
Lead Paint (% Pre-1960 Housing)	0.25	0.23	69	0.15	81	0.28	59
Superfund Proximity (site count/km distance)	0.052	0.039	80	0.083	60	0.13	43
RMP Facility Proximity (facility count/km distance)	0.043	0.67	6	0.6	3	0.75	3
Hazardous Waste Proximity (facility count/km distance)	0.03	0.77	11	0.62	3	2.2	3
Underground Storage Tanks (count/km²)	0	1.1	16	3.5	10	3.9	16
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00025	1.3	45	0.45	50	12	38
Socioeconomic Indicators							
Demographic Index	33%	26%	73	37%	50	36%	54
People of Color	0%	15%	8	39%	1	40%	1
Low Income	65%	37%	90	35%	91	31%	92
Unemployment Rate	11%	6%	85	6%	86	5%	87
Linguistically Isolated	0%	1%	73	3%	51	5%	45
Less Than High School Education	32%	14%	94	13%	94	12%	92
Under Age 5	7%	6%	68	6%	71	6%	68
Over Age 64	14%	16%	43	17%	46	16%	50

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's 2017 Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update. (https://www.epa.gov/haps/air-toxics-data-update)

For additional information, see: www.epa.gov/environmentaljustice (https://www.epa.gov/environmentaljustice)

EJScreen is a screening tool for pre-decisional use only. It can help identify areas that may warrant additional consideration, analysis, or outreach. It does not provide a basis for decision-making, but it may help identify potential areas of EJ concern. Users should keep in mind that screening tools are subject to substantial uncertainty in their demographic and environmental data, particularly when looking at small geographic areas. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJScreen documentation for discussion of these issues before using reports. This screening tool does not provide data on every environmental impact and demographic factor that may be relevant to a particular location. EJScreen outputs should be supplemented with additional information and local knowledge before taking any action to address potential EJ concerns.

Save as PDF

EJScreen Report (Version 2.0)

Blockgroup: 210139604002

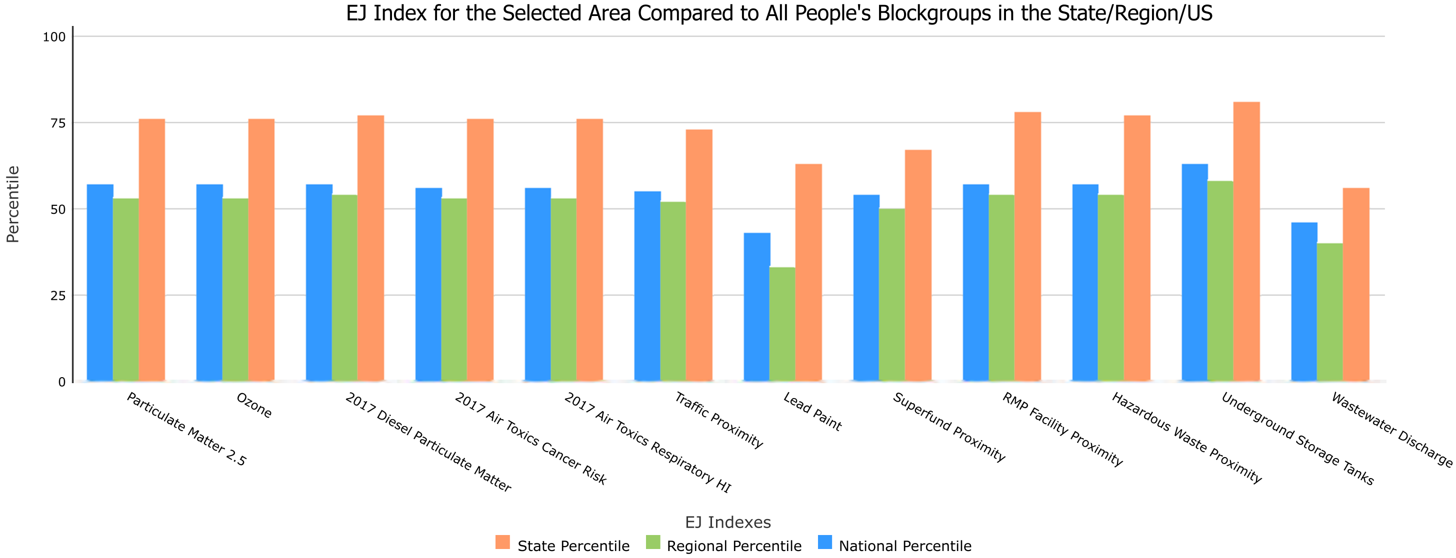
KENTUCKY, EPA Region 4

Approximate Population: 1,060

Input Area (sq. miles): 42.03

Selected Variables	Percentile in State	Percentile in EPA Region	Percentile in USA
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	76	53	57
EJ Index for Ozone	76	53	57
EJ Index for 2017 Diesel Particulate Matter*	77	54	57
EJ Index for 2017 Air Toxics Cancer Risk*	76	53	56
EJ Index for 2017 Air Toxics Respiratory HI*	76	53	56
EJ Index for Traffic Proximity	73	52	55
EJ Index for Lead Paint	63	33	43
EJ Index for Superfund Proximity	67	50	54
EJ Index for RMP Facility Proximity	78	54	57
EJ Index for Hazardous Waste Proximity	77	54	57
EJ Index for Underground Storage Tanks	81	58	63
EJ Index for Wastewater Discharge	56	40	46

EJ Index for the Selected Area Compared to All People's Blockgroups in the State/Region/US



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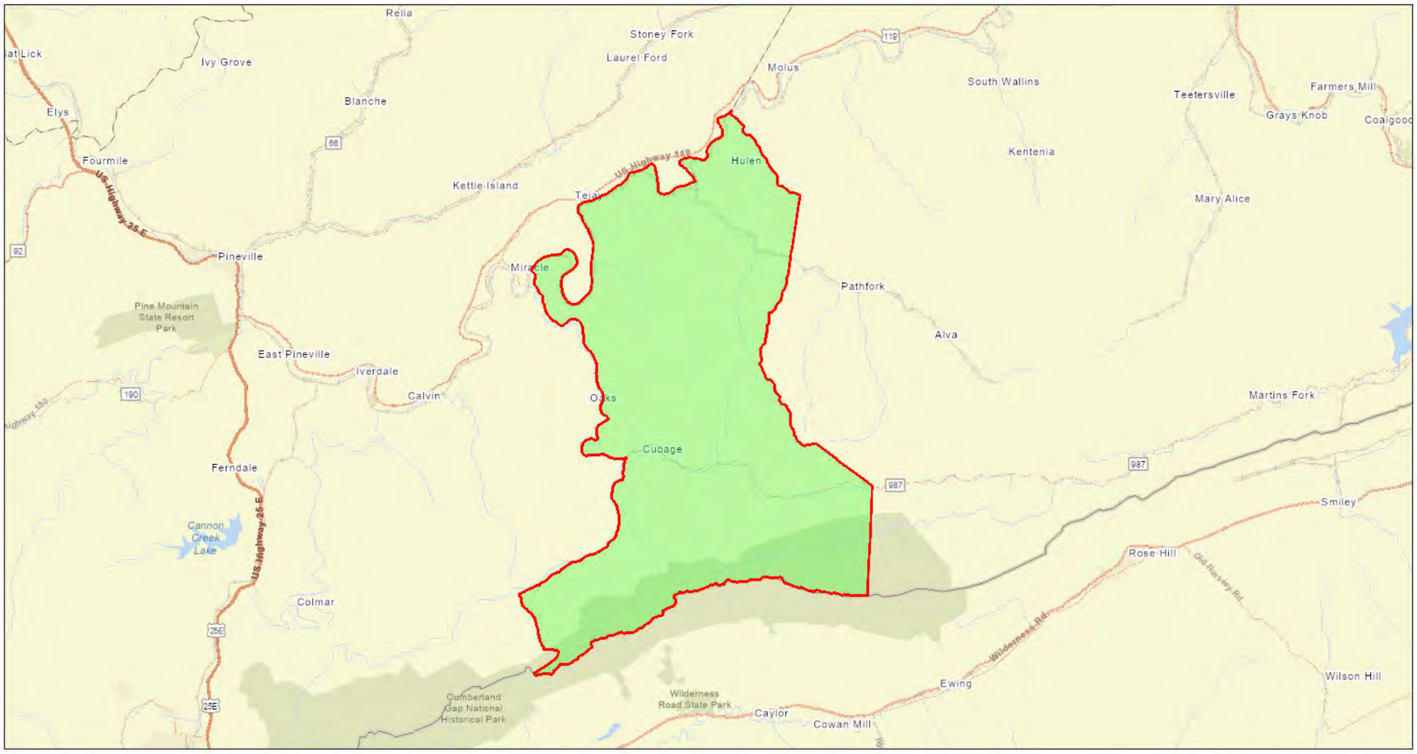

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Sites reporting to EPA	
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2017 Air Toxics Respiratory HI*	0.3	0.36	46	0.4	<50th	0.36	<50th
Traffic Proximity (daily traffic count/distance to road)	6.2	380	11	430	8	710	5
Lead Paint (% Pre-1960 Housing)	0.35	0.23	80	0.15	87	0.28	67
Superfund Proximity (site count/km distance)	0.059	0.039	84	0.083	64	0.13	48
RMP Facility Proximity (facility count/km distance)	0.043	0.67	6	0.6	3	0.75	3
Hazardous Waste Proximity (facility count/km distance)	0.035	0.77	13	0.62	5	2.2	4
Underground Storage Tanks (count/km²)	0	1.1	16	3.5	10	3.9	16
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00016	1.3	41	0.45	46	12	34
Socioeconomic Indicators							
Demographic Index	34%	26%	75	37%	52	36%	55
People of Color	1%	15%	14	39%	3	40%	3
Low Income	66%	37%	90	35%	92	31%	92
Unemployment Rate	2%	6%	31	6%	28	5%	30
Linguistically Isolated	2%	1%	80	3%	62	5%	55
Less Than High School Education	24%	14%	85	13%	86	12%	85
Under Age 5	2%	6%	11	6%	14	6%	13
Over Age 64	15%	16%	44	17%	48	16%	51

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's 2017 Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update. (https://www.epa.gov/haps/air-toxics-data-update)

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