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RESILIENCE 360° PROGRAM
FINAL PROGRAMMATIC ENVIRONMENTAL ASSESSMENT
TVA Power Service Area

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Table of Contents

CHAPTER 1 - PURPOSE OF AND NEED FOR THE PROPOSED ACTION 1-1

1.1 Introduction 1-1
1.2 Purpose and Need 1-2
1.3 Scope of the PEA 1-2
1.4 Public and Agency Involvement 1-4
1.5 Related Environmental Reviews 1-5
1.6 Required Permits and Licenses 1-5

CHAPTER 2 - DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES 2-1

2.1 Description of Alternatives 2-1
2.1.1 No Action Alternative – Alternative A 2-1
2.1.2 Resilience 360° Program – Alternative B 2-1
2.2 Comparison of Alternatives 2-2
2.3 Summary of Best Management Practices and Mitigation Measures 2-4
2.3.1 Standard and Routine Best Management Practices 2-4
2.3.2 Non-Routine Measures 2-5
2.4 Environmentally Preferred Alternative 2-6
2.5 The Preferred Alternative 2-6

CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES 3-1

3.1 Geology and Groundwater 3-1
3.1.1 Affected Environment 3-1
3.1.1.1 Geology 3-1
3.1.1.2 Groundwater 3-3
3.1.2 Environmental Consequences 3-6
3.1.2.1 Alternative A – No Action 3-6
3.1.2.2 Alternative B – Proposed Action 3-6
3.2 Land Use and Prime Farmland 3-7
3.2.1 Affected Environment 3-7
3.2.2 Environmental Consequences 3-9
3.2.2.1 Alternative A – No Action 3-9
3.2.2.2 Alternative B – Proposed Action 3-9
3.3 Soil Erosion and Surface Water 3-10
3.3.1 Affected Environment 3-10
3.3.2 Environmental Consequences 3-12
3.3.2.1 Alternative A – No Action 3-13
3.3.2.2 Alternative B – Proposed Action 3-13
3.4 Floodplains 3-14
3.4.1 Affected Environment 3-14
3.4.2 Environmental Consequences 3-14
3.4.2.1 Alternative A – No Action 3-14
3.4.2.2 Alternative B – Proposed Action 3-14
3.5 Wetlands 3-15

3.5.1 Affected Environment 3-15
3.5.2 Environmental Consequences 3-16
3.5.2.1 Alternative A – No Action 3-16
3.5.2.2 Alternative B – Proposed Action 3-16
3.6 Threatened and Endangered Species 3-16
3.6.1 Affected Environment 3-16
3.6.1.1 Terrestrial Zoology 3-17
3.6.1.2 Botany 3-20
3.6.1.3 Aquatic Ecology 3-22
3.6.2 Environmental Consequences 3-27
3.6.2.1 Terrestrial Zoology 3-28
3.6.2.2 Botany 3-28
3.6.2.3 Aquatic Ecology 3-29
3.7 Cultural and Historic Resources 3-29
3.7.1 Affected Environment 3-30
3.7.2 Environmental Consequences 3-30
3.7.2.1 Alternative A – No Action 3-31
3.7.2.2 Alternative B – Proposed Action 3-31
3.8 Visual Resources 3-32
3.8.1 Affected Environment 3-32
3.8.2 Environmental Consequences 3-33
3.8.2.1 Alternative A – No Action 3-33
3.8.2.2 Alternative B – Proposed Action 3-33
3.9 Noise 3-34
3.9.1 Affected Environment 3-34
Noise Regulations 3-34
Background Noise Levels 3-35
3.9.2 Environmental Consequences 3-35
3.9.2.1 Alternative A – No Action 3-35
3.9.2.2 Alternative B – Proposed Action 3-35
3.10 Air Quality 3-36
3.10.1 Affected Environment 3-36
3.10.2 Environmental Consequences 3-40
3.10.2.1 Alternative A – No Action 3-41
3.10.2.2 Alternative B – Proposed Action 3-41
3.11 Greenhouse Gas and Climate Change 3-41
3.11.1 Affected Environment 3-41
3.11.2 Environmental Consequences 3-44
3.11.2.1 Alternative A – No Action 3-44
3.11.2.2 Alternative B – Proposed Action 3-44
3.12 Transportation and Navigation 3-44
3.12.1 Affected Environment 3-44
3.12.2 Environmental Consequences 3-45
3.12.2.1 Alternative A – No Action 3-45
3.12.2.2 Alternative B – Proposed Action 3-45
3.13 Hazardous Materials and Solid Waste 3-46
3.13.1 Affected Environment 3-46

3.13.2 Environmental Consequences 3-46
3.13.2.1 Alternative A – No Action 3-46
3.13.2.2 Alternative B – Proposed Action....3-46
3.14 Public Health and Safety....3-47
3.14.1 Affected Environment....3-48
3.14.2 Environmental Consequences 3-48
3.14.2.1 Alternative A – No Action 3-48
3.14.2.2 Alternative B – Proposed Action....3-48
3.15 Socioeconomics....3-48
3.15.1 Affected Environment....3-48
3.15.1.1 Socioeconomics 3-48
3.15.2 Environmental Consequences 3-61
3.15.2.1 Alternative A – No Action 3-61
3.15.2.2 Alternative B – Proposed Action....3-61
3.16 Unavoidable Adverse Impacts 3-62
3.17 Relationship of Short-Term Uses and Long-Term Productivity....3-62
3.18 Irreversible and Irretrievable Commitments of Resources 3-62

CHAPTER 4 - LITERATURE CITED....4-1

CHAPTER 5 - LIST OF PREPARERS 5-1

5.1 NEPA Management 5-1
5.2 Other Contributors....5-1

List of Appendices

Appendix A Environmental Screening Checklist
Appendix B Comprehensive Federally and State-Listed Species List
Appendix C Draft National Historic Preservation Act Section 106 Programmatic Agreement
Appendix D Socioeconomics
Appendix E Public Comments and Responses

List of Tables

Table 2-1. Summary and Comparison of Alternatives by Resource Area 2-2
Table 3-1. Aquifer, Well, and Water Quality Characteristics in the TVA PSA 3-4
Table 3-2. Special Status and Federally Protected Terrestrial Wildlife Species in the TVA PSA 3-17
Table 3-3. Special Status and Federally Protected Vegetation Species in the TVA PSA 3-21
Table 3-4. Special Status and Federally Protected Aquatic Species in the TVA PSA 3-23
Table 3-5. Major Greenhouse Gases and Their Global Warming Potentials 3-43
Table 3-6. Population Data for the TVA PSA, TVA MSAs, Division 6, and U.S. 3-49
Table 3-7. Demographics of the TVA PSA, Division 6, and U.S. 3-52
Table 3-8. Counties in the TVA PSA with Minority Populations Exceeding 50 Percent 3-54
Table 3-9. Population Data for the Most/Least Populous Counties in the TVA PSA 3-55
Table 3-10. TVA Capital Investment Between 2019 and 2023 3-56
Table 3-11. Employment in Occupations in the TVA PSA, Division 6, and U.S. 3-57
Table 3-12. TVA-Assisted Jobs Between 2019 and 2023 3-57
Table 3-13. Demographics of Federally Recognized Tribal Nations in the TVA PSA 3-60

List of Figures

Figure 1-1. TVA Power Service Area 1-3
Figure 3-1. Physiographic Areas of TVA PSA 3-2
Figure 3-2. Groundwater Use by Category in the Tennessee River Basin, 2000 to 2020 3-6
Figure 3-3. Groundwater and Surface Water Withdrawals in the Tennessee River Basin, 1995 to 2020 3-11
Figure 3-4. Major Watersheds Within TVA PSA 3-12
Figure 3-5. Class I Areas in and near the TVA PSA 3-37
Figure 3-6. Variation in Population of Counties in the TVA PSA 3-51
Figure 3-7. Minority Populations at the County Level in the TVA PSA 3-53
Figure 3-8. Urban and Rural Areas in the TVA PSA 3-55
Figure 3-9. Per Capita Incomes of TVA PSA Counties 3-58

Symbols, Acronyms, and Abbreviations

°F	degree(s) Fahrenheit
µm	micrometer
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
BESS	battery energy storage systems
BMP	best management practice
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CWA	Clean Water Act
dB	decibels
dBA	A-weighted decibels
DER	distributed energy resources
EBCI	Eastern Band of Cherokee Indians
EIS	environmental impact statement
EO	Executive Order
ESA	Endangered Species Act
GHG	greenhouse gas
gpm	gallons per minute
HAP	hazardous air pollutant
HUD	Housing and Urban Development
Hz	hertz
IPaC	Information for Planning and Consultation
IRP	Integrated Resource Plan
kW	kilowatt(s)
Ldn	day-night sound level
Leq	Equivalent sound level
LPC	local power company(ies)
MBCI	Mississippi Band of Choctaw
MGD	million gallons per day
MSA	metropolitan statistical area
MW	megawatt(s)
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
PEA	programmatic environmental assessment
PM	particulate matter
$PM_{2.5}$	PM less than 2.5 micrometers in diameter

PM_{10}	PM less than 10 micrometers in diameter
PPA	Power Purchase Agreement
PSA	Power Service Area
SHPO	State Historic Preservation Office
SMZ	Streamside Management Zone
SO_2	sulfur dioxide
SOx	sulfur oxides
SWPPP	Stormwater Pollution Prevention Plan
TVA	Tennessee Valley Authority
U.S.	United States
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound

CHAPTER 1 - PURPOSE OF AND NEED FOR THE PROPOSED ACTION

1.1 Introduction

The Tennessee Valley Authority (TVA) has prepared this Programmatic Environmental Assessment (PEA) to propose a “Commercial Resiliency” program, titled Resilience 360°, to partner with vendors and TVA customers to improve and enhance resiliency during events that challenge the transmission of power on the grid [e.g., extreme weather, and minor incidences of cyber-attack or domestic terrorism (vandalism of one or a few substations or switchyards)] and to periodically support demand on the TVA system. This PEA establishes general siting and environmental criteria to ensure that installations do not cause greater impacts than those addressed in this PEA.

Under the initial phases of the program, TVA would partner with multiple vendors through a qualified resiliency network to provide backup generation in the form of onsite modular natural gas units or battery energy storage systems (BESS) to improve commercial resiliency for qualified customers. Under the proposal, vendors of natural gas units or BESS would install the units at host locations and would own, operate, and maintain the units. The host would provide the location, contribute to the installation and maintenance costs of the units, and pay for power used during qualifying resiliency events at the host site. Additionally, TVA would enter into a single Power Purchase Agreement (PPA) with a vendor to purchase and have control or dispatch rights to the units. Under normal grid conditions, TVA would dispatch these units as deemed economical and reliable. During qualifying events, TVA would purchase the energy generated from these units and sell such energy to the host’s local power company (LPC) to sell to the host. During these qualifying events, the units would provide generation onsite to the host. While the backup generation would be important to the host, the generation provided by individual hosts to TVA would be aggregated by third-party developers and not solely impact TVA’s overall operation of the transmission grid. The unavailability of one or several Resilience 360° installations would not materially affect TVA’s ability to balance generation and load on the TVA transmission grid.

Each host site would contain natural gas units or BESS that would generate about 100 kilowatts (kW) up to 25 megawatts (MW) of power. TVA anticipates establishing a Qualified Resilience Network of vendors to participate in the program. While each vendor’s equipment may vary in configuration, the individual units would typically be smaller than a standard shipping container. While the number of units at each location would depend on the host’s needs, the installation and operation of the unit(s) would generally occupy a small footprint near the existing host facility on previously disturbed land. The natural gas units would run on distribution-level natural gas or onsite propane or liquified natural gas; pipeline-level natural gas supply would not be needed. BESS systems would utilize grid energy for storage. Both the gas and the BESS units are expected to have a relatively low generation demand. TVA anticipates the gas units would be used less than 400 hours annually for TVA demand and dispatch. Initial estimates from TVA are that the units would be dispatched infrequently, potentially only 150 to 200 hours annually. The generation from the units would be dispatched by TVA primarily during periods when the operating reserve is limited, such as during extraordinary weather events. In addition, the units could be used infrequently for qualifying resilience events as necessary.

Installations under the program could involve various potential transmission interconnection scenarios. Connections with an LPC distribution system would likely result in TVA screening each site as part of TVA's Affected System process, with deference given to the respective LPC's interconnection standards. Interconnections for TVA direct serve customers would more than likely fall within TVA's standard small generator or large generator interconnection protocol, which includes facilities studies and/or system impact studies. Such direct serve projects would require a separate environmental review and approval process and would not be part of the Resilience 360° program.

Eventually under future phases of the program, in addition to the natural gas and BESS generation resources, TVA's Resilience 360° options could be expanded to include other generation sources in the future (including but not limited to biofuels, solar, thermal storage, and advanced nuclear). TVA would not consider generation sources that are inconsistent with its Integrated Resource Plan (IRP; TVA 2019a). For instance, diesel generation would not be considered as a Resilience 360° source at this time. Diesel generation is currently the most common type of backup generation option for customers. By comparison, the installation and operation of natural gas units or BESS to address resiliency represents an environmentally beneficial, carbon reduction option for program participants. Locations wishing to convert end-of-life diesel generation to natural gas units or BESS could participate in the Resilience 360° program.

This PEA addresses the potential impacts associated with Resilience 360° natural gas units and BESS. Other generation sources may be addressed by TVA in other subsequent National Environmental Policy Act (NEPA) reviews.

1.2 Purpose and Need

Energy resiliency ensures that those reliant on the LPC distribution system have a reliable, regular supply of energy and contingency measures in place in the event of a small or isolated power failure. Like other power providers, TVA seeks ways in which to improve and enhance resiliency during events that challenge the transmission of power on the grid, such as extreme weather and minor incidences of cyber-attack or domestic terrorism (vandalism of one or a few substations or switchyards). Commercial and industrial facilities, critical county and city infrastructure, federal government, emergency response centers, communities, LPCs, and TVA all stand to benefit from enhanced reliability.

In addition, as identified in the 2019 IRP, TVA needs flexible, dispatchable power that can successfully integrate increasing amounts of renewable energy sources while ensuring it can meet required year-round generation and maximum capacity system demands and planning reserve margin targets in responding to grid emergencies. While ensuring the host's critical resiliency needs are met, the proposed Resilience 360° program would also deliver near-term generation capacity to TVA as power demand increases under normal grid conditions. The Resilience 360° program would leverage the host's need for backup generation and resiliency in a manner which benefits both the grid and the host.

1.3 Scope of the PEA

TVA has prepared this PEA to develop new guidance, including an Environmental Screening Checklist, and a bounding analysis that would facilitate implementation of the program. The PEA analyzes the expected impacts of deploying up to 25 MW of natural gas or BESS

generation from the proposed Resilience 360° units at various locations across the TVA Power Service Area (PSA; Figure 1-1). This programmatic approach allows TVA to adequately address most of the site-specific activities that would occur under the PPA with the respective vendors, thereby streamlining the implementation of the Resilience 360° program.

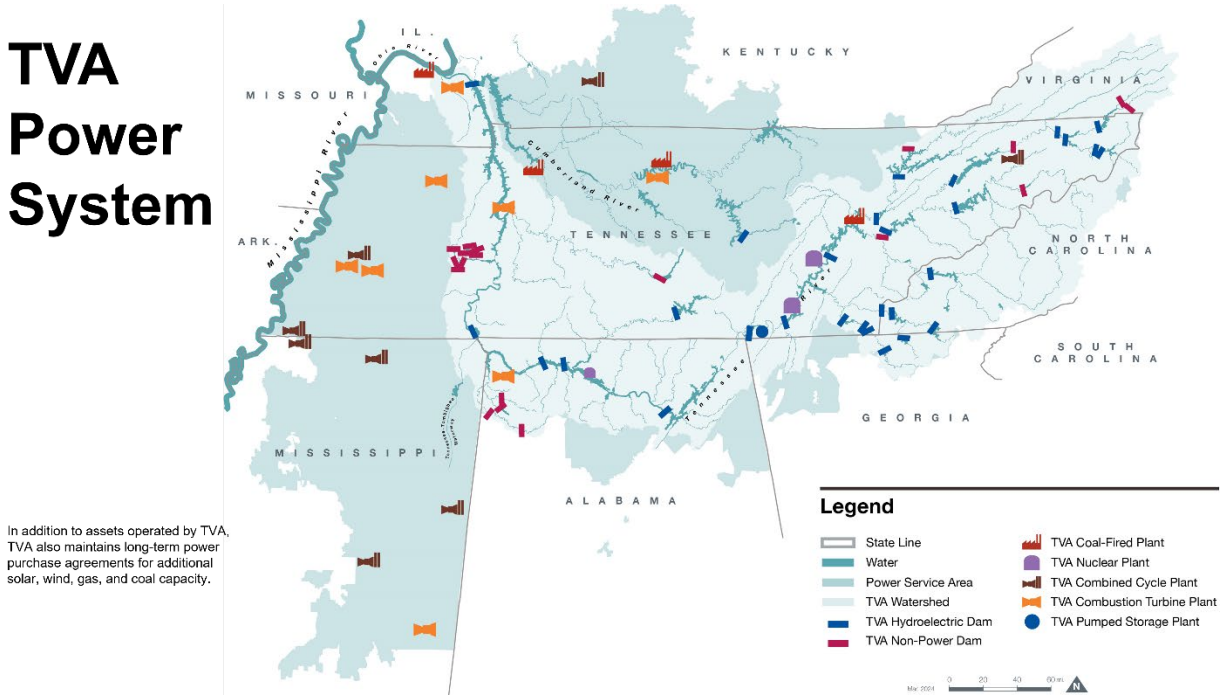


Figure 1-1. TVA Power Service Area

In this PEA, TVA establishes general siting and environmental criteria that would ensure that installations do not cause greater impacts than those addressed in the PEA. Among the criteria for siting these units are general requirements to ensure that impacts to archaeological and historic resources are mitigated. These criteria would likely be incorporated into a Programmatic Agreement (PA) with the State Historic Preservation Office (SHPO) of each of the seven TVA states and federally recognized Tribes with interest in the Valley, to ensure compliance with Section 106 of the National Historic Preservation Act (NHPA). TVA anticipates that the PA would allow site-specific actions to take place without additional Section 106 consultation for installations covered by the PA.

Should the siting of a natural gas unit or BESS not fully comply with the criteria established in the PEA, TVA may be required to complete additional environmental review on a case-by-case basis. In addition, if new gas pipelines or TVA transmission upgrades are required outside of the host's property to install generation at a site, in most cases TVA would be required to conduct a site-specific environmental review of those actions.

At this time, TVA does not believe an environmental impact statement (EIS) is necessary, given that the proposed installations of these units would occur primarily on previously disturbed lands already under use for commercial or industrial purposes, there would be a relatively low

capacity for these generation sources, and potential impacts to the environment would be non-significant.

TVA notes that it is not possible to complete the review of the program under one of TVA's categorical exclusions. TVA does not have a categorical exclusion that explicitly includes PPAs of this type, or which relate to actions involving installation and operation of new natural gas generation or BESS facilities. However, TVA intends to use Categorical Exclusion 14 for conducting or funding minor research, development, and demonstration projects and programs to conduct a pilot program for a few individual sites to help develop and test the Resilience 360° Program Environmental Screening Checklist. The results of the pilot program would inform the development of the Final PEA.

Based on initial information about the program, TVA has identified the following environmental resources that would require analysis in this review:

- Geology and Groundwater
- Land Use and Prime Farmland
- Soil Erosion and Surface Water
- Floodplains
- Wetlands
- Threatened and Endangered Species
- Terrestrial Zoology
- Botany
- Aquatic Ecology
- Cultural and Historic Resources
- Visual Resources
- Noise
- Air Quality
- Greenhouse Gas and Climate Change
- Transportation and Navigation
- Hazardous Materials and Solid Waste
- Public Health and Safety
- Socioeconomics

TVA's action would satisfy the requirements of Executive Order (EO) 11988 (Floodplain Management), EO 11990 (Protection of Wetlands), and EOs 13112 and 13751 (Invasive Species); and applicable laws including the NHPA, Endangered Species Act (ESA), Clean Water Act (CWA), and Clean Air Act (CAA).

1.4 Public and Agency Involvement

TVA's public and agency involvement includes publication of a notice of availability and a 30-day public review of the Draft PEA. The Draft PEA was posted to TVA's website, and a media advisory was issued on March 18, 2025. TVA also notified interested federal, state, and local agencies of the availability of the Draft during the 30-day public review period. Fourteen public comment submittals were received from individuals, businesses, non-profits (including the Center for Biological Diversity, the Southern Environmental Law Center, CleanUpTVA, Sierra Club, and Appalachian Voices), and governmental agencies (including the Virginia Department of Environmental Quality and Tennessee Department of Environment and Conservation).

Individual comments focused on alternatives, best management practices (BMPs), the Environmental Screening Checklist (Appendix A), resource areas, as well as implementation and support. Comments and responses are included in the Public Comments and Responses Appendix (Appendix E).

1.5 Related Environmental Reviews

The proposed Resilience 360° program would be consistent with TVA's 2019 IRP, for which TVA completed a Final EIS in June 2019. The promotion of resiliency and distributed energy resources (DER) were important issues studied by TVA during the development of its 2019 IRP. TVA considered the benefits of resiliency and DER in two of five strategies in the IRP process. Resiliency addresses operational flexibility and the ability to respond to short-term disruptions on the power system, while DER achieves higher, long-term penetration levels. The IRP also identified the need to "add up to 5,200 MW of combustion turbines by 2028 and up to 8,600 MW by 2038 if a high level of load growth materializes." The proposal would be consistent with TVA's objectives in promoting resiliency and DER while also helping meet TVA's need for new dispatchable generation.

1.6 Required Permits and Licenses

TVA does not anticipate the need for the natural gas units or BESS in this program to require issuance of an air permit under the CAA. However, if the installation and operation occur at a site that already has an air permit for other activities, the host would work with the permitting authority to determine if modifications to their permit are needed. Depending on the siting of these installations, however, some projects in this program may require other types of permitting, including but not limited to an individual or Nationwide Permit under Section 404 of the CWA, Section 401 Water Quality Certification, and local floodplain development permits.

Local building permits would be required for most projects. Likewise, a National Pollutant Discharge Elimination System (NPDES) construction stormwater permit would often be required. Because BESS and natural gas projects of the size considered in this PEA typically do not involve discharges to surface waters, are unlikely to be situated in wetlands or floodplains or involve work in streams, the remaining permits mentioned below are not likely to be required. Nevertheless, the following permits could apply to proposed resiliency projects, depending on site-specific circumstances.

Permit Type	Applicability
Local building or construction permit	As required by local governments.
Individual NPDES permit/permit modification	Required for new wastewater discharges or changes to existing discharges.
NPDES Construction Stormwater Permit and/or Non-coal Mining Permit	Required if 1 or more acres would be disturbed by construction activities such as clearing, grubbing, soil borrow or grading.
Clean Water Act Section 404 Permit	Required if work would be performed in streams, wetlands, reservoirs or other waters of the United States (U.S.) This also includes work below the normal high-water elevation even if the site is not inundated at the time the work is performed.
Clean Water Act Section 401 Water Quality Certification	Required for work under federal license or permit that would result in a discharge to waters of the U.S.

Permit Type	Applicability
Floodplain Development Permit	As required by local governments.
State Operating or “no discharge” permits	Required for activities that generate or manage wastewater where no discharge occurs (e.g., sewage and/or process wastewater holding tanks, equipment washing/cleaning).
Permit By Rule (Air Quality)	Required for stationary engines or generators allowing permitting under state-wide permits.
Local Air Permit	Required for facilities located in Davidson, Hamilton, Knox, or Shelby Counties, TN.

CHAPTER 2 - DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 Description of Alternatives

There are two reasonable alternatives available to TVA. These include the No Action Alternative and the Action Alternative. These alternatives are described below.

2.1.1 No Action Alternative – Alternative A

The No Action alternative provides a baseline for comparing against the Action Alternative. Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Individual properties could independently provide their own backup generation.

2.1.2 Resilience 360° Program – Alternative B

TVA would partner with Qualified Resilience vendors to provide backup generation in the form of onsite modular natural gas units or BESS to improve resiliency for qualified customers (hosts). Under the proposal, a vendor would install these natural gas units or BESS at hosts' locations and own, operate, and maintain the units. The host would provide the location, contribute to the installation and maintenance costs of the units, and pay for power used during qualifying resiliency events. TVA would enter into a single PPA with each vendor, including a site-specific addendum for each host site, to purchase and have control or dispatch rights to the units, except during qualifying resiliency events when the units would provide generation onsite to the host. Under normal grid conditions, TVA would dispatch these units to support demand; however, during qualifying resiliency events, the units would provide generation onsite to the host.

Each unit would generate about 100 kW up to 25 MW of power and is smaller than a standard shipping container. Installations under the program could involve various potential transmission interconnection scenarios. Connections with an LPC distribution system would likely result in TVA taking a passive role, with deference given to the respective LPC's interconnection standards.

Typical host sites are up to 2 acres of previously disturbed land. Once materials arrive, construction would be completed in 4 to 12 weeks, typically finishing in 2 months. During construction, 3 trucks and 10 workers are anticipated daily. The most efficient route using existing infrastructure would be used for transport, maintenance, and waste disposal. All sites would comply with local regulations, including the use of a stormwater pollution prevention plan (SWPPP), as applicable. In addition, BMPs, as determined by local ordinances and state regulations, would be used to minimize disruption and to avoid contamination in the project area.

During construction and installation, preparation of the host site may include grubbing and grading, as well as excavation up to 5 feet deep for foundations. Trenching or directional boring up to 5 feet in depth could be used to connect the proposed project to existing natural gas and/or electrical lines. Alternatively, transmission connections may be above ground. Using BMPs and building on a previously disturbed site would minimize the disruption.

When developed, operations of the proposed project would be monitored remotely. The proposed project would have no water discharge but would have air and greenhouse gas (GHG) emissions associated with natural gas-powered units.

And, finally, end-of-life cycle decommissioning activities would generate a similar magnitude of impacts as construction activities. BMPs, as determined by local ordinances and state regulations, would be used to minimize disturbance. Units would be dismantled and materials disposed of or recycled in accordance with all applicable local, state, and federal regulations.

To ensure that each action falling under the PPA with the vendors would be adequately covered by the analysis in the PEA, TVA would establish an administrative approval process that considers the siting of each natural gas unit or BESS. TVA has prepared an Environmental Screening Checklist (Appendix A) to gather information about each proposed site during the approval process. TVA has successfully used such a checklist to streamline TVA's Fast Charge Network program for electric vehicle charging stations. By completing a similar checklist for each location/host, TVA specialists can verify whether the siting decision is adequately covered by the PEA or if an additional environmental review under NEPA is required.

2.2 Comparison of Alternatives

Impacts evaluated may be beneficial or adverse and may apply to the full range of natural, aesthetic, historic, cultural, and socioeconomic resources within the project areas of each alternative and within the surrounding areas. Impact severity is dependent upon their relative magnitude and intensity and resource sensitivity. In this document, four descriptors are used to characterize the level of impacts in a manner that is consistent with TVA's current practice. In order of degree of impact, the descriptors are as follows:

- No Impact (or "absent") – Resource not present or, if present, not affected by project alternatives under consideration.
- Minor – Environmental effects are not detectable or are so minor that they would not noticeably alter any important attribute of the resource.
- Moderate – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- Significant – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

A comparison of the environmental consequences associated with each alternative is presented in Table 2-1.

Table 2-1. Summary and Comparison of Alternatives by Resource Area

Resource Area	Impacts From No Action	Impacts From Proposed Action Alternative
Geology and Groundwater	No change from existing conditions	Construction – Temporary, Minor Operation – Minor Decommission – Temporary, Minor
Land Use and Prime Farmland	No change from existing conditions	Construction – Temporary, Minor Operation – Minor impact Decommission – Temporary, Minor

Resource Area	Impacts From No Action	Impacts From Proposed Action Alternative
Soil Erosion and Surface Water	No change from existing conditions	Construction – Temporary, Minor Operation – Minor Decommission – Temporary, Minor
Floodplains	No change from existing conditions	Construction – Temporary, Minor Operation – Minor impact Decommission – Temporary, Minor
Wetlands	No change from existing conditions	Construction – Temporary, Minor Operation – Minor Decommission – Temporary, Minor
Threatened and Endangered Species – Terrestrial Zoology	No change from existing conditions	Construction – Temporary, Minor Operation – Minor Decommission – Temporary, Minor
Threatened and Endangered Species – Botany	No change from existing conditions	Construction – Temporary, Minor Operation – Temporary, Minor Decommission – Temporary, Minor
Threatened and Endangered Species – Aquatic Ecology	No change from existing conditions	Construction – Temporary, Minor Operation – Temporary, Minor Decommission – Temporary, Minor
Cultural and Historic Resources	No change from existing conditions	Construction – No adverse effect with compliance with the Programmatic Agreement Operation – No adverse effect with compliance with the Programmatic Agreement Decommission – No adverse effect with compliance with the Programmatic Agreement
Visual Resources	No change from existing conditions	Construction – Temporary, Minor Operation – Minor Decommission – Temporary, Minor
Noise	No change from existing conditions	Construction – Temporary, Minor Operation – Minor Decommission – Temporary, Minor
Air Quality	No change from existing conditions	Construction – Temporary, Minor Operation – Minor Decommission – Temporary, Minor
Greenhouse Gas and Climate Change	No change from existing conditions	Construction – Temporary, Minor Operation – Minor Decommission – Temporary, Minor
Transportation and Navigation	No change from existing conditions	Construction – Temporary, Minor Operation – Minor Decommission – Temporary, Minor
Hazardous Materials and Solid Waste	No change from existing conditions	Construction – Minor Operation – Minor Decommission – Temporary, Minor
Public Health and Safety	No change from existing conditions	Construction – Temporary, Minor Operation – Minor Decommission – Temporary, Minor
Socioeconomics	No change from existing conditions	Construction – Temporary, Minor Operation – Minor Decommission – Temporary, Minor

2.3 Summary of Best Management Practices and Mitigation Measures

All individual projects would be subject to BMPs, as determined by local ordinances and state regulations. The vendor and/or host would be responsible for employing standard practices, routine measures, and other project-specific measures to avoid and minimize effects to resources from the implementation of the Proposed Action Alternative. TVA's analysis of potential impacts includes consideration of BMPs and mitigation measures implemented as required to reduce or avoid adverse effects. Standard measures that TVA expects would be required are summarized below and incorporated into the analysis in Chapter 3.

2.3.1 Standard and Routine Best Management Practices

Soil Erosion and Surface Water

- Low ground-pressure-type equipment would be used in specified locations (such as areas with soft ground) to reduce the potential for environmental impacts.
- Measures would be implemented to minimize erosion during site preparation.
- The vendor and/or host would develop a project specific SWPPP, if required, prior to the start of construction.
- Perennial, intermittent, and ephemeral streams that could be affected by the proposed construction would be protected by implementing standard BMPs as identified in the project SWPPP.
- Equipment washing and dust control discharges would be handled in accordance with BMPs described in the SWPPP for water-only cleaning and/or applicable state Stormwater Pollution Prevention Plan Guidance Manual for Industrial Activities to minimize construction impacts to surface waters.
- BMP procedures for controlling soil erosion and sediment control, such as the use of buffer zones, to the extent practicable, surrounding perennial and intermittent streams, would be implemented.

Wetlands

- Any wetland impacts would be mitigated under regulations implementing Sections 401 and 404 of the CWA, applicable state regulations and EO 11990.

Air Quality

- Fugitive dust produced from construction activities would be controlled by BMPs (e.g., wet suppression) as required by state and local agencies.
- Construction equipment with diesel emission controls and cleaner fuel (ultra-low sulfur diesel) would be utilized when possible.
- The operation of trucks with up-to-date emission control technologies and proper maintenance would help to minimize vehicle and equipment emissions during operation and idling. Idling would also be minimized to the extent practicable to decrease the impact of mobile source emissions on ambient air quality.

Botany

- Construction areas would be revegetated with native and/or non-invasive vegetation consistent with EO 13112 (Invasive Species).

2.3.2 Non-Routine Measures

Floodplain Management

- The vendor would contact the local floodplain administrator for an official floodplain determination, for all components of their development, including fill and access roads, and comply with the community's local floodplain ordinance, including receiving a local permit as appropriate.

- Natural gas units, BESS, temporary and/or permanent laydown areas, buildings, storage sheds, tanks, storage areas, as well as fill for any of these facilities would be located outside 100-year floodplains and at least one foot above the 100-year flood elevation at that location.

Pollution Prevention

- Where appropriate, the vendor would develop an effective Environmental Management System to ensure that the proposed facility is committed to complying with environmental regulations, reducing risk, minimizing environmental impacts, setting environmental goals, and achieving improvements in its environmental performance.

- To the extent practicable, the vendor would consider environmental attributes when choosing and purchasing materials and products, including energy efficiency, sustainability, and environmental commitment of contractors.

- To the extent practicable, pollution prevention techniques would be incorporated into the proposed facility maintenance and operation, with maintenance facilities having sufficient and suitable space to allow for effective inventory control and preventive maintenance.

- In general, when pesticides or herbicides must be used, their use would be strictly in accordance with manufacturers' recommendations. To the extent practicable, the vendor or maintenance contractor would use the least toxic pesticides or herbicides effective in controlling the target species, and selection of pesticides or herbicides will be evaluated on a site-specific or unit basis.

Threatened and Endangered Species

- In areas requiring tree removal, clearing activities would be limited to trees less than 3 inches in diameter at breast height or would be elevated for additional review. Tree removal resulting in impacts to potential suitable summer roosting habitat for the federally listed Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septentrionalis*) and proposed endangered tricolored bat (*Perimyotis subflavus*) would be elevated to subject matter experts for additional review. Projects with the potential to adversely affect any federally listed species would be elevated for additional review. Relevant conservation measures required for categorical exclusion under this review would be identified in the Environmental Screening Checklist (Appendix A) and would be implemented as part of the proposed project.

Cultural and Historic Resources

- TVA has developed a PA with SHPOs, the Advisory Council on Historic Preservation (ACHP), and federally recognized Tribes with an interest in the PEA. The purpose of the PA is to establish an efficient program for compliance with Section 106 of the NHPA at a programmatic level. This PA stipulates roles and responsibilities and identifies undertakings exempt from further Section 106 review. TVA has received comments from the public, Advisory Council on Historic Preservation (ACHP), individual state SHPOs, and federally recognized Tribes with an interest in the PEA and is in the process of finalizing the document. For program activities not covered by this PA, or in the event that TVA does not have an executed PA with a particular SHPO, TVA would follow the Section 106 process for specific program related undertakings. The PA will be provided online at tva.com/nepa once it is executed.

2.4 Environmentally Preferred Alternative

The No Action Alternative would result in fewer impacts to the environment as no Resilience 360° units would be constructed. However, the No Action Alternative also means that these units would not be available to supply power for qualifying resiliency events or provide near-term generation capacity to TVA to meet power demand. Therefore, the No Action Alternative could potentially result in unanticipated environmental impacts if power is not available to certain facilities during qualifying resiliency events or at peak demand. Constraints to the bulk electric system during extreme weather or minor incidences of cyber-attack or domestic terrorism could lead to localized consequences including shutdown of essential services, with short-term health and safety or socioeconomic impacts. Therefore, the Preferred Alternative is the environmentally preferred alternative.

2.5 The Preferred Alternative

TVA has identified Alternative B as its preferred alternative. Under the preferred alternative, TVA would partner with Qualified Resilience vendors to provide backup generation in the form of onsite modular natural gas units or BESS to improve resiliency for qualified customers. TVA would also enter into a single PPA with the vendor to purchase and have control or dispatch rights to these units to support demand.

CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the natural and human environment that exists within the TVA PSA and the potential impacts (environmental consequences) associated with implementing the Proposed Action in accordance with the Council on Environmental Quality (CEQ) guidelines set forth in 40 Code of Federal Regulation [CFR] Part 1508.8. The specific criteria for evaluating the potential reasonably foreseeable environmental impacts of the Proposed Action Alternative and No Action Alternative are described in the following sections. The significance of an action is also measured in terms of its context and intensity.

The context and intensity of potential environmental impacts are described in terms of their duration, magnitude, whether they are direct or indirect, and whether they are adverse or beneficial, as summarized in the following paragraphs:

- Short-term or long-term. Short-term impacts are those that would occur only for a limited, finite time with respect to the Proposed Action. Long-term impacts are those that would be persistent and chronic throughout the life of the Proposed Action or would last years after an impact producing activity occurred.

- Less-than-significant (negligible, minor, moderate) or significant, as defined in Section 2.2.

- Direct or indirect. Direct impacts are those that would occur as a result of and at the same time and place as the Proposed Action. Indirect impacts are those that would be caused by the Proposed Action but would occur at a different time or place.

- Adverse or beneficial. An adverse impact would cause unfavorable or undesirable outcomes on the human-made or natural environment. A beneficial impact would cause positive outcomes on the human-made or natural environment.

- The impact analysis also includes consideration of impacts associated with reasonably foreseeable future actions that have a close causal relationship to host locations. Potential effects could result from projects occurring at the same time and in close proximity to projects at respective host locations. Because specific host locations have not yet been identified, specific reasonably foreseeable future actions with a close causal relationship also cannot be identified; however, overall effects from such actions are addressed in the impact assessment.

3.1 Geology and Groundwater

3.1.1 Affected Environment

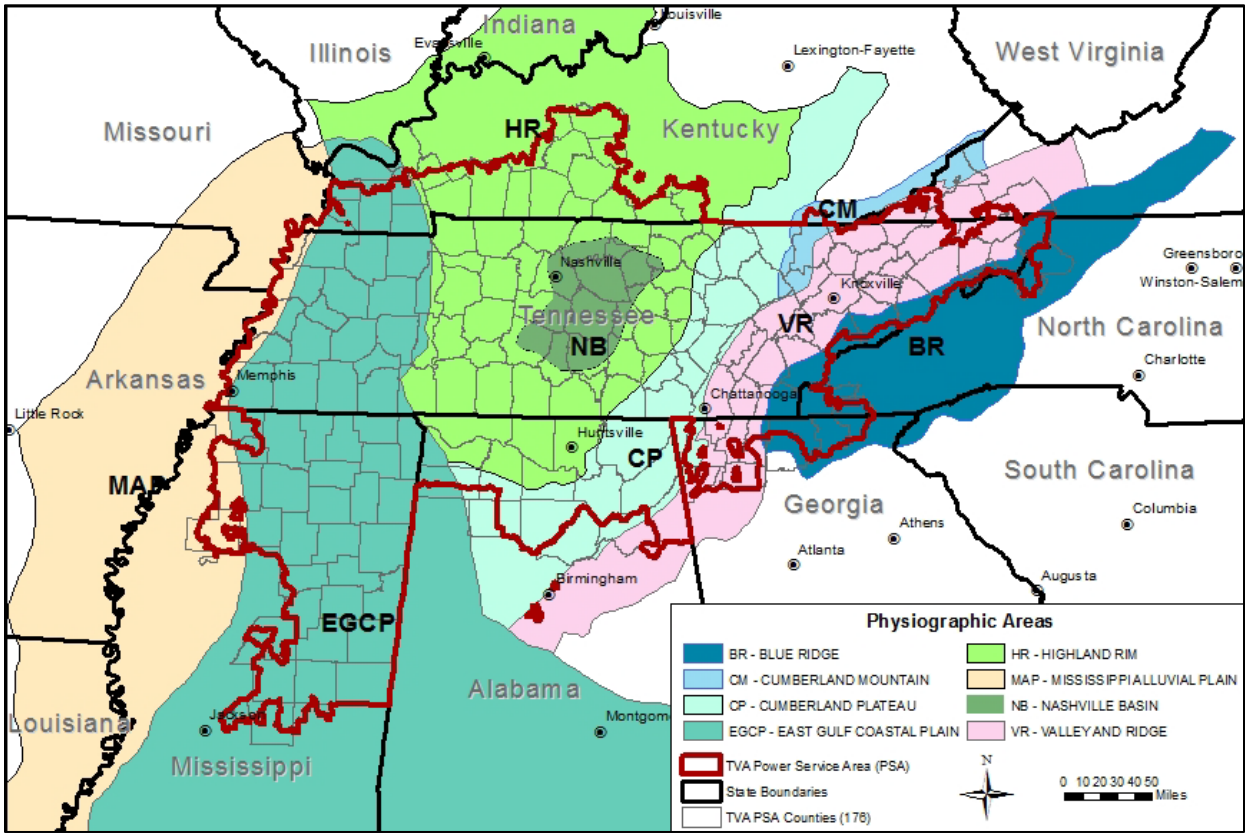
3.1.1.1 Geology

The TVA PSA encompasses portions of the following major physiographic provinces and physiographic sections (Figure 3-1; Fenneman 1938, Miller 1974):

1. Blue Ridge
2. Valley and Ridge

3. Interior Low Plateaus Province
4. Highland Rim
5. Nashville Basin
6. Appalachian Plateaus Province
7. Cumberland Plateau
8. Cumberland Mountains
9. Coastal Plain Province
10. East Gulf Coastal Plain

Physiographic provinces and sections are areas of characteristic geomorphology and geology resulting from similar geologic events.



Source: Adapted from Fenneman (1938).

Figure 3-1. Physiographic Areas of TVA PSA

The easternmost part of the TVA PSA is the Blue Ridge physiographic province, an area composed of the remnants of an ancient mountain chain. This province has the greatest variation in terrain within the TVA PSA. Terrain ranges from nearly level along floodplains at elevations of about 1,000 feet to rugged mountains that reach elevations greater than 6,000 feet above sea level. The rocks of the Blue Ridge have been subjected to significant folding and faulting and are primarily sedimentary (shales, sandstones, conglomerates, quartzite) and metamorphic (slate, phyllite, gneiss) rocks of Precambrian and Cambrian age.

Located west of the Blue Ridge and east of the Appalachian Plateau, the Valley and Ridge Province is characterized by alternating valleys and ridges that trend northeast to southwest.

Ridges have elevations up to 3,000 feet and are generally capped by dolomites and resistant sandstones, while valleys have been formed in less resistant dolomites and limestones. Dominant soils in this province are residual clays and silts derived from in-place weathering of rock. Karst features such as sinkholes and springs are common in the Valley and Ridge province.

The Appalachian Plateaus Province is an elevated area between the Valley and Ridge and Interior Low Plateaus provinces. It is comprised of two sections in the TVA PSA: the extensive Cumberland Plateau and the smaller Cumberland Mountains (Figure 3-1). The Cumberland Plateau rises about 1,000 to 1,500 feet above the adjacent provinces and is formed by layers of near horizontal Pennsylvanian sandstones, shales, conglomerates, and coals, and underlain by Mississippian and older shale and limestones. The sandstones are resistant to erosion and have produced a relatively flat landscape cut by deep stream valleys. Toward the northeast, the Cumberland Mountains section is more rugged due to extensive faulting and several peaks exceeding 3,000 feet elevation. This province has a long history of coal mining and encompasses the Appalachian coal field (USGS 1996). Coal mining has historically occurred in much of the province. The most recent Appalachian coal mining within the TVA PSA has been from the southern end of the province in Alabama, the northern portion of the Cumberland Plateau section in Tennessee and the Cumberland Mountains section.

Two sections of the Interior Low Plateaus Province occur in the TVA PSA. The Highland Rim section is a plateau that occupies much of central Tennessee and parts of Kentucky and northern Alabama. The bedrock of the Highland Rim is Mississippian limestones, chert, shale, and sandstone. The terrain varies from hilly to rolling to extensive relatively flat areas in the Northwest and Southeast. The southern end of the Illinois Basin coal region (USGS 1996) overlaps the Highland Rim in northwest Kentucky and includes part of the TVA PSA. The Nashville Basin (also known as the Central Basin) section is an oval area in middle Tennessee with an elevation about 200 feet below the surrounding Highland Rim. The bedrock is composed of generally flat-lying limestones. Soil cover is usually thin and streams cut into the limestone bedrock. Karst is well-developed in parts of both the Highland Rim and the Nashville Basin.

The Coastal Plain Province encompasses much of the western and southwestern TVA PSA (Figure 3-1). Most of the Coastal Plain portion of the TVA PSA is in the extensive East Gulf Coastal Plain section. The underlying geology is a mix of poorly consolidated gravels, sands, silts, and clays. Soils are primarily of windblown and alluvial (deposited by water) origin, low to moderate fertility and easily eroded. The terrain varies from hilly to flat in broad river bottoms.

The Mississippi Alluvial Plain section occupies the western edge of the TVA PSA and much of the historic floodplain of the Mississippi River. Soils are deep and often poorly drained. The New Madrid Seismic Zone, an area of large prehistoric and historic earthquakes, is in the northern portion of the section.

3.1.1.2 Groundwater

Three basic types of aquifers occur in the TVA PSA: alluvial, sand (composed primarily of sand with lesser amounts of gravel, clay, and silt), and fractured bedrock (primarily carbonate but non-carbonate also present). Groundwater movement in alluvial and sand aquifers occurs through the pore spaces between sediment particles. In some parts of the region, carbonate rocks, such as limestone and dolomite, readily transmit groundwater through enlarged fractures and cavities created by dissolution of carbonate minerals by acidic groundwater. Fractured non-carbonate rock aquifers include sedimentary and metamorphic rocks (e.g., sandstone,

conglomerate, and granite gneiss) which transmit groundwater through fractures, joints, and beddings planes.

Eight major aquifers occur in the TVA PSA (Table 3-1). These aquifers generally align with the major physiographic divisions of the PSA. The aquifers include (in order of increasing geologic age): Quaternary age alluvium occupying the floodplains of major rivers, notably the Mississippi River; Tertiary and Cretaceous age sand aquifers of the Coastal Plain Province; Pennsylvanian sandstone units found mainly in the Cumberland Plateau section; carbonate rocks of Mississippian, Silurian and Devonian age of the Highland Rim section; Ordovician age carbonate rocks of the Nashville Basin section; Cambrian-Ordovician age carbonate rocks within the Valley and Ridge Province; and Cambrian-Precambrian metamorphic and igneous crystalline rocks of the Blue Ridge Province.

Table 3-1. Aquifer, Well, and Water Quality Characteristics in the TVA PSA

Aquifer Description	Well Characteristics (common range, maximum)		Water Quality Characteristics
	Depth (feet)	Yield (gpm)	
Quaternary alluvium: Sand, gravel, and clay. Unconfined.	10–75, 100	20–50, 1,500	High iron concentrations in some areas.
Tertiary sand: Multi-aquifer unit of sand, clay, silt and some gravel and lignite. Confined; unconfined in the outcrop area.	100–1,300, 1,500	200–1,000, 2,000	Problems with high iron concentrations in some places.
Cretaceous sand: Multi-aquifer unit of interbedded sand, marl and gravel. Confined; unconfined in the outcrop area.	100–1,500, 2,500	50–500, 1,000	High iron concentrations in some areas.
Pennsylvanian sandstone: Multi-aquifer unit, primarily sandstone and conglomerate, interbedded shale and some coal. Unconfined near land surface; confined at depth.	100–200, 250	5–50, 200	High iron concentrations are a problem; high dissolved solids, sulfide or sulfate are problems in some areas.
Mississippian carbonate rock: Multi-aquifer unit of limestone, dolomite, and some shale. Water occurs in solution and bedding-plane openings. Unconfined or partly confined near land surface; may be confined at depth.	50–200, 250	5–50, 400	Generally hard; high iron, sulfide, or sulfate concentrations are a problem in some areas.
Ordovician carbonate rock: Multi-aquifer unit of limestone, dolomite, and shale. Partly confined to unconfined near land surface; confined at depth.	50–150, 200	5–20, 300	Generally hard; some high sulfide or sulfate concentrations in places.
Cambrian-Ordovician carbonate rock: Highly faulted multi-aquifer unit of limestone, dolomite, sandstone, and shale; structurally complex. Unconfined; confined at depth.	100–300, 400	5–200, 2,000	Generally hard, brine below 3,000 feet.
Cambrian-Precambrian crystalline rock: Multi-aquifer unit of dolomite, granite gneiss, phyllite, and metasedimentary rocks overlain by thick regolith. High yields occur in dolomite or deep colluvium and alluvium. Generally unconfined.	50–150, 200	5–50, 1,000	Low pH and high iron concentrations may be problems in some areas.

Note: gpm = gallons per minute
Source: Webbers 2003

The largest withdrawals of groundwater for public water supply are from the Tertiary and Cretaceous sand aquifers in the Mississippi Alluvial Plain and Coastal Plain physiographic areas. These withdrawals account for about two-thirds of all groundwater withdrawals for public water supply in the TVA PSA. The Pennsylvanian sandstone and Ordovician carbonate aquifers have the lowest groundwater use (less than 1 percent of withdrawals) and lowest potential for groundwater use.

The quality of groundwater in the TVA PSA largely depends on the chemical composition of the aquifer in which the water occurs (Table 3-1). Precipitation entering the aquifer is generally low in dissolved solids and slightly acidic. As it seeps through the aquifer it reacts with the aquifer matrix and the concentration of dissolved solids increases.

Groundwater quality may be degraded through spills, waste storage, and air pollutants:

- Spills – Electrical generating plants and other industrial facilities often utilize chemicals, including fuels, in their processes or to operate machinery. If accidental spills of these chemicals occur during usage, storage, or transport, vertical migration of the chemicals into the underlying groundwater aquifer may occur.

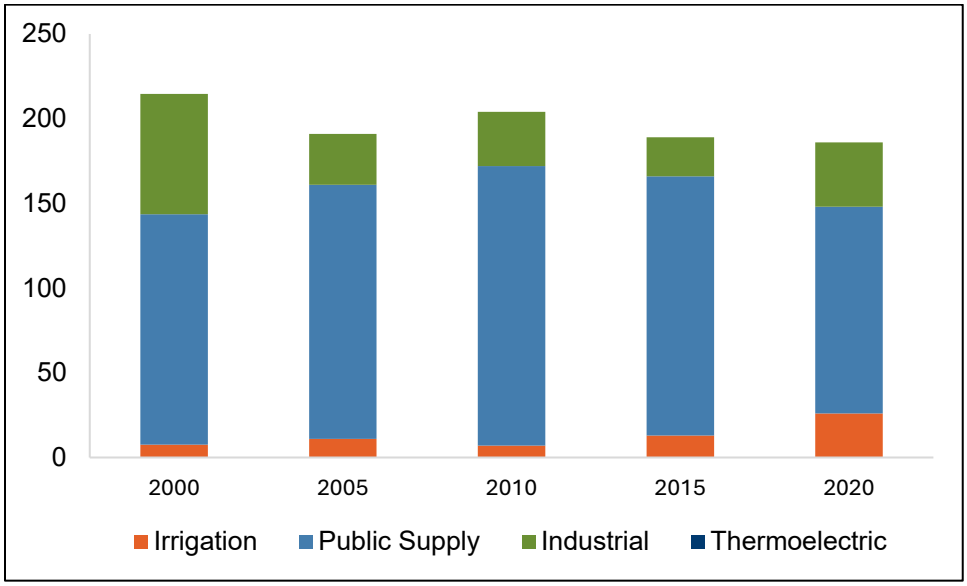
- Waste Storage – Over time, many electrical generating stations stored waste byproducts (e.g., coal combustion residuals) either in landfills or in surface impoundments. Rainfall infiltration into and through dry stacked waste can migrate vertically downward over time, carrying contaminants into groundwater, particularly in unlined landfills or surface impoundments. Capping and covering controls prevent rainfall infiltration. Depending on hydrogeologic and geologic conditions, storage of waste in unlined landfills and surface impoundments may result in direct contact between the waste material and groundwater, whereby contaminants can leach from the waste material into groundwater over time. Storage of waste in lined landfills could result in degraded groundwater quality if the liner fails and contaminants leach from the landfill into groundwater over time.

- Air pollution – Airborne pollutants (e.g., mercury, sulfates) can affect groundwater through rainfall and infiltration.

As discussed in Section 3.3.1, the majority of water use in the TVA PSA comes from surface water withdrawals, with the use of groundwater to meet public supply needs varying across the TVA PSA as the result of several factors, including water availability, quantity, and quality along with development of economic supply and public water demand. The use of groundwater to meet public water supply needs is greatest in West Tennessee and Northern Mississippi, where prolific aquifers and inadequate surface water resources have resulted in a predominance of groundwater use. In 2015, Shelby County, Tennessee (Memphis), accounted for about 38 percent of the annual total withdrawal. Approximately 60 percent of all groundwater withdrawals in the Tennessee River Basin were supplied by Tertiary sand aquifers in West Tennessee and North Mississippi. In addition, there are numerous sparsely populated, rural counties in the PSA that do not have public water systems but are self-served by individual wells or springs.

The largest use of groundwater is for public water supply, shown in Figure 3-2, which includes data for the Tennessee River Basin. Approximately 17.6 percent of the water used for domestic supply and 27.2 percent of water used for irrigation in the Tennessee River Basin is groundwater. Groundwater is also used for industrial, mining, livestock, and aquaculture purposes. Total groundwater use for public water supply in 2020 was 122 million gallons per day (MGD) in the Tennessee River Basin. Groundwater withdrawal for industrial use in the

Tennessee River Basin was 38 MGD, or 3.6 percent of total industrial withdrawal. Groundwater use for irrigation was 26 MGD, or 27.2 percent of total irrigation use. Wheeler-Wilson was the Water Use Tabulation Area with the highest groundwater withdrawal, at 43 MGD (Sharkey and Springston 2022). Except for 2010, groundwater use has shown a decreasing trend from 1995 to 2020. In 2020, groundwater withdrawals reached its lowest level since 1995.



Source: Sharkey and Springston 2022

Figure 3-2. Groundwater Use by Category in the Tennessee River Basin, 2000 to 2020

3.1.2 Environmental Consequences

The potential impacts to the geology and groundwater from a given action are assessed by evaluating the potential for an action to modify protected geologic resources, modify the availability of groundwater, or release contaminants to groundwater. Although the extent of geology and groundwater impacts would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.1.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts to geology or groundwater under the No Action Alternative.

3.1.2.2 Alternative B – Proposed Action

During construction and installation, preparation of the host site may include clearing, grubbing, and grading. Trenching or directional boring could be used to connect the proposed project to existing natural gas and/or electrical lines. Alternatively, transmission connections may be above ground. Compliance with all applicable regulations such as a SWPPP, use of BMPs, and building on a previously disturbed site would minimize the disruption. Additionally, excavation activities would not be expected to be more than 5 feet in depth. Therefore, construction impacts to geology and groundwater would be minor.

When developed, operations of the proposed project would be monitored remotely with periodic maintenance visits. Therefore, operational impacts to geology and groundwater would be minor.

Finally, end-of-life cycle decommissioning activities would generate a similar magnitude of impacts as construction activities. All applicable regulations would be followed and BMPs would be used to minimize disturbance. Therefore, decommissioning impacts to geology and groundwater would be minor.

Reasonably foreseeable future actions with a close causal relationship to the host locations could result in a wider spread of impacts to geology and groundwater depending on the nature of those actions. It is assumed that all projects would comply with all applicable local, state, and federal regulations and permit requirements including use of a SWPPP. Therefore, impacts to geology and groundwater associated with reasonably foreseeable future actions in the temporal and physical vicinity of host locations would be minor overall.

3.2 Land Use and Prime Farmland

This section describes the range of land uses in the TVA PSA. A majority of the Resilience 360° sites would likely occur on private property. However, some could also be placed on state or federal lands. Use of federal lands is generally regulated by the acts establishing the various agencies as well as other laws. For example, the TVA Act gives TVA the authority to regulate the use of lands it manages as well as development across, along, or in the Tennessee River or any of its tributaries. The Farmland Protection Policy Act of 1981 (7 United States Code [U.S.C.] §§ 4201 *et seq*.) recognizes the importance of prime farmland. Various state laws and local ordinances regulate land use, although a large portion of land in the TVA PSA is not subject to local zoning ordinances. The Environmental Screening Checklist would include data sources to identify and evaluate types of land uses that would or would not be compatible with each proposed host site.

3.2.1 Affected Environment

Major Land Uses in the TVA PSA

Major land uses in the TVA PSA include forestry, agriculture, and urban/suburban/industrial (USDA 2018). About 4.4 percent of the TVA PSA is water, primarily lakes and rivers (USDA 2020). This proportion has increased slightly since 1982 (when monitoring was started), primarily due to the construction of small lakes and ponds. About 5.7 percent of the land area is in federal ownership; this proportion has also increased slightly since 1982. The major components of federal land are national parks, national forests, national wildlife refuges, and TVA reservoir lands. Of the remaining non-federal land area, about 9 percent is classified as developed and 80 percent as rural (USDA 2020). Rural undeveloped lands include farmlands (19 percent of the rural area) and forestland (about 42 percent of the rural area). The greatest change since 1982 has been in developed land, which almost doubled in area due to high rates of urban and suburban growth in much of the TVA PSA. The rate of land development was high during the 1990s and early 2000s and slowed down in the late 2000s. More recent data for Tennessee shows that total developed land has grown almost 3 percent between 2012 and 2017 (USDA 2020).

Managed and Natural Areas

There are several managed and natural areas throughout the TVA PSA. Managed areas include lands held in public ownership that are managed by an entity (e.g., TVA, United States [U.S.]

Department of Agriculture [USDA], U.S. Forest Service, State of Tennessee) to protect and maintain certain ecological and/or recreational features. Natural areas include ecologically significant sites; federal, state, or local park lands; national or state forests; wilderness areas; scenic areas; wildlife management areas; recreational areas; greenways; trails; Nationwide Rivers Inventory streams; and state and national wild and scenic rivers. Ecologically significant sites are either tracts of privately owned land that are recognized by resource biologists as having significant environmental resources or identified tracts on TVA lands that are ecologically significant but not specifically managed by TVA's Natural Areas program.

Agriculture

Agriculture is a major land use and industry in the TVA PSA. In 2022, 40 percent of the land area in Tennessee, which makes up a majority of the TVA PSA, was farmland that comprised 63,105 individual farms (USDA 2024). The average farm size was 170 acres, smaller than the national average, though farm size in the TVA PSA varies considerably with numerous small farms and a smaller number of large farms.

Nationwide, farm average size has increased since 2007 by about 10 percent, though the total acreage and number of farms has decreased in that same period (USDA 2024). Statewide data for Tennessee follows the nationwide trends. For the state of Tennessee, cropland and pastureland comprise 17.8 and 15.2 percent, respectively, of rural, non-federal land in 2017 (USDA 2020). Both cropland and pastureland have decreased in area since 1982; however, the rate of cropland and pastureland loss in Tennessee has declined (USDA 2018).

Although the area of irrigated farmland is small (6.4 percent of farmland), it increased by 25 percent from 1987 to 2017 (USDA 2019). The area of irrigated farmland is likely to increase in the future as temperature and precipitation patterns become less predictable or if drought conditions become more prevalent (EPRI and TVA 2009). Between 2012 and 2017, statewide data from Kentucky, Tennessee, North Carolina, and Virginia show minor decreases in the percentage of farms using irrigation; however, in most cases, the acres of irrigated farmland have increased (USDA 2019).

Forest Management

Approximately 53 percent of the TVA PSA is forested (USGS 2021). Forestland increased in area through much of the 20th century; this rate of increase has slowed and/or reversed in parts of the TVA PSA in recent years (Conner and Hartsell 2002, USDA 2015). Forestland is predicted to decrease between 1997 and 2060 in most counties in the TVA PSA, with several counties in the vicinity of Memphis, Nashville, Huntsville, Chattanooga, Knoxville and the Tri-Cities area of Tennessee predicted to lose more than 25 percent of forest area (Wear and Greis 2013). Loss of forest area within the TVA PSA is primarily a result of increasing urbanization and development.

About 50 percent of the forestland in the TVA PSA is classified as timberland (USDA Forest Service 2024), forestland that is producing or capable of producing more than 20 cubic feet of merchantable wood per acre per year and is not withdrawn from timber harvesting by law. About 13.5 percent of timberland is in public ownership, which includes national forests, state and local lands, and other federal lands. About 87 percent is under private ownership, which includes both corporations and non-corporate owners. While the majority of corporate timberlands have historically been owned by forest industries, this proportion has decreased in recent years as many forest product companies have sold timberlands due to changing market conditions.

Prime Farmland

The federal Farmland Protection Policy Act was passed to minimize the amount of land irreversibly converted from prime farmland due to federal actions. It requires all federal agencies to evaluate impacts to prime and unique farmland prior to permanently converting to land use incompatible with agriculture. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses (USDA 2018). Prime farmland has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. Prime farmland is designated independently of current land use, but it cannot be areas of water, urban, or built-up land.

In general, prime farmlands have an adequate and dependable water supply, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content and few or no rocks. Prime farmland soils are permeable to water and air, not excessively erodible or saturated for extended period and are protected from frequent flooding.

Approximately 23 percent of the TVA PSA is classified as prime farmland (NRCS 2024). An additional roughly 4 percent of the TVA PSA would be classified as prime farmland if drained or protected from flooding.

Although the soils within a given project area may have the physical characteristics of prime farmland per the soil survey, lands at sites that have been converted to industrial uses are removed from the prime farmland category under the Farmland Protection Policy Act and its implementing regulations.

3.2.2 Environmental Consequences

The potential impacts to land use and prime farmland from a given action are assessed by evaluating the potential for an action to interfere with other land uses, including agriculture. Although the extent of land use and Prime Farmland impacts would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.2.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts to land use or prime farmland under the No Action Alternative.

3.2.2.2 Alternative B – Proposed Action

TVA anticipates that the majority of project sites, and therefore development, would be located on previously disturbed areas and occur on land zoned for light industrial or commercial development. Therefore, TVA does not anticipate an impact on land use in association with construction, operation, or decommissioning of the Resilience 360° units. Correspondingly the Resilience 360° project would not contribute to land use impacts in the area associated with reasonably foreseeable future actions.

TVA does not anticipate the program to result in new expansions or development within communities. However, if any area was to be newly affected, in compliance with the Farmland Protection Policy Act, TVA would determine on a case-by-case basis if prospective sites contain prime farmland. TVA would complete Form AD-1066 (Farmland Conversion Impact Rating), the

Natural Resources Conservation Service land evaluation and site assessment, using the established scoring system to evaluate potential adverse impacts on farmland. A score exceeding 160 indicates that the subject farmland needs further consideration for protection. For a site with a score exceeding 160, TVA would work with the vendor to consider alternative sites as appropriate. Therefore, impacts to prime farmland as a result of construction, operation, or decommissioning of the Resilience 360° units would be minor. Because TVA does not expect the program to result in new expansions or developments that affect prime farmland on most sites, the Resilience 360° project would not contribute to prime farmland impacts in the area associated with reasonably foreseeable future actions.

Thus, overall, potential effects to land use and prime farmlands for actions considered under this PEA are expected to be minor.

3.3 Soil Erosion and Surface Water

3.3.1 Affected Environment

The affected environment that would possibly be impacted by the Proposed Action would span several regions (including the Tennessee, Ohio, and lower Mississippi Rivers) and subregions (including the Cumberland, Mobile, Pearl, Tombigbee, Coosa, and Green Rivers). Fresh water abounds in much of this area and generally supports most beneficial uses, including fish and aquatic life, public and industrial water supply, waste assimilation, agriculture, and water-contact recreation (such as swimming, boating, and fishing). The quality of the TVA PSA's surface waters – its streams, rivers, lakes, and reservoirs – is critical to the protection of human health and aquatic life. Water resources provide habitat for aquatic life, recreation opportunities, domestic and industrial water supplies, and other benefits. Water quality in the TVA PSA is generally fair to good (TVA 2024a).

Surface water resources in the TVA PSA primarily consist of water bodies such as rivers, lakes or reservoirs, and tributary streams. These features collect and hold or convey precipitation from the surrounding landscape. Another source of surface water is groundwater that is hydraulically connected or discharges to surface waters through geologic features such as springs. Surface waters vary greatly in quality and size, based on land use (such as industrial activities, agriculture, urbanization, natural or managed wildlife habitat), soils, precipitation amounts, and influence from groundwater resources, which in turn influences soil erosion. These waters are regulated by the CWA and are managed by the individual states within the TVA PSA with oversight from the U.S. Environmental Protection Agency (USEPA).

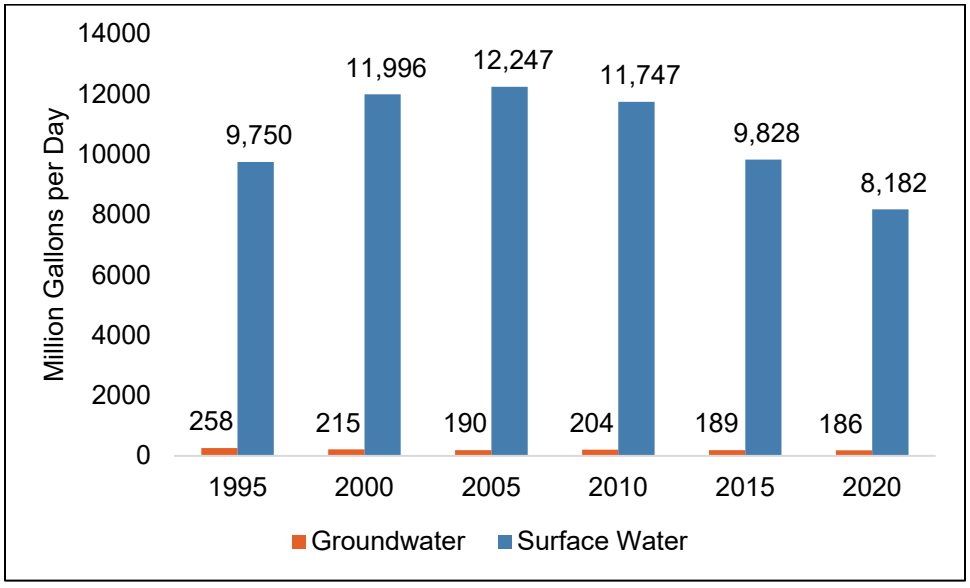
The seven states in the TVA PSA have enacted laws regulating water quality and implementing the Federal Water Pollution Control Act, commonly known as the CWA. As part of this implementation, the states classify water bodies according to their uses and establish water quality criteria specific to these uses. Each state has also issued an antidegradation statement containing specific conditions for regulated actions and designed to maintain and protect current uses and water quality conditions.

Major water quality concerns within the TVA PSA include point and non-point sources of pollution that degrade water quality at several locations on mainstream reservoirs and tributary rivers and reservoirs. Toxic substances have also been found in sediment and fish in reservoirs that otherwise have good water quality. Several of the water bodies discussed above are listed as impaired in 303(d) lists published by their respective state's environmental agencies. However, those 303(d) listings are primarily for pollutants such as mercury from atmospheric

deposition or toxic organics in contaminated sediments. Other water quality concerns include occurrences of low dissolved oxygen levels downstream of dams, which stress aquatic life and limit the ability of the water to assimilate waste. The river systems have seen extensive human alteration, including construction of reservoirs, navigation channels and locks. Despite these changes, diverse aquatic communities are present in each of these river systems.

The TVA PSA contains most of the Tennessee River Basin, which is one of the most water rich basins in the U.S. The Tennessee River Basin, which is about half of the TVA PSA, is one of the most intensively used basins in the contiguous U.S. as measured by intensity of freshwater withdrawals in gallons per day per square mile. While the withdrawal rate is high, the basin has a low consumptive use by returning over 95 percent of the withdrawals back for downstream use (Sharkey and Springston 2022).

Combined surface water and groundwater withdrawals in 2020 were estimated to average 8,368 MGD and the 2020 total withdrawal rate was 16.5 percent lower than it was in 2015. This was largely due to a reduction in thermoelectric withdrawal of 20.5 percent (Sharkey and Springston 2022). Of the total withdrawal, 97.8 percent, or 8,182 MGD came from surface water. Groundwater supplied the remaining 2.2 percent, or 186 MGD. Return flow totaled 7,965 MGD, or 95.2 percent of total withdrawal. Total net water demand was 403 MGD, or 4.8 percent of total withdrawal. Groundwater and surface water withdrawals in the Tennessee River Basin from 1995 to 2020 are shown in Figure 3-3.



Source: Sharkey and Springston 2022

Figure 3-3. Groundwater and Surface Water Withdrawals in the Tennessee River Basin, 1995 to 2020

Since 1995, the Tennessee River Basin's public water supply has been sourced primarily from surface water. In 2020, public supply water was comprised of 82.4 percent surface water and 17.6 percent groundwater. Total surface water withdrawals in the Tennessee River Basin have been decreasing since 2005.

While water resources are relatively abundant in the TVA PSA, future climate stressors could change that abundance, locally or regionally, leading to impacts and the need for adaptive measures by sectors of the economy, including aspects of the energy system (EPRI and TVA 2009). Increased precipitation during storms would increase flood risk, expand flood hazard areas, increase the variability of stream flows (i.e., higher high flows and lower low flows) and increase the velocity of water during high flow periods, thereby increasing erosion. On the other hand, intra-annual droughts, which are predicted to become more frequent and long-lasting in the Southeast, could reduce water availability. These changes would have adverse effects on water quality. Major watersheds in the region are shown in Figure 3-4.

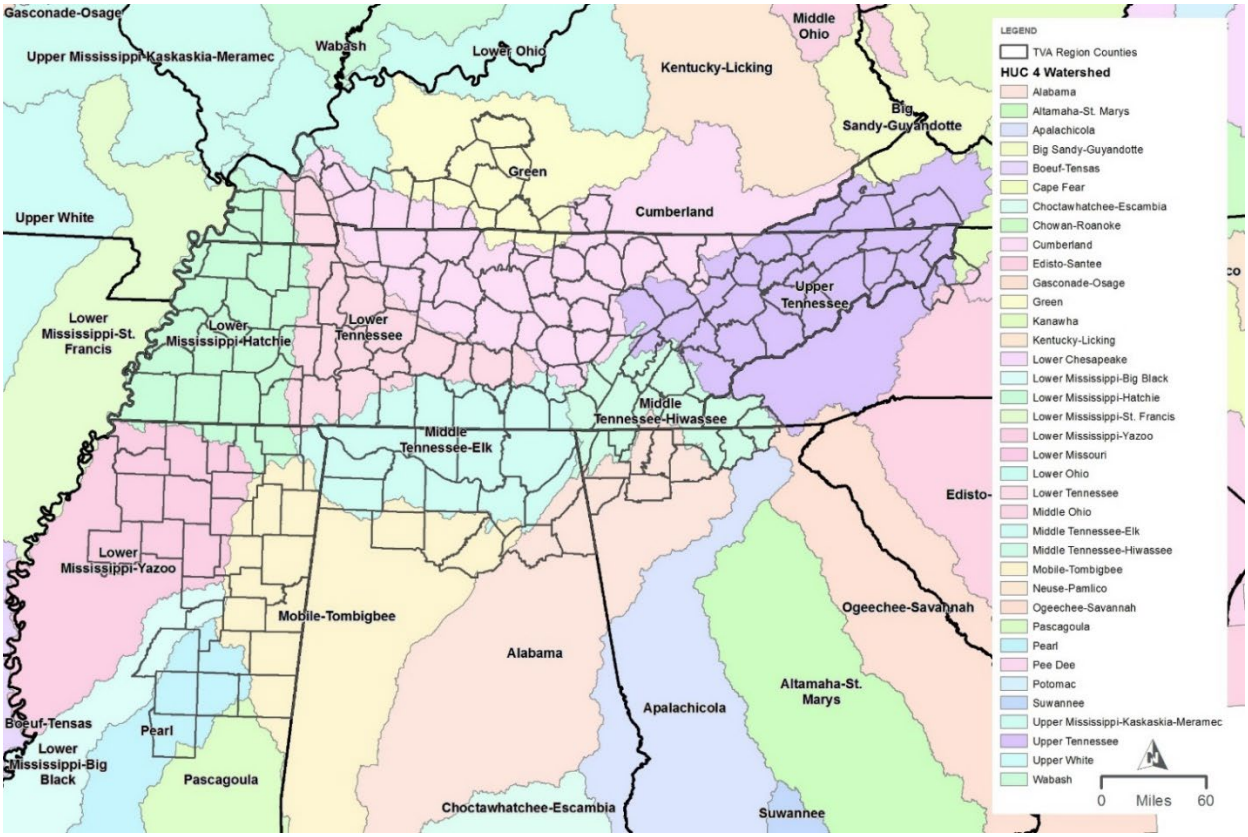


Figure 3-4. Major Watersheds Within TVA PSA

3.3.2 Environmental Consequences

Surface water quality can be affected by the construction of projects due to increased silt load resulting from runoff during and following soil-disturbing activities. Soil disturbances associated with installation or construction activities can potentially result in adverse water quality impacts. Soil erosion and sedimentation can clog streams and ground water features and can threaten aquatic life. Removal of onsite vegetation and the installation of impervious surfaces (e.g., paved areas and buildings) can alter site runoff patterns, though can be mitigated. During operations, the proposed project would have no cooling water needs and no water discharge and therefore would not cause a change in runoff volume or temperature from preconstruction conditions. Therefore, operational impacts to soil erosion and surface water would be minor for any proposed projects. Although the extent of soil and surface water impacts would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.3.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through existing methods, which could expand or be modified to ensure grid stability and meet power demand. TVA's mission to provide affordable, reliable power would be maintained and associated water quality impacts would be insignificant as all generation alternatives would continue to meet water regulatory compliance in alignment with antidegradation mandates. Therefore, there would be no impacts to soil or surface water under the No Action Alternative.

3.3.2.2 Alternative B – Proposed Action

Under this alternative, and with the application of appropriate BMPs, no significant impacts to surface water are anticipated. Rivers, streams, wetlands, and floodplains would be avoided to the extent practicable under the Proposed Action. Direct impacts to regulated water resources would be avoided by project design. Indirect impacts could result from stormwater runoff during construction, which would be adequately managed with adherence to BMPs to capture sediment prior to leaving the site. Potential impacts could occur directly or indirectly due to modification of the riparian zone and stormwater runoff resulting from construction or decommissioning activities. Potential impacts due to removal of streamside vegetation within the riparian zone include increased erosion and siltation (see Section 3.3), loss of instream habitat, and increased stream temperatures, though this is not anticipated. A potential indirect effect of routine maintenance includes potential herbicide runoff into streams. As necessary, appropriate BMPs determined by local ordinances and state regulations would be implemented to avoid potential adverse effects to water quality and aquatic life. Specifically, BMPs are expected to provide guidance for activities occurring in or around Streamside Management Zones (SMZs) to minimize the amount and length of disturbance to water bodies and maintain natural stream buffers. An NPDES stormwater construction permit would likely apply to most prospective projects. This permit requires the preparation of a SWPPP that outlines measures that would be implemented to avoid or reduce adverse effects to local waters.

All ground disturbance would be stabilized upon completion of construction or after decommissioning to prevent potential for long term erosion. Most project sites are not anticipated to require more than 1-2 acres of impervious surfaces, decreasing the possibility of erosion or damage to an area. The short duration (1-2 months) for construction and limited level of activity helps minimize potential for erosion. Other wastewaters generated during the proposed project may include domestic sewage, non-detergent equipment washings, dust control and hydrostatic test discharges. Overall, impacts to soil erosion and surface waters during construction (and later decommissioning) would be temporary and minor.

During operations, the proposed project would have no water discharge and would not cause a change in runoff volume or temperature from preconstruction conditions. Operational impacts to soil erosion and surface water would be minor.

BMPs would be determined by local ordinances and state regulations. Permits would be obtained and/or modified as necessary. Therefore, the Proposed Action would have temporary, minimal impact to erosion and surface waters.

It is assumed that all reasonably foreseeable future actions in the vicinity of the host locations would comply with all applicable local, state, and federal regulations and permit requirements including use of BMPs and implementation of a SWPPP. Therefore, impacts to soil erosion and

surface water associated with reasonably foreseeable future actions in the temporal and physical vicinity of host locations would be minor overall.

3.4 Floodplains

3.4.1 Affected Environment

A floodplain is the relatively level land area along a stream or river that is subject to periodic flooding. The area subject to a 1 percent chance of flooding in any given year is normally called the 100-year floodplain. The area subject to a 0.2 percent chance of flooding in any given year is normally called the 500-year floodplain. It is necessary to evaluate development in the floodplain to ensure that the project is consistent with the requirements of EO 11988 (Floodplain Management).

Natural gas units, BESS, transmission line interconnections, access roads, temporary and/or permanent laydown areas, gas pipelines, buildings, enclosed sheds, tanks, storage, and parking areas could be located anywhere on a host's property within the TVA PSA. Although likely placed on disturbed and/or developed areas, the potential exists for proposed facilities to be located within 100-year floodplains, the 500-year floodplain of the Tennessee River or a TVA reservoir, or on TVA property or where TVA owns property rights. Locations would vary based on the project site.

3.4.2 Environmental Consequences

As a federal agency, TVA adheres to the requirements of EO 11988 (Floodplain Management). The objective of EO 11988 is "…to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (EO 11988, Floodplain Management). The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances (U.S. Water Resources Council 1978). The EO requires that agencies avoid the 100-year floodplain unless there is no practicable alternative.

Although the extent of impacts to floodplains would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.4.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. No floodplains would be altered or built upon, so there would be no impacts to floodplains under the No Action Alternative.

3.4.2.2 Alternative B – Proposed Action

Project components such as transmission line interconnections, access roads, and gas pipelines associated with the Proposed Action could be located within 100-year floodplains. Consistent with EO 11988, these facilities are considered repetitive actions in the 100-year floodplain that should result in only minor impacts (TVA 1981). To minimize adverse impacts, the vendor would contact the local floodplain administrator for an official floodplain determination for all components of their development, including fill and access roads, and comply with the community's local floodplain ordinance, including receiving a local permit as appropriate.

Natural gas units, BESS, temporary and/or permanent laydown areas, buildings, storage sheds, tanks, storage areas, as well as fill for any of these facilities would be located outside 100-year floodplains and at least one foot above the 100-year flood elevation at that location; otherwise, additional analysis would be needed, because these facilities are not considered repetitive actions in the 100-year floodplain.

Under the Proposed Action, floodplain development permit requirements and BMPs determined by local ordinances and state regulations would be implemented to minimize adverse impacts to floodplains. Except where further review is needed, by implementing the measures associated with each floodplain question in the Environmental Screening Checklist, the proposed Resilience 360° program would have no significant impact on floodplains and their natural and beneficial values, only minor direct or indirect impacts are likely to occur.

It is assumed that all reasonably foreseeable future actions in the vicinity of the host locations would comply with all applicable local, state, and federal regulations and permit requirements pertaining to development within floodplains. Therefore, impacts to floodplains associated with reasonably foreseeable future actions in the temporal and physical vicinity of host locations would be minor overall.

3.5 Wetlands

3.5.1 Affected Environment

Wetlands are areas that are inundated or saturated by water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (40 CFR Part 230.3(t)). Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands are highly productive and biologically diverse ecosystems that provide multiple public benefits such as flood control, reservoir shoreline stabilization, improved water quality, and habitat for fish and wildlife resources. EO 11990 (Protection of Wetlands) directs federal agencies to minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Wetlands are also protected by federal and state laws and regulations (e.g. Tennessee’s Aquatic Resources Alteration Permit program; CWA Sections 401 and 404).

Wetlands are ecologically important because of their beneficial effect on water quality, their moderation of flow regimes by retaining and gradually releasing water, their value as wildlife habitat, and as areas of botanical diversity. Wetlands are typically transitional ecosystems between terrestrial and aquatic communities.

Wetlands occur across the TVA PSA and are most extensive in the South and West, where they comprise 5 percent or more of the landscape (USGS 2016). Wetlands in the TVA PSA consist of two main systems: palustrine wetlands such as marshes, swamps, and bottomland forests dominated by trees, shrubs, and persistent emergent vegetation, and lacustrine wetlands associated with lakes such as aquatic bed wetlands (Cowardin et al. 1979). Riverine wetlands associated with moving water within a stream channel are also present but relatively uncommon.

3.5.2 Environmental Consequences

The potential impacts to wetlands from a given action are assessed by evaluating the potential for an action to result in dredging, clearing, or filling wetlands through site grading or other activities. Although the extent of wetland impacts would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.5.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts to wetlands under the No Action Alternative.

3.5.2.2 Alternative B – Proposed Action

As part of its site-specific screening process, TVA would determine if a proposed installation of natural gas or BESS units on the host site would have adverse effects to wetlands. Impacts to wetlands would be identified in the Environmental Screening Checklist. This includes jurisdictional (i.e., those wetlands that are subject to federal regulation) and non-jurisdictional wetlands. Generally, sites within or containing wetland areas tend to be unsuitable for the installation of gas or BESS units due to the presence of water. Any wetland impacts would be mitigated under regulations implementing Sections 401 and 404 of the CWA, applicable state regulations and EO 11990.

Based on the limited size of the natural gas or BESS units, impacts to wetlands would be expected to be unlikely or minor for most projects. Those that would affect wetlands would be subject to mitigation in accordance with regulations.

It is assumed that all reasonably foreseeable future actions in the vicinity of the host locations would comply with all applicable local, state, and federal regulations and permit requirements. Additionally, it is assumed rivers, streams, wetlands, and floodplains would typically be avoided for these reasonably foreseeable future actions. Therefore, impacts to wetlands associated with reasonably foreseeable future actions in the temporal and physical vicinity of host locations would be minor overall.

3.6 Threatened and Endangered Species

3.6.1 Affected Environment

Special status species are those species for which state or federal agencies provide an additional level of protection by law, regulation, or policy. The ESA (16 U.S.C. §§ 1531-1543) was passed to conserve the ecosystems upon which endangered and threatened species depend and to conserve and recover those species. An endangered species is defined by the ESA as any species in danger of extinction throughout all or a significant portion of its range. A threatened species is likely to become endangered within the foreseeable future throughout all or a significant part of its range. Areas known as critical habitats, essential to the conservation of listed species, also can be designated under the ESA. The ESA establishes programs to conserve and recover endangered and threatened species and makes their conservation a priority for federal agencies. Under Section 7 of the ESA, federal agencies are required to consider the potential effects of their proposed action on endangered and threatened species and critical habitats. If the proposed action has the potential to affect these resources, the

federal agency is required to consult with the U.S. Fish and Wildlife Service (USFWS) and take measures to avoid or mitigate adverse effects.

In addition to the federal classifications, all seven states in the TVA PSA have enacted their own laws protecting special status species under a variety of their own, state-specific classification systems. In some states, only species listed under the federal ESA receive legal protection under these laws. In other states, the legal protections also apply to the additional species designated by the state. TVA considers impacts to state-listed species in its environmental reviews as appropriate.

3.6.1.1 Terrestrial Zoology

The TVA PSA spans across nine ecoregions (USEPA 2017). These nine regions include the Blue Ridge, Interior Plateau, Interior River Valley and Hills, Ridge and Valley, Mississippi Alluvial Plain, Mississippi Valley Loess Plains, Southeast Plains, and Southwestern Appalachians. A wide range of habitats are present within these eco-regions consisting of forested mountains, wetlands, floodplains, and river systems, each supporting a wide array of terrestrial animal species. The diversity of these eco-regions contributes to the PSA's high ecological value. Terrestrial animals addressed in this section include amphibians, reptiles, birds, mammals, and terrestrial invertebrates with federal status, either under the ESA or other regulatory protection.

Federally Listed Species

Table 3-2 lists federally endangered, threatened, and protected or other special status terrestrial wildlife species reported in the TVA PSA based on TVA's Natural Heritage Database and the USFWS Information for Planning and Consultation (IPaC) online system (https://ecos.fws.gov/ipac/). Species considered to be extinct or locally extirpated are not included in the table. State-listed species not concurrently listed with federally listed species, are included in Appendix B.

Table 3-2. Special Status and Federally Protected Terrestrial Wildlife Species in the TVA PSA

Scientific Name	Common Name	Federal Status*
Vertebrates		
Birds		
Calidris canutus rufa	Rufa Red Knot	T
Charadrius melodus	Piping Plover	T
Dryobates borealis	Red-cockaded Woodpecker	T
Grus americana	Whooping Crane	EXPN
Haliaeetus leucocephalus	Bald Eagle	DL
Laterallus jamaicensis jamaicensis	Eastern Black Rail	T
Sterna antillarum athalassos	Interior Least Tern	DL
Amphibians		
Cryptobranchus alleganiensis alleganiensis	Eastern Hellbender	PE
Necturus alabamensis	Black Warrior Waterdog	E
Mammals		
Corynorhinus townsendii virginianus	Virginia Big-eared Bat	E

Scientific Name	Common Name	Federal Status*
Glaucomys sabrinus coloratus	Carolina Northern Flying Squirrel	E
Myotis grisescens	Gray Bat	E
Myotis septentrionalis	Northern Long-eared Bat	E
Myotis sodalis	Indiana Bat	E
Perimyotis subflavus	Tricolored Bat	PE
Reptiles		
Glyptemys muhlenbergii	Bog Turtle	SAT
Gopherus polyphemus	Gopher Tortoise	T
Graptemys pearlensis	Pearl River Map Turtle	T
Graptemys oculifera	Ringed Map Turtle	T
Graptemys pulchra	Alabama Map Turtle	SAT
Macrochelys temminckii	Alligator Snapping Turtle	PT
Sternotherus depressus	Flattened Musk Turtle	T
Invertebrates		
Mollusks		
Anguispira picta	Painted Snake Coiled Forest Snail	T
Patera clarkii	Noonday snail	T
Arachnids		
Microhexura montivaga	Spruce-fir Moss Spider	E
Insects		
Neonympha mitchellii	Mitchell's Satyr Butterfly	E
Danaus plexippus	Monarch Butterfly	PT
Crustacenas		
Lirceus usdagalun	Lee County Cave Isopod	E

*DL=Delisted. E=Endangered. PE=Proposed Endangered. SAT=Similarity of Appearance, Threatened. PT=Proposed Threatened. T=Threatened. EXPN = Experimental Population Non-Essential.
Source: TVA Regional Natural Heritage Database 2024 and USFWS IPaC 2025 online system (https://ecos.fws.gov/ipac/) (Appendix B).

For the purpose of discussing affected environment, the TVA PSA has been grouped into the following six categories, primarily based on habitat use:

1. Aquatic Habitat
2. Early Successional Habitat
3. Forested Habitat
4. Karst Habitat
5. Montane Habitat
6. Mature pine-savannah woodlands

Aquatic Habitat

Aquatic habitats within the TVA PSA, including wetlands, rivers, streams, and floodplains, are vital ecosystems that support a diverse array of terrestrial species. The construction of reservoir systems by TVA and the U.S. Army Corps of Engineers (USACE) created large areas of habitat for waterfowl, herons and egrets, ospreys, gulls, and shorebirds, especially in the central and

eastern portions of the TVA PSA where this habitat was limited. The Tennessee River and Mississippi River systems serve as critical breeding and foraging grounds for many species. Presently, many resident and migratory populations of birds can be found in the TVA PSA. Wetlands generally include swamps, marshes, and bogs. The abundance of wetlands varies across the nine ecoregions encompassing the TVA region. In eastern portions of the TVA region, wetlands occupy a relatively small percent of the landscape relative to uplands within the Blue Ridge, Ridge and Valley, and Central Appalachians ecoregions. These ecoregions are typically marked by relatively steep topography and deeply incised stream channels. Farther west, the topography levels out and wetlands become more common. Broad, flat floodplain areas are common features, and various types of wetland habitats, especially bottomland hardwood forested wetlands, are widespread. Federally listed terrestrial animal species known from the TVA PSA primarily associated with these aquatic habitats include Alabama map turtle, alligator snapping turtle, bald eagle, black warrior waterdog, eastern black rail, eastern hellbender, flattened musk turtle, interior least tern, Mitchell's satyr butterfly, Pearl River map turtle, piping plover, ringed map turtle, rufa red knot, and whooping crane.

Early Successional Habitat

Early successional habitats are dynamic ecosystems characterized by open, grassy, or shrubby areas that emerge after disturbances such as fire, logging, and industrial or agricultural abandonment. These habitats are critical for a variety of species that rely on the dense vegetation, abundant sunlight, and diverse plant communities found in these transitional landscapes. Common features include grasslands, old fields, and shrublands, which provide food, cover, and breeding grounds for many wildlife species. A wide range of species including many grassland breeding and/or overwintering birds, amphibians, mammals, reptiles, and a variety of invertebrates (e.g., butterflies, dragonflies, and crickets) depend on this habitat. Monarch butterfly relies on early successional habitat for feeding and reproduction.

Forested Habitat

Forested habitats encompass a diverse range of ecosystems, including deciduous hardwood forests and mixed pine-hardwood forests. These forests are vital for maintaining biodiversity, providing critical habitat for numerous species, and supporting ecological processes such as carbon sequestration and water regulation. The region's forests are particularly prominent in the Appalachian Mountains and Cumberland Plateau, where they host a variety of tree species like oak, hickory, maple, and pine. Federal status species found in these forested habitats include Indiana bat, northern long-eared bat, and tricolored bat. During the spring and summer, Indiana bats and northern long-eared bats roost under exfoliating bark, cavities, cracks, and crevices of snags and live trees. Tricolored bats primarily roost among live and dead leaf clusters of live or recently dead deciduous hardwood trees. These bat species rely on forest edges, tree lines, and forest openings for foraging.

Karst Habitat

Karst habitats are unique landscapes formed by the dissolution of soluble bedrock, such as limestone, creating features like caves, sinkholes, and underground streams. Caves are abundant features throughout much of the TVA region, especially in north Alabama, northwest Georgia, and the eastern half of Tennessee. These sites provide a unique mixture of microhabitats used by a diverse array of cave-dependent species, some endemic to single cave systems. There are more than 14,000 known caves in these areas – 9,200 in Tennessee, 4,800 in Alabama, and 600 in Georgia (Jenkins 2009). Where conditions within a cave are suitable (e.g., humidity, air flow, temperature) there is potential for cave-dwelling bats to occur. Federally

listed species found in these habitats include gray bat and Virginia big-eared bat, which roost in caves and rely on karst systems for survival. The Indiana bat, northern long-eared bat, and tricolored bat also use caves for hibernation. Additionally, the Lee County cave isopod is only known from four subterranean basins and associated caves in Lee County, Virginia.

Montane Habitat

The montane habitats within the TVA PSA, particularly in the southern Appalachian Mountains, are characterized by high elevation forests, rugged terrain, and cool, moist climates. These areas are often dominated by mixed hardwood and coniferous forests. Montane habitats in this region are ecologically significant, providing critical refuge for numerous species and supporting unique biodiversity. Federally listed species found in these habitats include the bog turtle, which inhabits wetland areas often associated with montane regions, and the Carolina northern flying squirrel, which relies on high-elevation spruce-fir forests. Additionally, the painted snake coiled forest snail inhabits forested areas with mesic cliffs, exposed rock, and a thick humus layer. The spruce-fir moss spider is found in the moss-covered rocks and forests of these high-elevation ecosystems.

Mature Pine-Savannah Woodlands

Mature pine-savanna woodlands are unique and characterized by an open canopy of mature pine trees, a diverse understory of grasses, herbs, and shrubs, and a lack of dense mid-story vegetation. These habitats are typically maintained by frequent, low-intensity fires, which prevent the encroachment of hardwoods and promote the growth of fire-adapted species. Pine savannas support a wide range of plant and animal species, both endemic and rare. The open structure and diverse plant community provide habitat for numerous insects, birds, reptiles, and mammals. These habitats are home to several species that are adapted to the unique conditions of pine savannas, for example, the gopher tortoise and red-cockaded woodpecker. The gopher tortoise requires fire-maintained, open-understory habitat for foraging, nesting, and burrowing. The red-cockaded woodpecker relies on mature longleaf and loblolly pine forests for nesting and foraging. Only a small percentage of suitable habitat remains for the red-cockaded woodpecker throughout its range, and is limited, in most cases, to that which occurs on lands (e.g., U. S. Forest Service, national wildlife refuges, or state-managed park property) that are specifically managed for this species within the TVA PSA. Known colonies of the red-cockaded woodpecker are relatively stationary and are located in the Southwestern Appalachian, Interior Plateau, and Southeastern Plains Ecoregions.

State-listed Species

Based on TVA's Natural Heritage database, approximately 600 terrestrial wildlife species determined to be rare and in need of protection at the state level have also been documented within the seven-state TVA PSA. A listing of state-level endangered, threatened, and species of conservation concern within the TVA PSA can be found in Appendix B. TVA would utilize state-specific resources in the site-specific screening process to determine the potential for effects to state-listed species.

3.6.1.2 Botany

The TVA PSA spans a wide range of ecoregions containing forested mountains, wetlands, floodplains, and river systems, each supporting a wide array of terrestrial vegetation species. The diversity of these eco-regions contributes to the PSA's high ecological value. Terrestrial vegetation addressed in this section includes non-vascular and vascular plants with federal status, either under the ESA or other regulatory protection.

Special-Status Species

Table 3-3 lists federally endangered, threatened and protected or other special status vegetation species reported in the TVA PSA. Species considered to be locally extirpated are not listed. This list is from TVA's Natural Heritage Database which keeps records of these species as listed by state and federal agencies. State listed species not concurrently listed with federally listed species are included in Appendix B.

Table 3-3. Special Status and Federally Protected Vegetation Species in the TVA PSA

Scientific Name	Common Name	Federal Status
Non-Vascular Plants		
Gymnoderma lineare	Rock Gnome Lichen	E
Vascular Plants		
Apios priceana	Price's Potato-bean	T
Arabis georgiana	Georgia Rockcress	T
Arabis perstellata	Braun's Rock-cress	E
Asplenium scolopendrium var. americanum	American Hart's-tongue Fern	T
Astragalus bibullatus	Pyne's Ground Plum	E
Clematis morefieldii	Morefield's Leather-flower	E
Clematis socialis	Alabama Leather Flower	E
Conradina verticillata	Cumberland Rosemary	T
Dalea foliosa	Leafy Prairie-clover	E
Geum radiatum	Spreading Avens	E
Hedyotis purpurea var. montana	Roan Mountain Bluet	E
Helianthus verticillatus	Whorled Sunflower	E
Helonias bullata	Swamp-pink	T
Isotria medeoloides	Small Whorled Pogonia	T
Leavenworthia crassa	Fleshy-fruit Gladecress	E
Lesquerella lyrata	Lyre-leaf Bladderpod	T
Lesquerella perforata	Spring Creek Bladderpod	E
Liatris helleri	Heller's Blazing Star	T
Lindera melissifolia	Pondberry	E
Marshallia mohrii	Mohr's Barbara's Buttons	T
Physaria globosa	Short's Baldderpod/ Lesquereux's Mustard	E
Pityopsis ruthii	Ruth's Golden Aster	E
Platanthera integrilabia	White Fringeless Orchid	T
Ptilimnium nodosum	Harperella	E
Sagittaria secundifolia	Kral's Water-plantain/ Arrowhead	T
Sarracenia oreophila	Green Pitcher Plant	E
Scutellaria montana	Large-flowered Skullcap	T
Solidago spithamaea	Blue Ridge Goldenrod	T

Scientific Name	Common Name	Federal Status
Spiraea virginiana	Virginia Spiraea	T
Thelypteris pilosa var. alabamensis	Alabama Streak-sorus Fern	T
Xyris tennesseensis	Yellow-eyed-grass	E

E=Endangered. T=Threatened.
Source: TVA Regional Natural Heritage Database 2024 and USFWS IPaC 2025 online system (https://ecos.fws.gov/ipac/) (Appendix B).

Federally Listed Species

A majority of federally listed plant species within the TVA PSA are found in globally rare communities present within the Blue Ridge, Interior Plateau, and Southwest Appalachians Ecoregions. Thirty-six species of plants in the TVA PSA are listed under the ESA as endangered or threatened by the USFWS (Appendix B). Habitat requirements for species in the PSA are described and can be found in NatureServe (2024).

Federally listed plant species from the PSA could be affected by the Proposed Action; however, this would be dependent on the site and proximity to potential habitat.

Based on habitat evaluations of the federally listed plant species found within the TVA PSA, six species have the potential to be affected by actions associated with the installation of gas or BESS units on host sites and are discussed further in this section.

Alabama leather flower, Mohr's Barbara's buttons, and whorled sunflower are found in prairie openings.

Price's potato bean and green pitcher plant can occur within transmission line rights-of-way and other open spaces.

Fleshy-fruit gladecress, known from six populations in two northern Alabama counties, grows in limestone cedar glades that exhibit various degrees of disturbance, including pastures, roadside rights-of-way, and cultivated or plowed fields.

State-Listed Species

Based on TVA's Natural Heritage database, terrestrial vegetation species determined to be rare and in need of protection at the state level have also been documented within the TVA PSA. Each of the seven states within the TVA PSA maintains databases of listed species. A listing of state-level endangered, threatened, and species of conservation concern within the TVA PSA can be found in Appendix B. TVA would utilize state-specific resources in the site-specific screening process to determine the potential for effects to state-listed species.

3.6.1.3 Aquatic Ecology

The TVA PSA contains portions of several major river systems including all the Tennessee River drainage and portions of drainages of the Cumberland, Mobile (primarily the Coosa and Tombigbee rivers) and the Mississippi rivers. Aquatic features of these river systems drain a diverse physiography and associated topography providing abundant habitats which are occupied by extremely diverse aquatic faunas and represent important commercial and recreational fisheries (TVA 2004). These aquatic habitats have been affected by varying levels of agricultural, residential, and industrial land uses. A description of the aquatic communities within the Tennessee River system is provided in Section 3.2 of the update of TVA's Natural

Resource Plan Final Supplemental Environmental Impact Statement (TVA 2020a). Section 3.3 of this PEA covers water bodies and surface water for the TVA PSA.

The river systems within the TVA PSA support a large variety of freshwater fishes and invertebrates (including freshwater mussels, snails, crayfish and insects). Due to the presence of several major river systems, the PSA's high geologic diversity and the lack of glaciation, the PSA is recognized as a globally important area for freshwater biodiversity (Stein et al. 2000; TVA 2015).

As with other smaller impoundment types, phytoplankton, periphyton and macrophytes supply most of the organic matter to the food web in reservoirs and ponds. Due to fluctuating water levels, phytoplankton production can dominate freshwater impoundments like reservoirs; however, rooted and floating macrophytes can dominate where water levels are stable in a reservoir (Wallace et al. 1992). Fish, amphibians, reptiles, birds and mammals are the main groups of vertebrates found in and associated with reservoirs in the southeast during a portion of their life cycle (Wallace et al. 1992). Fish populations are mainly comprised of forage fishes including shads and silversides in reservoirs and sunfishes in impoundments (Noble 1981), while the dominant predators in reservoirs are typically basses (Wallace et al.1992).

Common invertebrate species found in southeastern reservoirs include rotifers, protozoans and crustaceans. Within the benthos of most reservoirs in the southeast, larvae of true midges and oligochaete worms are the dominant macroinvertebrates (Diggins and Thorp 1985). Most of the freshwater mussel species known to occur in the United States are distributed in the southeast, with approximately 182 species in Alabama, 130 species in Tennessee, and 126 species in Georgia (Neves et al. 1997). However, many benthic organisms have narrow habitat requirements that are not always met in reservoirs or tailwaters below dams.

Special Status Species

Table 3-4 lists federally endangered, threatened and protected or other special status aquatic species reported in the TVA PSA. Species considered to be locally extirpated are not listed. This list is from TVA's Natural Heritage Database, which keeps records of these species as listed by state and federal agencies. State-listed species not concurrently listed with federally listed species are included in Appendix B.

Table 3-4. Special Status and Federally Protected Aquatic Species in the TVA PSA

Scientific Name	Common Name	Fed Status
Invertebrates		
Alasmidonta atropurpurea	Cumberland Elktoe	E
Alasmidonta raveneliana	Appalachian Elktoe	E
Athearnia anthonyi	Anthony's River Snail	E, XN
Cambarus cracens	Slenderclaw Crayfish	E
Cambarus williami	Brawleys Fork Crayfish	PT*
Campeloma decampi	Slender Campeloma	E
Cumberlandia monodonta	Spectaclecase (mussel)	E
Cyprogenia stegaria	Fanshell	E, XN
Dromus dromas	Dromedary Pearlymussel	E, XN
Epioblasma brevidens	Cumberlandian Combshell	E, XN
Epioblasma capsaeformis	Oyster Mussel	E, XN

Scientific Name	Common Name	Fed Status
Epioblasma florentina florentina	Yellow-blossom Pearlymussel	DL*
Epioblasma florentina walkeri	Tan Riffleshell	E
Epioblasma metastriata	Upland Combshell	DL*
Epioblasma obliquata obliquata	Purple Cat's Paw	E, XN
Epioblasma othcaloogensis	Southern Acornshell	DL*
Epioblasma penita	Southern Combshell	E
Epioblasma torulosa gubernaculum	Green Blossom Pearlymussel	DL*
Epioblasma torulosa rangiana	Northern Riffleshell	E
Epioblasma torulosa torulosa	Tuberculed Blossom Pearlymussel	DL*
Epioblasma triquetra	Snuffbox Mussel	E
Epioblasma turgidula	Turgid Blossom Pearlymussel	DL*
Fusconaia cor	Shiny Pigtoe Pearlymussel	E, XN
Fusconaia cuneolus	Fine-rayed Pigtoe	E, XN
Fusconaia subrotunda	Longsolid	T
Hamiota altilis	Finelined Pocketbook	T
Hamiota perovalis	Orangenacre Mucket	T
Hemistena lata	Cracking Pearlymussel	E, XN
Lampsilis abrupta	Pink Mucket	E
Lampsilis altilis	Fine-lined Pocketbook	T*
Lampsilis perovalis	Orange-nacre Mucket	T*
Lampsilis virescens	Alabama Lampmussel	E, XN
Lasmigona subviridis	Green Floater	PT
Lemiox rimosus	Birdwing Pearlymussel	E, XN
Leptodea leptodon	Scaleshell	E*
Leptoxis ampla	Round Rocksnail	T
Leptoxis compacta	Oblong Rocksnail	PE
Leptoxis foreman	Interrupted (=georgia) Rocksnail	E
Lioplax cyclostomaformis	Cylindrical Lioplax	E*
Marstonia ogmorhaphe	Royal Springsnail	E
Marstonia pachyta	Armored marstonia	E
Medionidus acutissimus	Alabama Moccasinshell	T
Medionidus conradicus	Cumberland Moccasinshell	PE
Medionidus parvulus	Coosa Moccasinshell	E
Obovaria cf. unicolor		PT
Obovaria retusa	Ring Pink	E, XN
Obovaria subrotunda	Round Hickorynut	T
Obovaria unicolor	Alabama Hickorynut	PE
Orconectes shoupi	Nashville Crayfish	E, PDL
Palaemonias alabamae	Alabama Blind Cave Shrimp	E
Palaemonias ganteri	Mammoth Cave Shrimp	E
Pegias fabula	Little-wing Pearlymussel	E
Plethobasus cicatricosus	White Wartyback	E, XN
Plethobasus cooperianus	Orange-foot Pimpleback	E, XN

Scientific Name	Common Name	Fed Status
Plethobasus cyphyus	Sheepnose	E
Pleurobema clava	Clubshell	E, XN
Pleurobema curtum	Black Clubshell	E
Pleurobema decisum	Southern Clubshell	E
Pleurobema furvum	Dark Pigtoe	E
Pleurobema georgianum	Southern Pigtoe	E
Pleurobema hanleyianum	Georgia Pigtoe	E
Pleurobema marshalli	Flat Pigtoe	DL*
Pleurobema oviforme	Tennessee Clubshell	PE
Pleurobema perovatum	Ovate Clubshell	E
Pleurobema plenum	Rough Pigtoe	E, XN
Pleurobema rubrum	Pyramid Pigtoe	PT*
Pleurobema taitianum	Heavy Pigtoe	E
Pleuronaia barnesiana	Tennessee Pigtoe	PE
Pleuronaia dolabelloides	Slabside Pearlymussel	E
Pleuronaia gibber (Pleurobema gibberum)	Cumberland Pigtoe	E
Potamilus capax	Fat Pocketbook	E
Potamilus inflatus	Inflated Heelsplitter	T
Ptychobranchus greenii	Triangular Kidneyshell	E
Ptychobranchus subtentus (subtentum)	Fluted Kidneyshell	E
Quadrula cylindrica	Rabbitsfoot	T*
Quadrula cylindrica cylindrica	Smooth Rabbitsfoot	T
Quadrula cylindrica strigillata	Rough Rabbitsfoot	E
Quadrula fragosa	Winged Mapleleaf	E, XN
Quadrula stapes	Stirrupshell	DL*
Simpsonaias ambigua	Salamander Mussel	PE
Theliderma (Quadrula) intermedia	Cumberland Monkeyface (pearlymussel)	E, XN
Theliderma (Quadrula) sparsa	Appalachian Monkeyface (pearlymussel)	E, XN
Toxolasma cylindrellus	Pale Lilliput	E
Venustaconcha trabalis	Tennessee Bean	E*
Villosa fabalis	Rayed Bean	E
Villosa perpurpurea	Purple Bean	E
Villosa trabalis	Cumberland Bean (pearlymussel)	E, XN
Vertebrates		
Chrosomus saylori	Laurel Dace	E
Cyprinella caerulea	Blue Shiner	T
Elassoma alabamae	Spring Pygmy Sunfish	T
Erimonax monachus	Spotfin Chub	T, XN
Erimystax cahni	Slender Chub	T, XN
Etheostoma akatulo	Bluemask Darter	E
Etheostoma boschungi	Slackwater Darter	T
Etheostoma chermocki	Vermilion Darter	E
Etheostoma chienense	Relict Darter	T

Scientific Name	Common Name	Fed Status
Etheostoma etowahae	Etowah Darter	E
Etheostoma lemniscatum	Tuxedo Darter	LE*
Etheostoma marmorpinnum	Marbled Darter	LE*
Etheostoma nuchale	Watercress darter	E
Etheostoma percnurum	Duskytail Darter	E, XN
Etheostoma phytophilum	Rush Darter	E
Etheostoma scotti	Cherokee Darter	T
Etheostoma sitikuense	Citico Darter	LE, XN*
Etheostoma susanae	Cumberland Darter	E
Etheostoma trisella	Trispot Darter	T
Etheostoma wapiti	Boulder Darter	E, XN
Fundulus julisia	Barrens Topminnow	E
Notropis albizonatus	Palezone Shiner	E
Notropis cahabae	Cahaba Shiner	E
Noturus baileyi	Smoky Madtom	E, XN
Noturus crypticus	Chucky Madtom	E
Noturus flavipinnis	Yellowfin Madtom	T, XN
Noturus munitus	Frecklebelly Madtom	T
Noturus stanauli	Pygmy Madtom	E, XN
Percina antesella	Amber Darter	E
Percina aurolineata	Goldline Darter	T
Percina brevicauda	Coal Darter	PT
Percina jenkinsi	Conasauga Logperch	E
Percina tanasi	Snail Darter	DL*
Percina williamsi	Sickle Darter	T
Phoxinus cumberlandensis	Blackside Dace	T
Scaphirhynchus albus	Pallid Sturgeon	E
Speoplatyrhinus poulsoni	Alabama Cavefish	E

DL=Delisted. E=Endangered. LE=Listed Endangered. PE=Proposed Endangered. PT=Proposed Threatened. T=Threatened. XN=Experimental Population Non-Essential. * = only TVA Natural Heritage Database
Source: TVA Regional Natural Heritage Database 2024 and USFWS IPaC 2025 online system (https://ecos.fws.gov/ipac/) (Appendix B).

Federally Listed Species

Over 90 percent of the federally listed species occur within five of the nine ecoregions in the TVA PSA. A majority of federally listed animal species are found in the Interior Plateau, the Ridge and Valley, Southwest Appalachians, and Southeastern Plains Ecoregions. One hundred-six species of aquatic animals in the TVA PSA are listed under the ESA by the USFWS (Appendix B). Of these, 82 are listed as endangered and 24 are listed as threatened. Eleven additional species have been proposed for listing as threatened or endangered. Habitat requirements for species in the PSA are described and can be found in NatureServe (2024).

The highest concentrations of aquatic species listed under the ESA occur in the Blue Ridge, Appalachian Plateaus, and Interior Low Plateau regions. Relatively few listed species occur in the Coastal Plain and Mississippi Alluvial Plain regions. The taxonomic groups with the highest

proportion of species listed under the ESA are fish and mollusks. Factors contributing to the high proportions of vulnerable species in these groups include the high number of endemic species in the TVA PSA and the alteration of their habitats by reservoir construction and water pollution. River systems with the highest numbers of listed aquatic species include the Tennessee, Cumberland, and Coosa rivers (TVA 2015).

Federally listed aquatic species from the PSA that could be affected by the Proposed Action because of their use of aquatic habitats would be dependent on the site and proximity to aquatic habitat.

State-listed Species

Based on TVA's Natural Heritage database, roughly 300 aquatic species determined to be rare and in need of protection at the state level have also been documented within the TVA PSA. Each of the seven states within the TVA PSA maintains databases of listed species. A listing of state-level endangered, threatened, and species of conservation concern within the TVA PSA can be found in Appendix B. TVA would utilize state-specific resources in the site-specific screening process to determine the potential for effects to state-listed species.

Invasive Species

Invasive species are species that are not native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (NISC 2016). Human actions, both intentional and unintentional, are the primary means of their introduction.

Several aquatic plants designated by the USDA as noxious weeds under the Plant Protection Act occur in the TVA PSA: hydrilla, giant salvinia, and giant hogweed (USDA 2025). Hydrilla is a submersed aquatic plant present in several TVA reservoirs. Giant salvinia, also an aquatic plant, occurs in ponds, reservoirs, and slow-moving streams. It primarily occurs south of the TVA PSA and has not yet been reported from the Tennessee River drainage. Giant hogweed generally occurs near stream bank areas as water is an important link to giant hogweed establishment and proliferation.

There are additional invasive plants considered to be an established or emerging threat that occur on or near TVA generating facilities in an aquatic environment (TN-IPC 2023). These include phragmites and Eurasian water milfoil. Phragmites occur in ash ponds at several TVA coal-fired plants and are otherwise uncommon in the TVA PSA. In recent years, the non-native eelgrass Rockstar Hybrid has displaced native aquatic plants in several TVA reservoirs.

Other invasive aquatic animals in the TVA PSA that harm or potentially harm aquatic communities include the common, grass, bighead, and silver carp; alewife; blueback herring; rusty crayfish; Asiatic clam; and zebra mussel. Because of their potential to affect water intake systems, TVA uses chemical and warm-water treatments to control Asiatic clams and zebra mussels at some of its generating facilities.

3.6.2 Environmental Consequences

The potential impacts to terrestrial zoology, botany, or aquatic ecology from a given action are assessed by evaluating the potential for an action to injure or kill individuals, disturb habitat, or otherwise result in a reduction in the populations of protected species. Although the extent of impacts to these resources would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.6.2.1 Terrestrial Zoology

3.6.2.1.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts to terrestrial animal species under the No Action Alternative.

3.6.2.1.2 Alternative B – Proposed Action

The installation of onsite modular natural gas or BESS units has low potential to adversely affect any federally listed terrestrial animals. Given that these units would be installed in areas that have already been disturbed or developed and are adjacent to existing facilities, there is a low likelihood that federally listed terrestrial animals would be present in these areas. To further minimize the potential to affect any of these listed species, each site would be analyzed using the USFWS IPaC tool and the Environmental Screening Checklist (Appendix A). By reviewing the site-specific Environmental Screening Checklists, TVA would independently determine if a proposed project associated with the proposed Resilience 360° program would adversely affect protected species. For those projects with the potential to cause adverse effects to listed species, further review would be warranted and mitigation measures to eliminate the potential for any significant impacts to listed terrestrial species would be developed and implemented. With additional review and implementation of these mitigative measures, no significant effects on listed terrestrial species are expected. If a proposed project cannot implement conservation measures, additional consultation with the USFWS may be warranted. Overall, impacts to terrestrial species as a result of construction, operation, or decommissioning of the Resilience 360° project would be minor.

It is assumed that all reasonably foreseeable future actions in the vicinity of the host locations would comply with all applicable local, state, and federal regulations. Therefore, impacts to terrestrial species associated with reasonably foreseeable future actions in the temporal and physical vicinity of host locations would be minor overall.

3.6.2.2 Botany

3.6.2.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts to vegetation under the No Action Alternative.

3.6.2.2.2 Alternative B – Proposed Action

Under the Proposed Action, establishment of new structures would require construction and clearing of areas. BMPs determined by local ordinances and state regulations, and use of the Environmental Screening Checklist, would be used to determine the best areas for construction. These would likely avoid any sensitive or protected species or habitats. Any herbicides or pesticides used during construction may also need mitigation for impacts caused by runoff or other soil contamination. Post-construction, re-planting of an area may take place for various reasons including to restore native plant communities or to obscure visual disturbances (see Section 3.8). Botanical species within the TVA PSA are unlikely to be impacted by the proposed installation of natural gas or BESS units on host sites. Overall, impacts to botanical areas would likely be temporary and minor.

3.6.2.3 Aquatic Ecology

3.6.2.3.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts to aquatic species under the No Action Alternative.

3.6.2.3.2 Alternative B – Proposed Action

Aquatic ecology could be affected by the proposed Resilience 360° program. Potential impacts could occur directly or indirectly due to modification of the riparian zone and stormwater runoff resulting from construction activities. Potential impacts due to removal of streamside vegetation within the riparian zone include increased erosion and siltation (see Section 3.3), loss of instream habitat, and increased stream temperatures, though this is not anticipated. A potential indirect effect of routine maintenance includes potential herbicide runoff into streams. As necessary, appropriate BMPs determined by local ordinances and state regulations would be implemented to avoid potential adverse effects to water quality and aquatic life. Specifically, these BMPs would provide guidance for activities occurring in or around SMZs to minimize the amount and length of disturbance to water bodies and maintain natural stream buffers.

By reviewing the site-specific Environmental Screening Checklists, TVA would independently determine if a prospective project associated with the proposed Resilience 360° program would adversely affect protected aquatic species. For those projects that would cause adverse effects to such species, mitigation measures to eliminate the potential for any significant impacts to listed aquatic species would be developed and implemented in consultation with USFWS. With the implementation of these measures, no significant effects on listed aquatic species are expected.

Overall, minor temporary direct adverse impacts during construction and decommissioning are possible. However, because appropriate BMPs and SMZs would be implemented during construction, operation, maintenance, and decommissioning, and because all appropriate permits would be obtained, any direct or indirect impacts to aquatic life are anticipated to be minor. No substantial loss or degradation of aquatic habitat would occur because of the Proposed Action; therefore, the Proposed Action would have no effect on any critical habitat.

It is assumed that all reasonably foreseeable future actions in the vicinity of the host locations would comply with all applicable local, state, and federal regulations. Additionally, it is assumed rivers, streams, wetlands, and floodplains would typically be avoided for these reasonably foreseeable future actions. Therefore, impacts to aquatic species associated with reasonably foreseeable future actions in the temporal and physical vicinity of host locations would not be anticipated.

3.7 Cultural and Historic Resources

Cultural resources include pre-contact and historic archaeological sites, districts, buildings, structures, and objects, as well as locations of important historic events that lack material evidence of those events. Historic architectural structures are also cultural resources and include standing structures (e.g., houses, barns, dams, power plants) that are usually at least 50 years of age and are considered eligible for listing on the National Register of Historic Places (NRHP). Cultural resources are considered historic properties if included in, or considered eligible for inclusion in, the NRHP maintained by the National Park Service. The eligibility of a

resource for inclusion in the NRHP is based on the Secretary of the Interior's criteria for evaluation (36 CFR Part 60.4), which state that significant cultural resources possess integrity of location, design, setting, materials, workmanship, feeling and association, and:

1. are associated with important historical events; or

2. are associated with the lives of significant historic persons; or

3. embody distinctive characteristics of a type, period, or method of construction or represent the work of a master, or have high artistic value; or

4. have yielded or may yield information (data) important in history or prehistory.

Because of their importance to the Nation's heritage, historic properties are protected by multiple laws. Federal agencies, including TVA, have a statutory obligation to facilitate the preservation of historic properties, stemming primarily from NHPA (16 U.S.C. §§ 470 et seq.). Other relevant laws include the Archaeological and Historic Preservation Act (16 U.S.C. §§ 469-469c), Archaeological Resources Protection Act (16 U.S.C. §§ 470aa-470mm) and the Native American Graves Protection and Repatriation Act (25 U.S.C. §§ 3001- 3013).

Section 106 of the NHPA requires federal agencies to consider the potential effects of their actions on historic properties and to allow the ACHP an opportunity to comment on the action. Section 106 involves four steps: 1) initiate the process; 2) identify historic properties; 3) assess adverse effects; and 4) resolve adverse effects. This process is conducted in consultation with the SHPO of the state in which the action would occur, all federally recognized Tribes with interest in the project location, and with other interested consulting parties.

Section 110 of the NHPA sets out the broad historic preservation responsibilities of federal agencies and is intended to ensure that historic preservation is fully integrated into their ongoing programs. Federal agencies are responsible for identifying and protecting historic properties and avoiding unnecessary damage to them. Section 110 also charges each federal agency with the affirmative responsibility for considering projects and programs that further the purposes of the NHPA, and it declares that the costs of preservation activities are eligible project costs in all undertakings conducted or assisted by a federal agency.

3.7.1 Affected Environment

Archaeological resources typically are identified through Phase I archaeological surveys conducted for compliance with Section 106. Numerous surveys have been conducted along reservoir shorelines, within reservoirs, and on power plant reservations. Some TVA transmission line corridors and roadways have also been surveyed. Outside of TVA reservoirs and plant reservations, the overall density of archaeological resources can be difficult to quantify due to the lack of consistent survey coverage. Archaeological surveys outside of reservations for power generation vary state by state with most surveys conducted on a project-by-project basis. Across all these types of areas, through hundreds of surveys, TVA has identified many thousands of archaeological sites, representing the entire time range of known human habitation of the Tennessee Valley including historic periods.

3.7.2 Environmental Consequences

The potential impacts to cultural or historic resources from a given action are assessed by evaluating the potential for an action to directly damage, or indirectly modify the context, of a

protected resource. Although the extent of impacts to cultural or historic resources would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.7.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts to cultural resources under the No Action Alternative.

3.7.2.2 Alternative B – Proposed Action

The installation of onsite modular natural gas units or BESS has the potential to adversely affect cultural resources. Given that these units can be installed anywhere across the TVA PSA, there is potential that pre-contact and/or historic period archaeological sites would be present. Extant historic architectural resources could also be present, especially in urban areas. Any activities associated with the installation and operation of these units that have potential to cause ground disturbance could affect sub-surface cultural deposits. Furthermore, any unit installed within a historic district or within direct line of sight of a historic architectural structure could adversely affect the historic significance and integrity of the district or historic structure.

Under the Proposed Action, TVA has developed a PA with SHPOs, the ACHP, and federally recognized Tribes with an interest in the PEA. The purpose of the PA is to establish an efficient program for compliance with Section 106 of the NHPA at a programmatic level. This PA stipulates roles and responsibilities and identifies undertakings exempt from further Section 106 review. TVA has received comments from the public, ACHP, individual state SHPOs, and federally recognized Tribes with an interest in the PEA and is in the process of finalizing the document. The Draft PA is included in Appendix C. The PA will be provided online at tva.com/nepa once it has been executed.

For states with which TVA does not have an executed PA in place, or for activities which are not covered by the PA, TVA would conduct an individual site-specific assessment of effects to historic properties under Section 106. Any individual project associated with the Proposed Action that has the potential to adversely affect cultural resources would require mitigation to resolve the adverse effect. Mitigation methods to be employed are dependent upon factors such as the nature and extent of prior cultural resource investigations of the area, eligibility and integrity of any resources present, and the scope of the proposed undertaking. Such mitigation would be undertaken in accordance with Section 106.

With adherence to the stipulations of the PA, overall, adverse effects to cultural and historic resources as a result of construction, operation, and decommissioning of the Resilience 360° project are not expected.

It is assumed that all reasonably foreseeable future actions in the vicinity of the host locations would comply with all applicable local, state, and federal regulations. Therefore, impacts to cultural and historic resources associated with reasonably foreseeable future actions in the temporal and physical vicinity of host locations would not be anticipated.

3.8 Visual Resources

3.8.1 Affected Environment

Visual resources are the visual characteristics of a place and include both natural and manmade attributes. To many observers, including residents and visitors, visual resources of a particular location provide the context of historical and culturally significant settings. The human response to visual changes in the landscape can vary dramatically depending on the setting. For example, changes in agricultural and rural settings solicit different feelings in an observer than those in urban or industrial areas.

This assessment provides a review and classification of the visual attributes of existing scenery, along with the anticipated attributes resulting from the Proposed Action. The classification criteria used in this analysis are adapted from a scenic management system developed by the U.S. Forest Service and integrated with planning methods used by TVA. The classification process is also based on fundamental methodology and descriptions adapted from Landscape Aesthetics, A Handbook for Scenery Management, Agriculture Handbook Number 701 (U.S. Forest Service 1995).

The visual landscape of an area is formed by physical, biological and man-made features that combine to influence both landscape identifiability and uniqueness. Scenic resources within a landscape are evaluated based on a number of factors that include scenic attractiveness, integrity and visibility. Scenic attractiveness is a measure of scenic quality based on human perceptions of intrinsic beauty as expressed in the forms, colors, textures and visual composition of each landscape. Scenic integrity is a measure of scenic importance based on the degree of visual unity and wholeness of the natural landscape character. The varied combinations of natural features and human alterations both shape landscape character and help define their scenic importance. The subjective perceptions of a landscape's aesthetic quality and sense of place is dependent on where and how it is viewed.

Scenic visibility of a landscape may be described in terms of three distance contexts: (1) foreground, (2) middleground and (3) background. In the foreground, an area within 0.5 miles of the observer, individual details of specific objects are important and easily distinguished. In the middleground, from 0.5 to 4 miles from the observer, object characteristics are distinguishable, but their details are weak and tend to merge into larger patterns. In the distant part of the landscape, the background, details and colors of objects are not normally discernible unless they are especially large, standing alone, or have a substantial color contrast. In this assessment, the background is measured as 4 to 10 miles from the observer. Visual and aesthetic impacts associated with a particular action may occur because of the introduction of a feature that is not consistent with the existing viewshed. Consequently, the character of an existing site is an important factor in evaluating potential visual impacts.

For this analysis, the affected environment is considered to include the project area within an existing industrial or commercial location, which encompasses both permanent and temporary impact areas, as well as the physical and natural features of the landscape. Principal features in the foreground would vary depending on the nature and use of the site. It is expected that most of the potential sites would have limited amounts of vegetation, although there may be some small patches of grassed areas and/or small trees within the facility grounds. Therefore, scenic attractiveness of the affected environment is considered to be minimal to common (industrial to commercial in appearance), whereas the scenic integrity is considered to be low.

Individuals that would likely have the most direct views of the project area include authorized employees, contactors and visitors to the facility adjacent to the project area. Views of the project area are generally restricted to the foreground (i.e., within a half mile) in all directions, however that may be buffered by nearby vegetation and the local topography.

3.8.2 Environmental Consequences

The potential impacts to the visual environment from a given action are assessed by evaluating the potential for changes in the scenic value class ratings based upon landscape scenic attractiveness, integrity and visibility. The location and context of the setting, whether urban or rural, flat or mountainous, affect the visual experience. Sensitivity of viewing points available to the general public, their viewing distances and visibility of the Proposed Action are also considered during the analysis. These measures help identify changes in visual character based on commonly held perceptions of landscape beauty and the aesthetic sense of place.

Although the extent of visual impacts would vary from site to site, general visual effects from the Proposed Action within the TVA PSA are discussed below.

3.8.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts to visual resources under the No Action Alternative.

3.8.2.2 Alternative B – Proposed Action

The Proposed Action would include minor discernible alterations that would be viewed within and adjacent to any given facility where the units are located. TVA anticipates that installations would take place within existing developed areas and property boundaries of host facilities. During the construction and decommissioning phase, there would be slight visual discord from the existing conditions due to an increase in personnel and equipment in the area. Visual impacts from additional vehicular traffic associated with the transport of materials and construction-related traffic to the work site are expected to be insignificant as the roads in the vicinity of facilities are already likely used regularly for industrial or commercial activity. This small increase in visual discord would be temporary and primarily occur during construction and decommissioning.

The resulting visual footprint of the Proposed Action would differ on a case-by-case basis. Some installations may be adjacent to or at an angle where they may be viewed by the public. Enclosures and facilities would be a maximum 12.5 feet in height. Some may have a stack of 0-30 feet depending on local air permitting requirements in some areas. However, the installations would not be anticipated to exceed existing structure heights or result in a significant visual contrast. It may also be likely that the existing buildings and structures would result in the project area to not be visible or to not result in visual contrast since the surrounding area is already developed.

Once the Proposed Action is completed, landscaping to cover new additions may enhance the foreground landscape character compared to the current condition. In more distant views, changes would likely merge with the overall industrial/commercial components of the facility. Therefore, the Proposed Action would generally be absorbed by existing adjacent facilities and would become visually subordinate to the overall landscape character associated with the site. Therefore, visual impacts resulting from implementation of the Proposed Action would be minor.

It is assumed that all reasonably foreseeable future actions in the vicinity of the host locations would comply with all applicable local, state, and federal regulations. Because most of the host sites are already located in developed areas, likely zoned for industrial or commercial uses, impacts to visual resources from the Resilience 360° sites in conjunction with reasonably foreseeable future actions in the temporal and physical vicinity of host locations would not be anticipated.

3.9 Noise

3.9.1 Affected Environment

Sound occurs when vibrations travel through a medium, such as air, and are interpreted by biological components of the ear. Noise is defined as any sound that becomes unpleasant, disruptive, loud, or damaging. Sound levels are quantified in units called decibels (dB), which can be amplified by frequency and intensity, and are given a level on a logarithmic scale. The higher the decibel level, the louder the noise. The sound intensity the human ear hears can be quantified in A-weighted decibels (dBA) (FAA 2022). The “pitch” (high or low) of the sound is a description of frequency, which is measured in Hertz (Hz). Most common environmental sounds are a composite of sound energy at various frequencies. A normal human ear can usually detect sounds that fall within frequencies from 20 Hz to 20,000 Hz. However, humans are most sensitive to frequencies between 500 Hz to 4,000 Hz.

Generally, noise levels decrease by approximately 6 dBA as the distance doubles from the point source (e.g., a piece of construction equipment or an airplane) (Abbott 2022). Noise levels in rural, suburban, and urban environments can differ, especially when considering time of day and location of measurement. Wildlife and human responses to noise can vary depending on the type of noise, proximity to the noise, sensitivity to the noise, and times of day the noise-generating events take place. Typically, environmental noise causes annoyance or stress in humans, but exposures to high noise levels can cause hearing loss (National Institute on Deafness and Other Communication Disorders 2022). Settings where occupants are more vulnerable to the negative effects of noise exposure are generally referred to as sensitive receptors and typically include hospitals, schools, daycare facilities, elderly housing, convalescent facilities, and residential settings.

Noise Regulations

State and local governments are the primary entities responsible for controlling and regulating noise sources and levels in the environment. The Noise Control Act of 1972 (42 U.S.C. § 4901 et seq.) and subsequent amendments, such as the Quiet Communities Act of 1978, delegate authority to the states to regulate environmental noise and direct government agencies to comply with local community regulations and statutes. Many local noise ordinances are qualitative, such as prohibiting excessive noise or noise that results in a public nuisance. Because of the subjective nature of such ordinances, they are often difficult to enforce. Only one of the counties in which TVA fossil fuel power plants are located (Anderson County, Tennessee) has established quantitative sound-level regulations specifying environmental sound level limits based on the land use of the property receiving the noise. The U.S. Department of Housing and Urban Development (HUD) considers a day-night sound level (Ldn) of 65 dBA or less to be compatible with residential areas (HUD 1985).

Background Noise Levels

The average ambient noise level ranges from approximately 35 to 45 dBA in rural areas, approximately 45 to 55 dBA in suburban neighborhoods, and approximately 55 dBA to 70 or 80 dBA in urban areas (Nextech 2024). To account for sound fluctuations, environmental noise is commonly described in terms of the equivalent sound level or Leq. The Leq value, expressed in dBA, is the energy averaged, A-weighted sound level for the time period of interest. The Ldn is the 24-hour equivalent sound level, which incorporates a 10-dBA correction penalty for the hours between 10 p.m. and 7 a.m., to account for the increased sensitivity of people to sounds that occur at night.

Noise levels continuously vary with location and time. In general, noise levels are high around major transportation corridors along highways, railways, airports, industrial facilities and construction activities. Sound from a source spreads out as it travels from the source, and the sound pressure level diminishes with distance. In addition to distance attenuation, the air absorbs sound energy; atmospheric effects (wind, temperature, precipitation) and terrain/vegetation effects also influence sound propagation and attenuation over distance from the source. An individual's sound exposure is determined by measurement of the noise that the individual experiences over a specified time interval.

Community noise refers to outdoor noise near a community. A continuous source of noise is rare for long periods and is typically not a characteristic of community noise. Typical background day/night noise levels for rural areas range between 35 and 50 dB whereas higher-density residential and urban areas background noise levels range from 43 dB to 72 dB (USEPA 1974). Background noise levels greater than 65 dBA can interfere with normal conversation, watching television, using a telephone, listening to the radio and sleeping.

3.9.2 Environmental Consequences

The potential noise impacts of a given action are assessed by evaluating the potential for an action to generate noise in excess of state or local regulations or guidance. Although the extent of noise impacts would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.9.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts from noise under the No Action Alternative.

3.9.2.2 Alternative B – Proposed Action

Potential noise impacts associated with implementation of the Proposed Action would occur primarily during construction and decommissioning. Heavy equipment such as front-end loaders, graders, equipment to drive support pilings, and backhoes, if used for site preparation, could produce noise levels as great as 95 dBA within a distance of 50 feet. Such noise decreases as distance from its source increases, and noise levels would decrease to approximately 66 dBA at 0.25 mile (TVA 2001). A noise level of 65 dBA is comparable to ambient noise in a commercial area or normal speech at a range of 3 feet. Construction is anticipated to take between 4-12 weeks once materials are available. Thus, construction (and later similar decommissioning) activities could contribute temporary, short-duration noise to the ambient sound environment around each project site. However, construction activities would be

of relatively short duration and would occur during daylight hours, when people are less disturbed by noise.

Transportation noise related to the Proposed Action includes noise from highway traffic. Three primary factors influence highway noise generation: traffic volume, traffic speed and vehicle type. Generally, heavier traffic volumes, higher speeds and greater numbers of trucks increase the loudness of highway traffic noise. Other factors that affect the loudness of traffic noise include a change in engine speed and power, such as at traffic lights, hills and intersecting roads and pavement type. Highway traffic noise is not usually a serious problem for people who live more than 500 feet from heavily traveled freeways or more than 100 to 200 feet from lightly traveled roads (FHWA 2011). Due to the nature of the decibel scale and the attenuating effects of noise with distance, a doubling of traffic would result in a 3 dBA increase in noise levels, which in and of itself would not normally be a perceivable noise increase.

Maximum noise levels within 50 feet of facilities during operations are anticipated to be approximately 68 dB for 500 kW sets, and 80 dB or below for other sets. These would constitute a minor increase in site noise levels and can be customized to meet any other noise requirements (i.e. use of enclosures). Individual sites would comply with all local and state ordinances and restrictions related to noise. Though, TVA does not anticipate that projects would result in offsite noise impacts.

The associated inverters and transformers typically emit a hum during operation. Inverters are typically encased in cabinets and are frequently located centrally on the site for practical reasons. The level of noise generated by inverters and transformers depends on several factors such as their electrical capacity and the amount of noise damping provided by their enclosures. Nevertheless, because noise levels from this equipment are typically low, noise at the site boundary tends to be indistinguishable from background noise.

A significant adverse effect to noise would occur if generated noise were permanently intrusive to nearby sensitive receptors; if it exceeds applicable noise limit thresholds; or if it causes harm or injury to people or communities. As any of the construction noise would be temporary, and operational noise would be minimal, the Proposed Action would have a long-term, minimal impact to noise.

It is assumed that all reasonably foreseeable future actions in the vicinity of the host locations would comply with all applicable local, state, and federal regulations. Construction and operation of the Resilience 360° host sites in conjunction with reasonably foreseeable future actions in the temporal and physical vicinity of host locations could result in impacts to noise in the immediate vicinity. These impacts would be anticipated to be minor overall, with temporary short-term impacts during construction and intermittent short-term impacts during operations.

3.10 Air Quality

3.10.1 Affected Environment

Air quality is a vital resource that impacts us in many ways. Poor air quality can affect human health, ecosystem health, forest and crop productivity, economic development and enjoyment of scenic views. This section summarizes current conditions and trends over the past 35 years for key air quality issues. Air quality within the TVA PSA has steadily improved over the past 35 years (TVA 2024b).

The CAA is the comprehensive law that affects air quality by regulating emissions of air pollutants from stationary sources (such as power plants) and mobile sources (such as automobiles). It requires USEPA to establish National Ambient Air Quality Standards (NAAQS) and directs the states to develop State Implementation Plans to achieve these standards. This is primarily accomplished through permitting programs that establish limits for emissions of air pollutants (USEPA 2024a).

In this PEA, the affected environment is the TVA PSA shown in Figure 1-1. This service area includes 178 counties in a seven-state region and has an estimated population of about 10 million people. The primary air quality parameters of concern for this PEA are NAAQS criteria air pollutants, hazardous air pollutants and volatile organic compounds (VOCs).

Criteria Air Pollutants

The USEPA has established NAAQS for the six criteria air pollutants: Sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone, carbon monoxide (CO), particulate matter (PM), and lead. There are two different standards for PM. Primary standards protect public health, while secondary standards protect public welfare (e.g., visibility, crops, forests, soils, and materials). Class 1 areas are locations where air quality is deemed especially sensitive such as national parks and wilderness areas and receive heightened protection under the CAA (USEPA 2024b). There are several Class 1 areas in and near the TVA PSA (e.g., Mammoth Cave National Park) as shown in Figure 3-5.

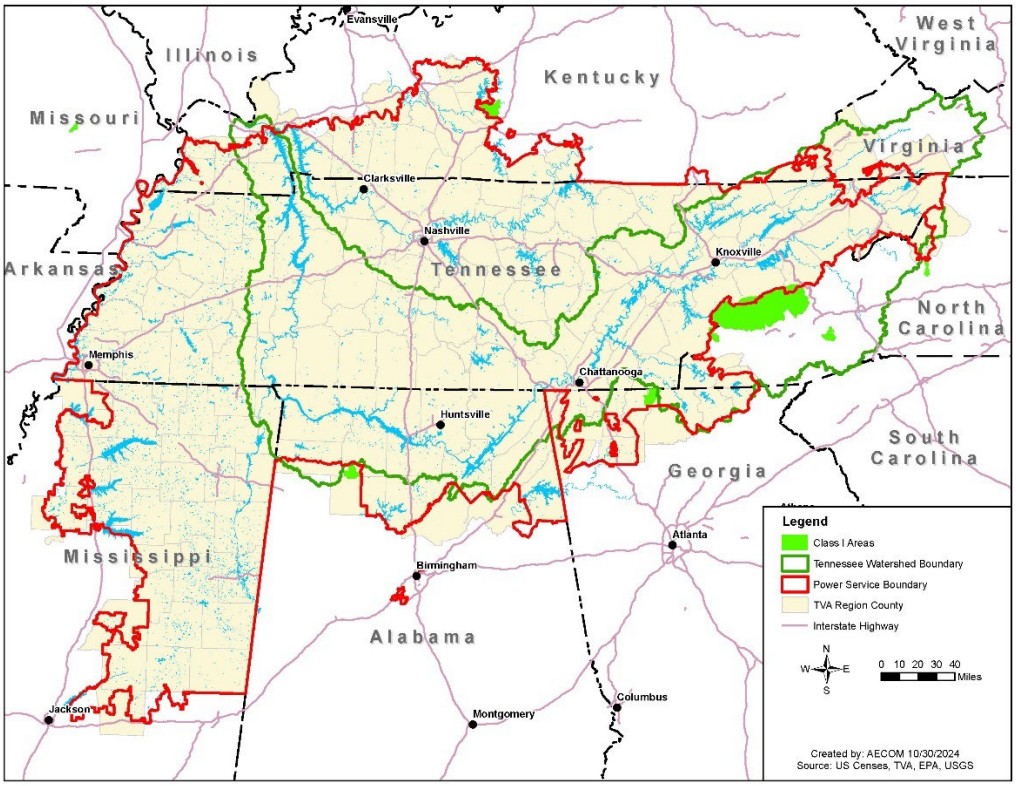


Figure 3-5. Class I Areas in and near the TVA PSA

USEPA has numerous ambient air quality monitoring programs related to the NAAQS. The most basic is the Ambient Air Monitoring Program, which collects national air quality data on criteria pollutants and VOCs. The program is carried out by USEPA and state and local air pollution agencies with oversight and guidance provided by USEPA. USEPA has several other programs involving local, tribal, state, regional, and national air quality data (USEPA 2024c).

Sulfur Dioxide

USEPA's national ambient air quality standards for SO_2 are designed to protect against exposure to the entire group of sulfur oxides (SOx). SO_2 is the component of greatest concern and is used as the indicator for the larger group of gaseous SOx. Other gaseous SOx are found in the atmosphere at concentrations much lower than SO_2 (USEPA 2024d).

Control measures that reduce SO_2 can generally be expected to reduce people's exposures to all gaseous SOx. This may have the important co-benefit of reducing the formation of particulate sulfur pollutants, such as fine sulfate particles (USEPA 2024d).

Emissions that lead to high concentrations of SO_2 generally also lead to the formation of other SOx. The largest sources of SO_2 emissions are from fossil fuel combustion at power plants and other industrial facilities (USEPA 2024d). Natural gas combustion produces very little SO_2 compared to other fossil fuels (Swarthmore 2024).

Short-term exposures to SO_2 can harm the human respiratory system and make breathing difficult. People with asthma, particularly children, are sensitive to these effects of SO_2 (USEPA 2024d).

TVA's SO_2 emissions have decreased by 94 percent since 1974. This reduction is in part by switching to low-sulfur coal at some plants and equipping most of its coal-fired capacity with scrubbers (TVA 2024c). The majority of the TVA PSA is in attainment for SO_2 except for Sullivan County in Tennessee, Henderson and Webster Counties in Kentucky, and Giles County in Virginia (USEPA 2024e).

Nitrogen Oxides

NO_2 is one of a group of highly reactive gases known as oxides of nitrogen or nitrogen oxides (NOx). Other nitrogen oxides include nitrous acid and nitric acid. NO_2 is used as the indicator for the larger group of nitrogen oxides (USEPA 2024f).

NO_2 is primarily generated from fuel burning in forms from emissions from cars, trucks and buses, power plants, and off-road equipment. NO_2 along with other NOx reacts with other chemicals in the air to form both PM and ozone. Both of these are also harmful when inhaled due to effects on the respiratory system. NO_2 and other NOx interact with water, oxygen and other chemicals in the atmosphere to form acid rain. Acid rain harms sensitive ecosystems such as lakes and forests (USEPA 2024f).

In the TVA PSA, transportation sources such as on-road and off-road vehicles, boats and airplanes account for about two-thirds of total NOx emissions. All point sources in the PSA such as power plants, refineries and mills account for about one-fourth of total NOx emissions, but TVA point sources only account for about one-tenth of the total NOx emissions in the PSA. The remaining amount comes from area sources such as decaying vegetation, industrial processes and nitrogen fertilizers (TVA 2024d).

Across the TVA system, NOx emissions have decreased by 91 percent since 1995 and all counties withing the TVA PSA are in attainment for NO_2 (USEPA 2024e).

Ozone

Naturally occurring ozone in the upper layer of the atmosphere forms a protective shield around the Earth, filtering out harmful solar radiation. The ozone NAAQS applies to ground-level ozone. Ground-level ozone is produced by a series of reactions involving other chemicals, mostly VOCs and NOx. Especially high levels of ozone develop in the summer, when the sunlight is intense, and the air is hot and stagnant (TVA 2024e).

Ozone is most likely to reach unhealthy levels on hot sunny days in urban environments but can still reach high levels during colder months. Ozone can also be transported long distances by wind, so even rural areas can experience high ozone levels. Ozone in the air we breathe can harm our health, especially on hot sunny days when ozone can reach unhealthy levels. People at greatest risk of harm from breathing air containing ozone include people with asthma (USEPA 2024g).

Non-attainment areas in the TVA PSA for ozone include Bullett, Jefferson, and Oldham counties in Kentucky and Arlington, Fairfax, Loudon, and Price William counties in Virginia (USEPA 2024e).

Carbon Monoxide

CO is a colorless, odorless gas that can be harmful when inhaled in large amounts. CO is released when something is burned. The greatest sources of CO to outdoor air are cars, trucks and other vehicles or machinery that burn fossil fuels (USEPA 2024h).

Breathing air with a high concentration of CO reduces the amount of oxygen that can be transported in the blood stream to critical organs like the heart and brain. At very high levels, which are possible indoors or in other enclosed environments, CO can cause dizziness, confusion, unconsciousness and death. Very high levels of CO are not likely to occur outdoors. However, when CO levels are elevated outdoors, they can be of particular concern for people with some types of heart disease. These people already have a reduced ability for getting oxygenated blood to their hearts in situations where the heart needs more oxygen than usual. They are especially vulnerable to the effects of CO when exercising or under increased stress. In these situations, short-term exposure to elevated CO may result in reduced oxygen to the heart accompanied by chest pain also known as angina (USEPA 2024h).

All counties within the TVA PSA are in attainment for CO (USEPA 2024e).

Particulate Matter

PM consists of small solid “dust” particles or liquid droplets. PM is regulated by size class: PM less than 10 micrometers (µm) in diameter (PM_{10}), and PM less than 2.5 µm in diameter ($PM_{2.5}$). Particles emitted directly from a pollution source are called primary particles, whereas those formed after emission—by the chemical and physical conversion of gaseous pollutants—are called secondary particles (USEPA 2024i).

PM has many natural and human-made sources. Natural sources include windblown dust, forest fires, volcanoes, and ocean spray, while human-made sources include motor vehicles, fossil-fuel combustion, industrial processes, mining, agricultural activities, waste incineration and construction. Some are emitted directly from a source, such as construction sites, unpaved roads, fields, smokestacks or fires. Most particles form in the atmosphere as a result of complex

reactions of chemicals such as SO_2 and NOx, which are pollutants emitted from power plants, industries and automobiles (USEPA 2024i).

Particulate Matter contains microscopic solids or liquid droplets that are so small that they can be inhaled and cause serious health problems. Some particles less than 10 µm in diameter can get deep into the lungs and even the bloodstream. Of these, particles less than 2.5 µm in diameter, also known as fine particles or $PM_{2.5}$ pose the greatest risk to health. Fine particles are also the main cause of reduced visibility (haze) in parts of the U.S., including in national parks and wilderness areas (USEPA 2024i).

There are no non-attainment areas for PM in the TVA PSA (USEPA 2024e).

Lead

While lead is one of the criteria pollutants, major sources of lead in the air are ore and metals processing and not fuel combustion (USEPA 2024j); therefore, lead is not considered for this PEA. Additionally, there are no non-attainment areas for lead in the TVA PSA (USEPA 2024e).

Other Air Pollutants and Air Quality Concerns

Other pollutants that could affect air quality include other GHGs, hazardous air pollutants and VOCs. The most common air pollutants and emissions associated with natural gas combustion are methane and carbon dioxide. Both contribute to GHG emissions (USEPA 1998).

Hazardous Air Pollutants

Hazardous air pollutants (HAPs) are toxic air pollutants, which are known or suspected to cause cancer or other serious health effects or adverse environmental effects. The CAA identifies 188 pollutants as HAPs (USEPA 2024k). Most HAPs are emitted by human activity, including motor vehicles, factories, refineries and power plants.

Volatile Organic Compounds

VOCs are compounds that have a high-vapor pressure and low water solubility and are emitted as gases from certain solids or liquids. VOCs are often components of petroleum fuels, hydraulic fluids, paint thinners, and dry-cleaning agents. Organic chemicals are widely used as ingredients in household products including paints, varnishes, cleaning and disinfecting products, cosmetics, degreasing, and hobby products. All of these products can release organic compounds while in use, and, to some degree, when they are stored (USEPA 2024l).

The most common sources of man-made VOCs are petrochemical storage and transport, chemical processing, motor vehicles, paints and solvents. Natural sources of VOCs include vegetation, biological decay and forest fires. In many areas of the Southeast, natural sources contribute up to 90 percent of total VOCs. TVA does not emit a significant amount of VOC emissions. While VOCs are not a criteria pollutant, they are important because they are a precursor to ground-level ozone (TVA 2024e).

Most VOCs in the Tennessee Valley's air come from natural sources, and the remaining ones are generated by motor vehicles and some industries (TVA 2024e).

3.10.2 Environmental Consequences

The potential impacts to air quality from a given action are assessed by evaluating the potential for an action to generate air or dust emissions in excess of federal, state, or local regulations.

Although the extent of air emission impacts would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.10.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts to air quality under the No Action Alternative.

3.10.2.2 Alternative B – Proposed Action

Alternative B involves activities that would result in air emissions. Construction and decommissioning of generator sites, including transportation of the gas-fired or BESS units, other equipment, and workers, would result in vehicle, equipment, and dust emissions. Emissions from equipment that use diesel or gas as fuel may include particulates, CO, carbon dioxide (CO_2), HAPs, NOx, ozone, SO_2 and VOCs. Earth moving could produce dust that could affect particulate levels. Air quality impacts from construction activities would be temporary and would be dependent upon both man-made factors (e.g., intensity of activity, control measures), and natural factors (e.g., wind speed, wind direction, soil moisture). However, construction and later decommissioning would be temporary and limited to an area of up to 2 acres (including laydown areas). If disposal of trees or vegetation is necessary during construction, vegetation would be disposed of through means other than open burning. Therefore, construction and decommissioning would result in minor impacts.

Emissions would also occur during operations as a result of operation of the gas units. Each unit would be anticipated to operate no more than 400 hours per year. Natural gas generator emissions would include particulates, CO, CO_2, NOx, SO_2, ozone, HAPs, and VOCs. However, the total amount of these emissions would be temporary and small occurring only when the gas units are operational. Operational use would result in minor impacts.

Battery storage facilities would presumably operate with no emissions during normal operation, but lithium-ion battery fires, may generate substantial quantities of criteria pollutants, HAPs, or other pollutants. Where appropriate, the vendor would apply hazard mitigation practices if and where siting of battery storage units is required.

It is assumed that all reasonably foreseeable future actions in the vicinity of the host locations would comply with all applicable local, state, and federal regulations and permit requirements pertaining to air quality and emissions. Because construction activities are short-term and TVA anticipates the respective Resilience 360° sites would be operated less than 400 hours annually and dispatched infrequently, both construction and operation of individual Resilience 360° host sites would have a minor impact on air quality and local emissions in conjunction with reasonably foreseeable future actions in the vicinity. Additionally, while multiple Resilience 360° sites could be constructed across the TVA PSA, the geographic separation between individual sites would minimize the project's contribution to regional air quality conditions.

3.11 Greenhouse Gas and Climate Change

3.11.1 Affected Environment

Since 1901, the average surface temperature across the contiguous 48 states has risen at an average rate of 0.17 degrees Fahrenheit (°F) per decade. Average temperatures have risen more quickly since the late 1970s (0.32 to 0.51°F per decade since 1979). For the contiguous

U.S., nine of the ten warmest years on record have occurred since 1998, and 2012 and 2016 were the two warmest years on record. Worldwide, 2023 was the warmest year on record and 2014–2023 was the warmest decade on record since thermometer-based observations began. Global average surface temperature has risen at an average rate of 0.17°F per decade since 1901, similar to the rate of warming within the contiguous U.S. Since the late 1970s, however, the U.S. has warmed faster than the global rate. Some parts of the U.S. have experienced more warming than others, while some parts of the Southeast have experienced little change (USEPA 2024m).

Because human-induced warming is superimposed on a naturally varying climate, the temperature rise has not been, and will not be, uniform or smooth across the country over time (USGCRP 2023).

The 2023 National Climate Assessment concluded global climate is projected to continue to change over this century and beyond. The amount of warming projected beyond the next few decades is directly linked by these studies to the cumulative global emissions of GHG and particulates. By the end of this century, the 2023 National Climate Assessment concluded a 3.6°F rise is expected under the lower emissions scenario and a 5.4°F to 7.2°F rise for a higher emissions scenario. As with all future scenario modeling exercises, there is an important distinction to be made between a “prediction” of what “will” happen, and a “projection” of what future conditions are likely given a particular set of assumptions (USGCRP 2023).

The Southeastern U.S. is one of the few regions globally that does not exhibit an overall warming trend in surface temperature over the 20th century. This “warming hole” also includes part of the Great Plains and Midwest regions in the summer. Historically, temperatures increased rapidly in the Southeast during the early part of the 20th century, then decreased rapidly during the middle of the 20th century. Since the 1960s, temperatures in the Southeast have been increasing. Recent increases in temperature in the Southeast have been most pronounced in the summer season, particularly along the Gulf and Atlantic coasts. However, temperature trends in the Southeast over the period of 1895 to 2011 are found to be statistically insignificant for any season. Generally, in the Southeast, the number of extreme hot days has tended to decrease or remain the same while the number of very warm summer nights has tended to increase. The number of extreme cold days has tended to decrease. Global warming is a long-term trend, but that does not mean that every year will be warmer. Day-to-day and year-to-year changes in weather patterns will continue to produce variation, even as the climate warms. Generally, climate change results in Earth’s lower atmosphere becoming warmer and moister, resulting in the potential for more energy for storms and certain severe weather events. Trends in extreme rainfall vary from region to region (NOAA 2013).

Natural Greenhouse Gas Emissions

The sun is the primary source of energy for the Earth’s climate. About 30 percent of the sun’s energy that reaches Earth is reflected to space by clouds, gases and small particles in the atmosphere. The remainder is absorbed by the atmosphere and the surface. The Earth’s temperature depends on the balance between the energy entering and leaving the planet’s system. When energy is absorbed by the Earth’s system, global temperatures increase. Conversely, when the sun’s energy is reflected into space, global temperatures decrease (Walsh et al. 2014).

In nature, CO_2 is exchanged continually between the atmosphere, plants and animals through processes of photosynthesis, respiration and decomposition, and between the atmosphere and oceans through gas exchange. Billions of tons of carbon in the form of CO_2 are annually

absorbed by oceans and living biomass (i.e., sinks) and are annually emitted to the atmosphere through natural and man-made processes (i.e., sources). When in equilibrium, carbon fluxes among these various global reservoirs are roughly balanced (Galloway et al. 2014).

Greenhouse Effect

Like the glass in a greenhouse, certain gases, primarily CO_2, nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride, absorb heat that is radiated from the surface of the Earth. It is believed that increases in the atmospheric concentrations of these gases cause the Earth to warm by trapping more heat. The common term for this phenomenon is the “greenhouse effect,” and these gases are typically referred to as GHGs. Atmospheric levels of CO_2 are currently increasing at a rate of 0.5 percent per year. Atmospheric levels measured at Mauna Loa in Hawaii and at other sites around the world reached 400 parts per million in 2013, higher than the Earth has experienced in over a million years (Walsh et al. 2014).

While water vapor is the most abundant GHG in the atmosphere, it is not included in the list of GHGs because changes in the atmospheric concentration of water vapor are generally considered to be the result of climate feedbacks related to the warming of the atmosphere, rather than a direct result of human activity. That said, the impact of water vapor is critically important to projecting future climate change and quantifying the effect of feedback loops on global and regional climate is the subject of ongoing data collection and active research (Walsh et al. 2014).

The modeling projections of warming depend largely on the amount of GHG accumulating in the atmosphere. GHGs can remain in the atmosphere for different amounts of time, ranging from a few years to thousands of years. GHGs are assigned global warming potentials, a measure of the relative amount of infrared radiation they absorb, their absorbing wavelengths and their persistence in the atmosphere (Table 3-5). All these gases remain in the atmosphere long enough to become well mixed, meaning the amount that is measured in the atmosphere is roughly the same all over the world, regardless of the source of the emissions (Walsh et al. 2014).

Table 3-5. Major Greenhouse Gases and Their Global Warming Potentials

Gas	Global Warming Potential
Carbon Dioxide	1
Methane	28
Nitrous oxide	265
Hydrofluorocarbons	4-12,400
Perfluorocarbons	6,630-11,100
Sulfur hexafluoride	23,500

Source: Intergovernmental Panel on Climate Change 2014

Greenhouse Gas Emissions

Electric utilities are one of the major emitters of CO_2 as a result of the combustion of coal, natural gas and other fossil fuels. Global energy-related CO_2 emissions increased to over 36.8 billion tons in 2022 (IEA 2023).

In 2022, U.S. GHG emissions totaled 6,343 million metric tons of CO_2 equivalents. It is estimated that 25 percent of those emissions were from electric power generation (USEPA 2024n). CO_2 emissions from TVA-owned generating facilities were 44,871,628 tons in 2022 and 41,620,653 tons in 2023 (TVA 2024f).

3.11.2 Environmental Consequences

The potential impacts to GHG emissions and global climate change from a given action are assessed by evaluating the potential for an action to generate GHG emissions in excess of federal, state, or local regulations. Although the magnitude of such emissions would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.11.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts, adverse or beneficial, resulting from changes to GHG emissions under the No Action Alternative.

3.11.2.2 Alternative B – Proposed Action

Changes to climate can result from the discharge of large quantities of GHGs to the atmosphere. Climate effects occur on a regional or larger scale. GHG emissions associated with this alternative relate to the emissions produced from the operation of combustion engine equipment during construction and the operation of the gas generators. Emissions from these activities would include CO_2, methane, and NOx.

Because construction (and later decommissioning) activities for individual host locations would be temporary, generally lasting from 4 to 12 weeks, the contribution to climate change in association with construction and decommissioning would be negligible. Additionally, operation of the generation units at individual host sites is anticipated to be no more than 400 hours per unit, annually. Therefore, the operational GHG emissions are also expected to be temporary and minor. Finally, the individual host locations are anticipated to be widely dispersed across the TVA PSA and thus would not contribute to local effects in conjunction with reasonably foreseeable future actions in the vicinity. Therefore, no changes to climate or significant increases in GHGs are anticipated as a result of either construction, operation, or decommissioning of the Resilience 360° units.

3.12 Transportation and Navigation

3.12.1 Affected Environment

This section describes the transportation and navigation infrastructure that could be affected by the project alternatives. The approach taken in this programmatic review focuses on a regional scale rather than a site-specific scale. Transportation refers to how raw materials for construction or operation reach the intended facilities, or waste is removed. Methods of transportation evaluated in this PEA include road, rail, and barge. Navigation refers to the commercial navigation channel of the Tennessee River system, secondary channels, and use of public waters on tributary reservoirs. TVA works with USACE and the U.S. Coast Guard to manage navigation on the Tennessee River system.

There are numerous public roadways, railways, and navigable water bodies in the TVA PSA. Roads that would be used to reach potential project sites vary from two-lane roads to four-lane

divided highways. Public road managers for this system include state departments of transportation, county highway departments and municipal road departments. Rail lines are managed by large railroad operators such as Union Pacific Railroad and Burlington Northern and Santa Fe Railway) in the western part of the PSA, Norfolk Southern Railway in the eastern part and CSX Transportation, Inc. throughout the PSA. Several short-line and local railroads exist in the PSA as well. Barge operation is present on the Mississippi River, Ohio River, Tennessee River and the Tennessee-Tombigbee Waterway.

3.12.2 Environmental Consequences

The potential impacts to transportation or navigation from a given action are assessed by evaluating the potential for an action to interfere with existing traffic and shipping levels, or to cause the potential for safety hazards associated with traffic and ships. Although the extent of transportation and navigation impacts would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.12.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts to transportation or navigation under the No Action Alternative.

3.12.2.2 Alternative B – Proposed Action

Individual projects covered under this document are not anticipated to adversely affect local roadway networks. TVA anticipates that most of the transportation for material delivery and disposal would be via truck utilizing existing roads which support commercial deliveries. The material required for construction would not require the use of oversized trucks and would not normally require roadway closures. Construction (and later decommissioning) activities and the deliveries of construction materials and equipment could possibly cause minor temporary delays on adjacent roadways. However, potential traffic delays could be avoided through mitigation strategies such as flagging during heavy commute periods and avoiding deliveries during periods of heavy traffic load.

The construction (and decommissioning) workforce traveling to and from a host site would contribute to the traffic on the local transportation network. A construction workforce of approximately 10 workers per day could be expected to support activities under this alternative. This workforce volume would occur at the beginning and end of the workday. Additional construction related vehicles (including but not limited to dozers, backhoes, graders, and loaders) would be delivered to or removed from each site on flatbed trailers under both the mobilization and demobilization stages of the project. Overall, the traffic volume generated by the construction workforce and the construction-related vehicles would be relatively minor. It is assumed that these motorists would use interstate highways or major arterial roadways as much as possible but would likely have to use lower functioning roadways (such as collectors and local roads) closer to individual project sites.

Given the units are typically transported by truck, unusual circumstances would be needed to require use of rail or barge for transport, and it would only be for a small number of sites. Rail or barge transport may only be used for a destination site that already has an existing rail or barge unloading facility and existing rail or barge traffic. Given that the destination sites would have to already have existing services using pre-established routes, there would be no new impacts to railways or river navigation because of this action.

Operation and maintenance of the facilities are not anticipated to change the existing levels of service on the surrounding road network since most operations would be conducted remotely. Therefore, overall, impacts to transportation and navigation are expected to be negligible to minor.

It is possible that construction of the Resilience 360° host sites could occur in close temporal and physical proximity to reasonably foreseeable future actions in the vicinity with a resulting increase in local transportation volume or congestion. Because the Resilience 360° construction activities would be of short duration (1-2 months), it is expected these impacts would be temporary and minor.

3.13 Hazardous Materials and Solid Waste

3.13.1 Affected Environment

This section focuses on the solid and hazardous waste produced by the construction and operation of the gas-fired generating and BESS units. Wastes typically produced by construction activities include vegetation, demolition debris, oily debris, packing materials, scrap lumber, and domestic wastes (garbage). During operations, the units are not expected to be a direct source of either hazardous materials or solid waste. However, general maintenance of these units may add, slightly, to the volume of non-hazardous waste produced by the host facility. These materials may include personal protective equipment, paint, oils and lubricants, spent resins, desiccants, batteries, and domestic waste. Any additional wastes associated with the units are not expected to add significantly to the total volume, and would likely be combined with other materials stored, managed, and disposed by the host facility.

3.13.2 Environmental Consequences

The potential impacts associated with hazardous materials or solid waste from a given action are assessed by evaluating the potential for an action to use, store, generate, spill, or dispose of these materials during construction or operations. Although the extent of hazardous material or solid waste impacts would vary from site to site and would depend on the types and numbers of units installed on a site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.13.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts due to the use or generation of hazardous materials or solid waste under the No Action Alternative.

3.13.2.2 Alternative B – Proposed Action

Under the Proposed Action Alternative, the proposed Resilience 360° program would be established at host sites.

Units at host sites would be constructed, operated, and decommissioned as required pursuant to state and federal regulations, which could include groundwater monitoring, corrective measures, and post-closure care activities.

During construction, waste generated would primarily be solid, non-hazardous waste including wood, paper, steel, and plastic. Using BMPs determined by local ordinances and state

regulations, oils and solvents would be recycled, and their use deliberate. Sanitary waste from the portable toilets would be the vendor's responsibility and would be removed by a contracted sanitary service. Construction impacts to waste would be minor.

When developed, operations of the proposed project would be monitored remotely. During operations, the proposed project would have no water discharge. Both natural gas and BESS facilities produce little waste during operation. Used oil and coolant, along with maintenance wastes, would be the responsibility of the vendor and would be disposed in accordance with all local, state, and federal regulations. Operational impacts to waste would be minor.

Similarly, end-of-life cycle decommissioning activities would generate waste similar to construction waste. The vendor would be responsible for the fate of the units. All proposed closure activities would be conducted in accordance with state and local regulations, and it is expected that waste materials would be contained.

Any lighting ballasts containing polychlorinated biphenyls would be removed and properly disposed offsite during preliminary activities after power termination and during the early stages of demolition. Other materials that are removed and typically recycled in early retirement activities include used oils, glycols, and refrigerants. Consumer commodities (such lubricants, aerosols, and cleaners) are reused if possible, or sent for disposal if an outlet cannot be found. Fuels would be used elsewhere or sent for recycling. Bulk chemicals/materials are typically recycled or disposed of as applicable. Mercury devices, batteries, light bulbs, and e-waste are recycled.

The vendor would manage removal and disposal of solid and hazardous wastes in accordance with local, state, and federal regulations, and recycle these wastes as practical; thus, decommissioning impacts to solid and hazardous waste would be minor.

It is assumed that all reasonably foreseeable future actions in the vicinity of the host locations would also comply with all applicable local, state, and federal regulations and permit requirements pertaining to hazardous materials and solid waste. Therefore, impacts to hazardous materials and solid waste associated with reasonably foreseeable future actions in the temporal and physical vicinity of host locations would be minor overall.

3.14 Public Health and Safety

Workplace health and safety regulations are designed to eliminate personal injuries and illnesses from occurring in the workplace. These laws may comprise both federal and state statutes. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) is the main statute protecting the health and safety of workers in the workplaces. OSHA regulations are presented in Title 29 CFR Part 1910 (29 CFR Part 1919), OSHA Standards. A related statute, 29 CFR Part 1926, contains health and safety regulations specific to the construction industry. The Tennessee Department of Labor and Workforce Development has adopted federal OSHA standards contained in 29 CFR Parts 1910 and 1926 pursuant to Tennessee Code Annotated Section 50-3-201. Additionally, the federal regulations govern workplace health and safety requirements in private sector workplaces in Alabama since no state law governs workplace safety for public sector employers. The Kentucky Occupational Safety and Health Program, under the statutory authority of Kentucky Revised Statutes Chapter 338 has a state plan approved by the OSHA to protect the health and safety of workers in the workplaces.

3.14.1 Affected Environment

The implementation of proper engineering and equipment design, administrative controls such as employee training and compliance with regulatory requirements related to Health and Safety, would help ensure that the risks associated with installation and operations of the gas or BESS units at the host sites would be minimal. Health risks are also associated with emissions and discharges from the facilities as well as accidental spills/releases and there are comprehensive environmental regulatory programs in place to manage and reduce such risks to acceptable levels.

3.14.2 Environmental Consequences

The potential public health and safety impacts from a given action are assessed by evaluating the potential for construction or operations to be accessible to the general public, and the extent to which site employees would be trained and operate in accordance with regulations and industry standards. Although the extent of these impacts would vary from site to site and depend on the number and type of gas-powered or BESS units deployed, general effects from the Proposed Action within the TVA PSA are discussed below.

3.14.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program. TVA would continue to provide generation through alternative methods. Therefore, there would be no impacts to public health or safety under the No Action Alternative.

3.14.2.2 Alternative B – Proposed Action

The Proposed Action would be implemented consistent with standards as established by OSHA and state requirements. These activities include construction, operation, and decommissioning tasks. TVA anticipates that the vendor(s) would have established health and safety plans that are approved by the host(s). Additionally, only trained and certified workers would be used for both construction and operational activities. For the public, TVA anticipates that all sites would be within a secured, protected area. Examples of BMP barriers may include, but are not limited to fencing, perimeter walls, and restricted access. The equipment is also closed and locked to prevent unauthorized access. Therefore, the risk of adverse impacts to workers and public safety would be minimal.

It is assumed that all reasonably foreseeable future actions in the vicinity of the host locations would also comply with all applicable standards as established by OSHA and state requirements. Therefore, impacts to public health and safety associated with reasonably foreseeable future actions in the temporal and physical vicinity of host locations would be negligible.

3.15 Socioeconomics

3.15.1 Affected Environment

Socioeconomics

This section describes social and economic conditions in the TVA PSA. It presents and compares qualitative and quantitative data from varying geographies to characterize the regional human population and associated demographics and economics. Depending on availability and comparability, the census data derive from the U.S. Census Bureau (USCB) 2010 decennial census, the 2020 decennial census, and the most current population estimates

from the 2022 American Community Survey (ACS; 2018 – 2022 5 Year estimates). These data were obtained utilizing USCB American FactFinder and USCB TIGER Products. Spatial data for figures were obtained through USCB TIGER Products and ESRI. Other quantitative and qualitative data were gathered from TVA staff, regional commissions, counties and communities, and other relevant sources, as cited within each subsection.

Generally, when census data are presented, information on the TVA PSA is given as a baseline for comparison to smaller parts of the PSA. The TVA PSA considered for socioeconomics consists of 181 counties and two independent cities in seven states, including all counties in Tennessee and portions of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia (see Appendix D-1 for a complete list of counties considered). Smaller areas are defined as relevant to the topic and may consist of metropolitan statistical areas (MSAs), urban or rural areas, counties, or census tracts.

Where relevant, information from USCB Division 6, East South Central, is employed for comparative purposes. Division 6 includes the majority of the TVA PSA, consisting of Alabama, Kentucky, Mississippi, and Tennessee (USCB 2000). USCB Division 6 data may be more comparable to the TVA PSA than that of USCB Region 3, the South, because of similarities in population densities, demographics, sociocultural characteristics, and economics. For many topics, U.S.-wide data are also employed due to their usefulness in understanding how the TVA PSA compares with the rest of the nation.

Population and Demographics

Population and various demographic data including minorities are presented in this subsection. First, population change for the TVA PSA between 2010 and 2022 are compared with that for Division 6 and the U.S. Then, population variation across the TVA PSA and among its most populous MSAs is discussed. Finally, demographic variables for the TVA PSA are compared with those of Division 6 and the nation.

On March 11, 2020, the novel coronavirus COVID-19 pandemic was declared by the World Health Organization. The pandemic affected the main components of population change; natural increase (or decrease) related to the number of births and deaths within the population, and net migration gain (or loss). As a result, population trends were altered in both rural and urban America, producing a patchwork of population loss and gain across the country.

Population

As shown in Table 3-6, the estimated population of the TVA PSA was 9.8 million in 2010 and 10.5 million in 2022, a 7.4 percent increase. During the same time, population in Division 6 and in the U.S. increased 5.2 percent and 7.0 percent respectively. The rate of population growth was greater in the TVA PSA as compared to the Division and the nation (USCB 2010, USCB 2022a).

Table 3-6. Population Data for the TVA PSA, TVA MSAs, Division 6, and U.S.

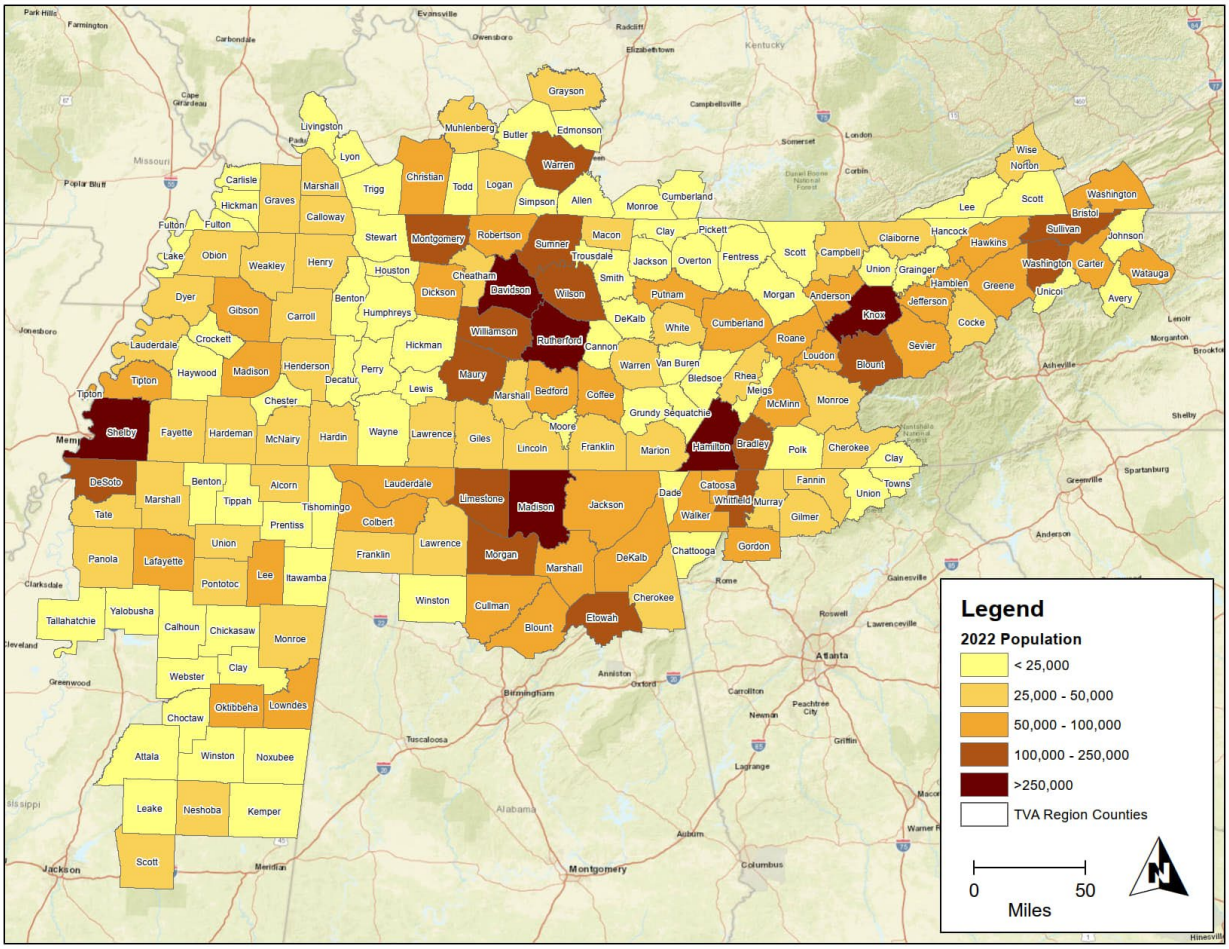
Area	2010 Population	2020 Population	2022 Population	% Increase 2010 – 2020	% Increase 2010 – 2022	% of TVA PSA Pop., 2022
United States	309,338,421	331,449,281	331,097,593	7.1	7.0	--
Division 6 (East South Central)	18,459,846	19,402,234	19,413,645	5.1	5.2	--
TVA PSA	9,810,629	10,520,062	10,540,347	7.2	7.4	--

Area	2010 Population	2020 Population	2022 Population	% Increase 2010 – 2020	% Increase 2010 – 2022	% of TVA PSA Pop., 2022
MSAs in TVA PSA						
Bowling Green, KY	159,309	179,639	180,624	12.8	13.4	1.7
Chattanooga, TN-GA	529,196	562,647	564,466	6.3	6.7	5.4
Clarksville, TN-KY	261,619	320,535	322,949	22.5	23.4	3.1
Cleveland, TN	115,913	126,164	126,479	8.8	9.1	1.2
Dalton, GA	142,315	142,837	143,096	0.4	0.5	1.4
Decatur, AL	153,949	156,494	156,218	1.7	1.5	1.5
Florence-Muscle Shoals, AL	147,260	150,791	151,599	2.4	2.9	1.4
Huntsville, AL	419,279	491,723	493,980	17.3	17.8	4.7
Jackson, TN	130,031	180,504	180,446	38.8	38.8	1.7
Johnson City, TN	199,010	207,285	207,442	4.2	4.2	2.0
Kingsport-Bristol-Bristol, TN-VA	309,494	307,614	308,386	-0.6	-0.4	2.9
Knoxville, TN	838,748	879,773	884,359	4.9	5.4	8.4
Memphis, TN-AR	1,326,280	1,337,779	1,335,804	0.9	0.7	12.7
Morristown, TN	114,219	142,709	143,196	24.9	25.4	1.4
Nashville- Davidson-Murfreesboro-Franklin, TN	1,675,757	1,989,519	1,990,873	18.7	18.8	18.9
TVA MSA TOTALS	6,522,379	7,176,013	7,189,917	10.0	10.2	68.2

Source: USCB 2010, USCB 2020, USCB 2022a

However, in more recent years, the rate of population increase has declined in the TVA PSA, Division 6, and the nation. The annual rate of population growth in the TVA PSA declined from 0.72 percent between 2010 and 2020 to 0.1 percent between 2020 and 2022. In the nation, population decreased from 331.4 million at the 2020 decennial census, to 331.0 million in 2022. Growth in Division 6 was flat during the same period (USCB 2010, USCB 2020, USCB 2022a). Between 2022 and 2040, the annual rate of population growth in the TVA PSA is projected to be 0.69 percent, greater than the projected growth rate of the nation of 0.4 percent (CBER 2022, GOPB 2023, KSDC 2022, SDC MS 2024, NC OSBM 2023, TN SDC 2022, Cooper Center 2022, USCB 2023a).

Population varies greatly among the counties in the TVA PSA as shown in Figure 3-6. The larger population concentrations tend to be located along major river corridors: the Tennessee River and its tributaries from northeast Tennessee through Knoxville and Chattanooga into north Alabama; the Nashville area along the Cumberland River; and the Memphis area on the Mississippi River. Low population counties are scattered around the PSA, but most are in Mississippi, the Cumberland Plateau in Tennessee, and the Highland Rim in Tennessee and Kentucky.



Source: USCB 2023b, USCB 2020

Figure 3-6. Variation in Population of Counties in the TVA PSA

As shown in Table 3-6, an increasing proportion of the total population of the TVA PSA, 66.5 percent in 2010 and an estimated 68.2 percent in 2020 and 2022, lives in USCB-defined metropolitan statistical areas[1]. Two of these areas were estimated to have populations greater than one million in 2022: Nashville, 1.9 million, and Memphis, 1.3 million. The Knoxville and Chattanooga MSAs were estimated to have populations of approximately 884,000 and 564,000, respectively. These four MSAs accounted for 45 percent of the TVA PSA's population in 2022 (USCB 2010, USCB 2020, USCB 2022a).

While the proportion of the TVA PSA's population living in metropolitan areas was estimated to be lower than the national average of about 80 percent, the proportion has been increasing, and this trend appears likely to continue in the future. This is reflective of a decades-long nationwide trend of urbanization, characterized by a decline of population in rural areas and an increase in metropolitan areas. Population increase in metropolitan areas may be attributed to a combination of internal growth, outward expansion to include new growth or integration of communities previously existing outside the urban area, and in-migration of young adults seeking lifestyle and employment opportunities (USCB 2023c, Frey 2019). As a result,

[1] The Memphis MSA has two counties outside the TVA PSA, Crittenden County, Arkansas and Tunica County, Mississippi.

residential populations in the urban core areas of several cities in the TVA PSA have increased, including the largest cities. A notable exception to this trend is Memphis, Tennessee, which experienced a 4 percent decline in population between 2010 and 2022 (Bellow 2023).

The COVID-19 pandemic caused a major opposing shift in the migration flows of most states as people moved from metropolitan areas to rural counties. A shift to remote work as many businesses remained closed potentially influenced geographic mobility. As a result, population grew in rural counties during the pandemic, especially in Southern states. Most people that relocated during this time, moved to rural areas within their state of origin (Melotte 2023, USDA 2022).

Southern states within the TVA PSA – including Alabama, Georgia, North Carolina, and Tennessee – also benefit from another decades-long migration pattern of northeast residents moving to southern states. Many are seniors of the large Baby Boomer generation seeking a warmer climate, lower cost of living, housing opportunities, and a favorable tax environment. Others are opportunity-seeking young adults of the equally large Millennial generation, who form the backbone of labor forces and consumer bases. According to the Tennessee State Data Center, the population of both metropolitan and rural counties in Tennessee increased during and after the pandemic, resulting in widespread gains across the state (TN SDC 2022, Frey 2019).

Demographics

As shown in Table 3-7, the median age in the TVA PSA was 41.4 years in 2022, an increase from the median age of 37.9 years in 2010. In 2022, the TVA PSA had a higher population of people over 65 years of age (17 percent) as compared to Division 6 or the nation as a whole, which had 16.8 percent and 16.5 percent, respectively. The percentage of people identifying themselves as white was 73.3 percent in the TVA PSA, greater than Division 6 and the U.S., which were 70.4 percent and 58.9 percent, respectively (USCB 2022a, USCB 2022b, USCB 2022c).

Table 3-7. Demographics of the TVA PSA, Division 6, and U.S.

Geography	Median Age	% White Alone	% Age 65 or More	% High School or Higher
United States	38.5	58.9	16.5	89.1
Division 6	38.9	70.4	16.8	88.2
TVA PSA	41.4	73.3	17.0	88.1

Source: USCB 2022a, USCB 2022b, USCB 2022c

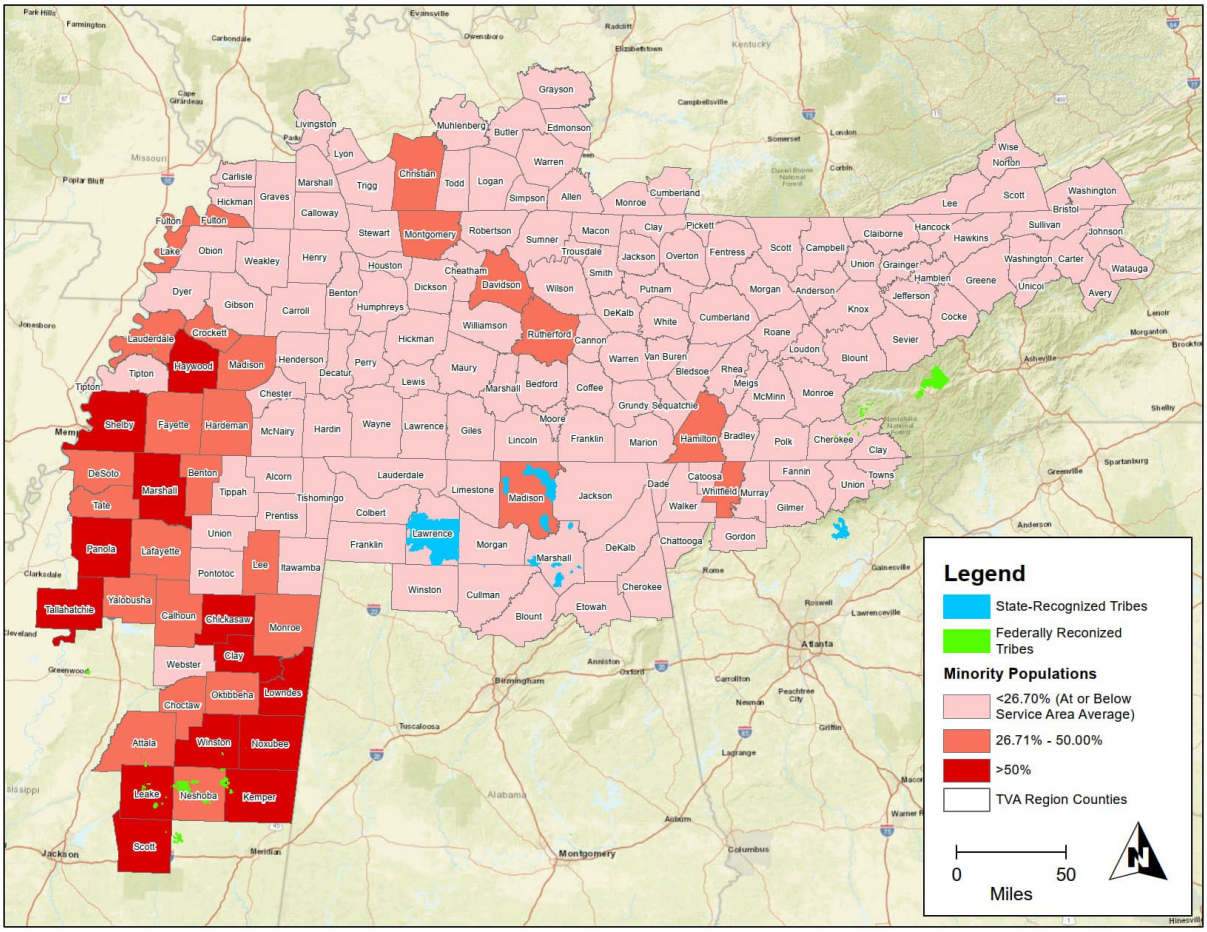
As shown in Table 3-7, of the TVA PSA population 25 years old or older, approximately 88 percent held a high school diploma, equivalency diploma, or higher degree in 2022. This percentage is similar to Division 6 (88 percent) and the U.S. as a whole (89 percent) (USCB 2022c).

Minority Populations

The TVA PSA contains minority populations which were identified using the 2022 ACS (2018 – 2022 5 Year estimates) for each of the 181 counties or independent cities in the TVA PSA. Minority populations are identified when either the minority population of the affected area exceeds 50 percent, or the minority population percentage of the study area is meaningfully greater than the minority population percentage in the general population or other appropriate

unit of geographic analysis In 2022, the minority population in the TVA PSA was 26.7 percent. As shown in Figure 3-7, 13 counties in the PSA had minority populations that exceeded 50 percent, well above the TVA PSA average. These included Haywood and Shelby counties in Tennessee and Lowndes, Winston, Chickasaw, Scott, Leake, Marshall, Panola, Clay, Tallahatchie, Kemper, and Noxubee counties in Mississippi. The minority percentages of each county are shown in Table 3-8. In these areas, the African American population composed the highest percentage of the population, averaging 52 percent (USCB 2022b).

An additional 38 counties had a minority population greater than the TVA PSA average. All of the counties with minority percentages higher than the TVA PSA as a whole are listed in Appendix D-4 (USCB 2022b).



Source: USCB 2022b, USCB 2023b

Figure 3-7. Minority Populations at the County Level in the TVA PSA

Table 3-8. Counties in the TVA PSA with Minority Populations Exceeding 50 Percent

Geography	2022 Population	2022 Minority (%)	Black or African American (%)	American Indian, Alaskan Native (%)	Asian (%)	Native Hawaiian, Pacific Islander (%)	Some other race (%)	Two or more races (%)	Hispanic or Latino (%)
Division 6	19,413,645	29.6	20.0	0.2	1.5	0.0	0.3	2.7	4.8
TVA PSA	10,540,347	26.7	15.7	0.2	1.6	0.1	0.3	2.9	6.0
TVA PSA Counties									
Chickasaw County, MS	17,024	50.9	43.7	0.0	0.2	0.0	0.0	1.9	5.1
Clay County, MS	18,598	62.0	60.0	0.0	0.0	0.0	0.0	1.8	0.2
Kemper County, MS	8,980	66.6	61.8	3.8	0.0	0.0	0.0	0.2	0.8
Leake County, MS	21,335	52.3	39.8	5.7	0.4	0.0	0.0	1.4	5.1
Lowndes County, MS	58,547	50.0	44.5	0.1	1.1	0.0	0.4	1.5	2.4
Marshall County, MS	33,980	52.9	45.5	0.0	0.1	0.0	0.5	2.4	4.3
Noxubee County, MS	10,261	74.4	73.6	0.4	0.0	0.0	0.0	0.2	0.3
Panola County, MS	33,157	53.1	49.6	0.1	0.3	0.4	0.1	1.9	0.6
Scott County, MS	27,943	51.3	35.6	0.1	0.1	0.0	0.2	3.5	11.8
Tallahatchie County, MS	12,621	65.1	61.4	0.0	0.1	0.0	0.2	1.5	1.9
Winston County, MS	17,741	50.4	46.7	0.5	0.1	0.0	0.0	1.6	1.5
Haywood County, TN	17,806	56.3	50.0	0.0	0.1	0.0	0.4	1.4	4.3
Shelby County, TN	926,440	65.5	53.6	0.1	2.9	0.0	0.3	1.9	6.8

Urban-Rural Distinctions

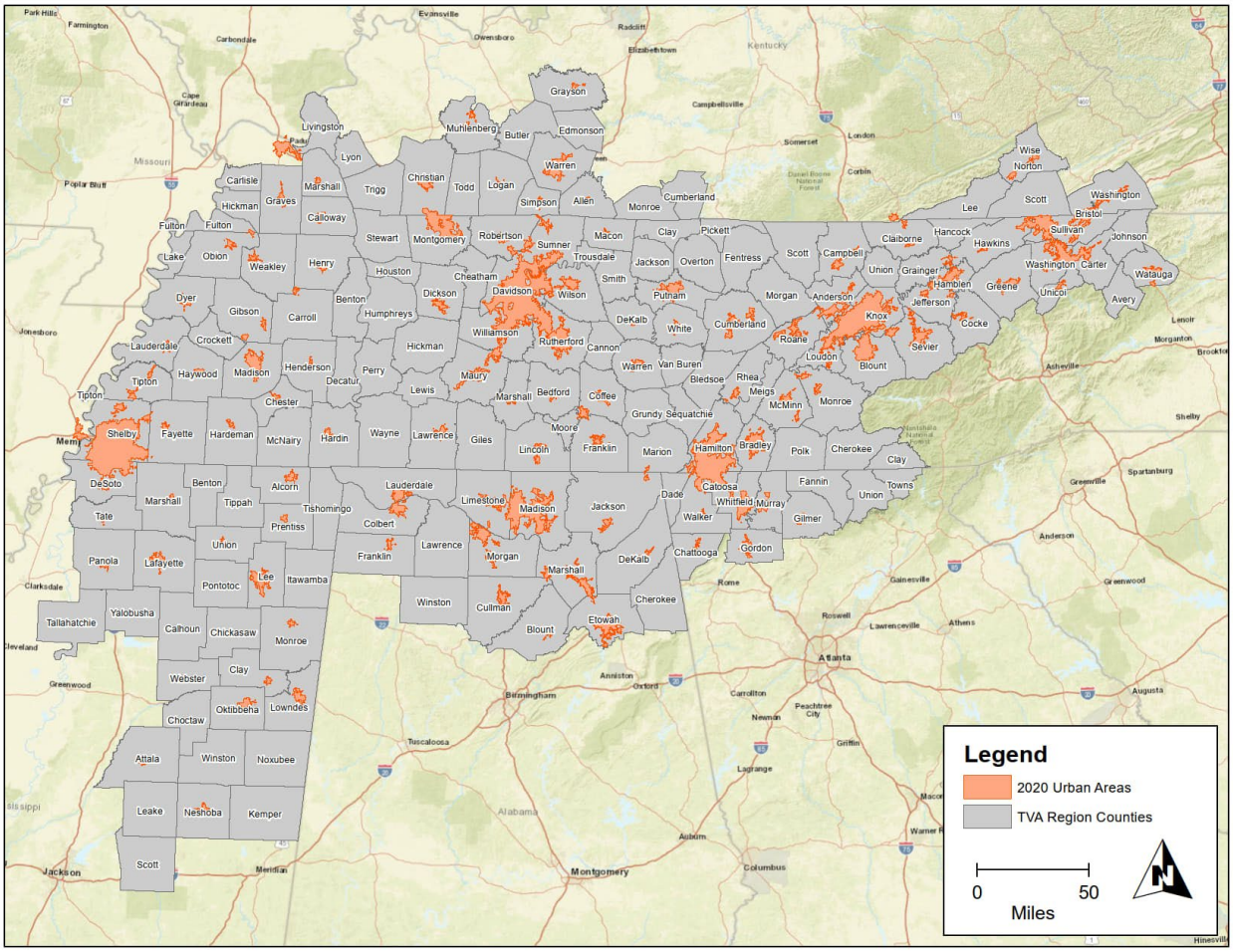
Distinctions between urban and rural areas across the TVA PSA are described in this subsection. Following the 2020 Census, the USCB changed the way urban areas are defined, and released a new list of urban areas. USCB-defined urban areas comprise a densely settled core of census blocks that have at least 2,000 housing units or a population of at least 5,000. This includes adjacent territory containing non-residential and commercial uses. Rural areas are defined as all population, housing and territory not included within an urban area. In general, population density of urban areas has increased from 2,343 persons per square mile in 2010 to 2,553 in 2020 (USCB 2023c).

As shown in Figure 3-8, the TVA PSA included 120 separate USCB-designated urban areas in 2020. Urban areas comprised approximately 5 percent of the TVA PSA and contained nearly 56 percent of the population (USCB 2023b, USCB 2023d). This is compared with the U.S., where approximately 80 percent of the population resided within approximately 3.1 percent of the total land area in 2020. Across Division 6, approximately 59 percent of the population lived in urban areas (USCB 2023c, USCB 2024, Visual Capitalist 2020).

USCB considers all portions outside of designated urban areas to be rural areas. In 2020, approximately 95 percent of the TVA PSA was considered rural, accounting for almost 44 percent of the population in the TVA PSA (USCB 2023b, USCB 2023d). Twenty percent of the U.S. population was considered rural in the same year (USCB 2024).

In 2022, the three most populous counties in or partially within the TVA PSA were Shelby, Davidson, and Knox counties, Tennessee as shown in Table 3-9. Each county had a population greater than 430,000 residents, and greater than 50 percent of land was classified as urban in the 2020 Census (USCB 2023d). Nashville and portions of its metropolitan area encompass Davidson County, Tennessee, and Shelby County is primarily composed of the City of Memphis. Knox County is largely composed of the Knoxville metropolitan area. The population of Davidson and Knox counties increased 13.3 percent and 11.4 percent respectively between

2010 and 2022, while the population of Shelby County decreased 0.1 percent (USCB 2010, USCB 2022a).



Source: USCB 2023b, USCB 2023d

Figure 3-8. Urban and Rural Areas in the TVA PSA

Table 3-9. Population Data for the Most/Least Populous Counties in the TVA PSA

Geography	2010 Population	% Urban Population, 2010	2020 Population	% Urban Population, 2020	% Land classified as Urban, 2020	2022 Population	% Increase 2010 – 2022
Shelby County, TN	927,644	97.2	929,744	96.6	50.9	926,440	-0.1%
Davidson County, TN	626,681	96.6	715,884	96.9	58.6	709,786	13.3%
Knox County, TN	432,226	89.1	478,971	90.8	54.8	481,406	11.4%
Pickett County, TN	5,077	0.0	5,001	0.0	0.0	5,042	-0.7%
Carlisle County, KY	5,104	0.0	4,826	0.0	0.0	4,782	-6.3%
Hickman County, KY	4,902	0.0	4,521	0.0	0.0	4,491	-8.4%

Source: USCB 2010, USCB 2022a, USCB 2023d

In 2022, the three least populous counties in or partially within the TVA PSA were Pickett County, Tennessee, and Carlisle and Hickman counties, Kentucky, as shown in Table 3-9. The entirety of these counties was considered rural areas in 2020, as defined by the USCB (USCB

2023d). The population of each county declined between 2010 and 2022. The population of Hickman County decreased the most (8.4 percent); while the population of Carlisle and Pickett declined in population 6.3 percent and 0.7 percent, respectively (USCB 2010, USCB 2022a).

Economics

In this subsection, major industries and employment, income, and poverty data are presented for the TVA PSA, as compared with Division 6 and the U.S.

Regional Economy

The gross domestic product for the TVA PSA for FY 2023 was estimated at $685.5 billion, based on the Bureau of Economic Analysis gross domestic product data by state and Bureau of Labor Statistics county level employment data. In 2022, the top three industries for employment in the TVA PSA and Division 6, listed by rank highest to lowest, were: (1) educational services, health care, and social assistance industries; (2) manufacturing; and (3) retail trade. For the U.S., these were: (1) educational services, health care, and social assistance industries; (2) professional, scientific, management, administrative, and waste management industries; and (3) retail trade (USCB 2023e). TVA revenues in FY 2023 were $12.1 billion, representing about 1.8 percent of the total TVA PSA economy.

In the TVA PSA and Division 6, the economy depends more on manufacturing than the U.S. as a whole. While the relative importance of manufacturing has been declining for years, this has occurred to a greater degree for the nation overall than for the TVA PSA. In the TVA PSA, manufacturing jobs still employ 14.6 percent of the civilian working population, second among industrial sectors (USCB 2023e). Factors contributing to the high proportion of manufacturing include location with good access to markets in the Northeast, Midwest, Southwest, and the rest of the Southeast; good transportation; relatively low wages and cost of living; right-to-work laws; and abundant, relatively low-cost resources including land and electricity.

TVA plays an important role in the regional economy through its Economic Development program. TVA works to attract new businesses to the Tennessee Valley, engage with communities and existing companies to grow the economy, and partner with state, regional, and local economic development organizations to amplify job growth and capital investment in the PSA (TVA 2022a). TVA offers site selection services, incentives, research and technical assistance to help companies locate, stay, and expand existing operations in the Tennessee Valley (TVA 2020b). Development efforts target six key markets: aerospace and defense, automotive and mobility technologies, clean technologies, food and industrial technologies, information systems and security and life sciences (TVA 2023). Table 3-10 shows the amount of capital investment by TVA for FY 2019 through FY 2023.

Table 3-10. TVA Capital Investment Between 2019 and 2023

Fiscal Year	Capital Investment (in billions of U.S. dollars)
2019	$8.9
2020	$8.6
2021	$8.8
2022	$10.2
2023	$9.2
Total	$57.0

Source: TVA 2022a, TVA 2023, TVA 2020c, TVA 2021

Employment

In 2022, the participation rate of the civilian labor force, defined as the percentage of the population aged 16 or more that is either working or actively looking for work, was estimated to be 5.1 million, or 60.1 percent, in the TVA PSA. In comparison, the participation rate of the civilian work force was less than the nation (62.2percent) but more than Division 6 (59.2 percent). The unemployment rate in the TVA PSA was 5.0 percent, lower than the nation (5.3 percent) and Division 6 (5.3 percent) during the same time period. There was considerable geographic variation in unemployment rates with adjacent counties sometimes having large differences. Unemployment rates across the TVA PSA range from a low of 0.8 percent in Trousdale County, Tennessee, located within the Nashville-Davidson-Murfreesboro-Franklin, Tennessee, metropolitan area, to a high of 14.1 percent in the rural county of Kemper County, Mississippi (USCB 2023e).

In 2022, the TVA PSA and Division 6 had similar percentages of people employed in various occupations as shown in Table 3-11. The TVA PSA had a higher percentage of employees in production, transportation, and material moving fields (17.7 percent) as compared to the nation (13.1 percent) (USCB 2023e).

Table 3-11. Employment in Occupations in the TVA PSA, Division 6, and U.S.

Geography	% Employed in:				
	Mgt., Business, Science, and Arts	Service	Sales and Office	Natural Res., Construction, Maintenance	Production, Transportation, Material Moving
United States	41.0	16.8	20.5	8.7	13.1
Division 6	33.6	16.1	20.8	9.1	17.5
TVA PSA	36.5	15.7	20.9	9.2	17.7

Source: USCB 2023e

TVA's Economic Development program fosters job growth throughout the PSA by forming partnerships with state, regional, and local economic development organizations. TVA's efforts bring greater opportunities for businesses and working people in the cities and rural communities it serves. Table 3-12 shows the number of TVA assisted jobs between 2019 and 2023. New and retained job numbers reported by TVA are certified and provided to TVA by TVA customers, defined as an entity that purchases or distributes power from TVA. New jobs are defined as newly created, paid positions (including contract jobs) at a facility of a TVA customer. Retained jobs are paid positions (including contract jobs) at a facility of a TVA customer that were created prior to the current TVA fiscal year and that continue to be filled in the current TVA fiscal year (TVA 2023).

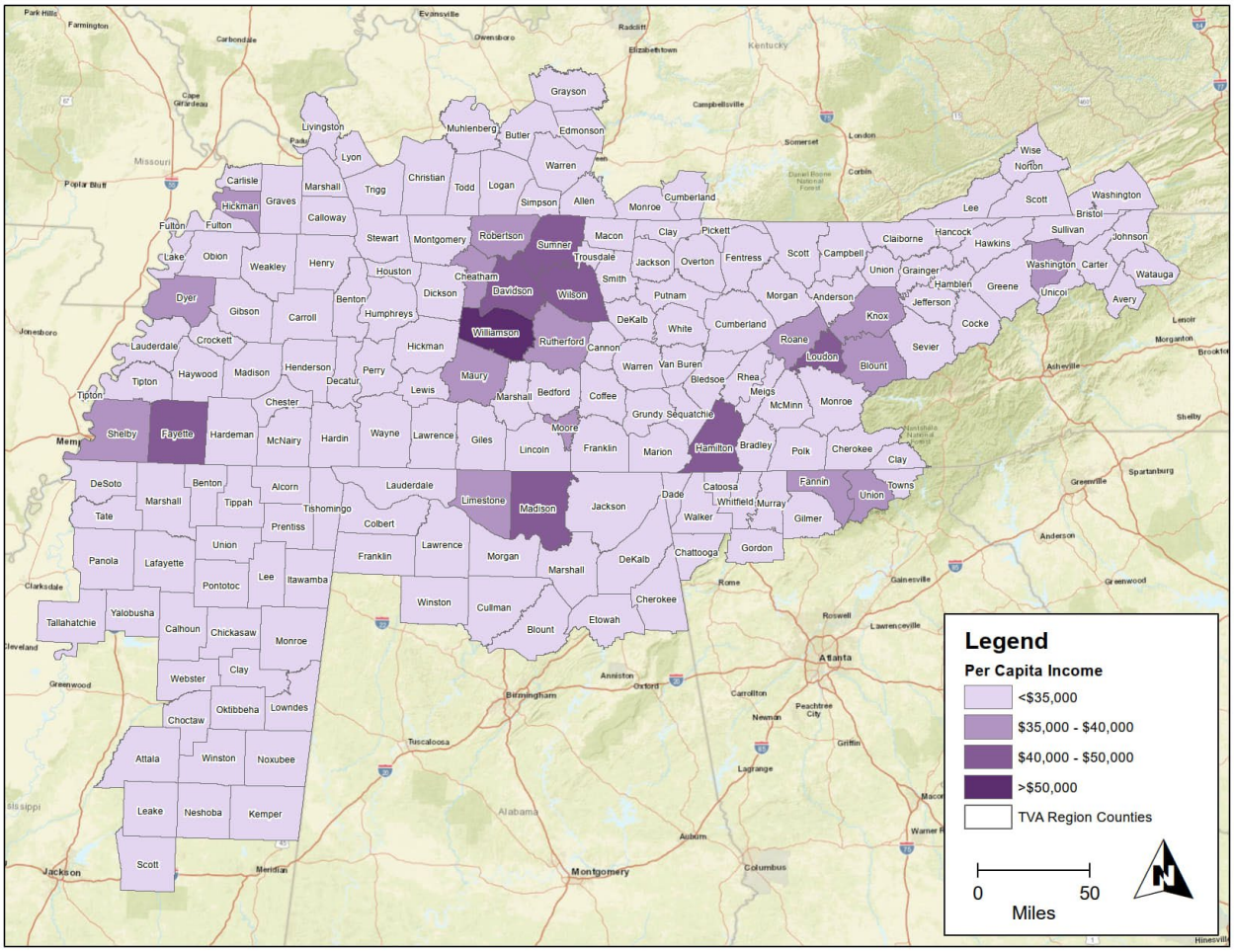
Table 3-12. TVA-Assisted Jobs Between 2019 and 2023

Fiscal Year	New Jobs	Retained Jobs	Total Jobs
2019	21,400	45,100	66,500
2020	19,000	48,000	67,000
2021	22,550	58,350	80,900
2022	26,500	40,000	66,500
2023	12,275	46,125	58,400

Source: TVA 2018, TVA 2019b, TVA 2020c, TVA 2021, TVA 2022b, TVA 2023

Income and Poverty

In 2022, per capita income in the TVA PSA ranged from $19,695 (Lake County, Tennessee) to $61,451 (Williamson County, Tennessee). Only five counties in the TVA PSA had incomes above the nation's per capita income of $41,261. Four of the five were located in Tennessee (Williamson County, Davidson County, Wilson County, and Hamilton County). One county was located in Madison County, Alabama. Each of these counties were located within a metropolitan area. Per capita income in Division 6 was $33,716. Within the TVA PSA, only 29 counties had per capita income greater than the Division, indicating that higher per capita income concentrates in few areas in the TVA PSA. Figure 3-9 illustrates the differences in per capita income rates of TVA PSA counties (USCB 2023e).



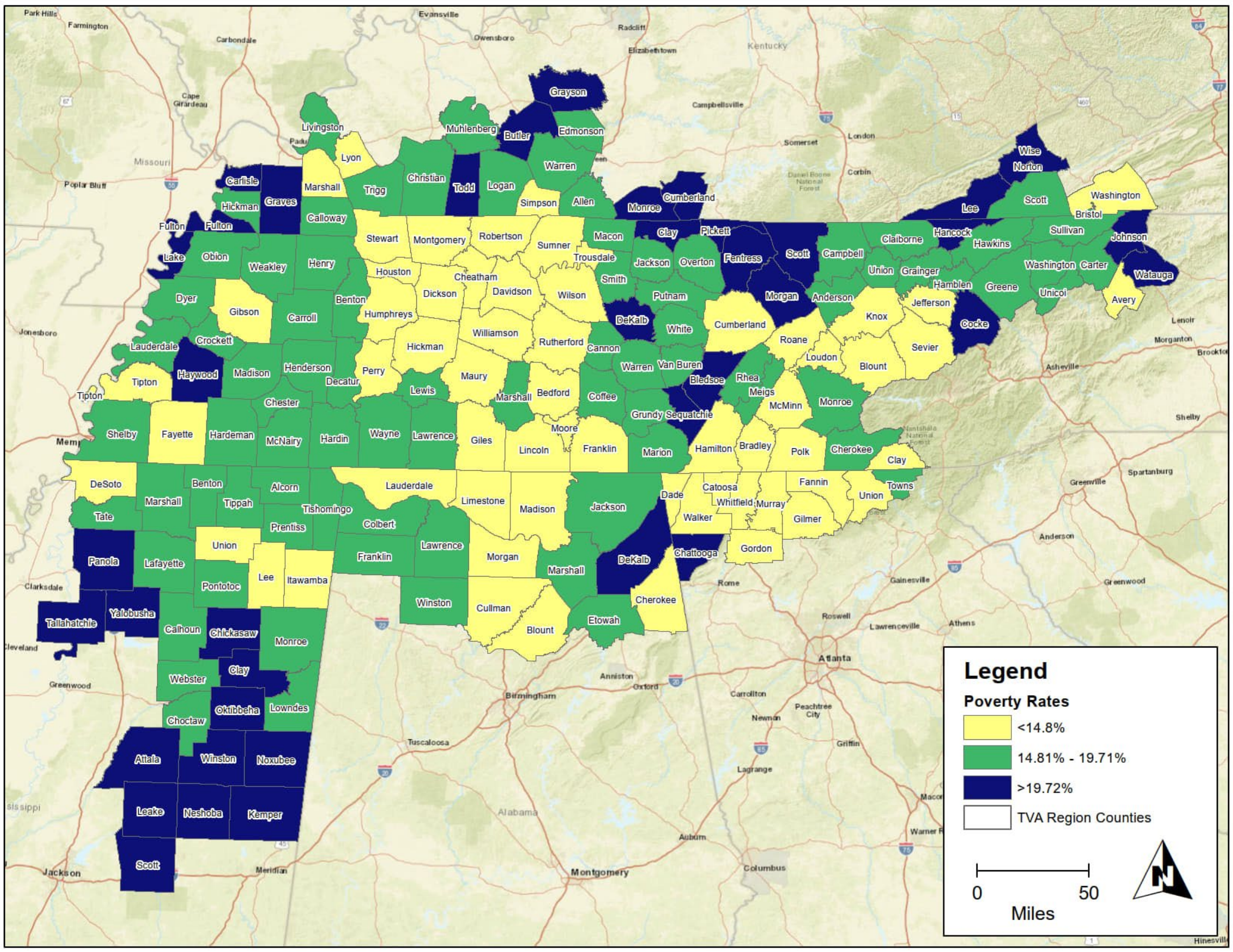
Source: USCB 2023e, USCB 2023b

Figure 3-9. Per Capita Incomes of TVA PSA Counties

Low-income populations are identified using the annual statistical poverty threshold from the USCB Current Population Reports Series P-60 on Income and Poverty. Where relevant, TVA PSA-wide low-income data is compared with information from USCB Division 6, East South Central. Division 6 includes the majority of the TVA PSA, consisting of Alabama, Kentucky, Mississippi, and Tennessee (USCB 2000).

The USCB-provided 2022 poverty threshold for an individual was $13,590 and the official poverty rate for the U.S. in 2022 was 11.5 percent (USCB 2023f, USDHHS 2022). For this analysis, low-income populations were defined as those with poverty rates above the TVA PSA average rate of 14.8 percent. Additional low-income populations were identified at the census tract level using poverty rates reported in the 2022 ACS (USCB 2023g). Within the TVA PSA 124 counties and two independent cities had poverty rates above the PSA average, as illustrated in Figure 3-10. The 2022 ACS estimates for per capita income and the percentage of the population living in poverty for PSA counties are included in Appendix D-2 (USCB 2023g).

A total of 1,196 census tracts in 178 counties or independent cities and seven states had poverty rates above the TVA PSA average. Low-income census tracts are in all but five counties of the TVA PSA. The per capita income levels and poverty rates from the 2022 ACS are included in Appendix D-3 (USCB 2023h).



Source: USCB 2023f, USCB 2023b

Figure 3-10. Poverty Rates of Counties in the TVA PSA

Federally Recognized Tribes

The federal government has a unique relationship and trust responsibility to federally recognized Tribes. TVA upholds this responsibility and consults with Tribes on a government-to-

government basis. TVA must consult with Tribes on programs and undertakings pursuant to the American Indian Religious Freedom Act, Archaeological Resources Protection Act, Native American Graves Protection and Repatriation Act, NHPA, and other laws, executive orders, and presidential memoranda.

With respect for tribal sovereignty and self-determination, TVA regularly consults with over 20 federally recognized Tribes that have religious and cultural interests in TVA's PSA. Many of the Tribes with whom TVA consults were subject to forcible relocation to Indian territory (now Oklahoma), mandated by the Federal government in the Indian Removal Act of 1830. Currently, the majority of these Nations are headquartered in the state of Oklahoma, and they retain strong ties to their ancestral homelands. Two federally recognized Tribes – the Eastern Band of Cherokee Indians (EBCI) in southwestern North Carolina and the Mississippi Band of Choctaw Indians (MBCI) in east central Mississippi – still reside in the Tennessee Valley.

The two Tribes residing in the Valley are shown in Figure 3-7. These sovereign nations are part of the minority population in the TVA PSA. The EBCI has approximately 13,000 tribal members. About 60 percent live on the 56,000-acre Qualla Boundary, land held in trust for the Tribe by the federal government located in western North Carolina. Tribal lands span Swain and Jackson counties, with smaller parcels in Cherokee, Graham and Haywood counties (DOJ 2024, Cherokee Chamber of Commerce 2024). The MBCI has approximately 10,000 tribal members, located on 35,000 acres in east central Mississippi, spanning 10 counties. Neshoba County is the largest of the reservation areas, and the location of the Tribe's headquarters. The MBCI is a major contributor to the state's economy and provides permanent full-time jobs for over 5,000 employees (Choctaw.org 2024a, Choctaw.org 2024b, RRT 2024).

In a 2017 study, the Center for Disease Control found that compared with other racial or ethnic groups, American Indians have a "lower life expectancy, lower quality of life, and are more likely to be affected by many chronic conditions" (CDC 2018). Demographic characteristics of Tribal Nations EBCI and MCBI located within the TVA PSA is shown in Table 3-13.

Table 3-13. Demographics of Federally Recognized Tribal Nations in the TVA PSA

	Eastern Band of Cherokee Indians (EBCI)	Mississippi Band of Choctaw Indians (MBCI)
Population	7,930	7,384
Percent of Population under 5 years	4.9	9.0
Percent of Population between ages 25 and 54	32.1	37.29
Percent of Population 65 and over	17.4	8.7
Median Age	37.7	28.3
Percent of Population between ages 25 and 54	32.1	37.29
Graduated high school or higher, 25 years old and over	83.8	72.7
Attained bachelor's degree or higher, 25 years old and over	14.0	8.2
Military veterans in the civilian population 18 years and over	8.2	5.7
Population 16 years and over in labor force	2,875	2,917
Percent Employed Population 16 years and over in the labor force	91.3	89.4
Unemployment Rate	8.7	10.6
Employed in service occupations	32.2	43
Median household income	44,925	39,955
Percent of Individuals Living below the Poverty Level	21.0	42.8

	Eastern Band of Cherokee Indians (EBCI)	Mississippi Band of Choctaw Indians (MBCI)
Occupied Housing Units	3,324	1,976
Percent of owner-occupied units	73.0	79.8
Median Housing Value	137,900	71,800
Percent of civilian noninstitutionalized population with health insurance	62.3	65.6
Percent of civilian noninstitutionalized population with no health insurance	37.7	34.4

Source: USCB 2022d, USCB 2022e

3.15.2 Environmental Consequences

This section describes the potential impacts to socioeconomic resources of concern should the No Action or the Proposed Action Alternatives be implemented. Social and economic issues considered for evaluation within the impact area include change to current and projected population levels, change in expenditures for goods and services, and short-term or long-term impacts on employment and income. Although the extent of socioeconomic impacts would vary from site to site, general effects from the Proposed Action within the TVA PSA are discussed below.

3.15.2.1 Alternative A – No Action

Under the No Action Alternative, TVA would not establish the proposed Resilience 360° program; therefore, no project related changes to socioeconomic resources would occur. Also, no disproportionately high and adverse direct or indirect impacts to any minority or low-income populations would occur. Therefore, there would be no impacts to socioeconomics under the No Action Alternative.

3.15.2.2 Alternative B – Proposed Action

Implementation of the Proposed Action would entail a variety of construction, operation and maintenance, and decommissioning activities; however, these activities would not result in any significant change to population, demographic, or employment and income, characteristics.

There is no site-specific location in which to analyze communities, but it is possible that project activities could take place in minority and low-income communities, or areas near indigenous sacred sites However, project activities would occur in compliance with the criteria established in this PEA.

For purposes of this programmatic analysis, siting and environmental criteria, and the range of known construction activities provided the bounding conditions which informed the impact analysis for all resource areas presented in this PEA. It was determined that there would be no significant adverse health impacts on members of the public or significant adverse environmental impacts on the physical environment (water, air, aquatic, and terrestrial resources) for facilities meeting the environmental checklist criteria. Therefore, construction, operation, and decommissioning of Resilience 360° units at host locations would be expected to have negligible to minor impacts on socioeconomics in the vicinity and within the PSA.

Because of the scale of the individual Resilience 360° activities at host locations, it is unlikely that the project would result in impacts in conjunction with reasonably foreseeable future actions in the temporal and physical vicinity of host locations.

3.16 Unavoidable Adverse Impacts

Because the Proposed Action would include the construction and operation of new natural gas generating units, an increase in vehicle and dust emissions during construction, emissions from the combustion of natural gas, and emissions of GHGs are unavoidable. Because these emissions would contribute to the overall emissions in the TVA PSA, they would be, by definition, adverse. However, these emissions are not likely to be significant contributors to existing air quality or global climate change impacts.

3.17 Relationship of Short-Term Uses and Long-Term Productivity

Other than transportation and materials used for construction, there would be no short-term uses associated with the project. The land area needed for construction is not expected to be much larger than the units themselves, and the area would be confined to within the host's facility. Following construction, the host's operation of the units is expected to be long-term. Because the purpose of the Proposed Action is to support continued power supply to the host facilities during extreme events, the project would protect long-term productivity objectives by minimizing damage or loss of materials during these events, thus allowing the facilities to return to normal operations much more quickly. In addition, operation of the BESS units to support the TVA grid would help to achieve long-term carbon reduction goals.

3.18 Irreversible and Irretrievable Commitments of Resources

Because the size of the natural gas and BESS units is small, they are not expected to use any land area that would be needed for other long-term productivity uses. Use of natural gas would be, by definition, an irretrievable use of that resource, making it unavailable for later use for another purpose. However, the volume of gas to be used would be so small that it would not significantly interfere with the needs of future users. While the production of metals for the units would be irreversible, at least some of those materials could be recycled after use and therefore, may not be completely irretrievable.

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CHAPTER 5 - LIST OF PREPARERS

5.1 NEPA Management

Carol Butler Freeman (TVA)
Position: Project Manager, NEPA Specialist
Education: MS, Geological Sciences and Space Studies; BS, Geology
Experience: 17 years in NEPA Compliance
Involvement: NEPA Compliance and Project Management

Dana Nelson (TVA)
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Experience: 17 years environmental compliance; 6 years NEPA document preparation
Involvement: Environmental Planning and Project Management

James W. Allen III (TVA)
Position: Project Manager
Education: B.S. Finance and Computer Information Systems, PMP
Experience: 7 years of project and portfolio management for large capital and construction projects, and executive Business Plan development, 2 years Power Billing, and 5 years of Business Development
Involvement: Resilience 360° senior program lead

Thomas Minwell (TVA), NCSO, PMP
Position: Sr. Consultant, Business Development & Strategy
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Involvement: Resilience 360° program design and implementation

Susan Innis (AECOM)
Position: Project Manager
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5.2 Other Contributors

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Involvement: Socioeconomics

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Experience:	29 years in project administration and 20 years of experience in NEPA document preparation
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Education:	Ph.D., Ecology and Evolutionary Biology, M.A., Ecology and Evolutionary Biology; B.A, Biology
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Role:	Aquatic Ecology, Soil Erosion, Surface Water, Navigation, Land Use, Prime Farmland, Noise, Public Health and Safety, Transportation, Visual

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Role:	Air Quality, Greenhouse Gas, Climate Change

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Position:	Ecologist
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Role:	Project Reviewer, QA/QC

Cameron Wyse (AECOM)

Position:	Biologist
Education:	B.S., Biology
Experience:	3 years in environmental services
Role:	Terrestrial Zoology, Wetlands

Sara McLaughlin-Johnson (TVA)

Position:	Terrestrial Zoologist
Education:	B.S., Biology
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Emily Doub (TVA/ Johnson Service Group)

Position:	Terrestrial Zoologist
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Role:	Terrestrial Zoology

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Fang Yang (AECOM)

Position:	Air Quality Scientist
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Role:	Air Quality, Greenhouse Gas and Climate Change Reviewer

Carrie Williamson, P.E. (TN), CFM

Position:	Program Manager, Flood Risk
Education:	M.S., Civil Engineering; B.S., Civil Engineering; Professional Engineer, Certified Floodplain Manager
Experience:	12 years in Floodplains and Flood Risk; 3 years in River Forecasting; 11 years in Compliance Monitoring
Involvement:	Floodplains and Flood Risk

Fallon Parker Hutcheon, PWS

Position:	Wetland Biologist
Education:	M.S., Environmental Studies; B.S., Biology; Professional Wetland Scientist
Experience:	6 years in wetland delineation, wetland impact analysis, and NEPA and CWA compliance
Involvement:	Wetlands

Appendix A – Environmental Screening Checklist

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Resilience 360° Environmental Screening Checklist

The goal of this program is to improve and enhance resiliency during events that challenge the transmission of power on the grid. TVA will review this checklist and follow up with the Program Participant as appropriate, in accordance with TVA's legal and policy requirements associated with this program.

Please provide the following information to TVA program management staff via email (Resilience360@tva.gov) at least six (6) months before any ground disturbing activities are scheduled to begin. TVA's final environmental review and site approval must be completed before any construction activities begin. Review and approval could take approximately 6 weeks and up to 6 months.

In general, if the proposed Resilience 360° site is located within previously developed areas, such as: parking lots, recently graded land, sites situated on fill material, sites situated on high ground relative to the remainder of the property, or other similar low impact situations; and associated activities such as installation of signage, construction of new utility distribution poles or underground utilities, etc. are completely within previously disturbed areas, reviews should be more expeditious.

The Program Participant (Vendor) should complete sections 1.0, 2.0, 3.0, and 4.0 of the Checklist.

1.0 General Project Description

Vendor Name: _____

Proposed Customer Facility (Host Site): _____

Proposed Site Address (or lat/long): _____

_____

Property Landowner: _____

2.0 Project Attachments

Attach/submit the following to/with this checklist:

- ☐ Labeled pictures showing the proposed project location and surrounding environment including:
  - from a variety of angles (at a minimum of four photos looking in each of the cardinal directions looking at the site)
  - the area surrounding the installation (looking outward away from the site) capturing all neighboring facilities
  - any structures proposed for modification or demolition (external and internal if possible)
  - any vegetation proposed for clearing from multiple angles (see Attachment A for guidance)
  - tops of nearby utility poles, lights, or other tall structures adjacent to the proposed site
  - any visible nests
  - any areas on or near the site where water ponds frequently
  - interconnection point to existing transmission

- interconnection point to nearest existing gas supply

- ☐ Aerial map/diagram of the proposed site with an imposed project footprint identifying (including shapefiles, kmz, and/or CAD files):
  - the project location
  - laydown area(s)
  - nearest gas pipeline access point/existing lines
  - access route(s) to the project location
  - the associated facility (including but not limited to gas units, BESS, proposed utilities, parking, grading, excavation, storage sheds, tanks, and fill)
  - interconnection point(s) to existing transmission
  - interconnection point(s) to existing gas supply
  - trenching locations/layout
  - overall site layout plan showing locations of all proposed new facilities
- ☐ Any documentation showing past disturbance at the proposed site (previous construction maps, grading diagrams, historic photographs, survey reports, etc.) including any evidence of the depth of previous disturbance
- ☐ Phase I Environmental Site Assessment(s) if available
- ☐ Attachments associated with the checklist in Section 4.0:
  - 4.6 Air Quality & Climate: US Environmental Protection Agency Green Book Current Nonattainment Area Counties for All Criteria Pollutants | US EPA (https://www3.epa.gov/airquality/greenbook/astate.html
  - 4.6 Air Quality & Climate: US Environmental Protection Agency List of Areas Protected by the Regional Haze Program | US EPA (https://www.epa.gov/visibility/list-areas-protected-regional-haze-program

3.0 Project Characteristics

Project Characteristic	**Site-Specific Detail**
Facility land use (i.e. commercial, industrial, medical, etc.)	
Facility function (i.e. water treatment, server farm, chemical manufacturing, etc.)	
Resilience 360 Unit Generation Type (Gas or BESS)	
Minimum generation at the site	
Maximum generation at the site	
Maximum disturbance area (including laydown up to 2 acres)	
Maximum trenching depth	
Anticipated new build facilities/structures (e.g. buildings, tanks, storage, parking, new utility poles, etc.)	
Total number of natural gas/battery units at the site (both existing and new)	Existing (if any) – New –

Project Characteristic	**Site-Specific Detail**
Maximum height of new build facilities/structures (including any new utility poles)	
Maximum emissions for all relevant criteria pollutants (in pounds per Megawatt hour [lb/MWh]), *not applicable for BESS units*	NOx – CO – VOC – PM – SO_2 –
Foundation Characteristics	Style (pad, piers, piles, etc.) – Depth of foundation –
Anticipated required permits and the dates those permits would be expected to be acquired	
Anticipated new distribution equipment required	
Anticipated construction duration (including anticipated construction start)	
Anticipated daily construction truck traffic needs (not including worker vehicles)	
Anticipated types of construction equipment (particularly consider whether pile drivers or other higher decibel equipment may be needed)	
Approximate maximum number of construction workers expected to be needed	
Approximate maximum number of full-time employees during operations	
Anticipated commencement of operations date	
Anticipated types and estimated quantities of construction waste (including but not limited to any hazardous wastes)	
Anticipated types and estimated quantities of operational waste (including but not limited to any hazardous wastes)	

4.0 Project Checklist

TVA subject matter experts (SMEs) will review the specific resources potentially affected. Based on the SME review(s), further review of environmental impacts by TVA or by the Program Participant, as directed by TVA (such as site visits and/or field surveys), or specific best management practices (BMPs), may be required. If the answer to any question is *YES*, consider reconfiguring the site or locating another site that avoids these potential impacts and reach out to TVA to understand additional review responsibilities, potential longer review times, and costs.

Consider the entire site footprint/disturbance area, including laydown areas and interconnection points, when answering the questions below.

4.1 General	
□ Yes □ No	Would the installation (including the interconnect to utility/gas) or operation of the proposed unit(s) require ground disturbance? If yes, what is the maximum depth of excavation? _____ feet below ground surface and identify excavation areas on the provided maps/diagrams
□ Yes □ No	If yes to the above question, would the ground disturbance affect previously undisturbed soils/areas? If yes, show the area including undisturbed soils on the attached aerial map(s).
□ Yes □ No	Would the installation of the unit(s) require the demolition or alteration of any structure or building? If yes, list/describe the affected structures (including the date the structure was constructed) and the modifications needed:
□ Yes □ No	Would best management practices including use of dust suppression measures and covering of equipment carrying loose material (such as borrow/fill) be utilized? If yes, describe: If no, describe why these measures would not be necessary:
□ Yes □ No	Would drilling, blasting, or pile driving be required? If yes, describe the planned actions including anticipated duration:
□ Yes □ No	Would anticipated noise levels exceed Occupational Safety and Health Administration limits, local ordinances, and/or 65 dBA at the site boundary during either construction or operations? If yes, provide additional details:
□ Yes □ No	Would offsite borrow material be required? If yes, what is the maximum that would be needed and from where would this material be procured:
□ Yes □ No	Would soil/rock be removed from the site to an offsite disposal area? If yes, how much and where would this material be disposed:

□ Yes □ No	Would all equipment and facilities be removed upon future decommissioning? If no, what facilities or structures would need to be left in place?
4.2 Water Resources (including Wetlands)	
□ Yes □ No	Would development of the site require disturbance to known wetlands, streams, rivers, reservoirs, or jurisdictional features or to onsite areas where water is currently present or ponds frequently? If yes, please provide additional description:
□ Yes □ No	Is there or would there be a Stormwater Pollution Prevention Plan (SWPPP) in place? In no, describe the onsite stormwater management system in relation to the proposed action.
4.3 Floodplains	
□ Yes □ No	Is the proposed site (including any gas units, BESS, temporary and/or permanent laydown areas, buildings, enclosed sheds, tanks, storage areas, as well as fill for any of these facilities) located below the 100-year flood elevation at the proposed site (if the 100-year flood elevation is known) or within the 100-year floodplain or floodway?
4.4 Ecological Resources	
□ Yes □ No	Would removal of trees with a trunk diameter greater than 3 inches at breast height be necessary? If so, how many trees or acres of trees would be cleared? _____ trees/acres If yes, how would the cleared trees be disposed (i.e. sold, hauled offsite, mulched, burned, etc.): _____
□ Yes □ No	Can the project commit to tree clearing only within a winter window (approximately October 15-March 31 dates may vary depending on site location)?
□ Yes □ No	Are there any visible caves, rock ledges, overhangs, sinkholes, or large springs in view of the host site?
4.5 Cultural Resources	
□ Yes □ No	Is the associated host site facility greater than 50 years of age? If yes, what was the year the facility was constructed:
4.6 Air Quality and Climate	
□ Yes □ No	Are the new generation units replacing older generation units? If yes, describe the older units:
□ Yes □ No	Is the site located in a county that is in a non-attainment status for any criteria pollutant per the US Environmental Protection Agency Green Book Current Nonattainment Area Counties for All Criteria Pollutants | US EPA (https://www3.epa.gov/airquality/greenbook/astate.html)? Attach the state nonattainment areas report to this checklist.

□ Yes □ No	Is this site located within 0.5 mile of a Class I area per the US Environmental Protection Agency List of Areas Protected by the Regional Haze Program | US EPA (https://www.epa.gov/visibility/list-areas-protected-regional-haze-program)? Attach the Class I areas list to this checklist.
□ Yes □ No	Would a construction permit be required to construct the proposed units at the specific host site? If so, provide details and attach the supporting information for the permit:
□ Yes □ No	Would an air permit be required to operate the proposed units at the specific host site? If so, provide details and attach the supporting information for the air permit:
□ Yes □ No	Would emissions from construction or operations of the proposed action lead to concentrations of any pollutants exceeding National Ambient Air Quality Standards (NAAQS)? If yes, provide additional details regarding which pollutants are exceeded and mitigation measures that would be applied:
4.7 Health and Safety	
□ Yes □ No	Is the edge of the facility property located more than 0.1 mile from a gas supply line? If yes, provide the distance from the facility boundary to the interconnection point and the landownership/easement information necessary to access that interconnection point.
□ Yes □ No	Has there been prior contamination or waste storage at the proposed site, in the immediate vicinity (approximately 200 feet from the site), or is there potential for contamination? (ex. previously used for other industry, disturbance, or fill issues on-site). If yes, provide applicable documentation along with the Phase I Environmental Site Survey in the attachments.

This form must be completed and signed by an authorized representative or agent for the Program Participant, an individual who can certify, under penalty of law, and based on information and belief formed after reasonable inquiry and appropriate training or licensing, that the statements and information contained in this Environmental Screening Checklist are true, accurate and complete.

Vendor Representative (Signature): _____ Date: _____
(or Designated Agent)

Vendor Representative (Name, Title): _____
(or Designated Agent)

5.0 TVA Review

TVA subject matter experts reviewed the material presented in this checklist. Documentation of their review is attached.

In accordance with the National Environmental Policy Act (NEPA), TVA must evaluate and document whether the proposed action described within this document is already covered under an existing NEPA review. The following questions record the evaluation of three criteria for making this determination.

Determination of NEPA Adequacy	
□ Yes □ No	Are there significant circumstances or information relevant to site-specific environmental concerns that would substantially change the analysis in the Resilience 360° PEA? If yes, describe:
□ Yes □ No	Are there effects that would result from the site-specific proposed action that were not addressed in the Resilience 360° PEA? If yes, describe:
□ Yes □ No	Is additional site-specific NEPA necessary? If yes, explain:

Based on the evaluation documented herein, I conclude that the Resilience 360° Programmatic Environmental Assessment (PEA) and Finding of No Significant Impact (FONSI) fully covers the proposed site-specific action and constitutes TVA's compliance with the requirements of NEPA. The site-specific project does not present significant changes to the proposed action or significant new circumstances or information relevant to environmental concerns that would require supplemental analysis. Impacts associated with the proposed action would be minor to moderate and are bounded by the conclusions of the Final PEA and FONSI and the information in the Determination of NEPA Adequacy section of this form. This form documents TVA's compliance with the NEPA for this site-specific action. The completed form will be transmitted to Resilience360@tva.gov.

_____ _____

NAME
Manager, NEPA Compliance
Tennessee Valley Authority

Date Signed

Photographing Trees to Determine Suitability for Indiana & Northern Long-eared Bats

Definition of Suitable Habitat*:*

Suitable summer habitat consists of forested/wooded areas where Indiana bats (*Myotis sodalis*) and northern long-eared bats (*Myotis septentrionalis*) roost, forage, and travel, and may also include adjacent and interspersed non-forested habitats (e.g., emergent wetlands, adjacent edges of agricultural fields, old fields, pastures). This includes forests and woodlots containing potential roosts (i.e., live and dead trees ≥ 3 inches in diameter at breast height (7.62 centimeter) that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features (e.g., fencerows, riparian forests, other wooded corridors). Wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other suitable trees.

Characteristics of Suitable Roost Trees:

Physical characteristics we look for to determine if trees are suitable (need to be able to make these determinations from pictures provided):

- **Trees can be alive or dead (snags).**
- **Trees are typically greater than or equal to 3 inches in diameter at breast height (DBH) using a diameter tape. If you do not have a diameter tape, a standard measuring tape can be used to measure the circumference of the tree at breast height, then divide that number by 3.14 to find diameter.**
    - Ex. A standard tape measure shows a tree is 10 inches in circumference, the diameter would be 10 ÷ 3.14 = 3.18 inches.
- **Trees must have bark that is separated from the tree (exfoliating), or cracks, crevices and hollows where the bats can hide. These bats are about as long as a lighter and weigh about the same as a pencil.**
    - Indiana bats are approximately 1.5-2” long and only weigh about 7 grams.
    - Northern long-eared bats are approximately 3-3.7” long and weigh between 5-8 grams
- **Live trees that often have suitable bark are shagbark hickory and white oak.**
    - Bachelor bats (and non-reproductive females) that roost alone or in small numbers are more likely to use these.
    - Other species of live tree have been used by these bats in the past.
- **Snags of any species can be used if bark is suitable.**
    - In the southeast, maternity roosts have been found in snags of loblolly pine, white pine, shortleaf pine, table mountain pine, pitch pine, eastern hemlock, red maple, & tulip poplar.

To Photograph a Tree for Suitability Determination (see example photos below):

- Stand at the base of the tree, point the camera up the trunk of the tree and photograph the tree on two sides to show the quality of the bark
- Stand about 4 feet from the tree and take a picture of the tree from the ground to about midway up the trunk.
- Stand about 4 feet from the tree and take a picture showing the canopy of the tree from about midway up the trunk to the top.
- Do not take backlit pictures (where the sun is shining in the background) as this will silhouette the tree and we will not be able to determine suitability.
- Take the picture so the sun is beside or behind YOU and illuminates the tree.
- Please provide at least 3-4 pictures of each tree for best results.

Examples of exfoliating bark on known Indiana bat maternity roost trees:



Photos: TVA staff, Cherokee National Forest, Spring 2013

Examples of exfoliating bark on known Indiana bat maternity roost trees:













This piece of bark fell off a maternity roost snag. Researchers estimate up to 40 Indiana bats could roost under this piece of bark when it was still on the tree.



Examples of exfoliating bark on live trees that offer potential roosts for Indiana bats and northern long-eared bats:



Shag bark hickory



White oak

Appendix B – Comprehensive Federally and State-Listed Species List

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	SCIENTIFIC	COMMON_NAM	FED_STATUS
Vertebrates			
	Accipiter striatus	Sharp-shinned Hawk	PS
	Charadrius melodus	Piping Plover	E, T
	Chrosomus saylori	Laurel Dace	E
	Corynorhinus townsendii virginianus	Virginia Big-eared Bat	E
	Cryptobranchus alleganiensis	Hellbender	PS
	Cryptobranchus alleganiensis alleganiensis	Eastern Hellbender	PS:E
	Cyprinella caerulea	Blue Shiner	T
	Elassoma alabamae	Spring Pygmy Sunfish	T
	Erimonax monachus	Spotfin Chub	T
	Erimystax cahni	Slender Chub	T
	Etheostoma akatulo	Bluemask Darter	E
	Etheostoma boschungi	Slackwater Darter	T
	Etheostoma chienense	Relict Darter	T
	Etheostoma lemniscatum	Tuxedo Darter	LE
	Etheostoma marmorpinnum	Marbled Darter	LE
	Etheostoma nuchale	Watercress darter	E
	Etheostoma percnurum	Duskytail Darter	LE
	Etheostoma sitikuense	Citico Darter	LE
	Etheostoma susanae	Cumberland Darter	E
	Etheostoma trisella	Trispot Darter	T
	Etheostoma wapiti	Boulder Darter	E
	Falco peregrinus	Peregrine Falcon	PS:LE
	Fundulus julisia	Barrens Topminnow	E
	Gallinula galeata	Common Gallinule	PS
	Glaucomys sabrinus coloratus	Carolina Northern Flying Squirrel	E
	Glyptemys muhlenbergii	Bog Turtle	T, SAT
	Graptemys oculifera	Ringed Map Turtle	T
	Graptemys pulchra	Alabama Map Turtle	SAT
	Grus canadensis	Sandhill Crane	PS
	Lanius ludovicianus	Loggerhead Shrike	PS
	Laterallus jamaicensis	Black Rail	T
	Macrochelys temminckii	Alligator Snapping Turtle	PT
	Myotis grisescens	Gray Bat	E
	Myotis septentrionalis	Northern Long-eared Bat	E
	Myotis sodalis	Indiana Bat	E
	Necturus alabamensis	Black Warrior Waterdog	E
	Nerodia erythrogaster neglecta	Copperbelly Watersnake	PS:LT
	Notropis albizonatus	Palezone Shiner	E
	Noturus baileyi	Smoky Madtom	E
	Noturus crypticus	Chucky Madtom	E
	Noturus flavipinnis	Yellowfin Madtom	T
	Noturus munitus	Frecklebelly Madtom	PS:T
	Noturus stanauli	Pygmy Madtom	E
	Percina antesella	Amber Darter	E
	Percina aurolineata	Goldline Darter	T
	Percina jenkinsi	Conasauga Logperch	E
	Percina williamsi	Sickle Darter	T

	SCIENTIFIC	COMMON_NAM	FED_STATUS
	Perimyotis subflavus	Tricolored Bat	PE
	Peromyscus gossypinus	Cotton Mouse	PS
	Peromyscus polionotus	Oldfield Mouse	PS
	Phoxinus cumberlandensis	Blackside Dace	T
	Picoides borealis	Red-cockaded Woodpecker	T
	Pituophis melanoleucus	Pine Snake	PS
	Scaphirhynchus albus	Pallid Sturgeon	E
	Speoplatyrhinus poulsoni	Alabama Cavefish	E
	Sternotherus depressus	Flattened Musk Turtle	T
	Tamiasciurus hudsonicus	Red Squirrel	PS
	Vireo bellii	Bell's Vireo	PS
	Zapus hudsonius	Meadow Jumping Mouse	PS
Invertebrates			
	Alasmidonta atropurpurea	Cumberland Elktoe	E
	Alasmidonta raveneliana	Appalachian Elktoe	E
	Anguispira picta	Painted Snake Coiled Forest Snail	T
	Athearnia anthonyi	Anthony's River Snail	E
	Bombus affinis	Rusty-patched Bumble Bee	E
	Cambarus cracens	Slenderclaw	E
	Cambarus williami	Brawleys Fork Crayfish	PT
	Campeloma decampi	Slender Campeloma	E
	Cumberlandia monodonta	Spectaclecase	E
	Cyprogenia stegaria	Fanshell	E
	Dromus dromas	Dromedary Pearlymussel	E
	Epioblasma brevidens	Cumberlandian Combshell	E
	Epioblasma capsaeformis	Oyster Mussel	E
	Epioblasma capsaeformis	Duck River Dartersnapper	E
	Epioblasma florentina walkeri	Tan Riffleshell	E
	Epioblasma obliquata obliquata	Purple Catspaw	E
	Epioblasma penita	Southern Combshell	E
	Epioblasma torulosa rangiana	Northern Riffleshell	E
	Epioblasma triquetra	Snuffbox	E
	Fusconaia cor	Shiny Pigtoe Pearlymussel	E
	Fusconaia cuneolus	Fine-rayed Pigtoe	E
	Fusconaia subrotunda	Longsolid	T
	Hemistena lata	Cracking Pearlymussel	E
	Hesperia leonardus	Leonard's Skipper	PS
	Lampsilis abrupta	Pink Mucket	E
	Lampsilis altilis	Fine-lined Pocketbook	T
	Lampsilis perovalis	Orange-nacre Mucket	T
	Lampsilis virescens	Alabama Lampmussel	E
	Lemiox rimosus	Birdwing Pearlymussel	E
	Leptodea leptodon	Scaleshell	E
	Lioplax cyclostomaformis	Cylindrical Lioplax	E
	Lirceus usdagalun	Lee County Cave Isopod	E
	Marstonia ogmorhaphe	Royal Springsnail	E
	Marstonia pachyta	Armored marstonia	E
	Medionidus acutissimus	Alabama Moccasinshell	T

	SCIENTIFIC	COMMON_NAM	FED_STATUS
	Medionidus conradicus	Cumberland Moccasinshell	PE
	Medionidus parvulus	Coosa Moccasinshell	E
	Neonympha mitchellii	Mitchell's Satyr	LE
	Nicrophorus americanus	American Burying Beetle	T
	Obovaria retusa	Ring Pink	E
	Obovaria subrotunda	Round Hickorynut	T
	Obovaria unicolor	Alabama Hickorynut	PE
	Orconectes shoupi	Nashville Crayfish	E, PDL
	Palaemonias alabamae	Alabama Blind Cave Shrimp	E
	Palaemonias ganteri	Mammoth Cave Shrimp	E
	Pegias fabula	Little-wing Pearlymussel	E
	Plethobasus cicatricosus	White Wartyback	E
	Plethobasus cooperianus	Orange-foot Pimpleback	E
	Plethobasus cyphyus	Sheepnose	E
	Pleurobema clava	Clubshell	E
	Pleurobema curtum	Black Clubshell	E
	Pleurobema decisum	Southern Clubshell	E
	Pleurobema georgianum	Southern Pigtoe	E
	Pleurobema gibberum	Cumberland Pigtoe	E
	Pleurobema hanleyianum	Georgia Pigtoe	E
	Pleurobema oviforme	Tennessee Clubshell	PE
	Pleurobema perovatum	Ovate Clubshell	E
	Pleurobema plenum	Rough Pigtoe	E
	Pleurobema rubellum	Warrior Pigtoe	PS
	Pleurobema taitianum	Heavy Pigtoe	E
	Pleuronaia barnesiana	Tennessee Pigtoe	PE
	Pleuronaia dolabelloides	Slabside Pearlymussel	E
	Potamilus capax	Fat Pocketbook	E
	Ptychobranchus greenii	Triangular Kidneyshell	E
	Ptychobranchus greenii	Rayed Kidneyshell	E
	Ptychobranchus subtentum	Fluted Kidneyshell	E
	Quadrula cylindrica cylindrica	Smooth Rabbitsfoot	T
	Quadrula cylindrica strigillata	Rough Rabbitsfoot	E
	Quadrula fragosa	Winged Mapleleaf	E
	Quadrula intermedia	Cumberland Monkeyface	E
	Quadrula sparsa	Appalachian Monkeyface	E
	Simpsonaias ambigua	Salamander Mussel	PE
	Speyeria idalia	Regal Fritillary Butterfly	PE,PT
	Toxolasma cylindrellus	Pale Lilliput	E
	Venustaconcha trabalis	Tennessee Bean	E
	Villosa fabalis	Rayed Bean	E
	Villosa ortmanni	Kentucky Creekshell	PE
Non-Vascular Plants			
	Gymnoderma lineare	Rock Gnome Lichen	E

	SCIENTIFIC	COMMON_NAM	FED_STATUS
Vascular Plants			
	Agalinis decemloba	Blue Ridge False Foxglove	PS
	Apios priceana	Price's Potato-bean	T
	Arabis georgiana	Georgia Rockcress	T
	Arabis perstellata	Braun's Rock-cress	E
	Asplenium scolopendrium var. americanum	American Hart's-tongue Fern	T
	Astragalus bibullatus	Pyne's Ground Plum	E
	Clematis morefieldii	Morefield's Leather-flower	E
	Clematis socialis	Alabama Leather Flower	E
	Conradina verticillata	Cumberland Rosemary	T
	Dalea foliosa	Leafy Prairie-clover	E
	Geum radiatum	Spreading Avens	E
	Hedyotis purpurea var. montana	Mountain Bluet	E
	Helianthus verticillatus	Whorled Sunflower	E
	Helonias bullata	Swamp-pink	T
	Isotria medeoloides	Small Whorled Pogonia	T
	Leavenworthia crassa	Fleshy-fruit Gladecress	E
	Lesquerella lyrata	Lyre-leaf Bladderpod	T
	Lesquerella perforata	Spring Creek Bladderpod	E
	Liatris helleri	Heller's Blazing Star	T
	Lindera melissifolia	Pondberry	E
	Marshallia mohrii	Mohr's Barbara's Buttons	T
	Physaria globosa	Lesquereux's Mustard	E
	Pityopsis ruthii	Ruth's Golden Aster	E
	Platanthera integrilabia	White Fringeless Orchid	T
	Ptilimnium nodosum	Harperella	E
	Sagittaria secundifolia	Arrowhead	T
	Sarracenia oreophila	Green Pitcher Plant	E
	Scutellaria montana	Large-flowered Skullcap	T
	Solidago spithamaea	Blue Ridge Goldenrod	T
	Spiraea virginiana	Virginia Spiraea	T
	Torreya taxifolia	Florida Torreya	E
	Xyris tennesseensis	Yellow-eyed-grass	E

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
Alabama				
Vertebrates				
	Aneides aeneus	Green Salamander	S3	SP
	Bonasa umbellus	Ruffed Grouse	S1	GBNOS
	Carpiodes carpio	River Carpsucker	S2	CNGF
	Chondestes grammacus	Lark Sparrow	S3B	SP
	Coluber flagellum flagellum	Eastern Coachwhip	S3	SP
	Corynorhinus rafinesquii	Rafinesque's Big-eared bat	S2	SP
	Cryptobranchus alleganiensis	Hellbender	S1S2	SP
	Cyprinella caerulea	Blue Shiner	S1	SP
	Elassoma alabamae	Spring Pygmy Sunfish	S1	SP
	Erimonax monachus	Spotfin Chub	SX	SP
	Etheostoma boschungi	Slackwater Darter	S1	SP
	Etheostoma neopterum	Lollipop Darter	S1	SP
	Etheostoma nuchale	Watercress darter	S1	SP
	Etheostoma trisella	Trispot Darter	S1	SP
	Etheostoma tuscumbia	Tuscumbia Darter	S2	SP
	Etheostoma wapiti	Boulder Darter	S1	SP
	Falco peregrinus	Peregrine Falcon	SHB,S3N	SP
	Haliaeetus leucocephalus	Bald Eagle	S4B	SP
	Macrochelys temminckii	Alligator Snapping Turtle	S3	SP
	Moxostoma anisurum	Silver Redhorse	S2	CNGF
	Mustela frenata	Long-tailed Weasel	S3	SP
	Myotis austroriparius	Southeastern Bat	S2	SP
	Myotis grisescens	Gray Bat	S2	SP
	Myotis lucifugus	Little Brown Bat	S3	SP
	Myotis septentrionalis	Northern Long-eared Bat	S2	SP
	Myotis sodalis	Indiana Bat	S2	SP
	Necturus alabamensis	Black Warrior Waterdog	S1	SP
	Notropis albizonatus	Palezone Shiner	S1	SP
	Noturus eleutherus	Mountain Madtom	S1	CNGF
	Noturus exilis	Slender Madtom	S3	CNGF
	Noturus flavus	Stonecat	S1	CNGF
	Noturus miurus	Brindled Madtom	S1	CNGF
	Pandion haliaetus	Osprey	S4	SP
	Percina tanasi	Snail Darter	S1	SP
	Peucaea aestivalis	Bachman's Sparrow	S3	SP
	Picoides borealis	Red-cockaded Woodpecker	S2	SP
	Pituophis melanoleucus melanoleucus	Northern Pine Snake	S3	SP
	Plestiodon anthracinus	Coal Skink	S3	SP
	Polyodon spathula	Paddlefish	S3	SP, CNGF
	Sciurus niger	Eastern Fox Squirrel	S3S4	GA
	Speoplatyrhinus poulsoni	Alabama Cavefish	S1	SP
	Spilogale putorius	Eastern Spotted Skunk	S2S3	SP
	Sternotherus depressus	Flattened Musk Turtle	S2	SP
	Sylvilagus obscurus	Appalachian Cottontail	S1	GA
	Thryomanes bewickii bewickii	Bewick's Wren	SP	SP
	Typhlichthys subterraneus	Southern Cavefish	S3	SP
	Tyto alba	Common Barn-owl	S3	SP
	Vireo gilvus	Warbling Vireo	S1B	SP
	Zapus hudsonius	Meadow Jumping Mouse	S1	SP

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
Invertebrates				
	Actinonaias ligamentina	Mucket	S2	PSM
	Actinonaias pectorosa	Pheasantshell	SX	PSM
	Alasmidonta marginata	Elktoe	S1	PSM
	Alasmidonta viridis	Slippershell Mussel	S1	SP
	Arcidens confragosus	Rock Pocketbook	S3	PSM
	Athearnia anthonyi	Anthony's River Snail	S1	SP
	Campeloma decampi	Slender Campeloma	S1	SP
	Cumberlandia monodonta	Spectaclecase	S1	SP
	Cyclonaias tuberculata	Purple Wartyback	S5	PSM
	Cyprogenia stegaria	Fanshell	S1	SP
	Dromus dromas	Dromedary Pearlymussel	SX	SP
	Ellipsaria lineolata	Butterfly	S4	PSM
	Elliptio crassidens	Elephant-ear	S5	CHM
	Epioblasma arcaeformis	Sugarspoon	SX	PSM
	Epioblasma biemarginata	Angled Riffleshell	SX	PSM
	Epioblasma brevidens	Cumberlandian Combshell	S1	SP
	Epioblasma capsaeformis	Oyster Mussel	SX	SP
	Epioblasma florentina florentina	Yellow-blossom Pearlymussel	SX	SP
	Epioblasma florentina walkeri	Tan Riffleshell	SX	SP
	Epioblasma haysiana	Acornshell	SX	PSM
	Epioblasma lenior	Narrow Catspaw	SX	PSM
	Epioblasma metastriata	Upland Combshell	SX	SP
	Epioblasma obliquata obliquata	Purple Catspaw	SX	SP
	Epioblasma othcaloogensis	Southern Acornshell	SX	SP
	Epioblasma personata	Round Combshell	SX	PSM
	Epioblasma propinqua	Tennessee Riffleshell	SX	PSM
	Epioblasma stewardsonii	Cumberland Leafshell	SX	PSM
	Epioblasma torulosa torulosa	Tuberculed Blossom Pearlymussel	SX	SP
	Epioblasma triquetra	Snuffbox	S1	PSM
	Eurynia dilatata	Spike	S1	PSM
	Fusconaia cor	Shiny Pigtoe Pearlymussel	S1	SP
	Fusconaia cuneolus	Fine-rayed Pigtoe	S1	SP
	Fusconaia subrotunda	Longsolid	S1	PSM
	Hemistena lata	Cracking Pearlymussel	S1	SP,P1
	Lampsilis abrupta	Pink Mucket	S1	SP
	Lampsilis fasciola	Wavy-rayed Lampmussel	S2	PSM
	Lampsilis ovata	Pocketbook	S2	PSM
	Lampsilis virescens	Alabama Lampmussel	S1	SP
	Lasmigona complanata	White Heelsplitter	S2	PSM
	Lasmigona costata	Flutedshell	S2	PSM
	Lasmigona holstonia	Tennessee Heelsplitter	S1	PSM
	Lemiox rimosus	Birdwing Pearlymussel	S1	SP
	Leptodea fragilis	Fragile Papershell	S5	PSM
	Leptodea leptodon	Scaleshell	SX	SP
	Ligumia recta	Black Sandshell	S2	PSM
	Marstonia pachyta	Armored marstonia	S1	SP
	Medionidus acutissimus	Alabama Moccasinshell	S2	SP
	Medionidus conradicus	Cumberland Moccasinshell	S1	SP
	Obovaria olivaria	Hickorynut	SX	PSM
	Obovaria retusa	Ring Pink	SH	SP
	Obovaria subrotunda	Round Hickorynut	S2	PSM

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Palaemonias alabamae	Alabama Blind Cave Shrimp	S1	SP
	Plethobasus cicatricosus	White Wartyback	S1	SP
	Plethobasus cooperianus	Orange-foot Pimpleback	SX	SP
	Plethobasus cyphyus	Sheepnose	S1	SP
	Pleurobema clava	Clubshell	SX	SP
	Pleurobema cordatum	Ohio Pigtoe	S2	PSM
	Pleurobema decisum	Southern Clubshell	S2	SP
	Pleurobema georgianum	Southern Pigtoe	S1	SP
	Pleurobema oviforme	Tennessee Clubshell	S1	PSM
	Pleurobema perovatum	Ovate Clubshell	S1	SP
	Pleurobema plenum	Rough Pigtoe	S1	SP
	Pleurobema rubellum	Warrior Pigtoe	S1	SP
	Pleurobema rubrum	Pyramid Pigtoe	S1	SP
	Pleurobema sintoxia	Round Pigtoe	S1	SP
	Pleuronaia barnesiana	Tennessee Pigtoe	S1	PSM
	Pleuronaia dolabelloides	Slabside Pearlymussel	S1	SP
	Potamilus alatus	Pink Heelsplitter	S5	CHM
	Potamilus ohiensis	Pink Papershell	S3	PSM
	Ptychobranchus fasciolaris	Kidneyshell	S2	PSM
	Ptychobranchus greenii	Triangular Kidneyshell	S1	SP
	Ptychobranchus subtentum	Fluted Kidneyshell	SX	SP
	Quadrula cylindrica cylindrica	Smooth Rabbitsfoot	S1	SP
	Quadrula fragosa	Winged Mapleleaf	SNA	SP
	Quadrula intermedia	Cumberland Monkeyface	SX	SP
	Strophitus subvexus	Southern Creekmussel	S3	PSM
	Strophitus undulatus	Squawfoot	S1	PSM
	Theliderma metanevra	Monkeyface	S3	PSM
	Toxolasma cylindrellus	Pale Lilliput	S1	SP
	Toxolasma lividus	Purple Lilliput	S2	PSM
	Toxolasma parvum	Lilliput	S3	PSM
	Tritogonia verrucosa	Pistolgrip	S4	CHM
	Truncilla truncata	Deertoe	S1	PSM
	Villosa iris	Rainbow Mussel	S3	PSM
	Villosa nebulosa	Alabama Rainbow	S3	PSM
	Villosa taeniata	Painted Creekshell	S2	PSM
	Villosa vanuxemensis	Mountain Creekshell	S3	PSM
Georgia				
Vertebrates				
	Aneides aeneus	Green Salamander	S3	R
	Corynorhinus rafinesquii	Rafinesque’s Big-eared bat	S3	R
	Cryptobranchus alleganiensis	Hellbender	T	R
	Cyprinella caerulea	Blue Shiner	S2	E
	Erimystax insignis	Blotched Chub	S2	E
	Etheostoma brevirostrum	Holiday Darter	S1	E
	Etheostoma ditrema	Coldwater Darter	S1	E
	Etheostoma duryi	Black Darter	S1	R
	Etheostoma rupestre	Rock Darter	S2	R
	Etheostoma trisella	Trispot Darter	S1	E
	Etheostoma vulneratum	Wounded Darter	S1	E
	Falco peregrinus	Peregrine Falcon	S1	R
	Fundulus catenatus	Northern Studfish	S2	R
	Glyptemys muhlenbergii	Bog Turtle	S2	E

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Graptemys geographica	Map Turtle	S1	R
	Graptemys pulchra	Alabama Map Turtle	S3	R
	Gyrinophilus palleucus	Tennessee Cave Salamander	S1	T
	Haliaeetus leucocephalus	Bald Eagle	S3	T
	Hemitremia flammea	Flame Chub	S1	E
	Hybopsis amblops	Bigeye Chub	S1S2	R
	Ichthyomyzon bdellium	Ohio Lamprey	S1	R
	Macrhybopsis etnieri	Cf. M. Aestivalis	S1	E
	Moxostoma carinatum	River Redhorse	S3	R
	Moxostoma sp. 2	Sicklefin Redhorse	S1	E
	Myotis grisescens	Gray Bat	S1	E
	Myotis septentrionalis	Northern Long-eared Bat	E	T
	Notropis ariommus	Popeye Shiner	S1	E
	Notropis asperifrons	Burrhead Shiner	S2	T
	Notropis lineapunctata	Lined Chub	S2	R
	Notropis photogenis	Silver Shiner	S1	E
	Noturus munitus	Frecklebelly Madtom	S1	E
	Percina antesella	Amber Darter	S1	E
	Percina aurantiaca	Tangerine Darter	S2	E
	Percina aurolineata	Goldline Darter	S2	E
	Percina jenkinsi	Conasauga Logperch	S1	E
	Percina kusha	Bridled Darter	S1	E
	Percina lenticula	Freckled Darter	S2	E
	Percina sciera	Dusky Darter	S3	R
	Percina squamata	Olive Darter	S1	E
	Percina tanasi	Snail Darter	S1	E
	Peucaea aestivalis	Bachman's Sparrow	S2	R
	Phenacobius uranops	Stargazing Minnow	S1	T
	Plethodon petraeus	Pigeon Mountain Salamander	S2	R
	Sylvilagus obscurus	Appalachian Cottontail	S1S2	R
	Typhlichthys subterraneus	Southern Cavefish	S1	E
	Vermivora chrysoptera	Golden-winged Warbler	S1B,S2M	E
Invertebrates				
	Bombus affinis	Rusty-patched Bumble Bee	SH	E
	Cambarus cymatilis	Conasauga Blue Burrower	S1	E
	Cambarus extraneus	Chickamauga Crayfish	S2	T
	Cambarus parrishi	Hiwassee Headwaters Crayfish	S1	E
	Cambarus scotti	Chattooga River Crayfish	S2	T
	Cambarus unestami	Blackbarred Crayfish	S3	T
	Elliptio arca	Alabama Spike	S1	E
	Elliptio arctata	Delicate Spike	S2	E
	Epioblasma metastriata	Upland Combshell	SX	E
	Epioblasma othcaloogensis	Southern Acornshell	SX	E
	Gomphus consanguis	Cherokee Clubtail	S2	T
	Lampsilis altilis	Fine-lined Pocketbook	S2	T
	Medionidus acutissimus	Alabama Moccasinshell	S1	T
	Medionidus parvulus	Coosa Moccasinshell	S1	E
	Pleurobema decisum	Southern Clubshell	S1	E
	Pleurobema georgianum	Southern Pigtoe	S1	E
	Pleurobema hanleyianum	Georgia Pigtoe	S1	E
	Pleurobema perovatum	Ovate Clubshell	SH	E
	Ptychobranchus foremanianus	Rayed Kidneyshell	S1	E

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Ptychobranchus greenii	Triangular Kidneyshell	S1	E
	Strophitus connasaugaensis	Alabama Creekmussel	S1	E
Vascular Plants				
	Arabis georgiana	Georgia Rockcress	S1	T
	Aureolaria patula	Spreading False-foxglove	S1	T
	Berberis canadensis	American barberry	S1	E
	Calamagrostis porteri	Porter's Reedgrass	S1	R
	Carex biltmoreana	Biltmore Sedge	S1	T
	Coreopsis latifolia	Broad-leaved Tickseed	S1	R
	Crataegus triflora	Three-flowered Hawthorn	S1	T
	Cymophyllus fraserianus	Fraser's Sedge	S1	T
	Cypripedium acaule	Pink Lady's-slipper	S4	U
	Cypripedium parviflorum	Small Yellow Lady's-slipper	S3	R
	Cypripedium parviflorum var. pubescens	Large Yellow Lady's-slipper	S3	R
	Desmodium ochroleucum	Creamflower Tick-trefoil	S1	T
	Gentianopsis crinita	Fringed Gentian	S1	T
	Helonias bullata	Swamp-pink	S1	T
	Hydrastis canadensis	Goldenseal	S2	E
	Isotria medeoloides	Small Whorled Pogonia	S2	T
	Jeffersonia diphylla	Twinleaf	S1	R
	Leavenworthia exigua var. exigua	Glade Cress	S2	T
	Lilium michiganense	Michigan Lily	S1	R
	Lysimachia fraseri	Fraser Loosestrife	S2	R
	Marshallia mohrii	Mohr's Barbara's Buttons	S2	T
	Melanthium woodii	Ozark Bunchflower	S2	R
	Neviusia alabamensis	Alabama Snow-wreath	S1	T
	Pedicularis lanceolata	Swamp Lousewort	S1	E
	Potentilla tridentata	Three-toothed Cinquefoil	S1	E
	Sabatia capitata	Cumberland Rose Gentian	S2	R
	Sanguisorba canadensis	Canada Burnet	S1	T
	Sarracenia oreophila	Green Pitcher Plant	S1	E
	Sarracenia purpurea var. montana	Mountain Purple Pitcherplant	S1	E
	Scutellaria montana	Large-flowered Skullcap	S3	T
	Silene ovata	Ovate Catchfly	S1S2	R
	Spiraea virginiana	Virginia Spiraea	S1	T
	Spiranthes magnicamporum	Great Plains Ladies'-tresses	S1	E
	Symphyotrichum georgianum	Georgia Aster	S3	T
	Thalictrum debile	Southern Meadow-rue	S1	T
	Thaspium pinnatifidum	cutleaf meadow-parsnip	S1	E
	Torreya taxifolia	Florida Torreya	S1	E
	Trientalis borealis	Northern Starflower	S1S2	E
	Viburnum bracteatum	Arrow-wood	S1	E
	Xerophyllum asphodeloides	Eastern Turkeybeard	S1	R
	Xyris tennesseensis	Yellow-eyed-grass	S1	E
Kentucky				
Vertebrates				
	Accipiter striatus	Sharp-shinned Hawk	S3B,S4N	S
	Acipenser fulvescens	Lake Sturgeon	S1	E
	Alosa alabamae	Alabama Shad	S1	E
	Ammocrypta clara	Western Sand Darter	S1	E
	Ammodramus henslowii	Henslow's Sparrow	S3B	S
	Amphiuma tridactylum	Three-toed Amphiuma	S1	E

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	Anas clypeata	Northern shoveler	S1B	E
	Anas discors	Blue-winged Teal	S1S2B	T
	Apalone mutica mutica	Midland Smooth Softshell	S3	N
	Ardea alba	Great Egret	S2B	T
	Atractosteus spatula	Alligator Gar	S1	E
	Botaurus lentiginosus	American Bittern	SHB	H
	Bubulcus ibis	Cattle Egret	S1S2B	S
	Cemophora coccinea	Scarlet Snake	S3	S
	Certhia americana	Brown Creeper	S1S2B,S4S5N	T
	Chondestes grammacus	Lark Sparrow	S2S3B	S
	Chrysemys picta dorsalis	Southern Painted Turtle	S2	T
	Circus hudsonius	Northern Harrier	S1S2B,S4N	T
	Cistothorus stellaris	Sedge Wren	S3B	S
	Clonophis kirtlandii	Kirtland's Snake	S2	T
	Corvus ossifragus	Fish Crow	S3B	S
	Corynorhinus rafinesquii	Rafinesque’s Big-eared bat	S3	S
	Cryptobranchus alleganiensis alleganiensis	Eastern Hellbender	S2S3	S
	Cyprinella camura	Bluntface Shiner	S1	E
	Cyprinella venusta	Blacktail Shiner	S3	S
	Egretta caerulea	Little Blue Heron	S1B	E
	Elaphe guttata	Corn Snake	S3	S
	Erimystax insignis	Blotched Chub	S1	E
	Erimyzon sucetta	Lake Chubsucker	S2	T
	Esox niger	Chain Pickerel	S3	S
	Etheostoma chienense	Relict Darter	S1	E
	Etheostoma fusiforme	Swamp Darter	S1	E
	Etheostoma lemniscatum	Tuxedo Darter	S1	E
	Etheostoma lynceum	Brighteye Darter	S1	E
	Etheostoma maculatum	Spotted Darter	S2	T
	Etheostoma microlepidum	Smallscale Darter	S1	E
	Etheostoma parvipinne	Goldstripe Darter	S1	E
	Etheostoma proeliare	Cypress Darter	S2	T
	Etheostoma pyrrhogaster	Firebelly Darter	S1	E
	Etheostoma sagitta	Arrow Darter	S3	S
	Etheostoma susanae	Cumberland Darter	S1	E
	Etheostoma swaini	Gulf Darter	S1	E
	Etheostoma tecumsehi	Shawnee Darter	S2S3	S
	Eumeces inexpectatus	Southeastern Five-lined Skink	S2S3	S
	Eurycea guttolineata	Three-lined Salamander	S2	T
	Falco peregrinus	Peregrine Falcon	S1B	E
	Farancia abacura reinwardtii	Western Mud Snake	S3	S
	Fulica americana	American Coot	S1B	E
	Fundulus chrysotus	Golden Topminnow	S1	E
	Fundulus dispar	Starhead Topminnow	S1	E
	Gallinula galeata	Common Gallinule	S1S2B	T
	Haliaeetus leucocephalus	Bald Eagle	S3B,S3S4N	S
	Hemitremia flammea	Flame Chub	S1	E
	Hybognathus hayi	Cypress Minnow	S1	E
	Hyla avivoca	Bird-voiced Treefrog	S3S4	N
	Hyla cinerea	Green Treefrog	S4S5	N
	Hyla gratiosa	Barking Treefrog	S3S4	N
	Hyla versicolor	Gray Treefrog	S2S3	S

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Ichthyomyzon castaneus	Chestnut Lamprey	S2	S
	Ichthyomyzon gagei	Southern Brook Lamprey	S1	E
	Ichthyomyzon greeleyi	Mountain Brook Lamprey	S2	T
	Ictinia mississippiensis	Mississippi Kite	S2S3B	S
	Ictiobus niger	Black Buffalo	S3	S
	Ixobrychus exilis	Least Bittern	S1S2B	T
	Lampetra appendix	American Brook Lamprey	S2	T
	Lampetra sp. 1	A brook lamprey	S1	E
	Lampropeltis elapsoides	Scarlet Kingsnake	S1	E
	Lepomis marginatus	Dollar Sunfish	S1	E
	Lepomis miniatus	Redspotted Sunfish	S2	T
	Lithobates blairi	Plains Leopard Frog	S1	E
	Lophodytes cucullatus	Hooded Merganser	S2B,S3S4N	T
	Macrochelys temminckii	Alligator Snapping Turtle	S1	E
	Menidia beryllina	Inland Silverside	S2	T
	Moxostoma poecilurum	Blacktail Redhorse	S1	E
	Myotis austroriparius	Southeastern Bat	S3	S
	Myotis grisescens	Gray Bat	S2	T
	Myotis leibii	Eastern small-footed bat	S2	T
	Myotis septentrionalis	Northern Long-eared Bat	S1	E
	Myotis sodalis	Indiana Bat	S1S2	E
	Nerodia cyclopion	Mississippi Green Water Snake	S1	E
	Nerodia fasciata confluens	Broad-banded Water Snake	S1	E
	Notropis albizonatus	Palezone Shiner	S1	E
	Notropis amnis	Pallid Shiner	S1	E
	Notropis maculatus	Taillight Shiner	S2S3	T
	Noturus exilis	Slender Madtom	S1	E
	Noturus hildebrandi	Least Madtom	S1	E
	Noturus phaeus	Brown Madtom	S1	E
	Nyctanassa violacea	Yellow-crowned Night-heron	S2B	T
	Nycticorax nycticorax	Black-crowned Night-heron	S1S2B	T
	Ophisaurus attenuatus longicaudus	Eastern Slender Glass Lizard	S2	T
	Pandion haliaetus	Osprey	S3S4B	S
	Percina macrocephala	Longhead Darter	S1	E
	Percopsis omiscomaycus	Trout-perch	S3	S
	Perimyotis subflavus	Tricolored Bat	S2	T
	Peromyscus gossypinus	Cotton Mouse	S2	T
	Peucaea aestivalis	Bachman's Sparrow	S1B	E
	Phalacrocorax auritus	Double-crested Cormorant	S2B	S
	Phenacobius uranops	Stargazing Minnow	S2S3	S
	Phoxinus cumberlandensis	Blackside Dace	S2	T
	Pituophis melanoleucus melanoleucus	Northern Pine Snake	S1	E
	Plestiodon anthracinus	Coal Skink	S1	E
	Podilymbus podiceps	Pied-billed Grebe	S1B,S4N	E
	Rallus elegans	King Rail	S1B	E
	Rana areolata circulosa	Northern Crawfish Frog	S3	S
	Riparia riparia	Bank Swallow	S3B	S
	Scaphirhynchus albus	Pallid Sturgeon	S1	E
	Sistrurus miliarius streckeri	Western Pigmy Rattlesnake	S1	E
	Sorex cinereus	Common Shrew	S3	S
	Sterna antillarum athalassos	Interior Least Tern	S1S2B	E
	Thamnophis proximus	Western Ribbon Snake	S1S2	T

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Thamnophis proximus proximus	Western Ribbon Snake	S1	E
	Thamnophis sauritus sauritus	Common Ribbon Snake	S3	S
	Thoburnia atripinnis	Blackfin Sucker	S2	S
	Thryomanes bewickii	Bewick's Wren	SHB	H
	Typhlichthys subterraneus	Southern Cavefish	S2S3	S
	Tyto alba	Common Barn-owl	S3	S
	Umbra limi	Central Mudminnow	S2S3	T
	Vireo bellii	Bell's Vireo	S2S3B	S
Invertebrates				
	Alasmidonta marginata	Elktoe	S2	T
	Allocapnia cunninghami	Karst Snowfly	S1S2	T
	Amphiagrion saucium	Eastern Red Damsel	S1S2	E
	Anodontoides denigratus	Cumberland Papershell	S1	E
	Arigomphus maxwelli	Bayou Clubtail	S1S2	T
	Barbicambarus cornutus	Bottlebrush Crayfish	S2S3	S
	Batriasymmodes quisnamus	A Cave Obligate Beetle	SH	H
	Batrisodes henroti	ant loving beetle	SH	H
	Cambarellus shufeldtii	Cajun Dwarf Crayfish	S2S3	S
	Cambarus friaufi	Hairy Crayfish	S3S4	S
	Crangonyx longidactylus	An Amphipod	S2	T
	Cumberlandia monodonta	Spectaclecase	S1	E
	Cyprogenia stegaria	Fanshell	S1	E
	Dromus dromas	Dromedary Pearlymussel	S1	E
	Epioblasma florentina walkeri	Tan Riffleshell	S1	E
	Epioblasma obliquata obliquata	Purple Catspaw	S1	E
	Epioblasma torulosa rangiana	Northern Riffleshell	S1	E
	Epioblasma triquetra	Snuffbox	S1	E
	Euphyes dukesi	Dukes' Skipper	S2	T
	Fumonelix wetherbyi	Clifty Covert	S2	S
	Fusconaia subrotunda	Longsolid	S3	S
	Helicodiscus notius specus	A Land Snail	S1	T
	Hemistena lata	Cracking Pearlymussel	SX	X
	Kleptochthonius microphthalmus	A Cave Obligate Pseudoscorpion	SH	H
	Lampsilis abrupta	Pink Mucket	S1	E
	Lampsilis ovata	Pocketbook	S1	E
	Leaunio pataecus	Dwarf Rainbow	S1	E
	Leptoxis praerosa	Onyx Rocksnail	S3S4	S
	Lioplax sulculosa	Furrowed Lioplax	S3S4	S
	Lithasia armigera	Armored Rocksnail	S3S4	S
	Lithasia salebrosa	Muddy Rocksnail	S2S4	S
	Lithasia verrucosa	Varicose Rocksnail	S3S4	S
	Nicrophorus americanus	American Burying Beetle	SX	X
	Obovaria retusa	Ring Pink	S1	E
	Orconectes burri	Blood River Crayfish	S2	T
	Orconectes lancifer	Shrimp Crayfish	S1	E
	Orconectes palmeri palmeri	Gray-Speckled Crayfish	S1	E
	Orconectes pellucidus	Mammoth Cave Crayfish	S3	S
	Orconectes ronaldi	Mud River Crayfish	S2S3	N
	Palaemonias ganteri	Mammoth Cave Shrimp	S1	E
	Papaipema sp. 5	Rare Cain Borer Moth	S1S2	T
	Papaipema speciosissima	Osmunda Borer Moth	S2	T
	Pegias fabula	Little-wing Pearlymussel	S1	E

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Plethobasus cooperianus	Orange-foot Pimpleback	S1	E
	Plethobasus cyphyus	Sheepnose	S1	E
	Pleurobema clava	Clubshell	S1	E
	Pleurobema oviforme	Tennessee Clubshell	S1	E
	Pleurobema plenum	Rough Pigtoe	S1	E
	Pleurobema rubrum	Pyramid Pigtoe	S1	E
	Pleurocera alveare	Rugged Hornsnail	S3S4	S
	Pleurocera curta	Shortspire Hornsnail	S2	S
	Pleuronaia dolabelloides	Slabside Pearlymussel	SX	X
	Poanes viator		S1	E
	Potamilus capax	Fat Pocketbook	S2	T
	Potamilus purpuratus	Bleufer	S1	E
	Procambarus viaeviridis	Vernal Crayfish	S1S2	T
	Pseudanophthalmus calcareus	Limestone Cave Beetle	S1	E
	Pseudanophthalmus pubescens intrepidus	A Cave Beetle	S1S2	T
	Pseudanophthalmus transfluvialis	A Cave Obligate Ground Beetle	SH	H
	Quadrula cylindrica cylindrica	Smooth Rabbitsfoot	S2	T
	Rabdotus dealbatus	Whitewashed Rabdotus	S1S2	T
	Satyrium favonius ontario	Northern Hairstreak	S2	S
	Scoterpes copei	A Cave Obligate Millipede	S3S4	N
	Stygobromus vitreus	An Amphipod	S1	S
	Stylurus notatus	Elusive Clubtail	S1	E
	Toxolasma lividus	Purple Lilliput	S1	E
	Toxolasma texasense	Texas Lilliput	S2	T
	Triodopsis multilineata	Striped Whitelip Snail	S2	T
	Villosa ortmanni	Kentucky Creekshell	S1S2	E
	Villosa vanuxemensis	Mountain Creekshell	S2	T
	Phaeophyscia leana	Lea's Bog Lichen	S1?	E
Vascular Plants				
	Adiantum capillus-veneris	Southern Maidenhair Fern	S2S3	T
	Aesculus pavia	Red Buckeye	S2S3	T
	Agalinis auriculata	Earleaf Foxglove	S1	E
	Amianthium muscitoxicum	Fly Poison	S1	E
	Amsonia tabernaemontana var. gattingeri	A Blue-star	S2?	N
	Anagallis minima	Chaffweed	S2	S
	Apios priceana	Price's Potato-bean	S1	E
	Aralia nudicaulis	Wild Sarsaparilla	S2S3	T
	Armoracia lacustris	Lake-cress	S1S2	T
	Asclepias hirtella	Green Milkweed	S2	T
	Aureolaria patula	Spreading False-foxglove	S3	S
	Baptisia aberrans	Eastern Prairie Blue Wild Indigo	S1	E
	Baptisia bracteata var. leucophaea	Cream Wild Indigo	S3	S
	Baptisia tinctoria	Yellow Wild-indigo	S1S2	T
	Bartonia virginica	Screwstem	S2	T
	Berchemia scandens	Supple-jack	S1S2	T
	Cabomba caroliniana	Carolina Fanwort	S2	T
	Callicarpa americana	American Beautyberry	S1	E
	Carex alata	Broadwing Sedge	S1S2	T
	Carex atlantica ssp. capillacea	Howe Sedge	S1S2	E
	Carex aureolensis	Southern Frank's sedge	S1?	T
	Carex corrugata	Prune-fruit sedge	S3?	S
	Carex crawei	Sedge	S3	S

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Carex crebriflora	Sedge	S1?	E
	Carex decomposita	Epiphytic Sedge	S2	T
	Carex gigantea	Large Sedge	S1S2	E
	Carex reniformis	Sedge	S1?	E
	Carex seorsa	Weak Stellate Sedge	S2	T
	Carex superata	Limestone Forest Sedge	S2S3	S
	Carex timida	Timid Sedge	S2	T
	Carex venusta	Dark Green Sedge	S1	E
	Carya aquatica	Water Hickory	S2S3	T
	Carya carolinae-septentrionalis	Southern Shagbark Hickory	S3S4	N
	Cayaponia quinqueloba	Five-lobe Cayaponia	S1?	E
	Ceanothus herbaceus	Prairie Redroot	S2	T
	Centrosema virginianum	Coastal Butterfly-pea	S2S3	T
	Chelone obliqua var. speciosa	Rose Turtlehead	S3	S
	Clematis catesbyana	satincurls	S1	E
	Clematis crispa	Blue Jasmine Leather-flower	S2	T
	Collinsonia verticillata	Whorled Horsebalm	S1?	E
	Dalea candida	White Prairie-clover	S3	S
	Dalea purpurea	Purple Prairie-clover	S3?	S
	Decodon verticillatus	Water-willow	S3?	N
	Delphinium carolinianum	Carolina Larkspur	S1S2	T
	Desmodium ochroleucum	Creamflower Tick-trefoil	S1	E
	Diarrhena obovata	Beak Grass	S2?	N
	Didiplis diandra	Water-purslane	S1S2	E
	Dodecatheon frenchii	French's Shootingstar	S3	S
	Draba cuneifolia	Wedge-leaf Whitlow-grass	S1	E
	Echinodorus berteroi	Burhead	S2	T
	Echinodorus tenellus	Dwarf Burhead	S1	E
	Eryngium integrifolium	Button Snakeroot	S1	E
	Erysimum capitatum var. capitatum	Western Wallflower	S1?	E
	Euphorbia mercurialina	Mercury Spurge	S1S2	T
	Eurybia hemispherica	Tennessee Aster	S1	E
	Fimbristylis perpusilla	Harper's Fimbristylis	S1?	S
	Fimbristylis puberula	Hairy Fimbristylis	S2	T
	Forestiera ligustrina	Upland Swamp Privet	S2S3	T
	Gentiana puberulenta	Downy Gentian	S1	E
	Glandularia canadensis	Rose Vervain	S1?	E
	Gleditsia aquatica	Water Locust	S3?	S
	Gratiola pilosa	Shaggy Hedgehyssop	S2	T
	Gratiola quartermaniae	Quarterman's Hedge-hyssop	S1	E
	Gymnopogon ambiguus	Broadleaf Beardgrass	S2S3	S
	Halesia carolina	Carolina Silverbell	S1S2	E
	Halesia tetraptera var. tetraptera	Common Silverbell	S1S2	E
	Hedeoma hispida	Rough Pennyroyal	S2	T
	Helianthus eggertii	Eggert's Sunflower	S2	T
	Heteranthera dubia	Grassleaf Mud-plantain	S3	S
	Heteranthera limosa	Smaller Mud-plantain	S2S3	S
	Heterotheca subaxillaris var. latifolia	Broad-leaf Golden-aster	S2	T
	Hieracium longipilum	Hairy Hawkweed	S2	T
	Hydrocotyle ranunculoides	Floating Pennywort	S1S2	E
	Hydrolea ovata	Hydrolea	S1	E
	Hydrolea uniflora	One-flower Fiddleleaf	S1	E

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Hydrophyllum virginianum var. virginianum	Eastern Waterleaf	S2	T
	Iris brevicaulis	Lamance Iris	S1S2	T
	Iris fulva	Red Iris	S1	E
	Isoetes butleri	Butler's Quillwort	S1	E
	Isoetes melanopoda	Blackfoot Quillwort	S1	E
	Juglans cinerea	Butternut	S2S3	T
	Juncus filipendulus	Plain's Rush	S2?	T
	Leavenworthia torulosa	Necklace Glade-cress	S2	T
	Lespedeza capitata	Round-head Bush-clover	S3	S
	Liatris cylindracea	Slender Blazing-star	S2S3	T
	Lilium michiganense	Michigan Lily	S4?	N
	Lilium superbum	Turk's Cap Lily	S1S2	T
	Limnobium spongia	American Frog's-bit	S2S3	T
	Lobelia nuttallii	Nuttall's Lobelia	S2	T
	Ludwigia hirtella	False Looestrife	S1	E
	Lycopodiella appressa	Southern Bog Clubmoss	S1	E
	Lysimachia terrestris	Swamp Loosestrife	S1	E
	Malus angustifolia	Southern Crabapple	S3S4	N
	Malus ioensis	Iowa Crabapple	S2?	S
	Malvastrum hispidum	Hispid Falsemallow	S2?	T
	Matelea carolinensis	Carolina Anglepod	S1?	E
	Melanthera nivea	Snow Squarestem	S3?	S
	Melanthium virginicum	Bunchflower	S1	E
	Melanthium woodii	Ozark Bunchflower	S2	T
	Muhlenbergia cuspidata	Plains Muhlenbergia	S2	T
	Muhlenbergia glabrifloris	Muhly	S2S3	S
	Myriophyllum heterophyllum	Broadleaf Water Milfoil	S3?	S
	Najas gracillima	Naiad	S2S3	S
	Nemophila aphylla	Nemophila	S2?	T
	Oenothera linifolia	Sundrops	S1S2	E
	Oenothera perennis	Small Sundrops	S1S2	E
	Oenothera triloba	Sundrops	S1S2	T
	Oldenlandia uniflora	Oldenlandia	S1	E
	Onosmodium hispidissimum	Hairy False Gromwell	S2	E
	Onosmodium molle ssp. occidentale	Western False Gromwell	S1	E
	Orbexilum onobrychis	Lanceleaf Scurfpea	S3?	N
	Packera paupercula var. paupercula	Balsam Ragwort	S2?	T
	Paspalum boscianum	Bull-grass	S2S3	S
	Perideridia americana	Perideridia	S2	T
	Phacelia ranunculacea	Blue Scorpion-weed	S3	S
	Phemeranthus calcaricus	Limestone Fame-flower	S1	E
	Philadelphus inodorus	Mock-orange	S1S2	T
	Philadelphus pubescens	Hoary Mock-orange	S1	E
	Polygala cruciata	Crossleaf Milkwort	S1	E
	Polymnia laevigata	Tennessee Leafcup	S1S2	E
	Prenanthes aspera	Rough Rattlesnake-root	S1	E
	Prenanthes crepidinea	Nodding Rattlesnake-root	S3	S
	Ptilimnium capillaceum	Hair-like Mock Bishop-weed	S1S2	T
	Ptilimnium costatum	Eastern Mock Bishop's-weed	S1?	E
	Ptilimnium nuttallii	Nuttall's Mock Bishop's-weed	S1S2	E
	Quercus texana	Nuttall's Oak	S2S3	T
	Rhododendron canescens	Hoary Azalea	S1	E

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Rhynchosia tomentosa	Hairy Snoutbean	S1S2	E
	Rudbeckia subtomentosa	Sweet Coneflower	S1	E
	Sabatia campanulata	Slender Marsh Pink	S1	E
	Sagittaria graminea	Grassleaf Arrowhead	S1S2	T
	Sagittaria platyphylla	Ovate-leaved Arrowhead	S1	E
	Schoenoplectus hallii	Hall's Bulrush	S1	E
	Silene ovata	Ovate Catchfly	S1	E
	Silphium integrifolium	Rosinweed	S3S4	N
	Silphium laciniatum	Compass-plant	S2	T
	Silphium pinnatifidum	Prairie-dock	S3	S
	Solidago buckleyi	Buckley's Goldenrod	S2S3	S
	Solidago curtisii	Curtis' Goldenrod	S3	S
	Solidago puberula	Downy Goldenrod	S2	S
	Sphenopholis pensylvanica	Swamp Wedgescale	S1S2	S
	Spiranthes magnicamporum	Great Plains Ladies'-tresses	S2	T
	Sporobolus clandestinus	Rough Dropseed	S2S3	T
	Stellaria longifolia	Longleaf Stitchwort	S2S3	S
	Styrax grandifolius	Bigleaf Snowbell	S1S2	E
	Symphyotrichum pratense	Barrens Silky Aster	S3	S
	Symphyotrichum priceae	White Heath Aster	S1	E
	Symphyotrichum puniceum var. puniceum	Swamp Aster	S2S3	T
	Trepocarpus aethusae	Trepocarpus	S3	S
	Trichomanes boschianum	Appalachian Bristle Fern	S3S4	N
	Trifolium reflexum	Buffalo Clover	S1S2	E
	Trillium pusillum	Least Trillium	S1	E
	Ulmus serotina	September Elm	S3	S
	Utricularia macrorhiza	Greater Bladder-wort	S1	E
	Viburnum molle	Kentucky Viburnum	S3?	S
	Viburnum nudum	Possum-haw Viburnum	S1	E
	Viola egglestonii	Eggleston's Violet	S3	S
	Vitis rupestris	Sand Grape	S2	T
	Zizaniopsis miliacea	Southern Wildrice	S1S2	T
Mississippi				
Vertebrates				
	Aneides aeneus	Green Salamander	S1	LE
	Chrosomus erythrogaster	Southern Redbelly Dace	S2	LE
	Cryptobranchus alleganiensis	Hellbender	S1	LE
	Crystallaria asprella	Crystal Darter	S1	LE
	Eurycea lucifuga	Cave Salamander	S1	LE
	Graptemys nigrinoda	Black-knobbed Map Turtle	S2	LE
	Graptemys oculifera	Ringed Map Turtle	S2	LE
	Gyrinophilus porphyriticus	Spring Salamander	S1	LE
	Myotis grisescens	Gray Bat	S1	LE
	Myotis sodalis	Indiana Bat	S1B	LE
	Notropis boops	Bigeye Shiner	S1	LE
	Noturus munitus	Frecklebelly Madtom	S2	LE
	Noturus stigmosus	Northern Madtom	S1	LE
	Phenacobius mirabilis	Suckermouth Minnow	S1	LE
	Picoides borealis	Red-cockaded Woodpecker	S1	LE
	Ursus americanus luteolus	Louisiana Black Bear	S1	LE

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
Invertebrates				
	Cyclonaias tuberculata	Purple Wartyback	S1	LE
	Epioblasma penita	Southern Combshell	S1	LE
	Lampsilis perovalis	Orange-nacre Mucket	S1	LE
	Medionidus acutissimus	Alabama Moccasinshell	S1	LE
	Neonympha mitchellii	Mitchell's Satyr	S1	LE
	Nicrophorus americanus	American Burying Beetle	SX	LE
	Pleurobema curtum	Black Clubshell	SX	LE
	Pleurobema perovatum	Ovate Clubshell	S1	LE
	Pleurobema taitianum	Heavy Pigtoe	SX	LE
	Ptychobranchus fasciolaris	Kidneyshell	S1	LE
North Carolina				
Vertebrates				
	Aegolius acadicus	Northern Saw-whet Owl	S2B,S2N	T
	Ambystoma talpoideum	Mole Salamander	S2S3	SC
	Catharus ustulatus	Swainson's Thrush	S1B,S5N	SR
	Clinostomus funduloides ssp. 1	Smoky Dace	S2	SC
	Coccyzus erythropthalmus	Black-billed Cuckoo	S2B	SR
	Corynorhinus townsendii virginianus	Virginia Big-eared Bat	S1	E
	Cottus carolinae	Banded Sculpin	S1	SC
	Crotalus horridus	Timber Rattlesnake	S3	SC
	Cryptobranchus alleganiensis	Hellbender	S3	SC
	Cryptobranchus alleganiensis alleganiensis	Eastern Hellbender	S3	SC
	Desmognathus aeneus	Seepage Salamander	S3	WL
	Desmognathus organi	Northern Pygmy Salamander	S2	SR
	Desmognathus wrighti	Southern Pygmy Salamander	S2S3	SR
	Empidonax alnorum	Alder Flycatcher	S2B	SR
	Erimystax insignis	Blotched Chub	S2	SR
	Eurycea junaluska	Junaluska Salamander	S1S2	T
	Eurycea longicauda longicauda	Longtail Salamander	S1S2	SC
	Eurycea quadridigitata	Silver-bellied Dwarf Salamander	S1	SC
	Falco peregrinus	Peregrine Falcon	S1B,S2N	E
	Glaucomys sabrinus coloratus	Carolina Northern Flying Squirrel	S2	E
	Glyptemys muhlenbergii	Bog Turtle	S2	T
	Haliaeetus leucocephalus	Bald Eagle	S3B,S3N	T
	Hemidactylium scutatum	Four-toed Salamander	S3	SC
	Ichthyomyzon bdellium	Ohio Lamprey	S1	SC
	Loxia curvirostra	Red Crossbill	S3B,S3N	SC
	Microtus chrotorrhinus carolinensis	Southern Rock Vole	S3	SC
	Moxostoma sp. 2	Sicklefin Redhorse	S2	T
	Mustela nivalis	Least Weasel	S2	SR
	Myotis austroriparius	Southeastern Bat	S2	SC
	Myotis leibii	Eastern small-footed bat	S2	SC
	Myotis lucifugus	Little Brown Bat	S3	SR
	Myotis septentrionalis	Northern Long-eared Bat	S2	T
	Myotis sodalis	Indiana Bat	S1S2	E
	Necturus maculosus	Mudpuppy	S1	SC
	Neotoma magister	Allegheny Woodrat	S2S3	SC
	Percina squamata	Olive Darter	S2	SC
	Perimyotis subflavus	Tricolored Bat	S3	SR
	Pituophis melanoleucus melanoleucus	Northern Pine Snake	S2	T
	Plethodon aureolus	Tellico Salamander	S2?	SR

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Plethodon chattahoochee	Chattahoochee slimy salamander	S1?	SR
	Plethodon welleri	Weller's Salamander	S2	SC
	Poecile atricapilla	Black-capped Chickadee	S3	SC
	Pooecetes gramineus	Vesper Sparrow	S2B,S2N	SC
	Pseudacris brachyphona	Mountain Chorus Frog	S2	SC
	Setophaga cerulea	Cerulean Warbler	S2B	SC
	Setophaga coronata	yellow-rumped warbler	S1B,S5N	SR
	Setophaga magnolia	Magnolia Warbler	S2B	SR
	Sphyrapicus varius	Yellow-bellied Sapsucker	S2S3B,S5N	SC
	Sternotherus minor	Stripeneck Musk Turtle	S1	SC
	Sylvilagus obscurus	Appalachian Cottontail	S3	SR
	Thryomanes bewickii altus	Appalachian Bewick's Wren	SXB	E
	Vermivora chrysoptera	Golden-winged Warbler	S2S3B	SC
	Vermivora pinus	Blue Winged Warbler	S2B	SR
	Zapus hudsonius	Meadow Jumping Mouse	S3	WL
Invertebrates				
	Anguispira strongylodes	Southeastern Tigersnail	S2S3	SR
	Appalachina sayana	Spike-lip Crater Snail	S2	SR
	Callophrys irus	Frosted Elfin	S2	SR
	Cambarus brimleyorum	Valley River Crayfish	S3	E
	Cambarus eeseeohensis	Grandfather Mountain Crayfish	S1	E
	Cambarus hiwasseensis	Hiwassee Crayfish	S3S4	WL
	Cambarus parrishi	Hiwassee Headwaters Crayfish	S1	SC
	Discus bryanti	Saw-tooth Disc	S2	SC
	Elimia christyi	Christy's Elimia	S1	E
	Elimia interrupta	Knotty Elimia	SNA	E
	Erora laeta	Early Hairstreak	S2S3	SR
	Euphydryas phaeton	Baltimore	S2	SR
	Eurynia dilatata	Spike	S2	SC
	Fusconaia subrotunda	Longsolid	S1	E
	Glyphyalinia vanattai	Honey Glyph	S1	SC
	Idia majoralis	Greater Idia Moth	S1S3	SR
	Lacanobia grandis	Grand Arches Moth	S1S2	SR
	Lampsilis fasciola	Wavy-rayed Lampmussel	S2	SC
	Mesodon andrewsae	Balsam Globe	S2S3	SR
	Mesodon subpalliatus	Velvet Covert	S2S3	SC
	Nesticus mimus	A Cave Spider	S2?	SR
	Nesticus sheari	A Cave Spider	S2?	SR
	Paravitrea andrewsae	High Mountain Supercoil	S2	SC
	Paravitrea multidentata	Dentate Supercoil	S2S3	SR
	Paravitrea umbilicaris	Open Supercoil	S2	SC
	Pleurobema oviforme	Tennessee Clubshell	S1	E
	Pleuronaia barnesiana	Tennessee Pigtoe	S1	E
	Polygonia progne	Gray Comma	S1	SR
	Speyeria idalia	Regal Fritillary Butterfly	SX	SR
	Vaejovis carolinianus	Carolina Scorpion	S2?	WL
	Ventridens coelaxis	Bidentate Dome	S3?	SC
	Ventridens decussatus	Crossed Dome	S3?	SR
	Ventridens lawae	Rounded Dome	S2S3	SR
	Ventridens suppressus	Flat Dome Snail	S1S2	SR
	Villosa iris	Rainbow Mussel	S2	T
	Villosa vanuxemensis	Mountain Creekshell	S1?	T

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Non-Vascular Plants				
	Gymnoderma lineare	Rock Gnome Lichen	S3	E
	Homalia trichomanoides	Lime Homalia	S1	SR-P
	Porella wataugensis	Liverwort	S1	SR-L
	Rockefellera crossophylla	Old Gray Crosslobes	S2	SR-T
Vascular Plants				
	Abies fraseri	Fraser Fir	S2	WL
	Arethusa bulbosa	Bog-rose	S1	E
	Buchnera americana	Bluehearts	S1	E
	Carex leptonervia	Sedge	S3	WL
	Carex oligosperma	Few-seeded Sedge	S1	E
	Carex projecta	Sedge	S1	SR-P
	Coeloglossum viride var. virescens	American Frog Orchid	S1	E
	Dichanthelium annulum	Witchgrass	S1	SR-P
	Dryopteris cristata	crested woodfern	S3	WL
	Epilobium ciliatum	Willow-herb	S2	SR-P
	Frasera caroliniensis	American Columbo	S2S3	SR-P
	Geum aleppicum	Yellow Avens	S1	E
	Geum geniculatum	Bent Avens	S1S2	SC-V
	Geum laciniatum var. trichocarpum	Rough Avens	S1	E
	Geum radiatum	Spreading Avens	S2	E
	Glyceria nubigena	Smoky Mountain Manna-grass	S2	SR-L
	Hedyotis purpurea var. montana	Mountain Bluet	S2	E
	Huperzia appalachiana	Appalachian Fir-clubmoss	S3	WL
	Hypericum mitchellianum	Blue Ridge St. John's-wort	S2S3	WL
	Juglans cinerea	Butternut	S2S3	WL
	Juncus caesariensis	New Jersey Rush	S1	E
	Liatris helleri	Heller's Blazing Star	S2	T
	Lilium grayi	Gray's Lily	S1S2	T
	Muhlenbergia glomerata	Muhly	S1	SC-V
	Orbexilum pedunculatum	Sampson's Snakeroot	S1	SR-P
	Orbexilum pedunculatum var. pedunculatum	Sampson's Snakeroot	S1	E
	Platanthera integrilabia	White Fringeless Orchid	SH	SC-H
	Rhodiola rosea	Roseroot Stonecrop	SH	E
	Sarracenia oreophila	Green Pitcher Plant	S1	E
	Shortia galacifolia var. galacifolia	Southern Shortia	S2	SC-V
	Solidago spithamaea	Blue Ridge Goldenrod	S2	T
	Sporobolus heterolepis	Northern Dropseed	S1	T
	Stewartia ovata	Mountain Camellia	S2	SR-P
	Trichophorum cespitosum	Tufted Clubrush	S2S3	SR-D
	Vaccinium macrocarpon	Large Cranberry	S2	T
Tennessee				
Vertebrates				
	Acipenser fulvescens	Lake Sturgeon	S1	E
	Ambystoma barbouri	Streamside Salamander	S2	E
	Ammocrypta beani	Naked Sand Darter	S2	D
	Ammocrypta clara	Western Sand Darter	S1	T
	Ammocrypta vivax	Scaly Sand Darter	S2	D
	Ammodramus henslowii	Henslow's Sparrow	S1B	T
	Aquila chrysaetos	Golden Eagle	S1	D
	Atractosteus spatula	Alligator Gar	S1	D
	Carpiodes velifer	Highfin Carpsucker	S2S3	D

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Chrosomus saylori	Laurel Dace	S1	E
	Chrosomus tennesseensis	Tennessee Dace	S3	D
	Clinostomus funduloides ssp. 1	Smoky Dace	S1S2	D
	Corynorhinus rafinesquii	Rafinesque's Big-eared bat	S3	D
	Corynorhinus townsendii virginianus	Virginia Big-eared Bat	S1	E
	Cryptobranchus alleganiensis	Hellbender	S3	E
	Cycleptus elongatus	Blue Sucker	S2	T
	Cyprinella caerulea	Blue Shiner	S1	T
	Desmognathus abditus	Cumberland Dusky Salamander	S2S3	D
	Desmognathus aeneus	Seepage Salamander	S2	D
	Desmognathus welteri	Black Mountain Salamander	S3	D
	Desmognathus wrighti	Southern Pygmy Salamander	S2S3	D
	Egretta caerulea	Little Blue Heron	S2B,S3N	D
	Erimonax monachus	Spotfin Chub	S2	T
	Erimystax cahni	Slender Chub	S1	T
	Etheostoma akatulo	Bluemask Darter	S1	E
	Etheostoma aquali	Coppercheek Darter	S2S3	T
	Etheostoma baileyi	Emerald Darter	S2	D
	Etheostoma barbouri	Teardrop Darter	S2	D
	Etheostoma barrenense	Splendid Darter	S3	D
	Etheostoma bellum	Orangefin Darter	S3	D
	Etheostoma boschungi	Slackwater Darter	S1	T
	Etheostoma brevirostrum	Holiday Darter	S1	T
	Etheostoma cinereum	Ashy Darter	S2S3	E
	Etheostoma corona	Crown Darter	S1S2	E
	Etheostoma denoncourti	Golden Darter	S2	D
	Etheostoma ditrema	Coldwater Darter	S1	T
	Etheostoma forbesi	Barrens Darter	S1	E
	Etheostoma gutselli	Tuckasegee Darter	S1	E
	Etheostoma lemniscatum	Tuxedo Darter	S1	E
	Etheostoma luteovinctum	Redband Darter	S4	D
	Etheostoma marmorpinnum	Marbled Darter	S1	E
	Etheostoma microlepidum	Smallscale Darter	S2	D
	Etheostoma neopterum	Lollipop Darter	S1S2	D
	Etheostoma olivaceum	Sooty Darter	S3	D
	Etheostoma pseudovulatum	Egg-mimic Darter	S1	E
	Etheostoma pyrrhogaster	Firebelly Darter	S2	D
	Etheostoma sagitta	Arrow Darter	S2	D
	Etheostoma sitikuense	Citico Darter	S1	E
	Etheostoma striatulum	Striated Darter	S1	T
	Etheostoma susanae	Cumberland Darter	S1	E
	Etheostoma tippecanoe	Tippecanoe Darter	S1S2	D
	Etheostoma trisella	Trispot Darter	S1	T
	Etheostoma vulneratum	Wounded Darter	S2S3	D
	Etheostoma wapiti	Boulder Darter	S1	E
	Eurycea junaluska	Junaluska Salamander	S2	D
	Fundulus chrysotus	Golden Topminnow	S1S2	D
	Fundulus julisia	Barrens Topminnow	S1	E
	Glaucomys sabrinus coloratus	Carolina Northern Flying Squirrel	S1S2	E
	Glyptemys muhlenbergii	Bog Turtle	S1	T
	Gyrinophilus gulolineatus	Berry Cave Salamander	S1	T
	Gyrinophilus palleucus	Tennessee Cave Salamander	S2	T

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Haliaeetus leucocephalus	Bald Eagle		D
	Hemidactylium scutatum	Four-toed Salamander	S3	D
	Hemitremia flammea	Flame Chub	S3	D
	Ichthyomyzon gagei	Southern Brook Lamprey	S1	D
	Ichthyomyzon unicuspis	Silver Lamprey	S2	D
	Ixobrychus exilis	Least Bittern	S2B	D
	Limnothlypis swainsonii	Swainson's Warbler	S3	D
	Macrhybopsis etnieri	Cf. M. Aestivalis	S1	E
	Macrhybopsis gelida	Sturgeon Chub	S1	D
	Macrhybopsis meeki	Sicklefin Chub	S2	D
	Macrochelys temminckii	Alligator Snapping Turtle	S2S3	T
	Microtus chrotorrhinus carolinensis	Southern Rock Vole	S2	D
	Myotis grisescens	Gray Bat	S2	E
	Myotis leibii	Eastern small-footed bat	S2S3	D
	Myotis lucifugus	Little Brown Bat	S3	T
	Myotis septentrionalis	Northern Long-eared Bat	S1S2	T
	Myotis sodalis	Indiana Bat	S1	E
	Neotoma floridana haematoreia	Southern Appalachian Woodrat	S2	D
	Neotoma floridana illinoensis	Eastern Woodrat	S3	D
	Neotoma magister	Allegheny Woodrat	S3	D
	Nerodia cyclopion	Mississippi Green Water Snake	S2	D
	Notropis buccatus	Silverjaw Minnow	S1	E
	Notropis dorsalis	Bigmouth Shiner	S1	D
	Notropis lineapunctata	Lined Chub	S1	D
	Notropis rupestris	Bedrock Shiner	S2	D
	Noturus baileyi	Smoky Madtom	S1	E
	Noturus crypticus	Chucky Madtom	S1	E
	Noturus fasciatus	Saddled Madtom	S2	T
	Noturus flavipinnis	Yellowfin Madtom	S1	T
	Noturus munitus	Frecklebelly Madtom	S1	T
	Noturus stanauli	Pygmy Madtom	S1	E
	Noturus stigmosus	Northern Madtom	S3	D
	Ophisaurus attenuatus longicaudus	Eastern Slender Glass Lizard	S3	D
	Parascalops breweri	Hairy-tailed Mole	S3	D
	Percina antesella	Amber Darter	S1	E
	Percina apina	Tennessee logperch	S2	D
	Percina aurantiaca	Tangerine Darter	S3	D
	Percina burtoni	Blotchside Logperch	S2	D
	Percina jenkinsi	Conasauga Logperch	S1	E
	Percina macrocephala	Longhead Darter	S2	T
	Percina phoxocephala	Slenderhead Darter	S3	D
	Percina squamata	Olive Darter	S2	D
	Percina stictogaster	Frecklebelly Darter	S1	D
	Percina tanasi	Snail Darter	S2S3	T
	Percina williamsi	Sickle Darter	S2	T
	Perimyotis subflavus	Tricolored Bat	S2S3	T
	Peucaea aestivalis	Bachman's Sparrow	S1B	E
	Phenacobius catostomus	Riffle Minnow	S2	D
	Phoxinus cumberlandensis	Blackside Dace	S2	T
	Pituophis melanoleucus melanoleucus	Northern Pine Snake	S3	T
	Plestiodon anthracinus	Coal Skink	S1	D
	Plethodon welleri	Weller's Salamander	S2	D

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Rallus elegans	King Rail	S2	D
	Scaphirhynchus albus	Pallid Sturgeon	S1	E
	Setophaga cerulea	Cerulean Warbler	S3B	D
	Sistrurus miliarius streckeri	Western Pigmy Rattlesnake	S2S3	T
	Sorex palustris	Water Shrew	S2	D
	Sterna antillarum athalassos	Interior Least Tern		E
	Synaptomys cooperi	Southern Bog Lemming	S4	D
	Thoburnia atripinnis	Blackfin Sucker	S2	D
	Vermivora chrysoptera	Golden-winged Warbler	S3B	T
Invertebrates				
	Alasmidonta atropurpurea	Cumberland Elktoe	S1S2	E
	Alasmidonta raveneliana	Appalachian Elktoe	S1	E
	Anguispira picta	Painted Snake Coiled Forest Snail	S1	T
	Athearnia anthonyi	Anthony's River Snail	S1	E
	Barbicambarus simmonsi	Tennessee Bottlebrush Crayfish	S2?	T
	Cambarus bouchardi	Big South Fork Crayfish	S1	E
	Cambarus cymatilis	Conasauga Blue Burrower	S1	E
	Cambarus extraneus	Chickamauga Crayfish	S1S2	E
	Cambarus obeyensis	Obey Crayfish	S2	E
	Cambarus pristinus	Pristine Crayfish	S2	E
	Cambarus stockeri	Cocoa Crayfish	S1S2	T
	Cambarus williami	Brawleys Fork Crayfish	S2	T
	Cumberlandia monodonta	Spectaclecase	S2S3	E
	Cyprogenia stegaria	Fanshell	S1	E
	Dromus dromas	Dromedary Pearlymussel	S1	E
	Epioblasma brevidens	Cumberlandian Combshell	S1	E
	Epioblasma capsaeformis	Oyster Mussel	S1	E
	Epioblasma florentina walkeri	Tan Riffleshell	S1	E
	Epioblasma metastriata	Upland Combshell	SH	E
	Epioblasma obliquata obliquata	Purple Catspaw	S1	E
	Epioblasma torulosa torulosa	Tuberculed Blossom Pearlymussel	SX	E
	Epioblasma triquetra	Snuffbox	S3	E
	Epioblasma turgidula	Turgid Blossom Pearlymussel	SX	E
	Fallicambarus hortoni	Hatchie Burrowing Crayfish	S1	E
	Faxonius alabamensis	Alabama Crayfish	S2	D
	Fusconaia cor	Shiny Pigtoe Pearlymussel	S1	E
	Fusconaia cuneolus	Fine-rayed Pigtoe	S1	E
	Hemistena lata	Cracking Pearlymussel	S1	E
	Lampsilis abrupta	Pink Mucket	S2	E
	Lampsilis altilis	Fine-lined Pocketbook	S1S2	T
	Lampsilis virescens	Alabama Lampmussel	S1	E
	Lemiox rimosus	Birdwing Pearlymussel	S1	E
	Marstonia ogmorhaphe	Royal Springsnail	S1	E
	Medionidus acutissimus	Alabama Moccasinshell	S1	T
	Medionidus parvulus	Coosa Moccasinshell	S1	E
	Obovaria retusa	Ring Pink	S1	E
	Orconectes incomptus	Tennessee Cave Crayfish	S1	E
	Orconectes shoupi	Nashville Crayfish	S1S2	E
	Orconectes wrighti	Hardin Crayfish	S2	E
	Pegias fabula	Little-wing Pearlymussel	S1	E
	Plethobasus cicatricosus	White Wartyback	S1	E
	Plethobasus cooperianus	Orange-foot Pimpleback	S1	E

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Plethobasus cyphyus	Sheepnose	S2S3	E
	Pleurobema clava	Clubshell	SH	E
	Pleurobema georgianum	Southern Pigtoe	S1	E
	Pleurobema gibberum	Cumberland Pigtoe	S1	E
	Pleurobema hanleyianum	Georgia Pigtoe	S1	E
	Pleurobema perovatum	Ovate Clubshell	SH	E
	Pleurobema plenum	Rough Pigtoe	S1	E
	Pleuronaia dolabelloides	Slabside Pearlymussel	S2	E
	Ptychobranchus foremanianus	Rayed Kidneyshell	S1	E
	Ptychobranchus greenii	Triangular Kidneyshell	S1	E
	Ptychobranchus subtentum	Fluted Kidneyshell	S2	E
	Quadrula cylindrica cylindrica	Smooth Rabbitsfoot	S3	T
	Quadrula cylindrica strigillata	Rough Rabbitsfoot	S2	E
	Quadrula fragosa	Winged Mapleleaf	S1	E
	Quadrula intermedia	Cumberland Monkeyface	S1	E
	Quadrula sparsa	Appalachian Monkeyface	S1	E
	Toxolasma cylindrellus	Pale Lilliput	S1	E
	Villosa fabalis	Rayed Bean	S1	E
Non-Vascular Plants				
	Archidium alternifolium	A moss	S1	T
	Bryoxiphium norvegicum	Sword Moss	S1	T
	Cephaloziella spinicaulis	Liverwort	S1	S
	Cololejeunea ornata	Liverwort	S1	T
	Drepanolejeunea appalachiana	a liverwort	S1	S
	Frullania caulisequa	Liverwort	S1	S
	Funaria americana	American Funaria Moss	S1?	T
	Grimmia olneyi	Grimmia Moss	SH	S
	Homaliadelphus sharpii	Sharp's Homaliadelphus	S1	E
	Jungermannia fossombronioides	A liverwort	S1	S
	Lejeunea blomquistii	Blomquist Leafy Liverwort	S1S2	S
	Lejeunea sharpii	Sharp's Lejeunea	S1S2	E
	Megaceros aenigmaticus	Hornwort	S2S3	S
	Metzgeria uncigera	Liverwort	S1	S
	Myurella julacea	Small Mousetail Moss	SH	S-P
	Palamocladium leskeoides	Palamocladium	S1	T
	Pellia appalachiana	A Liverwort	S2	S
	Plagiochila punctata	Spotty featherwort	S1	S
	Plagiomnium carolinianum	Mountain Wavy-leaf Moss	S1	S
	Porella wataugensis	Liverwort	S1S2	T
	Preissia quadrata	Narrow Mushroom-headed Liverwort	S1	T
	Radula voluta	Liverwort	S2	S
	Rhachithecium perpusillum	Budding Tortula	SH	S
	Scopelophila cataractae	Agoyan Cataract Moss	S1	S
	Tortula fragilis	Fragmented Screw-moss	S1	E
Vascular Plants				
	Abies fraseri	Fraser Fir	S1S2	T
	Acalypha deamii	Deam's Copperleaf	S1	S
	Aconitum reclinatum	White Monkshood	S1	E
	Actaea rubifolia	Appalachian Bugbane	S3	W
	Adlumia fungosa	Climbing Fumitory	S2	T
	Agalinis auriculata	Earleaf Foxglove	S2	E
	Agalinis decemloba	Blue Ridge False Foxglove	S1	E

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	Agalinis heterophylla	Prairie False-foxglove	S1	E
	Agalinis oligophylla	Ridge-stem False-foxglove	S1	E
	Agalinis plukenetii	Purple Gerardia	S1	E
	Agalinis setacea	Thread-leaved Gerardia	SH	S
	Agastache scrophulariifolia	Giant Hyssop	S1S2	T
	Ageratina luciae-brauniae	Lucy Braun's White Snakeroot	S3	T
	Allium burdickii	Narrow-leaved Wild Leek	S1S2	T-CE
	Allium tricoccum	Small White Leek	S1S2	S-CE
	Amelanchier sanguinea	Round-leaved Serviceberry	S2	T
	Ammoselinum popei	Pope Sand-parsley	S2	T
	Amsonia tabernaemontana var. gattingeri	A Blue-star	S3	S
	Anemone caroliniana	Carolina Anemone	S1S2	E
	Apios priceana	Price's Potato-bean	S3	E
	Arabis hirsuta	Western Hairy Rock-cress	S1	T
	Arabis patens	Spreading Rockcress	S1	E
	Arabis perstellata	Braun's Rock-cress	S1	E
	Arenaria lanuginosa	A Sandwort	S1	E
	Aristida ramosissima	Branched Three-awn Grass	S1	E
	Armoracia lacustris	Lake-cress	S2	S
	Arnoglossum plantagineum	Fen Indian-plantain	S2	T
	Asclepias purpurascens	Purple Milkweed	S1	S
	Asplenium scolopendrium var. americanum	American Hart's-tongue Fern	S1	E
	Astragalus bibullatus	Pyne's Ground Plum	S1	E
	Astragalus tennesseensis	Tennessee Milk-vetch	S3	S
	Athyrium filix-femina ssp. angustum	Lady Fern	S2	S
	Aureolaria patula	Spreading False-foxglove	S3	S
	Baptisia bracteata var. leucophaea	Cream Wild Indigo	S1S2	S
	Berberis canadensis	American barberry	S2	S
	Blephilia subnuda	Smooth Blephilia	S1	E
	Boechera shortii	Short's Rock-cress	S1S2	S
	Bolboschoenus fluviatilis	River Bulrush	S1	S
	Botrychium jenmanii	Alabama Grapefern	S1	T
	Botrychium matricariifolium	Matricary Grapefern	S1	S
	Botrychium oneidense	Blunt-lobe Grapefern	S1	S
	Brachyelytrum aristosum	Northern Shorthusk	S2	S
	Buckleya distichophylla	piratebush	S2	T
	Bulbostylis ciliatifolia var. coarctata	Beak-rush	S1	E
	Calamagrostis porteri	Porter's Reedgrass	S1	E
	Calamovilfa arcuata	Sandreed Grass	S2	T
	Caltha palustris	Marsh-marigold	S1	E
	Campanula aparinoides	Marsh Bellflower	S2	S
	Cardamine clematitis	mountain bittercress	S2	T
	Cardamine flagellifera	Bitter Cress	S2	T
	Cardamine rotundifolia	Roundleaf Water-cress	S2S3	S
	Carex barrattii	Barratt's Sedge	S2	E
	Carex bromoides ssp. montana	Brome-like Sedge	S1	T
	Carex bullata	Button Sedge	S3	S
	Carex buxbaumii	Buxbaum's Sedge	S1	E
	Carex comosa	Sedge	S2	T
	Carex davisii	Davis' Sedge	S1	S
	Carex echinata ssp. echinata	Little Prickly Sedge	S1?	S
	Carex folliculata	northern long sedge	S1	T

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	Carex hirtifolia	Sedge	S1S2	S
	Carex hitchcockiana	Sedge	S1	T
	Carex hyalina	Tissue Sedge	S1	S
	Carex manhartii	Manhart's Sedge	S2	E
	Carex misera	Wretched Sedge	S2	T
	Carex muskingumensis	Sedge	S1	E
	Carex ouachitana	Ouachita Sedge	S1	S
	Carex pellita	Wooly Sedge	S1	E
	Carex reniformis	Sedge	S1	S
	Carex roanensis	Sedge	S2	S
	Carex ruthii	Ruth's Sedge	S2	T
	Carex tetanica	Rigid Sedge	S1	E
	Castanea dentata	American Chestnut	S2S3	S
	Caulophyllum giganteum	Blue Cohosh	S1	T
	Ceratophyllum echinatum	Prickly Hornwort	S1	S
	Chelone obliqua	Red Turtlehead	S1	S
	Chrysogonum virginianum	Green-and-gold	S2	T
	Clematis fremontii	Fremont's Virgin's-bower	S1	E
	Clematis glaucophylla	Whiteleaf Leatherflower	S1	S
	Clematis morefieldii	Morefield's Leather-flower	S2	E
	Clethra alnifolia	Coast Pepper-bush	S1	E
	Coeloglossum viride var. virescens	American Frog Orchid	S1	E
	Collinsia verna	Blue-eyed Mary	S1	E
	Comptonia peregrina	Sweet Fern	S1	E
	Conradina verticillata	Cumberland Rosemary	S3	T
	Corallorhiza maculata	Spotted Coral-root	S1	T
	Coreopsis latifolia	Broad-leaved Tickseed	S1S2	E
	Corydalis sempervirens	Pale Corydalis	S1S2	S
	Cotinus obovatus	American Smoke-tree	S2	S
	Crataegus harbisonii	Harbison's Hawthorn	S1	E
	Cymophyllus fraserianus	Fraser's Sedge	S3	S
	Cyperus dentatus	Toothed Sedge	S1	S
	Cyperus plukenetii	Plukenet's Cyperus	S1	S
	Cypripedium kentuckiense	Lady-slipper	S2	E
	Cypripedium reginae	Showy Lady-slipper	S1	E
	Dalea candida	White Prairie-clover	S2	T
	Dalea foliosa	Leafy Prairie-clover	S2S3	E
	Dalea purpurea	Purple Prairie-clover	S1	E
	Danthonia epilis	Bog Oat-grass	S1S2	S
	Delphinium exaltatum	Tall Larkspur	S2	E
	Desmodium ochroleucum	Creamflower Tick-trefoil	S1	E
	Diamorpha smallii	Small's Stonecrop	S1S2	E
	Diarrhena obovata	Beak Grass	S1	S
	Dichanthelium acuminatum ssp. leucothrix	Panic-grass	S1	S
	Dichanthelium acuminatum ssp. spretum	Eaton's Witchgrass	S1	E
	Dichanthelium ensifolium ssp. curtifolium	Panic-grass	S1	E
	Didiplis diandra	Water-purslane	S1	T
	Diervilla lonicera	Northern Bush-honeysuckle	S2	T
	Diervilla sessilifolia var. rivularis	Mountain Bush-honeysuckle	S2	T
	Draba cuneifolia	Wedge-leaf Whitlow-grass	S1S2	S
	Draba ramosissima	Branching Whitlow-wort	S2	S
	Drosera brevifolia	Dwarf Sundew	S2	T

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	Drosera capillaris	Sundew	S1	T
	Drosera intermedia	Spoon-leaved Sundew	S2	S
	Drosera rotundifolia	Roundleaf Sundew	S1	T
	Dryopteris carthusiana	Spinulose Woodfern	S1	T
	Dryopteris cristata	crested woodfern	S2	T
	Echinacea pallida	Pale-purple Coneflower	S1	E
	Echinacea simulata	Wavy-leaf Purple-coneflower	S2	T
	Echinacea tennesseensis	Tennessee Coneflower	S2	T
	Echinochloa walteri	Walter's Barnyard Grass	S1	S
	Eleocharis compressa	Flat-stemmed Spike-rush	S1	S
	Eleocharis elliptica	Elliptic Spikerush	S1	E
	Eleocharis equisetoides	Horse-tail Spikerush	S1	E
	Eleocharis intermedia	Spike-rush	S1	E
	Eleocharis lanceolata	Lance-like Spikerush	S1	S
	Eleocharis tortilis	Twisted Spike-rush	S1	S
	Eleocharis wolfii	Wolf Spikerush	S1	E
	Elodea nuttallii	Waterweed	S2	S
	Elymus svensonii	Svenson's Wild-rye	S2	T
	Epilobium ciliatum	Willow-herb	S1	T
	Epilobium leptophyllum	Willow-herb	S1	T
	Eriocaulon decangulare	Ten-angle Pipewort	S1	E
	Eriogonum harperi	Harper's Umbrella-plant	S1	E
	Eriophorum virginicum	Tawny Cotton-grass	S1S2	E
	Eryngium integrifolium	Button Snakeroot	S1	T
	Erysimum capitatum	Western Wallflower	S1S2	E
	Erythronium rostratum	Yellow Trout-lily	S2	S
	Eupatorium godfreyanum	Godfrey's Thoroughwort	S1	S
	Eupatorium leucolepis	White-bract Thoroughwort	S1	E
	Eurybia saxicastellii	Rockcastle Aster	S1S2	E
	Eurybia schreberi	Schreber Aster	S1	S
	Euthamia gymnospermoides	Viscid Bushy Goldenrod	S1	E
	Evolvulus nuttallianus	Evolvulus	S3	S
	Festuca paradoxa	Cluster Fescue	S1	S
	Fimbristylis perpusilla	Harper's Fimbristylis	S1	E
	Fimbristylis puberula	Hairy Fimbristylis	S1S2	T
	Fothergilla major	Witch-alder	S2	T
	Fuirena squarrosa	Hairy Umbrella-sedge	S1	S
	Galium asprellum	Rough Bedstraw	S1	S
	Galium palustre	Marsh Bedstraw	S1	S
	Gaylussacia dumosa	Dwarf Huckleberry	S3	T
	Gentiana austromontana	Appalachian Gentian	S3	WL
	Gentiana puberulenta	Downy Gentian	S1	E
	Geranium robertianum	Herb-robert	S1	S
	Geum aleppicum	Yellow Avens	S1	E
	Geum geniculatum	Bent Avens	S1	E
	Geum laciniatum	Rough Avens	S1	S
	Glyceria acutiflora	Manna-grass	S2	S
	Glyceria laxa	Northern Manna-grass	S1	E
	Goodyera repens	Dwarf Rattlesnake-plantain	S1	S
	Gratiola floridana	Florida Hedge-hyssop	S1	E
	Gymnopogon brevifolius	Shortleaf Beardgrass	S1S2	S
	Hasteola suaveolens	Sweet-scented Indian-plantain	S2	S

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	Helenium brevifolium	Shortleaf Sneezeweed	S1	E
	Helianthemum propinquum	Low Frostweed	S1S2	E
	Helianthus eggertii	Eggert's Sunflower	S3	S
	Helianthus glaucophyllus	White-leaved Sunflower	S1	T
	Helianthus occidentalis	naked-stem sunflower	S2	S
	Helianthus verticillatus	Whorled Sunflower	S1	E
	Heracleum maximum	Cow Parsnip	S2	S
	Heteranthera limosa	Smaller Mud-plantain	S1S2	T
	Heteranthera missouriensis	Multiflowered Mud-plantain	S1	S
	Hexastylis virginica	Virginia Heartleaf	S2	S
	Hieracium longipilum	Hairy Hawkweed	S1	S
	Hieracium scabrum	Rough Hawkweed	S2	T
	Hottonia inflata	Featherfoil	S2	S
	Hydrocotyle americana	American Water-pennywort	S1	E
	Hydrolea ovata	Hydrolea	S1	S
	Hydrophyllum virginianum	Virginia Waterleaf	S3	T
	Hymenophyllum tayloriae	Gorge Filmy Fern	S2	S
	Hypericum adpressum	Creeping St. John's-wort	S1	E
	Hypericum ellipticum	Pale St. John's-wort	S1	E
	Hypericum graveolens	Mountain St. John's-wort	S3	E
	Hypericum mitchellianum	Blue Ridge St. John's-wort	S2	T
	Hypericum nudiflorum	St. John's-wort	S2	S
	Iris brevicaulis	Lamance Iris	S1	E
	Iris fulva	Red Iris	S2	T
	Iris prismatica	Narrow Blue Flag	S2S3	T
	Isoetes melanopoda	Blackfoot Quillwort	S1S2	E
	Isoetes tennesseensis	Hiwassee Quillwort	S1	E
	Isotria medeoloides	Small Whorled Pogonia	S1	E
	Juglans cinerea	Butternut	S3	T
	Juncus brachycephalus	Short-head Rush	S2	S
	Lachnanthes caroliana	Red Root	S1	E
	Lachnocaulon anceps	Bog-buttons	SH	S
	Lathyrus palustris	Marsh Pea	S1	S
	Lechea pulchella	Leggett's Pinweed	S1	E
	Lespedeza angustifolia	Narrowleaf Bushclover	S2	T
	Lesquerella perforata	Spring Creek Bladderpod	S1	E
	Leucothoe racemosa	Fetter-bush	S2	T
	Liatris cylindracea	Slender Blazing-star	S2	T
	Lilium grayi	Gray's Lily	S1	E
	Lilium michiganense	Michigan Lily	S3	W
	Lilium philadelphicum	Wood Lily	S1	E
	Liparis loeselii	Loesel's Twayblade	S1	T
	Listera australis	Southern Twayblade	S1S2	E
	Lobelia amoena	Southern Lobelia	S1S2	T
	Lonicera canadensis	American Fly-honeysuckle	S1	T
	Lonicera dioica	Mountain Honeysuckle	S2	S
	Lonicera flava	Yellow Honeysuckle	S1	T
	Ludwigia sphaerocarpa	Globe-fruited Ludwigia	S1	T
	Lycopodiella alopecuroides	Foxtail Clubmoss	S2	T
	Lysimachia fraseri	Fraser Loosestrife	S2	E
	Lysimachia hybrida	Lanceleaf Loosestrife	S2	S
	Lysimachia quadriflora	Four-flowered Loosestrife	S1	E

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	Lysimachia terrestris	Swamp Loosestrife	S1	E
	Lysimachia x producta	Loosestrife	S1	S
	Magnolia virginiana	Sweetbay Magnolia	S2	T
	Maianthemum stellatum	Starflower Solomons-seal	S1	E
	Marshallia obovata	Obovate Marshallia	S1	E
	Marshallia pulchra	Large-flowered Barbara's-buttons	S2	E
	Marshallia trinervia	Broadleaf Barbara's-buttons	S2S3	T
	Meehania cordata	Meehania Mint (Heart-leaf Meehania)	S2	T
	Melanthium latifolium	Broadleaf Bunchflower	S1S2	E
	Melanthium virginicum	Bunchflower	S1	E
	Melanthium woodii	Ozark Bunchflower	S2	S
	Menziesia pilosa	Fetterbush	S2	S
	Minuartia cumberlandensis	Cumberland Sandwort	S2	E
	Minuartia godfreyi	Godfrey's Stitchwort	S1	E
	Mirabilis albida	Pale Umbrella-wort	S2	T
	Monotropsis odorata	Sweet Pinesap	S2	T
	Muhlenbergia cuspidata	Plains Muhlenbergia	S1	E
	Muhlenbergia glabrifloris	Muhly	S1	S
	Muhlenbergia torreyana	Torrey Muhly	S1	E
	Myriophyllum pinnatum	Water-milfoil	S1	E
	Nestronia umbellula	Nestronia	S1	E
	Neviusia alabamensis	Alabama Snow-wreath	S2	T
	Oenothera macrocarpa	Missouri Primrose	S2	T
	Oenothera parviflora	Northern Evening-primrose	S1	S
	Oligoneuron album	Prairie Goldenrod	S1S2	E
	Onosmodium hispidissimum	Hairy False Gromwell	S1	E
	Onosmodium molle ssp. occidentale	Western False Gromwell	S1S2	T
	Onosmodium molle ssp. subsetosum	False Gromwell	S1	E
	Packera plattensis	Prairie Ragwort	S1	S
	Panax quinquefolius	American ginseng	S3S4	S-CE
	Panicum hemitomon	Maidencane	S2	S
	Parnassia grandifolia	Large-leaved Grass-of-parnassus	S3	S
	Paronychia argyrocoma	Silverling	S1S2	T
	Patis racemosa	Mountain ricegrass	S1	E
	Paysonia densipila	Duck River Bladderpod	S3	S
	Paysonia stonensis	Stones River Bladderpod	S1	E
	Pedicularis lanceolata	Swamp Lousewort	S1S2	S
	Penstemon tubiflorus	Small Flowered Beardtongue	S1	S
	Perideridia americana	Perideridia	S2	E
	Phegopteris connectilis	Northern Beechfern	S1	E
	Phemeranthus calcaricus	Limestone Fame-flower	S3	S
	Phemeranthus mengesii	Fame-flower	S2	T
	Phemeranthus teretifolius	Roundleaf Fameflower	S2	T
	Phlox bifida ssp. stellaria	Cleft Phlox	S3	T
	Phlox ovata	Wideflower phlox	S2S3	S
	Phlox pilosa ssp. ozarkana	Downy Phlox	S1S2	S
	Phlox subulata	Moss phlox	S1	S
	Physaria globosa	Lesquereux's Mustard	S2	E
	Pieris floribunda	Mountain Fetter-bush	S2	T
	Pilularia americana	American Pillwort	S1S2	S
	Pityopsis ruthii	Ruth's Golden Aster	S1	E
	Plantago cordata	Heartleaved Plantain	S1	E

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	Platanthera cristata	Yellow-crested Orchid	S2S3	S
	Platanthera flava var. herbiola	Pale Green Orchid	S2	T
	Platanthera grandiflora	Large Purple Fringed Orchid	S2	E
	Platanthera integra	Yellow Fringeless Orchid	S1	E
	Platanthera integrilabia	White Fringeless Orchid	S2S3	E
	Platanthera nivea	Snowy Orchid	S1	E
	Platanthera psycodes	Small Purple Fringe Orchid	S2	S
	Poa palustris	Fowl Bluegrass	S1	E
	Poa saltuensis	Drooping Bluegrass	S1	T
	Pogonia ophioglossoides	Rose Pogonia	S2	E
	Polygala boykinii	Boykin's Milkwort	S2	T
	Polygala mariana	Maryland Milkwort	S1	S
	Polygala nana	Dwarf Milkwort	S1	E
	Polygala nuttallii	Nuttall's Milkwort	S1	E
	Polygonella americana	Southern Jointweed	S1S2	E
	Polygonum arifolium	Halberd-leaf Tearthumb	S1	T
	Polygonum cilinode	Fringed Black Bindweed	S1S2	T
	Polymnia johnbeckii	John Beck's Leafcup	S1	E
	Polytaenia nuttallii	Prairie Parsley	S1	T
	Ponthieva racemosa	Shadow-witch Orchid	S1	E
	Potamogeton amplifolius	Large-leaf Pondweed	S1	T
	Potamogeton epihydrus	Creekgrass	S1S2	S
	Potamogeton tennesseensis	Tennessee Pondweed	S2	T
	Prenanthes alba	White Rattlesnake-root	S1	S
	Prenanthes aspera	Rough Rattlesnake-root	S1	E
	Prenanthes barbata	Barbed Rattlesnake-root	S2	S
	Prunus pumila	Sand Cherry	S1	E
	Prunus virginiana	Chokecherry	S1	S
	Pseudognaphalium helleri	Heller's Catfoot	S2	S
	Pycnanthemum torreyi	Torrey's Mountain Mint	S1	E
	Pycnanthemum verticillatum	Mountain-mint	S1	E
	Pyrola americana	American Wintergreen	S2	E
	Quercus margaretta	Sand Post Oak	S1	S
	Ranunculus aquatilis var. diffusus	White Water Buttercup	S1	E
	Ranunculus flabellaris	Yellow Water-crowfoot	S2	T
	Rhamnus alnifolia	Alderleaf Buckthorn	S1	E
	Rhynchospora caduca	Falling Beaked-rush	S1	S
	Rhynchospora capillacea	Horned Beakrush	S1	E
	Rhynchospora chalarocephala	Loose-head Beakrush	S1	T
	Rhynchospora inexpansa	Nodding Beakrush	S1	S
	Rhynchospora perplexa	Beakrush	S2	T
	Rhynchospora rariflora	Beakrush	S1	E
	Ribes curvatum	Granite Gooseberry	S1	T
	Ribes missouriense	Missouri gooseberry	S2	S
	Ribes odoratum	Buffalo Currant	S1	T
	Rudbeckia subtomentosa	Sweet Coneflower	S2	T
	Sabatia capitata	Cumberland Rose Gentian	S2	E
	Sacciolepis striata	Gibbous Panic-grass	S1	S
	Sagittaria brevirostra	Short-beak Arrowhead	S1	T
	Sagittaria graminea	Grassleaf Arrowhead	S1	T
	Sagittaria platyphylla	Ovate-leaved Arrowhead	S2S3	S
	Sagittaria rigida	Sessile-fruited Arrowhead	S1	E

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Salvia azurea var. grandiflora	Blue Sage	S3	S
	Sanguisorba canadensis	Canada Burnet	S1	E
	Saxifraga caroliniana	Carolina saxifrage	S1S2	E
	Saxifraga pensylvanica	Swamp Saxifrage	S1	E
	Schisandra glabra	Bay Starvine	S2	T
	Schoenolirion croceum	Sunnybell	S3	T
	Schoenoplectus subterminalis	Water Bulrush	S1	E
	Scleria verticillata	Low Nutrush	S2	S
	Scutellaria montana	Large-flowered Skullcap	S4	T
	Sedum nevii	Nevius' Stonecrop	S1	E
	Silene caroliniana ssp. pensylvanica	Wild Pink	S1S2	T
	Silene ovata	Ovate Catchfly	S2	E
	Silphium brachiatum	Cumberland Rosinweed	S3	E
	Silphium laciniatum	Compass-plant	S2	T
	Silphium pinnatifidum	Prairie-dock	S2	T
	Smilax laurifolia	Laurel-leaf Greenbrier	S1	S
	Solidago austrina	Virginia goldenrod	S1	S
	Solidago gattingeri	Gattinger's Goldenrod	S1	E
	Solidago porteri	Porter's Goldenrod	S1	E
	Solidago rupestris	Rock Goldenrod	S1	E
	Solidago tarda	Late Goldenrod	S1	S
	Sparganium androcladum	Branching Burreed	S1	E
	Spiraea alba	Narrow-leaved Meadow-sweet	S1	E
	Spiraea virginiana	Virginia Spiraea	S2	E
	Spiranthes lucida	Shining Ladies'-tresses	S1S2	T
	Spiranthes magnicamporum	Great Plains Ladies'-tresses	S1	E
	Spiranthes ochroleuca	Yellow Nodding Ladies'-tresses	S1	E
	Spiranthes odorata	Sweetscent Ladies'-tresses	S1	E
	Sporobolus heterolepis	Northern Dropseed	S1	T
	Sporobolus junceus	A Dropseed	S1	E
	Stachys clingmanii	Clingman's Hedge-nettle	S1S2	T
	Stellaria alsine	Trailing Stitchwort	S1	E
	Stellaria fontinalis	Water Stitchwort	S3	S
	Stellaria longifolia	Longleaf Stitchwort	S1	S
	Stenanthium diffusum	Lily	S1	E
	Stenanthium tennesseense	Death-camas	S2	T
	Streptopus amplexifolius	Clasping Twisted-stalk	S1	T
	Stylisma humistrata	Southern Southern Morning-glory	S1	T
	Sullivantia sullivantii	Sullivantia	S1	E
	Symphyotrichum praealtum	Willow Aster	S1	E
	Symphyotrichum pratense	Barrens Silky Aster	S1	E
	Symplocarpus foetidus	Skunk Cabbage	S1	E
	Symplocos tinctoria	Horsesugar	S2	S
	Taxus canadensis	Canadian Yew	S1	E
	Thaspium pinnatifidum	cutleaf meadow-parsnip	S1	E
	Thermopsis fraxinifolia	Ash-leaved Bush-pea	S3	T
	Thermopsis mollis	Soft-haired Thermopsis	S2S3	S
	Torreyochloa pallida	Pale Manna Grass	S1	S
	Trautvetteria fonticalcarea	Leatherleaf Tassel-rue	S2	T
	Triadenum fraseri	Fraser's Marsh St. Johnswort	S1?	S
	Triantha glutinosa	Sticky False-asphodel	S1	E
	Triantha racemosa	Coastal False-asphodel	S1	E

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
	Trichomanes boschianum	Appalachian Bristle Fern	S1S2	T
	Trichomanes petersii	Dwarf Filmy-fern	S2	T
	Trichophorum cespitosum	Tufted Clubrush	S1	E
	Tridens flavus var. chapmanii	Chapman's Redtop	S1	E
	Trientalis borealis	Northern Starflower	S1	T
	Trifolium calcaricum	Running Glade Clover	S1	E
	Trifolium reflexum	Buffalo Clover	S1	E
	Trillium decumbens	Trailing Trillium	S1	E
	Trillium lancifolium	Lance-leaf Trillium	S1	E
	Trillium pusillum	Least Trillium	S2	E
	Trillium rugelii	Southern Nodding Trillium	S2	E
	Trillium tennesseense	Lilly	S1	E
	Tsuga caroliniana	Carolina Hemlock	S3	T
	Turritis glabra	Tower-mustard	S1	S
	Ulmus crassifolia	Cedar Elm	S2	S
	Utricularia cornuta	Horned Bladderwort	S1	E
	Utricularia subulata	Zigzag Bladderwort	S1	T
	Vaccinium elliottii	Elliott's Blueberry	S1	E
	Vaccinium macrocarpon	Large Cranberry	S2	T
	Veronica americana	American Speedwell	S1	S
	Veronica catenata	Sessile Water-speedwell	S1	E
	Veronica scutellata	Marsh-speedwell	S1	E
	Viburnum bracteatum	Arrow-wood	S2	S
	Vitis rupestris	Sand Grape	S1	E
	Woodsia scopulina ssp. appalachiana	Appalachian Cliff-fern	S1S2	S
	Woodwardia virginica	Virginia Chainfern	S2	S
	Xerophyllum asphodeloides	Eastern Turkeybeard	S3	T
	Xyris ambigua	Coastal-plain Yellow-eyed-grass	S1	E
	Xyris fimbriata	Fringed Yellow-eyed-grass	S1	E
	Xyris laxifolia var. iridifolia	Yellow-eyed-grass	S2	T
	Xyris tennesseensis	Yellow-eyed-grass	S1	E
	Zanthoxylum americanum	Northern Prickly-ash	S2	S
Virginia				
Vertebrates				
	Ammocrypta clara	Western Sand Darter	S1	LT
	Erimonax monachus	Spotfin Chub	S1	LT
	Erimystax cahni	Slender Chub	S1	LT
	Lanius ludovicianus	Loggerhead Shrike	S1B,S2N	LT
	Myotis grisescens	Gray Bat	S1	LE
	Myotis septentrionalis	Northern Long-eared Bat	S1S3	LT
	Myotis sodalis	Indiana Bat	S1	LE
	Notropis atherinoides	Emerald Shiner	S1S2	LT
	Noturus flavipinnis	Yellowfin Madtom	S1	LT
	Perimyotis subflavus	Tricolored Bat	S1S3	LE
	Phoxinus cumberlandensis	Blackside Dace	S1	LT
	Polyodon spathula	Paddlefish	S1	LT

STATE1	SCIENTIFIC_NAME	COMMON_NAME	ST_RANK	ST_STATUS
Invertebrates				
	Cumberlandia monodonta	Spectaclecase	S1	LE
	Cyclonaias pustulosa	Pimpleback	S2	LT
	Cyprogenia stegaria	Fanshell	S1	LE
	Dromus dromas	Dromedary Pearlymussel	S1	LE
	Elliptio crassidens	Elephant-ear	S1	LE
	Epioblasma brevidens	Cumberlandian Combshell	S1	LE
	Epioblasma capsaeformis	Oyster Mussel	S1	LE
	Epioblasma triquetra	Snuffbox	S1	LE
	Fusconaia cor	Shiny Pigtoe Pearlymussel	S1	LE
	Fusconaia cuneolus	Fine-rayed Pigtoe	S1	LE
	Hemistena lata	Cracking Pearlymussel	S1	LE
	Holsingeria unthanksensis	Thankless ghostsnail	S2	LE
	Io fluvialis	Spiny Riversnail	S2	LT
	Lasmigona holstonia	Tennessee Heelsplitter	S1	LE
	Lemiox rimosus	Birdwing Pearlymussel	S1	LE
	Leptodea fragilis	Fragile Papershell	S1	LT
	Ligumia recta	Black Sandshell	S2	LT
	Lirceus usdagalun	Lee County Cave Isopod	S1	LE
	Pegias fabula	Little-wing Pearlymussel	S1	LE
	Plethobasus cyphyus	Sheepnose	S1	LE
	Pleuronaia dolabelloides	Slabside Pearlymussel	S2	LE
	Ptychobranchus subtentum	Fluted Kidneyshell	S2	LE
	Quadrula cylindrica strigillata	Rough Rabbitsfoot	S2	LE
	Quadrula intermedia	Cumberland Monkeyface	S1	LE
	Quadrula sparsa	Appalachian Monkeyface	S1	LE
	Toxolasma lividus	Purple Lilliput	SH	LE
	Truncilla truncata	Deertoe	S1	LE
Plants				
	Trifolium calcaricum	Running Glade Clover	S1	LE

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

NOT FOR CONSULTATION

Location

Alabama, Arkansas, Georgia, Kentucky, Mississippi, Missouri, North Carolina, Tennessee, and Virginia



Local offices

Missouri Ecological Services Field Office

(573) 234-2132
(573) 234-2181

101 Park Deville Drive

Suite A
Columbia, MO 65203-0057

Mississippi Ecological Services Field Office

(601) 965-4900

6578 Dogwood View Parkway, Suite A
Jackson, MS 39213-7856

Alabama Ecological Services Field Office

(251) 441-5181
(251) 441-6222
alabama@fws.gov

1208 B Main Street
Daphne, AL 36526-4419

Virginia Ecological Services Field Office

(804) 693-6694

6669 Short Lane
Gloucester, VA 23061-4410

Georgia Ecological Services Field Office

(706) 460-7161
(706) 613-6059

355 East Hancock Avenue
Room 320
Athens, GA 30601-2523

Arkansas Ecological Services Field Office

(501) 513-4470
(501) 513-4480

110 South Amity Suite 300
Conway, AR 72032-8975

Tennessee Ecological Services Field Office

(931) 528-6481
(931) 528-7075

446 Neal Street
Cookeville, TN 38501-4027

NOT FOR CONSULTATION

Asheville Ecological Services Field Office

(828) 258-3939
(828) 258-5330

160 Zillicoa Street, Suite B
Asheville, NC 28801-1082

Kentucky Ecological Services Field Office

(502) 695-0467
(502) 695-1024
kentuckyes@fws.gov

J C Watts Federal Building, Room 265
330 West Broadway
Frankfort, KY 40601-8670

NOT FOR CONSULTATION

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. 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.

NOT FOR CONSULTATION

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Carolina Northern Flying Squirrel Glaucomys sabrinus coloratus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2657	Endangered
Gray Bat Myotis grisescens Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6329	Endangered
Indiana Bat Myotis sodalis Wherever found There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat Myotis septentrionalis Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Endangered
Tricolored Bat Perimyotis subflavus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/10515	Proposed Endangered
Virginia Big-eared Bat Corynorhinus (=Plecotus) townsendii virginianus Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/8369	Endangered

Birds

NAME	STATUS

NOT FOR CONSULTATION

Eastern Black Rail Laterallus jamaicensis ssp. jamaicensis Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/10477	Threatened
Piping Plover Charadrius melodus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/6039	Threatened
Red-cockaded Woodpecker Dryobates borealis Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7614	Threatened
Rufa Red Knot Calidris canutus rufa Wherever found There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane Grus americana No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/758	EXPN

NOT FOR CONSULTATION

Reptiles

NAME	STATUS
Alligator Snapping Turtle Macrochelys temminckii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4658	Proposed Threatened
Bog Turtle Glyptemys muhlenbergii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6962	SAT
Flattened Musk Turtle Sternotherus depressus No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6961	Threatened

Gopher Tortoise Gopherus polyphemus — Threatened

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6994

Pearl River Map Turtle Graptemys pearlensis — Threatened

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/10895

Ringed Map Turtle Graptemys oculifera — Threatened

Wherever found

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2664

Amphibians

NAME	STATUS

Black Warrior (=sipsey Fork) Waterdog Necturus alabamensis — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/5426

Eastern Hellbender Cryptobranchus alleganiensis alleganiensis — Proposed Endangered

Wherever found

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/9039

Fishes

NAME	STATUS

Alabama Cavefish Speoplatyrhinus poulsoni — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/50

NOT FOR CONSULTATION

Amber Darter Percina antesella — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

https://ecos.fws.gov/ecp/species/53

Barrens Topminnow Fundulus julisia — Endangered

Wherever found

There is **proposed** critical habitat for this species. Your location overlaps the critical habitat.

https://ecos.fws.gov/ecp/species/5045

Blackside Dace Phoxinus cumberlandensis — Threatened

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/4775

Blue Shiner Cyprinella caerulea — Threatened

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/463

Bluemask Darter Etheostoma akatulo — Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/3969

Boulder Darter Etheostoma wapiti — Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/5398

Boulder Darter Etheostoma wapiti — EXPN

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/5398

Cahaba Shiner Notropis cahabae — Endangered

Wherever found

There is **proposed** critical habitat for this species.

https://ecos.fws.gov/ecp/species/650

NOT FOR CONSULTATION

Cherokee Darter Etheostoma scotti — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2553

Chucky Madtom Noturus crypticus — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/7735

Coal Darter Percina brevicauda — Proposed Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/9959

Conasauga Logperch Percina jenkinsi — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/8472

Cumberland Darter Etheostoma susanae — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/1011

Duskytail Darter Etheostoma percnurum — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/891

Duskytail Darter Etheostoma percnurum — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/891

Duskytail Darter Etheostoma percnurum — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/891

NOT FOR CONSULTATION

Etowah Darter Etheostoma etowahae — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4123

Frecklebelly Madtom Noturus munitus — Threatened
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/2800

Goldline Darter Percina aurolineata — Threatened
Wherever found
There is **proposed** critical habitat for this species.
https://ecos.fws.gov/ecp/species/7005

Laurel Dace Chrosomus saylori — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/1194

Palezone Shiner Notropis albizonatus — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6064

Pallid Sturgeon Scaphirhynchus albus — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7162

Pygmy Madtom Noturus stanauli — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7873

Pygmy Madtom Noturus stanauli — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7873

NOT FOR CONSULTATION

Relict Darter Etheostoma chienense — Threatened

Wherever found

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1979

Rush Darter Etheostoma phytophilum — Endangered

Wherever found

There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
https://ecos.fws.gov/ecp/species/2779

Sickle Darter Percina williamsi — Threatened

Wherever found

There is **proposed** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/9866

Slackwater Darter Etheostoma boschungi — Threatened

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/8058

Slender Chub Erimystax cahni — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6637

Slender Chub Erimystax cahni — Threatened

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/6637

Smoky Madtom Noturus baileyi — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/8211

Smoky Madtom Noturus baileyi — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/8211

NOT FOR CONSULTATION

Spotfin Chub Erimonax monachus — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1521

Spotfin Chub Erimonax monachus — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1521

Spotfin Chub Erimonax monachus — Threatened

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/1521

Spotfin Chub Erimonax monachus — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1521

Spring Pygmy Sunfish Elassoma alabamae — Threatened

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/652

Trispot Darter Etheostoma trisella — Threatened

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/8219

Vermilion Darter Etheostoma chermocki — Endangered

Wherever found

There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
https://ecos.fws.gov/ecp/species/296

Watercress Darter Etheostoma nuchale — Endangered

Wherever found

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1838

NOT FOR CONSULTATION

Yellowfin Madtom Noturus flavipinnis — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/8565

Yellowfin Madtom Noturus flavipinnis — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/8565

Yellowfin Madtom Noturus flavipinnis — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/8565

Yellowfin Madtom Noturus flavipinnis — Threatened
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/8565

Clams

NAME	STATUS

Alabama Hickorynut Obovaria unicolor — Proposed Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/9883

Alabama Lampmussel Lampsilis virescens — Endangered
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/916

Alabama Lampmussel Lampsilis virescens — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/916

Alabama Moccasinshell Medionidus acutissimus — Threatened
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/7287

NOT FOR CONSULTATION

Appalachian Elktoe Alasmidonta raveneliana — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/5039

Appalachian Monkeyface (pearlymussel) Theliderma sparsa — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7154

Appalachian Monkeyface (pearlymussel) Theliderma sparsa — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7154

Birdwing Pearlymussel Lemiox rimosus — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6636

Birdwing Pearlymussel Lemiox rimosus — Endangered
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6636

Birdwing Pearlymussel Lemiox rimosus — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6636

Black Clubshell Pleurobema curtum — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5429

Clubshell Pleurobema clava — Endangered
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3789

Clubshell Pleurobema clava — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3789

NOT FOR CONSULTATION

Coosa Moccasinshell Medionidus parvulus — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

https://ecos.fws.gov/ecp/species/2575

Cracking Pearlymussel Hemistena lata — EXPN

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/4130

Cracking Pearlymussel Hemistena lata — Endangered

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/4130

Cracking Pearlymussel Hemistena lata — EXPN

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/4130

Cumberland Bean (pearlymussel) Villosa trabalis — EXPN

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/6061

Cumberland Bean (pearlymussel) Villosa trabalis — EXPN

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/6061

Cumberland Bean (pearlymussel) Villosa trabalis — Endangered

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/6061

Cumberland Elktoe Alasmidonta atropurpurea — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

https://ecos.fws.gov/ecp/species/1248

Cumberland Moccasinshell Medionidus conradicus — Proposed Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/9881

NOT FOR CONSULTATION

Cumberland Monkeyface (pearlymussel) Theliderma intermedia — Endangered

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6999

Cumberland Monkeyface (pearlymussel) Theliderma intermedia — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6999

Cumberland Monkeyface (pearlymussel) Theliderma intermedia — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6999

Cumberland Pigtoe Pleuronaia gibber — Endangered

Wherever found

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1981

Cumberlandian Combshell Epioblasma brevidens — Endangered

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/3119

Cumberlandian Combshell Epioblasma brevidens — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3119

Cumberlandian Combshell Epioblasma brevidens — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3119

Dark Pigtoe Pleurobema furvum — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/1519

Dromedary Pearlymussel Dromus dromas — Endangered

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6377

NOT FOR CONSULTATION

Dromedary Pearlymussel Dromus dromas EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6377

Dromedary Pearlymussel Dromus dromas EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6377

Fanshell Cyprogenia stegaria Endangered

Wherever found

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4822

Fanshell Cyprogenia stegaria EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4822

Fat Pocketbook Potamilus capax Endangered

Wherever found

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2780

Finelined Pocketbook Hamiota altilis Threatened

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/1393

Finerayed Pigtoe Fusconaia cuneolus Endangered

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3038

Finerayed Pigtoe Fusconaia cuneolus EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3038

Finerayed Pigtoe Fusconaia cuneolus EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3038

NOT FOR CONSULTATION

Fluted Kidneyshell Ptychobranchus subtentus — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

https://ecos.fws.gov/ecp/species/1397

Georgia Pigtoe Pleurobema hanleyianum — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

https://ecos.fws.gov/ecp/species/6494

Green Floater Lasmigona subviridis — Proposed Threatened

Wherever found

There is **proposed** critical habitat for this species. Your location overlaps the critical habitat.

https://ecos.fws.gov/ecp/species/7541

Heavy Pigtoe Pleurobema taitianum — Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/298

Inflated Heelsplitter Potamilus inflatus — Threatened

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/7286

Littlewing Pearlymussel Pegias fabula — Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/2572

Longsolid Fusconaia subrotunda — Threatened

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

https://ecos.fws.gov/ecp/species/9880

Northern Riffleshell Epioblasma rangiana — Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/527

NOT FOR CONSULTATION

Obovaria cf. unicolor — Proposed Threatened
No critical habitat has been designated for this species.

Orangefoot Pimpleback (pearlymussel) Plethobasus cooperianus — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1132

Orangefoot Pimpleback (pearlymussel) Plethobasus cooperianus — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1132

Orangenacre Mucket Hamiota perovalis — Threatened
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/1980

Ovate Clubshell Pleurobema perovatum — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/5430

Oyster Mussel Epioblasma capsaeformis — Endangered
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/2099

Oyster Mussel Epioblasma capsaeformis — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2099

Oyster Mussel Epioblasma capsaeformis — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2099

NOT FOR CONSULTATION

Pale Lilliput (pearlymussel) Toxolasma cylindrellus — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3118

Pink Mucket (pearlymussel) Lampsilis abrupta — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7829

Purple Bean Villosa perpurpurea — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/4125

Purple Cat's Paw (=purple Cat's Paw Pearlymussel) Epioblasma obliquata — Endangered
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5602

Purple Cat's Paw (=purple Cat's Paw Pearlymussel) Epioblasma obliquata — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5602

Rabbitsfoot Quadrula cylindrica cylindrica — Threatened
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/5165

Rayed Bean Villosa fabalis — Endangered
Wherever found
There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat.
https://ecos.fws.gov/ecp/species/5862

Ring Pink Obovaria retusa — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4128

NOT FOR CONSULTATION

Ring Pink Obovaria retusa — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4128

Rough Pigtoe Pleurobema plenum — Endangered

Wherever found

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6894

Rough Pigtoe Pleurobema plenum — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6894

Rough Rabbitsfoot Quadrula cylindrica strigillata — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/5629

Round Hickorynut Obovaria subrotunda — Threatened

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/9879

Salamander Mussel Simpsonaias ambigua — Proposed Endangered

Wherever found

There is **proposed** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/6208

Sheepnose Mussel Plethobasus cyphyus — Endangered

Wherever found

There is **proposed** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/6903

Shiny Pigtoe Fusconaia cor — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2573

NOT FOR CONSULTATION

Shiny Pigtoe Fusconaia cor — Endangered

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2573

Shiny Pigtoe Fusconaia cor — EXPN

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2573

Slabside Pearlymussel Pleuronaia dolabelloides — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/1518

Snuffbox Mussel Epioblasma triquetra — Endangered

Wherever found

There is **proposed** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/4135

Southern Clubshell Pleurobema decisum — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/6113

Southern Combshell Epioblasma penita — Endangered

Wherever found

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7285

Southern Pigtoe Pleurobema georgianum — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/1520

Spectaclecase (mussel) Cumberlandia monodonta — Endangered

Wherever found

There is **proposed** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/7867

NOT FOR CONSULTATION

Tan Riffleshell Epioblasma florentina walkeri (=E. walkeri) Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1247

Tennessee Clubshell Pleurobema oviforme Proposed Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3254

Tennessee Pigtoe Pleuronaia barnesiana Proposed Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/9887

Triangular Kidneyshell Ptychobranchus greenii Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/4396

White Wartyback (pearlymussel) Plethobasus cicatricosus Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2549

White Wartyback (pearlymussel) Plethobasus cicatricosus EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2549

Winged Mapleleaf Quadrula fragosa Endangered
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4127

Winged Mapleleaf Quadrula fragosa EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4127

Snails

NAME STATUS

NOT FOR CONSULTATION

Anthony's Riversnail Athearnia anthonyi — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4827

Anthony's Riversnail Athearnia anthonyi — EXPN
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4827

Anthony's Riversnail Athearnia anthonyi — Endangered
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4827

Armored Snail Marstonia pachyta — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3972

Interrupted (=georgia) Rocksnail Leptoxis foremani — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/7019

Oblong Rocksnail Leptoxis compacta — Proposed Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2809

Painted Snake Coiled Forest Snail Anguispira picta — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7835

Round Rocksnail Leptoxis ampla — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/470

Royal Marstonia (snail) Marstonia ogmorhaphe — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7836

NOT FOR CONSULTATION

Slender Campeloma Campeloma decampi — Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/7009

Insects

NAME	STATUS

Mitchell's Satyr Butterfly Neonympha mitchellii mitchellii — Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/8062

Monarch Butterfly Danaus plexippus — Proposed Threatened

Wherever found

There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat.

https://ecos.fws.gov/ecp/species/9743

Arachnids

NAME	STATUS

Spruce-fir Moss Spider Microhexura montivaga — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

https://ecos.fws.gov/ecp/species/4801

Crustaceans

NAME	STATUS

Alabama Cave Shrimp Palaemonias alabamae — Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/5307

Kentucky Cave Shrimp Palaemonias ganteri — Endangered

Wherever found

There is **final** critical habitat for this species. Your location does not overlap the critical habitat.

https://ecos.fws.gov/ecp/species/5008

NOT FOR CONSULTATION

Lee County Cave Isopod Lirceus usdagalun — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1550

Nashville Crayfish Orconectes shoupi — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7181

Slenderclaw Crayfish Cambarus cracens — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/9792

Flowering Plants

NAME	STATUS

Alabama Leather Flower Clematis socialis — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6300

Blue Ridge Goldenrod Solidago spithamaea — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5821

Braun's Rock-cress Arabis perstellata — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/4704

Cumberland Rosemary Conradina verticillata — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3677

NOT FOR CONSULTATION

Dwarf-flowered Heartleaf Hexastylis naniflora — Threatened

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/2458

Fleshy-fruit Gladecress Leavenworthia crassa — Endangered

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

https://ecos.fws.gov/ecp/species/1435

Gentian Pinkroot Spigelia gentianoides — Endangered

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/4583

Georgia Rockcress Arabis georgiana — Threatened

Wherever found

There is **final** critical habitat for this species. Your location overlaps the critical habitat.

https://ecos.fws.gov/ecp/species/4535

Green Pitcher Plant Sarracenia oreophila — Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/2896

Guthrie's (=pyne's) Ground-plum Astragalus bibullatus — Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/1739

Harperella Ptilimnium nodosum — Endangered

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/3739

Heller's Blazingstar Liatris helleri — Threatened

Wherever found

No critical habitat has been designated for this species.

https://ecos.fws.gov/ecp/species/5962

NOT FOR CONSULTATION

Kral's Water-plantain Sagittaria secundifolia Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/8235

Large-flowered Skullcap Scutellaria montana Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4721

Leafy Prairie-clover Dalea foliosa Endangered
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5498

Lyrate Bladderpod Lesquerella lyrata Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4654

Mohr's Barbara's Buttons Marshallia mohrii Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7610

Morefield"s Leather Flower Clematis morefieldii Endangered
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/133

Pondberry Lindera melissifolia Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1279

Price"s Potato-bean Apios priceana Threatened
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7422

Roan Mountain Bluet Hedyotis purpurea var. montana Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1087

NOT FOR CONSULTATION

Ruth's Golden Aster Pityopsis ruthii — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/105

Short's Bladderpod Physaria globosa — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/7206

Small Whorled Pogonia Isotria medeoloides — Threatened
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1890

Smooth Coneflower Echinacea laevigata — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3473

Spreading Avens Geum radiatum — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6854

Spring Creek Bladderpod Lesquerella perforata — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2012

Swamp Pink Helonias bullata — Threatened
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4333

Tennessee Yellow-eyed Grass Xyris tennesseensis — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/6010

NOT FOR CONSULTATION

Virginia Spiraea Spiraea virginiana — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1728

White Fringeless Orchid Platanthera integrilabia — Threatened
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1889

Whorled Sunflower Helianthus verticillatus — Endangered
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/3375

Ferns and Allies

NAME	STATUS

Alabama Streak-sorus Fern Thelypteris pilosa var. alabamensis — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3604

American Hart's-tongue Fern Asplenium scolopendrium var. americanum — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/4232

Lichens

NAME	STATUS

Rock Gnome Lichen Gymnoderma lineare — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3933

NOT FOR CONSULTATION

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
Alabama Cavefish Speoplatyrhinus poulsoni https://ecos.fws.gov/ecp/species/50#crithab	Final
Alabama Moccasinshell Medionidus acutissimus https://ecos.fws.gov/ecp/species/7287#crithab	Final
Amber Darter Percina antesella https://ecos.fws.gov/ecp/species/53#crithab	Final
Appalachian Elktoe Alasmidonta raveneliana https://ecos.fws.gov/ecp/species/5039#crithab	Final
Barrens Topminnow Fundulus julisia https://ecos.fws.gov/ecp/species/5045#crithab	Proposed
Black Warrior (=sipsey Fork) Waterdog Necturus alabamensis https://ecos.fws.gov/ecp/species/5426#crithab	Final
Braun's Rock-cress Arabis perstellata https://ecos.fws.gov/ecp/species/4704#crithab	Final
Brawleys Fork Crayfish Cambarus williami For information on why this critical habitat appears for your project, even though Brawleys Fork Crayfish is not on the list of potentially affected species at this location, contact the local field office. https://ecos.fws.gov/ecp/species/9806#crithab	Proposed
Chucky Madtom Noturus crypticus https://ecos.fws.gov/ecp/species/7735#crithab	Final
Conasauga Logperch Percina jenkinsi https://ecos.fws.gov/ecp/species/8472#crithab	Final

NOT FOR CONSULTATION

Coosa Moccasinshell Medionidus parvulus — Final
https://ecos.fws.gov/ecp/species/2575#crithab

Cumberland Darter Etheostoma susanae — Final
https://ecos.fws.gov/ecp/species/1011#crithab

Cumberland Elktoe Alasmidonta atropurpurea — Final
https://ecos.fws.gov/ecp/species/1248#crithab

Cumberlandian Combshell Epioblasma brevidens — Final
https://ecos.fws.gov/ecp/species/3119#crithab

Dark Pigtoe Pleurobema furvum — Final
https://ecos.fws.gov/ecp/species/1519#crithab

Finelined Pocketbook Hamiota altilis — Final
https://ecos.fws.gov/ecp/species/1393#crithab

Fleshy-fruit Gladecress Leavenworthia crassa — Final
https://ecos.fws.gov/ecp/species/1435#crithab

Fluted Kidneyshell Ptychobranchus subtentus — Final
https://ecos.fws.gov/ecp/species/1397#crithab

Frecklebelly Madtom Noturus munitus — Final
https://ecos.fws.gov/ecp/species/2800#crithab

Georgia Pigtoe Pleurobema hanleyianum — Final
https://ecos.fws.gov/ecp/species/6494#crithab

Georgia Rockcress Arabis georgiana — Final
https://ecos.fws.gov/ecp/species/4535#crithab

Green Floater Lasmigona subviridis — Proposed
https://ecos.fws.gov/ecp/species/7541#crithab

Indiana Bat Myotis sodalis — Final
https://ecos.fws.gov/ecp/species/5949#crithab

NOT FOR CONSULTATION

Interrupted (=georgia) Rocksnail Leptoxis foremani — Final
https://ecos.fws.gov/ecp/species/7019#crithab

Kentucky Creekshell Villosa ortmanni — Proposed
For information on why this critical habitat appears for your project, even though Kentucky Creekshell is not on the list of potentially affected species at this location, contact the local field office.
https://ecos.fws.gov/ecp/species/8209#crithab

Laurel Dace Chrosomus saylori — Final
https://ecos.fws.gov/ecp/species/1194#crithab

Longsolid Fusconaia subrotunda — Final
https://ecos.fws.gov/ecp/species/9880#crithab

Orangenacre Mucket Hamiota perovalis — Final
https://ecos.fws.gov/ecp/species/1980#crithab

Ovate Clubshell Pleurobema perovatum — Final
https://ecos.fws.gov/ecp/species/5430#crithab

Oyster Mussel Epioblasma capsaeformis — Final
https://ecos.fws.gov/ecp/species/2099#crithab

Purple Bean Villosa perpurpurea — Final
https://ecos.fws.gov/ecp/species/4125#crithab

Rabbitsfoot Quadrula cylindrica cylindrica — Final
https://ecos.fws.gov/ecp/species/5165#crithab

Rough Rabbitsfoot Quadrula cylindrica strigillata — Final
https://ecos.fws.gov/ecp/species/5629#crithab

Round Hickorynut Obovaria subrotunda — Final
https://ecos.fws.gov/ecp/species/9879#crithab

Salamander Mussel Simpsonaias ambigua — Proposed
https://ecos.fws.gov/ecp/species/6208#crithab

NOT FOR CONSULTATION

Sheepnose Mussel Plethobasus cyphyus https://ecos.fws.gov/ecp/species/6903#crithab	Proposed
Short's Bladderpod Physaria globosa https://ecos.fws.gov/ecp/species/7206#crithab	Final
Sickle Darter Percina williamsi https://ecos.fws.gov/ecp/species/9866#crithab	Proposed
Slabside Pearlymussel Pleuronaia dolabelloides https://ecos.fws.gov/ecp/species/1518#crithab	Final
Slackwater Darter Etheostoma boschungi https://ecos.fws.gov/ecp/species/8058#crithab	Final
Slender Chub Erimystax cahni https://ecos.fws.gov/ecp/species/6637#crithab	Final
Slenderclaw Crayfish Cambarus cracens https://ecos.fws.gov/ecp/species/9792#crithab	Final
Smoky Madtom Noturus baileyi https://ecos.fws.gov/ecp/species/8211#crithab	Final
Snuffbox Mussel Epioblasma triquetra https://ecos.fws.gov/ecp/species/4135#crithab	Proposed
Southern Clubshell Pleurobema decisum https://ecos.fws.gov/ecp/species/6113#crithab	Final
Southern Pigtoe Pleurobema georgianum https://ecos.fws.gov/ecp/species/1520#crithab	Final
Spectaclecase (mussel) Cumberlandia monodonta https://ecos.fws.gov/ecp/species/7867#crithab	Proposed
Spotfin Chub Erimonax monachus https://ecos.fws.gov/ecp/species/1521#crithab	Final

NOT FOR CONSULTATION

Spring Pygmy Sunfish Elassoma alabamae https://ecos.fws.gov/ecp/species/652#crithab	Final
Spruce-fir Moss Spider Microhexura montivaga https://ecos.fws.gov/ecp/species/4801#crithab	Final
Triangular Kidneyshell Ptychobranchus greenii https://ecos.fws.gov/ecp/species/4396#crithab	Final
Trispot Darter Etheostoma trisella https://ecos.fws.gov/ecp/species/8219#crithab	Final
Whorled Sunflower Helianthus verticillatus https://ecos.fws.gov/ecp/species/3375#crithab	Final
Yellowfin Madtom Noturus flavipinnis https://ecos.fws.gov/ecp/species/8565#crithab	Final

NOT FOR CONSULTATION

Bald & Golden Eagles

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act [2] and the Migratory Bird Treaty Act (MBTA) [1]. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate avoidance and minimization measures, as described in the various links on this page.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are Bald Eagles and/or Golden Eagles in your project area.

Measures for Proactively Minimizing Eagle Impacts

For information on how to best avoid and minimize disturbance to nesting bald eagles, please review the National Bald Eagle Management Guidelines. You may employ the timing and activity-specific distance recommendations in this document when designing your project/activity to avoid and minimize eagle impacts. For bald eagle information specific to Alaska, please refer to Bald Eagle Nesting and Sensitivity to Human Activity.

The FWS does not currently have guidelines for avoiding and minimizing disturbance to nesting Golden Eagles. For site-specific recommendations regarding nesting Golden Eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

If disturbance or take of eagles cannot be avoided, an incidental take permit may be available to authorize any take that results from, but is not the purpose of, an otherwise lawful activity. For assistance making this determination for Bald Eagles, visit the Do I Need A Permit Tool. For assistance making this determination for golden eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

Ensure Your Eagle List is Accurate and Complete

If your project area is in a poorly surveyed area in IPaC, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to bald or golden eagles on your list, see the "Probability of Presence Summary" below to see when these bald or golden eagles are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NOT FOR CONSULTATION

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Sep 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds elsewhere

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (▪)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

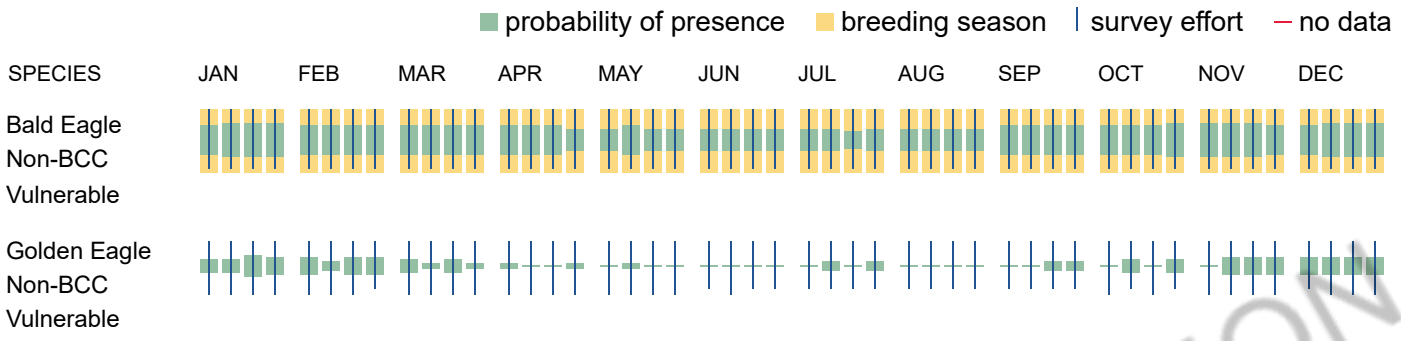
No Data (–)

NOT FOR CONSULTATION

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



NOT FOR CONSULTATION

Bald & Golden Eagles FAQs

What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are an eagle (Bald and Golden Eagle Protection Act requirements may apply).

Proper interpretation and use of your eagle report

On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort line or no data line (red horizontal) means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide you in knowing when to implement avoidance and minimization measures to eliminate or reduce potential impacts from your project activities or get the appropriate permits should presence be confirmed.

How do I know if eagles are breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If an eagle on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

NOT FOR CONSULTATION

Migratory birds

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service (Service). The incidental take of migratory birds is the injury or death of birds that results from, but is not the purpose, of an activity. The Service interprets the MBTA to prohibit incidental take.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management

- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

Measures for Proactively Minimizing Migratory Bird Impacts

Your IPaC Migratory Bird list showcases birds of concern, including Birds of Conservation Concern (BCC), in your project location. This is not a comprehensive list of all birds found in your project area. However, you can help proactively minimize significant impacts to all birds at your project location by implementing the measures in the Nationwide avoidance and minimization measures for birds document, and any other project-specific avoidance and minimization measures suggested at the link Measures for avoiding and minimizing impacts to birds for the birds of concern on your list below.

Ensure Your Migratory Bird List is Accurate and Complete

If your project area is in a poorly surveyed area, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles document, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the "Probability of Presence Summary" below to see when these birds are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
American Golden-plover Pluvialis dominica This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
American Kestrel Falco sparverius paulus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9587	Breeds Apr 1 to Aug 31
Bachman's Sparrow Peucaea aestivalis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/6177	Breeds May 1 to Sep 30

NOT FOR CONSULTATION

Bald Eagle Haliaeetus leucocephalus — Breeds Sep 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Black Skimmer Rynchops niger — Breeds May 20 to Sep 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/5234

Black-billed Cuckoo Coccyzus erythropthalmus — Breeds May 15 to Oct 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9399

Black-capped Chickadee Poecile atricapillus practicus — Breeds Apr 10 to Jul 31

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Bobolink Dolichonyx oryzivorus — Breeds May 20 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Brown-headed Nuthatch Sitta pusilla — Breeds Mar 1 to Jul 15

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Canada Warbler Cardellina canadensis — Breeds May 20 to Aug 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Cerulean Warbler Setophaga cerulea — Breeds Apr 23 to Jul 20

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/2974

Chimney Swift Chaetura pelagica — Breeds Mar 15 to Aug 25

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

NOT FOR CONSULTATION

Chuck-will's-widow Antrostomus carolinensis — Breeds May 10 to Jul 10
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Coastal (wayne□s) Black-throated Green Warbler Setophaga virens waynei — Breeds May 1 to Aug 15
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Eastern Whip-poor-will Antrostomus vociferus — Breeds May 1 to Aug 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Field Sparrow Spizella pusilla — Breeds Mar 1 to Aug 15
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Golden Eagle Aquila chrysaetos — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Golden-winged Warbler Vermivora chrysoptera — Breeds May 1 to Jul 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8745

Grasshopper Sparrow Ammodramus savannarum perpallidus — Breeds Jun 1 to Aug 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/8329

Gull-billed Tern Gelochelidon nilotica — Breeds May 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9501

NOT FOR CONSULTATION

Henslow's Sparrow Centronyx henslowii — Breeds May 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3941

Kentucky Warbler Geothlypis formosa — Breeds Apr 20 to Aug 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

King Rail Rallus elegans — Breeds May 1 to Sep 5
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8936

Le Conte's Sparrow Ammospiza leconteii — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Least Tern Sternula antillarum antillarum — Breeds Apr 25 to Sep 5
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Lesser Yellowlegs Tringa flavipes — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9679

Little Blue Heron Egretta caerulea — Breeds Mar 10 to Oct 15
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Northern Saw-whet Owl Aegolius acadicus — Breeds Mar 1 to Jul 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

NOT FOR CONSULTATION

Painted Bunting Passerina ciris — Breeds Apr 25 to Aug 15
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Pectoral Sandpiper Calidris melanotos — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Prairie Warbler Setophaga discolor — Breeds May 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Prothonotary Warbler Protonotaria citrea — Breeds Apr 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Red-headed Woodpecker Melanerpes erythrocephalus — Breeds May 10 to Sep 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Ruddy Turnstone Arenaria interpres morinella — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Rusty Blackbird Euphagus carolinus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Semipalmated Sandpiper Calidris pusilla — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Swallow-tailed Kite Elanoides forficatus — Breeds Mar 10 to Jun 30
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8938

NOT FOR CONSULTATION

Whimbrel Numenius phaeopus hudsonicus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Willet Tringa semipalmata This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 5
Wilson's Plover Charadrius wilsonia This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Aug 20
Wood Thrush Hylocichla mustelina This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31
Yellow Rail Coturnicops noveboracensis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9476	Breeds elsewhere

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

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2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

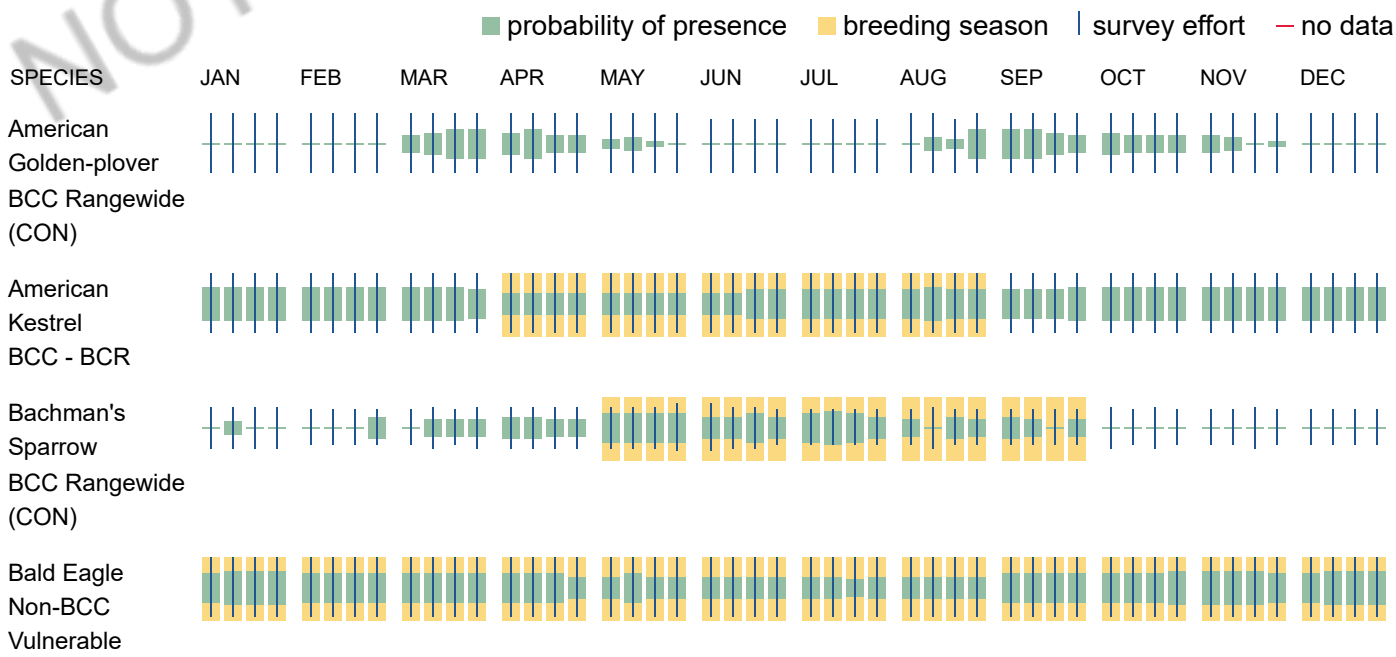
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

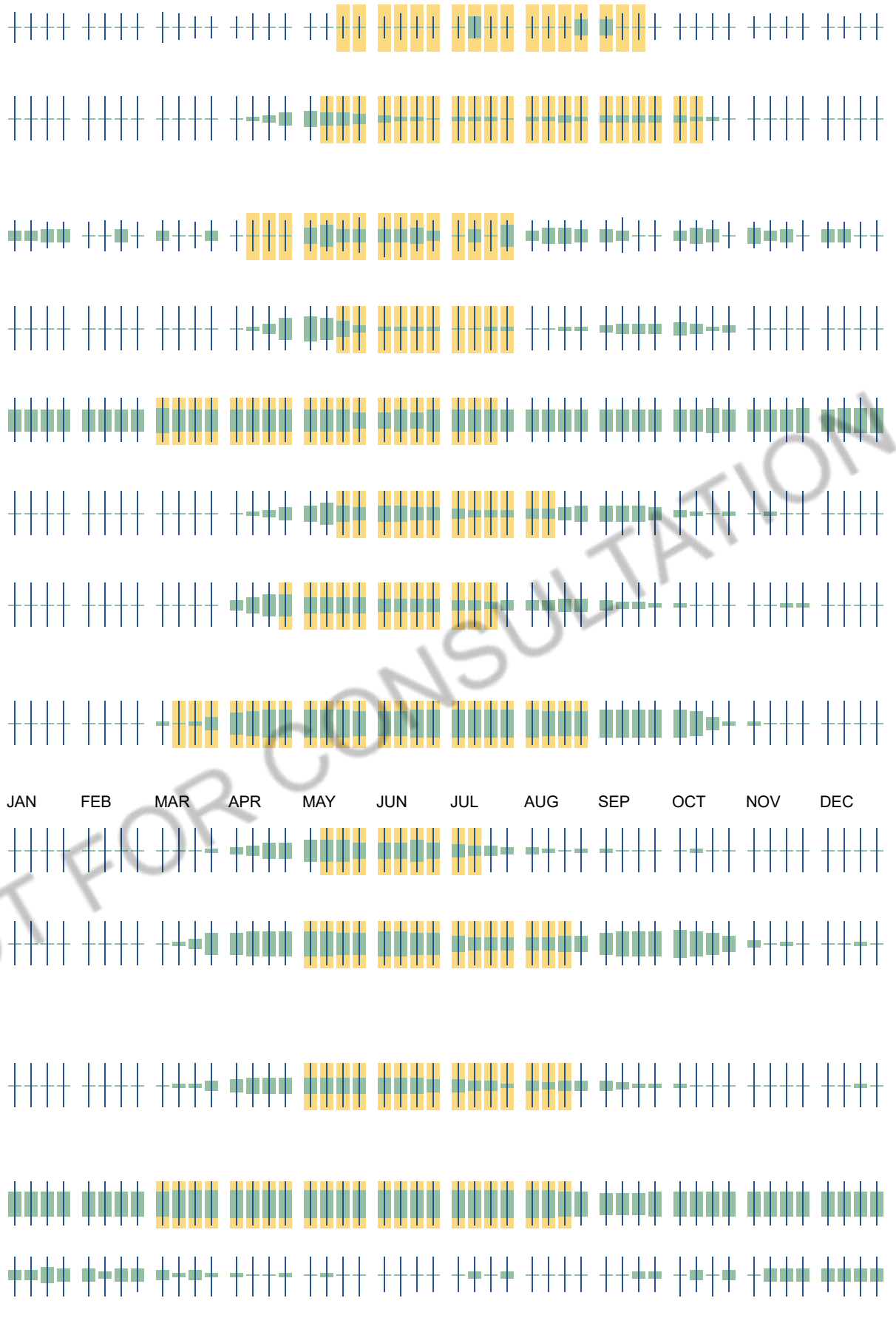
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

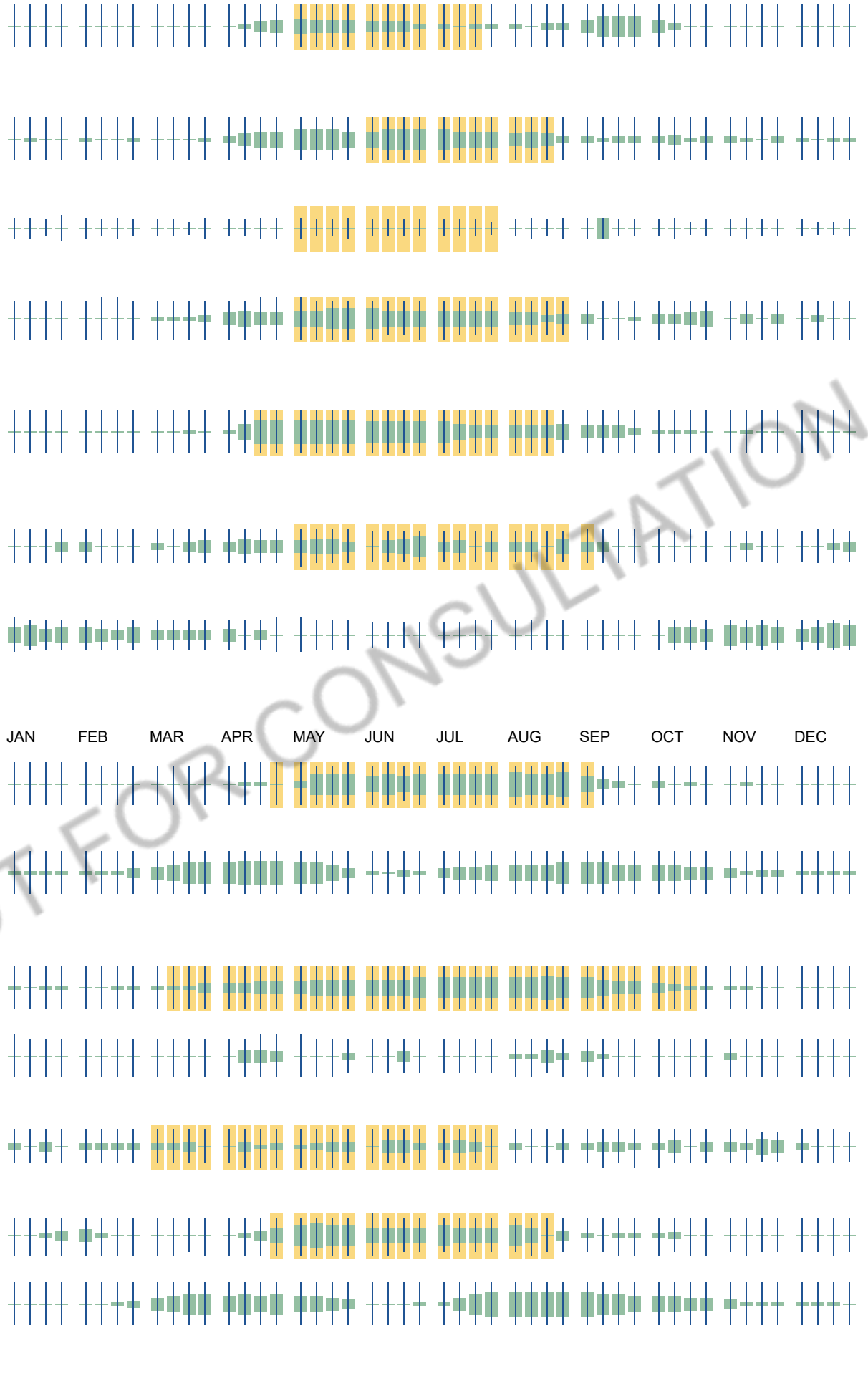
Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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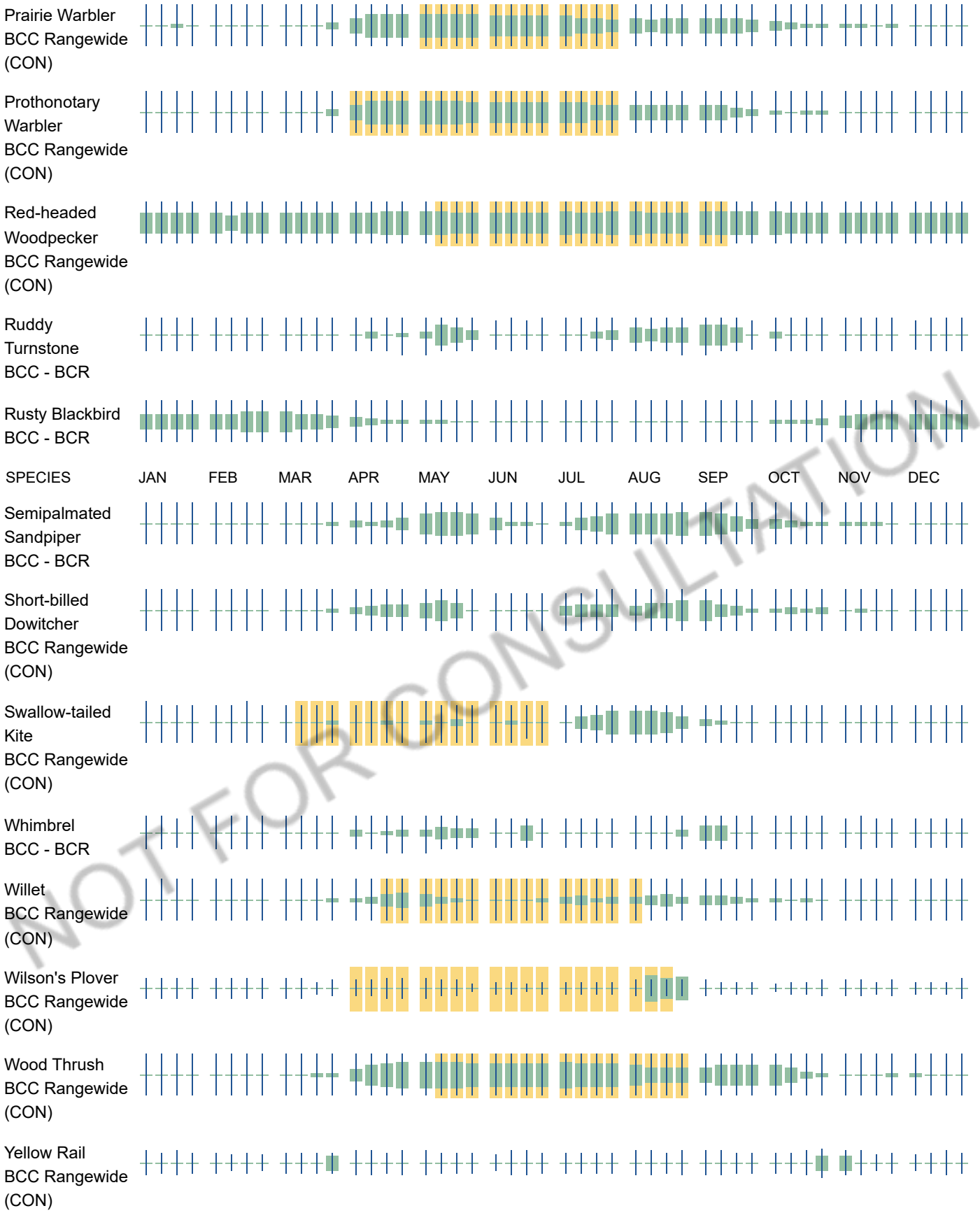




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Migratory Bird FAQs

Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Avoidance & Minimization Measures for Birds describes measures that can help avoid and minimize impacts to all birds at any location year-round. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is one of the most effective ways to minimize impacts. To see when birds are most likely to occur and breed in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location, such as those listed under the Endangered Species Act or the Bald and Golden Eagle Protection Act and those species marked as “Vulnerable”. See the FAQ “What are the levels of concern for migratory birds?” for more information on the levels of concern covered in the IPaC migratory bird species list.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) with which your project intersects. These species have been identified as warranting special attention because they are BCC species in that area, an eagle (Bald and Golden Eagle Protection Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, and to verify survey effort when no results present, please visit the Rapid Avian Information Locator (RAIL) Tool.

Why are subspecies showing up on my list?

Subspecies profiles are included on the list of species present in your project area because observations in the AKN for **the species** are being detected. If the species are present, that means that the subspecies may also be present. If a subspecies shows up on your list, you may need to rely on other resources to determine if that subspecies may be present (e.g. your local FWS field office, state surveys, your own surveys).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your IPaC migratory bird

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species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Bald and Golden Eagle Protection Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially BCC species. For more information on avoidance and minimization measures you can implement to help avoid and minimize migratory bird impacts, please see the FAQ “Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds”.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Proper interpretation and use of your migratory bird report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list does not represent all birds present in your project area. It is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide implementation of avoidance and minimization measures to eliminate or reduce potential impacts from your project activities, should presence be confirmed. To learn more about avoidance and minimization measures, visit the FAQ "Tell me about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

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Interpreting the Probability of Presence Graphs
Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:
The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

This location overlaps the following National Wildlife Refuge lands:

LAND	ACRES

CHICKASAW NATIONAL WILDLIFE REFUGE	26,896.89 acres
CLARKS RIVER NATIONAL WILDLIFE REFUGE	11,854.69 acres
CROSS CREEKS NATIONAL WILDLIFE REFUGE	8,823.84 acres
FARM SERVICE AGENCY INTEREST OF MS	104.47 acres
FARM SERVICE AGENCY INTEREST OF MS	6,851.59 acres
FARM SERVICE AGENCY INTEREST OF MS	7,123.63 acres
FARM SERVICE AGENCY INTEREST OF MS	49,097.6 acres
FERN CAVE NATIONAL WILDLIFE REFUGE	203.4 acres
HATCHIE NATIONAL WILDLIFE REFUGE	11,424.91 acres
KEY CAVE NATIONAL WILDLIFE REFUGE	1,059.82 acres
LAKE ISOM NATIONAL WILDLIFE REFUGE	1,813.25 acres
LOWER HATCHIE NATIONAL WILDLIFE REFUGE	14,211.06 acres
PAINT ROCK RIVER NATIONAL WILDLIFE REFUGE	87.38 acres
REELFOOT NATIONAL WILDLIFE REFUGE	10,428.62 acres
SAUTA CAVE NATIONAL WILDLIFE REFUGE	265.54 acres

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TENNESSEE NATIONAL WILDLIFE REFUGE	50,462.19 acres
WATERCRESS DARTER NATIONAL WILDLIFE REFUGE	24.06 acres
WHEELER NATIONAL WILDLIFE REFUGE	33,881.64 acres

Fish hatcheries

This location overlaps the following National Fish Hatcheries. Please contact them for further guidance.

HATCHERY	ACRES
CHATTAHOOCHEE FOREST NATIONAL FISH HATCHERY	44.45 acres
COHUTTA NATIONAL FISH HATCHERY	63.25 acres
DALE HOLLOW NATIONAL FISH HATCHERY	37.83 acres
ERWIN NATIONAL FISH HATCHERY	52.37 acres
PRIVATE JOHN ALLEN NATIONAL FISH HATCHERY	30.64 acres

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Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

The area of this project is too large for IPaC to load all NWI wetlands in the area. The list below may be incomplete. Please contact the local U.S. Fish and Wildlife Service office or visit the NWI map for a full list.

LAKE

- L1UBHh
- L2UBH
- L2AB3Hh
- L1UBH
- L2AB3Fh
- L2UBHh
- L2UBFh
- L1UBHx
- L2UB3Fh
- L2AB3H
- L2UBFb
- L2UBGh
- L2UBFx
- L2UB2Fh
- L1UBKx
- L2EM2Hh
- L2UB3H
- L2ABHh
- L1AB4Hh
- L1AB/UBHh
- L2ABFh
- L2EM2Fh

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

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The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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Appendix C – Draft National Historic Preservation Act Section 106 Programmatic Agreement

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TENNESSEE VALLEY AUTHORITY

400 West Summit Hill Drive, Knoxville, Tennessee 37902

March 14, 2025

Mr. Christopher Daniel
Program Analyst
Advisory Council on Historic Preservation
401 F Street NW, Suite 308
Washington, DC 20001

Ms. Renee Gledhill-Earley
Environmental Review Coordinator
Office of Archives and History
North Carolina State Historic Preservation Office
4617 Mail Service Center
Raleigh, North Carolina 27699-4617

Ms. Jennifer Flood
Deputy Director, State Historic Preservation Office
Department of Community Affairs
60 Executive Park South, NE
Atlanta, Georgia 30329

Ms. Lee Anne Hewitt
Deputy State Historic Preservation Officer
Alabama Historical Commission
468 South Perry Street
Montgomery, Alabama 36130-0900

Ms. Julie Langan
State Historic Preservation Officer
2801 Kensington Avenue
Virginia Department of Historic Resources
Richmond, Virginia 23221

Mr. E. Patrick McIntyre, Jr.
Executive Director
and State Historic Preservation Officer
Tennessee Historical Commission
2941 Lebanon Pike
Nashville, Tennessee 37243-0442

Mr. Craig Potts
Executive Director
and State Historic Preservation Officer
Kentucky Heritage Council
300 Washington Street

Mr. Barry White
Director
Mississippi Department of Archives and History
Historic Preservation Division
Post Office Box 571
Jackson, Mississippi 39205-0521

Dear Sir/ Madam:

TENNESSEE VALLEY AUTHORITY (TVA), RESILIENCE 360° PROGRAM PROGRAMMATIC AGREEMENT (PA), DRAFT REVIEW, MULTI-STATE, MULTI-COUNTY

TVA is proposing a “Commercial Resiliency” program, titled Resilience 360°, to partner with vendors and TVA customers to improve and enhance resiliency during events that challenge the transmission of power on the grid (e.g., extreme weather, and minor incidences of cyber-attack or domestic terrorism [e.g., vandalism of one or a few substations or switchyards]). Under the initial phases of the program, TVA would partner with multiple vendors through a qualified resiliency network to provide backup generation in the form of on-site modular natural gas units or battery energy storage systems (sometimes referred to as microgrids) to improve commercial

resiliency for qualified customers. The exact locations of these units are not yet known, but the program could place units across all seven states in the TVA power service area.

TVA initiated consultation with your office about the drafting of a PA for this program in a letter dated October 23, 2024. Your office agreed to participate in the development of the PA. Please find attached a draft of the Resilience 360° PA for your review.

Pursuant to 36 CFR Part 800.3(f)(2), TVA is consulting with federally recognized Indian tribes regarding the development of the PA.

Please contact Derek Reaux by email, djreaux@tva.gov with your comments.

Sincerely,



Michaelyn Harle
Manager, Cultural Projects, Economic Development, and Environment
Deputy Federal Preservation Officer
Cultural Resources

DJR:ERB

Appendix D – Socioeconomics

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D.1 Counties within the TVA PSA

State	County		
Alabama	Blount County	Etowah County	Limestone County
	Cherokee County	Franklin County	Madison County
	Colbert County	Jackson County	Marshall County
	Cullman County	Lauderdale County	Morgan County
	DeKalb County	Lawrence County	Winston County
Georgia	Catoosa County	Gilmer County	Union County
	Chattooga County	Gordon County	Walker County
	Dade County	Murray County	Whitfield County
	Fannin County	Towns County	
Kentucky	Allen County	Fulton County	Marshall County
	Butler County	Graves County	Monroe County
	Calloway County	Grayson County	Simpson County
	Carlisle County	Hickman County	Todd County
	Christian County	Livingston County	Trigg County
	Cumberland County	Logan County	Warren County
	Edmonson County	Lyon County	
Mississippi	Alcorn County	Leake County	Prentiss County
	Attala County	Lee County	Scott County
	Benton County	Lowndes County	Tallahatchie County
	Calhoun County	Marshall County	Tate County
	Chickasaw County	Monroe County	Tippah County
	Choctaw County	Neshoba County	Tishomingo County
	Clay County	Noxubee County	Union County
	De Soto County	Oktibbeha County	Webster County
	Itawamba County	Panola County	Winston County
	Kemper County	Pontotoc County	Yalobusha County
	Lafayette County		
North Carolina	Avery County	Clay County	
	Cherokee County	Watauga County	
Tennessee	Anderson County	Hamilton County	Morgan County
	Bedford County	Hancock County	Obion County
	Benton County	Hardeman County	Overton County
	Bledsoe County	Hardin County	Perry County
	Blount County	Hawkins County	Pickett County
	Bradley County	Haywood County	Polk County
	Campbell County	Henderson County	Putnam County
	Cannon County	Henry County	Rhea County
	Carroll County	Hickman County	Roane County
	Carter County	Houston County	Robertson County
	Cheatham County	Humphreys County	Rutherford County
	Chester County	Jackson County	Scott County
	Claiborne County	Jefferson County	Sequatchie County
	Clay County	Johnson County	Sevier County
	Cocke County	Knox County	Shelby County
	Coffee County	Lake County	Smith County
	Crockett County	Lauderdale County	Stewart County
	Cumberland County	Lawrence County	Sullivan County
	Davidson County	Lewis County	Sumner County
	Decatur County	Lincoln County	Tipton County
	DeKalb County	Loudon County	Trousdale County
	Dickson County	McMinn County	Unicoi County
	Dyer County	McNairy County	Union County
	Fayette County	Macon County	Van Buren County
	Fentress County	Madison County	Warren County
	Franklin County	Marion County	Washington County
	Gibson County	Marshall County	Wayne County
	Giles County	Maury County	Weakley County
	Grainger County	Meigs County	White County

State	County		
	Greene County	Monroe County	Williamson County
	Grundy County	Montgomery County	Wilson County
	Hamblen County	Moore County	
Virginia Counties and	Lee County	Washington County	Bristol City
Independent Cities	Scott County	Wise County	Norton City

D.2 Limited-Income Counties in the TVA PSA

Geography	Population 16 years and Over	Per Capita Income ($)	Poverty (%)
Lawrence County, Alabama	26,784	29,486	15.8
Colbert County, Alabama	46,692	30,724	15.9
Etowah County, Alabama	83,569	28,479	15.9
Franklin County, Alabama	24,985	24,874	16.6
Marshall County, Alabama	75,849	29,509	16.6
Winston County, Alabama	19,441	26,933	18.2
Jackson County, Alabama	43,027	27,695	18.6
DeKalb County, Alabama	56,883	24,915	20.2
Gilmer County, Georgia	26,144	34,412	14.8
Towns County, Georgia	11,180	33,443	15.3
Chattooga County, Georgia	19,821	21,576	19.9
Logan County, Kentucky	21,629	27,741	15.7
Muhlenberg County, Kentucky	25,111	31,621	16.3
Allen County, Kentucky	16,412	28,307	16.5
Christian County, Kentucky	54,414	25,973	16.7
Hickman County, Kentucky	3,724	38,895	16.7
Livingston County, Kentucky	7,432	31,024	16.8
Edmonson County, Kentucky	10,186	26,781	17.0
Warren County, Kentucky	107,619	34,201	17.2
Trigg County, Kentucky	11,426	30,172	18.2
Calloway County, Kentucky	31,421	27,850	18.7
Butler County, Kentucky	9,872	23,862	19.8
Graves County, Kentucky	28,886	28,978	19.8
Carlisle County, Kentucky	3,790	31,403	20.1
Monroe County, Kentucky	9,035	26,549	20.9
Grayson County, Kentucky	20,959	25,565	21.1
Todd County, Kentucky	9,432	30,252	21.1
Fulton County, Kentucky	5,273	19,960	27.4
Cumberland County, Kentucky	4,784	22,668	28.3
Webster County, Mississippi	7,802	27,836	15.8
Prentiss County, Mississippi	20,085	27,979	16.3
Monroe County, Mississippi	27,302	27,619	16.7
Pontotoc County, Mississippi	23,824	26,359	16.7
Tate County, Mississippi	22,445	28,306	16.7
Alcorn County, Mississippi	27,882	27,320	17.1
Benton County, Mississippi	6,299	24,690	17.6
Lowndes County, Mississippi	46,255	29,750	18.1
Calhoun County, Mississippi	10,644	24,192	18.8
Tippah County, Mississippi	17,150	27,762	18.9
Choctaw County, Mississippi	6,615	27,628	19.1
Tishomingo County, Mississippi	15,268	26,896	19.2
Marshall County, Mississippi	27,768	27,680	19.5
Lafayette County, Mississippi	46,935	32,536	19.6
Panola County, Mississippi	25,797	25,822	20.4
Yalobusha County, Mississippi	10,171	24,719	20.5
Leake County, Mississippi	17,041	25,662	21.0
Scott County, Mississippi	21,373	23,043	21.9
Kemper County, Mississippi	7,547	22,046	22.0
Clay County, Mississippi	14,892	24,702	23.0
Noxubee County, Mississippi	7,996	19,804	23.2
Attala County, Mississippi	13,759	27,625	23.6
Tallahatchie County, Mississippi	10,281	20,348	25.7
Winston County, Mississippi	14,208	27,743	26.0
Chickasaw County, Mississippi	13,269	21,968	26.6
Neshoba County, Mississippi	22,051	23,538	28.0
Oktibbeha County, Mississippi	43,626	28,221	28.5
Cherokee County, North Carolina	24,817	28,752	16.7

Geography	Population 16 years and Over	Per Capita Income ($)	Poverty (%)
Watauga County, North Carolina	48,773	30,807	24.9
Smith County, Tennessee	16,117	31,446	14.9
Cannon County, Tennessee	11,799	30,234	15.1
Sullivan County, Tennessee	132,231	33,934	15.2
Anderson County, Tennessee	62,800	32,803	15.4
Meigs County, Tennessee	10,544	26,843	15.4
Crockett County, Tennessee	10,987	30,362	15.6
Greene County, Tennessee	58,501	28,237	15.6
Marshall County, Tennessee	27,611	32,225	15.6
Rhea County, Tennessee	26,860	26,678	15.7
Washington County, Tennessee	111,727	35,562	15.7
Chester County, Tennessee	14,082	24,788	15.8
Union County, Tennessee	16,123	28,174	15.9
Monroe County, Tennessee	38,029	27,356	16.0
Hardeman County, Tennessee	21,321	22,098	16.1
Lawrence County, Tennessee	34,372	26,865	16.1
Obion County, Tennessee	24,703	28,782	16.1
Dyer County, Tennessee	28,929	37,415	16.3
Marion County, Tennessee	23,698	29,314	16.3
Putnam County, Tennessee	65,684	29,419	16.3
Carroll County, Tennessee	22,845	26,818	16.4
Macon County, Tennessee	19,914	24,979	16.5
McNairy County, Tennessee	21,082	25,004	16.7
Unicoi County, Tennessee	14,956	27,930	16.7
Warren County, Tennessee	32,671	27,059	16.8
Coffee County, Tennessee	45,845	29,277	16.9
Hawkins County, Tennessee	47,568	28,648	16.9
Van Buren County, Tennessee	5,156	24,099	17.0
Hamblen County, Tennessee	51,238	27,845	17.1
White County, Tennessee	21,993	26,213	17.1
Overton County, Tennessee	18,398	29,556	17.3
Grainger County, Tennessee	19,744	26,545	17.6
Benton County, Tennessee	13,164	27,185	18.0
Henderson County, Tennessee	22,415	25,873	18.0
Lauderdale County, Tennessee	20,161	24,358	18.0
Carter County, Tennessee	47,403	28,321	18.1
Henry County, Tennessee	26,438	28,098	18.1
Shelby County, Tennessee	721,643	36,230	18.1
Grundy County, Tennessee	11,124	25,075	18.2
Madison County, Tennessee	79,529	31,380	18.2
Claiborne County, Tennessee	26,655	25,408	18.3
Lewis County, Tennessee	10,232	26,873	18.9
Weakley County, Tennessee	27,581	26,820	18.9
Decatur County, Tennessee	9,438	27,578	19.2
Campbell County, Tennessee	32,109	26,791	19.4
Hardin County, Tennessee	22,102	26,068	19.4
Wayne County, Tennessee	13,806	26,538	19.6
Jackson County, Tennessee	9,973	25,534	19.7
Cocke County, Tennessee	29,708	25,864	20.1
DeKalb County, Tennessee	16,416	27,684	20.2
Fentress County, Tennessee	15,403	24,595	20.2
Morgan County, Tennessee	17,542	27,320	20.9
Pickett County, Tennessee	4,201	27,259	21.0
Johnson County, Tennessee	15,396	26,627	21.6
Haywood County, Tennessee	14,396	26,031	21.9
Clay County, Tennessee	6,208	22,931	22.3
Sequatchie County, Tennessee	13,212	25,954	22.3
Scott County, Tennessee	17,387	22,273	25.7
Bledsoe County, Tennessee	12,644	24,241	26.0
Lake County, Tennessee	6,018	19,695	27.9

Geography	Population 16 years and Over	Per Capita Income ($)	Poverty (%)
Hancock County, Tennessee	5,417	24,120	32.3
Bristol city, Virginia	13,904	30,419	17.0
Scott County, Virginia	18,094	26,681	17.0
Wise County, Virginia	30,055	23,702	19.9
Lee County, Virginia	18,676	23,257	26.0
Norton city, Virginia	3,138	27,666	29.1

Source: USCB 2023f

D.3 Low-Income Census Tracts in the TVA PSA

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 207.05; Colbert County; Alabama	913	26,663	14.8
Census Tract 9792.01; Lawrence County; Alabama	1,464	25,628	14.9
Census Tract 307.02; Marshall County; Alabama	3,175	38,894	14.9
Census Tract 9558.01; Cherokee County; Alabama	1,852	23,869	15.0
Census Tract 104.01; Etowah County; Alabama	3,232	21,477	15.0
Census Tract 9506.01; Jackson County; Alabama	3,195	23,851	15.0
Census Tract 310.01; Marshall County; Alabama	2,443	22,629	15.0
Census Tract 208.02; Colbert County; Alabama	2,850	28,554	15.1
Census Tract 9649.01; Cullman County; Alabama	3,035	37,422	15.2
Census Tract 9793; Lawrence County; Alabama	3,335	35,025	15.3
Census Tract 14.04; Madison County; Alabama	3,194	36,939	15.4
Census Tract 112.02; Madison County; Alabama	4,545	52,382	15.4
Census Tract 57.01; Morgan County; Alabama	1,697	29,545	15.4
Census Tract 57.03; Morgan County; Alabama	2,578	31,875	15.5
Census Tract 31; Madison County; Alabama	5,078	49,399	15.6
Census Tract 110.02; Etowah County; Alabama	3,855	22,382	15.7
Census Tract 505.02; Blount County; Alabama	2,911	32,678	15.8
Census Tract 304.01; Marshall County; Alabama	3,757	31,212	15.8
Census Tract 9561.02; Cherokee County; Alabama	1,918	24,271	15.9
Census Tract 9657; Winston County; Alabama	3,163	29,720	15.9
Census Tract 9729; Franklin County; Alabama	3,113	24,515	16.1
Census Tract 5.02; Madison County; Alabama	1,627	31,700	16.2
Census Tract 9642.02; Cullman County; Alabama	2,742	24,585	16.6
Census Tract 17; Etowah County; Alabama	1,124	26,497	16.8
Census Tract 111; Etowah County; Alabama	3,985	24,836	16.9
Census Tract 104.05; Madison County; Alabama	3,181	45,558	16.9
Census Tract 9558.02; Cherokee County; Alabama	2,318	31,300	17.0
Census Tract 9602; DeKalb County; Alabama	2,666	24,020	17.1
Census Tract 7.02; Madison County; Alabama	2,395	30,742	17.1
Census Tract 109.01; Lauderdale County; Alabama	3,090	30,844	17.3
Census Tract 9641; Cullman County; Alabama	5,145	28,445	17.4
Census Tract 9; Etowah County; Alabama	2,111	21,511	17.6
Census Tract 308.01; Marshall County; Alabama	3,815	31,889	17.6
Census Tract 501.07; Blount County; Alabama	2,042	23,043	17.7
Census Tract 9606.02; DeKalb County; Alabama	3,931	25,305	17.8
Census Tract 201.04; Limestone County; Alabama	2,743	27,553	17.8
Census Tract 9504; Jackson County; Alabama	1,806	38,913	17.9
Census Tract 206; Limestone County; Alabama	3,880	22,903	17.9
Census Tract 9510; Jackson County; Alabama	3,569	28,695	18.0
Census Tract 14.03; Madison County; Alabama	2,066	40,351	18.1
Census Tract 103; Etowah County; Alabama	2,326	23,128	18.2
Census Tract 6.02; Madison County; Alabama	1,798	30,976	18.5
Census Tract 9792.02; Lawrence County; Alabama	1,870	25,583	18.6
Census Tract 204.04; Limestone County; Alabama	2,513	58,030	18.6
Census Tract 25.02; Madison County; Alabama	2,852	22,233	18.7
Census Tract 9605; DeKalb County; Alabama	5,303	23,222	18.8
Census Tract 308.04; Marshall County; Alabama	3,793	17,610	18.8
Census Tract 53.05; Morgan County; Alabama	4,650	27,137	18.9
Census Tract 203; Limestone County; Alabama	2,675	34,130	19.2
Census Tract 501.03; Blount County; Alabama	1,614	29,396	19.3
Census Tract 9611; DeKalb County; Alabama	2,602	23,331	19.3
Census Tract 106; Lauderdale County; Alabama	2,183	25,518	19.3
Census Tract 205; Limestone County; Alabama	2,384	24,036	19.3
Census Tract 9655.02; Winston County; Alabama	2,981	31,126	19.3
Census Tract 503.02; Blount County; Alabama	2,130	24,425	19.4
Census Tract 307.01; Marshall County; Alabama	2,775	31,594	19.4

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 202; Colbert County; Alabama	1,478	22,512	19.5
Census Tract 9733; Franklin County; Alabama	2,610	24,243	19.5
Census Tract 9503.01; Jackson County; Alabama	2,132	25,326	19.7
Census Tract 15; Madison County; Alabama	5,425	20,873	20.1
Census Tract 51.09; Morgan County; Alabama	3,636	23,010	20.1
Census Tract 9730; Franklin County; Alabama	3,922	19,369	20.2
Census Tract 6.01; Madison County; Alabama	1,097	29,506	20.4
Census Tract 501.05; Blount County; Alabama	4,113	32,880	20.5
Census Tract 9; Morgan County; Alabama	4,495	22,269	20.5
Census Tract 308.03; Marshall County; Alabama	2,005	23,045	20.6
Census Tract 106.25; Madison County; Alabama	4,405	22,280	20.8
Census Tract 9655.03; Winston County; Alabama	2,451	27,346	20.9
Census Tract 9557.01; Cherokee County; Alabama	2,547	25,478	21.2
Census Tract 9607.02; DeKalb County; Alabama	1,236	25,111	21.2
Census Tract 107; Etowah County; Alabama	2,970	26,449	21.2
Census Tract 208.01; Colbert County; Alabama	3,744	33,718	21.3
Census Tract 211.01; Limestone County; Alabama	3,040	28,553	21.4
Census Tract 8; Morgan County; Alabama	2,174	23,590	21.4
Census Tract 205; Colbert County; Alabama	4,126	26,362	21.7
Census Tract 6; Etowah County; Alabama	1,785	17,336	21.7
Census Tract 9614; DeKalb County; Alabama	3,039	31,060	21.8
Census Tract 9603.03; DeKalb County; Alabama	3,604	26,475	22.1
Census Tract 302.04; Marshall County; Alabama	1,432	30,844	22.2
Census Tract 306.02; Marshall County; Alabama	3,578	28,834	22.5
Census Tract 52.02; Morgan County; Alabama	3,793	27,008	22.5
Census Tract 507.02; Blount County; Alabama	2,259	24,848	22.6
Census Tract 9653; Cullman County; Alabama	3,729	25,619	23.0
Census Tract 102; Lauderdale County; Alabama	1,777	28,096	23.0
Census Tract 9608; DeKalb County; Alabama	3,532	19,388	23.1
Census Tract 9656.02; Winston County; Alabama	2,587	22,144	23.1
Census Tract 9609; DeKalb County; Alabama	3,227	23,645	23.2
Census Tract 305.02; Marshall County; Alabama	3,911	31,618	23.2
Census Tract 110; Lauderdale County; Alabama	3,670	26,385	23.3
Census Tract 312; Marshall County; Alabama	4,262	24,146	23.3
Census Tract 9655.01; Winston County; Alabama	1,525	23,570	23.4
Census Tract 108; Lauderdale County; Alabama	2,623	18,842	23.6
Census Tract 311; Marshall County; Alabama	3,634	22,889	23.6
Census Tract 309.03; Marshall County; Alabama	3,684	23,337	24.1
Census Tract 9737.01; Franklin County; Alabama	1,014	22,960	24.2
Census Tract 9795.02; Lawrence County; Alabama	3,034	29,820	24.2
Census Tract 9734; Franklin County; Alabama	1,945	23,618	24.4
Census Tract 9794; Lawrence County; Alabama	3,749	24,501	24.5
Census Tract 301.01; Marshall County; Alabama	1,665	20,613	24.5
Census Tract 201; Colbert County; Alabama	2,960	30,897	24.7
Census Tract 108; Etowah County; Alabama	2,315	34,421	24.9
Census Tract 210; Colbert County; Alabama	3,059	29,298	25.3
Census Tract 9659; Winston County; Alabama	1,866	21,463	25.4
Census Tract 5.01; Madison County; Alabama	1,596	21,242	25.5
Census Tract 310.02; Marshall County; Alabama	2,601	18,983	25.7
Census Tract 1; Morgan County; Alabama	3,559	22,400	25.9
Census Tract 9507; Jackson County; Alabama	3,658	32,148	26.0
Census Tract 9508; Jackson County; Alabama	3,458	27,246	26.1
Census Tract 9502; Jackson County; Alabama	2,822	28,990	26.2
Census Tract 9606.01; DeKalb County; Alabama	996	26,988	26.3
Census Tract 9650.02; Cullman County; Alabama	3,592	29,958	26.6
Census Tract 501.06; Blount County; Alabama	2,322	22,148	27.3
Census Tract 107; Lauderdale County; Alabama	1,028	14,658	27.4
Census Tract 9607.03; DeKalb County; Alabama	3,539	22,581	27.5
Census Tract 109.02; Lauderdale County; Alabama	3,395	29,019	27.7

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 9501.01; Jackson County; Alabama	2,389	21,901	28.1
Census Tract 9654.01; Cullman County; Alabama	2,793	20,158	28.5
Census Tract 24; Madison County; Alabama	2,788	21,210	28.5
Census Tract 56.02; Morgan County; Alabama	1,804	29,076	28.6
Census Tract 3.01; Madison County; Alabama	3,069	21,318	28.9
Census Tract 12; Etowah County; Alabama	2,163	26,936	29.5
Census Tract 23; Madison County; Alabama	4,404	20,903	29.5
Census Tract 9503.02; Jackson County; Alabama	2,520	22,071	29.9
Census Tract 5; Etowah County; Alabama	1,424	20,902	31.0
Census Tract 112; Etowah County; Alabama	2,201	25,029	31.1
Census Tract 54.05; Morgan County; Alabama	4,054	27,138	31.7
Census Tract 2; Etowah County; Alabama	2,537	18,933	32.0
Census Tract 9736; Franklin County; Alabama	1,081	21,089	32.2
Census Tract 104; Lauderdale County; Alabama	2,921	24,694	32.8
Census Tract 7.01; Madison County; Alabama	2,294	23,670	33.8
Census Tract 22; Madison County; Alabama	1,588	19,803	34.1
Census Tract 9506.02; Jackson County; Alabama	1,671	24,884	34.4
Census Tract 9613; DeKalb County; Alabama	4,158	20,787	35.2
Census Tract 13.01; Madison County; Alabama	3,080	18,711	35.5
Census Tract 7; Morgan County; Alabama	2,935	16,115	35.5
Census Tract 2.03; Madison County; Alabama	5,173	10,815	35.6
Census Tract 3.02; Madison County; Alabama	3,167	14,035	35.9
Census Tract 207; Limestone County; Alabama	1,914	28,442	36.7
Census Tract 8; Etowah County; Alabama	864	15,001	36.9
Census Tract 9607.01; DeKalb County; Alabama	1,802	18,173	37.1
Census Tract 25.01; Madison County; Alabama	2,149	15,797	38.9
Census Tract 9601.01; DeKalb County; Alabama	1,414	22,419	39.0
Census Tract 10; Etowah County; Alabama	858	18,152	39.3
Census Tract 30; Madison County; Alabama	2,110	16,823	39.9
Census Tract 13; Etowah County; Alabama	2,312	21,427	40.1
Census Tract 203; Colbert County; Alabama	1,866	21,696	41.5
Census Tract 21; Madison County; Alabama	1,878	16,168	41.5
Census Tract 101; Lauderdale County; Alabama	2,007	12,400	41.9
Census Tract 3; Etowah County; Alabama	1,750	13,430	42.0
Census Tract 6; Morgan County; Alabama	1,987	16,191	43.4
Census Tract 12; Madison County; Alabama	2,145	13,548	43.6
Census Tract 7; Etowah County; Alabama	653	10,940	50.2
Census Tract 103; Lauderdale County; Alabama	948	15,330	60.6
Census Tract 9708.02; Gordon County; Georgia	1,632	31,506	14.8
Census Tract 803.01; Gilmer County; Georgia	1,908	30,347	15.0
Census Tract 15; Whitfield County; Georgia	5,187	26,931	15.0
Census Tract 307.02; Catoosa County; Georgia	3,755	27,878	15.1
Census Tract 11; Whitfield County; Georgia	3,693	20,343	15.2
Census Tract 401.02; Dade County; Georgia	3,072	23,792	15.5
Census Tract 2; Whitfield County; Georgia	3,783	27,020	15.5
Census Tract 9702.01; Gordon County; Georgia	2,745	35,677	15.6
Census Tract 104.01; Murray County; Georgia	2,034	20,818	15.6
Census Tract 9603.02; Towns County; Georgia	2,023	33,717	15.6
Census Tract 1.04; Union County; Georgia	2,195	32,709	16.2
Census Tract 206.02; Walker County; Georgia	3,778	22,778	16.4
Census Tract 208; Walker County; Georgia	2,347	31,192	16.5
Census Tract 101; Chattooga County; Georgia	2,069	25,825	16.6
Census Tract 9703.02; Gordon County; Georgia	4,014	25,981	16.6
Census Tract 802; Gilmer County; Georgia	5,400	35,078	17.4
Census Tract 104.02; Murray County; Georgia	2,198	23,606	17.4
Census Tract 1.01; Whitfield County; Georgia	3,048	29,350	17.4
Census Tract 9602; Towns County; Georgia	3,432	32,940	17.6
Census Tract 9706.02; Gordon County; Georgia	2,855	18,960	17.8
Census Tract 2.03; Union County; Georgia	1,833	34,257	18.1

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 203.01; Walker County; Georgia	4,279	25,834	18.3
Census Tract 9704; Gordon County; Georgia	4,922	32,643	18.4
Census Tract 101; Murray County; Georgia	2,762	28,902	18.6
Census Tract 805; Gilmer County; Georgia	3,530	29,806	18.7
Census Tract 203.02; Walker County; Georgia	4,247	24,384	20.0
Census Tract 105.01; Chattooga County; Georgia	2,332	11,259	20.1
Census Tract 1.01; Union County; Georgia	3,380	39,100	20.2
Census Tract 201.01; Walker County; Georgia	3,076	27,352	20.3
Census Tract 103; Chattooga County; Georgia	1,835	24,975	20.4
Census Tract 9707; Gordon County; Georgia	3,920	26,292	20.5
Census Tract 202; Walker County; Georgia	2,745	26,910	20.6
Census Tract 103; Murray County; Georgia	3,586	22,608	21.0
Census Tract 9701.02; Gordon County; Georgia	1,704	28,152	21.1
Census Tract 9705; Gordon County; Georgia	4,034	31,695	21.9
Census Tract 803.02; Gilmer County; Georgia	3,172	28,884	22.5
Census Tract 207.02; Walker County; Georgia	3,554	15,438	22.9
Census Tract 3.01; Whitfield County; Georgia	2,940	25,137	22.9
Census Tract 105.02; Chattooga County; Georgia	2,767	21,390	23.3
Census Tract 804.01; Gilmer County; Georgia	2,328	36,492	23.5
Census Tract 201.02; Walker County; Georgia	1,848	21,297	23.6
Census Tract 207.01; Walker County; Georgia	2,133	21,653	24.1
Census Tract 10; Whitfield County; Georgia	3,002	19,329	26.1
Census Tract 5.02; Whitfield County; Georgia	5,865	23,493	26.3
Census Tract 305.01; Catoosa County; Georgia	2,331	24,280	26.4
Census Tract 4.01; Whitfield County; Georgia	5,200	20,734	27.2
Census Tract 209.02; Walker County; Georgia	1,580	24,655	29.2
Census Tract 104.02; Chattooga County; Georgia	2,066	17,659	30.3
Census Tract 102.02; Chattooga County; Georgia	2,410	17,999	31.1
Census Tract 9203; Edmonson County; Kentucky	1,157	27,436	14.8
Census Tract 9602.02; Muhlenberg County; Kentucky	2,600	40,555	14.9
Census Tract 2002; Christian County; Kentucky	2,847	26,201	15.1
Census Tract 9301; Monroe County; Kentucky	1,543	31,215	15.2
Census Tract 9602; Logan County; Kentucky	2,990	28,388	15.3
Census Tract 9704.01; Simpson County; Kentucky	3,728	25,940	15.3
Census Tract 9206; Allen County; Kentucky	2,599	25,197	15.7
Census Tract 108.05; Warren County; Kentucky	2,968	37,866	16.1
Census Tract 117.02; Warren County; Kentucky	2,895	24,805	16.1
Census Tract 9702.02; Trigg County; Kentucky	2,857	31,126	16.2
Census Tract 107.01; Warren County; Kentucky	4,573	30,386	16.4
Census Tract 9304; Monroe County; Kentucky	3,837	25,915	16.5
Census Tract 9202; Edmonson County; Kentucky	3,550	24,235	16.6
Census Tract 9701; Hickman County; Kentucky	3,724	38,895	16.7
Census Tract 107.02; Warren County; Kentucky	5,868	36,279	16.7
Census Tract 2009.01; Christian County; Kentucky	2,144	50,036	16.8
Census Tract 2013.01; Christian County; Kentucky	2,725	25,592	16.8
Census Tract 9601; Logan County; Kentucky	4,155	26,918	16.8
Census Tract 9602.01; Muhlenberg County; Kentucky	3,167	23,743	17.2
Census Tract 9701; Simpson County; Kentucky	2,046	35,361	17.2
Census Tract 9703; Simpson County; Kentucky	3,661	29,145	17.4
Census Tract 113; Warren County; Kentucky	3,665	26,620	17.4
Census Tract 9506; Grayson County; Kentucky	2,816	24,599	17.5
Census Tract 9506.02; Marshall County; Kentucky	1,980	29,020	17.5
Census Tract 108; Calloway County; Kentucky	2,821	27,792	17.7
Census Tract 401; Livingston County; Kentucky	2,357	28,966	17.7
Census Tract 9604; Logan County; Kentucky	3,684	25,207	17.8
Census Tract 209; Graves County; Kentucky	2,445	26,367	17.9
Census Tract 9703.02; Trigg County; Kentucky	1,679	28,132	18.1
Census Tract 9603; Carlisle County; Kentucky	1,160	25,477	18.3
Census Tract 9204.02; Edmonson County; Kentucky	3,076	30,352	18.4

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 9605; Muhlenberg County; Kentucky	2,999	44,620	18.6
Census Tract 2005; Christian County; Kentucky	3,173	27,893	18.9
Census Tract 9203; Allen County; Kentucky	3,952	25,997	19.0
Census Tract 9603; Logan County; Kentucky	4,807	25,241	19.0
Census Tract 9704.02; Simpson County; Kentucky	1,787	25,710	19.2
Census Tract 402.02; Livingston County; Kentucky	2,513	27,193	19.3
Census Tract 9603; Muhlenberg County; Kentucky	3,027	25,872	19.3
Census Tract 9204; Allen County; Kentucky	3,384	31,376	19.4
Census Tract 9201; Allen County; Kentucky	2,795	29,477	19.5
Census Tract 103.04; Calloway County; Kentucky	3,069	25,409	19.5
Census Tract 202; Graves County; Kentucky	3,669	27,885	19.5
Census Tract 9304; Butler County; Kentucky	1,433	25,372	19.6
Census Tract 104; Calloway County; Kentucky	2,035	23,762	19.6
Census Tract 106.01; Calloway County; Kentucky	2,254	26,506	19.7
Census Tract 9604; Muhlenberg County; Kentucky	4,150	29,619	19.7
Census Tract 9501.01; Grayson County; Kentucky	835	31,844	20.4
Census Tract 9702.01; Trigg County; Kentucky	2,326	28,119	20.4
Census Tract 9504.02; Grayson County; Kentucky	3,918	23,947	20.8
Census Tract 9602; Fulton County; Kentucky	2,341	21,229	20.9
Census Tract 2007; Christian County; Kentucky	4,591	30,422	21.4
Census Tract 2013.04; Christian County; Kentucky	2,302	20,844	21.4
Census Tract 9504.01; Grayson County; Kentucky	1,669	31,725	21.7
Census Tract 9503; Grayson County; Kentucky	3,119	20,477	22.2
Census Tract 110.02; Warren County; Kentucky	5,786	22,663	22.3
Census Tract 9502; Cumberland County; Kentucky	1,684	24,217	22.4
Census Tract 2004; Christian County; Kentucky	2,233	20,076	22.6
Census Tract 108.01; Warren County; Kentucky	2,985	51,880	22.6
Census Tract 205; Graves County; Kentucky	3,098	25,211	22.7
Census Tract 9502; Todd County; Kentucky	4,189	30,680	22.8
Census Tract 9506.03; Marshall County; Kentucky	860	45,661	22.9
Census Tract 9501.02; Marshall County; Kentucky	1,819	28,577	23.4
Census Tract 105; Calloway County; Kentucky	2,539	26,000	23.5
Census Tract 9303; Monroe County; Kentucky	2,051	26,342	24.2
Census Tract 9607; Muhlenberg County; Kentucky	2,544	21,057	24.2
Census Tract 9302; Butler County; Kentucky	1,332	20,929	24.3
Census Tract 9502; Grayson County; Kentucky	2,454	20,023	24.8
Census Tract 9507; Grayson County; Kentucky	1,754	25,778	25.3
Census Tract 9602; Carlisle County; Kentucky	1,449	21,925	25.9
Census Tract 2001; Christian County; Kentucky	3,337	19,605	26.6
Census Tract 110.01; Warren County; Kentucky	3,305	18,365	27.3
Census Tract 109; Warren County; Kentucky	3,658	39,472	27.8
Census Tract 2008; Christian County; Kentucky	1,971	13,318	28.7
Census Tract 9505; Grayson County; Kentucky	2,472	27,906	28.8
Census Tract 203.02; Graves County; Kentucky	1,448	26,566	29.5
Census Tract 9501; Cumberland County; Kentucky	3,100	21,878	31.3
Census Tract 9601; Fulton County; Kentucky	2,932	19,065	31.3
Census Tract 203.01; Graves County; Kentucky	2,813	23,705	31.4
Census Tract 9503; Todd County; Kentucky	1,788	27,926	31.6
Census Tract 104; Warren County; Kentucky	4,445	6,736	31.7
Census Tract 9302; Monroe County; Kentucky	1,604	24,058	32.1
Census Tract 9505.02; Marshall County; Kentucky	2,282	23,864	32.6
Census Tract 9701; Trigg County; Kentucky	2,152	25,837	32.6
Census Tract 108.04; Warren County; Kentucky	2,982	24,484	32.8
Census Tract 112; Warren County; Kentucky	3,444	24,321	32.8
Census Tract 201; Graves County; Kentucky	3,574	27,286	33.6
Census Tract 9303.02; Butler County; Kentucky	2,443	18,902	40.0
Census Tract 102; Warren County; Kentucky	2,597	15,122	40.6
Census Tract 2003; Christian County; Kentucky	2,612	14,386	44.2
Census Tract 103.03; Calloway County; Kentucky	2,833	15,297	49.0

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 105; Warren County; Kentucky	2,654	22,747	52.1
Census Tract 103; Warren County; Kentucky	2,760	13,508	56.6
Census Tract 103.01; Calloway County; Kentucky	2,667	5,764	56.7
Census Tract 101; Warren County; Kentucky	2,885	16,636	60.6
Census Tract 9801; Edmonson County; Kentucky	157	8,568	76.2
Census Tract 9504.03; Lafayette County; Mississippi	2,827	35,469	14.9
Census Tract 9504.04; Lafayette County; Mississippi	4,756	42,930	14.9
Census Tract 9501; Tate County; Mississippi	4,162	23,090	14.9
Census Tract 9504.01; Tippah County; Mississippi	3,992	27,418	14.9
Census Tract 9504; Calhoun County; Mississippi	2,283	24,699	15.0
Census Tract 9504.02; Tishomingo County; Mississippi	3,420	25,815	15.1
Census Tract 9504; Prentiss County; Mississippi	3,663	26,883	15.2
Census Tract 9501; Tallahatchie County; Mississippi	3,279	26,881	15.3
Census Tract 9503; Union County; Mississippi	3,589	31,110	15.3
Census Tract 9509.01; Lee County; Mississippi	2,184	39,421	15.4
Census Tract 9501; Tippah County; Mississippi	3,602	40,639	15.4
Census Tract 9503; Tallahatchie County; Mississippi	3,211	15,797	15.5
Census Tract 9502.02; Panola County; Mississippi	864	24,562	15.6
Census Tract 711.22; DeSoto County; Mississippi	1,673	36,104	15.7
Census Tract 9504; Panola County; Mississippi	4,197	25,795	15.8
Census Tract 9501.02; Prentiss County; Mississippi	1,780	38,949	15.8
Census Tract 9509.02; Lee County; Mississippi	2,718	30,033	16.0
Census Tract 603; Attala County; Mississippi	2,619	24,484	16.1
Census Tract 9502; Clay County; Mississippi	1,975	25,129	16.1
Census Tract 703.25; DeSoto County; Mississippi	2,543	26,027	16.1
Census Tract 604; Attala County; Mississippi	2,146	25,921	16.2
Census Tract 9504.01; Alcorn County; Mississippi	2,158	24,102	16.3
Census Tract 401; Leake County; Mississippi	2,204	35,562	16.3
Census Tract 9502.02; Lee County; Mississippi	4,114	27,001	16.4
Census Tract 705.23; DeSoto County; Mississippi	6,161	31,751	16.6
Census Tract 9504.02; Tippah County; Mississippi	2,048	16,962	16.6
Census Tract 405; Leake County; Mississippi	2,250	26,492	16.7
Census Tract 9501; Clay County; Mississippi	3,911	21,004	16.9
Census Tract 5; Lowndes County; Mississippi	3,261	29,396	16.9
Census Tract 205; Scott County; Mississippi	4,051	20,595	16.9
Census Tract 9507; Alcorn County; Mississippi	3,201	22,809	17.0
Census Tract 9503.02; Lee County; Mississippi	3,366	27,255	17.0
Census Tract 703.10; DeSoto County; Mississippi	3,068	25,341	17.1
Census Tract 703.23; DeSoto County; Mississippi	3,916	23,755	17.1
Census Tract 9505.02; Panola County; Mississippi	3,240	29,646	17.2
Census Tract 9504; Union County; Mississippi	2,679	23,895	17.2
Census Tract 9501; Yalobusha County; Mississippi	2,876	26,183	17.3
Census Tract 602; Attala County; Mississippi	1,971	23,482	17.4
Census Tract 9502.01; Prentiss County; Mississippi	3,002	34,594	17.5
Census Tract 9505.02; Monroe County; Mississippi	3,245	30,945	17.6
Census Tract 9502; Webster County; Mississippi	2,843	25,010	17.6
Census Tract 705.21; DeSoto County; Mississippi	2,180	23,869	17.7
Census Tract 9505; Prentiss County; Mississippi	1,361	19,877	17.7
Census Tract 9502; Benton County; Mississippi	1,970	23,242	17.8
Census Tract 9501.01; Pontotoc County; Mississippi	2,697	32,451	18.0
Census Tract 9505; Pontotoc County; Mississippi	3,670	26,080	18.0
Census Tract 9505.07; Lafayette County; Mississippi	3,810	30,377	18.3
Census Tract 9502; Noxubee County; Mississippi	2,168	23,735	18.3
Census Tract 9503; Pontotoc County; Mississippi	4,298	26,170	18.4
Census Tract 9510.01; Lee County; Mississippi	2,828	24,394	18.6
Census Tract 9511.01; Lee County; Mississippi	2,079	25,047	18.7
Census Tract 9502.01; Monroe County; Mississippi	2,691	21,644	18.7
Census Tract 9501.02; Pontotoc County; Mississippi	4,985	23,400	18.7
Census Tract 9503.02; Prentiss County; Mississippi	2,829	34,931	19.0

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 9501; Noxubee County; Mississippi	3,574	18,633	19.3
Census Tract 9501.01; Tishomingo County; Mississippi	1,470	33,095	19.5
Census Tract 9502; Winston County; Mississippi	2,553	29,989	19.5
Census Tract 9502.02; Marshall County; Mississippi	3,467	33,020	19.9
Census Tract 206; Scott County; Mississippi	2,504	19,689	19.9
Census Tract 704.22; DeSoto County; Mississippi	2,121	20,644	20.0
Census Tract 10; Lowndes County; Mississippi	2,077	39,856	20.1
Census Tract 703.22; DeSoto County; Mississippi	3,194	25,573	20.2
Census Tract 9504.01; Chickasaw County; Mississippi	1,520	22,280	20.3
Census Tract 9506.04; Oktibbeha County; Mississippi	2,207	24,207	20.4
Census Tract 9502; Choctaw County; Mississippi	3,453	24,756	20.5
Census Tract 9502.02; Monroe County; Mississippi	2,835	24,606	20.5
Census Tract 9504.02; Chickasaw County; Mississippi	2,364	26,600	20.6
Census Tract 702.21; DeSoto County; Mississippi	2,911	28,577	20.6
Census Tract 404.02; Leake County; Mississippi	2,237	18,537	20.6
Census Tract 9503.01; Marshall County; Mississippi	3,077	32,869	20.7
Census Tract 704.21; DeSoto County; Mississippi	2,489	26,893	20.8
Census Tract 9501.02; Panola County; Mississippi	2,204	24,597	21.5
Census Tract 9501.02; Benton County; Mississippi	1,853	23,175	21.6
Census Tract 9503.01; Tate County; Mississippi	3,612	32,317	21.8
Census Tract 9504.01; Marshall County; Mississippi	2,233	26,784	22.0
Census Tract 201.01; Scott County; Mississippi	2,444	27,874	22.0
Census Tract 9503.02; Tate County; Mississippi	4,264	30,961	22.1
Census Tract 202; Scott County; Mississippi	3,645	24,223	22.4
Census Tract 9504; Tate County; Mississippi	5,164	21,053	22.5
Census Tract 9503; Calhoun County; Mississippi	2,466	21,959	22.6
Census Tract 704.11; DeSoto County; Mississippi	1,406	16,020	22.6
Census Tract 701.01; DeSoto County; Mississippi	2,492	29,412	22.7
Census Tract 9506.02; Lee County; Mississippi	3,035	32,568	22.8
Census Tract 9502; Yalobusha County; Mississippi	3,593	23,180	23.1
Census Tract 4.05; Lowndes County; Mississippi	4,682	22,415	23.2
Census Tract 9506; Monroe County; Mississippi	2,218	24,582	23.4
Census Tract 9502.01; Marshall County; Mississippi	2,948	22,817	23.5
Census Tract 9505; Calhoun County; Mississippi	1,981	21,227	23.6
Census Tract 9503; Alcorn County; Mississippi	2,985	34,583	23.7
Census Tract 407; Leake County; Mississippi	3,129	30,556	23.8
Census Tract 9504; Monroe County; Mississippi	2,598	21,299	24.1
Census Tract 107; Neshoba County; Mississippi	3,176	28,177	24.2
Census Tract 605; Attala County; Mississippi	2,689	47,572	24.3
Census Tract 9503.03; Lafayette County; Mississippi	1,610	27,030	24.4
Census Tract 104; Neshoba County; Mississippi	2,814	29,862	24.8
Census Tract 9507; Lee County; Mississippi	2,992	29,198	25.2
Census Tract 9505.02; Lafayette County; Mississippi	2,250	22,795	25.4
Census Tract 11; Lowndes County; Mississippi	1,221	27,113	25.8
Census Tract 9502; Tishomingo County; Mississippi	1,668	22,968	25.8
Census Tract 9503; Chickasaw County; Mississippi	4,126	21,110	26.2
Census Tract 9504; Winston County; Mississippi	2,523	31,233	26.2
Census Tract 9505.01; Marshall County; Mississippi	1,872	23,350	26.5
Census Tract 9507; Monroe County; Mississippi	1,815	29,203	26.9
Census Tract 703.24; DeSoto County; Mississippi	3,350	19,474	27.1
Census Tract 9506.01; Oktibbeha County; Mississippi	4,796	38,858	27.3
Census Tract 9502.01; Tippah County; Mississippi	3,522	23,327	27.7
Census Tract 7; Lowndes County; Mississippi	4,036	21,834	27.9
Census Tract 9503; Oktibbeha County; Mississippi	2,764	20,400	28.4
Census Tract 406; Leake County; Mississippi	4,537	21,249	28.5
Census Tract 9505.02; Alcorn County; Mississippi	2,308	17,385	28.8
Census Tract 9508; Monroe County; Mississippi	2,129	26,868	28.9
Census Tract 9501; Winston County; Mississippi	2,429	24,821	29.1
Census Tract 9502; Chickasaw County; Mississippi	2,485	18,637	29.2

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 9503; Choctaw County; Mississippi	1,285	20,780	29.2
Census Tract 9510.02; Lee County; Mississippi	2,941	20,651	29.2
Census Tract 9505.02; Marshall County; Mississippi	2,208	35,316	29.3
Census Tract 9504.01; Tishomingo County; Mississippi	2,623	26,532	29.3
Census Tract 9502.01; Oktibbeha County; Mississippi	3,212	29,639	29.4
Census Tract 201.02; Scott County; Mississippi	2,840	16,624	29.5
Census Tract 9505.04; Lafayette County; Mississippi	2,554	25,655	29.6
Census Tract 9502.02; Tippah County; Mississippi	1,711	18,965	29.6
Census Tract 106; Neshoba County; Mississippi	3,579	20,288	29.7
Census Tract 102; Neshoba County; Mississippi	2,385	20,370	29.9
Census Tract 9507.02; Oktibbeha County; Mississippi	3,012	32,456	30.8
Census Tract 9501.02; Oktibbeha County; Mississippi	3,294	25,800	30.9
Census Tract 9504.02; Marshall County; Mississippi	4,093	15,538	31.2
Census Tract 9503; Webster County; Mississippi	1,309	21,914	31.4
Census Tract 9506.02; Panola County; Mississippi	1,871	13,721	31.7
Census Tract 9504.02; Oktibbeha County; Mississippi	2,255	28,425	32.1
Census Tract 9506.03; Oktibbeha County; Mississippi	2,274	47,548	32.4
Census Tract 9501; Chickasaw County; Mississippi	2,774	22,240	33.1
Census Tract 9502; Calhoun County; Mississippi	980	22,167	33.2
Census Tract 9502; Tallahatchie County; Mississippi	2,085	18,044	33.3
Census Tract 301; Kemper County; Mississippi	3,970	19,140	33.6
Census Tract 9504; Clay County; Mississippi	3,514	26,669	33.7
Census Tract 9503; Noxubee County; Mississippi	2,254	18,210	33.7
Census Tract 9501.02; Tishomingo County; Mississippi	1,191	25,651	34.1
Census Tract 9502.01; Alcorn County; Mississippi	2,783	21,086	34.4
Census Tract 606; Attala County; Mississippi	2,527	18,685	34.7
Census Tract 9501.01; Oktibbeha County; Mississippi	5,298	22,082	34.9
Census Tract 601; Attala County; Mississippi	1,807	22,346	35.0
Census Tract 9503.01; Prentiss County; Mississippi	2,459	16,844	35.1
Census Tract 9503.04; Lafayette County; Mississippi	2,032	27,561	35.4
Census Tract 9501.01; Panola County; Mississippi	2,990	14,595	35.4
Census Tract 704.12; DeSoto County; Mississippi	3,245	19,577	35.7
Census Tract 9503.01; Yalobusha County; Mississippi	1,623	23,508	36.0
Census Tract 204; Scott County; Mississippi	2,358	27,193	36.2
Census Tract 9.02; Lowndes County; Mississippi	1,825	28,577	36.3
Census Tract 9505; Oktibbeha County; Mississippi	3,558	26,313	37.3
Census Tract 9401; Neshoba County; Mississippi	3,288	15,227	38.6
Census Tract 9503; Winston County; Mississippi	3,174	23,623	40.1
Census Tract 8; Lowndes County; Mississippi	2,445	13,897	41.9
Census Tract 9503; Clay County; Mississippi	2,262	17,417	42.1
Census Tract 9502.04; Lafayette County; Mississippi	2,030	42,774	43.5
Census Tract 105; Neshoba County; Mississippi	2,581	21,693	45.1
Census Tract 9502.03; Lafayette County; Mississippi	2,704	25,802	46.0
Census Tract 9503.01; Lafayette County; Mississippi	6,213	8,404	49.0
Census Tract 6; Lowndes County; Mississippi	2,476	10,871	50.9
Census Tract 9504; Tallahatchie County; Mississippi	1,706	20,334	51.4
Census Tract 9504.01; Oktibbeha County; Mississippi	4,735	13,366	53.7
Census Tract 9502.01; Panola County; Mississippi	1,385	14,569	55.6
Census Tract 9305.02; Cherokee County; North Carolina	3,169	32,767	15.9
Census Tract 9303.02; Avery County; North Carolina	2,225	30,883	17.4
Census Tract 9207.03; Watauga County; North Carolina	5,270	39,658	17.7
Census Tract 9501.01; Clay County; North Carolina	2,516	34,744	18.6
Census Tract 9502.02; Clay County; North Carolina	2,318	23,387	20.9
Census Tract 9306.04; Cherokee County; North Carolina	1,504	24,760	22.9
Census Tract 9304.02; Cherokee County; North Carolina	1,589	27,543	23.0
Census Tract 9301.01; Cherokee County; North Carolina	2,021	27,293	23.1
Census Tract 9301.02; Cherokee County; North Carolina	1,741	23,312	23.5
Census Tract 9206.02; Watauga County; North Carolina	2,315	46,666	26.7
Census Tract 9304.01; Cherokee County; North Carolina	3,653	27,679	30.1

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 9205; Watauga County; North Carolina	7,387	11,327	38.9
Census Tract 9204; Watauga County; North Carolina	7,526	25,205	41.6
Census Tract 9206.01; Watauga County; North Carolina	6,322	17,068	62.3
Census Tract 102.01; Bradley County; Tennessee	2,121	32,463	14.8
Census Tract 9623; Carroll County; Tennessee	3,496	28,766	14.8
Census Tract 502; Hawkins County; Tennessee	4,112	23,100	14.8
Census Tract 9607; Lawrence County; Tennessee	3,196	27,140	14.8
Census Tract 14.01; Madison County; Tennessee	1,790	26,100	14.8
Census Tract 9203; Cocke County; Tennessee	3,962	34,753	14.9
Census Tract 9710.02; Coffee County; Tennessee	4,266	34,369	14.9
Census Tract 9502.02; Hickman County; Tennessee	2,714	25,819	14.9
Census Tract 106; Maury County; Tennessee	4,295	25,628	14.9
Census Tract 1020.01; Montgomery County; Tennessee	5,211	33,244	14.9
Census Tract 201.02; Shelby County; Tennessee	2,226	34,533	14.9
Census Tract 426; Sullivan County; Tennessee	3,112	32,383	14.9
Census Tract 611; Washington County; Tennessee	4,337	37,515	14.9
Census Tract 106; Blount County; Tennessee	3,577	23,985	15.0
Census Tract 9250.02; Monroe County; Tennessee	3,169	30,593	15.0
Census Tract 201.02; Sumner County; Tennessee	4,288	27,510	15.0
Census Tract 9633; Benton County; Tennessee	2,883	27,076	15.1
Census Tract 9550.03; Decatur County; Tennessee	1,955	23,903	15.1
Census Tract 48; Knox County; Tennessee	4,130	29,481	15.1
Census Tract 9554; Marshall County; Tennessee	3,529	31,413	15.1
Census Tract 9657; Obion County; Tennessee	3,648	28,088	15.1
Census Tract 206.35; Shelby County; Tennessee	2,198	30,951	15.1
Census Tract 413; Sullivan County; Tennessee	4,047	35,891	15.1
Census Tract 802; Unicoi County; Tennessee	5,002	28,267	15.1
Census Tract 9701.02; Chester County; Tennessee	2,869	28,858	15.2
Census Tract 1007; Hamblen County; Tennessee	4,684	27,972	15.2
Census Tract 9502; Hardeman County; Tennessee	5,702	12,402	15.2
Census Tract 706; Jefferson County; Tennessee	3,833	33,034	15.2
Census Tract 39.01; Knox County; Tennessee	3,382	34,639	15.2
Census Tract 63; Shelby County; Tennessee	2,180	42,802	15.2
Census Tract 112.01; Blount County; Tennessee	4,134	31,719	15.3
Census Tract 701.03; Cheatham County; Tennessee	3,292	29,420	15.3
Census Tract 9750; Rhea County; Tennessee	3,949	32,909	15.3
Census Tract 717; Carter County; Tennessee	2,794	29,273	15.4
Census Tract 104.01; Davidson County; Tennessee	4,620	29,237	15.4
Census Tract 173; Davidson County; Tennessee	2,428	28,185	15.4
Census Tract 602.01; Dickson County; Tennessee	2,857	26,002	15.4
Census Tract 9640.01; Dyer County; Tennessee	3,828	25,211	15.4
Census Tract 9609; Lawrence County; Tennessee	1,704	22,947	15.4
Census Tract 1016; Montgomery County; Tennessee	4,747	29,928	15.4
Census Tract 9650; Obion County; Tennessee	3,427	31,491	15.4
Census Tract 401.05; Rutherford County; Tennessee	3,282	28,142	15.4
Census Tract 9703.01; Cumberland County; Tennessee	3,009	27,955	15.5
Census Tract 137.02; Davidson County; Tennessee	3,326	36,226	15.5
Census Tract 908; Greene County; Tennessee	3,957	25,633	15.5
Census Tract 1304; Humphreys County; Tennessee	2,059	28,540	15.5
Census Tract 23; Knox County; Tennessee	2,854	28,926	15.5
Census Tract 9555; Marshall County; Tennessee	3,968	31,081	15.5
Census Tract 133; Davidson County; Tennessee	4,315	55,214	15.6
Census Tract 608; Fayette County; Tennessee	1,784	29,463	15.6
Census Tract 18; Hamilton County; Tennessee	2,244	33,762	15.6
Census Tract 9552; Marshall County; Tennessee	5,247	36,519	15.6
Census Tract 9708.01; Coffee County; Tennessee	3,141	30,124	15.7
Census Tract 9504; Hardeman County; Tennessee	4,129	25,919	15.7
Census Tract 9505; Hardeman County; Tennessee	3,360	25,002	15.7
Census Tract 9503; Wayne County; Tennessee	2,772	24,870	15.7

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 9301; McNairy County; Tennessee	3,284	24,362	15.8
Census Tract 427.03; Sullivan County; Tennessee	2,011	22,273	15.8
Census Tract 9252; Van Buren County; Tennessee	2,690	22,989	15.8
Census Tract 183.03; Davidson County; Tennessee	3,970	48,048	15.9
Census Tract 9606; Lawrence County; Tennessee	1,721	26,865	15.9
Census Tract 9654; Obion County; Tennessee	3,571	35,593	15.9
Census Tract 9754.02; Rhea County; Tennessee	2,759	29,379	15.9
Census Tract 206.58; Shelby County; Tennessee	4,673	26,325	15.9
Census Tract 156.29; Davidson County; Tennessee	4,294	25,898	16.0
Census Tract 157; Davidson County; Tennessee	1,382	34,213	16.0
Census Tract 31; Hamilton County; Tennessee	1,918	66,209	16.0
Census Tract 110.01; Hamilton County; Tennessee	1,697	26,607	16.0
Census Tract 9753; Rhea County; Tennessee	5,232	24,987	16.0
Census Tract 418; Rutherford County; Tennessee	3,912	29,568	16.0
Census Tract 9686; Weakley County; Tennessee	3,150	26,911	16.0
Census Tract 9506; Bedford County; Tennessee	6,049	24,473	16.1
Census Tract 715; Carter County; Tennessee	1,861	37,200	16.1
Census Tract 113; Davidson County; Tennessee	4,601	35,948	16.1
Census Tract 103.02; Davidson County; Tennessee	1,334	46,533	16.2
Census Tract 9201.01; DeKalb County; Tennessee	2,547	36,348	16.2
Census Tract 21; Knox County; Tennessee	2,253	23,253	16.2
Census Tract 9756.01; Lincoln County; Tennessee	5,076	27,943	16.2
Census Tract 420; Sullivan County; Tennessee	2,965	27,240	16.2
Census Tract 505.04; Williamson County; Tennessee	3,739	34,635	16.2
Census Tract 9503; Bedford County; Tennessee	2,804	30,836	16.3
Census Tract 103.01; Blount County; Tennessee	5,233	31,082	16.3
Census Tract 9704.01; Cumberland County; Tennessee	3,944	20,878	16.3
Census Tract 422; Rutherford County; Tennessee	4,011	29,445	16.3
Census Tract 407; Sullivan County; Tennessee	2,199	37,691	16.3
Census Tract 9507.01; Campbell County; Tennessee	1,732	27,913	16.4
Census Tract 605.02; Dickson County; Tennessee	2,789	35,426	16.4
Census Tract 62.08; Knox County; Tennessee	4,072	32,812	16.4
Census Tract 9707; McMinn County; Tennessee	3,809	33,344	16.4
Census Tract 804.01; Sevier County; Tennessee	2,577	36,038	16.4
Census Tract 16; Shelby County; Tennessee	2,961	43,312	16.4
Census Tract 431; Sullivan County; Tennessee	2,564	27,407	16.4
Census Tract 9506; Hardeman County; Tennessee	2,052	22,177	16.5
Census Tract 501; Hawkins County; Tennessee	3,543	24,938	16.5
Census Tract 75; Shelby County; Tennessee	922	34,999	16.5
Census Tract 711; Carter County; Tennessee	1,735	28,586	16.6
Census Tract 156.19; Davidson County; Tennessee	4,294	32,914	16.6
Census Tract 9202.02; DeKalb County; Tennessee	1,566	24,612	16.6
Census Tract 503.01; Hawkins County; Tennessee	3,939	27,118	16.6
Census Tract 602.03; Loudon County; Tennessee	2,505	19,981	16.6
Census Tract 9302; McNairy County; Tennessee	2,085	27,051	16.6
Census Tract 3; Madison County; Tennessee	3,606	33,415	16.6
Census Tract 9254.02; Monroe County; Tennessee	4,234	26,200	16.6
Census Tract 210.02; Anderson County; Tennessee	2,960	24,131	16.7
Census Tract 9205.02; Cocke County; Tennessee	4,120	27,768	16.7
Census Tract 9203; Hardin County; Tennessee	3,350	25,732	16.7
Census Tract 46.08; Knox County; Tennessee	2,354	33,632	16.7
Census Tract 9255.01; Monroe County; Tennessee	2,637	25,945	16.7
Census Tract 9753; Smith County; Tennessee	1,738	24,194	16.7
Census Tract 9302.02; Warren County; Tennessee	3,147	29,316	16.7
Census Tract 9208; Giles County; Tennessee	2,588	29,027	16.8
Census Tract 606; Loudon County; Tennessee	3,926	31,168	16.8
Census Tract 210.23; Shelby County; Tennessee	6,193	54,822	16.8
Census Tract 9302.01; Warren County; Tennessee	2,610	29,971	16.8
Census Tract 112.04; Hamilton County; Tennessee	4,510	37,769	16.9

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 9201; Hardin County; Tennessee	3,263	33,482	16.9
Census Tract 32; Knox County; Tennessee	2,679	23,962	16.9
Census Tract 103; Bradley County; Tennessee	2,939	22,171	17.0
Census Tract 9706; Claiborne County; Tennessee	4,058	31,787	17.0
Census Tract 161; Davidson County; Tennessee	2,038	46,981	17.0
Census Tract 9754; Lincoln County; Tennessee	3,549	28,590	17.0
Census Tract 3.03; Putnam County; Tennessee	1,723	22,497	17.0
Census Tract 305; Roane County; Tennessee	3,919	30,860	17.0
Census Tract 9755; Henderson County; Tennessee	3,197	24,722	17.1
Census Tract 9602; Lawrence County; Tennessee	2,282	23,612	17.1
Census Tract 102.05; Maury County; Tennessee	1,196	41,314	17.1
Census Tract 404.04; Rutherford County; Tennessee	2,416	31,782	17.1
Census Tract 205.11; Shelby County; Tennessee	1,992	36,989	17.1
Census Tract 201.01; Sumner County; Tennessee	2,829	26,746	17.1
Census Tract 9681.01; Weakley County; Tennessee	2,969	27,588	17.1
Census Tract 225; Shelby County; Tennessee	3,497	23,292	17.2
Census Tract 406.01; Tipton County; Tennessee	3,887	25,545	17.2
Census Tract 9508; Campbell County; Tennessee	2,106	28,899	17.3
Census Tract 164; Davidson County; Tennessee	4,381	24,509	17.3
Census Tract 9202; Giles County; Tennessee	3,936	27,924	17.3
Census Tract 9503.02; Hickman County; Tennessee	3,587	35,818	17.3
Census Tract 418; Sullivan County; Tennessee	3,569	30,132	17.3
Census Tract 430; Sullivan County; Tennessee	3,806	33,077	17.3
Census Tract 9630; Benton County; Tennessee	2,735	27,761	17.4
Census Tract 101; Bradley County; Tennessee	4,091	33,113	17.4
Census Tract 101.04; Hamilton County; Tennessee	3,188	30,634	17.4
Census Tract 108; Hamilton County; Tennessee	3,441	39,260	17.4
Census Tract 404.05; Rutherford County; Tennessee	3,366	32,517	17.4
Census Tract 427.02; Sullivan County; Tennessee	1,947	35,259	17.4
Census Tract 128.02; Davidson County; Tennessee	3,435	24,695	17.5
Census Tract 35.01; Knox County; Tennessee	2,446	45,391	17.5
Census Tract 505.03; Lauderdale County; Tennessee	1,856	27,791	17.5
Census Tract 406; Rutherford County; Tennessee	4,353	29,632	17.5
Census Tract 201; Anderson County; Tennessee	2,364	25,664	17.6
Census Tract 508; Hawkins County; Tennessee	4,094	28,382	17.6
Census Tract 410; Tipton County; Tennessee	2,306	24,999	17.6
Census Tract 9685; Weakley County; Tennessee	3,548	24,136	17.6
Census Tract 9664; Gibson County; Tennessee	3,860	20,986	17.7
Census Tract 9251.01; Pickett County; Tennessee	2,405	31,904	17.7
Census Tract 211.22; Shelby County; Tennessee	4,243	25,009	17.7
Census Tract 416; Sullivan County; Tennessee	2,199	31,234	17.7
Census Tract 217.52; Shelby County; Tennessee	4,172	29,606	17.8
Census Tract 103.03; Davidson County; Tennessee	4,180	31,647	17.9
Census Tract 9551.02; Decatur County; Tennessee	2,481	27,910	17.9
Census Tract 1005; Hamblen County; Tennessee	2,658	38,428	17.9
Census Tract 113.26; Hamilton County; Tennessee	5,114	43,527	17.9
Census Tract 504; Hawkins County; Tennessee	4,872	25,364	17.9
Census Tract 9253.02; Monroe County; Tennessee	2,788	22,229	17.9
Census Tract 1102; Morgan County; Tennessee	3,232	31,662	17.9
Census Tract 72; Shelby County; Tennessee	2,586	64,075	17.9
Census Tract 217.54; Shelby County; Tennessee	3,515	29,314	17.9
Census Tract 9703; Claiborne County; Tennessee	3,904	23,031	18.0
Census Tract 9709; Claiborne County; Tennessee	3,803	25,840	18.0
Census Tract 1017.01; Montgomery County; Tennessee	2,339	32,018	18.0
Census Tract 5004.02; Grainger County; Tennessee	4,237	28,071	18.1
Census Tract 9504; Hickman County; Tennessee	1,617	26,648	18.1
Census Tract 54.02; Knox County; Tennessee	2,698	30,211	18.1
Census Tract 108.20; Shelby County; Tennessee	3,210	25,731	18.1
Census Tract 9351; White County; Tennessee	4,923	28,934	18.1

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 9551; Clay County; Tennessee	2,064	25,975	18.2
Census Tract 9307; McNairy County; Tennessee	2,578	27,300	18.3
Census Tract 9301; Perry County; Tennessee	2,700	30,633	18.3
Census Tract 9250; Van Buren County; Tennessee	2,466	25,260	18.3
Census Tract 9354; White County; Tennessee	3,044	22,046	18.3
Census Tract 9552; Grundy County; Tennessee	3,476	20,009	18.4
Census Tract 308.02; Roane County; Tennessee	2,865	24,999	18.4
Census Tract 9502; Wayne County; Tennessee	4,405	27,147	18.4
Census Tract 703; Carter County; Tennessee	4,981	25,279	18.5
Census Tract 156.37; Davidson County; Tennessee	3,174	35,813	18.5
Census Tract 914; Greene County; Tennessee	2,316	25,173	18.5
Census Tract 1010.01; Montgomery County; Tennessee	3,342	23,660	18.5
Census Tract 118; Shelby County; Tennessee	4,639	31,953	18.5
Census Tract 910.01; Greene County; Tennessee	3,530	26,154	18.6
Census Tract 701.02; Jefferson County; Tennessee	4,436	32,847	18.6
Census Tract 503.01; Marion County; Tennessee	4,506	26,316	18.6
Census Tract 98; Shelby County; Tennessee	1,947	24,971	18.6
Census Tract 902; Trousdale County; Tennessee	2,438	26,165	18.6
Census Tract 9625; Carroll County; Tennessee	2,160	24,347	18.7
Census Tract 9705; Claiborne County; Tennessee	2,103	24,422	18.7
Census Tract 46.09; Knox County; Tennessee	4,015	30,021	18.7
Census Tract 9504; Campbell County; Tennessee	3,631	26,323	18.8
Census Tract 606.01; Dickson County; Tennessee	2,956	28,385	18.8
Census Tract 9305.02; McNairy County; Tennessee	4,154	23,299	18.8
Census Tract 402.01; Union County; Tennessee	3,200	24,396	18.8
Census Tract 9501; Campbell County; Tennessee	2,457	19,862	18.9
Census Tract 9602.01; Cannon County; Tennessee	1,907	26,194	18.9
Census Tract 1; Knox County; Tennessee	2,492	58,958	18.9
Census Tract 1019.06; Montgomery County; Tennessee	4,638	32,020	18.9
Census Tract 811.01; Sevier County; Tennessee	1,124	30,846	18.9
Census Tract 1107; Stewart County; Tennessee	3,723	30,345	18.9
Census Tract 9667.01; Gibson County; Tennessee	1,649	21,625	19.0
Census Tract 30; Hamilton County; Tennessee	1,664	23,888	19.0
Census Tract 502; Lauderdale County; Tennessee	2,568	28,386	19.0
Census Tract 703; Jefferson County; Tennessee	6,430	27,921	19.1
Census Tract 9252; Monroe County; Tennessee	4,207	32,330	19.1
Census Tract 9253.01; Monroe County; Tennessee	3,129	20,027	19.1
Census Tract 156.23; Davidson County; Tennessee	4,342	33,836	19.2
Census Tract 114.44; Hamilton County; Tennessee	3,068	22,882	19.2
Census Tract 9503; Hardeman County; Tennessee	3,323	26,060	19.2
Census Tract 1302; Humphreys County; Tennessee	1,708	22,361	19.2
Census Tract 217.21; Shelby County; Tennessee	3,312	22,789	19.2
Census Tract 9681.02; Weakley County; Tennessee	1,463	27,439	19.2
Census Tract 9708; Claiborne County; Tennessee	3,047	25,227	19.3
Census Tract 40; Knox County; Tennessee	3,937	27,506	19.3
Census Tract 46.15; Knox County; Tennessee	3,502	29,056	19.3
Census Tract 9506; Overton County; Tennessee	2,347	32,004	19.3
Census Tract 401.06; Rutherford County; Tennessee	3,520	22,571	19.3
Census Tract 605.01; Fayette County; Tennessee	3,602	30,687	19.4
Census Tract 9601; Franklin County; Tennessee	2,958	28,534	19.4
Census Tract 5001; Grainger County; Tennessee	3,840	20,195	19.4
Census Tract 903; Greene County; Tennessee	4,966	32,230	19.4
Census Tract 30; Knox County; Tennessee	4,070	27,360	19.4
Census Tract 59.11; Knox County; Tennessee	2,352	32,929	19.4
Census Tract 428.02; Sullivan County; Tennessee	3,540	21,143	19.4
Census Tract 911; Greene County; Tennessee	2,816	32,639	19.5
Census Tract 18; Knox County; Tennessee	2,122	30,531	19.5
Census Tract 106.02; Davidson County; Tennessee	2,914	28,182	19.6
Census Tract 107; Maury County; Tennessee	3,919	22,950	19.6

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 32; Hamilton County; Tennessee	2,886	31,946	19.7
Census Tract 220.24; Shelby County; Tennessee	2,464	23,190	19.7
Census Tract 9305; Warren County; Tennessee	4,106	22,136	19.7
Census Tract 9352; White County; Tennessee	3,471	27,365	19.7
Census Tract 901; Greene County; Tennessee	4,999	21,761	19.8
Census Tract 9202; Hardin County; Tennessee	4,025	27,491	19.8
Census Tract 3.05; Putnam County; Tennessee	2,460	27,676	19.8
Census Tract 9754.01; Rhea County; Tennessee	5,870	20,303	19.8
Census Tract 210.20; Shelby County; Tennessee	5,007	61,188	19.8
Census Tract 212.02; Anderson County; Tennessee	4,140	25,683	19.9
Census Tract 9509; Campbell County; Tennessee	2,401	30,628	19.9
Census Tract 9550.04; Decatur County; Tennessee	1,967	33,915	19.9
Census Tract 9705; McMinn County; Tennessee	3,353	25,315	19.9
Census Tract 156.34; Davidson County; Tennessee	8,893	29,465	20.0
Census Tract 23; Hamilton County; Tennessee	1,099	18,967	20.0
Census Tract 9504; Overton County; Tennessee	1,826	25,908	20.0
Census Tract 801; Unicoi County; Tennessee	2,025	27,468	20.0
Census Tract 210.01; Anderson County; Tennessee	2,093	25,812	20.1
Census Tract 9620; Carroll County; Tennessee	3,449	26,755	20.1
Census Tract 109; Maury County; Tennessee	2,720	29,092	20.1
Census Tract 9624; Carroll County; Tennessee	2,046	23,452	20.2
Census Tract 158.04; Davidson County; Tennessee	4,005	28,653	20.2
Census Tract 28; Knox County; Tennessee	3,386	21,691	20.2
Census Tract 37; Knox County; Tennessee	2,526	44,866	20.2
Census Tract 9750; Scott County; Tennessee	3,247	24,382	20.2
Census Tract 602; Sequatchie County; Tennessee	3,876	29,818	20.2
Census Tract 206.10; Shelby County; Tennessee	3,199	25,473	20.2
Census Tract 403; Sullivan County; Tennessee	2,131	30,279	20.2
Census Tract 402.02; Union County; Tennessee	4,941	25,848	20.2
Census Tract 9602.02; Cannon County; Tennessee	3,435	30,144	20.3
Census Tract 502.03; Marion County; Tennessee	2,275	22,391	20.3
Census Tract 104.02; Maury County; Tennessee	1,990	27,543	20.3
Census Tract 9659; Obion County; Tennessee	1,149	23,850	20.3
Census Tract 303.01; Roane County; Tennessee	2,708	42,957	20.3
Census Tract 9701; Claiborne County; Tennessee	2,118	21,493	20.4
Census Tract 9707; Claiborne County; Tennessee	4,734	22,643	20.4
Census Tract 402; Tipton County; Tennessee	1,683	23,734	20.4
Census Tract 9255.04; Monroe County; Tennessee	1,606	27,982	20.5
Census Tract 223.22; Shelby County; Tennessee	3,044	24,869	20.5
Census Tract 9704; Claiborne County; Tennessee	575	20,598	20.6
Census Tract 5004.01; Grainger County; Tennessee	2,256	20,075	20.6
Census Tract 602.01; Loudon County; Tennessee	3,734	27,123	20.6
Census Tract 9614; Crockett County; Tennessee	2,910	32,501	20.7
Census Tract 205.42; Shelby County; Tennessee	4,458	18,529	20.7
Census Tract 9306; Warren County; Tennessee	2,927	27,929	20.7
Census Tract 109.02; Hamilton County; Tennessee	620	34,290	20.8
Census Tract 222.10; Shelby County; Tennessee	3,592	23,054	20.8
Census Tract 223.21; Shelby County; Tennessee	2,760	20,528	20.8
Census Tract 804; Unicoi County; Tennessee	3,514	26,044	20.8
Census Tract 9621.02; Carroll County; Tennessee	2,851	30,192	20.9
Census Tract 158.06; Davidson County; Tennessee	3,348	22,332	20.9
Census Tract 9550.01; Decatur County; Tennessee	1,523	29,706	20.9
Census Tract 1017.02; Montgomery County; Tennessee	4,520	30,859	20.9
Census Tract 9612; Crockett County; Tennessee	1,401	32,182	21.0
Census Tract 174.02; Davidson County; Tennessee	4,831	37,292	21.0
Census Tract 9203; DeKalb County; Tennessee	4,301	29,347	21.0
Census Tract 1004; Hamblen County; Tennessee	5,487	25,751	21.0
Census Tract 505.01; Hawkins County; Tennessee	3,300	28,792	21.0
Census Tract 9502.01; Hickman County; Tennessee	3,363	27,360	21.0

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 9505.01; Overton County; Tennessee	3,557	32,282	21.0
Census Tract 714; Carter County; Tennessee	2,592	27,901	21.1
Census Tract 9702.01; Coffee County; Tennessee	3,132	26,160	21.1
Census Tract 156.28; Davidson County; Tennessee	2,972	26,964	21.1
Census Tract 49; Knox County; Tennessee	4,712	32,086	21.1
Census Tract 16.05; Madison County; Tennessee	2,877	32,418	21.1
Census Tract 201.01; Shelby County; Tennessee	2,675	24,292	21.1
Census Tract 9682.01; Weakley County; Tennessee	3,247	32,278	21.1
Census Tract 9650; Fentress County; Tennessee	3,012	24,756	21.2
Census Tract 15; Knox County; Tennessee	2,952	33,119	21.2
Census Tract 16.07; Madison County; Tennessee	4,218	31,161	21.2
Census Tract 110.04; Maury County; Tennessee	3,178	31,567	21.2
Census Tract 1021; Montgomery County; Tennessee	3,939	32,581	21.2
Census Tract 414.01; Rutherford County; Tennessee	5,385	39,640	21.2
Census Tract 81.20; Shelby County; Tennessee	4,366	22,526	21.2
Census Tract 619.04; Washington County; Tennessee	3,163	28,068	21.2
Census Tract 9631; Benton County; Tennessee	2,684	30,759	21.3
Census Tract 9503.01; Overton County; Tennessee	4,000	27,191	21.3
Census Tract 601.04; Sequatchie County; Tennessee	3,782	22,159	21.3
Census Tract 804.02; Sevier County; Tennessee	2,835	24,637	21.3
Census Tract 9643; Dyer County; Tennessee	4,429	27,727	21.4
Census Tract 9665.02; Gibson County; Tennessee	2,582	31,681	21.4
Census Tract 1104; Morgan County; Tennessee	3,210	37,306	21.4
Census Tract 428.01; Sullivan County; Tennessee	2,071	29,795	21.4
Census Tract 5003.01; Grainger County; Tennessee	2,657	26,577	21.5
Census Tract 9702; Lewis County; Tennessee	6,227	26,903	21.5
Census Tract 13; Madison County; Tennessee	4,848	24,390	21.5
Census Tract 7; Putnam County; Tennessee	2,842	22,975	21.5
Census Tract 806.01; Sevier County; Tennessee	3,488	31,546	21.5
Census Tract 9752; Smith County; Tennessee	4,772	29,787	21.5
Census Tract 9355; White County; Tennessee	2,985	22,246	21.5
Census Tract 304.02; Wilson County; Tennessee	3,504	26,960	21.5
Census Tract 9704.02; Coffee County; Tennessee	4,362	23,781	21.6
Census Tract 905.02; Greene County; Tennessee	1,313	41,538	21.6
Census Tract 1003; Montgomery County; Tennessee	4,625	30,274	21.7
Census Tract 417; Sullivan County; Tennessee	2,930	33,372	21.7
Census Tract 608; Washington County; Tennessee	2,264	34,133	21.7
Census Tract 9662; Gibson County; Tennessee	2,761	22,360	21.8
Census Tract 1011.02; Montgomery County; Tennessee	6,764	22,175	21.8
Census Tract 9501; Wayne County; Tennessee	3,859	20,247	21.8
Census Tract 9703.01; Chester County; Tennessee	1,247	25,584	21.9
Census Tract 9705.01; Cumberland County; Tennessee	2,520	26,631	21.9
Census Tract 9606; Franklin County; Tennessee	3,742	24,887	21.9
Census Tract 9551; Grundy County; Tennessee	1,424	26,993	21.9
Census Tract 202.02; Anderson County; Tennessee	3,828	36,502	22.0
Census Tract 15.01; Madison County; Tennessee	4,055	28,874	22.0
Census Tract 803.02; Robertson County; Tennessee	2,532	22,171	22.0
Census Tract 79; Shelby County; Tennessee	3,841	21,454	22.0
Census Tract 9502; Campbell County; Tennessee	1,844	26,047	22.1
Census Tract 144; Davidson County; Tennessee	2,553	40,562	22.1
Census Tract 416.02; Rutherford County; Tennessee	2,333	38,853	22.1
Census Tract 93; Shelby County; Tennessee	3,312	45,132	22.1
Census Tract 217.55; Shelby County; Tennessee	1,233	30,819	22.1
Census Tract 712; Carter County; Tennessee	3,050	24,141	22.2
Census Tract 709; Carter County; Tennessee	3,313	25,527	22.3
Census Tract 158.05; Davidson County; Tennessee	2,183	25,958	22.4
Census Tract 9604.01; Lawrence County; Tennessee	4,348	35,350	22.4
Census Tract 421.02; Rutherford County; Tennessee	3,458	21,024	22.4
Census Tract 88; Shelby County; Tennessee	4,913	16,186	22.4

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 9702; Chester County; Tennessee	4,355	17,993	22.6
Census Tract 9754; Henderson County; Tennessee	3,738	23,697	22.6
Census Tract 9603; Lawrence County; Tennessee	4,200	21,667	22.6
Census Tract 602.04; Loudon County; Tennessee	4,270	25,936	22.6
Census Tract 804.01; Robertson County; Tennessee	4,228	27,105	22.6
Census Tract 9753; Scott County; Tennessee	1,940	25,511	22.6
Census Tract 15; Shelby County; Tennessee	1,553	25,337	22.6
Census Tract 804.02; Robertson County; Tennessee	3,998	26,770	22.7
Census Tract 9203.01; Giles County; Tennessee	3,830	29,079	22.8
Census Tract 1008; Hamblen County; Tennessee	2,238	25,267	22.8
Census Tract 9205.02; Hardin County; Tennessee	1,272	20,101	22.8
Census Tract 913; Greene County; Tennessee	3,746	25,016	22.9
Census Tract 166; Davidson County; Tennessee	3,395	50,299	23.0
Census Tract 73; Shelby County; Tennessee	3,817	28,706	23.0
Census Tract 205.31; Shelby County; Tennessee	3,799	18,174	23.0
Census Tract 9510; Campbell County; Tennessee	1,828	21,738	23.1
Census Tract 9707; Coffee County; Tennessee	3,853	27,568	23.1
Census Tract 9602; Jackson County; Tennessee	1,912	26,602	23.1
Census Tract 9703; McMinn County; Tennessee	3,126	27,702	23.1
Census Tract 9304; McNairy County; Tennessee	1,728	24,073	23.1
Census Tract 227; Shelby County; Tennessee	6,148	18,465	23.1
Census Tract 407; Tipton County; Tennessee	3,931	23,847	23.1
Census Tract 9530; Bledsoe County; Tennessee	3,664	24,107	23.2
Census Tract 9701; Coffee County; Tennessee	2,965	26,010	23.2
Census Tract 9303.01; Haywood County; Tennessee	3,415	27,168	23.3
Census Tract 9251.01; Monroe County; Tennessee	3,708	24,157	23.3
Census Tract 1012.01; Montgomery County; Tennessee	1,778	26,771	23.3
Census Tract 308; Wilson County; Tennessee	5,602	27,710	23.3
Census Tract 189.05; Davidson County; Tennessee	2,440	36,854	23.4
Census Tract 9646; Dyer County; Tennessee	2,046	29,916	23.4
Census Tract 9563; Johnson County; Tennessee	4,812	24,511	23.4
Census Tract 505.04; Lauderdale County; Tennessee	1,945	22,637	23.5
Census Tract 60; Shelby County; Tennessee	1,487	18,912	23.5
Census Tract 9309; Warren County; Tennessee	1,730	24,342	23.5
Census Tract 419; Sullivan County; Tennessee	2,959	29,519	23.6
Census Tract 605.01; Washington County; Tennessee	3,804	23,341	23.6
Census Tract 9652.02; Fentress County; Tennessee	2,503	25,374	23.7
Census Tract 217.58; Shelby County; Tennessee	2,463	22,457	23.7
Census Tract 221.21; Shelby County; Tennessee	3,648	28,223	23.7
Census Tract 127.02; Davidson County; Tennessee	2,317	29,411	23.8
Census Tract 9205.01; Hardin County; Tennessee	3,179	23,951	23.8
Census Tract 9561; Johnson County; Tennessee	3,557	20,270	23.8
Census Tract 2; Madison County; Tennessee	4,602	27,771	23.8
Census Tract 9602; Meigs County; Tennessee	4,067	23,982	23.8
Census Tract 9703.01; Macon County; Tennessee	3,352	18,446	23.9
Census Tract 221.22; Shelby County; Tennessee	3,302	25,085	23.9
Census Tract 614.04; Washington County; Tennessee	2,983	60,045	23.9
Census Tract 156.13; Davidson County; Tennessee	4,123	20,478	24.0
Census Tract 182.04; Davidson County; Tennessee	2,578	36,894	24.0
Census Tract 124; Hamilton County; Tennessee	5,937	25,835	24.0
Census Tract 503.02; Marion County; Tennessee	2,569	35,518	24.0
Census Tract 9504; Wayne County; Tennessee	2,770	36,132	24.0
Census Tract 1103; Morgan County; Tennessee	4,770	15,948	24.1
Census Tract 9506.01; Campbell County; Tennessee	1,844	20,297	24.2
Census Tract 104.03; Davidson County; Tennessee	3,223	18,791	24.2
Census Tract 502.01; Marion County; Tennessee	3,311	26,700	24.2
Census Tract 205.32; Shelby County; Tennessee	4,990	27,384	24.2
Census Tract 408; Sullivan County; Tennessee	3,050	27,525	24.2
Census Tract 9550; Clay County; Tennessee	4,144	21,440	24.3

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 143; Davidson County; Tennessee	1,353	27,164	24.3
Census Tract 9302; Haywood County; Tennessee	1,198	31,407	24.3
Census Tract 39.02; Knox County; Tennessee	2,646	18,941	24.3
Census Tract 67; Knox County; Tennessee	2,182	29,416	24.3
Census Tract 414.07; Rutherford County; Tennessee	4,583	48,250	24.3
Census Tract 11; Shelby County; Tennessee	2,067	14,947	24.3
Census Tract 211.11; Shelby County; Tennessee	2,963	21,892	24.3
Census Tract 113.02; Bradley County; Tennessee	2,012	32,392	24.4
Census Tract 9694; Henry County; Tennessee	1,539	30,518	24.4
Census Tract 204; Anderson County; Tennessee	3,406	31,312	24.5
Census Tract 205; Anderson County; Tennessee	3,146	24,072	24.5
Census Tract 24; Knox County; Tennessee	3,619	22,536	24.5
Census Tract 409; Sullivan County; Tennessee	2,832	44,349	24.5
Census Tract 9698; Henry County; Tennessee	1,911	22,876	24.6
Census Tract 9305.01; McNairy County; Tennessee	1,869	21,683	24.6
Census Tract 421.01; Rutherford County; Tennessee	4,248	22,893	24.6
Census Tract 195.01; Davidson County; Tennessee	2,540	73,440	24.7
Census Tract 9551.01; Decatur County; Tennessee	1,512	22,554	24.7
Census Tract 9605; Franklin County; Tennessee	3,427	31,366	24.8
Census Tract 116; Hamilton County; Tennessee	5,401	27,237	24.8
Census Tract 123; Hamilton County; Tennessee	3,142	24,547	24.8
Census Tract 221.30; Shelby County; Tennessee	4,059	26,726	24.8
Census Tract 203; Sumner County; Tennessee	4,220	25,249	24.8
Census Tract 710; Carter County; Tennessee	2,115	24,374	24.9
Census Tract 507; Hawkins County; Tennessee	2,973	24,409	25.0
Census Tract 9670.02; Gibson County; Tennessee	2,739	23,301	25.1
Census Tract 221.32; Shelby County; Tennessee	2,038	28,668	25.1
Census Tract 9667.02; Gibson County; Tennessee	2,467	19,779	25.2
Census Tract 9692; Henry County; Tennessee	1,571	23,221	25.2
Census Tract 9251.02; Pickett County; Tennessee	1,796	21,491	25.2
Census Tract 803.01; Robertson County; Tennessee	2,132	24,451	25.2
Census Tract 221.11; Shelby County; Tennessee	4,003	30,131	25.2
Census Tract 156.20; Davidson County; Tennessee	5,152	26,205	25.3
Census Tract 165; Davidson County; Tennessee	4,551	15,784	25.4
Census Tract 9550; Grundy County; Tennessee	2,070	28,734	25.4
Census Tract 107; Bradley County; Tennessee	3,801	18,045	25.5
Census Tract 807.02; Sevier County; Tennessee	4,491	20,352	25.5
Census Tract 46; Shelby County; Tennessee	1,088	22,490	25.6
Census Tract 606.01; Washington County; Tennessee	3,032	35,196	25.6
Census Tract 610; Washington County; Tennessee	1,875	22,921	25.6
Census Tract 107.02; Davidson County; Tennessee	2,689	31,152	25.7
Census Tract 9564; Johnson County; Tennessee	4,034	25,082	25.7
Census Tract 609.02; Washington County; Tennessee	2,439	18,698	25.7
Census Tract 9304; Haywood County; Tennessee	2,745	22,045	25.8
Census Tract 27; Shelby County; Tennessee	1,433	35,397	25.8
Census Tract 66; Knox County; Tennessee	2,913	50,648	25.9
Census Tract 6; Madison County; Tennessee	1,506	30,598	25.9
Census Tract 9705.02; Cumberland County; Tennessee	3,315	21,774	26.0
Census Tract 156.18; Davidson County; Tennessee	5,673	29,926	26.0
Census Tract 427.04; Sullivan County; Tennessee	1,924	23,695	26.0
Census Tract 208; Anderson County; Tennessee	3,815	28,234	26.1
Census Tract 190.08; Davidson County; Tennessee	3,891	23,136	26.2
Census Tract 109.04; Hamilton County; Tennessee	2,497	41,663	26.2
Census Tract 226; Shelby County; Tennessee	2,940	19,152	26.2
Census Tract 19; Knox County; Tennessee	1,163	21,404	26.3
Census Tract 9751; Henderson County; Tennessee	3,137	22,473	26.4
Census Tract 118; Davidson County; Tennessee	2,239	47,881	26.5
Census Tract 190.03; Davidson County; Tennessee	2,878	20,475	26.5
Census Tract 9605; Hancock County; Tennessee	2,083	29,388	26.5

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 102.20; Shelby County; Tennessee	5,112	20,638	26.5
Census Tract 612; Washington County; Tennessee	3,244	31,372	26.5
Census Tract 9710.01; Coffee County; Tennessee	1,018	43,787	26.6
Census Tract 509; Hawkins County; Tennessee	2,602	22,219	26.6
Census Tract 9701; Macon County; Tennessee	3,807	21,842	26.6
Census Tract 1; Putnam County; Tennessee	4,217	23,045	26.6
Census Tract 613.01; Washington County; Tennessee	2,592	30,255	26.6
Census Tract 190.04; Davidson County; Tennessee	2,990	18,934	26.8
Census Tract 9753.02; Henderson County; Tennessee	3,036	22,694	26.8
Census Tract 25; Shelby County; Tennessee	2,362	29,235	26.8
Census Tract 1001; Hamblen County; Tennessee	4,735	20,317	26.9
Census Tract 102.10; Shelby County; Tennessee	4,119	19,730	27.0
Census Tract 9205.01; Cocke County; Tennessee	5,065	24,546	27.1
Census Tract 505.05; Lauderdale County; Tennessee	2,787	22,087	27.1
Census Tract 100.02; Shelby County; Tennessee	2,312	19,656	27.1
Census Tract 9307; Warren County; Tennessee	3,810	26,388	27.1
Census Tract 9604; Jackson County; Tennessee	1,622	24,492	27.2
Census Tract 308.01; Roane County; Tennessee	1,501	25,204	27.2
Census Tract 36; Shelby County; Tennessee	1,470	42,436	27.2
Census Tract 80; Shelby County; Tennessee	3,451	22,863	27.2
Census Tract 9504.02; Bedford County; Tennessee	5,137	20,946	27.3
Census Tract 9632; Benton County; Tennessee	1,669	27,014	27.3
Census Tract 181.01; Davidson County; Tennessee	3,630	41,748	27.3
Census Tract 912; Greene County; Tennessee	2,886	23,101	27.3
Census Tract 156.32; Davidson County; Tennessee	3,250	37,911	27.5
Census Tract 9602; Lake County; Tennessee	1,799	20,249	27.6
Census Tract 9501; Polk County; Tennessee	1,244	27,744	27.6
Census Tract 20; Shelby County; Tennessee	1,136	22,107	27.6
Census Tract 217.56; Shelby County; Tennessee	1,613	31,405	27.7
Census Tract 9503; Campbell County; Tennessee	1,578	21,828	27.8
Census Tract 9644.01; Dyer County; Tennessee	2,193	24,017	27.8
Census Tract 9693; Henry County; Tennessee	2,274	23,795	27.8
Census Tract 24; Shelby County; Tennessee	1,426	23,218	28.1
Census Tract 110.10; Shelby County; Tennessee	2,427	20,913	28.1
Census Tract 213.04; Anderson County; Tennessee	2,764	25,852	28.2
Census Tract 503.02; Hawkins County; Tennessee	3,203	24,213	28.2
Census Tract 9601; Lake County; Tennessee	4,219	19,402	28.3
Census Tract 701; Carter County; Tennessee	1,745	25,405	28.4
Census Tract 119; Davidson County; Tennessee	2,264	36,753	28.6
Census Tract 506; Lauderdale County; Tennessee	1,935	18,358	28.6
Census Tract 8; Putnam County; Tennessee	5,702	14,534	28.6
Census Tract 808.01; Sevier County; Tennessee	2,166	19,888	28.6
Census Tract 9532; Bledsoe County; Tennessee	3,966	21,455	28.8
Census Tract 1; Madison County; Tennessee	3,068	31,128	28.8
Census Tract 19; Hamilton County; Tennessee	2,550	22,501	28.9
Census Tract 46.10; Knox County; Tennessee	3,608	27,262	28.9
Census Tract 9702.02; McMinn County; Tennessee	2,942	22,841	28.9
Census Tract 9751.02; Scott County; Tennessee	3,347	24,424	28.9
Census Tract 20; Knox County; Tennessee	2,311	19,753	29.0
Census Tract 421; Sullivan County; Tennessee	4,456	34,168	29.0
Census Tract 9695.02; Henry County; Tennessee	3,121	25,273	29.1
Census Tract 403.05; Rutherford County; Tennessee	2,039	19,313	29.1
Census Tract 97; Shelby County; Tennessee	1,796	18,210	29.1
Census Tract 107.10; Shelby County; Tennessee	3,101	20,239	29.2
Census Tract 13; Hamilton County; Tennessee	1,685	29,051	29.3
Census Tract 107.20; Shelby County; Tennessee	2,394	23,132	29.3
Census Tract 1101; Morgan County; Tennessee	2,392	24,905	29.4
Census Tract 109.04; Davidson County; Tennessee	2,363	23,270	29.5
Census Tract 419; Rutherford County; Tennessee	3,354	22,885	29.5

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 62; Shelby County; Tennessee	1,462	19,566	29.6
Census Tract 68; Shelby County; Tennessee	1,422	18,801	29.6
Census Tract 220.23; Shelby County; Tennessee	1,552	22,180	29.7
Census Tract 34; Hamilton County; Tennessee	3,309	26,368	29.8
Census Tract 10; Madison County; Tennessee	1,674	17,872	29.9
Census Tract 3; Shelby County; Tennessee	530	13,353	29.9
Census Tract 405; Sullivan County; Tennessee	3,768	20,186	30.0
Census Tract 29; Hamilton County; Tennessee	2,254	31,649	30.1
Census Tract 136; Davidson County; Tennessee	4,860	19,266	30.2
Census Tract 21; Shelby County; Tennessee	1,022	19,187	30.2
Census Tract 105; Maury County; Tennessee	3,444	23,310	30.3
Census Tract 56; Shelby County; Tennessee	3,191	19,814	30.3
Census Tract 601.03; Sequatchie County; Tennessee	3,459	22,114	30.4
Census Tract 102.02; Bradley County; Tennessee	2,130	39,023	30.5
Census Tract 1002; Hamblen County; Tennessee	4,676	19,008	30.5
Census Tract 414.06; Rutherford County; Tennessee	4,206	33,643	30.5
Census Tract 9752; Scott County; Tennessee	4,896	18,174	30.6
Census Tract 12; Shelby County; Tennessee	2,417	19,700	30.6
Census Tract 156.14; Davidson County; Tennessee	3,098	29,985	30.8
Census Tract 9680; Weakley County; Tennessee	913	24,253	30.8
Census Tract 156.15; Davidson County; Tennessee	4,268	16,747	31.0
Census Tract 108; Blount County; Tennessee	2,398	25,994	31.1
Census Tract 108; Bradley County; Tennessee	2,530	18,159	31.1
Census Tract 706; Carter County; Tennessee	2,153	25,710	31.1
Census Tract 9601; Jackson County; Tennessee	1,650	24,725	31.1
Census Tract 57; Shelby County; Tennessee	1,942	16,175	31.1
Census Tract 220.26; Shelby County; Tennessee	1,268	18,132	31.1
Census Tract 402; Sullivan County; Tennessee	1,872	25,726	31.1
Census Tract 194.01; Davidson County; Tennessee	2,772	58,752	31.2
Census Tract 67; Shelby County; Tennessee	2,794	19,059	31.2
Census Tract 191.08; Davidson County; Tennessee	2,249	19,373	31.3
Census Tract 9303.02; Haywood County; Tennessee	2,384	19,697	31.7
Census Tract 620; Washington County; Tennessee	3,860	24,103	31.8
Census Tract 9202.01; DeKalb County; Tennessee	4,099	19,561	31.9
Census Tract 138; Davidson County; Tennessee	1,368	23,519	32.0
Census Tract 113; Shelby County; Tennessee	1,042	29,949	32.1
Census Tract 9656; Obion County; Tennessee	2,931	19,717	32.2
Census Tract 128.01; Davidson County; Tennessee	4,099	28,048	32.3
Census Tract 9651; Fentress County; Tennessee	3,575	19,006	32.3
Census Tract 304.01; Roane County; Tennessee	2,231	23,599	32.3
Census Tract 9531.02; Bledsoe County; Tennessee	3,562	23,061	32.4
Census Tract 24; Hamilton County; Tennessee	3,224	21,650	32.4
Census Tract 9702.01; McMinn County; Tennessee	1,768	20,531	32.4
Census Tract 112; Shelby County; Tennessee	782	16,666	32.4
Census Tract 9682.03; Weakley County; Tennessee	2,689	23,562	32.4
Census Tract 103; Shelby County; Tennessee	955	15,050	32.6
Census Tract 7; Madison County; Tennessee	2,590	22,257	32.7
Census Tract 9507.02; Campbell County; Tennessee	2,205	23,340	32.8
Census Tract 704; Carter County; Tennessee	1,528	20,303	33.1
Census Tract 606.02; Washington County; Tennessee	3,680	28,106	33.3
Census Tract 11; Hamilton County; Tennessee	1,572	28,786	33.4
Census Tract 9506.02; Campbell County; Tennessee	1,724	27,882	33.8
Census Tract 1002; Montgomery County; Tennessee	1,235	22,032	33.8
Census Tract 106.20; Shelby County; Tennessee	2,365	16,387	33.8
Census Tract 14; Knox County; Tennessee	1,738	13,696	34.0
Census Tract 65; Shelby County; Tennessee	1,634	20,655	34.0
Census Tract 109.03; Davidson County; Tennessee	5,092	25,130	34.1
Census Tract 27; Knox County; Tennessee	1,640	16,796	34.1
Census Tract 810.02; Sevier County; Tennessee	2,205	25,039	34.1

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 4; Madison County; Tennessee	2,418	19,834	34.2
Census Tract 9605.01; Lawrence County; Tennessee	3,788	19,126	34.5
Census Tract 601; Washington County; Tennessee	3,359	26,482	34.5
Census Tract 191.05; Davidson County; Tennessee	3,829	24,817	34.6
Census Tract 7; Shelby County; Tennessee	3,322	22,528	34.6
Census Tract 9644.02; Dyer County; Tennessee	2,154	23,733	34.7
Census Tract 106.10; Shelby County; Tennessee	4,156	21,545	34.7
Census Tract 30; Shelby County; Tennessee	2,266	41,440	34.8
Census Tract 9204.02; Hardin County; Tennessee	2,288	19,654	35.0
Census Tract 53; Shelby County; Tennessee	2,413	15,723	35.3
Census Tract 205.21; Shelby County; Tennessee	1,912	14,595	35.3
Census Tract 205.43; Shelby County; Tennessee	2,295	20,499	35.3
Census Tract 26; Hamilton County; Tennessee	1,697	21,012	35.5
Census Tract 108.10; Shelby County; Tennessee	4,477	19,703	35.5
Census Tract 8; Knox County; Tennessee	4,268	40,799	35.8
Census Tract 13; Shelby County; Tennessee	1,810	19,440	35.9
Census Tract 406; Sullivan County; Tennessee	2,600	20,362	36.0
Census Tract 207; Anderson County; Tennessee	1,226	21,596	36.1
Census Tract 9606; Hancock County; Tennessee	3,334	20,765	36.1
Census Tract 122; Hamilton County; Tennessee	1,665	16,348	36.2
Census Tract 110.20; Shelby County; Tennessee	952	31,532	36.4
Census Tract 26; Knox County; Tennessee	1,927	15,852	36.5
Census Tract 89; Shelby County; Tennessee	3,023	18,128	36.6
Census Tract 205.44; Shelby County; Tennessee	1,921	22,371	37.0
Census Tract 12; Hamilton County; Tennessee	2,620	21,234	37.1
Census Tract 9; Shelby County; Tennessee	1,916	22,379	37.2
Census Tract 69; Shelby County; Tennessee	1,933	21,809	37.3
Census Tract 159; Davidson County; Tennessee	2,820	22,859	37.4
Census Tract 203.02; Shelby County; Tennessee	2,360	21,910	37.4
Census Tract 9709; Coffee County; Tennessee	3,541	21,319	37.6
Census Tract 9553; Marshall County; Tennessee	3,288	15,089	37.6
Census Tract 37; Shelby County; Tennessee	1,058	26,028	38.0
Census Tract 87; Shelby County; Tennessee	3,604	20,969	38.0
Census Tract 4; Hamilton County; Tennessee	2,409	16,234	38.1
Census Tract 127.01; Davidson County; Tennessee	4,747	21,953	38.4
Census Tract 16; Hamilton County; Tennessee	2,191	30,424	38.6
Census Tract 217.31; Shelby County; Tennessee	1,970	13,602	38.8
Census Tract 70; Knox County; Tennessee	2,152	18,930	39.0
Census Tract 9202; Cocke County; Tennessee	4,466	19,192	39.2
Census Tract 100.01; Shelby County; Tennessee	2,610	18,618	39.3
Census Tract 609.01; Washington County; Tennessee	2,369	17,765	39.3
Census Tract 307; Wilson County; Tennessee	3,082	20,455	39.6
Census Tract 9751.01; Scott County; Tennessee	1,813	25,237	39.8
Census Tract 78.21; Shelby County; Tennessee	3,995	26,214	39.8
Census Tract 208; Sumner County; Tennessee	5,417	16,542	39.8
Census Tract 38; Shelby County; Tennessee	634	21,035	39.9
Census Tract 74; Shelby County; Tennessee	2,849	21,617	39.9
Census Tract 82; Shelby County; Tennessee	3,726	12,265	40.7
Census Tract 14; Shelby County; Tennessee	1,080	17,866	40.8
Census Tract 1009; Montgomery County; Tennessee	2,214	17,108	41.2
Census Tract 217.10; Shelby County; Tennessee	1,555	18,557	41.2
Census Tract 8; Madison County; Tennessee	1,299	16,570	41.9
Census Tract 81.10; Shelby County; Tennessee	1,513	15,163	41.9
Census Tract 78.22; Shelby County; Tennessee	1,154	22,923	42.4
Census Tract 4; Shelby County; Tennessee	1,046	17,382	42.7
Census Tract 78.10; Shelby County; Tennessee	1,609	16,613	42.8
Census Tract 29; Knox County; Tennessee	2,476	17,597	42.9
Census Tract 39; Shelby County; Tennessee	1,454	26,710	43.0
Census Tract 105; Shelby County; Tennessee	1,897	14,883	43.0

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 221.31; Shelby County; Tennessee	2,087	25,483	43.1
Census Tract 223.30; Shelby County; Tennessee	3,774	18,390	43.1
Census Tract 2; Shelby County; Tennessee	880	12,578	43.5
Census Tract 99.01; Shelby County; Tennessee	2,315	16,136	43.6
Census Tract 139; Davidson County; Tennessee	1,380	24,762	44.1
Census Tract 19; Shelby County; Tennessee	1,102	17,840	44.2
Census Tract 114.01; Shelby County; Tennessee	900	14,179	44.2
Census Tract 115; Shelby County; Tennessee	1,612	12,796	44.7
Census Tract 91; Shelby County; Tennessee	2,173	15,531	45.3
Census Tract 70; Shelby County; Tennessee	2,420	21,286	45.5
Census Tract 1003; Hamblen County; Tennessee	2,320	13,728	46.6
Census Tract 9; Madison County; Tennessee	1,600	15,483	46.6
Census Tract 3.04; Putnam County; Tennessee	3,778	16,143	46.7
Census Tract 68; Knox County; Tennessee	3,817	18,619	46.8
Census Tract 223.10; Shelby County; Tennessee	4,086	14,373	46.8
Census Tract 106.30; Shelby County; Tennessee	2,417	13,584	46.9
Census Tract 8; Shelby County; Tennessee	1,475	21,765	47.0
Census Tract 6; Shelby County; Tennessee	1,206	15,557	47.3
Census Tract 1008; Montgomery County; Tennessee	2,399	11,901	47.9
Census Tract 101.21; Shelby County; Tennessee	1,682	17,148	48.0
Census Tract 117; Shelby County; Tennessee	813	19,803	48.0
Census Tract 104; Bradley County; Tennessee	2,264	14,230	48.2
Census Tract 160; Davidson County; Tennessee	2,018	27,708	49.4
Census Tract 101.22; Shelby County; Tennessee	2,352	14,516	49.4
Census Tract 162; Davidson County; Tennessee	2,497	45,142	49.8
Census Tract 55; Shelby County; Tennessee	1,588	13,398	49.8
Census Tract 25; Hamilton County; Tennessee	3,431	18,188	49.9
Census Tract 28; Shelby County; Tennessee	2,231	16,995	49.9
Census Tract 217.57; Shelby County; Tennessee	1,717	18,833	50.5
Census Tract 205.23; Shelby County; Tennessee	2,164	13,096	51.1
Census Tract 222.20; Shelby County; Tennessee	3,887	17,307	51.4
Census Tract 111; Shelby County; Tennessee	1,291	18,765	51.9
Census Tract 114.02; Shelby County; Tennessee	3,348	16,102	52.4
Census Tract 142; Davidson County; Tennessee	1,928	12,426	52.7
Census Tract 1001; Montgomery County; Tennessee	1,350	13,975	52.8
Census Tract 5; Madison County; Tennessee	3,061	10,536	52.9
Census Tract 58; Shelby County; Tennessee	692	10,646	54.0
Census Tract 35.02; Knox County; Tennessee	2,080	25,565	55.0
Census Tract 193; Davidson County; Tennessee	3,018	22,695	57.5
Census Tract 11; Madison County; Tennessee	832	11,081	57.5
Census Tract 101.20; Shelby County; Tennessee	2,780	12,050	57.9
Census Tract 116; Shelby County; Tennessee	1,767	12,615	58.0
Census Tract 220.25; Shelby County; Tennessee	2,393	13,136	58.6
Census Tract 99.02; Shelby County; Tennessee	1,482	15,731	59.3
Census Tract 50; Shelby County; Tennessee	659	8,737	64.4
Census Tract 59; Shelby County; Tennessee	1,418	14,355	68.8
Census Tract 45; Shelby County; Tennessee	539	11,371	69.6
Census Tract 69.01; Knox County; Tennessee	4,124	10,996	69.7
Census Tract 69.02; Knox County; Tennessee	3,034	9,266	72.4
Census Tract 148; Davidson County; Tennessee	1,037	6,434	77.9
Census Tract 69.03; Knox County; Tennessee	2,227	9,761	79.0
Census Tract 9682.02; Weakley County; Tennessee	2,069	8,229	82.6
Census Tract 9.02; Knox County; Tennessee	3,061	4,852	96.1
Census Tract 109; Washington County; Virginia	3,808	26,902	15.0
Census Tract 9310; Wise County; Virginia	1,573	26,736	15.4
Census Tract 306; Scott County; Virginia	3,358	25,001	15.5
Census Tract 101.01; Washington County; Virginia	2,754	32,527	15.9
Census Tract 304; Scott County; Virginia	3,038	28,322	16.2
Census Tract 9309; Wise County; Virginia	3,482	26,812	19.9

Geography	Population 16 Years and Over	Per Capita Income ($)	Poverty (%)
Census Tract 302; Scott County; Virginia	3,428	21,052	20.3
Census Tract 103.01; Washington County; Virginia	2,514	26,229	20.3
Census Tract 9307; Wise County; Virginia	2,712	19,897	21.9
Census Tract 9315; Wise County; Virginia	2,918	20,610	22.0
Census Tract 105.02; Washington County; Virginia	3,920	39,896	22.2
Census Tract 9504; Lee County; Virginia	2,092	25,950	22.4
Census Tract 9316; Wise County; Virginia	1,963	27,112	23.0
Census Tract 203; Bristol city; Virginia	1,938	20,437	23.9
Census Tract 9314; Wise County; Virginia	4,401	23,582	24.3
Census Tract 9503.02; Lee County; Virginia	2,579	12,921	26.2
Census Tract 201; Bristol city; Virginia	2,952	21,899	26.6
Census Tract 9501; Lee County; Virginia	2,224	19,173	27.4
Census Tract 9317; Wise County; Virginia	1,333	23,738	28.9
Census Tract 9601; Norton city; Virginia	3,138	27,666	29.1
Census Tract 303; Scott County; Virginia	2,509	23,050	30.4
Census Tract 9311; Wise County; Virginia	1,959	18,176	32.8
Census Tract 9505; Lee County; Virginia	3,878	21,393	36.0
Census Tract 202.01; Bristol city; Virginia	1,849	19,257	46.1
Census Tract 9503.01; Lee County; Virginia	1,528	19,876	50.4

Source: USCB 2023h

D.4 Minority Populations in the TVA PSA

Geography	2022 Population	% White Alone	% Minority Population	% Black or African American	% American Indian and Alaska Native	% Asian	% Native Hawaiian and Other Pacific Islander	% Some Other Race	% Two or More Races	% Hispanic or Latino
Blount County, Alabama	59,077	85.7	14.3	1.2	0.1	0.2	0.2	0.1	2.8	9.7
Cherokee County, Alabama	25,069	90.7	9.3	4.0	0.5	0.1	0.0	0.1	2.8	1.9
Colbert County, Alabama	57,270	77.7	22.3	16.0	0.3	0.4	0.1	0.1	2.2	3.2
Cullman County, Alabama	88,284	90.8	9.2	1.1	0.3	0.3	0.0	0.1	2.8	4.6
DeKalb County, Alabama	71,680	79.1	20.9	1.5	0.5	0.1	0.0	0.5	2.9	15.4
Etowah County, Alabama	103,348	77.1	22.9	15.0	0.1	0.7	0.0	0.4	2.3	4.4
Franklin County, Alabama	32,011	75.2	24.8	4.2	0.2	0.1	0.0	0.2	1.5	18.4
Jackson County, Alabama	52,618	88.8	11.2	3.2	0.8	0.4	0.0	0.1	3.5	3.2
Lauderdale County, Alabama	94,329	83.4	16.6	9.7	0.2	0.6	0.1	0.1	2.8	3.0
Lawrence County, Alabama	33,116	76.3	23.7	10.2	5.0	0.3	0.1	0.0	5.6	2.5
Limestone County, Alabama	104,199	74.7	25.3	13.0	0.4	1.8	0.1	0.1	3.6	6.3
Madison County, Alabama	389,781	63.5	36.5	24.3	0.4	2.4	0.0	0.3	3.8	5.3
Marshall County, Alabama	97,923	79.1	20.9	2.7	0.1	0.6	0.1	0.2	2.1	15.1
Morgan County, Alabama	123,102	74.3	25.7	12.9	0.2	0.5	0.0	0.3	3.0	8.8
Winston County, Alabama	23,655	92.3	7.7	1.1	0.2	0.4	0.0	0.0	2.7	3.2
Catoosa County, Georgia	68,052	89.0	11.0	2.2	0.1	1.5	0.1	0.6	3.3	3.4
Chattooga County, Georgia	24,902	82.0	18.0	9.5	0.1	0.1	0.0	0.0	2.7	5.7
Dade County, Georgia	16,239	92.2	7.8	1.0	0.0	0.8	0.0	0.3	3.1	2.6
Fannin County, Georgia	25,436	93.1	6.9	0.3	0.0	0.5	0.0	0.4	3.0	2.8
Gilmer County, Georgia	31,519	84.3	15.7	0.5	0.2	0.4	0.0	0.1	2.1	12.4
Gordon County, Georgia	57,785	76.0	24.0	3.3	0.1	1.1	0.1	0.2	2.4	16.8
Murray County, Georgia	40,063	80.2	19.8	0.4	0.1	0.8	0.0	0.4	2.2	15.9
Towns County, Georgia	12,546	93.6	6.4	1.3	0.1	0.2	0.0	0.1	1.8	2.9
Union County, Georgia	24,880	92.9	7.1	0.6	0.2	0.2	0.0	0.0	2.4	3.8
Walker County, Georgia	68,065	89.9	10.1	3.9	0.2	0.6	0.0	0.1	2.8	2.7
Whitfield County, Georgia	103,033	56.6	43.4	3.2	0.1	1.5	0.0	0.1	1.8	36.8
Allen County, Kentucky	20,773	94.1	5.9	0.8	0.0	0.0	0.0	0.3	2.3	2.4
Butler County, Kentucky	12,365	93.7	6.3	0.4	0.1	0.7	0.0	0.0	1.4	3.8
Calloway County, Kentucky	37,345	88.7	11.3	3.4	0.2	1.6	0.3	0.4	2.7	2.8
Carlisle County, Kentucky	4,782	92.3	7.7	1.2	0.3	0.5	0.1	0.1	3.0	2.5
Christian County, Kentucky	72,766	64.7	35.3	19.7	0.1	1.2	0.3	0.4	5.1	8.4
Cumberland County, Kentucky	5,974	93.0	7.0	2.7	0.3	0.8	0.0	0.0	1.5	1.8
Edmonson County, Kentucky	12,179	95.2	4.8	0.8	0.1	0.0	0.0	0.0	2.3	1.6
Fulton County, Kentucky	6,480	69.8	30.2	23.6	0.4	0.0	0.9	0.0	3.8	1.5
Graves County, Kentucky	36,701	85.0	15.0	4.0	0.0	0.4	0.0	0.3	2.9	7.4
Grayson County, Kentucky	26,465	95.1	4.9	0.5	0.0	0.3	0.0	0.2	2.3	1.5
Hickman County, Kentucky	4,491	86.1	13.9	9.4	0.1	0.0	0.0	0.0	2.1	2.2
Livingston County, Kentucky	8,980	94.5	5.5	0.3	0.0	0.0	0.0	0.0	2.6	2.6

Geography	2022 Population	% White Alone	% Minority Population	% Black or African American	% American Indian and Alaska Native	% Asian	% Native Hawaiian and Other Pacific Islander	% Some Other Race	% Two or More Races	% Hispanic or Latino
Logan County, Kentucky	27,498	88.1	11.9	5.8	0.0	0.4	0.0	0.2	2.3	3.1
Lyon County, Kentucky	8,721	87.9	12.1	6.5	0.5	0.7	0.1	0.3	1.6	2.5
Marshall County, Kentucky	31,706	96.0	4.0	0.6	0.3	0.2	0.0	0.0	1.0	1.8
Monroe County, Kentucky	11,331	93.2	6.8	2.6	0.1	0.2	0.0	0.0	0.8	3.2
Muhlenberg County, Kentucky	30,735	92.5	7.5	1.9	0.2	1.1	0.0	0.0	2.4	1.7
Simpson County, Kentucky	19,574	84.9	15.1	9.3	0.0	0.4	0.0	0.1	2.6	2.8
Todd County, Kentucky	12,281	85.1	14.9	8.0	0.0	0.1	0.0	0.4	1.6	4.8
Trigg County, Kentucky	14,154	87.1	12.9	6.3	0.0	0.3	0.0	0.4	3.3	2.5
Warren County, Kentucky	135,307	76.6	23.4	8.6	0.1	4.9	0.5	0.1	3.5	5.7
Avery County, North Carolina	17,679	87.5	12.5	3.6	0.8	0.5	0.0	0.0	2.4	5.1
Cherokee County, North Carolina	28,868	90.1	9.9	1.5	1.6	0.5	0.0	0.1	2.5	3.7
Clay County, North Carolina	11,186	91.7	8.3	1.0	1.1	1.1	0.1	0.0	1.1	3.9
Watauga County, North Carolina	54,540	91.1	8.9	1.7	0.3	1.4	0.0	0.1	1.5	4.0
Lee County, Virginia	22,287	92.1	7.9	4.0	0.1	0.3	0.0	0.0	1.4	2.1
Scott County, Virginia	21,536	96.1	3.9	1.2	0.1	0.1	0.2	0.1	0.8	1.5
Washington County, Virginia	53,985	94.8	5.2	1.7	0.1	0.5	0.0	0.1	1.3	1.6
Wise County, Virginia	36,105	90.8	9.2	4.6	0.1	1.1	0.0	0.2	1.9	1.3
Bristol city, Virginia	17,036	86.6	13.4	6.3	0.0	0.3	0.0	0.7	3.6	2.6
Norton city, Virginia	3,668	94.4	5.6	2.0	0.0	0.1	0.0	0.0	3.5	0.0
Alcorn County, Mississippi	34,717	80.8	19.2	9.4	0.1	0.4	0.1	0.1	5.6	3.5
Attala County, Mississippi	17,842	52.6	47.4	42.2	0.1	0.3	0.0	0.0	2.6	2.2
Benton County, Mississippi	7,637	60.1	39.9	32.9	0.0	0.4	0.1	0.0	3.3	3.1
Calhoun County, Mississippi	13,193	63.8	36.2	28.4	0.0	0.0	0.0	0.1	1.3	6.5
Chickasaw County, Mississippi	17,024	49.1	50.9	43.7	0.0	0.2	0.0	0.0	1.9	5.1
Choctaw County, Mississippi	8,208	67.0	33.0	29.2	0.1	0.4	0.0	0.2	1.3	1.8
Clay County, Mississippi	18,598	38.0	62.0	60.0	0.0	0.0	0.0	0.0	1.8	0.2
DeSoto County, Mississippi	186,214	59.8	40.2	30.8	0.1	1.3	0.0	0.2	2.7	5.2
Itawamba County, Mississippi	23,888	88.8	11.2	6.0	0.4	0.2	0.0	0.2	2.6	1.8
Kemper County, Mississippi	8,980	33.4	66.6	61.8	3.8	0.0	0.0	0.0	0.2	0.8
Lafayette County, Mississippi	56,172	69.9	30.1	23.3	0.1	2.3	0.0	0.1	1.6	2.6
Leake County, Mississippi	21,335	47.7	52.3	39.8	5.7	0.4	0.0	0.0	1.4	5.1
Lee County, Mississippi	83,343	63.7	36.3	29.7	0.1	1.0	0.2	0.5	1.8	3.0
Lowndes County, Mississippi	58,547	50.0	50.0	44.5	0.1	1.1	0.0	0.4	1.5	2.4
Marshall County, Mississippi	33,980	47.1	52.9	45.5	0.0	0.1	0.0	0.5	2.4	4.3
Monroe County, Mississippi	34,168	66.7	33.3	30.2	0.0	0.3	0.0	0.0	1.3	1.5
Neshoba County, Mississippi	28,970	57.7	42.3	22.8	16.0	0.6	0.1	0.7	1.9	0.2
Noxubee County, Mississippi	10,261	25.6	74.4	73.6	0.4	0.0	0.0	0.0	0.2	0.3
Oktibbeha County, Mississippi	51,388	56.0	44.0	36.6	0.1	3.1	0.1	0.1	2.3	1.8
Panola County, Mississippi	33,157	46.9	53.1	49.6	0.1	0.3	0.4	0.1	1.9	0.6
Pontotoc County, Mississippi	31,202	75.1	24.9	14.4	0.2	0.0	0.0	0.1	2.8	7.5

Geography	2022 Population	% White Alone	% Minority Population	% Black or African American	% American Indian and Alaska Native	% Asian	% Native Hawaiian and Other Pacific Islander	% Some Other Race	% Two or More Races	% Hispanic or Latino
Prentiss County, Mississippi	24,945	79.9	20.1	10.7	0.1	2.5	0.0	1.0	4.3	1.5
Scott County, Mississippi	27,943	48.7	51.3	35.6	0.1	0.1	0.0	0.2	3.5	11.8
Tallahatchie County, Mississippi	12,621	34.9	65.1	61.4	0.0	0.1	0.0	0.2	1.5	1.9
Tate County, Mississippi	28,094	64.2	35.8	30.4	0.0	0.0	0.1	0.0	1.8	3.4
Tippah County, Mississippi	21,769	77.1	22.9	14.5	0.0	0.0	0.0	0.4	3.2	4.7
Tishomingo County, Mississippi	18,837	91.0	9.0	1.3	0.4	0.6	0.0	0.4	2.7	3.5
Union County, Mississippi	27,880	77.2	22.8	15.7	0.2	0.2	0.0	0.6	1.6	4.6
Webster County, Mississippi	9,942	78.2	21.8	18.5	0.1	0.8	0.0	0.1	0.8	1.6
Winston County, Mississippi	17,741	49.6	50.4	46.7	0.5	0.1	0.0	0.0	1.6	1.5
Yalobusha County, Mississippi	12,499	57.8	42.2	38.3	0.2	0.1	0.0	0.0	1.0	2.6
Anderson County, Tennessee	77,337	87.6	12.4	3.2	0.3	1.3	0.1	0.6	3.6	3.4
Bedford County, Tennessee	50,533	75.2	24.8	6.5	0.3	0.3	0.0	0.5	3.7	13.6
Benton County, Tennessee	15,933	91.4	8.6	1.9	0.1	1.1	0.8	0.0	2.9	1.8
Bledsoe County, Tennessee	14,816	87.3	12.7	5.7	0.3	0.1	0.0	0.2	3.3	3.0
Blount County, Tennessee	135,951	89.9	10.1	2.6	0.1	0.7	0.0	0.2	2.6	3.8
Bradley County, Tennessee	108,859	83.9	16.1	4.6	0.2	1.0	0.0	1.0	2.5	6.9
Campbell County, Tennessee	39,397	95.9	4.1	0.3	0.0	0.4	0.0	0.0	1.6	1.7
Cannon County, Tennessee	14,481	92.9	7.1	2.5	0.1	0.0	0.0	0.0	1.7	2.7
Carroll County, Tennessee	28,381	84.0	16.0	8.8	0.1	0.3	0.0	0.0	3.6	3.1
Carter County, Tennessee	56,315	92.9	7.1	2.2	0.1	0.5	0.0	0.0	1.6	2.7
Cheatham County, Tennessee	41,184	90.2	9.8	1.9	0.2	0.5	0.0	0.7	2.5	3.8
Chester County, Tennessee	17,392	84.6	15.4	10.3	0.0	0.2	0.0	0.6	1.4	2.9
Claiborne County, Tennessee	32,092	94.7	5.3	0.8	0.1	0.8	0.0	0.0	2.1	1.5
Clay County, Tennessee	7,592	93.9	6.1	0.7	0.4	0.6	0.0	0.0	1.7	2.8
Cocke County, Tennessee	36,186	92.5	7.5	1.2	0.5	0.5	0.1	0.0	2.4	2.8
Coffee County, Tennessee	58,080	86.7	13.3	3.8	0.0	1.3	0.2	0.4	2.3	5.2
Crockett County, Tennessee	13,955	72.0	28.0	11.0	0.6	0.5	0.1	0.0	4.3	11.5
Cumberland County, Tennessee	61,552	93.8	6.2	0.8	0.2	0.3	0.0	0.1	1.7	3.2
Davidson County, Tennessee	709,786	55.6	44.4	26.0	0.1	3.6	0.1	0.5	3.6	10.6
Decatur County, Tennessee	11,483	91.0	9.0	2.4	0.0	0.1	0.0	0.0	2.9	3.6
DeKalb County, Tennessee	20,209	87.0	13.0	1.6	0.3	0.4	0.0	0.1	2.1	8.4
Dickson County, Tennessee	54,563	88.2	11.8	3.6	0.2	0.1	0.0	0.4	3.3	4.2
Dyer County, Tennessee	36,818	78.3	21.7	13.3	0.1	0.5	0.0	0.0	4.1	3.8
Fayette County, Tennessee	42,228	66.7	33.3	26.9	0.0	0.7	0.0	0.2	2.2	3.2
Fentress County, Tennessee	18,642	95.3	4.7	0.3	0.0	0.3	0.1	0.0	2.1	1.8
Franklin County, Tennessee	42,980	87.7	12.3	4.8	0.0	0.6	0.1	0.2	2.8	3.8
Gibson County, Tennessee	50,455	75.9	24.1	16.0	0.2	0.3	0.0	0.1	4.5	3.0
Giles County, Tennessee	30,317	82.7	17.3	8.8	0.1	0.1	0.0	0.4	4.6	3.3
Grainger County, Tennessee	23,648	93.0	7.0	0.9	0.2	0.1	0.3	0.1	1.7	3.6
Greene County, Tennessee	70,399	92.0	8.0	1.7	0.1	0.5	0.0	0.2	2.3	3.3
Grundy County, Tennessee	13,550	94.8	5.2	0.4	0.2	0.3	0.0	0.0	2.7	1.6

Geography	2022 Population	% White Alone	% Minority Population	% Black or African American	% American Indian and Alaska Native	% Asian	% Native Hawaiian and Other Pacific Islander	% Some Other Race	% Two or More Races	% Hispanic or Latino
Hamblen County, Tennessee	64,531	80.3	19.7	3.1	0.2	0.9	0.4	0.3	2.6	12.3
Hamilton County, Tennessee	367,193	70.1	29.9	17.7	0.1	1.9	0.0	0.4	3.6	6.2
Hancock County, Tennessee	6,726	96.2	3.8	0.6	0.0	0.5	0.0	0.1	1.9	0.7
Hardeman County, Tennessee	25,519	53.9	46.1	39.4	0.6	0.4	0.0	0.1	3.6	2.0
Hardin County, Tennessee	26,824	90.9	9.1	3.4	0.3	0.1	0.0	0.1	2.7	2.6
Hawkins County, Tennessee	57,107	94.1	5.9	1.0	0.1	0.5	0.1	0.1	2.3	1.8
Haywood County, Tennessee	17,806	43.7	56.3	50.0	0.0	0.1	0.0	0.4	1.4	4.3
Henderson County, Tennessee	27,845	86.5	13.5	8.2	0.1	0.1	0.1	0.1	2.2	2.7
Henry County, Tennessee	32,305	86.4	13.6	7.4	0.5	0.4	0.0	0.0	2.5	2.8
Hickman County, Tennessee	24,996	89.6	10.4	3.4	0.5	0.9	0.0	0.2	2.5	2.9
Houston County, Tennessee	8,253	91.0	9.0	3.4	0.3	0.3	0.2	0.0	1.9	2.8
Humphreys County, Tennessee	19,032	90.4	9.6	1.2	0.2	0.8	0.0	0.9	3.7	2.7
Jackson County, Tennessee	11,730	93.3	6.7	0.7	0.1	0.0	0.1	0.0	3.4	2.4
Jefferson County, Tennessee	55,017	91.0	9.0	1.7	0.1	0.6	0.0	0.4	2.4	3.9
Johnson County, Tennessee	17,982	90.4	9.6	3.6	0.6	0.2	0.0	0.3	2.7	2.3
Knox County, Tennessee	481,406	81.1	18.9	8.2	0.1	2.3	0.1	0.4	3.2	4.8
Lake County, Tennessee	6,898	65.8	34.2	25.5	0.7	0.2	0.1	0.0	4.7	2.9
Lauderdale County, Tennessee	25,171	58.8	41.2	34.4	0.4	0.2	0.0	0.3	3.2	2.9
Lawrence County, Tennessee	44,377	92.2	7.8	1.4	0.0	0.4	0.1	0.4	2.9	2.5
Lewis County, Tennessee	12,637	92.1	7.9	1.2	0.0	1.1	0.0	0.0	3.0	2.6
Lincoln County, Tennessee	35,365	85.4	14.6	6.2	0.1	0.7	0.0	0.1	3.6	3.9
Loudon County, Tennessee	55,507	86.3	13.7	1.2	0.1	1.0	0.0	0.4	1.4	9.6
McMinn County, Tennessee	53,532	87.1	12.9	3.4	0.1	0.8	0.0	0.1	4.1	4.5
McNairy County, Tennessee	25,895	89.1	10.9	5.9	0.3	0.6	0.0	0.1	1.7	2.4
Macon County, Tennessee	25,365	90.3	9.7	0.6	0.1	0.4	0.0	0.0	3.3	5.3
Madison County, Tennessee	98,644	54.5	45.5	37.1	0.1	1.0	0.1	0.5	2.5	4.3
Marion County, Tennessee	28,852	90.9	9.1	2.9	0.1	0.5	0.0	0.1	3.5	2.1
Marshall County, Tennessee	34,567	84.4	15.6	4.7	0.3	0.6	0.0	0.6	3.4	6.0
Maury County, Tennessee	102,002	78.0	22.0	10.8	0.2	0.9	0.0	0.1	3.3	6.6
Meigs County, Tennessee	12,839	90.4	9.6	2.4	0.0	0.5	0.0	0.4	5.1	1.2
Monroe County, Tennessee	46,489	88.0	12.0	1.8	0.1	0.4	0.0	0.2	4.9	4.6
Montgomery County, Tennessee	222,305	60.9	39.1	19.6	0.2	2.3	0.3	0.6	5.3	10.7
Moore County, Tennessee	6,558	92.3	7.7	3.7	0.5	0.9	0.0	0.0	2.1	0.5
Morgan County, Tennessee	21,124	90.5	9.5	4.7	0.3	0.2	0.0	0.0	2.7	1.6
Obion County, Tennessee	30,670	80.1	19.9	10.5	0.1	0.2	0.1	0.2	3.7	5.1
Overton County, Tennessee	22,576	95.5	4.5	1.3	0.1	0.3	0.0	0.0	1.0	1.9
Perry County, Tennessee	8,432	90.9	9.1	0.4	0.5	2.2	0.0	0.0	5.0	1.0
Pickett County, Tennessee	5,042	95.2	4.8	0.3	0.0	0.0	0.0	0.0	2.3	2.2
Polk County, Tennessee	17,620	90.6	9.4	0.4	0.3	0.2	0.0	0.2	6.0	2.2
Putnam County, Tennessee	80,157	87.2	12.8	2.1	0.1	1.0	0.0	0.0	2.8	6.7
Rhea County, Tennessee	33,031	88.0	12.0	1.7	0.1	0.5	0.0	0.3	3.9	5.5

Geography	2022 Population	% White Alone	% Minority Population	% Black or African American	% American Indian and Alaska Native	% Asian	% Native Hawaiian and Other Pacific Islander	% Some Other Race	% Two or More Races	% Hispanic or Latino
Roane County, Tennessee	53,777	91.2	8.8	2.7	0.2	0.6	0.0	0.1	2.8	2.2
Robertson County, Tennessee	73,297	81.4	18.6	7.1	0.1	0.7	0.0	0.6	2.5	7.7
Rutherford County, Tennessee	343,727	67.5	32.5	15.0	0.1	3.6	0.0	0.3	4.3	9.1
Scott County, Tennessee	21,917	96.8	3.2	0.3	0.2	0.4	0.0	0.3	1.8	0.2
Sequatchie County, Tennessee	16,065	92.3	7.7	0.5	0.4	0.3	0.1	0.3	2.2	4.0
Sevier County, Tennessee	98,455	88.4	11.6	0.9	0.2	1.2	0.0	0.3	2.1	6.9
Shelby County, Tennessee	926,440	34.5	65.5	53.6	0.1	2.9	0.0	0.3	1.9	6.8
Smith County, Tennessee	20,034	90.5	9.5	1.7	0.1	0.4	0.0	0.3	3.8	3.2
Stewart County, Tennessee	13,724	90.1	9.9	0.7	0.1	0.5	0.8	0.0	4.2	3.6
Sullivan County, Tennessee	158,722	92.4	7.6	1.9	0.1	0.8	0.0	0.3	2.3	2.2
Sumner County, Tennessee	196,845	81.1	18.9	8.2	0.1	1.6	0.0	0.3	2.9	5.7
Tipton County, Tennessee	61,116	74.5	25.5	18.5	0.1	0.6	0.0	0.7	2.7	2.9
Trousdale County, Tennessee	11,596	81.9	18.1	11.8	0.4	0.2	0.0	0.0	2.8	2.9
Unicoi County, Tennessee	17,845	91.3	8.7	0.3	0.4	0.2	0.0	0.0	2.0	5.9
Union County, Tennessee	19,860	95.1	4.9	0.5	0.0	0.0	0.0	0.1	2.3	2.0
Van Buren County, Tennessee	6,182	95.1	4.9	0.1	0.4	0.2	0.0	0.0	3.2	0.9
Warren County, Tennessee	41,163	84.1	15.9	2.6	0.2	0.4	0.1	0.0	3.0	9.5
Washington County, Tennessee	133,282	87.4	12.6	3.7	0.1	1.5	0.0	0.1	3.4	3.9
Wayne County, Tennessee	16,325	88.9	11.1	4.8	0.1	0.1	0.1	0.1	3.5	2.4
Weakley County, Tennessee	32,946	85.5	14.5	7.9	0.2	1.2	0.1	0.3	1.9	3.0
White County, Tennessee	27,420	92.7	7.3	1.8	0.1	0.3	0.2	0.0	2.0	2.9
Williamson County, Tennessee	248,897	82.7	17.3	3.9	0.0	5.1	0.0	0.4	2.8	5.1
Wilson County, Tennessee	149,096	82.1	17.9	6.9	0.1	1.9	0.0	1.0	3.1	5.0

Source: USCB 2022b

County has a minority population greater than the TVA PSA average of 26.7%

County has a minority population greater than 50%

Appendix E – Public Comments and Responses

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Comment-Response Appendix
TENNESSEE VALLEY AUTHORITY RESILIENCE 360° PROGRAM
COMMENTS ON DRAFT PROGRAMATIC ENVIRONMENTAL ASSESSMENT

The Draft PEA was posted to TVA's website and a media advisory was issued on March 18, 2025 for a 30-day comment period. TVA also notified interested federal, state, and local agencies of the availability of the Draft PEA. Fourteen public comment submittals were received from individuals, businesses, non-profits (including the Center for Biological Diversity, the Southern Environmental Law Center, CleanUpTVA, Sierra Club, and Appalachian Voices), and governmental agencies (including the Virginia Department of Environmental Quality and Tennessee Department of Environmental Conservation). Individual comments focused on alternatives considered, best management practices, the Environmental Screening Checklist (Appendix A), resource areas, as well as implementation and support.

Alternatives

1. **Renew-O-Gen – Jason Ware.** I would like to inquire if the program is open to alternative technologies—such as hydrokinetic and hybrid renewable systems—or if it is limited exclusively to natural gas and battery energy storage systems.

   Ricky Pickett – Individual. I have 20 acres on Wilson lake of the Tennessee river. There could be a dam made to create backup water reservoir. A solar grid could pump water up into the reservoir, during times of less demand, then the potential energy could be released, during peak demand.

   Response: While the current plan for the Resilience 360° program only considers natural gas and BESS, under future phases of the Resilience 360° program, other generation options may be considered consistent with TVA's Integrated Resource Plan.

2. **Cliff Bahlinger – Individual.** If you propose letting businesses to generate power, then let homeowners generate power and increase the rate of net metering. Please be open minded. Home solar, and home battery storage is the answer to our energy needs. TVA should allow "Base Power" to operate in their service area. Base Power installs batteries to homeowners, and buys the power at peak demand. Batteries are recharged at night or by solar in the day. Let's do it! This is good for TVA, customers, and our environment. We do not need jet engine power generation because it is not efficient and dirty. Who wants a jet engine running 24/7 near their home?

   Response: Part of the purpose and need for the Resilience 360 Program is to provide "Commercial Resiliency" for businesses. TVA has a variety of energy efficiency programs for residential purposes such as the Dispersed Power Production program which addresses excess solar generation buyback. See https://energyright.com/residential/.

3. **Center for Biological Diversity – Gaby Sarri-Tobar**
   - We commend TVA for proposing a program to enhance grid and energy resilience; however, TVA makes a grave error in considering backup fossil gas generation as a qualifying resilience project. Fossil gas generation is not only unreliable, but it produces harmful greenhouse gas emissions that endanger communities, species, and the climate. We urge TVA to consider a project alternative that prioritizes non-fossil fuel backup generation, including distributed energy resources ("DERs") such as rooftop and community-solar with battery energy storage systems ("BESS").

     As a threshold matter, the climate emergency and growing energy inequity in the Tennessee Valley demands an expedited phasing out of fossil fuels. However, in TVA's attempt to promote resilience the utility is carelessly encouraging vendors and TVA customers to invest in technologies that would pump more planet-warming emissions into the atmosphere which contribute to climate change that is intensifying the very disasters putting TVA's grid and communities at risk. If TVA is serious about building a more resilient energy system and supporting communities whose health and safety and access to life-saving power is threatened by extreme weather events, the utility should avoid cementing the region's dependence on fossil fuels.

     Furthermore, TVA has failed to propose any other reasonable action alternatives that would not involve the construction of new polluting resources. The Final PEA must therefore fully and fairly consider alternatives for resilient distributed renewable energy, battery storage, and demand response, in order to comply with the National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321, et seq. Importantly, such an alternative would help put TVA on track with addressing the most pressing issue today: the urgent need for a rapid transition away from all fossil fuels toward a renewable energy economy to avoid the worst impacts of the climate crisis and address the disproportionate harm experienced by communities from the fossil fuel economy.

   - TVA Must Examine Fossil Fuel-Free Alternatives to Comply with NEPA and The TVA Act and Achieve Rapid Greenhouse Gas Reductions That Are Critical To Addressing The Climate Emergency and Saving Lives.

   - Furthermore, TVA should be ensuring all steps are taken to protect the environment and communities who will be most impacted by this program. In line with this, it is reckless for TVA to only examine new fossil gas generation that would add to the region's already alarming air quality crisis, and not focus on other alternatives [...]

   - TVA must properly define the purpose and need for the proposed program and consider additional alternatives.

   - TVA's Final PEA Must Analyze Distributed, Renewable Energy Alternatives That Would Advance Energy Justice, Lower Costs, and Improve Resilience in The Region.

   - The impacts of the climate crisis and worsening energy injustice for the communities that TVA serves are concrete, palpable, and are projected to worsen — and will certainly do so should TVA fail to consider and pursue non-fossil fuel alternatives. TVA's inclusion of on-site modular fossil gas units in the Resilience 360 program is out of step with climate science, community

demands, and the TVA Act. TVA has an opportunity to improve the quality of life of people in the region, and that starts with completing a PEA that examines DERs, and energy efficiency in addition to BESS instead of expanding fossil gas operations.

Response: The proposed Resilience 360° program already includes BESS in addition to natural gas options. Eventually under future phases of the program, TVA's Resilience 360° options could be expanded to include other generation sources that are consistent with TVA's Integrated Resource Plan. The current program focuses on natural gas and BESS energy resources to fulfill the purpose and need: to improve and enhance commercial resiliency during events that challenge the transmission of power on the grid [e.g., extreme weather, and minor incidences of cyber-attack or domestic terrorism] and to periodically support demand on the TVA system. Dispatchable generation is necessary, and other generation options do not provide the same capabilities as natural gas and BESS to meet this purpose. For example, solar is not a reliable generation source to provide power during weather emergencies.

4. **Joe and Sally Schiller - Brokenpoint Farm.** My wife and I are retired professors of biology now farming in Montgomery County, TN. We have lived in an off-grid solar home in Montgomery County Tennessee since 1996. We have acquired considerable firsthand experience with solar energy and storage systems and confidence in their capabilities. Thus, we find it odd that the proposed TVA 360 deg. Resilience Program seems to target only distributed methane gas generation and no other energy sources such as solar and storage as a resilience strategy. There are numerous problems with such a strategy.

   One problem is that if these systems are to be reliable they will have to be run briefly at regular intervals to be sure they are functioning when they are really needed. This means the owner will incur some cost and impacts even when the system is not needed for resilience. Another problem is these systems will generate emissions whenever they run, but TVA's assumption that these systems will not create significant emissions impacts because they will be widely distributed overlooks the local impacts on the employees of the business operating them and any employees of nearby businesses. Having worked for an institution that required backup power for critical materials preservation I can attest to the fact that when these backup systems run, they have noticeable adverse effects on the local environment.

   Solar combined with storage, by contrast, is not only affordable and reliable it offers ongoing benefits to businesses that install it. It can reliably provide resilience during grid emergencies but can also offset purchased energy and provide other benefits on an ongoing basis 365 days a year. This can be an especially compelling economic incentive for businesses that are subject to regular capacity pricing costs. The battery components of such solar and storage systems also provide continuous grid services such as capacity, load shifting, and frequency regulation. Taken together the bundle of services provided by solar and storage offer a much more attractive business case to the host business while providing grid resilience TVA seeks—not just during grid emergencies, but 365 days a year!

   We sincerely hope TVA will reconsider the narrow focus on fossil methane gas the draft Programmatic EA considers and expands it to evaluate a range of distributed energy technologies. We believe a more technology agnostic strategy that compares costs and impacts of a variety of distributed generation technologies that meet a specified set of resilience criteria

will provide more affordable, more effective, and less harmful solutions to the resilience goals TVA seeks.

Response: See responses to Comments #2, #3, and #14.

5. **Southern Environmental Law Center, Sierra Club, and Appalachian Voices (collectively, "Conservation Groups") - Amanda Garcia.**
TVA should consider and pursue an alternative based on renewable energy and storage.

   To improve resilience without increasing pollution, TVA should consider an alternative program that pairs renewable energy with storage solutions. NEPA requires agencies to consider a "reasonable range of alternatives to the proposed agency action." Yet TVA has not meaningfully considered a single alternative to its proposal. Instead, TVA proposes a single program design: allowing end-use customers to host methane gas turbines or battery storage systems.

   The programmatic EA itself acknowledges obvious alternatives, recognizing that the program "could be expanded to include other generation sources in the future (including but not limited to biofuels, solar, thermal storage, and advanced nuclear)." Renewable solutions like wind and solar are available now to support system resilience.

   [...] TVA fails to acknowledge that distributed methane gas turbines are inconsistent with the 2019 IRP. Accordingly, TVA does not have a reasonable basis to conclude that distributed gas turbines help TVA provide electricity at the lowest system cost. Instead, TVA should consider an alternative design that better aligns with its definition of DER and the low-cost "Promote DER" strategy in the 2019 IRP. [...]

   To maximize these benefits and avoid the unnecessary pollution of methane gas, Conservation Groups encourage TVA to consider an alternative Resilience 360° Program design that relies on renewable energy and storage solutions, as outlined in the Energy Innovation report hereby incorporated.

   Response: See responses to Comments #2 and #3. Energy parks such as those described in the Energy Innovation report are more traditionally tailored to meet the power demands of nearby large consumers, though the paper notes that such parks could also be integrated into the grid to meet overall demand. TVA acknowledges the advantages of such energy parks with diverse generation facilities; however, due to the scale, those projects would require separate NEPA reviews and such parks fall outside the scope of the Resilience 360° Program review.

6. **Conservation Groups.** Conservation Groups encourage TVA to consider an alternative program that relies on renewable energy and storage and to analyze the site-specific impacts of any proposed methane gas turbines.

   Response: See responses to Comments #2 and #3.

   This PEA establishes general siting and environmental criteria to ensure that construction and operation of the Resilience 360° units at specific host sites do not cause greater impacts than those addressed in this PEA. The natural gas units could run on a variety of gas mixes including

methane. The specific gas would be determined on a site-specific basis based on the unit and available gas at each host site. As described in Section 3.3.2, cooling water would not be required, as all systems evaluated in this PEA are closed-loop cooling systems. TVA would review the submitted site-specific Environmental Screening Checklist (Appendix A) with regard to impacts to all resources including air quality and health and safety for each proposed host site and the surrounding area. If the potential impacts of the proposed project are not bounded by the evaluation in the PEA, additional review would be required.

7. **CleanUpTVA - Leah McCord**. The CleanUpTVA Coalition submits these comments regarding the Tennessee Valley Authority's Draft Programmatic Environmental Assessment (PEA) for TVA's Resilience 360° Program. While the organizations within our coalition believe strongly in the potential benefits of distributed energy resources (DERs), we have grave concerns about a proposal that intends to incentivize methane gas facilities in an already burdened region.

   The members of the CleanUpTVA coalition have long supported a system that incorporates more DERs to increase reliability and flexibility. The 2019 IRP, as well as the 2025 draft IRP, showed that DERs are a cost effective, low risk way to address load demand increases and seasonal power demand fluctuations.

   The PEA for the Resilience 360° Program states that TVA "would not consider generation resources that are inconsistent with its Integrated Resource Plan," but it does exactly that by specifically choosing methane gas turbines as one of two options under the program. The 2019 IRP includes "solar, storage, combined heat and power, energy efficiency, and demand response" as sources of DER; it did not include methane gas turbines as DERs. [...] The Resilience 360° Program should remove the methane gas turbines in the proposal and replace them with solar, storage, and non-fossil fuel based combined heat and power. In this way, TVA can quickly bring critically needed clean energy online, in alignment with the Board's current strategic direction, benefiting everyone in the Tennessee Valley.

   Response: See responses to Comments #2 and #3.

Best Management Practices

8. **Virginia Department of Environmental Quality (DEQ) – Bettina Rayfield.**
   Effective siting, planning, and on-site BMPs will help to ensure that environmental impacts are minimized. DEQ has several pollution prevention recommendations that may be helpful as future projects are considered:
   - Consider development of an effective Environmental Management System (EMS) to ensure that the proposed facility is committed to complying with environmental regulations, reducing risk, minimizing environmental impacts, setting environmental goals, and achieving improvements in its environmental performance.
   - Consider environmental attributes when purchasing materials.
   - Consider energy efficiency when choosing materials and products.
   - Consider contractors' commitment to the environment when choosing contractors.
   - Choose sustainable materials and practices for building construction and design.

- Integrate pollution prevention techniques into the facility maintenance and operation. Maintenance facilities should have sufficient and suitable space to allow for effective inventory control and preventive maintenance.

Response: Resilience 360° vendors would adhere to best management practices such as those outlined in the PEA (Section 2.3). These include both standard and routine measures as well as non-routine measures which could result from TVA's review of the Environmental Screening Checklist (Appendix A). Section 2.3.2 of the PEA has been updated to include reference to the BMPs described above. Further integration of DEQ's suggested pollution prevention measures would be addressed as appropriate for each participant in TVA's proposed resiliency network as well as on a site-specific or unit basis.

9. **Virginia DEQ.** In general, when pesticides or herbicides must be used, their use should be strictly in accordance with manufacturers' recommendations. In addition, DEQ recommends that the responsible agent use the least toxic pesticides or herbicides effective in controlling the target species.

   Response: Participants in the Resilience 360° program would be expected to comply with all applicable federal, state, and local regulations regarding use of pesticides and herbicides. Any herbicides or pesticides used during construction would be used according to manufacturer instructions. Selection of pesticides or herbicides would be evaluated on a site-specific or unit basis by the vendor or host site as applicable. TVA will share the recommendation to use the least toxic methods with the vendors and host sites.

10. **Virginia DEQ**
    - The following requirements may be applicable:
      - During land-disturbing activities, fugitive dust must be kept to a minimum by using control methods.
      - If project activities change to include open burning or the use of special incineration devices are employed in the disposal of land-clearing debris during demolition and construction, these activities must meet the requirements for open burning. The applicant should contact the locality to determine what local requirements, if any, exist.
      - The installation of fuel-burning equipment (e.g. boilers and generators) may require permitting from DEQ prior to beginning construction of the facility.
      - Stationary air emissions sources constructed at this location may be subject to 9 VAC 5-80-1120. The regulation requires obtaining an air permit before starting actual construction of, or operation of any new stationary source.

    - Permanent and temporary impacts, including conversion of wetlands from one Cowardin class to another, to surface waters or wetlands may require prior approval by DEQ's VWPP and/or the U.S. Army Corps of Engineers.

    - VMRC states that projects may encroach over jurisdictional areas and may require a permit. When site-specific plans are developed, this determination may change.
      - It is recommended that the Applicant coordinate with VMRC when site-specific projects are proposed to determine potential impacts to jurisdictional areas.
      - If any portion of the subject project involves any encroachments channel ward of ordinary high water along non-tidal, natural rivers and streams with a drainage area greater than

5-square miles, a permit may be required from VMRC or DEQ. Any jurisdictional impacts will be reviewed by the VMRC during the JPA process.

- There is a possible need for Erosion and Sediment Control and Stormwater Management Plans, as well as General Permit for Stormwater Discharges from Construction Activities.

- Each local floodplain ordinance must comply with the minimum standards of the NFIP. […] For federal projects, the applicant/developer is encouraged to contact the local floodplain administrator and comply with the community's local floodplain ordinance. DCR's comments indicate that the following may be applicable:
  - All development within a SFHA, as shown on the locality's FIRM, must be permitted and comply with the requirements of the local floodplain ordinance.
  - Projects conducted by federal agencies within the SFHA must comply with federal EO 11988.
  - The applicant/developer must contact the local floodplain administrator for an official floodplain determination and comply with the community's local floodplain ordinance, including receiving a local permit. Failure to comply with the local floodplain ordinance could result in enforcement action from the locality.

Response: Participants in the TVA Resilience 360° program would be expected to comply with all applicable federal, state, and local regulations, permits, requirements, and best management practices in regard to natural resources, including air quality, water quality, wetlands, surface water, erosion, solid and hazardous waste, biological resources, floodplain management, public drinking water, pollution prevention, and pesticides and herbicides. TVA would review site-specific requirements and provide guidance and recommendations as needed during review of the Environmental Screening Checklists for each host site.

11. **Virginia DEQ.** DEQ encourages all projects to implement pollution prevention principles, including (1) the reduction, reuse and recycling of all solid wastes generated; and (2) the minimization and proper handling of generated hazardous wastes. The following requirements may apply to future projects:
    - The project manager is reminded that if any solid or hazardous waste is generated/encountered during construction, the project manager would follow applicable federal, state, and local regulations for their disposal.
    - The removal, relocation or closure or installation/operation of any regulated petroleum storage tanks, aboveground storage tank (AST) or underground storage tank (UST), must be conducted in accordance with the requirements of the Virginia Tank Regulations. Submit appropriate documentation to DEQ.
    - Test and dispose of any soil/sediment that is suspected of contamination or wastes that are generated during construction-related activities in accordance with applicable federal, state, and local laws and regulations.
    - Any future site activities involving excavation or disturbance of formerly petroleum contaminated soils and or groundwater must be reported to DEQ.
    - Petroleum-contaminated soils and ground water generated during implementation of this project must be properly characterized and disposed of properly.
    - All construction and demolition waste, including any excess soil, must be characterized in accordance with the Virginia Hazardous Waste Management Regulations and disposed of at an appropriate facility as applicable.

- If evidence of a petroleum release is discovered during implementation of this project, it must be reported to DEQ.

Response: Participants in the TVA Resilience 360° program would be expected to comply with all applicable federal, state, and local regulations, permits, requirements, and best management practices in regard to management, disposal, and handling of solid and hazardous wastes.

12. **Virginia DEQ.** The DEQ DLPR recommends a search (>200-ft radius) of any land-based project areas using designated Virginia and/or US Agency Online solid and hazardous waste databases to identify waste sites (including petroleum releases) in close proximity to those project areas.

    Response: Participants in the Resilience 360° Program would be expected to comply with all applicable federal, state, and local regulations in regard to solid and hazardous waste management. A proximity search to identify any waste sites would take place during the siting process for given unit. The siting Environmental Screening Checklist has been modified to include a verification of previous waste storage and/or contamination in the vicinity of the site (Appendix A).

13. **Tennessee Department of Environmental Conservation (TDEC)**
    - Several actions could negatively impact air quality on a short-term basis. TDEC recommends that TVA evaluate such potential impacts prior to any clearing, demolition, or construction. Such impacts may include, but are not limited to, air pollution from construction equipment, open burning associated with land clearing activities, and fugitive dust. Local air quality conditions are available online at https://www.airnow.gov/.

    - Prevention of Significant Deterioration (PSD) and Nonattainment New Source Review (NNSR): PSD applies to new major sources or major modifications at existing sources for pollutants where the area the source is located is in attainment or unclassifiable with the National Ambient Air Quality Standards (NAAQS). PSD requires installation of Best Available Control Technology (BACT), an air quality analysis, an additional impacts analysis, and public participation in the permitting process. NNSR applies to new major sources or major modifications at existing sources for pollutants where the area the source is located is not in attainment with the NAAQS. NNSR requirements are customized for the nonattainment area, but all NNSR permits require the installation of the lowest achievable emission rate (LAER) controls, emission offsets, and public participation in the permitting process. Compliance with applicable PSD or NNSR regulations would be the responsibility of the site owner/operator, but TDEC recommends that TVA consider the applicability of the preconstruction programs in the siting of any new or modified emission source.

    - New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP): Certain source categories, including combustion turbines, are subject to federal NSPS and NESHAP standards, which are codified at 40 CFR Part 60 and 40 CFR Part 63, respectively. Compliance with applicable NSPS or NESHAP regulations would be the responsibility of the site owner/operator, but TDEC recommends that TVA consider the applicability of these standards in the siting of any new or modified emission source.

    - Truck traffic associated with construction projects generate emissions of PM, CO, NO2, SO2, VOC, and CO2, and TDEC recommends the operation of trucks with up-to-date emission

control technologies and proper maintenance to minimize vehicle and equipment emissions. The Department also recommends the adoption of best practices to minimize vehicle idling to minimize the impact of mobile source emissions on ambient air quality.

- If disposal of trees or vegetation is necessary during construction, TDEC recommends the evaluation of alternatives to open burning. Tennessee's open burning regulations can be found at https://publications.tnsosfiles.com/rules/1200/1200-03/1200-03-04.pdf.

- If fugitive dust will be generated from construction activities, TDEC recommends the use of wet suppression or other measures to minimize the generation of fugitive dust.

- For air contaminant sources not subject to PSD or NNSR, the Tennessee Air Pollution Control Regulations require certain sources to obtain permits prior to commencing construction or operation. Additional information is available online at https://www.tn.gov/content/tn/environment/permit-permits/air-permits/construction.html.

- Battery storage facilities would presumably operate with no emissions during normal operation, but lithium-ion battery fires, such as the recent Moss Landing fire in California, may generate substantial quantities of criteria pollutants, HAPs, or other pollutants. TDEC recommends that TVA consider these impacts, as well as appropriate hazard mitigation, if siting of battery storage units is required.

Response: Participants in the Resilience 360° program would be expected to comply with all applicable federal, state, and local regulations, permits, requirements, and best management practices in regard to air quality. Most Resilience 360° projects would occur on previously developed areas such as recently graded land, sites situated on fill material, parking lots, and other similar low-impact areas, TVA would conduct site-specific reviews for each completed Environmental Screening Checklist and would integrate TDEC's best management practice suggestions to the extent possible for applicable sites.

Resource Areas

14. **Center for Biological Diversity.** Further reliance on fossil fuels will harm public health and safety and pump more greenhouse gas emissions into the atmosphere that fuel climate risk and undermine resilience. [...] Despite being smaller in size, on-site modular gas units still spew harmful greenhouse gas emissions that dirty the air and harm public health, which contradicts TVA's policy to "improve quality of life and the environment in the Tennessee Valley by providing reliable, affordable, and increasingly clean energy." [...] The harms associated with back-up fossil gas generation are on full display in South Memphis, where the new xAI "Colossus" facility is running on 35 un-permitted portable gas generators. These units are pumping hazardous chemicals, including formaldehyde, that worsen air pollution, especially ground level ozone, which contributes to serious health harms like cancer. Given these impacts, it is concerning that TVA suggests that air permits would not be necessary for the on-site modular gas units. Draft PEA at 1-5. This is a major oversight that could allow gas plant operators to take advantage of relaxed requirements in much the same way that xAI has. Even if TVA anticipates that these gas units will

not operate for more than 400 hours per year, and that emissions would be “temporary and small,” these units are spewing harmful chemicals, nonetheless. Draft PEA at 3-41. Memphis is already out of compliance with the Clean Air Act’s air quality standards, in large part due to xAI’s on-site gas turbines.

Response: TVA would evaluate site-specific impacts and requirements based on the Environmental Screening Checklist (Appendix A) which includes a review of air quality. Each installation would be evaluated on a case-by-case basis for air quality parameters, and all applicable federal, state and local guidance, requirements and permits would be adhered to by the Participants in the Resilience 360° Program.

15. **Conservation Groups.** TVA acknowledges that the proposed methane gas turbines emit CO, CO2, NOx, SO2, hazardous air pollutants, and volatile organic compounds. TVA concludes that these emissions “would result in minor impacts,” without analyzing key information, including how much pollution the methane gas turbines would emit, how many there might be, or where they would be. TVA states that “the geographic separation between sites would minimize the project’s contribution to regional air quality conditions,” but TVA does not provide a basis for that key assumption. Large energy users—potential hosts of Resilience 360° projects—often concentrate into industrialized areas. That concentration can produce air toxics hotspots [...].

    Response. The PEA presents a bounding analysis for air quality impacts but that does not represent the end of TVA's environmental review. Vendors would submit an Environmental Screening Checklist for each site proposed for the program. TVA would conduct a site-specific review for all resource areas on each Checklist including air quality.

16. **CleanUpTVA.** TVA’s assertions that “the geographic separation between sites would minimize the project’s contribution to regional air quality conditions” cannot be validated without site-specific environmental impact assessments. Redesigning the program to promote renewable DERs, however, would greatly reduce the potential environmental impacts and would not raise concerns over close siting in existing industrialized areas.

    Response. TVA would be evaluating specific sites based on the Environmental Screening Checklist (Appendix A) which includes a review of air quality parameters. Each proposed project location will be evaluated on regional air quality impacts on a case-by-case basis, and all federal, state and local guidance, requirements and permits would be adhered to.

17. **TDEC.** Hazardous Air Pollutants: Page 3-41 of the draft PEA identifies methane and carbon dioxide as hazardous air pollutants (HAPs), but neither pollutant is a HAP

    Response. Designation of HAPs has been corrected in the Final PEA.

18. **Virginia DEQ.** DCR supports TVA utilizing state-specific resources in the site-specific screening process to determine the potential effects to state-listed species. Several of DCR’s Virginia State Natural Area Preserves (https://www.dcr.virginia.gov/natural-heritage/natural-area-preserves/) are also located within the service area in Virginia. DCR has the following recommendations:
    - As specific projects are developed under Alternative B - Proposed Action, DCR recommends coordination with the DCR Division of Natural Heritage for updated natural heritage information and determination of potential impacts to natural heritage resources

from BESS or gas installation projects including construction, operation and decommissioning.
    - DCR supports the siting of proposed projects away from sensitive areas on previously disturbed land such as brownfields and coal mine reclamation sites to minimize impacts to natural heritage resources and large contiguous tracts of forestland that support these resources.
    - Due to the decline in pollinators, DCR recommends the planting of native pollinator plants in the buffer areas of the planned activities, which bloom throughout the growing season as well as the development of an invasive species management plan for these projects.
    - Contact the DCR DNH and resubmit project information and a map if the scope of the project changes and/or six months has passed before it is utilized.

Response. Participants in the Resilience 360 program would be expected to comply with all applicable federal, state, and local regulations in regard to natural heritage resources. This includes coordination with the appropriate agencies and adherence to timely evaluations. Siting concerns will be partially addressed via the Environmental Screening Checklist (Appendix A).

Units would be installed primarily in areas that have already been disturbed or developed and are adjacent to existing facilities, decreasing the likelihood that federally or state-listed terrestrial animals would be present in these areas. Each site would also be analyzed using the USFWS Information for Planning and Consultation tool in addition to the Environmental Screening Checklist. TVA would coordinate with DCR staff as appropriate during review of projects located in Virginia. By reviewing the site-specific Environmental Screening Checklists, TVA would independently determine if a prospective project associated with the proposed Resilience 360° program would adversely affect protected species.

For those projects with the potential to cause adverse effects to listed species, further review would be warranted and mitigation measures to eliminate the potential for any significant impacts to listed terrestrial species would be developed and implemented. Post-construction, re-planting of an area may take place for various reasons including to restore native plant communities to be revegetated with native and/or non-invasive vegetation consistent with EO 13112 (Invasive Species). With the implementation of these measures, no significant effects on listed terrestrial species are expected.

19. **Virginia DEQ.** The VDH ODW has no comments to submit at this time. Potential impacts to public water distribution systems or sanitary sewage collection systems must be verified by the local utility.

    Response. Comment noted. As the project would not require connection to public water distribution or sanitary sewage collection systems, no impacts to such systems are expected. However, the vendor would coordinate with the local utility as appropriate to ensure impacts are avoided.

20. **Conservation Groups.**
    - **TVA must analyze site-specific pollution from methane gas plants**.
      [...] TVA must analyze the site-specific impacts of any Resilience 360° project that uses methane gas. The Draft Programmatic EA does not disclose localized impacts to air quality, water resources, or other impacts relevant to site-adjacent communities. TVA states that

"[d]irect impacts to regulated water resources would be avoided by project design," without disclosing whether the methane gas turbines would use cooling water and, if so, how much. Accordingly, TVA does not disclose enough information for the public to understand the potential impacts to local surface water and groundwater resources.

- TVA must analyze potential impacts to communities like Southwest Memphis, where a low-wealth, majority Black community has already borne a disproportionate burden of environmental pollution. TVA has not satisfied its NEPA obligations to consider inherently site-specific impacts of air pollution, water resources, and community health impacts. TVA's "bounding analysis," combined with its failure to consider a single alternative to its proposed action, obscures the impacts of the proposed methane gas turbines. TVA must analyze these site-specific impacts for any Resilience 360° project that uses methane gas turbines.

Response: This PEA establishes general siting and environmental criteria to ensure that construction and operation of the Resilience 360° units do not cause greater impacts than those addressed in this PEA. The natural gas units could run on a variety of gas mixes including methane and the specific gas would be determined on a site-specific basis based on the unit and available gas at each specific location. As described in Section 3.3.2, cooling water would not be required, as all systems evaluated in this PEA are closed-loop cooling systems. TVA would review the site-specific Environmental Screening Checklist (Appendix A) with regard to impacts to all resources including air quality and health and safety for each site and the surrounding area.

Environmental Screening Checklist

21. **Renew-O-Gen - Jason Ware.** Additionally, I would appreciate clarification on the administrative approval process for participating sites, and whether third-party developers working with TVA customers may also submit Environmental Screening Checklists for consideration under this program. I am eager to explore how our systems, designed to function both independently and within the grid to provide clean, dispatchable energy, might align with TVA's vision for Resilience 360°.

    Response: Resilience 360° is open to commercial and industrial entities located within the TVA PSA and to all customers including the 153 local power companies and direct serve customers. Any customer or entity is welcome to submit a site for consideration to be screened for its viability. TVA would help facilitate potential sites with available vendors. TVA has developed requirements that potential Qualified Resilience Network vendors must meet to be included in the Resilience 360° program. Third-party vendors that are actively working with customers are also welcome to submit sites to be screened under this program. Ultimately, the vendors would complete the Environmental Screening Checklist for all prospective sites and submit the Checklist to TVA for review and consideration prior to a site being accepted into the program.

22. **Brenton Montgomery - Nashville Electric Service.** I reviewed pages 98-105 briefly. They seem quite detailed, maybe too detailed. You'll likely get the best feedback from the first few applicants on how difficult or time consuming it was to complete the Checklist. We don't want this to be a barrier to participation. Most people are used to submitting applications, plans, and prints with electrical loads, but the other requirements might be new to end users.

Response: The Environmental Screening Checklist (Appendix A) has been revised in response to input received during the public comment period.

23. **Virginia DEQ.** DCR has the following recommendations regarding the Resilience 360-Environmental Screening Checklist (Appendix A):
    1) DCR recommends avoidance of C1 and C2 ecological cores as identified in the Virginia Natural Landscape Assessment (https://www.dcr.virginia.gov/naturalheritage/vaconvisvnla) during the siting of proposed projects in Virginia. Mapped cores in the project area can be viewed via the Virginia Natural Heritage Data Explorer, available here: http://vanhde.org/content/map.
    2) In addition to determining if there are any visible caves, rock ledges, overhangs, sinkholes in view of the host site, DCR also recommends determining if there are large springs in the project vicinity.
    3) In addition, to generating a list from IPaC of federally listed species within the proposed project vicinity, DCR recommends the use of the updated TVA Regional Natural Heritage Database to generate a list of natural heritage resources and attaching it to the checklist also.

    Response: During review of the site-specific Environmental Screening Checklists, TVA will review the proximity of the proposed sites to C1 and C2 ecological cores as identified in the Virginia Natural Landscape Assessment. Additionally, TVA will review the presence of local springs in proximity to the site. A TVA Natural Heritage Database review would be conducted for each site-specific review and saved with the project record. Section 4.4 of the Checklist has been updated per recommendation 2 above regarding large springs in the project vicinity.

24. **Enchanted Rock - Taylor Puskar.** Environmental Checklist Section 2.0 Labeled pictures showing the proposed project location and surrounding environment including: … interconnection point to nearest existing gas supply – What is the procedure for if gas supply does not currently exist from an environmental perspective?

    Response: The Environmental Screening Checklist (Appendix A) has been revised to specify that the interconnection point to the nearest existing gas supply should be identified. If gas supply does not currently exist, the vendor can approach TVA for discussion about options. One option could be a more detailed site-specific review.

25. **Enchanted Rock – Taylor Puskar**. Environmental Checklist Section 3.0
    - Anticipated facilities included (e.g. buildings, tanks, storage, parking, new utility poles, etc.); (C) Maximum height of facilities (including any new utility poles) – Erock's assumption is TVA will advise proposed utility facilities information.
    - Foundation characteristics (style- Pad, piers, piles, etc), depth of foundation – Erock's assumption is that best known information being provided is sufficient, however is subject to change dependent on geotechnical findings/civil engineering completion.
    - New Transmission line requirements – Erock's assumption is TVA will advise transmission line requirements.
    - Anticipated types of construction equipment (particularly consider whether pile drivers or other higher decibel equipment may be needed) – Erock's assumption is that best known information being provided is sufficient, however is subject to change dependent on geotechnical findings/civil engineering completion.

- Shound there be a field to capture expected construction and operational waste streams?

Response: The Environmental Screening Checklist was updated to clarify questions in Section 3.0 Project Characteristics to those the vendor should be able to answer directly. The vendor can consult with TVA as needed during the checklist process. Section 3.0 of the Checklist has also been modified to clarify that the project characteristics portion of the checklist should include identification of all anticipated new build facilities/structures. It is expected the vendor will identify all required facilities and equipment that will need to be constructed to support the generation units. The vendor should inform TVA if that information changes at a future date so that change can be documented. Additional reviews may be required if there were a significant change in information such as selection of a different location, identification of an unknown resource, etc. A field to capture expected construction and operational waste streams has also been added to Section 3.0 of the Checklist.

26. **Enchanted Rock - Taylor Puskar.** Environmental Checklist Section 4.0
    - Will drilling, blasting, or pile driving be required? If yes, describe the planned actions including anticipated duration. Will offsite borrow material be required? If yes, what is the maximum that would be needed and from where will this material be procured.– Erock's assumption is that best known information being provided is sufficient, however is subject to change dependent on geotechnical findings/civil engineering completion.
    - Land Use, Water Resources, Floodplains, Ecological Resources, Cultural Resources – Erock's assumption is that Erock and TVA collaborate on these sections.

    Response: Yes, the vendor should provide best known information at the time of application. The vendor should inform TVA if that information changes at a future date so that change can be documented. Additional reviews may be required if there were a significant change in information such as selection of a different location, identification of an unknown resource, etc. Section 4.0 of the Environmental Screening Checklist has been streamlined to focus on project specific details that should be available to the vendor and would not require TVA input to complete. The vendor can reach out to TVA for assistance if needed. TVA SMEs will conduct site-specific reviews after receipt of the Checklist. The outcomes of those reviews will be attached as part of Section 5.0.

27. **Enchanted Rock - Taylor Puskar.** Environmental Checklist Section 4.0 – Air Quality and Climate and Waste
    - Should there be a question regarding if emissions from construction or operations lead to any concentrations of pollutants exceeding NAAQS?
    - Should there be a question regarding if noise emissions exceed OSHA or local limits?
    - Should there be a question regarding if federally hazardous waste be generated from construction or operations?

    Response: An additional question was added in Section 4.1of the Environmental Screening Checklist regarding noise emissions and OSHA limits. TVA's bounding assumption is that there would be no exceedances of NAAQS. Section 4.6 of the Checklist has been modified to include this question and an additional question asking if an air permit will be required for the site. Rows to submit information regarding waste streams were added in Section 3.0 of the Checklist.

28. **Enchanted Rock - Taylor Puskar.** Environmental Checklist Section 4.0 – Signature, Program Participant Representative – Please confirm if Erock or host customer is the program participant representative

Response: The vendor is the Program Participant Representative. Clarification added in Section 1.0 and in Section 4.0 of the Environmental Screening Checklist.

Other Comments

29. **Jason Ware - Renew-O-Gen.** I am writing to submit comments on the Draft Programmatic Environmental Assessment (PEA) for the Tennessee Valley Authority's proposed Resilience 360° Program. First, I commend TVA for taking proactive steps to enhance grid resiliency and mitigate the effects of weather events and other disruptions. The concept of creating a qualified resiliency network through partnerships with vendors and customers is a critical step toward strengthening our region's energy infrastructure. As the founder of a renewable energy initiative currently preparing to issue secured corporate bonds to fund modular, self-recharging hydroelectric units with 1 GWh capacity per unit, I am particularly interested in how TVA intends to integrate innovative, scalable energy solutions into the proposed network.

    Response: TVA has prepared this PEA to develop new guidance, including an Environmental Screening Checklist and a bounding analysis, to facilitate implementation of the Resilience 360° program. The PEA analyzes the expected impacts of deploying up to 25 MW of natural gas or BESS generation from the proposed Resilience 360° units at various locations across the TVA Power Service Area. This programmatic approach allows TVA to adequately address most of the site-specific activities that would occur under the PPA with the respective vendors, thereby streamlining the implementation of the Resilience 360° program. It is possible that in the future the program could be expanded to include other technologies. Additional environmental review would be necessary to expand the program.

30. **Center for Biological Diversity.** It is TVA's responsibility, under NEPA, to analyze and address any "reasonably foreseeable environmental effects of the proposed agency action." [...] TVA must address the foreseeable environmental harms that will come from this choice.

    Response: The impact analysis for each resource area includes evaluation of reasonably foreseeable environmental impacts. An Environmental Screening Checklist would be completed for each specific proposed project which would look at the site-specific impacts at respective host sites within the Resilience 360° program.

31. **Volta Grid - Mohsen Raissy.** We are pleased to participate in the public comment about your 360 Resiliency Program. VoltaGrid is an Energy as a service provider. We utilize all Natural Gas, Hydrogen ready assets. We have modular designs that can deploy quickly. We provide all necessary assets for generation, synchronization, controls and distribution and protection. We own and operate and maintain the assets. Where gas may not be available, VoltaGrid has a Compressed Natural Gas (CNG) business which can deliver gas to the sites. Our assets are all generating at 15KV and are available in 2.5MW, 3.5MW and 4.5MW units all having a very low heat rate of about 7.9MMBtu/MWHr. We also have some gas turbines 25MW each, We would like to offer TVA a set of assets to be strategically located on the system for support of the program. Although we have not specifically selected a site for attached questionnaire, we are sensitive to the compliance requirements. We would love the opportunity to present our capabilities for your consideration

Response: Comment noted. TVA will provide information on the program to all interested vendors and parties.

32. **New Millennium – Matthew Jones.** We would love to be apart of this opportunity. We are exploring adding a backup generator to our operational plant as we speak.

    Response: Comment noted. TVA will provide information on the program to all interested vendors and parties.

33. **Jack B. McPherson – Individual.** Our family owns the oil and gas rights underneath 281.75 acres in Muhlenberg County, Kentucky. I understand the Tennessee Valley Authority is inviting public comments with regard to its Grid Resiliency Effort and although I am not directly involved in the production of electricity generated by TVA, our family's oil and gas rights are located within the service area of the Paradise Combined Cycle Plant which derives its fuel from natural gas and is an integral link within the TVA grid system. Although we have not, thus far, received any offers to purchase our rights it appears likely that our natural gas will eventually be included within the TVA supply chain.

    I understand that TVA generates and sells energy at wholesale prices to a wide range of power companies within its grid system who then sell the power at retail prices to the general public. During times of heavy demand the grid system can be stressed beyond its limits requiring TVA or its affiliates to purchase power from outside sources. In order to alleviate that problem a proposal has been made allowing TVA to partner with qualified vendors who will build, own and operate on site modular gas units or battery energy storage systems that will generate between 500 kilowatts and 25 megawatts of electric power. The environmental review process will establish siting and environmental criteria.

    This proposal has great merit. It will improve the self-reliance of the TVA grid system by eliminating dependency upon outside sources in times of excess demand. Moreover, these subordinate units will be subject to the regulatory and environmental authority of TVA which will allocate the distribution of the power generated through their operations.

    As an aside, this proposal is similar to the plan whereby small, factory built modular nuclear reactors are shipped to the site and assembled there. This arrangement reduces cost and construction time while concurrently increasing flexibility when compared to traditional nuclear power plants. The generation and distribution of electric power by subordinate modular units is the wave of the future. Accordingly, I am pleased to submit this letter in support of the proposal.

    Response: Comment noted.

From: Jason Ware
To: Freeman, Carol
Subject: Comment on TVA's Draft Programmatic Environmental Assessment – Resilience 360° Program
Date: Tuesday, March 25, 2025 4:13:05 PM

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Dear Ms. Freeman,

I am writing to submit comments on the Draft Programmatic Environmental Assessment (PEA) for the Tennessee Valley Authority's proposed Resilience 360° Program.

First, I commend TVA for taking proactive steps to enhance grid resiliency and mitigate the effects of weather events and other disruptions. The concept of creating a qualified resiliency network through partnerships with vendors and customers is a critical step toward strengthening our region's energy infrastructure.

As the founder of a renewable energy initiative currently preparing to issue secured corporate bonds to fund modular, self-recharging hydroelectric units with 1 GWh capacity per unit, I am particularly interested in how TVA intends to integrate innovative, scalable energy solutions into the proposed network. I would like to inquire if the program is open to alternative technologies—such as hydrokinetic and hybrid renewable systems—or if it is limited exclusively to natural gas and battery energy storage systems.

Additionally, I would appreciate clarification on the administrative approval process for participating sites, and whether third-party developers working with TVA customers may also submit Environmental Screening Checklists for consideration under this program.

I am eager to explore how our systems, designed to function both independently and within the grid to provide clean, dispatchable energy, might align with TVA's vision for Resilience 360°.

Thank you for your time and consideration of this comment. Please include me in future updates related to the development of this program.

Sincerely,

Jason Ware

Founder, Renew-O-Gen

Jason@renewogen

[redacted]

From: Allen, James Wilfred III
To: Freeman, Carol; Nelson, Dana Marie
Cc: Minwell, Thomas A
Subject: FW: TENNESSEE VALLEY AUTHORITY (TVA) – NOTICE OF AVAILABILITY AND PUBLIC COMMENT PERIOD – DRAFT PROGRAMMATIC ENVIRONMENTAL ASSESSMENT RESILIENCE 360° PROGRAM
Date: Thursday, March 27, 2025 2:20:15 PM
Attachments: image001.png

FYI on some feedback I've received already on the Site Screening Checklist from NES.

Thanks

Jimmy Allen, PMP
Senior Consultant
Business Development & Strategy, Business Strategy & Commercial Affairs

TENNESSEE VALLEY AUTHORITY

W. 423-751-7144 **M.** 706-455-2092 **E.** jwallen3@tva.gov

1101 Market Street, Chattanooga, TN 37402

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From: Brenton Montgomery <BMontgomery@nespower.com>
Sent: Wednesday, March 26, 2025 3:29 PM
To: Allen, James Wilfred III <jwallen3@tva.gov>; Tony Richman <TRichman@NESPOWER.COM>
Cc: Minwell, Thomas A <taminwell@tva.gov>
Subject: RE: TENNESSEE VALLEY AUTHORITY (TVA) – NOTICE OF AVAILABILITY AND PUBLIC COMMENT PERIOD – DRAFT PROGRAMMATIC ENVIRONMENTAL ASSESSMENT RESILIENCE 360° PROGRAM

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Thanks, Jimmy. I reviewed pages 98-105 briefly. They seem quite detailed, maybe too detailed. You'll likely get the best feedback from the first few applicants on how difficult or time-consuming it was to complete the Checklist. We don't want this to be a barrier to participation. Most people are used to submitting applications, plans, and prints with electrical loads, but the other requirements might be new to end users.

Brenton Montgomery, P.E.

Manager, Customer Insights and Programs
1214 Church Street | Room 289 | Nashville, TN 37246 | (O) 615-747-3161 | (M) 615-592-1006
Nashville Electric Service | www.nespower.com

From: Allen, James Wilfred III <jwallen3@tva.gov>
Sent: Wednesday, March 26, 2025 2:01 PM
To: Brenton Montgomery <BMontgomery@nespower.com>; Tony Richman <TRichman@NESPOWER.COM>
Cc: Minwell, Thomas A <taminwell@tva.gov>
Subject: RE: TENNESSEE VALLEY AUTHORITY (TVA) – NOTICE OF AVAILABILITY AND PUBLIC COMMENT PERIOD – DRAFT PROGRAMMATIC ENVIRONMENTAL ASSESSMENT RESILIENCE 360° PROGRAM

***Warning: External Sender**. Please exercise caution before replying, clicking links, or opening attachments.**

There is no specific action from your team other than notification that this is open for public comment, and you are welcome to provide thoughts or comments. As a reminder, the purpose of the draft PEA is to produce the Environmental Site Checklist which is the initial screening form we will ask to be completed for each potential site. I would specifically look at the Resilience 360° Environmental Screening Checklist on page 98 – 105. This is an opportunity for your team to have input and feedback on that as well.

Thanks

Jimmy Allen, PMP
Senior Consultant
Business Development & Strategy, Business Strategy & Commercial Affairs

TENNESSEE VALLEY AUTHORITY

W. 423-751-7144 **M.** 706-455-2092 **E.** jwallen3@tva.gov

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From: Allen, James Wilfred III
Sent: Tuesday, March 25, 2025 2:33 PM
To: Brenton Montgomery <bmontgomery@nespower.com>; trichman@nespower.com
Cc: Minwell, Thomas A <taminwell@tva.gov>

Subject: TENNESSEE VALLEY AUTHORITY (TVA) – NOTICE OF AVAILABILITY AND PUBLIC COMMENT PERIOD – DRAFT PROGRAMMATIC ENVIRONMENTAL ASSESSMENT RESILIENCE 360° PROGRAM

Tony/Brenton – Hope you are doing well. See below the official notice of availability and public comment period for the draft Programmatic Environmental Assessment for the Resilience 360° Program. We welcome your comments and feedback. You can send comments or feedback directly to myself or to Carol Freeman as noted in the email body below. To clarify, you can click on the link below and scroll down to the "Related Documents" section to view the PDF file of the draft PEA.

Resilience 360° Program Draft Programmatic Environmental Assessment

Thanks!

To Whom It May Concern:

TENNESSEE VALLEY AUTHORITY (TVA) – NOTICE OF AVAILABILITY AND PUBLIC COMMENT PERIOD – DRAFT PROGRAMMATIC ENVIRONMENTAL ASSESSMENT RESILIENCE 360° PROGRAM

The Tennessee Valley Authority (TVA) released the Draft Programmatic Environmental Assessment (PEA) for the Resilience 360° Program. TVA is proposing a "Commercial Resiliency" program, titled Resilience 360°, to partner with vendors and TVA customers to improve and enhance resiliency during events that challenge the transmission of power on the grid [e.g., extreme weather, and minor incidences of cyber-attack or domestic terrorism (vandalism of one or a few substations or switchyards)] and to periodically support demand on the TVA system. TVA would partner with multiple vendors through a qualified resiliency network to provide backup generation in the form of on-site modular natural gas units or battery energy storage systems (BESS) to improve commercial resiliency for qualified customers. Additionally, TVA would enter into a single Power Purchase Agreement (PPA) with a vendor to have control or dispatch rights to the units when not in use for a qualifying resiliency event. Each host site would contain natural gas units or BESS that would generate about 100 kilowatts (kW) up to 25 megawatts (MW) of power. This PEA establishes general siting and environmental criteria to ensure that installations do not cause greater impacts than those addressed in this PEA.

TVA is seeking public comments on the alternatives, information, and analyses and the summary thereof in the SEIS. Comments must be received or postmarked by April 17, 2025. Comments may be submitted electronically at: www.tva.gov/nepa under 'Open for Public Comment' or by email to nepa@tva.gov. Written comments should be sent to Carol Butler

Freeman, NEPA Compliance, 400 West Summit Hill Drive, WT 11B, Knoxville, TN 37902.

If you have any questions, please contact Carol Butler Freeman at cfreeman2@tva.gov.

Jimmy Allen, PMP
Senior Consultant
Business Development & Strategy, Business Strategy & Commercial Affairs

TENNESSEE VALLEY AUTHORITY

W. 423-751-7144 **M.** 706-455-2092 **E.** jwallen3@tva.gov

1101 Market Street, Chattanooga, TN 37402

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From: [redacted]
To: nepa
Subject: Power generation
Date: Monday, March 31, 2025 6:23:51 AM

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This is an EXTERNAL EMAIL from outside TVA. THINK BEFORE you CLICK links or OPEN attachments. If suspicious, please click the "Report Phishing" button located on the Outlook Toolbar at the top of your screen.

I have 20 acres on Wilson lake of the Tennessee river. There could be a dam made to create backup water reservoir. A solar grid could pump water up into the reservoir, during times of less demand, then the potential energy could be released, during peak demand.

Ricky Pickett

From: [redacted]
To: nepa
Subject: Expand Net Metering for homeowners
Date: Monday, March 31, 2025 10:20:29 AM

You don't often get email from [redacted]. Learn why this is important

This is an EXTERNAL EMAIL from outside TVA. THINK BEFORE you CLICK links or OPEN attachments. If suspicious, please click the "Report Phishing" button located on the Outlook Toolbar at the top of your screen.

If you propose letting businesses to generate power, then let homeowners generate power and increase the rate of net metering. Please be open minded. Home solar, and home battery storage is the answer to our energy needs. TVA should allow "Base Power" to operate in their service area. Base Power installs batteries to homeowners, and buys the power at peak demand. Batteries are recharged at night or by solar in the day. Let's do it! This is good for TVA, customers, and our environment. We do not need jet engine power generation because it is not efficient and dirty. Who wants a jet engine running 24/7 near their home?
Thank you for listening,
I am a TVA power user.

Cliff Bahlinger
[redacted]

From: [redacted]
To: nepa
Cc: [redacted]
Subject: TVA Grid Resiliency Effort
Date: Wednesday, April 9, 2025 5:58:52 PM

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This is an EXTERNAL EMAIL from outside TVA. THINK BEFORE you CLICK links or OPEN attachments. If suspicious, please click the "Report Phishing" button located on the Outlook Toolbar at the top of your screen.

Our family owns the oil and gas rights underneath 281.75 acres in Muhlenberg County, Kentucky. I understand the the Tennessee Valley Authority is inviting public comments with regard to its Grid Resiliency Effort and although I am not directly involved in the production of electricity generated by TVA, our family's oil and gas rights are located within the service area of the Paradise Combined Cycle Plant which derives its fuel from natural gas and is an integral link within the TVA grid system. Although we have not, thus far, received any offers to purchase our rights it appears likely that our natural gas will eventually be included within the TVA supply chain.

I understand that TVA generates and sells energy at wholesale prices to a wide range of power companies within its grid system who then sell the power at retail prices to the general public. During times of heavy demand the grid system can be stressed beyond its limits requiring TVA or its affiliates to purchase power from outside sources. In order to alleviate that problem a proposal has been made allowing TVA to partner with qualified vendors who will build, own and operate on site modular gas units or battery energy storage systems that will generate between 500 kilowatts and 25 megawatts of electric power. The environmental review process will establish siting and environmental criteria.

This proposal has great merit. It will improve the self-reliance of the TVA grid system by eliminating dependency upon outside sources in times of excess demand. Moreover, these subordinate units will be subject to the regulatory and environmental authority of TVA which will allocate the distribution of the power generated through their operations.

As an aside, this proposal is similar to the plan whereby small, factory built modular nuclear reactors are shipped to the site and assembled there. This arrangement reduces cost and construction time while concurrently increasing flexibility when compared to traditional nuclear power plants.

The generation and distribution of electric power by subordinate modular

units is the wave of the future.

Accordingly, I am pleased to submit this letter in support of the proposal.

Jack B. McPherson

[redacted]

Checklist Question	Erock Question
Anticipated facilities included (e.g. buildings, tanks, storage, parking, new utility poles, etc.)	Erock's assumption is TVA will advise proposed utility facilities
Maximum height of facilities (including any new utility poles)	Erocks assumption is TVA will advise proposed utility facilities information
Foundation characteristics (style- Pad, piers, piles, etc), depth of foundation	Erocks assumption is that best known information being provided is sufficient, however is subject to change dependent on geotechnical findings/civil engineering completion
New Transmission line requirements	Erocks assumption is TVA will advise transmission line requirements
Anticipated types of construction equipment (particularly consider whether pile drivers or other higher decibel equipment may be needed)	Erocks assumption is that best known information being provided is sufficient, however is subject to change dependent on geotechnical findings/civil engineering completion
	Shound there be a field to capture expected construction and operational waste streams?
Will drilling, blasting, or pile driving be required? If yes, describe the planned actions including anticipated duration:	Erocks assumption is that best known information being provided is sufficient, however is subject to change dependent on geotechnical findings/civil engineering completion
Will offsite borrow material be required? If yes, what is the maximum that would be needed and from where will this material be procured:	Erocks assumption is that best known information being provided is sufficient, however is subject to change dependent on geotechnical findings/civil engineering completion
Land Use	Erocks assumption is that Erock and TVA collaborate on this section
Water Resources	Erocks assumption is that Erock and TVA collaborate on this section
Floodplains	Erocks assumption is that Erock and TVA collaborate on this section
Water Resources	Erocks assumption is that Erock and TVA collaborate on this section
Floodplains	Erocks assumption is that Erock and TVA collaborate on this section
Ecological Resources	Erocks assumption is that Erock and TVA collaborate on this section
Cultural Resources	Erocks assumption is that Erock and TVA collaborate on this section
Air Quality and Climate	Should there be a question regarding if emissions from construction or operations lead to any concentrations of pollutants exceeding NAAQS?

Air Quality and Climate	Should there be a question regarding if noise emissions exceed OSHA or local limits?
Air Quality and Climate	Should there be a question regarding if federally hazardous waste be generated from construction or operations?
Program Participant Representative	Please confirm if Erock or host customer is the program participant representative

Commonwealth of Virginia

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

www.deq.virginia.gov

Stefanie K. Taillon
Secretary of Natural and Historic Resources

Michael S. Rolband, PE, PWD, PWS Emeritus
Director

April 10, 2025

Ms. Carol Butler Freeman
Tennessee Valley Authority
Sent via email: nepa@tva.gov

RE: Draft Programmatic Environmental Assessment, Tennessee Valley Authority: Resilience 360° Program, Counties of Lee, Scott, Washington, Wise and City of Norton (DEQ 25-050F)

Dear Ms. Freeman:

The Commonwealth of Virginia has completed its review of the draft Programmatic Environmental Assessment (PEA) issued on March 18, 2025. The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of federal environmental documents prepared pursuant to the National Environmental Policy Act (NEPA) and responding to appropriate federal officials on behalf of the Commonwealth. The following agencies participated in this review:

Department of Environmental Quality
Department of Conservation and Recreation (DCR)
Department of Health (VDH)
Virginia Marine Resources Commission (VMRC)

The Department of Wildlife Resources, Department of Historic Resources, Department of Forestry, Lenowisco Planning District Commission, Mount Rodgers Planning District Commission, Lee County, Scott County, Washington County, Wise County and City of Norton also were invited to comment.

PROJECT DESCRIPTION

The Tennessee Valley Authority (TVA) has prepared PEA to propose a "Commercial Resiliency" program, called Resilience 360°, to partner with vendors and TVA customers to

improve and enhance resiliency during events that challenge the transmission of power on the grid (such as extreme weather) and to support periodic demand on the TVA system. The PEA establishes general siting and environmental criteria to ensure that installations do not cause greater impacts than those address in the PEA. Under the initial phases of the program, TVA would partner with multiple vendors through a qualified resiliency network to provide backup generation in the form of on-site modular natural gas units or battery energy storage systems (BESS) to improve commercial resiliency for qualified customers. Under the proposal, vendors of natural gas units or BESS would install the units at host locations and would own, operate, and maintain the units. Each host site would contain natural gas units or BESS that would generate about 100 kilowatts (kW) up to 25 megawatts (MW) of power. While each vendor's equipment may vary in configuration, the individual units would typically be smaller than a standard shipping container. While the number of units at each location would depend on the host's needs, the installation and operation of the unit(s) would generally occupy a small footprint near the existing facility on previously disturbed land. The natural gas units would run on distribution-level natural gas or onsite propane or liquified natural gas; pipeline-level natural gas supply would not be needed. BESS systems would utilize grid energy for storage. Both the gas and the BESS units are expected to have a relatively low generation demand. TVA anticipates the gas units would be used less than 400 hours annually for TVA demand and dispatch. Initial estimates from TVA are that the units would be dispatched infrequently, potentially only 150 to 200 hours annually.

ENVIRONMENTAL IMPACTS AND MITIGATION

1. Point Source Air Pollution. The PEA (page 3-41) states that operation of the generation units would be no more than 400 hours annually. There may be more than one unit at a site. Construction and decommission of the generator sites would result in vehicle, equipment and dust emissions. It is assumed that future actions would comply with applicable state and local regulations.

1(a) Agency Jurisdiction. The DEQ Air Division, on behalf of the State Air Pollution Control Board, is responsible for developing regulations that implement Virginia's Air Pollution Control Law (Virginia Code §10.1-1300 *et seq.*). DEQ is charged with carrying out mandates of the state law and related regulations as well as Virginia's federal obligations under the Clean Air Act as amended in 1990. The objective is to protect and enhance public health and quality of life through control and mitigation of air pollution. The division ensures the safety and quality of air in Virginia by monitoring and analyzing air quality data, regulating sources of air pollution, and working with local, state and federal agencies to plan and implement strategies to protect Virginia's air quality. The appropriate DEQ regional office is directly responsible for the issuance of necessary permits to construct and operate all stationary sources in the region as well as monitoring emissions from these sources for compliance. As a part of this mandate, environmental impact reviews (EIRs) of projects to be undertaken in the state are also reviewed.

In the case of certain projects, additional evaluation and demonstration must be made under the general conformity provisions of state and federal law.

The Air Division regulates emissions of air pollutants from industries and facilities and implements programs designed to ensure that Virginia meets national air quality standards. The most common regulations associated with projects are:

- Open burning: 9 VAC 5-130 *et seq.*
- Fugitive dust control: 9 VAC 5-50-60 *et seq.*
- Permits for fuel-burning equipment: 9 VAC 5-80-1100 *et seq.*

1(b) Requirements. The following requirements may be applicable:

1(b)(i) Fugitive Dust. During land-disturbing activities, fugitive dust must be kept to a minimum by using control methods outlined in 9VAC5-50-60 *et seq.* of the Regulations for the Control and Abatement of Air Pollution. These precautions include, but are not limited to, the following:

- Use, where possible, of water or suitable chemicals for dust control during the proposed demolition and construction operations and from material stockpiles;
- Installation and use of hoods, fans and fabric filters to enclose and vent the handling of dusty materials;
- Covering of open equipment for conveying materials; and
- Prompt removal of spilled or tracked dirt or other materials from paved streets and removal of dried sediments resulting from soil erosion.

1(b)(ii) Open Burning. If project activities change to include open burning or the use of special incineration devices are employed in the disposal of land-clearing debris during demolition and construction, these activities must meet the requirements under 9VAC5-130 *et seq.* for open burning. Whereas, the regulation provides for, but does not require, the local adoption of a model ordinance concerning open burning, the applicant should contact the locality to determine what local requirements, if any, exist. Some applicable provisions of the regulation include, but are not limited to:

- Open burning or the use of special incineration devices for the destruction of clean burning waste and debris waste resulting from clearing operations is prohibited from May 1 through September 30.

- Open burning for forest management, agricultural practices, and highway construction and maintenance programs that have been approved by the board shall be at least 1,000 feet from any occupied building unless the occupants have given prior permission, other

than a building located on the property on which the burning is conducted. The burning shall be attended at all times.

- Special attention should be directed to § 10.1-1142 of the Code of Virginia, which is enforced by the Department of Forestry.

- Special attention should also be directed to the regulations of the Virginia Waste Management Board.

- Follow the open burning prohibitions as outlined in 9VAC5-130-30.

1(b)(iii) Fuel-Burning Equipment. Fuel Burning Equipment. The installation of fuel burning equipment (e.g. boilers and generators) may require permitting from DEQ prior to beginning construction of the facility (9VAC5-80, Article 6, Permits for New and Modified Sources).

1(b)(iv) Stationary Source. Stationary air emissions sources constructed at this location may be subject to 9 VAC 5-80-1120. The regulation requires obtaining an air permit before starting actual construction of, or operation of any new stationary source.

2. Water Quality and Wetlands. The PEA (page 3-13) states that rivers, streams and wetlands would be avoided to the extent practicable. Direct impacts to regulated water resources would be avoided by project design. Indirect impacts could result from stormwater runoff during construction, which would be adequately managed with adherence to best management practices (BMPs). As necessary, appropriate BMPs determined by local ordinances and state regulations would be implemented to avoid potential adverse effects to water quality and aquatic life. In addition, the EA (page 3-16) states that any wetland impacts would be mitigated under regulations implementing Sections 401 and 404 of the Clean Water Act, applicable state regulations and EO 11990.

2(a) Agency Jurisdiction. The State Water Control Board promulgates Virginia's water regulations covering a variety of permits to include the Virginia Pollutant Discharge Elimination System Permit regulating point source discharges to surface waters, Virginia Pollution Abatement Permit regulating sewage sludge, storage and land application of biosolids, industrial wastes (sludge and wastewater), municipal wastewater, and animal wastes, the Surface and Groundwater Withdrawal Permit, and the Virginia Water Protection (VWP) Permit regulating impacts to streams, wetlands, and other surface waters. The VWP permit is a state permit which governs activities in state surface waters including wetlands, and certain surface water withdrawals, diversion, and impoundments. It also may serve as Section 401 Water Quality Certification of the federal licenses and permits under the Clean Water Act. The VWP Permit Program is under the Office of Wetlands and Stream Protection, within the DEQ Division of

Water Permitting. Six DEQ regional offices perform permit application reviews and issue permits or coverages for the covered activities.

- Clean Water Act Sections 404 and 401 (33 U.S.C. § 1251 *et seq*.);
- Section 404(b)(i) Guidelines Mitigation Memorandum of Agreement (2/90) (40 CFR Part 230);
- State Water Control Law, Chapter 3.1 of Title 62.1 of the Code of Virginia; and
- State Water Control Board regulations 9VAC25-210 *et seq*.; 9VAC25-660 *et seq*.; 9VAC25-670 *et seq*.; 9VAC25-680 *et seq*; and 9VAC25-690 *et seq*.

2(b) Requirements. Permanent and temporary impacts, including conversion of wetlands from one Cowardin class to another, to surface waters or wetlands may require prior approval by DEQ's Virginia Water Protection Program (VWPP) and/or the U.S. Army Corps of Engineers.

3. Subaqueous Lands and Tidal Wetlands. The PEA (page 3-13) states that rivers, streams and wetlands would be avoided to the extent practicable. Direct impacts to regulated water resources would be avoided by project design.

3(a) Agency Jurisdiction. The Virginia Marine Resources Commission (VMRC) regulates encroachments in, on or over state-owned subaqueous beds as well as tidal wetlands pursuant to Virginia Code §28.2-1200 through 1400, as well as sharing jurisdiction for tidal wetlands with DEQ. For nontidal waterways, VMRC states that it has been the policy of the Habitat Management Division to exert jurisdiction only over the beds of perennial streams where the upstream drainage area is 5 square miles or greater. The beds of such waterways are considered public below the ordinary high water line mark. However, in nontidal waters where a Virginia Water Protection (VWP) permit or coverage is obtained issued for in-stream activities, a VMRC permit is not required in certain circumstances (Memorandum of Agreement between VMRC and DEQ for Implementation of 2023 Va. Acts Chs. 258 and 259 Regarding Permitting in Non-tidal Waters of the Commonwealth (Amd 8/23)).

3(b) Agency Findings. VMRC states that projects may encroach over jurisdictional areas and may require a permit. When site-specific plans are developed, this determination may change.

3(c) Agency Recommendations. Coordinate with VMRC when site-specific projects are proposed to determine potential impacts to jurisdictional areas.

3(d) Requirements. Pursuant to §28.2-1200 et seq of the Code of Virginia, VMRC has jurisdiction over encroachments in, on, or over the beds of the bays, ocean, rivers, streams, or creeks which are the property of the Commonwealth. Accordingly, if any portion of the subject project involves any encroachments channelward of ordinary high water along non-tidal, natural rivers and streams with a drainage area greater than 5-square miles, a permit may be required

from VMRC or DEQ. Any jurisdictional impacts will be reviewed by the VMRC during the JPA process.

4. Erosion and Sediment Control and Stormwater Management. The PEA (page 2) states that a discharge stormwater construction permit would likely apply to most prospective projects. This permit requires the preparation of a SWPPP that outlines measures that would be implemented to avoid or reduce adverse effects to local waters. All ground disturbance would be stabilized upon completion of construction or after decommissioning to prevent potential for long term erosion. Most project sites are not anticipated to require more than 1-2 acres of impervious surfaces, decreasing the possibility of erosion or damage to an area. The short duration (1-2 months) for construction and limited level of activity helps minimize potential for erosion.

4(a) Agency Jurisdiction. The DEQ Office of Stormwater Management (OSM) administers the following laws and regulations governing construction activities:

- Virginia Erosion and Sediment Control Law (VESCL) (§ 62.1-44.15:51 *et seq.*);
- Virginia Stormwater Management Act (VSMA) (§ 62.1-44.15:24 *et seq.*);
- Virginia Erosion and Stormwater Management Regulation (VESMR) (9VAC25-875 *et. seq.*) and
- 2024 General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Construction Activities (9VAC25-875 *et. seq.*).

In addition, DEQ is responsible for VSMP General Permit for Stormwater Discharges from Construction Activities related to Municipal Separate Storm Sewer Systems (MS4s) and construction activities for the control of stormwater discharges from MS4s and land disturbing activities under the Virginia Stormwater Management Program (9VAC25-890-40).

4(b) Requirements. The following may be applicable to future projects:

4(b)(i) Erosion and Sediment Control and Stormwater Management Plans. The applicant and its authorized agents conducting regulated land-disturbing activities on private and public lands in the state must comply with the Virginia Erosion and Sediment Control Law and Regulations (VESCL&R) and Virginia Stormwater Management Law and Regulations (VSWML&R), including coverage under the general permit for stormwater discharge from construction activities, and other applicable federal nonpoint source pollution mandates (e.g. Clean Water Act-Section 313, federal consistency under the Coastal Zone Management Act). Clearing and grading activities, installation of staging areas, parking lots, roads, buildings, utilities, borrow areas, soil stockpiles, and related land-disturbing activities that result in the total land disturbance of equal to or greater than 10,000 square feet would be regulated by VESCL&R. Accordingly, the applicant must prepare and implement an erosion and sediment

control (ESC) plan to ensure compliance with state law and regulations. Land-disturbing activities that result in the total land disturbance of equal to or greater than 1 acre would be regulated by the VSWML&R. Accordingly, the applicant must prepare and implement a stormwater management (SWM) plan to ensure compliance with state law and regulations. The ESC/SWM plan should be submitted to the DEQ regional office that serves the area where the project is located for review and compliance. The applicant is ultimately responsible for achieving project compliance through oversight of on-site contractors, regular field inspection, prompt action against non-compliant sites, and other mechanisms consistent with agency policy (Reference: VESCL 62.1-44.15 *et seq*.; consolidated ESC/SWM regulations 9VAC25-875-10 *et seq*.).

4(b)(ii) General Permit for Stormwater Discharges from Construction Activities (VAR10). DEQ is responsible for the issuance, denial, revocation, termination and enforcement of the Virginia Stormwater Management Program (VSMP) General Permit for Stormwater Discharges from Construction Activities related to municipal separate storm sewer systems (MS4s) and construction activities for the control of stormwater discharges from MS4s and land disturbing activities under the Virginia Stormwater Management Program. The owner or operator of projects involving land-disturbing activities of equal to or greater than 1 acre is required to register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project-specific Stormwater Pollution Prevention Plan. Construction activities requiring registration also include land disturbance of less than one acre of total land area that is part of a larger common plan of development or sale if the larger common plan of development will collectively disturb equal to or greater than one acre. The SWPPP must be prepared prior to submission of the registration statement for coverage under the general permit and the SWPPP must address water quality and quantity in accordance with the VSMP Permit Regulations (Reference: Virginia Stormwater Management Act 62.1-44.15 *et seq*.; VSMP Permit Regulations *9*VAC25-880 *et seq.*).

5. Solid and Hazardous Waste Management. The PEA (pages 3-46 to 3-47) states that wastes typically produced by construction activities include vegetation, demolition debris, oily debris, packing materials, scrap lumber, and domestic wastes (garbage). During operations, the units are not expected to be a direct source of either hazardous materials or solid wastes. Units at host sites would be constructed, operated, and decommissioned as required pursuant to state and federal regulations, which could include groundwater monitoring, corrective measures, and post-closure care activities. During construction, waste generated would primarily be solid, non-hazardous waste including wood, paper, steel, and plastic.

5(a) Agency Jurisdiction. On behalf of the Virginia Waste Management Board, the DEQ Division of Land Protection and Revitalization is responsible for carrying out the mandates of the Virginia Waste Management Act (Virginia Code §10.1-1400 *et seq*.), as well as meeting Virginia's federal obligations under the Resource Conservation and Recovery Act (RCRA) and

the Comprehensive Environmental Response Compensation Liability Act (CERCLA), commonly known as Superfund. The DEQ Division of Land Protection and Revitalization also administers those laws and regulations on behalf of the State Water Control Board that govern Petroleum Storage Tanks (Virginia Code §62.1-44.34:8 *et seq*.), including Aboveground Storage Tanks (9VAC25-91 *et seq*.) and Underground Storage Tanks (9VAC25-580 *et seq*. and 9VAC25-580-370 *et seq*.), also known as Virginia Tank Regulations, and § 62.1-44.34:14 *et seq*. which covers oil spills.
Virginia:

- Virginia Waste Management Act, Virginia Code § 10.1-1400 *et seq*.
- Virginia Solid Waste Management Regulations, 9VAC20-81
    - (9VAC20-81-620 applies to asbestos-containing materials)
- Virginia Hazardous Waste Management Regulations, 9VAC20-60
    - (9VAC20-60-261 applies to lead-based paints)
- Virginia Regulations for the Transportation of Hazardous Materials, 9VAC20-110.

Federal:

- Resource Conservation and Recovery Act (RCRA), 42 U.S. Code sections 6901 *et seq*.
- U.S. Department of Transportation Rules for Transportation of Hazardous Materials, 49 Code of Federal Regulations, Part 107
- Applicable rules contained in Title 40, Code of Federal Regulations.

5(b) Agency Recommendations. The DEQ Division of Land Protection and Revitalization (DLPR) recommends a search (at least 200-foot radius) of any land-based project areas using the following solid and hazardous waste databases to identify waste sites (including petroleum releases) in close proximity to those project areas.

- Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Database: Superfund Information Systems Information on hazardous waste sites, potentially hazardous waste sites and remedial activities across the nation, including sites that are on the National Priorities List (NPL) or being considered for the NPL:

    - https://cumulis.epa.gov/supercpad/CurSites/srchsites.cfm

- DEQ Online Database: Virginia Environmental Geographic Information Systems Information on Permitted Solid Waste Management Facilities, Impaired Waters, Petroleum Releases, Registered Petroleum Facilities, Permitted Discharge (Virginia

Pollution Discharge Elimination System Permits) Facilities, Resource Conservation and Recovery Act (RCRA) Sites, Water Monitoring Stations, National Wetlands Inventory:

- https://apps.deq.virginia.gov/EDM/

DEQ encourages all projects to implement pollution prevention principles, including:

- the reduction, reuse and recycling of all solid wastes generated; and
- the minimization and proper handling of generated hazardous wastes.

5(c) Requirements. The following requirements may apply to future projects:

- The project manager is reminded that if any solid or hazardous waste is generated/encountered during construction, the project manager would follow applicable federal, state, and local regulations for their disposal.
- The removal, relocation or closure or installation/operation of any regulated petroleum storage tanks, aboveground storage tank (AST) or underground storage tank (UST), must be conducted in accordance with the requirements of the Virginia Tank Regulations 9 VAC 25-91-10 *et seq.* (AST) and / or 9 VAC 25-580-10 *et seq*. (UST). Submit appropriate documentation to DEQ.
- Test and dispose of any soil/sediment that is suspected of contamination or wastes that are generated during construction-related activities in accordance with applicable federal, state, and local laws and regulations.
- Any future site activities involving excavation or disturbance of formerly petroleum contaminated soils and or groundwater must be reported to DEQ, as authorized by Virginia Code § 62.1-44.34.8 through 9 and 9 VAC 25-580-10 *et seq*.
- Petroleum-contaminated soils and ground water generated during implementation of this project must be properly characterized and disposed of properly.
- All construction and demolition waste, including any excess soil, must be characterized in accordance with the Virginia Hazardous Waste Management Regulations and disposed of at an appropriate facility as applicable.
- If evidence of a petroleum release is discovered during implementation of this project, it must be reported to DEQ, as authorized by Code of Virginia 62.1-44.34.8 through 19 and 9VAC 25-580-10 *et seq*.

6. Natural Heritage Resources. The EA (page 3-28) states that establishment of new structures would require construction and clearing of areas. BMPs determined by local ordinances and state regulations, and use of the Environmental Screening Checklist, would be used to determine the best areas for construction. These would likely avoid any sensitive or protected species or habitats.

6(a) Agency Jurisdiction.

6(a)(i) Virginia Department of Conservation and Recreation's (DCR) Division of Natural Heritage (DNH): DNH's mission is conserving Virginia's biodiversity through inventory, protection and stewardship. The Virginia Natural Area Preserves Act (Virginia Code §10.1-209 through 217), authorized DCR to maintain a statewide database for conservation planning and project review, protect land for the conservation of biodiversity, and the protect and ecologically manage the natural heritage resources of Virginia (the habitats of rare, threatened and endangered species, significant natural communities, geologic sites, and other natural features).

6(a)(ii) Virginia Department of Agriculture and Consumer Services (VDACS): The Endangered Plant and Insect Species Act of 1979 (Virginia Code Chapter 39 §3.1-1020 through 1030) authorizes VDACS to conserve, protect and manage endangered and threatened species of plants and insects. Under a Memorandum of Agreement established between VDACS and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species.

6(b) Agency Findings – Natural Heritage. According to the information currently in DCR's files, natural heritage resources (including federally and state listed species) are documented within the Tennessee Valley Authority (TVA) Power Service Area outlined in Figure 1-1: TVA Power Service Area (PSA) and listed in Table 3-2 Special Status and Federally Protected Terrestrial Wildlife Species in TVA's PSA.

DCR supports TVA utilizing state-specific resources in the site-specific screening process to determine the potential effects to state-listed species as stated on page 3-20 and 3-22 of the draft EA.

6(c) Agency Findings – Threatened and Endangered Plant and Insect Species. Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state- listed threatened and endangered plant and insect species.

6(d) Agency Findings – State Natural Area Preserves. Several of DCR's Virginia State Natural Area Preserves (https://www.dcr.virginia.gov/natural-heritage/natural-area-preserves/) are also located within the service area in Virginia.

6(e) Agency Recommendations. DCR has the following recommendations:

As specific projects are developed under Alternative B- Proposed Action, DCR recommends coordination with the DCR Division of Natural Heritage for updated natural heritage information

and determination of potential impacts to natural heritage resources from Battery Energy Storage System (BESS) or gas installation projects including construction, operation and decommissioning.

DCR has the following recommendations regarding the Resilience 360- Environmental Screening Checklist (Appendix A):

> 1) DCR recommends avoidance of C1 and C2 ecological cores as identified in the Virginia Natural Landscape Assessment (https://www.dcr.virginia.gov/natural-heritage/vaconvisvnla) during the siting of proposed projects in Virginia. Mapped cores in the project area can be viewed via the Virginia Natural Heritage Data Explorer, available here: http://vanhde.org/content/map.
>
> 2) In addition to determining if there are any visible caves, rock ledges, overhangs, sinkholes in view of the
> host site, DCR also recommends determining if there are large springs in the project vicinity.
>
> 3) In addition, to generating a list from IPaC of federally listed species within the proposed project vicinity, DCR recommends the use of the updated TVA Regional Natural Heritage Database to generate a list of natural heritage resources and attaching it to the checklist also.

DCR supports the siting of proposed projects away from sensitive areas on previously disturbed land such as brownfields and coal mine reclamation sites to minimize impacts to natural heritage resources and large contiguous tracts of forestland that support these resources.

Due to the decline in pollinators, DCR also recommends the planting of native pollinator plants in the buffer areas of the planned activities, which bloom throughout the growing season as well as the development of an invasive species management plan for these projects.

Contact the DCR DNH and resubmit project information and a map if the scope of the project changes and/or six months has passed before it is utilized.

7. Floodplain Management. The EA (page 3-14) states that project components such as transmission line interconnections, access roads, and gas pipelines associated with the proposed action could be located within 100-year floodplains. Consistent with EO 11988, these facilities are considered repetitive actions in the 100-year floodplain that should result in only minor impacts.

7(a) Agency Jurisdiction. DCR is the lead coordinating agency for the Commonwealth's floodplain management program and the National Flood Insurance Program (Code of Virginia § 10.1-602).

7(b) Agency Findings. DCR states that the National Flood Insurance Program (NFIP) is administered by Federal Emergency Management Agency (FEMA) and communities that elect to participate in this voluntary program manage and enforce the program on the local level through that community's local floodplain ordinance. Each local floodplain ordinance must comply with the minimum standards of the NFIP, outlined in 44 CFR 60.3; however, local communities may adopt more restrictive requirements in their local floodplain ordinance, such as regulating the 0.2% annual chance flood zone (Shaded X Zone).

The DCR Floodplain Management Program does not have regulatory authority for projects in the Special Flood Hazard Area (SFHA). For federal projects, the applicant/developer is encouraged to contact the local floodplain administrator and comply with the community's local floodplain ordinance.

7(c) Requirements. DCR's comments indicate that the following may be applicable:

- All development within a SFHA, as shown on the locality's Flood Insurance Rate Map (FIRM), must be permitted and comply with the requirements of the local floodplain ordinance.
- Projects conducted by federal agencies within the SFHA must comply with federal Executive Order 11988: Floodplain Management.
- The applicant/developer must contact the local floodplain administrator for an official floodplain determination and comply with the community's local floodplain ordinance, including receiving a local permit. Failure to comply with the local floodplain ordinance could result in enforcement action from the locality.

8. Public Drinking Water. The EA (page 3-13) states that rivers, streams and wetlands would be avoided the extent practicable.

8(a) Agency Jurisdiction. The Virginia Department of Health (VDH) Office of Drinking Water reviews projects for the potential to impact drinking water sources (groundwater wells, springs, and surface water intakes) serving waterworks. VDH administers the Virginia Waterworks Regulations (12VAC5-590) governing waterworks operation and construction, and has primacy for the National Primary Drinking Water Regulations (40 CFR § 141) and implements the National Secondary Drinking Water Regulations (40 CFR § 143).

8(b) Agency Findings. The VDH ODW has no comments to submit at this time.

8(c) Requirements. Potential impacts to public water distribution systems or sanitary sewage collection systems must be verified by the local utility.

9. Pollution Prevention. DEQ's Office of Pollution of Prevention hosts a number of programs and initiatives that serve for non-regulatory assistance to businesses, institutions, and communities including the Virginia Environmental Excellence Program and Virginia Green. DEQ advocates that principles of pollution prevention and sustainability be used in all construction projects as well as in facility operations. Effective siting, planning, and on-site Best Management Practices (BMPs) will help to ensure that environmental impacts are minimized. However, pollution prevention and sustainability techniques also include decisions related to construction materials, design, and operational procedures that will facilitate the reduction of wastes at the source.

9(a) Recommendations. DEQ has several pollution prevention recommendations that may be helpful as future projects are considered:

- Consider development of an effective Environmental Management System (EMS). An effective EMS will ensure that the proposed facility is committed to complying with environmental regulations, reducing risk, minimizing environmental impacts, setting environmental goals, and achieving improvements in its environmental performance. DEQ offers EMS development assistance and recognizes facilities with effective Environmental Management Systems through its Virginia Environmental Excellence Program (VEEP). VEEP provides recognition, annual permit fee discounts, and the possibility for alternative compliance methods.
- Consider environmental attributes when purchasing materials. For example, the extent of recycled material content, toxicity level, and amount of packaging should be considered and can be specified in purchasing contracts.
- Consider energy efficiency when choosing materials and products, like insulation, fixtures, and HVAC systems.
- Consider contractors' commitment to the environment when choosing contractors. Specifications regarding raw materials and construction practices can be included in contract documents and requests for proposals.
- Choose sustainable materials and practices for building construction and design.
- Integrate pollution prevention techniques into the facility maintenance and operation, to include inventory control for centralized storage of hazardous materials. Maintenance facilities should have sufficient and suitable space to allow for effective inventory control and preventive maintenance.

DEQ's Office of Pollution Prevention provides information and technical assistance relating to pollution prevention techniques and EMS. If interested, please contact DEQ (Meghann Quinn at Meghann.Quinn@deq.virginia.gov or 804-774-9076).

10. Pesticides and Herbicides. In general, when pesticides or herbicides must be used, their use should be strictly in accordance with manufacturers' recommendations. In addition, DEQ recommends that the responsible agent use the least toxic pesticides or herbicides effective in controlling the target species. For more information on pesticide or herbicide use, please contact the Virginia Department of Agriculture and Consumer Services (804- 371-6560).

REGULATORY AND COORDINATION NEEDS

1. Air Quality Regulations. The following regulations may apply during construction or operation:

- fugitive dust and emissions control (9VAC5-50-60 *et seq.*)
- open burning restrictions (9VAC5-130 *et seq.*)
- permits for new and modified sources (fuel-burning equipment) (9VAC5-80, Article 6)
- stationary air emissions sources (9VAC5-80-1120 *et seq.*)

Contact officials with the appropriate locality for information on any local requirements pertaining to open burning if necessary. Contact DEQ Southwest Regional Office (Rob Feagins at Rob.Feagins@deq.virginia.gov or 276-608-8506) for additional information on potential air permitting as necessary.

2. Water Quality and Wetlands. Coordinate with the DEQ SWRO (David Nishida at David.Nishida@deq.virginia.gov or 276-698-7680) if impacts are proposed to waters, including wetlands, or if discharge to state waters will be anticipated, including changes to the storm water system or infrastructure.

3. Subaqueous Lands. VMRC states that a permit may be required. Coordinate with VMRC (Kylie Harris at 757-247-8032 or by email at kylie.harris@mrc.virginia.gov) on potential impacts once projects are identified.

4. Erosion and Sediment Control and Stormwater Management Plans. The applicant and its authorized agents conducting regulated land-disturbing activities on private and public lands in the state must comply with Virginia Erosion and Stormwater Management Regulation, including coverage under the general permit for stormwater discharge from construction activities, and other applicable federal nonpoint source pollution mandates (e.g. Clean Water Act-Section 313, federal consistency under the Coastal Zone Management Act). Submit the ESC and SWM plans

to DEQ SWRO (Reference: Virginia Erosion and Stormwater Management Regulation, 9VAC25-875 *et. seq.*). Coordinate with DEQ SWRO (Kelly Miller at 276-676-4879 or Kelly.Miller@deq.virginia.gov) for additional information.

5. General Permit for Stormwater Discharges from Construction Activities (VAR10). The operator or owner of a construction activity involving land disturbance of equal to or greater than 1 acre is required to register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project specific stormwater pollution prevention plan (SWPPP). Coordinate with DEQ SWRO (Kelly Miller at 276-676-4879 or Kelly.Miller@deq.virginia.gov) for additional information as necessary.

6. Solid Waste and Hazardous Substances. All solid waste, hazardous waste, and hazardous materials must be managed in accordance with all applicable federal, state, and local environmental regulations. If free product, discolored soils, or other evidence of contaminated soils are encountered, contact DEQ SWRO (Stacy Bowers at Stacy.Bowers@deq.virginia.gov or 276-608-8777). Any future site activities involving excavation or disturbance of formerly petroleum contaminated soils and or groundwater must be reported to DEQ, as authorized by Code of Virginia 62.1-44.34.8 through 19 and 9VAC25-580-10 *et seq.*

7. Natural Heritage Resources. Contact the DCR DNH (804-371-2708) about its recommendations and re-submit project information and a map for an update on natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

8. Floodplain. As applicable, the applicant should ensure compliance with applicable floodplain requirements. To find community NFIP participation and local floodplain administrator contact information, use DCR's Local Floodplain Management Directory: www.dcr.virginia.gov/dam-safety-and-floodplains/floodplain-directory.

Thank you for the opportunity to comment on this PEA. The detailed comments of reviewers are attached. If you have questions, please feel free to contact me or Julia Wellman at (804) 774-8237.

Sincerely,

Bettina Rayfield, Manager
Environmental Impact Review and Long Range Priorities Program
Virginia Department of Environmental Quality

804-659-1915
Bettina.Rayfield@deq.virginia.gov
Central Office
1111 E. Main St., Suite 1400
Richmond, VA 23219
804-698-4000

ec: Lee Brann, DWR
Allison Tillett, DCR
Arlene Warren, VDH
Samantha Henderson, DHR
Tiffany Birge, VMRC
Clint Folks, DOF
Duane Miller, Lenowisco PDC
Aaron Sizemore, Mount Rogers PDC
Robby Wright, Lee County
Freda Starnes, Scott County
Jason Berry, Washington County
Michael Hatfield, Wise County
Jeff Shupe, City of Norton

COMMONWEALTH of VIRGINIA

Marine Resources Commission
380 Fenwick Road
Building 96
Fort Monroe, VA 23651

Stefanie K. Taillon
Acting Secretary of Natural
and Historic Resources

Jamie L. Green
Commissioner

March 24, 2025

Department of Environmental Quality
Attn: Julia Wellman
1111 East Main Street
Richmond, VA 23219

Re: TVA Resilience 360 Program, DEQ 25-050F, Draft Programmatic Environmental Assessment

Dear Ms. Wellman:

This will respond to the request for comments regarding the Draft Programmatic Environmental Assessment for the TVA Resilience 360 Program, DEQ 25-050F, prepared by the Tennessee Valley Authority (TVA). Specifically, the TVA has proposed to partner with vendors and TVA customers to improve and enhance resiliency during events that challenge the transmission of power on the grid in the City of Norton and Lee, Scott, Washington, and Wise Counties, Virginia.

We reviewed the provided project documents and found the proposed project may encroach over jurisdictional areas of the Virginia Marine Resources Commission (VMRC) and may require a permit from this agency. When site-specific plans are developed, this determination may change.

Please be advised that the VMRC, pursuant to §28.2-1200 et seq of the Code of Virginia, has jurisdiction over encroachments in, on, or over the beds of the bays, ocean, rivers, streams, or creeks which are the property of the Commonwealth. Accordingly, if any portion of the subject project involves any encroachments channelward of ordinary high water along non-tidal, natural rivers and streams with a drainage area greater than 5-square miles, a permit may be required from our agency or the Department of Environmental Quality. Any jurisdictional impacts will be reviewed by the VMRC during the JPA process.

Please contact me at (757) 247-8032 or by email at kylie.harris@mrc.virginia.gov if you have any questions. Thank you for the opportunity to comment.

Sincerely,

Kylie Harris

Kylie Harris
Environmental Engineer, Habitat Management

KH
HM

Outlook

RE: NEW PROJECT TVA Resilience 360 Program, DEQ 25-050F

From Angueira, Antony (DEQ) <Antony.Angueira@deq.virginia.gov>
Date Thu 4/3/2025 9:22 AM
To Wellman, Julia (DEQ) <Julia.Wellman@deq.virginia.gov>

Good morning Julia,

Here is the OSWM comment for 205-050F.

1. **Non-point Source Water Pollution**. The policy addresses the control of stormwater runoff to protect the quality and quantity of state waters from the potential harm of unmanaged stormwater. Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth. This program is administered by DEQ (*Virginia Code §§ 62.1-44.15:25, 62.1-44.15:52; 9VAC25-875-10 et. seq.*).

2. **Erosion and Sediment Control and Stormwater Management Plans.** The Applicant and its authorized agents conducting regulated land-disturbing activities on private and public lands in Virginia must comply with *VESCL&R* and *VSWML&R*, including coverage under the general permit for stormwater discharge from construction activities, and other applicable federal nonpoint source pollution mandates (e.g. Clean Water Act-Section 313, federal consistency under the Coastal Zone Management Act). Clearing and grading activities, installation of staging areas, parking lots, roads, buildings, utilities, borrow areas, soil stockpiles, and related land-disturbing activities that result in the total land disturbance of ≥10,000 square feet (≥2,500 square feet in Chesapeake Bay Preservation Area) would be regulated by *VESCL&R*. Accordingly, the Applicant must prepare and implement an erosion and sediment control (ESC) plan to ensure compliance with state law and regulations. Land-disturbing activities that result in the total land disturbance of ≥1 acre (≥2,500 square feet in Chesapeake Bay Preservation Area) would be regulated by *VSWML&R*. Accordingly, the Applicant must prepare and implement a Stormwater Management (SWM) plan to ensure compliance with state law and regulations. The ESC/SWM plan is submitted to the DEQ Regional Office that serves the area where the project is located for compliance review. The Applicant is ultimately responsible for achieving project compliance through oversight of onsite contractors, regular field inspection, prompt action against non-compliant sites, and other mechanisms consistent with agency policy. [ref: VESCL §62.1-44.15 et seq.; consolidated ESC/SWM regs 9VAC25-875-10 et. seq.]

3. **General Permit for Stormwater Discharges from Construction Activities (VAR10).** DEQ is responsible for the issuance, denial, revocation, termination, and enforcement of the Virginia Stormwater Management Program (VSMP) General Permit for Stormwater Discharges from Construction Activities related to municipal separate storm sewer systems (MS4s) and construction activities for the control of stormwater discharges from MS4s and land disturbing activities under the VSMP.The owner or operator of projects involving land-disturbing activities of ≥1 acre is required to register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project-specific Stormwater Pollution Prevention Plan (SWPPP).
   Construction activities requiring registration also include land disturbance of <1 acre of total land area that is part of a larger common plan of development or sale if the larger common plan of

development will collectively disturb ≥1 acre The SWPPP must be prepared prior to submission of the registration statement for coverage under the general permit and the SWPPP must address water quality and quantity in accordance with the *VSMP Permit Regulations*. [ref: Virginia Stormwater Management Act 62.1-44.15 et seq.; VSMP Permit Regulations *9*VAC25-880 *et seq*.]

Thank you,
Tony

Tony Angueira
Stormwater Team Lead
Office of Stormwater Management
Virginia Department of Environmental Quality
1111 E. Main St., Suite 1400
Richmond, VA 23219
(804) 584-6265

From: Fulcher, Valerie (DEQ) <Valerie.Fulcher@deq.virginia.gov>
Sent: Wednesday, March 19, 2025 2:52 PM
To: dgif-ESS Projects (DWR) <ESSProjects@dwr.virginia.gov>; DCR-PRR Environmental Review (DCR) <envreview@dcr.virginia.gov>; odwreview (VDH) <odwreview@vdh.virginia.gov>; Churchill, Nikolas (DEQ) <Nikolas.Churchill@deq.virginia.gov>; Frantz, Allyson (DEQ) <Allyson.B.Frantz@deq.virginia.gov>; Lovain, Ava (DEQ) <Anna.Lovain@deq.virginia.gov>; Angueira, Antony (DEQ) <Antony.Angueira@deq.virginia.gov>; Robertson, Cynthia (DEQ) <Cynthia.Robertson@deq.virginia.gov>; Henderson, Samantha (DHR) <Samantha.Henderson@dhr.virginia.gov>; Folks, Clint (DOF) <Clint.Folks@dof.virginia.gov>; MRC - Scoping (MRC) <Scoping@mrc.virginia.gov>; Miller, Duane <dmiller@lenowisco.org>; Aaron Sizemore <ASizemore@mrpdc.org>; ddpoe@leecova.org (ddpoe@leecova.org) <ddpoe@leecova.org>; Starnes, Freda <fstarnes@scottcountyva.com>; Berry, Jason <jberry@washcova.com>; hatfield_m@wisecounty.org (hatfield_m@wisecounty.org) <hatfield_m@wisecounty.org>; Jeff Shupe <jeffs@nortonva.org>
Cc: Wellman, Julia (DEQ) <Julia.Wellman@deq.virginia.gov>
Subject: NEW PROJECT TVA Resilience 360 Program, DEQ 25-050F

Good afternoon- this is a new OEIR review request/project:

Document Type: Draft Programmatic Environmental Assessment
Project Sponsor: Tennessee Valley Authority
Project Title: Resilience 360° Program
Location: Lee, Scott, Washington, Wise Counties, City of Norton
Project Number: DEQ #25-050F

The document is attached.

The due date for comments is APRIL 3, 2025. You can send your comments either directly to JULIA WELLMAN by email (Julia.Wellman@deq.virginia.gov), or you can send your comments by regular interagency/U.S. mail to the Department of Environmental Quality, Office of Environmental Impact Review, P.O. Box 1105, Richmond, VA 23218.

NOTES: This request has an expedited deadline due to the federal deadline. Since this is a programmatic draft EA, specific project sites within the TVA territory are not identified.

If you cannot meet the deadline, please notify the project coordinator prior to the comment due date. Arrangements may be made to extend the deadline for comments if

possible. An agency will be considered to have no concerns if comments are not received (or contact is made) within the review period. However, it is important that agencies consistently participate in accordance with Virginia Code Section 10.1-1192.

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been previously reviewed (e.g. as a draft EIS or a Part 1 EIR), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency (agency stationary or email) and include the project number on all correspondence.

If you have any questions, please email Julia.

Thanks!

Valerie

Valerie A. Fulcher, CAP, OM, Admin/Data Coordinator Senior

Department of Environmental Quality

Environmental Enhancement - Office of Environmental Impact Review

1111 East Main Street

Richmond, VA 23219

PHONE NUMBER: 804-659-1550

Email: Valerie.Fulcher@deq.virginia.gov

https://www.deq.virginia.gov/permits-regulations/environmental-impact-review

For program updates and public notices please subscribe to the Environmental Impact Review Public Notices Bulletin: https://public.govdelivery.com/accounts/VADEQ/subscriber/new

Stefanie K. Taillon
Secretary of Natural and Historic Resources

Matthew S. Wells
Director

Andrew W. Smith
Chief Deputy Director

Frank N. Stovall
Deputy Director for Operations

Darryl Glover
Deputy Director for Dam Safety, Floodplain Management and Soil and Water Conservation

Laura Ellis
Deputy Director for Administration and Finance

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

MEMORANDUM

DATE: March 27, 2025

TO: Julie Wellman, DEQ

FROM: Allison Tillett, Environmental Impact Review Coordinator

SUBJECT: DEQ 25-050F, Resilience 360 Program- Draft Environmental Assessment

Division of Planning and Recreation Resources

DCR's Division of Planning and Recreational Resources (DCR-PRR) administers the Virginia Scenic Rivers (Virginia Code § 10.1-200), state trails programs (Virginia Code §10.1-204), and the state park master planning process (Virginia Code §10.1-200.1). DCR-PRR develops the Virginia Outdoors Plan (VOP), the state's comprehensive outdoor recreation and open space plan (Virginia Code §10.1-200) and administers the state-assistance side of the Land and Water Conservation Fund (LWCF). The VOP recognizes the importance of scenery, natural landscapes, and access to recreational opportunities for Virginians.

Division of Natural Heritage

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, natural heritage resources including federally and state listed species are documented within the Tennessee Valley Authority (TVA) Power Service Area outlined in Figure 1-1: TVA Power Service Area (PSA) and listed in Table 3-2 Special Status and Federally Protected Terrestrial Wildlife Species in TVA's PSA. In addition, several of DCR's Virginia State Natural Area Preserves (https://www.dcr.virginia.gov/natural-heritage/natural-area-preserves/) are also located within the service area in Virginia.

As specific projects are developed under Alternative B- Proposed Action, DCR recommends coordination with the natural heritage programs for updated natural heritage information and determination of potential impacts to natural heritage resources from Battery Energy Storage System (BESS) or gas installation projects including construction, operation and decommissioning. DCR supports the siting of proposed projects away from sensitive areas on previously disturbed land such as brownfields and coal mine reclamation sites to minimize impacts to natural heritage resources and large contiguous tracts of forestland that support these resources. Due to the decline in pollinators, DCR also recommends the planting of native pollinator plants in the buffer areas of the planned

facilities, which bloom throughout the growing season as well as the development of an invasive species management plan for these projects.

DCR provides the following comments regarding the Resilience 360- Environmental Screening Checklist (Appendix A).

4.4 Ecological Resources	
□ Yes □ No	Will removal of trees with a trunk diameter greater than 3 inches at breast height be necessary? If so, how many trees or acres of trees will be cleared? _____ trees/acres If yes, how will the cleared trees be disposed (i.e. sold, hauled offsite, mulched, burned, etc.): _____
□ Yes □ No	Can the project commit to tree clearing only within a winter window (approximately October 15-March 31 dates may vary depending on site location)?
□ Yes □ No	Are there any visible caves, rock ledges, overhangs, sinkholes in view of the host site?
□ Yes □ No	Have any species with federal status been identified within the potential project vicinity based on the US Fish and Wildlife Service Information for Planning and Consultation process (IPaC: Home - https://ipac.ecosphere.fws.gov/)? Attach the IPaC form to this checklist.

1) DCR recommends avoidance of C1 and C2 ecological cores as identified in the Virginia Natural Landscape Assessment (https://www.dcr.virginia.gov/natural-heritage/vaconvisvnla) during the siting of proposed projects in Virginia. Mapped cores in the project area can be viewed via the Virginia Natural Heritage Data Explorer, available here: http://vanhde.org/content/map.

2) In addition to determining if there are any visible caves, rock ledges, overhangs, sinkholes in view of the host site, DCR also recommends determining if there are large springs in the project vicinity.

3) In addition, to generating a list from IPaC of federally listed species within the proposed project vicinity, DCR recommends the use of the updated TVA Regional Natural Heritage Database to generate a list of natural heritage resources and attaching it to the checklist also. DCR supports TVA utilizing state-specific resources in the site-specific screening process to determine the potential effects to state-listed species as stated on page 3-20 and 3-22 of the draft EA.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species.

New and updated information is continually added to Biotics. Please re-submit project information and map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

The Virginia Department of Wildlife Resources (VDWR) maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed at https://svcgis.dwr.virginia.gov/fwis/ or contact Lee Brann at Lee.Brann@dcw.virginia.gov .

The U.S. Fish and Wildlife Service (USFWS) utilizes an online project review process (https://www.fws.gov/office/virginia-ecological-services/virginia-field-office-online-review-process) to facilitate compliance with the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884) (ESA), as amended. The process enables users to 1) follow step-by-step guidance; 2) access information that will

allow them to identify threatened and endangered species, designated critical habitat, and other Federal trust resources that may be affected by their project; and 3) accurately reach determinations regarding the potential effects of their project on these resources as required under the ESA. If you have questions regarding the online review process, please contact virginiafieldoffice@fws.gov.

Division of State Parks

DCR's Division of State Parks is responsible for acquiring and managing, state parks. Park development and master planning are managed by the Division of Planning and Recreation Resources. Master plans are required prior to a parks opening and are updated every ten years (Virginia Code § 10.1-200 *et seq.*).

Division of Dam Safety and Floodplain Management

Dam Safety Program:
The Dam Safety program was established to provide proper and safe design, construction, operation and maintenance of dams to protect public safety. Authority is bestowed upon the program according to *The Virginia Dam Safety Act*, Article 2, Chapter 6, Title 10.1 (10.1-604 et seq) of the Code of Virginia and Dam Safety Impounding Structure Regulations (Dam Safety Regulations), established and published by the Virginia Soil and Water Conservation Board (VSWCB).

Floodplain Management Program:
The National Flood Insurance Program (NFIP) is administered by the Federal Emergency Management Agency (FEMA), and communities who elect to participate in this voluntary program manage and enforce the program on the local level through that community's local floodplain ordinance. Each local floodplain ordinance must comply with the minimum standards of the NFIP, outlined in 44 CFR 60.3; however, local communities may adopt more restrictive requirements in their local floodplain ordinance, such as regulating the 0.2% annual chance flood zone (Shaded X Zone).

All development within a Special Flood Hazard Area (SFHA), as shown on the locality's Flood Insurance Rate Map (FIRM), must be permitted and comply with the requirements of the local floodplain ordinance.

State Agency Projects Only

All agencies and departments of the Commonwealth shall comply with the Code of Virginia § 10.1-603. State agency compliance.

Federal Agency Projects Only
Projects conducted by federal agencies within the SFHA must comply with federal Executive Order 11988: Floodplain Management.

DCR's Floodplain Management Program does not have regulatory authority for projects in the SFHA. The applicant/developer must reach out to the local floodplain administrator for an official floodplain determination and comply with the community's local floodplain ordinance, including receiving a local permit. Failure to comply with the local floodplain ordinance could result in enforcement action from the locality. For state projects, DCR recommends that compliance documentation be provided prior to the project being funded. For federal projects, the applicant/developer is encouraged reach out to the local floodplain administrator and comply with the community's local floodplain ordinance.

To find flood zone information, use the Virginia Flood Risk Information System (VFRIS): www.dcr.virginia.gov/vfris

To find community NFIP participation and local floodplain administrator contact information, use DCR's Local Floodplain Management Directory: www.dcr.virginia.gov/dam-safety-and-floodplains/floodplain-directory

The remaining DCR divisions have no comments regarding the scope of this project. Thank you for the opportunity to comment.

Cc: Hannah Schul, VDWR

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

MEMORANDUM

TO: Julia Wellman, DEQ/EIR Environmental Program Planner

FROM: Nikolas I. Churchill, Division of Land Protection & Revitalization Review Coordinator

DATE: March 28, 2025

COPIES: Sanjay Thirunagari, Division of Land Protection & Revitalization Review Manager; file

SUBJECT: Environmental Impact Review: 25-050F Resilience 360° Program in Lee, Scott, Washington, and Wise Counties and the City of Norton, Virginia.

The Division of Land Protection & Revitalization (DLPR) has completed its review of the Tennessee Valley Authority' March 19, 2025 EIR for 25-050F Resilience 360° Program in Lee, Scott, Washington, and Wise Counties and the City of Norton, Virginia.

DLPR staff recommends a search (at least 200 ft. radius) of any land-based project areas using the following solid and hazardous waste databases to identify waste sites (including petroleum releases) in close proximity to those project areas:

- Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Database: Superfund Information Systems Information on hazardous waste sites, potentially hazardous waste sites and remedial activities across the nation, including sites that are on the National Priorities List (NPL) or being considered for the NPL:
    - https://cumulis.epa.gov/supercpad/CurSites/srchsites.cfm
- DEQ Online Database: Virginia Environmental Geographic Information Systems Information on Permitted Solid Waste Management Facilities, Impaired Waters, Petroleum Releases, Registered Petroleum Facilities, Permitted Discharge (Virginia Pollution Discharge Elimination System Permits) Facilities, Resource Conservation and Recovery Act (RCRA) Sites, Water Monitoring Stations, National Wetlands Inventory:
    - https://apps.deq.virginia.gov/EDM/

PROJECT SPECIFIC COMMENTS

None

GENERAL COMMENTS

Soil, Sediment, Groundwater, and Waste Management

Any soil, sediment or groundwater that is suspected of contamination or wastes that are generated must be tested and disposed of in accordance with applicable Federal, State, and local laws and regulations. Some of the applicable state laws and regulations are: Virginia Waste Management Act, Code of Virginia Section 10.1-1400 *et seq.*; Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC 20-60); Virginia Solid Waste Management Regulations (VSWMR) (9VAC 20-81); Virginia Regulations for the Transportation of Hazardous Materials (9VAC 20-110). Some of the applicable Federal laws and regulations are: the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901 *et seq.*, and the applicable regulations contained in Title 40 of the Code of Federal Regulations; and the U.S. Department of Transportation Rules for Transportation of Hazardous Materials, 49 CFR Part 107.

Asbestos and/or Lead-based Paint

All structures being demolished/renovated/removed should be checked for asbestos-containing materials (ACM) and lead-based paint (LBP) prior to demolition. If ACM or LBP are found, in addition to the federal waste-related regulations mentioned above, State regulations 9VAC 20-81-620 for ACM and 9VAC 20-60-261 for LBP must be followed. Questions may be directed to the DEQ's Southwest Regional Office at (276) 676-4800.

Pollution Prevention – Reuse - Recycling

Please note that DEQ encourages all construction projects and facilities to implement pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately.

If you have any questions or need further information, please contact Nikolas Churchill by phone at (804) 659-2663 or email nikolas.churchill@deq.virginia.gov.

Outlook

RE: NEW PROJECT TVA Resilience 360 Program, DEQ 25-050F

From Warren, Arlene (VDH) <Arlene.Warren@vdh.virginia.gov>
Date Wed 3/26/2025 12:08 PM
To Wellman, Julia (DEQ) <Julia.Wellman@deq.virginia.gov>

Project Number: DEQ #25-050F
Document Type: Draft Programmatic Environmental Assessment
Project Sponsor: Tennessee Valley Authority
Project Title: Resilience 360° Program
Location: Lee, Scott, Washington, Wise Counties, City of Norton

VDH – Office of Drinking Water has reviewed the above project and has no comments to submit at this time.

Best Regards,

Arlene F. Warren
GIS Program Support Technician
Mobile 804-389-2167 (office/cell/text)
Email [arlene.warren@vdh.virginia.gov]arlene.warren@vdh.virginia.gov
VDH, Office of Drinking Water
109 Governor Street, 6th Floor
Richmond, VA 23219

From: Fulcher, Valerie (DEQ) <Valerie.Fulcher@deq.virginia.gov>
Sent: Wednesday, March 19, 2025 2:52 PM
To: dgif-ESS Projects (DWR) <ESSProjects@dwr.virginia.gov>; DCR-PRR Environmental Review (DCR) <envreview@dcr.virginia.gov>; odwreview (VDH) <odwreview@vdh.virginia.gov>; Churchill, Nikolas (DEQ) <Nikolas.Churchill@deq.virginia.gov>; Frantz, Allyson (DEQ) <Allyson.B.Frantz@deq.virginia.gov>; Lovain, Ava (DEQ) <Anna.Lovain@deq.virginia.gov>; Angueira, Antony (DEQ) <Antony.Angueira@deq.virginia.gov>; Robertson, Cynthia (DEQ) <Cynthia.Robertson@deq.virginia.gov>; Henderson, Samantha (DHR) <Samantha.Henderson@dhr.virginia.gov>; Folks, Clint (DOF) <Clint.Folks@dof.virginia.gov>; MRC - Scoping (MRC) <Scoping@mrc.virginia.gov>; Miller, Duane <dmiller@lenowisco.org>; Aaron Sizemore <ASizemore@mrpdc.org>; ddpoe@leecova.org (ddpoe@leecova.org) <ddpoe@leecova.org>; Starnes, Freda <fstarnes@scottcountyva.com>; Berry, Jason <jberry@washcova.com>; hatfield_m@wisecounty.org (hatfield_m@wisecounty.org) <hatfield_m@wisecounty.org>; Jeff Shupe <jeffs@nortonva.org>
Cc: Wellman, Julia (DEQ) <Julia.Wellman@deq.virginia.gov>
Subject: NEW PROJECT TVA Resilience 360 Program, DEQ 25-050F

Good afternoon- this is a new OEIR review request/project:

Document Type: Draft Programmatic Environmental Assessment
Project Sponsor: Tennessee Valley Authority
Project Title: Resilience 360° Program

Location: Lee, Scott, Washington, Wise Counties, City of Norton
Project Number: DEQ #25-050F

The document is attached.

The due date for comments is APRIL 3, 2025. You can send your comments either directly to
JULIA WELLMAN by email (Julia.Wellman@deq.virginia.gov), or you can send your comments by regular interagency/U.S. mail to the Department of Environmental Quality, Office of Environmental Impact Review, P.O. Box 1105, Richmond, VA 23218.

NOTES: This request has an expedited deadline due to the federal deadline. Since this is a programmatic draft EA, specific project sites within the TVA territory are not identified.

If you cannot meet the deadline, please notify the project coordinator prior to the comment due date. Arrangements may be made to extend the deadline for comments if possible. An agency will be considered to have no concerns if comments are not received (or contact is made) within the review period. However, it is important that agencies consistently participate in accordance with Virginia Code Section 10.1-1192.

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been previously reviewed (e.g. as a draft EIS or a Part 1 EIR), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency (agency stationary or email) and include the project number on all correspondence.

If you have any questions, please email Julia.

Thanks!

Valerie

Valerie A. Fulcher, CAP, OM, Admin/Data Coordinator Senior

Department of Environmental Quality

Environmental Enhancement - Office of Environmental Impact Review

1111 East Main Street

Richmond, VA 23219

PHONE NUMBER: 804-659-1550

Email: Valerie.Fulcher@deq.virginia.gov

https://www.deq.virginia.gov/permits-regulations/environmental-impact-review

For program updates and public notices please subscribe to the Environmental Impact Review Public Notices Bulletin: https://public.govdelivery.com/accounts/VADEQ/subscriber/new

Outlook

RE: reminder: NEW PROJECT TVA Resilience 360 Program, DEQ 25-050F

From Robertson, Cynthia (DEQ) <Cynthia.Robertson@deq.virginia.gov>
Date Tue 4/1/2025 1:49 PM
To Wellman, Julia (DEQ) <Julia.Wellman@deq.virginia.gov>

Good Afternoon Julia,

DEQ has no comments.

Thank you,

Cindy Robertson
FOIA Coordinator
EIR Coordinator
Administrative & Data Coordinator
Air Permitting, Compliance & Enforcement
Virginia Dept. of Environmental Quality
355 Deadmore St., Abingdon, VA 24210
(276) 698-8546

From: Wellman, Julia (DEQ) <Julia.Wellman@deq.virginia.gov>
Sent: Tuesday, April 1, 2025 1:45 PM
To: dgif-ESS Projects (DWR) <ESSProjects@dwr.virginia.gov>; Frantz, Allyson (DEQ) <Allyson.B.Frantz@deq.virginia.gov>; Lovain, Ava (DEQ) <Anna.Lovain@deq.virginia.gov>; Angueira, Antony (DEQ) <Antony.Angueira@deq.virginia.gov>; Robertson, Cynthia (DEQ) <Cynthia.Robertson@deq.virginia.gov>; Henderson, Samantha (DHR) <Samantha.Henderson@dhr.virginia.gov>; Folks, Clint (DOF) <Clint.Folks@dof.virginia.gov>; Miller, Duane <dmiller@lenowisco.org>; Aaron Sizemore <ASizemore@mrpdc.org>; ddpoe@leecova.org (ddpoe@leecova.org) <ddpoe@leecova.org>; Starnes, Freda <fstarnes@scottcountyva.com>; Berry, Jason <jberry@washcova.com>; hatfield_m@wisecounty.org (hatfield_m@wisecounty.org) <hatfield_m@wisecounty.org>; Jeff Shupe <jeffs@nortonva.org>
Subject: reminder: NEW PROJECT TVA Resilience 360 Program, DEQ 25-050F

This email is an early friendly reminder that comments are due on this project April 3.

Regards, Julia

Julia Wellman
Environmental Impact Review Coordinator
Office of Environmental Impact Review and Long Range Priorities
Division of Environmental Enhancement
Virginia Department of Environmental Quality
1111 East Main Street, Suite 1400
Richmond, Virginia 23219
(804) 774-8237

From: Wufoo
To: nepa
Subject: Resilience 360° Program Draft PEA [#1]
Date: Tuesday, April 15, 2025 10:25:42 AM

This is an EXTERNAL EMAIL from outside TVA. THINK BEFORE you CLICK links or OPEN attachments. If suspicious, please click the "Report Phishing" button located on the Outlook Toolbar at the top of your screen.

Name	Matthew Jones
City	Memphis
State	TN
Organization	New Millennium
Email	matthew.jones@newmill.com
Phone Number	[redacted]
Please provide your comments by uploading a file or by entering them below. *	We would love to be apart of this opportunity. We are exploring adding a backup generator to our operational plant as we speak.

From: Wufoo
To: nepa
Subject: Resilience 360° Program Draft PEA [#2]
Date: Wednesday, April 16, 2025 10:33:17 AM

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Name	Gaby Sarri-Tobar
City	Washington, DC
State	Washington, DC
Organization	Center for Biological Diversity
Email	gsarritobar@biologicaldiversity.org
Phone Number	(202) 594-7271
Please provide your comments by uploading a file or by entering them below. *	Comments attached, urging TVA to consider renewable energy alternatives in the Draft PEA.
Upload File #1	04.17.2025_center_for_biological_diversity_comments_to_tva_on_resilience_360_draft_pea.pdf 343.28 KB • PDF

April 17, 2025

Via Submission to TVANepaComments.com and Electronic Mail

Ms. Carol Butler Freeman
NEPA Project Manager
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville TN 37902
nepa@tva.com
cfreeman2@tva.gov

Re: Comments on the Draft Programmatic Environmental Assessment for TVA's Resilience 360 Program

Dear Ms. Freeman,

On behalf of the Center for Biological Diversity ("Center"), we submit these comments on the Tennessee Valley Authority's ("TVA") Draft Programmatic Environmental Assessment ("Draft PEA") for the proposed "Commercial Resiliency," or Resilience 360, program ("Resilience 360"). We commend TVA for proposing a program to enhance grid and energy resilience; however, TVA makes a grave error in considering backup fossil gas generation as a qualifying resilience project. Fossil gas generation is not only unreliable, but it produces harmful greenhouse gas emissions that endanger communities, species, and the climate. **We urge TVA to consider a project alternative that prioritizes non-fossil fuel backup generation, including distributed energy resources ("DERs") such as rooftop and community-solar with battery energy storage systems ("BESS").**

As a threshold matter, the climate emergency and growing energy inequity in the Tennessee Valley demands an expedited phasing out of fossil fuels. However, in TVA's attempt to promote resilience the utility is carelessly encouraging vendors and TVA customers to invest in technologies that would pump more planet-warming emissions into the atmosphere which contribute to climate change that is intensifying the very disasters putting TVA's grid and communities at risk. If TVA is serious about building a more resilient energy system and supporting communities whose health and safety and access to life-saving power is threatened by extreme weather events, the utility should avoid cementing the region's dependence on fossil fuels.

Furthermore, TVA has failed to propose any other reasonable action alternatives that would not involve the construction of new polluting resources. The Final PEA must therefore fully and fairly consider alternatives for resilient distributed renewable energy, battery storage, and demand response, in order to comply with the National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321, *et seq*. Importantly, such an alternative would help put TVA on track with addressing the most pressing issue today: the urgent need for a rapid transition away from all fossil fuels toward a renewable energy economy to avoid the worst impacts of the climate crisis and address the disproportionate harm experienced by communities from the fossil fuel economy.

We look forward to reviewing TVA's Final PEA addressing these issues.

DISCUSSION

I. TVA Must Examine Fossil Fuel-Free Alternatives to Comply with NEPA and The TVA Act and Achieve Rapid Greenhouse Gas Reductions That Are Critical To Addressing The Climate Emergency and Saving Lives.

It is well established that the actions taken this decade are crucial to avoid the most devastating impacts of the climate crisis. As detailed by the Intergovernmental Panel on Climate Change ("IPCC"), without prompt action across all sectors, the world is likely to *surpass* 1.5°C of warming — its most ambitious climate target — in less than a decade.[1] In fact, the UN warns that we are on track for 2.6 to 3.1 degrees Celsius of warming this century.[2] Worse yet, a 2023 report further warned that at our current emission rate we will surpass our carbon budget (in line with a 50% chance of limiting warming to 1.5°C) by 2030.[3]

Persistent fossil fuel dependence will make it nearly impossible to preserve a livable planet. As United Nations Secretary General Antonio Guterres has made clear, "Fossil fuels are a dead end – for our planet, for humanity, and […] for economies. A prompt, well-managed transition to

[1] Intergovernmental Panel on Climate Change, *Synthesis Report of the IPCC Sixth Assessment Report (AR6)* (2023), https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf.

[2] Zia Weise and Lucia Mackenzie, "World on track for catastrophic 3 degrees Celsius warming, UN warns," Politico, (October 24, 2024), https://www.politico.eu/article/united-nations-emissions-gap-global-warming-data-climate-change-report/.

[3] Lamboll, R.D., Nicholls, Z.R.J., Smith, C.J. et al., "Assessing the size and uncertainty of remaining carbon Budget," Nat. Clim. Chang. (October 30, 2023). https://doi.org/10.1038/s41558-023-01848-5.

renewables is the only pathway to energy security, universal access and the green jobs our world needs."[4]

Despite this clear warning, TVA is moving in the opposite direction by *expanding* fossil fuels in the Valley. TVA has one of the largest planned gas buildouts among all other utilities by 2030 — 6.9 GW of new gas.[5] And, although TVA is currently updating its Integrated Resource Plan ("IRP"), under the most recent IRP the agency will not achieve full decarbonization until *sometime after 2080*.[6] Moreover, with increased reliance on gas, TVA currently forecasts that it will *generate more than 34 million tons of CO_2 each year in 2038*.[7]

As a result of TVA's delinquent transition away from fossil fuels, communities throughout the Valley are facing lasting and devastating consequences, including record-breaking heat waves, tornadoes, floods, winter storms, and hurricanes. These catastrophic fossil fuel-driven disasters put lives at risk. The U.S. Government Accountability Office (GAO) found that TVA's grid faces several climate-related risks that could cost customers billions of dollars in outages, capacity disruptions, and infrastructure damage.[8] When the power goes out and fossil fuel plants fail — as they did during Winter Storm Elliot — families lose access to electricity to power medical devices, air conditioning to keep homes cool, and heat to stay warm during the coldest months. This is a life-or-death matter, and an increasingly dangerous and common circumstance as the fossil fuel-driven climate emergency brings more intense and frequent disasters to the Valley.

The TVA Act mandates that, in managing its electric generation system, TVA protect "the economic, environmental, social, or physical well-being" of the customers it serves. 16 U.S.C. § 831a(g)(1)(K)(ii). Congress has also mandated that, in planning for new resources, TVA must "evaluate[ ] the *full range* of existing and incremental resources (including new power supplies, energy conservation and efficiency, and renewable energy resources)" that can be relied on to serve "electric customers of the Tennessee Valley Authority at the lowest system cost." *Id.* § 831m-

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4 *See* Secretary-General's video message to the Press Conference Launch of IPCC Report, (February 28, 2022), https://www.un.org/sg/en/content/sg/statement/2022-02-28/secretary-generals-video-message-the-press-conference-launch-of-ipcc-report-scroll-down-for-languages.

5 Caroline Eggers, "TVA plans 9th gas plant since 2020," WPLN, (September 20, 2024), https://wpln.org/post/tva-plans-9th-gas-plant-since-2020/.

6 Southern Alliance for Clean Energy, "Tracking Decarbonization in the Southeast," Generation and CO2 Emissions Report, (June 2022), https://cleanenergy.org/wp-content/uploads/Tracking-Decarbonization-in-the-Southeast-Fourth-Annual-Report.pdf.

7 TVA 2019 Environmental Impact Statement, Final EIS at 5-27.

8 Tennessee Valley Authority: Additional Steps Are Needed to Better Manage Climate-Related Risks, U.S. Government Accountability Office (January 30, 2023), https://www.gao.gov/products/gao-23-105375.

1(b)(1)(emphasis added); *see also id*. § 831a(b)(5) (setting out TVA's mission to be "a national leader in technological innovation, low-cost power, and environmental stewardship").

Given the climate emergency, and the present and threatened impacts of climate change on TVA customers, the agency's plan to encourage further fossil gas generation through its Resilience 360 program — and refusal to consider truly resilient energy solutions like distributed renewable energy — is in flat violation of the TVA Act and will leave communities more vulnerable to intensifying storms.

As the nation's largest power provider, with massive GHG emissions, TVA must abandon plans to expand fossil gas generation in any form, even as backup generation, and instead promote resilient, affordable and decentralized renewable energy alternatives like rooftop and community solar with battery storage, energy efficiency, and demand response.

1. Further reliance on fossil fuels will harm public health and safety and pump more greenhouse gas emissions into the atmosphere that fuel climate risk and undermine resilience.

Unlike renewable energy alternatives, fossil gas is a highly polluting energy source that results in a host of harms to communities, the environment, and the climate throughout the resource's life cycle. Despite being smaller in size, on-site modular gas units still spew harmful greenhouse gas emissions that dirty the air and harm public health, which contradicts TVA's policy to "improve quality of life and the environment in the Tennessee Valley by providing reliable, affordable, and increasingly clean energy."[9]

Fossil gas units produce hazardous methane emissions — a more potent greenhouse gas than CO_2, with a warming potential nearly 30 times more powerful over 100 years.[10] A new study from the Massachusetts Institute of Technology reports that methane emissions — including from burning fossil fuels — are responsible for a third of the total warming the planet has experienced.[11]

It is also well established that fossil fuels significantly threaten air and water quality.[12] Fossil gas plants produce well over 60 hazardous air pollutants — including volatile organic

[9] Tennessee Valley Authority, Environmental Policy, https://www.tva.com/environment/environmental-stewardship/environmental-policy.

[10] U.S. Environmental Protection Agency, "Understanding Global Warming Potentials," available at: https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.

[11] Casey Crownhart, "Methane leaks in the US are worse than we thought," MIT Technology Review, (March 13, 2024), https://www.technologyreview.com/2024/03/13/1089725/methane-leaks-oil-gas/.

[12] Environmental Protection Agency, "Power Plants and Neighboring Communities,"

compounds, carcinogens, and endocrine disrupting chemicals — that severely impact public health, especially for low-income communities and people of color.[13] Moreover, gas generation exposes communities within closer proximity to gas facilities to elevated ozone levels which, among other harms, can exacerbate asthma and other diseases.[14]

The fossil fuel economy particularly harms Black, Indigenous, and other communities of color.[15] Black Americans are exposed to 56% more polluted air than White Americans, on average, and more than one million Black Americans live within a half mile of gas facilities, resulting in higher risks of cancer and other health problems.

The harms associated with back-up fossil gas generation are on full display in South Memphis, where the new xAI "Colossus" facility is running on 35 *un-permitted* portable gas generators.[16] These units are pumping hazardous chemicals, including formaldehyde, that worsen air pollution, especially ground level ozone, which contributes to serious health harms like cancer.[17] Given these impacts, it is concerning that TVA suggests that air permits would not be necessary for the on-site modular gas units. Draft PEA at 1-5. This is a major oversight that could allow gas plant operators to take advantage of relaxed requirements in much the same way that xAI has. Even if TVA anticipates that these gas units will not operate for more than 400 hours per year, and that emissions would be "temporary and small," these units are spewing harmful

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https://www.epa.gov/power-sector/power-plants-and-neighboring-communities.

[13] Greenpeace, "Fossil Fuel Racism: How Phasing Out Oil, Gas, and Coal Can Protect Communities," (2021), https://www.greenpeace.org/usa/wp-content/uploads/2021/04/Fossil-Fuel-Racism.pdf.

[14] *Id.*

[15] See NAACP et al. (2017), Fumes Across the Fenceline, http://www.catf.us/wp-content/uploads/2017/11/CATF_Pub_FumesAcrossTheFenceLine.pdf; see also Mikati et al. (2018). Disparities in Distribution of Particulate Matter Emission Sources by Race and Poverty Status, American Public Health Association, https://ajph.aphapublications.org/doi/abs/10.2105/AJPH.2017.304297; See also Sarah Kaplan, "Climate Justice is a Racial Justice Problem," Washington Post, June 29, 2020.

[16] Reuters, Musk's xAI increased Tennessee gas turbines without permits, community groups say, Reuters, (April 10, 2025), https://www.reuters.com/sustainability/boards-policy-regulation/musks-xai-increased-tennessee-gas-turbines-without-permits-community-groups-say-2025-04-09/.

[17] Southern Environmental Law Center, "Elon Musk's xAI facility is polluting South Memphis," (November 15, 2024), https://www.selc.org/news/elon-musks-xai-facility-is-polluting-south-memphis/. *See also* National Institute of Environmental Health Sciences, "Air Pollution and Your Health," available at https://www.niehs.nih.gov/health/topics/agents/air-pollution. *See also* Bria Bolden, "Air quality concerns as xAI intends to keep gas turbines at supercomputer site in Southwest Memphis," Action News 5, (February 14, 2025), https://www.actionnews5.com/2025/02/15/air-quality-concerns-xai-intends-keep-gas-turbines-supercomputer-site-southwest-memphis/.

chemicals, nonetheless. Draft PEA at 3-41. Memphis is already out of compliance with the Clean Air Act's air quality standards, in large part due to xAI's on-site gas turbines.[18]

It is TVA's responsibility, under NEPA, to analyze and address any "reasonably foreseeable environmental effects of the proposed agency action."[19] Furthermore, TVA should be ensuring all steps are taken to protect the environment and communities who will be most impacted by this program. In line with this, it is reckless for TVA to only examine new fossil gas generation that would add to the region's already alarming air quality crisis, and not focus on other alternatives, and TVA must address the foreseeable environmental harms that will come from this choice.

Furthermore, and as previously stated, rising greenhouse gas emissions from expanded fossil gas generation is destabilizing our climate and contributing to more frequent extreme weather events that put lives and TVA's own grid infrastructure at risk. TVA's preferred alternative in the Draft PEA defies logic — rather than promote truly resilient and non-emitting back-up technologies like rooftop solar with battery storage that will make communities safer, TVA is unnecessarily sinking the Valley deeper into a costlier, riskier, and less reliable fossil fuel future.

The TVA Act clearly states that TVA's mission is to be "a national leader in technological innovation, low-cost power, and environmental stewardship." The Resilience 360 program is a great opportunity to accomplish that goal by facilitating the transition to renewable energy technologies that will help bring costs down for struggling families, help drive job creation to boost local economies, and improve local air and water quality. Furthermore, this alternative approach would align with TVA's strategic commitments to "provide reliable, resilient, affordable, and clean energy to the region [through] being a leader in carbon-free energy […] innovation and decarbonization solutions."[20]

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[18] Neil Strebig, "Shelby County health director blasts Memphis mayor in letter over handling of xAI project," Memphis Commercial Appeal, (April 9, 2025), https://www.commercialappeal.com/story/money/business/development/2025/04/09/xai-in-memphis-air-pollution-mayor-paul-young-shelby-county-health-department/83015910007/.

[19] 42 U.S.C. § 4332.

[20] Tennessee Valley Authority, "FY 2025 Budget Proposal & Management Agenda and FY 2023 Annual Performance Report," (March 2024), https://www.tva.com/docs/default-source/about-tva/guidelines-reports/tva-annual-performance-report-fy2025-fy-2023.pdf.

2. TVA must properly define the purpose and need for the proposed program and consider additional alternatives.

The starting point for any agency's NEPA analysis must be a proper delineation of the purpose and need for the agency action. *E.g. Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 196 (D.C. Cir. 1991); *City of Carmel-By-The-Sea v. Dept. of Transp*., 123 F.3d 1142, 1155 (9th Cir. 1997); *Nat'l Parks & Conservation Ass'n v. Bureau of Land Mgmt*, 606 F.3d 1058 (9th Cir. 2009). Thus, it is well-established that an agency cannot "define the objectives of its action" in a way that eliminates alternatives that would meet the agency's legitimate goals, *Busey*, 938 F.2d at 196, for the "stated goal of a project necessarily dictates the range of reasonable' alternatives . . . ." *City of Carmel-By-The-Sea*, 123 F.3d at 1155; *Little Traverse Lake Prop. Owners Ass'n v. Nat'l Park Serv.*, 883 F.3d 644, 656 (6th Cir. 2018); *Meister v. Dep't of Agric.*, 623 F.3d 363, 377 (6th Cir. 2010); *W. Watersheds Project v. Vilsack*, No. 23-8081, 2024 U.S. App. LEXIS 27235, at *21-22 (10th Cir. Oct. 28, 2024).

TVA frames the purpose of the Resilience 360 program as ensuring a "regular supply of energy and contingency measures in place in the event of a small or isolated power failure"; providing "flexible, dispatchable power that can successfully integrate increasing amounts of renewable energy sources"; and delivering "near-term generation capacity to TVA as power demand increases under normal grid conditions." Draft PEA at 1-2. As TVA notes, resilience "addresses operational flexibility and the ability to respond to short-term disruptions on the power system, while DER achieves higher, long-term penetration levels." Draft PEA at 1-5. That said, nowhere else does TVA consider DERs as an action alternative even though the 2019 IRP identified them as key to achieving energy resilience. Instead, TVA claims that the 2019 IRP identified a need to build more combustion gas turbines that supersedes DERs.

TVA's narrowed view of resilience, and ultimately its prioritization of building "flexible, dispatchable power" to address rising load — primarily driven by high-energy using customers like data centers — unfairly disqualifies truly resilient technologies like distributed renewable energy from consideration in this PEA. Furthermore, TVA is responsible for encouraging that increasing demand; therefore, it should not serve as a legitimate purpose of more fossil gas generation.

TVA spends significant resources working to attract new businesses, and thus new demand. The American Public Power Association recently recognized the role TVA played in attracting more than $45 billion in new investments over the past five years, including almost $9 billion in 2024 alone.[21] TVA's own website proudly declares that TVA "works to attract new companies—

[21] Paul Ciampoli, "Board Recognizes TVA's 2024 Performance Across a Range of Categories," American

which results in more jobs and investments in the Valley," including data centers and other high-energy users.[22]

Given TVA's affirmative effort to increase electricity demand in its service territory, it is entirely disingenuous — and violates NEPA — for TVA to make increasing demand a premise for emphasizing gas, and shirking DERs, in the Draft PEA, when TVA is playing an active role in driving that demand. Making demand reduction a goal—to make the grid more resilient and lessen harmful impacts to communities in the Valley—would open up new alternatives TVA must consider in the Resilience 360 program.

II. TVA's Final PEA Must Analyze Distributed, Renewable Energy Alternatives That Would Advance Energy Justice, Lower Costs, and Improve Resilience in The Region.

The purpose of NEPA is to identify reasonable alternatives to an agency's proposed action and then expose and discuss the multitude of public health, environmental, socio-economic, wildlife, and other impacts of those alternatives. However, regardless of the ultimate decisions made, NEPA does not permit an agency to refuse to even *consider* reasonable alternatives.[23]

TVA's proposal to incentivize new fossil generation — and refusal to even consider renewable energy alternatives — is completely unacceptable and will only further harm communities of color and low wealth who continue to bear the brunt of the Corporation's reliance on fossil fuels. As TVA promotes new fossil gas generation and simultaneously stunts local, community-based renewable energy, the agency is fueling the climate crisis and energy injustice which threaten people's quality of life.

Furthermore, it is outright hypocritical of TVA to build a program to solely promote more fossil fuel generation while implementing policies like the 5 percent cap on self-generation which restrict residential customers, who suffer the highest costs in the region, from accessing resilient

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Public Power Association, (November 12, 2024), https://www.publicpower.org/periodical/article/board-recognizes-tvas-2024-performance-across-range-categories#:~:text=TVA%20Helped%20attract%20%248.9%20billion,Liebherr%2C%20and%20Ashley%20Furniture%20Industries.

[22] See Tennessee Valley Authority, "Economic Development," available at https://www.tva.com/economic-development. Indeed, TVA has a separate webpage entitled "Attract New Companies" expressly designed to bring more demand to TVA's service territory. See https://www.tva.com/economic-development/attract-new-companies. *See also* Tennessee Valley Authority, "Attract New Companies," available at https://www.tva.com/economic-development/attract-new-companies/target-industries.

[23] *See, e.g., Nat'l Wildlife Fed'n v. Nat'l Marine Fisheries Serv.*, 235 F. Supp. 2d 1143, 1154 (W.D. Wash. 2002) ("An agency may not reject a reasonable alternative because it is not within the jurisdiction of the lead agency").

DERs like rooftop solar.[24] In effect, TVA is catering to industries like data centers versus working families in the Valley who would greatly benefit from increased access to resilient, renewable energy.

Synapse Energy Economics' *TVA Clean Energy Future* study demonstrates that the agency can reliably meet energy needs in the Valley without fossil fuels and by transitioning to 100% clean, renewable energy by 2035.[25] The report shows that such a transition **would save customers in the region over $255 billion over the next two decades, reduce energy burdens, create thousands of new jobs annually, and improve public health with reduced air pollution**. Furthermore, the report points out, if TVA were to maximize distributed energy in the region, these costs savings could be greater with avoided costs for utility-scale solar and transmission.

In addition to cost savings, DERs bring several additional benefits including grid management and demand response., which are growing concerns for TVA especially in light of an influx of data centers.[26] TVA has expressed skepticism that alternatives prioritizing renewables like solar are capable of addressing peak demand. But a Vibrant Clean Energy report demonstrates that DERs can *minimize peak demand by about 17 percent* and effectively shift demand to meet variable supply rather than forcing supply to meet demand.[27]

The *TVA Clean Energy Future Study* similarly demonstrates that maximizing distributed energy and flexible load in the TVA region could help reduce demand in peak hours.[28] This is especially important considering increased grid stresses from extreme weather, such as during Winter Storm Elliot where demand soared yet conventional energy sources failed to deliver

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[24] Maggie Shober, "TVA Bait and Switch: Says local utilities can self-generate 5% of energy, then offers program that only allows 1-2%," Southern Alliance for Clean Energy, (April 28, 2020), https://www.cleanenergy.org/blog/tva-bait-and-switch-says-local-utilities-can-self-generate-5-of-energy-then-offers-program-that-only-allows-1-2/.

[25] The full Study is available at the following URL, and is incorporated here by reference: https://www.biologicaldiversity.org/programs/energy-justice/pdfs/TVAs-Clean-Energy-Future.pdf. The accompanying Policy Brief is available here: https://www.biologicaldiversity.org/programs/energy-justice/pdfs/TVA-Clean-Energy-Roadmap_Policy-Brief.pdf. We expect that any decision by TVA not to follow this Study's recommendations in connection with this project will address the entire Study, and detail the technical bases for any TVA disagreement with the Study's findings and recommendations.

[26] Armstrong et. al., "Techno–Ecological Synergies of Solar Energy for Global Sustainability," 2 Nature Sustainability 560 (July 2019); Crystal, et. al., Rooftop Solar Justice (2023), https://www.biologicaldiversity.org/programs/energy-justice/pdfs/Rooftop-Solar-Justice-Report-March-2023.pdf.

[27] Vibrant Clean Energy Technical Report (2020) at 48 (emphasis added).

[28] *See* TVA Clean Energy Future Study at https://www.biologicaldiversity.org/programs/energy-justice/pdfs/TVAs-Clean-Energy-Future.pdf.

reliable power. In effect, **DERs and especially flexible load could provide system-wide benefits by displacing the need for polluting and health hazardous fossil gas turbines**.

DERs also have a strong track record of withstanding the impacts of extreme weather events, keeping the lights on for families to meet critical needs. During Hurricane Irma, nearly 7 million Floridians lost power but those with rooftop solar and battery storage systems did not.[29] Even in Puerto Rico, where multiple hurricanes and storms have left much of the archipelago without power, households with rooftop solar and battery storage systems kept the lights on.[30] When Hurricane Beryl rammed through Houston knocking out the power grid for millions of people for weeks on end, households with rooftop solar and battery storage managed to keep the lights on and more importantly the air conditioning running just in time for a deadly heat wave.[31] Even more recently, rooftop solar systems with back-up battery storage played in a pivotal, and sometimes life-saving, role when floods took out critical power grid infrastructure.[32]

Lastly, distributed solar generation can provide additional benefits to communities and ecosystems including reduced water use, reduced land use, and even improved wildlife habitat, which are critically important to TVA's customers.[33]

In short, to meet its purpose of providing safe, clean, and affordable electricity to all its customers, TVA must consider a *full range of renewable energy alternatives*, including an alternative that completely relies on DERs and BESS, to meet new energy demand and build a truly resilient grid and communities.

* * *

[29] Lyndsey Gilpin, "After the Hurricane, Solar Kept Florida Homes and a City's Traffic Lights Running," Inside Climate News, (September 15, 2017), https://insideclimatenews.org/news/15092017/after-hurricane-irma-solar-florida-homes-power-gird-out-city-traffic-lights-running/.

[30] Mariah Espada, "Solar Power Is Helping Some Puerto Rico Homes Avoid Hurricane Fiona Blackouts," TIME, (September 20, 2022), https://time.com/6215138/solar-power-puerto-rico-hurricane-fiona/.

[31] Jeff Young, "Hurricane Beryl Hit His Home. Solar Power Kept His Lights On," Newsweek, (July 12, 2024), https://www.newsweek.com/hurricane-beryl-hit-his-home-solar-power-kept-his-lights-1924625. Jeff St. John, "Houston's post-Beryl outages highlight benefits of distributed energy," Canary Media, (July 18, 2024), https://www.canarymedia.com/articles/distributed-energy-resources/houstons-post-beryl-outages-highlight-benefits-of-distributed-energy.

[32] Jeff St. John, "Hurricane Helene underscores need for more solar-battery microgrids," Canary Media, (October 18, 2024), https://www.canarymedia.com/articles/distributed-energy-resources/hurricane-helene-underscores-need-for-more-solar-battery-microgrids.

[33] Techno-Ecological Synergies of Solar Energy for Global Sustainability (2019) at 563.

The impacts of the climate crisis and worsening energy injustice for the communities that TVA serves are concrete, palpable, and are projected to worsen — and will certainly do so should TVA fail to consider and pursue non-fossil fuel alternatives. TVA's inclusion of on-site modular fossil gas units in the Resilience 360 program is out of step with climate science, community demands, and the TVA Act. TVA has an opportunity to improve the quality of life of people in the region, and that starts with completing a PEA that examines DERs, and energy efficiency in addition to BESS instead of expanding fossil gas operations.

We look forward to seeing a Final PEA for the Resilience 360 program that fully addresses these concerns. In the meantime, please contact us should there be any further information we can provide.

Sincerely,

CENTER FOR BIOLOGICAL DIVERSITY

/s/ Gaby Sarri-Tobar
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From: Wufoo
To: nepa
Subject: Resilience 360° Program Draft PEA [#3]
Date: Wednesday, April 16, 2025 6:05:20 PM

This is an EXTERNAL EMAIL from outside TVA. THINK BEFORE you CLICK links or OPEN attachments. If suspicious, please click the "Report Phishing" button located on the Outlook Toolbar at the top of your screen.

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Please provide your comments by uploading a file or by entering them below. *	Please see attached comments.
Upload File #1	20250416_selc_et_al_comments_on_resilience_360_ea.pdf 5.36 MB • PDF

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April 16, 2025

Via TVA online portal and electronic mail to nepa@tva.gov

Carol Butler Freeman
NEPA Project Manager
400 West Summit Hill Drive
WT 11B
Knoxville, TN 37902

RE: Comments on Draft Programmatic Environmental Assessment for Resilience 360° Program

Dear Ms. Freeman:

Southern Environmental Law Center, Sierra Club, and Appalachian Voices (collectively, "Conservation Groups") submit these comments regarding the Tennessee Valley Authority's Draft Programmatic Environmental Assessment ("EA") for TVA's Resilience 360° Program. Distributed energy resources have the potential to improve grid resiliency and capacity, lower costs to ratepayers, and reduce pollution. Conservation Groups encourage TVA to consider an alternative program that relies on renewable energy and storage and to analyze the site-specific impacts of any proposed methane gas turbines.

I. TVA should consider and pursue an alternative based on renewable energy and storage.

To improve resilience without increasing pollution, TVA should consider an alternative program that pairs renewable energy with storage solutions. NEPA requires agencies to consider a "reasonable range of alternatives to the proposed agency action."[1] Yet TVA has not meaningfully considered a single alternative to its proposal. Instead, TVA proposes a single program design: allowing end-use customers to host methane gas turbines or battery storage systems.[2]

The programmatic EA itself acknowledges obvious alternatives, recognizing that the program "could be expanded to include other generation sources in the future (including but not limited to biofuels, solar, thermal storage, and advanced nuclear)."[3]

[1] 42 U.S.C. 4332(C)(iii).
[2] Draft EA at 2-1.
[3] Draft EA at 1-2.

Renewable solutions like wind and solar are available now to support system resilience.

TVA's 2019 IRP demonstrated that promoting DER helps TVA to provide electricity at the lowest system cost, as the "Promote DER" strategy was among the lowest-cost options despite numerous flawed assumptions that overestimated DER's costs.[4] However, the 2019 IRP did not analyze methane gas turbines as distributed energy resources. Instead, the 2019 IRP DER resources are "solar, storage, combined heat and power, energy efficiency, and demand response."[5] In the programmatic EA for the Resilience 360° Program, TVA states that it "would not consider generation resources that are inconsistent with its Integrated Resource Plan."[6] However, TVA fails to acknowledge that distributed methane gas turbines are inconsistent with the 2019 IRP. Accordingly, TVA does not have a reasonable basis to conclude that distributed gas turbines help TVA provide electricity at the lowest system cost.

Instead, TVA should consider an alternative design that better aligns with its definition of DER and the low-cost "Promote DER" strategy in the 2019 IRP. TVA's Board recently adopted a new strategic element to "accelerate the deployment of existing clean technologies, including solar, storage, energy efficiency, and demand response."[7] A redesigned Resilience 360° Program can do just that. By allowing TVA and its partners to co-locate renewable generation sources and storage solutions on or adjacent to existing industrial sites, TVA can bring on clean energy quickly, benefiting TVA, the energy hosts, and all TVA ratepayers.

As a 2024 Energy Innovation report found, "energy parks" that combine renewables with storage provide cost-effective flexibility that is "essential to an affordable, reliable, clean electricity system."[8] Clean energy parks are "compelling for large customers due to the cost advantages of sourcing electricity directly from the cheapest, cleanest sources due to the challenges of connecting large capacities to the existing grid. Energy parks also provide new pathways to achieving the increases in clean electricity generation needed to achieve climate goals, including TVA's goal to achieve net-zero emissions by 2050.[9]

---

[4] The 2019 IRP underestimated the cost effectiveness of the Promote DER strategy by, among other errors, mischaracterizing DER participant costs and overestimating capital costs of DER. *See* SELC 2019 comments.
[5] *See* 2019 IRP at 7-12 ("Promote DER focuses on increasing the pace of DER adoption by incenting distributed solar and storage, combined heat and power, energy efficiency and demand response.").
[6] Draft Programmatic EA at 1-2.
[7] Att. 1, TVA Board Resolution, TVA Strategic Elements (approved August 22, 2024), *available* at https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/about-tva/board-of-directors/august-22--2024/resolutions/strategic-elements.pdf?sfvrsn=58997419_1.
[8] Att. 2, Energy Innovation, Energy Parks: A New Strategy to Meet Rising Electricity Demand (Dec. 2024).
[9] Att. 3, TVA, 2023 EEI ESG/Sustainability Report, 3 (Sept. 2024) ("TVA . . . aspires to achieve net-zero emissions by 2050"), *available at* https://s25.q4cdn.com/191816265/files/doc_downloads/2024/09/2024-eei-esg-report_final.pdf.

To maximize these benefits and avoid the unnecessary pollution of methane gas, Conservation Groups encourage TVA to consider an alternative Resilience 360° Program design that relies on renewable energy and storage solutions, as outlined in the Energy Innovation report hereby incorporated.

II. TVA must analyze site-specific pollution from methane gas plants.

The Draft Programmatic EA relies heavily on a "bounding" analysis to consider environmental effects based on "general siting and environmental criteria" across the region TVA serves.[10] Based on that bounding analysis, TVA concludes that the Resilience 360° Program would result in only minor impacts to air quality, climate change, water resources, and public health. TVA does not conduct any analysis to determine whether the program may adversely and disproportionately impact site-adjacent communities that are already overburdened by pollution.

TVA must analyze the site-specific impacts of any Resilience 360° project that uses methane gas. The Draft Programmatic EA does not disclose localized impacts to air quality, water resources, or other impacts relevant to site-adjacent communities. TVA states that "[d]irect impacts to regulated water resources would be avoided by project design,"[11] without disclosing whether the methane gas turbines would use cooling water and, if so, how much. Accordingly, TVA does not disclose enough information for the public to understand the potential impacts to local surface water and groundwater resources.

TVA acknowledges that the proposed methane gas turbines emit CO, CO_2, NOx, SO_2, hazardous air pollutants, and volatile organic compounds.[12] TVA concludes that these emissions "would result in minor impacts," without analyzing key information, including *how much* pollution the methane gas turbines would emit, *how many* there might be, or *where* they would be. TVA states that "the geographic separation between sites would minimize the project's contribution to regional air quality conditions,"[13] but TVA does not provide a basis for that key assumption. Large energy users—potential hosts of Resilience 360° projects—often concentrate into industrialized areas. That concentration can produce air toxics hotspots like Southwest Memphis, which hosts 17 toxic release inventory facilities and suffers from a cancer risk four times the national average. TVA must analyze potential impacts to communities like Southwest Memphis, where a low-wealth, majority Black community has already borne a disproportionate burden of environmental pollution.

[10] Draft Programmatic EA at 1-2–1-3.
[11] Draft Programmatic EA at 3-13.
[12] Draft Programmatic EA at 3-41.
[13] Draft Programmatic EA at 3-42.

TVA has not satisfied its NEPA obligations to consider inherently site-specific impacts of air pollution, water resources, and community health impacts. TVA's "bounding analysis,"[14] combined with its failure to consider a single alternative to its proposed action, obscures the impacts of the proposed methane gas turbines. TVA must analyze these site-specific impacts for any Resilience 360° project that uses methane gas turbines.

Sincerely,

/s/ *Trey Bussey*

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[14] *Oak Ridge Environmental Peace Alliance*, 412 F. Supp. 3d 786, 856 (E.D. Tenn. 2019) ("The concern presented by a bounding analysis is that by using it, the agency may obscure differences in impacts among alternatives. And that is exactly what happened here.").

PROPOSED BOARD RESOLUTION
(TVA Strategic Elements)

WHEREAS, TVA's integrated planning process consists of periodically reassessing its strategic direction in line with its core mission of service, as outline in the TVA Act;

WHEREAS, pursuant to that process, TVA develops and Strategic Priorities and Strategic Elements, which are designed to ensure alignment between TVA's strategic objectives and operational activities;

WHEREAS, beginning in April, 2024, TVA management reviewed its Strategic Priorities and Strategic Elements with the five committees of the TVA Board, seeking input from each Committee on proposed changes to the Strategic Elements based on each Committee's jurisdiction over specific strategic focus areas;

WHEREAS, Committee members provided feedback to TVA management on proposed changes to TVA's Strategic Elements to further refine TVA's strategic direction;

WHEREAS, Attachment 1 to this resolution is a copy of TVA's Strategic Elements, grouped within each of the corresponding Strategic Priorities, which incorporates feedback management has received from the Committees;

WHEREAS, the Board finds that the Strategic Elements will help ensure alignment for TVA as it establishes new operational priorities, as they will serve to inform TVA's actions over the coming years, including the metrics and goals TVA will use to establish performance measures for TVA employees;

BE IT RESOLVED, That the Board of Directors hereby approves the Strategic Elements included in Attachment 1 to this resolution.

Approved by TVA Board of Directors

August 22, 2024

ECM

ASSISTANT SECRETARY

Attachment 1

Strategic Elements

People Advantage

Foster a culture that embraces, adapts quickly to, and anticipates changes needed for TVA to excel in the future public power utility marketplace

Support inclusion with diversity efforts to attract and retain the best talent for TVA

Deliver an efficient and agile HR service model that enables enterprise effectiveness

Develop the next generation of TVA leaders

Operational Excellence

Nation's top nuclear fleet by 2025

Achieve leading operational performance by managing the generation fleet based on the mission of each asset

- Gas and hydro to top quartile
- Coal fleet based on end of life

Increase generation and transmission capacity while fostering excellence in project management and construction

Advance TVA's grid capabilities to increase flexibility for future additions and to meet the reliability and resiliency needs of the future

Accelerate the deployment of existing clean technologies including solar, storage, energy efficiency, and demand response

Financial Strength

Maintain financial health while funding TVA's energy transition

Ensure sufficient revenues to meet financial commitments (revenue requirements)

Evolve the public power model while incorporating Valley Vision 2035

Powerful Partnerships

Build partnerships and community connections to enable solutions

Champion the public power model through the region's energy expansion

Align with our customers and economic development agencies to target industries that are critical to the Valley's long-term success

Responsibly foster excellence in natural resource management and environmental stewardship as we transition to the energy system of the future

Igniting Innovation

Advance energy transformation in the Valley through leveraging technology and innovation in all our work

Refine innovation framework to align with TVA's strategic intent

Support the development of new technologies to further accelerate decarbonization and prepare to deploy commercially viable technologies

TVA TENNESSEE VALLEY AUTHORITY



ENERGY PARKS

A New Strategy to Meet Rising Electricity Demand

Eric Gimon[a], Mark Ahlstrom[b], and Mike O'Boyle[a]

December 2024

[a] Energy Innovation Policy & Technology LLC, [b] Energy Systems Integration Group

Photo Credit: NextEra Energy Resources

EXECUTIVE SUMMARY

On December 15th of 2023 at a public meeting in Gray County, Texas, the clean energy company, Intersect Power, presented an innovative new billion-dollar project to produce hydrogen from clean electricity in this wind- and solar-rich region[i] The Meitner project would leverage long-term tax incentives from the 2022 Inflation Reduction Act (IRA) to feed 400 Megawatts (MW) of electrolyzers (capable of producing almost a half-ton of hydrogen per day) with 460 MW of on-site wind and 340 megawatts of on-site solar renewable electricity, creating 750 construction jobs and 15 permanent jobs along with significant annual tax revenues.

This single project shows the impact of both cheap renewables and federal clean energy support, while serving as a promising example for how large electricity consumers across the country could leverage similar benefits—speed, direct access, shared infrastructure, and credit for clean energy—in an "energy park."

Energy park projects like the Meitner project have common features defined in this paper. They can integrate multiple renewable energy sources, storage solutions like batteries, and potentially co-located electricity consumers such as manufacturing facilities or data centers, all connected to the grid at a single point.

As wind and solar power costs continue falling alongside cost declines in battery energy storage systems, these clean energy resources are attracting retail customers and wholesale loads that are willing to assume additional costs, risks and responsibilities that have traditionally been addressed by existing markets and utilities in return for getting faster and cheaper access to clean energy. For large consumers (especially flexible consumers), energy parks remove barriers to efficiently accessing the low-cost power they need and the clean energy they demand.

Along with defining energy parks and sharing real-world applications, this paper explores the potential for energy parks to be coordinated with the grid itself, providing benefits to energy park economics and all electricity customers as the energy transition accelerates.

Energy parks provide faster access to clean energy for power consumers, but if they fully defect from the grid, they leave significant benefits on the table. For example, a wind-solar-hydrogen project without any grid connection will sometimes curtail energy generation that could otherwise flow onto the grid to meet other demands, and a flexible load could ramp down to provide more power to the grid in response to grid needs. An isolated project may make economic sense on its own but could be even more valuable and less risky to potential financiers if it were interconnected with the grid.

But integrating energy parks with the grid of today will require changes to markets including rules for how resources participate in those markets. Today, the grid in the United States functions under a traditional operating paradigm that centralizes control and dispatch of generators as a response to load. This approach evolved naturally from the days of having a few large generators (coal, hydro, nuclear, etc.), but the usefulness of this paradigm is evaporating as wind, solar, demand flexibility, and storage become the lowest-cost resources in a low-carbon future. While renewable resources are variable and storage is energy-limited, they are also digitally controllable and can respond to grid needs more quickly and

accurately than existing generators. New market rules can encourage and fairly value these benefits, while explicitly determining which services can complement them. Properly integrated into electricity markets, energy parks can become even more versatile and flexible resources that can provide a wide range of services benefitting the grid.

Far from a hypothetical concept, energy parks are informed by existing hybrid projects, and increasingly complex energy parks are cropping up in the U.S. today. For instance, solar power plants increase their inverter-loading ratios to provide additional energy and grid services to the grid, and renewable-storage hybrids expanded upon this by adding dedicated storage behind a single point of interconnection (POI). Even more complex arrangements are now emerging, including multiple utility-scale resources bundled together, energy parks with thermal storage, and hydrogen energy parks.

These examples suggest that even more variety and potential are rapidly emerging. Energy parks are modular—able to add elements like additional storage, load, and generation behind a single POI to optimize for the needs of both the on-site load and the grid. Energy parks with on-site loads can achieve multiple benefits, building on what hybrid resources already have proven:

- Larger equipment savings: Directly connecting load and generation to the same grid interface, such as sharing the same single-directional or bi-directional high-voltage transformer, can significantly reduce equipment costs.
- Leveraging tax credits, green product certification, and local economic development benefits: Investors and local governments eager to secure government incentives for clean energy and clean manufacturing could combine supply- and demand-side projects to improve project viability and boost local economies.
- Modularity: allowing for adding different components to the energy park as market and project needs evolve.

The flexibility that energy parks provide is essential to an affordable, reliable, clean electricity system. This paper details the policies that can help lay the foundation for an electricity system that encourages and fairly values energy parks that co-locate load, variable renewables, storage technologies, and whatever comes next.

We're on the precipice of a huge clean energy economic opportunity that policymakers and utilities can seize by opening their regulatory and legislative forums to energy parks and the stakeholders eager to invest in their states and communities.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

Executive Summary 2

Acknowledgements 4

Table of Contents 5

Introduction 7

What Is an Energy Park? 8

The Historical Evolutionary Path for Energy Parks to Date 9

- Opportunity ONE: OverGeneration (Benefit 1) 10
- Opportunity TWO: Solar-plus-Storage Hybrids (Benefits 1-4) 11
- Opportunity THREE: Maximizing Hybrid Resources (Benefits 1-5) 13

Taking The Next Step: Adding Co-Located Loads to an Energy Park 14

- Opportunity FOUR: Maximizing Local Energy Use and Electricity Export Value in Energy Parks 16
- Opportunity FIVE: Convert Electricity into a Tradeable Commodity with Credible Clean Sourcing 17
- Opportunity SIX: Faster to market 19

Energy Park Policy Stakes and Challenges 21

- Rules of the Road for Connecting to the Grid 22
- Market Participation Challenges for Energy Parks 23
- Challenges to Energy ParkS from Monopolies for Distribution and Retail Sales of Electricity 24

Policy Solutions 24

- Engage with Technical Bodies Early and Persistently 24
- Fostering a New Paradigm 26
- New State Legal Frameworks 27
- Stakeholder Engagement 28

Conclusion 29

Appendix 1: Energy Parks and the Bulk Power System 30

- Energy Park Connection Types on a Spectrum 30
- Interconnection Challenges for Energy Parks 31
- Market Participation Models 33
- Market Manipulation Concerns 34
- Energy Import Rules for Load-Generation Hybrids 35
- A Paradigm Shift: Energy Parks as “Digital Resources” 37

Challenges to Energy ParkS from Monopolies for Distribution and Retail Sales of Electricity 39
Appendix 2: Historical Examples of Energy Parks 41
Example 1: Solar Star 41
Example 2: California Solar Battery Hybrids 42
Example 3: The Wheatridge Hybrid Renewable Energy Facility 44
Appendix 3: Example Future Directions for Energy Parks 45
Example 4: Industrial Thermal Battery 45
Example 5: Electrolysis of Hydrogen from Water 49
Appendix 4: General Considerations Relating to Energy Parks 53
Price choice 54
Quantity choice 54
Capital investment choice 55
References 57

INTRODUCTION

In recent decades, significant cost reductions in wind and solar energy, coupled with decreases in the costs of enabling technologies like lithium-ion batteries, have positioned renewable energy as a front-runner in the U.S. energy market.

The "2035" series of reports by the University of California, Berkeley, GridLab, and Energy Innovation illustrates how integrating affordable wind and solar projects alongside storage solutions can help the U.S. achieve 90 percent clean energy levels by 2035 at costs comparable to today's electricity prices.[1] The IRA also included at least 10 years of tax credits for these clean energy technologies, increasing expectations of rapid growth.[ii] Renewables currently represent most new planned energy capacity in the U.S., with wind, solar, and batteries accounting for 93 percent of planned additions for 2024,[2] prompting a significant shift in energy planning and interconnection processes.

As expected,[3] cost-competitive renewables are already being built at an increasing clip. However, massive amounts of renewables must be deployed (while ensuring reliability and affordability) to capitalize on the opportunity they offer to cut costs and emissions by electrifying vehicles, buildings, and industry. But challenges like siting, interconnection, transmission, and integration into grid operations are major barriers that are slowing deployment. Insufficient transmission and distribution capacity for interconnecting new renewables is particularly challenging, as it limits where additional renewable projects can interconnect and leads to more costly case-by-case transmission and distribution upgrades.

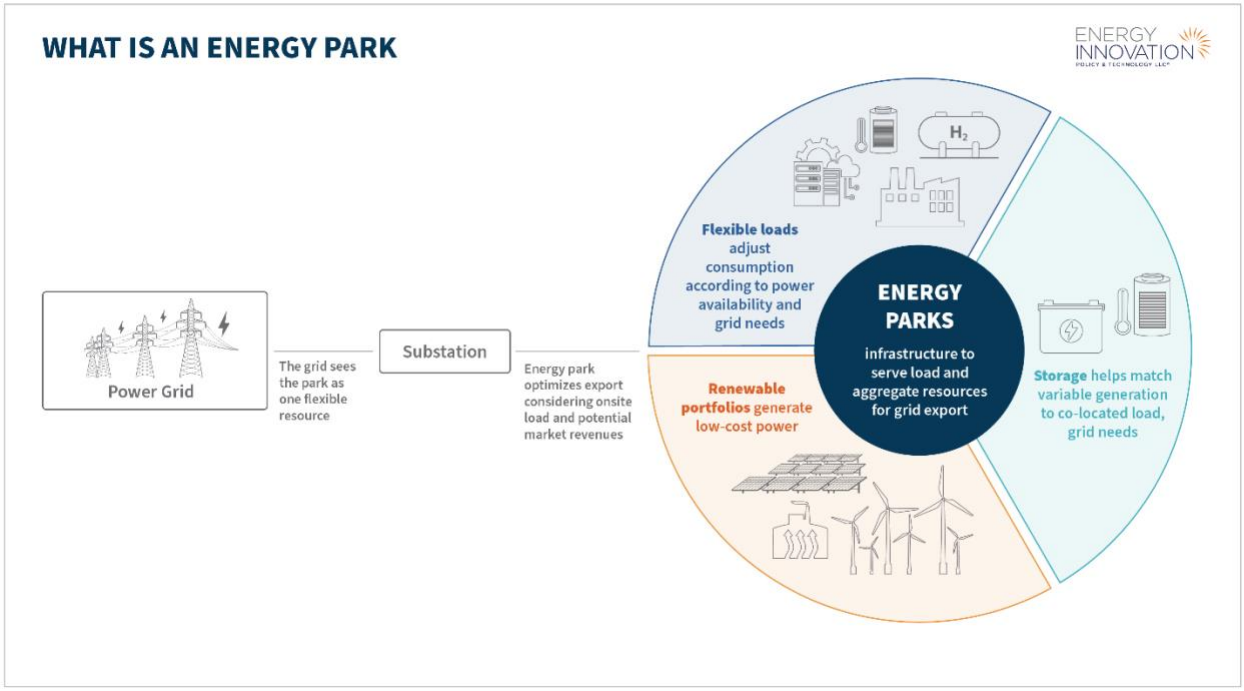
Energy parks could overcome these challenges. With the right guardrails and market rules, energy parks could significantly reduce electricity delivery costs for large, co-located commercial and industrial consumers. In a world where this optimization thrives, large consumers, grid customers, and the climate all benefit from a faster, reliable transition to clean electricity.

While energy parks are gaining momentum, they face numerous regulatory hurdles that impede their development and connection to the grid. This paper aims to define energy parks, provide case studies, explain their commercial and societal benefits, and discuss the non-technical barriers they encounter. We also provide recommendations for policymakers to foster a supportive regulatory environment for energy parks, emphasizing the broader benefits of accelerating their development.

[1] See generally 2035report.com, which contains each of the technical and policy reports from the series.
[2] See U.S. Energy Information Administration 860M 2024 data at https://www.eia.gov/electricity/data/eia860m/.
[3] The latest cost numbers show that wind and solar are more competitive than other power generation options on a levelized cost basis: https://www.lazard.com/research-insights/levelized-cost-of-energyplus/.

WHAT IS AN ENERGY PARK?

Figure 1. Energy Park



An energy park combines generation assets, complementary resources like storage, and connected customers (co-located loads). Energy parks can feed electricity and grid reliability services to the bulk power grid while maintaining a degree of self-sufficiency to provide crucial support for co-located loads. Essentially, an energy park is a large-scale microgrid.[4]

Energy parks with co-located loads are particularly compelling for large customers due to the cost advantages of sourcing electricity directly from the cheapest, cleanest sources and due to the challenges of connecting large capacities to the existing grid. Energy parks also provide new pathways to achieving the massive increases in clean electricity generation needed to achieve U.S. climate goals, including the target of halving economy-wide emissions by 2030.

Energy parks can connect to clean energy resources and the grid in a variety of ways. They could in theory be fully isolated from the grid, an outcome that leaves significant grid benefits and project economics on the table. They could export power to the grid without importing it. An export-only energy park would meet all its internal load with co-located generation and storage resources, then export at will to the grid as a flexible generator. Flexible arrangements, where the energy park sometimes draws from the grid to meet its own demand, are also possible. The body of this paper describes these arrangements at a very high level, and the appendices delve into more detail.

The widespread availability of very cheap, geographically concentrated, variable renewable resources along with the modularity and falling cost of storage technologies have made

[4] For clarity, we distinguish energy parks connected to the grid at the transmission level from smaller microgrids connected on the distribution network, but the distinction is somewhat academic. Others refer to energy parks where loads bring their own generation as microgrids. See, for example, https://www.aei.org/articles/data-center-electricity-use-v-implications/.

energy parks a viable concept that complements the grid and its economies of scale. In regions with high quality renewable resources, enterprising large consumers find portfolios of renewables and storage that provide consistent power economically competitive with grid power. New inflexible loads like data centers[5] looking to connect as fast as possible to new clean generation resources would have to be willing to incur some extra premium associated with serving all of their electricity consumption locally, while other new industrial-scale flexible loads associated with the energy transition such as hydrogen electrolysis, fleet EV charging, and thermal batteries will have an easier time than baseload demand in matching local supply directly.

Energy parks also benefit from the convergence of declining busbar costs[6] of renewable resources with rising grid access and interconnection fees.[7] This cost dynamic makes co-located load-generation projects increasingly attractive. By integrating generation and load at a single connection point to the high-voltage grid, energy parks can streamline transactions and provide unique grid services that would be harder to sustain on an individual basis. They can provide services that help stabilize and balance the power grid, such as quickly adjusting to changes in supply and demand.[8]

The combination of generation and load simplifies transactions and optimizes the use of shared resources such as inverters, power electronics, controls, and personnel. Furthermore, shared equipment and reduced transmission needs also implies reduced land-use needs, which means less money spent buying or leasing land and less time dedicated to siting and permitting. Co-location not only reduces overhead costs but also strengthens the business case for energy parks.

Far from being an isolated solution, energy parks are essential for providing clean, efficient, and locally optimized energy services. They can play a crucial role in the rapid electrification and renewable resource build-out needed to meet economic and climate goals, accelerating the transition to a sustainable energy future.

THE HISTORICAL EVOLUTIONARY PATH FOR ENERGY PARKS TO DATE

Combining generation and storage to reduce costs and increase flexibility is not a new idea. It has already flourished in some distinct cases where market opportunities aligned with consumers' and investors' bottom lines. The impetus can come from the generation side when a developer is looking for ways to increase margins to sell a differentiated product and get to market faster. It can also come from the load side, when the developer of a new industrial or commercial project with heavy electrical usage wants to find a faster, cheaper

[5] Data centers currently are characterized as inflexible but could become flexible with the right incentives and innovative practices as these large energy consumers evolve and become more sophisticated.
[6] "Busbar cost" represents the cost of generating electricity at the power plant before it is sent to the grid. It does not include transmission and distribution costs or balancing and integration costs. For data on falling busbar and system integration costs, see, for example, https://www.nrel.gov/solar/market-research-analysis/solar-installed-system-cost.html.
[7] See https://emp.lbl.gov/interconnection_costs.
[8] Examples of grid services are energy shifting (sometime over multiple days, weeks, or years), reactive power, regulation (grid balancing of shorter periods), rapid frequency response, and short-circuit strength.

way to meet its energy needs, to directly show that it is using carbon-free energy, or to reduce its energy costs through subsidies on carbon-free energy.

Historically, there have been five broad categories of benefits from building energy parks that go beyond simply building one type of resource and connecting it:

1. *Equipment savings*: Savings from sharing equipment or reducing the need for equipment.
2. *Tax savings*: More tax credits available, avoided loss of credits from wasted generation.
3. *Storage*: The ability to store excess energy beyond what the grid connection or local inverters can accept to be sold later. This also includes some opportunistic purchases from the grid.
4. *Synergies*: Savings on development time and grid access charges by sharing a common POI for different types of resources.
5. *New abilities*: Increasing the flexibility/dispatchability of the hybrid resource to better align production with grid value and offer grid services beyond just energy (ancillary services, capacity, etc.).

Developing energy parks must be a gradual process because developers need to raise significant capital, and financiers are often cautious about new project models. The evolution of this concept is driven by the need to maximize financial returns and fulfill contractual obligations by learning how to plan and operate new equipment configurations while balancing different sources of capital costs. Each new project uncovers new ways to increase efficiency, reduce costs, and provide additional value to the grid. Once completed, these successful examples provide a foundation to understand energy parks' potential today, and they can become an even bigger part of a cost-effective, low-carbon energy system in the future.

Below, we outline three key stages in this evolution, framing each around an opportunity, an example, and an insight. More detailed information for each example can be found in Appendix 2.

OPPORTUNITY ONE: OVERGENERATION (BENEFIT 1)

Overgeneration occurs when the generation resources behind a POI to the bulk power system exceed the equipment's ability to export power, or when operational or administrative constraints require a reduction in output. While this might seem wasteful for a zero marginal cost resource like wind and solar, it can sometimes be justified by cost savings elsewhere. Solar farms are a clear example of this trade-off, where generating more power than can be immediately used maximizes the return on investment, even with occasional energy losses.

In the solar industry, projects often increase what's known as the inverter loading ratio (ILR). This refers to the ratio of the solar panels' DC capacity to the AC capacity of the inverters that convert energy for the grid. According to Lawrence Berkeley National Laboratory, the average ILR for new solar-only projects has increased from 1.2 in 2010 to more than 1.3 in 2017, where it has remained steady. The rationale behind this increase is that a small amount of energy loss during peak generation—known as clipping—is outweighed by the cost savings leveraged from the increased use of AC equipment during non-peak periods.

Example One: Solar Star

To illustrate how overgeneration can be economically viable, consider Solar Star, one of the country's largest solar farms. It has a 776 MW_{DC} capacity and a 585 MW_{AC} grid connection, yielding an ILR of 1.32.

While approximately 1 percent of energy is lost to clipping, this is offset by lower AC equipment costs and more efficient inverter usage during non-peak periods. Historical price analysis shows that the revenue loss from clipping balances is compensated for with savings from avoiding 200 MW of additional AC conversion costs, confirming the viability of an ILR around 1.32.

Insight One: Decoupling. Decoupling refers to situations when what a grid operator sees at the POI is not the predictable result of what generation hardware sits behind that point. In the example above, whatever the solar panels generate goes straight onto the grid most of time, minus some losses along the way. But at or near peak output, some of that electricity gets clipped and doesn't reach the bulk power system. Without knowing the ILR, the grid operator cannot anticipate or predict the exact output of the solar farm based on local insolation.

In this example, what we see is just the green shoots of decoupling. Presumably when the solar farm gets interconnected, ILR is part of the information the developer provides so that the grid operator is not blind to the effect of clipping. Under normal conditions, there is no "internal operator" making choices on a moment-by-moment basis about how much power will flow through to the grid. But we would argue that the adoption of high ILR pushed developers to start considering the separation between the electric output seen by the grid at a project's interface with the bulk power grid from the exact electric generation available behind this interface. In this shift of thinking, the equipment taking the raw DC output and feeding it to the bulk AC power grid (inverters, transformers, etc.) goes from a simple conversion step to being a bridge keeper. Further evolution of the energy park concept with batteries and flexible co-located loads means the bridge-keeping function involves fixed equipment choices as well as real-time decisions about how much power to feed to a co-located load or take in or out of a battery inside the park.

OPPORTUNITY TWO: SOLAR-PLUS-STORAGE HYBRIDS (BENEFITS 1-4)

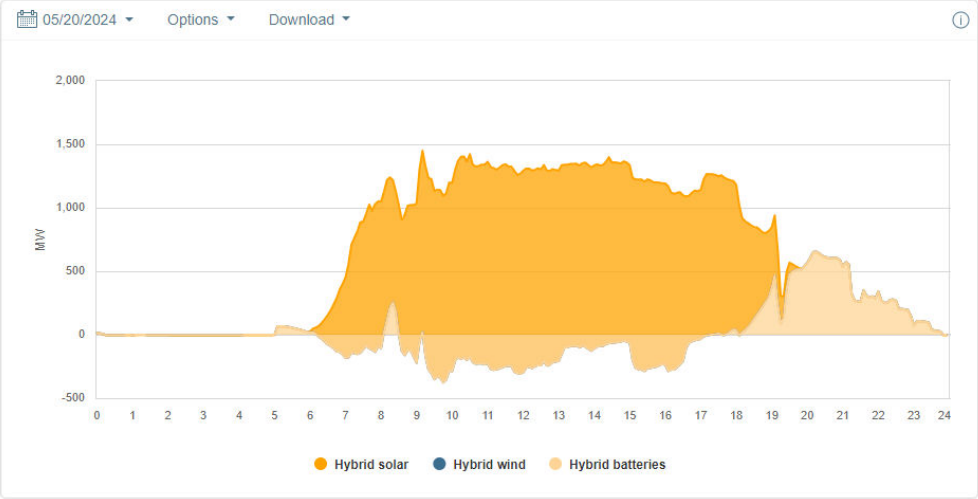
In the mid-2010s, as battery costs dropped, solar-plus-storage hybrids emerged as a key innovation in energy parks. These systems extended the benefits of overgeneration by storing excess energy instead of simply clipping it, allowing that energy to be used later when the AC equipment isn't fully utilized or when market prices justify shifting generation. This further leveraged capital savings from shared infrastructure. While batteries involve significant up-front costs, they provide additional financial advantages by time-shifting energy to periods of higher market value or selling it as firm capacity to utilities. These advantages, available in both stand-alone storage and hybrid systems, were particularly lucrative in hybrid configurations due to the 30 percent federal tax credit offered for solar-charged batteries. These tax rules helped seed the early solar-plus-storage hybrid projects, yet despite the introduction of the stand-alone storage tax credit through the IRA, interest in hybrids remains strong because of their ability to share equipment (reducing capital costs)

while controlling and optimizing solar energy output. Solar-plus-storage hybrids are especially attractive in mature markets like California and Texas.

Example Two: California's Solar-Plus-Storage Hybrid Fleet

Solar-plus-storage hybrids are an especially attractive form of energy park in solar-heavy markets like California, where they also qualify for resource adequacy payments from electricity buyers. More than 98 percent of the solar capacity proposed in the California Independent System Operator (CAISO) footprint is hybrid.[iii]

Figure 2. Combined output of solar + battery hybrids on CAISO system on May 20, 2024 (5-minute resolution)



Source: CAISO, 2024

The operational advantages of these systems are clearly demonstrated in the aggregate effect of solar-plus-storage hybrids in California.

Figure 2 shows the real-time dispatch of the CAISO hybrid fleet on May 20, 2024, with batteries dynamically responding to grid signals. This fleet adjusts its output throughout the day, smoothing solar generation, extending energy delivery into the evening, and actively adapting to grid conditions. This flexibility not only supports grid reliability but also enables the hybrids to provide firm energy and capacity when solar alone would fall short.

Insight Two: Beyond Time-Shifting

While the main advantage of solar battery hybrids is their ability to store excess solar generation and time-shift output to periods of higher demand, their potential goes beyond this. Hybrids can capitalize on additional revenue streams by providing ancillary services, adjusting output to real-time price signals, and responding to local and regional grid conditions. This makes hybrids more valuable participants in the energy market, capable of earning revenues from both traditional energy delivery and flexible grid services.

With their new dispatchability, solar-plus-storage hybrids catalyzed new perspectives on what grid participation models should look like for modern generators. A report from the Energy Systems Integration Group (ESIG) task force titled *Hybrid Power Plants – Flexible Resources to Simplify Markets and Support Grid Operations*[iv] suggested that future deployment of energy resources on the electric power system would increasingly take a

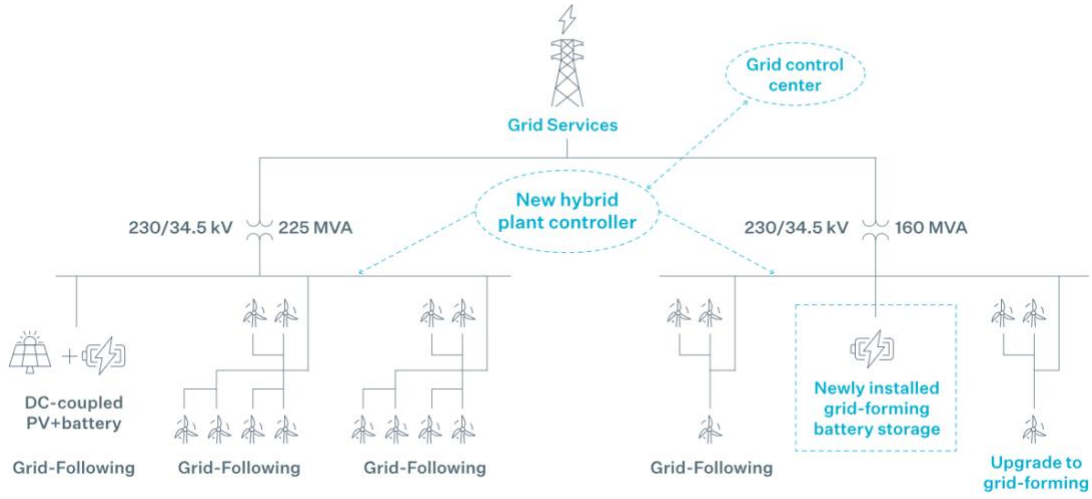
more general form that the task force called “hybrid resources,” essentially an energy park (although at the time co-located loads in these energy parks were not yet on the horizon).

OPPORTUNITY THREE: MAXIMIZING HYBRID RESOURCES (BENEFITS 1-5)

As solar-plus-storage hybrids advanced energy park design, developers recognized the potential to diversify resources and further enhance flexibility. By combining multiple types of generation and storage behind a single POI, energy parks could increase their ability to match production with grid needs, offer a range of services such as ancillary support and capacity, and become more dispatchable like traditional power plants.

Example Three: The Wheatridge Hybrid Renewable Energy Facility

Figure 3. Wheatridge Hybrid Renewable Energy Facility



Source: Portland General Electric

The Wheatridge facility in Oregon is a pioneering example of a hybrid energy park, combining 200 MW of wind, 50 MW of solar, and a 30 MW, four-hour battery. While it already delivers multiple types of generation and storage through a single POI, planned upgrades will develop it further by adding advanced controls and grid-forming inverters. These enhancements are supported by a $4.5 million grant from the U.S. Department of Energy’s (DOE) Solar Energy Technology Office and underscore the cutting-edge nature of the project. By de-risking these technologies, the DOE is helping push the boundaries of what hybrid energy parks can offer in terms of grid flexibility, capacity, and ancillary services, marking Wheatridge as a key step in the future evolution of energy parks.

These upgrades will equip the facility to provide new grid services, and future versions could further enhance this by incorporating co-located loads and islanding capabilities.

Insight Three: Gradually and Flexibly Replacing Traditional Firm Generation

The Wheatridge facility shows how energy parks can evolve into cleaner, more flexible alternatives to traditional power plants, offering the dispatchability needed to support grid reliability without relying on fossil fuels. While no single generation facility is immune to

drops in output, the range of services that energy parks like Wheatridge can provide is impressive. Even more impressive is the ability to upgrade these facilities by adding new components, such as additional storage and grid-forming inverters, which allows them to better support the grid both locally—through voltage support and system stability—and across the broader network.

The modularity and ability to upgrade energy parks is a key advantage of their concept. Wheatridge lays the foundation for continually improving energy parks, allowing them to adapt over time and better serve grid needs. This flexibility enables developers to prioritize specific services, but utilities and system operators must provide the right incentives to encourage upgrades and ensure energy parks deliver the services the grid requires.

Although some traditional power plants could theoretically invest in new capabilities to provide a wider range of grid services, their high operational costs and dirty emissions make such upgrades less practical. By contrast, energy parks—unburdened by these legacy constraints—can evolve to offer a more diverse and tailored range of services over time.

Looking ahead, the modular design of energy parks prepares them for the next stage of development, including integrating co-located loads. This step will further enhance the value of energy parks by optimizing resource use and creating new opportunities for grid support.

The current state: To summarize so far, renewable projects are trending toward hybridization where developers assume the risk of more complex projects to take better advantage of scarce grid connectivity and better serve their customers.

TAKING THE NEXT STEP: ADDING CO-LOCATED LOADS TO AN ENERGY PARK

Historical examples reveal that the economics of hybrid and controllable energy portfolios behind a single POI are already promising and will continue to grow. Despite energy parks' potential societal benefits, such as helping decarbonize dirty industries or manage grids with high levels of renewable energy, they will only be developed if they provide sufficient private benefits for the investors who finance them. Developing variable energy projects is difficult as it is—and will be even more so when energy park configurations increase in complexity and involve many different technologies. Further development of more complex projects is not a foregone conclusion; these projects must offer significant financial advantages for any developer to bother and for investors to take on the risk of a new development model.

Adding a customer for electricity (co-located load) onto the internal network of a hybrid resource is a big new step in the evolution of energy parks. Adding load to a hybrid energy park that was previously dedicated to generation for export increases complexity even more than adding storage to a simple solar or wind project. This is distinct from an industrial-scale behind-the-meter or combined heat and power project, where large consumers' primary energy source is the grid, and the on-site resource offsets some demand.[9] Pairing load and generation behind a single point of grid interconnection is an emerging trend mostly driven

[9] Combined heat and power systems are typically sized based on the thermal energy needs of the local facility, since the primary benefit of these systems comes from using the waste heat. Often, the electrical output of the system is smaller than the facility's total electricity needs, meaning it might supplement but not fully replace grid power.

by corporate demand for clean electricity, difficulty accessing deliverable clean energy at scale, new classes of flexible consumers, and the cost advantages of getting clean electricity straight from the source. These expanded energy parks extend the five categories of benefits listed in the previous section:

1. *More savings on equipment*: Directly connecting load and generation to the same grid interface, such as sharing the same single-directional or bi-directional high-voltage transformer, leads to significant equipment cost savings.
2. *Further tax credits, green premiums, and local economic development benefits*: Investors and local governments eager to take advantage of the new government support for clean energy and clean manufacturing could combine supply- and demand-side projects to improve project viability and boost local economies.
3. *Reduced losses*: Directly connecting load and generation to the same local bus avoids the need for electricity to flow through high-voltage transformers and over long-distance transmission and can save an estimated 2-5 percent in transmission and distribution losses.[10]
4. *Power-to-X technologies:* Beyond the ability to use electrical storage, the ability to store electricity from variable renewable generation in alternate energy carriers (e.g., hydrogen or heat) that can be used on-site by the co-located load opens whole new possibilities for project configurations and grid value.
5. *Directly monetizing load flexibility*: The energy park operator can co-optimize on-site storage with load flexibility for maximum financial advantage without having to participate in any outside party's load-management program.

Co-locating customer loads adds another possible benefit type:

6. *Faster to market*: Bypassing the bulk power system to directly serve local loads can potentially accelerate the "time to power" for serving the local load when bulk power supply and delivery are limited, and it may take years for new generation to interconnect and transmission to be built. The lost opportunity cost of expensive investments, such as modern data centers, sitting idle for lack of power outweighs any extra costs of local generation and storage.

The complexity of these energy parks with loads is significantly higher than traditional generation-focused energy parks due to the need to serve the grid and the co-located load. Previously, hybrid resources only served one purpose: selling electricity and other power-provision-related ancillary services to the grid. Once co-located loads are included, the operator must decide how to allocate electricity between the grid and the co-located load, simultaneously considering various storage options within the energy park.

Beyond the operational complexity, energy park developers must make several critical decisions. These include determining the output power of the generation assets relative to the input power required by the co-located load, deciding on the size and type of the grid interface (e.g., whether it should be export-only or bi-directional) and therefore the terms of interconnection study and interconnection agreement, and selecting the appropriate types and sizes of internal electrical connections and storage options. Energy parks are inherently flexible in their configurations—they can add or remove elements (e.g., extra hours of

[10] National U.S. Energy Information Administration data for all transmission and distribution losses is around 5 percent, but some of these may occur on lower-voltage equipment that would not be relevant for larger loads.

storage) after the project is operational and should be encouraged to make such enhancements to their capabilities and performance in response to changing conditions (subject to grid rules and permissions).

Unlike the previous stages of energy park evolution, which followed a relatively linear path of increasing complexity from simple renewable generation to storage hybrids, the future of energy parks will be defined by a diverse range of possible configurations. These configurations don't just vary in technological complexity but rather reflect the unique demands and characteristics of different co-located loads. Each load—whether it be a thermal battery, an electrolyzer, or a data center—brings a distinct set of priorities, financial considerations, and operational dynamics. This diversity means that policies to enable energy parks should focus less on accommodating specific configurations, and more on removing barriers to developers who hope to find their own optimal internal operation strategies for generation, storage, and load that serve diverse objectives.

As we explore these possibilities, it becomes clear that the energy park model is not just evolving but branching into multiple directions, each unlocking different opportunities for innovation, cost savings, and grid services. Below, we outline key examples of how energy parks can be configured to serve various types of loads, presented through an opportunity/example/insight framework. More detailed explanations for the first two examples can be found in Appendix 3.

It is critical to note that the complexity of an energy park is internal to the energy park itself, and this complexity is being voluntarily borne by the operator of the energy park. At the POI with the bulk power system, the energy park can present a very simple and capable interface for the power system operator. To the operator of the power grid and power market, the energy park can look like a simple, idealized generator or storage resource.[v] This may have dramatic implications for simplifying and managing the computational complexity of future market designs.

OPPORTUNITY FOUR: MAXIMIZING LOCAL ENERGY USE AND ELECTRICITY EXPORT VALUE IN ENERGY PARKS

As energy parks evolve with co-located loads, the ability to flexibly transform and store energy locally opens new opportunities to optimize both local load supply and energy export. By converting energy into alternate forms, such as heat or hydrogen, parks can use the least valuable electricity to meet on-site demands while reserving higher-value energy for export. Any surplus renewable output can also be traded over the bulk power system. This strategy enables energy parks to capture more value by adjusting both the timing and the destination of energy use, thus increasing financial returns. Furthermore, the ability to store energy in forms that go beyond short-term solutions (e.g., thermal batteries or hydrogen storage) adds resilience, allowing parks to better manage energy fluctuations and respond to dynamic market conditions.

Thermal batteries, for example, achieve this by storing excess electricity as heat for industrial processes. This enables energy parks to use low-cost electricity for local consumption while exporting higher-value energy to the grid. By effectively managing when and where energy is used, thermal batteries allow parks to maximize revenue from grid sales while ensuring a steady, cost-efficient energy supply for on-site demands.

Example Four: Thermal Batteries

In July 2023, Energy Innovation published a report exploring the concept of thermal batteries, also known as heat batteries.[vi] These systems convert electricity into heat, store it for hours or days, and release it when needed. In practice, long-duration storage can convert variable electricity into the baseload heat that many industrial end users currently source from fossil fuel combustion. The report reviews two primary configurations: one where the thermal battery is directly connected to the grid in a "price-following" mode, and another where it sits within an energy park in a "generation-following" configuration. In the latter, the system is modeled as siloed, with no grid exports, which optimizes the use of low-cost renewable energy for local industrial heat but limits external market interaction.

Insight Four: Grid Connectivity Decreases Financial Risk and Allows Bigger Projects

In Appendix 3, we expand on the thermal battery report by looking more closely at a configuration with grid exports and providing a deeper analysis of how connecting these systems to the grid can enhance their operational and financial performance. We found that with real-world 2023 price data, used as one example year, export revenues were enough to completely support annual capital expenditure requirements for the solar farm (essentially free heat for the on-site industrial partner). We also explored the economics of converting stored heat back to electricity by reusing retired or mothballed steam power plants.

A park with thermal battery demand is more than theoretical—commercial projects already exist that incorporate thermal batteries into energy parks.[11] As developers look to expand these parks, they will recognize the value of enabling grid exports, which will appeal to financial backers who want to manage the risks associated with new technology by having the option to sell energy to the grid if the technology does not perform as anticipated. Additionally, integrating thermal batteries into energy parks allows for shared infrastructure, such as power electronics and transformers, which can facilitate faster charging and support the use of larger thermal storage capacities. Over time, operators will optimize the balance between local consumption and grid exports, increasing revenue from electricity markets while efficiently meeting the needs of co-located industrial loads.

OPPORTUNITY FIVE: CONVERT ELECTRICITY INTO A TRADEABLE COMMODITY WITH CREDIBLE CLEAN SOURCING

In the previous example, a thermal battery within an energy park converted inexpensive electricity from variable renewable generation into a steady supply of industrial heat. Since industrial heat creates huge demand for energy today (usually in the form of fossil fuels), this conversion type is very useful. Unfortunately, heat does not travel well, so it is necessary to use the heat on-site. However, other forms of transformation for electricity create much more portable forms of energy or energy-intensive products like liquid or gaseous fuels or chemicals. This opens the possibility of flexible delivery schedules from energy parks to

[11] For example, Rondo Energy already operates an energy park that captures intermittent renewable electricity, stores it at high temperatures, and delivers continuous industrial heat on demand for Calgren Renewable Fuels G at its Pixley, California, facility (https://rondo.com/calgren-case-study). It has announced funding for three further projects in Europe (https://www.prnewswire.com/news-releases/rondo-energy-announces-75m-project-funding-with-breakthrough-energy-catalyst-and-the-european-investment-bank-302183325.html).

markets other than electricity—markets that potentially put a premium on the clean credentials that come with clean local generation.

One broad class of transformations that turn electricity into tradeable and transportable industrial products is through electrolysis, which involves using DC electric current to drive non-spontaneous chemical reactions. Electrolysis has the potential to revolutionize industrial decarbonization, not just by producing hydrogen but also in producing other products. Apart from hydrogen and feedstocks like sustainable fuels and ammonia made with hydrogen,[vii] there exist applications such as cement production[12] (responsible for about 7 percent of global carbon emissions) and the direct reduction of iron[13] (iron and steel account for 8 percent of global carbon emissions). Still, the most well-known, or at least well-publicized, application of electrolysis today is the electrolysis of water using clean electricity to produce green hydrogen.

Example Five: Electrolysis of Hydrogen from Water

Hydrogen production via electrolysis requires significant electricity. The DOE's 2023 Clean Hydrogen Strategy and Roadmap targets 10 million metric tons of hydrogen by 2030, requiring 500 terawatt-hours (TWh) annually, representing about 12 percent of U.S. electricity.[viii] Electricity costs directly impact hydrogen prices, with every $20 per megawatt-hour (MWh) increase adding $1/kg.[14]

Electrolysis has high capital costs, so running an electrolyzer as close as possible to continuously is key to cost-effective unit costs for hydrogen output. Given the limited supplies of cheap, round-the-clock energy, if clean power is the requirement, some allowance for flexible production can be made to optimize access to cheaper but variable wind and solar resources.[15]

The IRA's $3/kg tax credit made clean hydrogen affordable much faster than market forces would have on their own. By passing a credit that disappears in 10 years, the IRA created two eras[ix] for clean electrolytic hydrogen: a tax-subsidized era where electrolytic hydrogen is competitive even with higher electricity prices, and a post-subsidy era where competitiveness depends on very cheap electricity.

Energy parks are well suited to both eras, providing clean electricity for tax credits and cheaper power later. Flexible hydrogen production, supported by export-enabled energy parks, is critical to financial viability in both periods.

Hydrogen primarily serves as an energy intermediary or carrier, and three energy parks include hydrogen production:

- Intersect Power's Meitner Project in Gray County, Texas, would combine 340 MW of solar with 460 MW of wind to power 400 MW of on-site electrolyzers for producing sustainable aviation fuel.

[12] See https://sublime-systems.com/.
[13] See https://www.electra.earth/media/ or https://www.bostonmetal.com/.
[14] For reference, the typical cost for hydrogen derived from methane is $1-2/kg.
[15] In the best resource areas, combined wind and solar portfolios (with some amount of overgeneration) can produce very reasonable power costs with more than 80 percent utilization of the electrolyzer. For examples, see appendix B of https://energyinnovation.org/publication/smart-design-of-45v-hydrogen-production-tax-credit-will-reduce-emissions-and-grow-the-industry/, or explore the Levelized Cost of Hydrogen calculator at https://zenodo.org/records/7948769/files/Interactive_LCOH_Calculator_v3.xlsx?download=1.

- The HyStor energy park in Mississippi has agreed to supply hydrogen to SSAB's green steel project.
- Hydrogen City, Texas proposes to serve a 2.2 GW hydrogen electrolyzer plant with 3.75 GW of on-site solar and wind power, with "additional renewable energy drawn from the ERCOT grid during periods of low prices." The hub would expand as needed and serve local facilities including ammonia and rocket fuel production.

The IRA's $3/kg production tax credit (PTC) is contingent on hydrogen production's emissions intensity, so combining the electrolyzer and generation resources via energy parks ensures these projects face no risk qualifying for lucrative tax credits.

In Appendix 3, we argue that in both eras, flexible hydrogen production is vital to project viability. Furthermore, making a hydrogen-producing energy park financially viable in either era will require the energy park to export power to the grid. As in the thermal battery example, these projects open the possibility of reconverting hydrogen back to power for sale on the open market when prices are high: Hydrogen stored on-site can also serve as a fuel in a combustion turbine to supplement output during high wholesale price periods.[16]

Insight Five: Premium on Connectivity to the Grid and Diverse Commodity Offtakers

In the tax-subsidized era, hydrogen energy parks will want to lean into overgeneration even more than energy parks feeding a thermal battery or traditional generation-only hybrid resources. The high value of collecting as much PTC as possible from a fixed input capacity of electrolyzer will lead the parks to super-scale their generation with peak output two to three times higher than the electrolyzer's peak capacity. This means they will need very good connectivity—a high megawatt AC export capacity relative to peak megawatts of generation—to sell surplus clean power (and de-risk the generation investment in case the co-located hydrogen electrolysis falls through). In the post-subsidy era, these energy parks will want to sell even more power to the grid.

OPPORTUNITY SIX: FASTER TO MARKET

Sometimes the impetus for an energy park is not only access to cheap, clean power but also faster access to power. Bypassing the bulk power system to directly serve local loads has the potential to drastically accelerate the pace at which additional demand can be met, especially when bulk power supply and delivery are constrained. Rapid demand growth is often driven by new manufacturing facilities and, notably, new data centers.

At first glance, data centers might not seem like ideal candidates for energy parks, which typically involve large, variable energy resources spread over vast areas, often far from urban centers. Data centers prefer proximity to the markets they serve—partly due to data latency issues—and benefit from being near pools of skilled labor. However, not all data center loads are equally sensitive to latency, and access to electricity—especially clean and firm supply—has quickly become a significant constraint on data center growth.[x] As previously mentioned, speeding the "time to power" for new data center loads can be highly valued. The lost opportunity cost of expensive investments sitting idle can be significant, and data centers

[16] Theoretically, with the PTC in place there are wholesale price levels where it makes sense to both produce hydrogen from electricity and consume electricity for power exports at the same time. We assume the IRS will disallow tax credits under these conditions.

can be built relatively quickly, while it may take years for new generation to interconnect and transmission upgrades to be built.

Example Six: The Amazon Web Services/Susquehanna Nuclear Plant Deal

This paper has mostly discussed energy parks in an implicit greenfield frame where new load and new generation come together in a new park. However, energy parks can also bring new load to existing generation (or the other way around[17]), potentially on an even faster path to market than co-locating with new generation with its own development timeline. The recent Amazon Web Services (AWS)/Susquehanna Nuclear Plant deal is an interesting case, revealing some of the issues all energy parks may face.

In March 2024, Talen Energy sold a data center campus in Pennsylvania to AWS for $650 million, and AWS plans to supply it with power directly from the Susquehanna Nuclear Plant.[xi] This direct connection to a nuclear plant effectively resolves some of the challenges data centers face: It offers clean baseload power near existing infrastructure and markets. AWS has agreed to purchase power in 120-MW increments, with the possibility of scaling up to 960 MW. Meanwhile, PJM Interconnection has requested approval from the Federal Energy Regulatory Commission (FERC) to increase the behind-the-meter connection from 300 MW to 480 MW. However, this arrangement has raised fairness concerns among other PJM stakeholders, who are wary of the potential impacts on reliability and AWS's ability to bypass charges that other loads must pay.[xii]

One notable aspect of this example is that because the clean power supplying the data center is not new or additional, it will remove existing generation from the market by load that potentially could be sited in another market.

Insight Six: Not All Stakeholder Concerns About Energy Parks Are Immediately Obvious

While the relationship between load and generation behind the POI for an energy park may seem like it should be a simple bilateral deal between private parties, connecting the park to the bulk power system (especially when diverting significant amounts of power from existing generation sources) can provoke considerable pushback from stakeholders concerned not only about fairness to consumers but also about reliability, cost allocation for infrastructure, emissions impacts, and competition for new loads.[xiii]

The AWS/Susquehanna deal demonstrates that questions can still be asked about why energy park loads should be exempt from costs and requirements that affect other loads—especially tariff riders that are not directly tied to transmission and distribution, like ancillary services for grid stability or support for low-income customers.

It is unclear whether concerns like those raised by the AWS/Susquehanna deal will present a widespread problem for other energy parks. For example, should we be looking at the policy stakes with a wider lens,[xiv] or are most concerns specific to this kind of data center deal? For concerns about repurposing existing generation, a ready solution may involve tying exceptional exemptions, tariffs, or legislation supporting export-only energy parks to some form of additionality—ensuring they provide new energy to the grid ("Bring Your Own Generation")—and other technical performance requirements around instantaneous

[17] However, typical existing loads are not directly connected to the transmission system so are not easy candidates to seed a new energy park.

backflow from the grid. However, even projects involving new supply could encounter technical issues.

Circling back to the general data center case, for example, AI-driven data centers tend to have spiky load profiles, a challenge that some developers aim to mitigate with battery storage[xv]—another likely common feature of energy parks. Data centers, especially in areas where they are heavily concentrated, like Texas, have become increasingly unpopular.[xvi] Some critiques center on their consumption of precious grid resources, and clean energy parks could help address these concerns. However, other issues, such as water use, might point to the kind of stakeholder engagement that will be essential for future energy park projects.

ENERGY PARK POLICY STAKES AND CHALLENGES

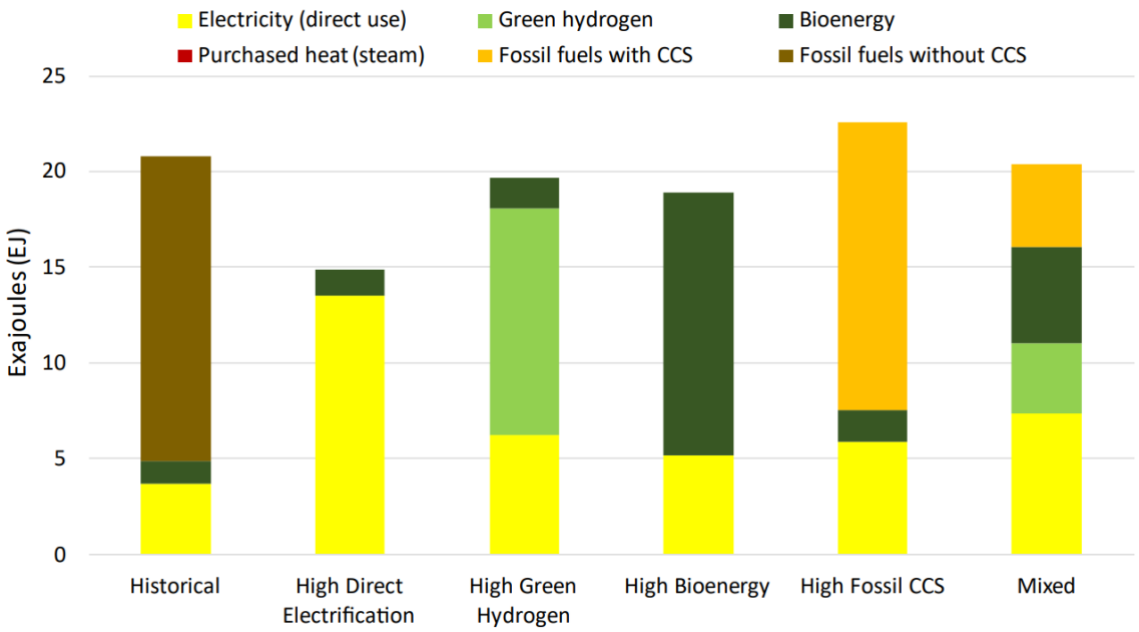
This paper has introduced what energy parks are, explored what they might become, and explained the combination of technological advancements and economic strategies that drive energy park economics. Energy parks are new portfolio resources that could be tremendously valuable to managing a cleaner grid with lots of variable energy resources.

Well-executed energy parks can create tremendous benefits, both private and public, especially when dedicated customers are able to co-locate with the generation resource in the energy park. What is at stake with energy parks?

A great deal is at stake for U.S. decarbonization goals and energy competitiveness when it comes to energy parks, even if we just limit the stakes to industrial loads.

A recent report from Energy Innovation[xvii]" analyzes several different scenarios for decarbonizing the U.S. industrial sector. Depending on the scenario, it foresees an incremental demand for electricity that could double total U.S. electricity consumption across all sectors. If energy parks became widely feasible, they could carry a significant fraction of that load, perhaps scaling up to between a fifth to a half of incremental demand, without unduly burdening (and perhaps even supporting) our existing bulk power system. Proper policy could make the difference between deploying energy parks solely in unique situations over the coming decades or deploying hundreds of thousands of gigawatts of new clean energy at scale.

Figure 4. Industry sector non-feedstock energy use in the U.S. (historical data and built-in scenarios)



Source: Jeffrey Rissman and Nik Sawe. The Industrial Zero Emissions Calculator. Energy Innovation. August 2024.

To get to that point, energy parks with co-located loads will need to overcome three broad buckets of challenges: rules of the road for connecting to the grid, wholesale market participation challenges, and resistance from monopolies in transmission, distribution, and retail markets. Below, we summarize some of the key elements of these challenges, with further details available in Appendix 1.

RULES OF THE ROAD FOR CONNECTING TO THE GRID

Energy parks face several technical and regulatory hurdles when attempting to connect to the grid. These challenges stem from the complex processes and standards required to ensure grid reliability while accommodating new types of hybrid energy systems.

Regulatory and Operational Uncertainty: The current rules governing interconnected generation (primarily FERC-approved tariffs as developed by Independent System Operators (ISOs)/Regional Transmission Organizations (RTOs), and transmission-owning regulated utilities) create uncertainty for energy parks with co-located loads. Grid operators require highly accurate models to predict how these parks—both their internal loads and their various generation and storage components (viewed as separate resources)—will behave under different conditions. Adding loads further complicates the interconnection study and approval processes: What if, for example, a large bank of hydrogen electrolyzers suddenly goes off-line and creates a large surge in supply where the energy park connects to the grid? Existing tariffs were designed for conventional generators (and are only recently struggling to adapt to storage resources), while loads have largely been addressed through state-

regulated distribution utilities, leading to significant confusion and complexity for interconnection of energy parks.

Overwhelmed Interconnection Queues: Energy parks must navigate an already complex interconnection process that includes multiple studies assessing viability, grid impact, and necessary upgrades. However, the sheer volume of projects in the queue exceeds grid planners' capacity to process them in a timely manner, and overly simplistic and reductive treatment of energy parks with co-located loads would further strain these overloaded processes.

Lack of Generalized Approaches for Hybrid Resources: Despite some progress, the lack of standardized approaches for hybrid resources—such as solar with storage, and now co-located loads—delays interconnection and increases costs. Each new technology requires detailed, custom models for short circuit, stability, and power flow analysis, further complicating and slowing down the process. Given the traditional approach where the grid operator feels compelled to have separate models for each component of generation, storage, and load (rather than a unified model of the energy park as a system), such considerations make it more difficult to plan around integrating energy parks smoothly into the bulk power system. Thus, energy parks with on-site loads face lengthy timetables before their unique attributes can be incorporated into standard practice.

MARKET PARTICIPATION CHALLENGES FOR ENERGY PARKS

Beyond the technical interconnection challenges, energy parks face significant difficulties when participating in competitive energy markets and maintaining compliance with operational regulations. These challenges arise from the evolving nature of energy generation and consumption in the hybrid systems that drive energy parks.

Market Participation Models: If energy parks are to participate in wholesale markets, market operators will need to address how energy parks interact with various market structures (energy, capacity, ancillary services), and the complications of adding co-located loads to these models.

Market Benefits and Concerns: Energy parks, particularly large ones, may have the potential to affect power prices and market stability. Energy parks' ability to rapidly switch between supplying the grid and serving internal loads makes them a significant and agile market participant. However, that coin has two sides. On the one hand, these qualities should help with market efficiency and price formation, and energy parks should stand to collect financial benefits from that benign role. On the other hand, energy parks could unduly influence market prices in tight supply conditions, potentially requiring more oversight and regulation.

Energy Import Rules: Ambiguity surrounds how participant energy parks should be categorized and treated by the grid: Are they generation assets, storage, or traditional loads? Today each of these categories falls under different tariffs and rules, meaning a load-generation hybrid energy park faces significant regulatory uncertainty.

CHALLENGES TO ENERGY PARKS FROM MONOPOLIES FOR DISTRIBUTION AND RETAIL SALES OF ELECTRICITY

Energy parks face not only grid connection and market participation challenges, but issues related to the monopoly rights of utilities in providing power within certain territories.

Retail Sales Monopolies: Under the Federal Power Act (FPA), FERC regulates wholesale electricity sales while states control retail sales and distribution. This creates a patchwork of regulations that energy parks must navigate. In practice it likely requires prospective parks in monopoly services territories to negotiate bilaterally with monopoly utility companies for grid access and then get regulatory approval for any utility expenses associated with giving the project access to the grid. Current strategies, like single-entity ownership to avoid sales between separate entities, are inefficient and increase financing costs without benefiting the public.

Internal Networks Versus Power Distribution Monopolies: Energy parks that require building internal transmission networks might conflict with state-granted utility monopolies, and the legal landscape around these issues is nebulous. On the one hand, generators typically own essential interconnection facilities (lines and equipment to connect to the bulk power system substation) as part of their generation facility without running into problems with the local utility transmission and distribution franchise. On the other hand, once a co-located load is in the picture, generators can't include the lines and hardware to connect to the load in the same way. If the generation and load don't share the same parent company and investors, an issue arises as to who bears the regulatory risk around grid equipment behind the POI.

Addressing these challenges is critical for unlocking energy parks' full potential, ensuring they can contribute meaningfully to decarbonization and grid modernization efforts.

POLICY SOLUTIONS

ENGAGE WITH TECHNICAL BODIES EARLY AND PERSISTENTLY

To overcome the technical and regulatory challenges energy parks face in interconnecting with the grid and participating in markets, engaging with key technical bodies—such as ISOs/RTOs, FERC, and state regulators—early and persistently is critical. Energy parks are new and complex systems, and proactive collaboration will help streamline processes, standardize rules, and ensure energy parks' unique needs are considered in the evolving regulatory framework.

Key Participants:

- **Market Operators (ISOs/RTOs):** Responsible for designing and managing interconnection and participation processes for energy parks.
- **FERC:** Provides the regulatory framework and oversight for interconnection and wholesale market participation at the federal level.

- **State Regulators and Legislatures:** Critical for ensuring state laws and regulations accommodate the unique structure and needs of energy parks, especially regarding retail sales and local transmission networks.

Summary of Solutions:

1. **Address Regulatory Uncertainty:** Policymakers and grid operators need to develop clear rules to handle the complexity of energy parks with co-located loads, including how they participate in energy and capacity markets, and to what extent they can participate in wholesale electricity markets outside the restructured markets. Standardized and generalized models should be developed to simplify the interconnection approval process and allow ongoing energy park innovation.
2. **Alleviate Overwhelmed Queues:** Existing interconnection queues are overloaded and—under current modeling approaches—integrating complex energy parks will add further strain. Much of this strain could be avoided if energy parks were treated as a "net" resource at the POI. Meanwhile, solutions like the "connect and manage" model should be adopted, focusing on immediate physical interconnection while deferring more complex deliverability studies. When they have the flexibility to serve internal co-located loads, energy parks are particularly well adapted to approaches like these that speed up the interconnection approval process at the expense of some increased wholesale market risks.
3. **Establish Generalized and Standardized Approaches:** The lack of standardized approaches (interconnection, operational protocols, obligations during contingencies, etc.) to hybrid resources, especially those with co-located loads, increases delays and costs. Persistent collaboration with technical bodies can help develop generalized models and frameworks for hybrid systems, viewing them as flexible and capable sources of energy and grid services at their POI rather than as a group of separate components, and making the interconnection process more efficient.
4. **Market Participation Models:** Complex hybrid resources face barriers to full participation in wholesale markets. ISOs and FERC should develop standardized participation models that allow energy parks to integrate into wholesale markets with certainty and without undue complexity. These models should account for the presence of co-located loads and offer flexibility for energy parks to participate in energy, capacity, and ancillary service markets.
5. **Mitigating Market Manipulation Concerns:** Energy parks pose unique challenges for market regulators to prevent the exercise of market power. Implement oversight measures with market operators to prevent large energy parks from manipulating power prices. Potential market power abuses can be mitigated by tracking internal operations and monitoring power flows between energy parks and the grid. FERC and market operators must ensure clear guidelines are in place for how energy parks operate during periods when prices are already high because supply is tight, while appreciating and rewarding them for their contributions to reliability and efficient market price formation.
6. **Energy Import Rules:** Unlike conventional consumers, energy parks serve as both demand and supply, and in theory they can pull from the grid as well as export power. Collaborate with state regulators and market operators to develop clear rules on how

energy parks can consume power from the grid. This includes ensuring energy parks that consume electricity are treated fairly under tariff structures. In some markets, like ERCOT, an energy park could switch back and forth between being treated as generation or load based on the net flow of electricity during each pricing interval. In markets where loads incur extra charges (like capacity payments), new forms of dynamic tariff adjustment to account for energy parks' hybrid nature (both producers and consumers of electricity) will be necessary.

This subsection sets the stage for persistent and coordinated engagement, crucial for addressing technical and regulatory barriers. Further details are available in Appendix 1.

FOSTERING A NEW PARADIGM

As energy parks evolve, they will join and reinforce a trend governing how the grid interacts with a multitude of very different resources, transitioning toward a more flexible, "digital resource" model that accommodates more complexity while keeping the task of the grid operator manageable. This is a paradigm shift because it involves a fundamental rethinking of how the grid should operate when it starts to integrate advanced electronics, software, and energy storage, and the dynamic capabilities of energy parks. The flexibility of energy parks offers tremendous potential for the grid, but energy park benefits to the grid will only achieve their full potential if current frameworks fundamentally shift as to how grid participants are managed, compensated, and planned for.

Key Participants:

- **Industry Experts:** Engineers and grid operators responsible for implementing new control and communication technologies that will allow energy parks to function as digital resources.
- **Academics and National Laboratories:** Researching the techno-economic advantages of energy parks, investigating the ramifications of digital resources in modeling modern grid frameworks.
- **Research Funders (e.g., Electric Power Research Institute, DOE):** Funding studies and pilot projects that explore how energy parks can transform grid operations.

Summary of Solutions:

- **Universal Participation Model:** A universal model may be best to accommodate energy parks within the grid. This model would focus on essential operational parameters—like ramp speeds, energy limits, and maximum/minimum output and input—offering flexibility for energy parks without the need for customized frameworks for each configuration. This approach allows operators to focus on outcomes (grid stability, reliability) without needing detailed knowledge of internal energy park operations.
- **Leveraging Energy Parks as Digital Resources:** Energy parks have the potential to serve as "digital resources" that interact with the grid in real time. Through advanced telemetry and software, energy parks can provide services like fast frequency response and rapid reserves, responding automatically to grid disturbances and maintaining balance. These parks' ability to combine generation, storage, and flexible loads means they can adapt dynamically to the grid's needs.

- **Modernizing Grid Operations:** Current grid operations still rely on mechanical-era principles, but energy parks are forcing a transition to more modern, software-driven methods. The key challenge is convincing grid operators to embrace these new methods, as many still view them as a entailing a loss of control over grid reliability. By adopting digital transaction and control systems that allow for simpler, more resilient and reliable management of dynamic resources at the POI, grid operators can unlock the full potential of energy parks. Learning from the design principles of complex software systems, well-established concepts of object-oriented design and systems of cooperating intelligent agents should be applied, allowing the system operator to manage the power grid at a higher level rather than as an exponentially growing collection of components.

The shift to this new paradigm is not just a technological shift but also a regulatory and cultural one. More details on the technical implications and proposed models are available in Appendix 1.

NEW STATE LEGAL FRAMEWORKS

Energy parks face significant hurdles due to existing monopoly rights over retail sales and power distribution, which are regulated by states. Energy parks involving new generation selling power to new demand implicate state definitions of public utilities subject to public utility commission (PUC) oversight, which could grind energy park development to a crawl. Parks could potentially violate exclusive monopoly rights already granted to incumbent utilities, prohibiting their development without involving the incumbent utility and requiring new tariff development.

To enable energy parks' full potential, states must take the lead in creating new legal frameworks that balance utility rights with the need for greater flexibility in directly connecting energy production and consumption. Cooperation between federal and state policymakers will be crucial to overcoming these regulatory challenges, but most of the responsibility will fall to state governments, including regulators, to foster the legal and political consensus required for these changes.

Key Participants:

- **State Legislatures:** Primarily responsible for creating the legal frameworks that address monopolistic control over retail sales and distribution.
- **State PUCs:** Regulators that will implement and oversee any new tariffs or rules designed to allow energy parks more freedom in power distribution and retail sales.
- **FERC:** regulates wholesale electricity and cooperates with state bodies to help reduce conflicts between state laws and federal energy policies.
- **Utilities:** Major stakeholders that will likely resist changes but could be brought into the fold through negotiations and compensation mechanisms.

Summary of Solutions (see Appendix 1 for more detail):

- **Reduce utility power:** One potential solution is to require utilities to accommodate energy parks but allow utilities to retain ownership of the internal distribution networks within energy parks. These terms must not compromise the financial viability of the parks and could evolve into pro forma agreements that allow for quick

approval. State regulators should, as a least-regrets step, investigate the viability of energy parks under current regulations, assess industry interest in developing these projects in their state, and develop policy positions that anticipate and encourage development that does not unduly harm the existing utility or other customers.

- **New State Legislation:** States could amend utility codes to grant energy parks more freedom, particularly in bypassing utility monopolies on distribution and retail sales. States not ready for this could at least require their PUCs to adopt policy proposals and recommendations to the legislature that promote the economic development of energy parks. State legislatures must navigate stakeholder concerns over fairness, but new laws could offer clarity and legal flexibility for energy parks to operate more efficiently, avoiding the current inefficiencies of single-entity ownership models.
- **Regulatory Cooperation:** The FPA gives FERC jurisdiction over wholesale electricity sales and transmission, while granting states jurisdiction over distribution and retail sales. Energy parks interacting with the bulk electricity system and on-site load implicate both state and federal regulators, so these distinct regulatory bodies must collaborate closely to ensure that they do not create conflicting regulatory frameworks. This cooperation is crucial for creating a cohesive regulatory environment where energy parks can flourish without running afoul of monopoly rights or state-federal jurisdictional conflicts.

By updating legal frameworks and fostering collaboration between utilities and energy parks, states can unlock the full potential of these innovative resources. More details on these legal challenges and proposed solutions are available in Appendix 1.

STAKEHOLDER ENGAGEMENT

Advancing the policy solutions needed for energy parks requires a broad coalition of stakeholders who have a vested interest in clean energy, economic development, competition in electricity markets, and environmental sustainability. At the same time, addressing the concerns of affected parties—such as incumbent utilities, local communities, and environmental justice advocates—will be key to building political momentum and fostering compromise. Stakeholder engagement is not only a technical and regulatory challenge but also a political one that requires finding common ground among groups with overlapping but sometimes conflicting priorities.

Key Participants:

- **Clean Energy Developers:** Interested in advancing renewable energy projects through energy parks, they are central advocates for scaling up clean generation technologies.
- **Industrial Loads (e.g., Data Centers):** Major energy consumers that would benefit from co-locating with energy parks to secure energy supplies more quickly and with desired clean attributes.
- **Governments and Economic Development Advocates:** community representatives that can influence energy park design to drive local job creation and investment in rural communities and other areas where economic development is encouraged.
- **Climate and Environmental Advocates:** Supporters of energy parks who serve as key drivers of decarbonization and sustainable energy infrastructure.

- **Land Use Advocates:** Focus on ensuring that energy parks are developed in a way that balances economic growth with responsible land use.

Example Stakeholders with Concerns to Address:

- **Incumbent Utilities:** As existing monopoly holders over energy distribution, incumbent utilities may resist changes that threaten their business model. They will need to be part of the conversation to find workable solutions.
- **Consumer Advocates:** Advocates who are concerned about energy affordability and access, especially for low- and fixed-income populations, can offer crucial support for equitable policy development.
- **Local Environmental and Land Use Stakeholders:** Communities that may face land or water use issues stemming from large energy parks, and possible pollution, will need to be engaged early to mitigate opposition.
- **Environmental Justice and Equity Advocates:** Ensuring that energy parks do not disproportionately impact vulnerable communities will be critical to gaining broad political support.
- **Local Government:** Providing some financial upside for local government and citizens is often the key to moving projects forward.

Summary of Solutions:

- **Broad Coalition Building:** Clean energy developers, industrial consumers, rural economic development interests, and climate advocates must come together to form a powerful coalition in support of energy parks. This coalition should focus on aligning economic, environmental, and social benefits to build a shared narrative that energy parks can advance a sustainable and prosperous future.
- **Compromise and Engagement:** Effective stakeholder engagement must go beyond coalition-building to directly address the concerns of utilities, local citizens, consumer advocates, and environmental justice groups. Transparent dialogue, public consultations, and ensuring that local communities see tangible benefits from energy parks will be essential to managing opposition.
- **Political Advocacy and Negotiation:** As the regulatory and policy landscape evolves, stakeholder engagement will need to include active participation in political advocacy. Compromise on key issues, such as utility compensation, consumer protections, and environmental impact mitigation, will help unlock legislative and regulatory reforms.

This effort will require a thoughtful, inclusive approach to engagement, acknowledging the diverse interests of all parties while finding common ground to support the growth of energy parks.

CONCLUSION

Energy parks are a new but rapidly changing concept, with projects emerging at an unprecedented pace and scale. This paper introduces energy parks, establishes the economic rationale and potential climate and grid benefits of energy parks, and shows how current markets and policies create barriers to innovation and rapid deployment of energy

parks. Policymakers interested in responding to this emerging economic development opportunity should consider whether their grids and electricity marketplaces are well positioned to accommodate these innovative resources and maximize their value both to existing consumers and the parks themselves.

APPENDIX 1: ENERGY PARKS AND THE BULK POWER SYSTEM

In this appendix, we examine in more detail the relationship between energy parks and the grid, both at the technical and regulatory levels. This means looking at permitting issues, participation models for market dispatch and consumption, and associated market concerns. Any serious analysis of energy parks also requires a careful examination of how they mesh with current state law and monopoly mandates as well as how energy parks challenge the delicate balance between state and federal jurisdiction over the modern power grid.

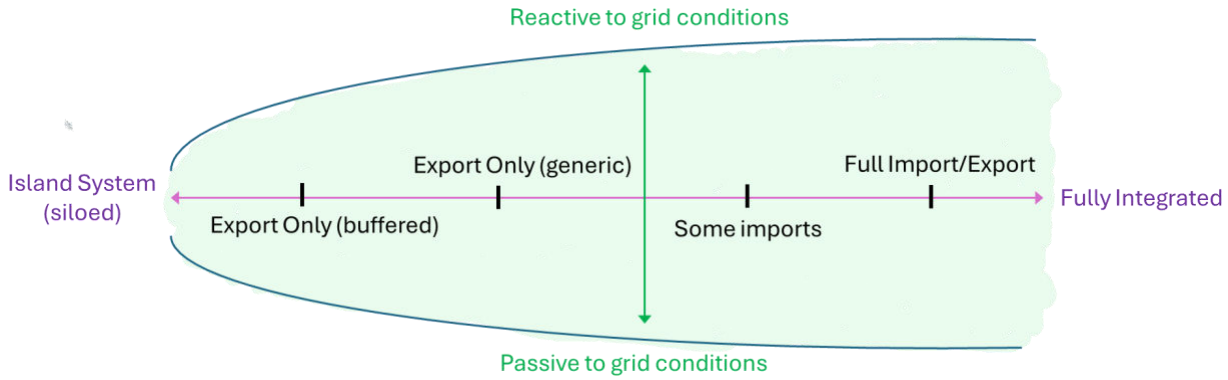
This appendix attempts to identify and crystallize some (but not likely not all) challenges for energy parks within the context of the current grid. In tandem, we also suggest some solutions addressing these issues and set out a paradigm shift that we think organized markets need to make to properly foster and take advantage of energy parks. We close by looking at permitting and franchise issues for serving a local load inside an energy park.

ENERGY PARK CONNECTION TYPES ON A SPECTRUM

Energy parks (we are mostly thinking of those with co-located loads here) have many options for how they connect to the grid. At one extreme, they may choose not to connect at all, preferring to avoid the technical, logistical, procedural, and legal challenges inherent to connecting new and complex projects like energy parks to the grid. With a co-located load, an energy park could become a self-sufficient island. Yet historical experience has taught us that interconnecting grids to share resources tends to yield tremendous benefits for all parties concerned. Islanding an energy park leaves significant benefits unrealized, deprives other grid participants of valuable resources, and makes large-scale projects like hydrogen electrolyzer parks financially risky or even infeasible. At the other extreme, keeping load and generation separate even though they could be co-located increases transactional costs, forgoes savings on shared equipment and, if these components end up geographically separated, creates extraneous power flows and an undue call on incremental transmission resources.

Figure A1. Energy Park Design Continuum

Energy parks connect to the grid on a continuum of possible arrangements for how much energy is exported and imported across the POI, and with a variety of operational arrangements for reacting to grid conditions: reacting to market prices, providing ancillary services, or actively responding to exceptional conditions in different ways.



Traditionally, energy parks have operated without co-located loads, functioning solely as export-only facilities. Even when storage is included, energy parks often maintain this export-only status. For energy parks looking to add loads, continuing as export-only may seem the simplest path, as it avoids incremental complications with grid operators and regulators. These parks can buffer their interactions with the grid using storage or power electronics to smooth large internal fluctuations in supply and demand, ensuring they maintain a steady source of export power within contracted trading or dispatch windows and are seen as "good citizens" on the grid (avoiding backflow, power and voltage spikes, etc.). Over time, as experience with these systems grows, some buffering needs may disappear.

With even more extensive deployment and increased engagement with grid operators and regulators, energy parks may choose to import a small fraction of their power. This might occur when very cheap power is available on the grid during specific intervals or when the energy park needs a backup source, like shared reserves between neighboring grids. As energy parks evolve and engage in more complex interactions with the bulk power grid, they will need to decide how best to tap into their inherent flexibility—either to help operators manage transmission contingencies or to capitalize on swings in power prices.

INTERCONNECTION CHALLENGES FOR ENERGY PARKS

Energy parks that seek to interconnect to the grid will face at least three kinds of problems tied to interconnection: regulatory and operational uncertainty, already overwhelmed interconnection queues, and lack of common standards.

Problem: Regulatory and Operational Uncertainty

Energy parks with co-located loads face regulatory and operational uncertainty under the current rules of interconnected generation in organized markets (often governed by "ISO tariffs") because these markets typically treat generators and loads very differently. It's not even clear to us whether such energy parks, neither fish nor fowl, would be allowed under existing rules and tariffs. Furthermore, grid operators prefer to have a clear picture of how each generator they dispatch is likely to behave. The internal dynamics of an energy park can muddy this picture. Power engineers responsible for approving interconnections need highly accurate models to predict how these hybrid resources, especially their internal loads, will behave under various stressed conditions. These models could vary significantly from energy park to energy park, complicating the approval process. Further, if an energy park wants to participate in other electricity markets such as capacity markets, planners will need detailed models (and perhaps ex ante commitments) of how it is likely to behave for their production cost models to calculate figures of merit like effective load-carrying capacity and determine appropriate compensation for capacity services.

Problem: Overwhelmed Interconnection Queues

Connecting energy parks with co-located loads to the bulk power system for export requires navigating an already highly complex interconnection process.[18] This process includes feasibility studies, system impact studies, and facilities studies, all aimed at assessing the project's viability and its impact on grid reliability, and identifying necessary upgrades and costs associated with adding a new project to the grid. However, interconnection queues are currently overwhelmed, with total capacity in process far exceeding what grid planners can study in a timely way. The more complex energy parks with internal loads are naively[19] incorporated into this work stream, the more they will stretch the limited capacity of grid operators and transmission owners to complete these studies quickly.

Problem: Lack of Generalized Approaches to Hybrid Resources

Despite efforts to streamline the interconnection process for hybrid resources, progress has been inconsistent. Hybrid solar/storage projects began emerging in the mid-2010s, but it wasn't until 2021 that FERC held a technical conference to address the issue. ISO and transmission operator responses remain fragmented, with some helpful standardizations but many organizational idiosyncrasies that delay widespread adoption of generalized approaches. A core issue is the need for detailed information about the internal workings of machines behind the POI for conducting short circuit, stability, and power flow analyses. Historically, even photovoltaic (PV) systems required new approaches to aggregate multiple components into a single model. Adding storage and loads to these hybrids introduces even more complexity to dynamic modeling, although it also presents new opportunities for optimization.

Solution: Reform Interconnection

One policy that could facilitate the interconnection of complex hybrid resources (and generation and storage resources in general) is the "connect and manage" approach. A team at the Center for Global Energy Policy, looking at the international experience with such an approach,[xviii] describes it as follows:

[18] Many ISO/RTOs still study storage interconnection as if storage could inject or withdraw power at the worst possible time for the grid. The result of these studies allocates to projects excessive network upgrade costs that are only needed in these unrealistic scenarios.
[19] Later in this appendix, we discuss the potential of more modern market participation models to simplify interconnection for energy parks.

> Under the "connect and manage" model, the grid operator narrows the scope of the interconnection study process to look at the grid enhancements necessary to allow the generator to physically interconnect to the grid. Questions around deliverability of the power are deferred to subsequent studies. This reduces the complexity of the interconnection process, resulting in faster studies and increased ability to process interconnection requests. In exchange, interconnecting generators accept higher congestion and curtailment risk until deliverability studies and necessary upgrades are completed.

In the ERCOT region of Texas, a similar approach applies:[xix] The "connect and manage" approach could be tuned to focus less on the internal details of an energy park and more on what that facility is expected to achieve, its capabilities, and how expectations will be enforced. Instead of trying to preempt every problem that might occur, it allows the grid operator to take mitigating measures, shifting some delivery and curtailment risk to the developer as the price for a simpler connection process. While this can be detrimental to the economics of a project selling power to the grid, for a load-generation hybrid whose main value proposition lies in serving the native load, the ability to sell excess generation with significant curtailment risk is less daunting. State and federal regulatory bodies working together to encourage transmission operators to adopt this approach could help streamline the interconnection process, leveraging the flexibility of actively controlled energy parks to avoid many contingencies and reduce system impact modeling and cost estimation complexities.

In a recent report from Grid Strategies LLC and The Brattle Group,[xx] the authors propose a vision for a more efficient interconnection process centered on the values of "cost certainty and transparency," "speed and schedule certainty," and "non-discrimination." These values should hold for energy parks, and it would be interesting to see how the reforms they propose would fit into the context of energy parks with co-located loads.

MARKET PARTICIPATION MODELS

To the extent load-generation hybrids want to participate in organized markets, they face similar issues around uncertainty and lack of standards regarding how they are allowed to participate in various markets, including energy, capacity, and ancillary service markets.

Problem: Non-Existent or Hodge-Podge Participation Models for Energy Parks

Most competitive wholesale markets have at least some kind of participation model for generation-storage hybrid energy parks. They accept either a *co-located* model for hybrid participation where individual resources participate separately in energy markets, capacity markets, and ancillary services, or an *integrated* model where all the resources are treated as one. With the addition of loads behind the POI, the co-located model seems impractical, as loads are treated very differently in organized markets and carry extra obligations (paying for transmission access, capacity payments, etc.) even if they never draw power from the bulk power system. The integrated model for hybrid resources can be quite different from one market to the next and will likely need some significant changes to accommodate co-located loads, even in the simpler export-only version.

FERC, which regulates resource participation in organized electricity markets, is aware of market participation issues brought up by hybrid resources[xxi] (along with the interconnection and accreditation issues mentioned above). It has mainly focused on generation-plus-storage hybrid resources (historical energy parks), although co-location with generation is at the table in 2024.[xxii] We note that in Order No 2222, which requires RTOs to accommodate distributed energy resources (DER) aggregators, FERC explains in footnote 7[20]: "In addition to tariff provisions that apply to all market participants, the RTOs/ISOs create tariff provisions for specific types of resources when those resources have unique physical and operational characteristics or other attributes that warrant distinctive treatment from other market participants. The tariff provisions that are created for a particular type of resource are what we refer to in this final rule as a participation model." FERC has in the past required RTOs to ensure that their rules accommodate specific resource types, such as storage and DER aggregators. It has not yet issued any rule specific to more general energy parks, but there's precedent for FERC doing so in the future.

Solution: Follow the Experts

In anticipating and resolving issues with market participation models, RTOs and FERC would do well to listen to the experts. In a March 2022 Report, *Unlocking the Flexibility of Hybrid Resources,*[xxiii] ESIG examined many of the issues we detail, with the following guiding principles for consideration when implementing market policies, interconnection requirements, and incentive mechanisms for hybrid resources:

- Become less prescriptive and more technology agnostic with definitions
- Leverage existing POIs for additional resources
- Create multiple participation model options to facilitate greater flexibility and innovation, while allowing resources to provide all services they are technically capable of providing
- Develop broad participation models in advance for technologies that are not yet tested
- Give the asset owner the option to manage internal operation of the hybrid facility when they choose to do so, as long as they aim to meet performance targets defined by the system operator
- Consider synergistic effects and diversity benefits of combining complementary resources
- Reconsider traditional requirements that close doors for future flexibility and services in a transforming grid

Hybrid resources and task forces related to their implementation, operation, and benefits remain an active topic at the ESIG System Operation & Market Design Working Group.[21]

MARKET MANIPULATION CONCERNS

With a load included, energy parks raise unique issues for monitoring market integrity and market manipulation that may require new regulatory approaches and rules. Manipulation of energy market prices can occur when a supplier has a large enough share of the market that

[20] We thank Ari Peskoe for drawing our attention to these matters and this footnote.
[21] https://www.esig.energy/system-operation-working-group/.

its decisions about whether to produce or withhold generation can set the price and affect all the bidders in the market. FERC has tests to determine whether these suppliers are "pivotal," and therefore earn additional regulatory scrutiny and reporting requirements in their bidding behavior.[22] Hybrid and storage resources already create unique issues related to market manipulation, and including a load in an energy park requires market operators to be more concerned about economic withholding during periods of scarcity regardless of whether the resource is a pivotal supplier. The concerns over withholding could be heightened if an energy park is part of a larger fleet of resources. Concerns are further intensified by the inclusion of co-located loads in energy parks because these provide an alternate sink for generation that an operator may want to pull off the market.

Any energy park of sufficient magnitude providing or withholding its power can materially affect power prices. Generically, their flexibility should help with market efficiency and price formation, and energy parks should stand to collect financial benefits from that benign role. However, more self-interested behavior such as influencing prices to enrich themselves at the expense of consumers, could be of concern. Market operators guard against such behavior in several ways, but these roughly boil down to two categories: tracking the marginal costs of generators and instituting controls on pricing during problematic periods.[23]

Smaller load-generation hybrids are unlikely to be of concern, unless they are part of a fleet of coordinated assets, but large energy parks with hundreds or thousands of megawatts of potential output, like the hydrogen electrolysis parks with a large export capacity, can switch quickly from feeding the grid to feeding their co-located load and back with potential material impacts on prices. In such cases, i.e., so long as any internal generation is serving any amount of internal load, the marginal cost for these large hybrid energy parks is the opportunity cost of not serving their internal co-located load, rather than their marginal cost of production. Where large pivotal generators must document and let the market operator know their fuel costs, ramp rates, and minimum/maximum output potential, large energy parks should do something similar.[24]. In a universal participation model (see below) there might not be any difference in how these parameters are presented, except for some additional parameters.

ENERGY IMPORT RULES FOR LOAD-GENERATION HYBRIDS

One way an energy park could look substantially different from existing bulk power system generating resources would be when they become a net consumer of power from the bulk power system.

Problem: Should Energy Parks Be Treated Like Generation or Load?

In today's grids, providers and consumers of power face very different tariffs. While generators may need to pay for some transmission upgrades as part of their interconnection process, in general they do not pay for the transmission and distribution of power—we live in a "consumer pays" world. One exception to this rule is energy storage, which is allowed to buy power at a wholesale rate. This is in recognition of the fact that it will sell it all back (albeit

[22] See generally https://www.ferc.gov/horizontal-market-power.
[23] These periods can include times when some market power criteria are satisfied, or when live modeling indicates a problem.
[24] For example, energy parks could provide their the local opportunity cost of supply as their "fuel cost," and "ramp rates" and output constraints set by the flexibility of their co-located load, storage, on-site backup and variable generation forecasts.

with some round-trip losses). It is possible that an importing energy park might not give the power back, raising the question of whether it is taking advantage of its situation to get unfair purchase rates relative to other loads on the grid.

Solution: Net Wholesale Power Sales

One way to reasonably enable imports for energy parks would be to institute a special form of metering, where all power purchases are credited against sales during each clearing interval. Any negative balance would incur a penalty to reflect transmission and delivery costs (easier said than done, but a deeper dive is beyond the scope of this paper). In the Texas market run by ERCOT, hybrids can operate as "private use networks" (PUNs) with billing along these lines.[25]

This net or bi-directional metering raises some complicated jurisdictional issues that Texas avoids because it regulates both retail and wholesale sales of electricity in ERCOT. FERC says that it has no jurisdiction over net metering, which is true at the level of retail customer transactions and DERs connecting to distribution systems but could be challenged when it comes to large loads that interconnect to the interstate transmission system and could effectively participate much like storage resources or "negative generation" at the wholesale level.

The term net metering comes up in two contexts at FERC.[26] First, FERC has determined that it has no jurisdiction to preempt state net metering programs for rooftop solar and other DERs. Second, more relevant to our context, FERC has said that it has no jurisdiction over "station power" netting. "Station power" refers to energy that a generator consumes for its own operations. "Netting" refers to billing conventions that can offset the generator's station power consumption from the transmission network by its own production. But FERC has distinguished what it calls "permitted netting," which it does assert jurisdiction over. Here's FERC's explanation from 172 FERC P 61243 at page 100:

> With Permitted Netting, a generating facility is using its own real-time electric generation to supply its station power behind-the-meter—it is not receiving station power supply from the interconnected grid. Self-supply monthly netting, on the other hand, concerns the ability of a generating facility to net the electric energy it consumes from the interconnected grid when it is offline and not producing against its wholesale sales. When a generating facility is offline and not producing energy and seeks to acquire power from the interconnected grid for its station power, this is a retail sale of electric energy for end use. There is no such sale with Permitted Netting.

Applying this to energy parks, FERC could allow for netting of production and consumption that is all behind the POI. But under the framework above, FERC may assert it cannot allow netting when some of the consumption is energy from the transmission network. Any energy delivered over the transmission network could potentially be ruled a retail sale subject to state regulation (although FERC has authority over any transmission charges associated with that delivered energy).

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[25] For an example discussion on PUNs, see https://www.jdsupra.com/post/contentViewerEmbed.aspx?fid=f3dc0287-b274-4636-8368-bab1f43905a8. More legal analysis is available for a nominal fee at https://utcle.org/index.php/ecourses/get-asset-file/asset_id/52804/code/OC8860/.

[26] Thanks again to Ari Peskoe for legal feedback here. Any mistakes and slips of wording are ours, not his.

Hence, some kind of state regulatory role (likely in collaboration with FERC) will be required to sort this out. Net-metering schemes have become contentious with distribution consumers, but the hope is that an acceptable solution can quickly be found for energy parks that only operate at the wholesale level. In the near term, most energy parks will likely stick to an export-only model, so there is some extra time to work with.

Co-Location in the News: The AWS/Susquehanna Deal

However, even in the export-only model, when an energy park subsumes an existing source of energy, objections still come up. Just as demand reductions affect supply and demand dynamics like new supply (hence the nickname "negawatts"), the sudden removal of previously available supply looks a lot like extra demand on the grid. As noted above, in March 2024 Talen sold a data center campus in Pennsylvania to AWS for $650 million and plans to supply power from its Susquehanna nuclear plant.[xxiv] AWS has agreed to purchase power in 120-MW increments, potentially growing to 960 MW, while PJM has requested FERC's approval to increase the behind-the-meter connection to the data center from 300 MW to 480 MW.

While the relationship between load and generation behind the POI for an energy park may seem like it should be a simple bilateral deal between private parties, connecting the park to the bulk power system (especially but not only when diverting significant amounts of power from existing generation sources) could provoke considerable pushback from stakeholders concerned not only about fairness to consumers but also about reliability, cost allocation for infrastructure, emissions impacts, and competition for new loads.[xxv] The AWS/Susquehanna deal demonstrates how questions can still be asked about why energy park loads should be exempt from costs and requirements that affect other loads (especially tariff riders that are not directly tied to transmission and distribution, like ancillary services for grid stability or support for low-income customers).

A PARADIGM SHIFT: ENERGY PARKS AS "DIGITAL RESOURCES"

Energy parks, especially ones with storage and flexible co-located loads, can orchestrate the behavior of multiple machines behind the POI to supply the demands of the co-located load and choose how to dispatch power to the grid. In this orchestration, failure to satisfy the co-located demand becomes an opportunity cost much like the ones encountered by ordinary hybrid resources due to fuel costs and energy limitations on batteries. The energy park portfolio can act as a flexible resource to the grid, within technical constraints, and responding to the economic incentive to serve the co-located load. One of us, Mark Ahlstrom in his capacity as ESIG President, referred to this phenomenon in his 2020 remarks to FERC[27] as the rise of power plants as a "digital resource" where potentially "given sufficient electronics, software, energy and storage, we can create essentially any kind of electrical machine that we want." Adding a flexible load only adds to the toolset for making such resources flexible grid participants.

[27] Written Remarks from Mark Ahlstrom – Panel 1. https://www.esig.energy/wp-content/uploads/2020/07/Ahlstrom-Comments-FERC-Hybrid-Resources-Conference.pdf.

Ahlstrom has further called for a "universal participation model"[xxvi] where instead of creating a framework for each possible hybrid resource, transmission owners, grid operators, and power markets start with a generic "universal" model and then add back in only the most relevant parameters, like ramp speed, energy limits, and maximum/minimum output. This allows a more abstract and generalized approach to integrating grid resources that offers the most flexibility in putting together all kinds of useful resources.[28]

To illustrate what this means for energy parks, we can look at the ancillary services for frequency response.[29] In the "analog" world full of large rotating iron masses, a sudden frequency drop suddenly creates an inertial response in all connected synchronous generators, which resist slowing down in a manner that arrests the frequency drop. Then an automated "governor response" in participating generators proportionally increases steam/fuel supply to restore frequency until human intervention can restore balance.

In a digital world, energy parks would sign up to provide similar services like "fast frequency response" and "rapid reserves." The grid operator doesn't need to know internal details of the hybrid but is in constant communication via telemetry to know how much of this service the hybrid is able to provide at any time. If a hybrid is currently committed during a grid disturbance, then it will automatically react to a frequency drop by injecting extra power in a pre-agreed manner and amount at the POI within a pre-determined time frame and then provide the requisite reserve power as it awaits further instructions. The grid operator doesn't need to know if the hybrid is discharging an electric battery or turning down demand from the co-located load to accomplish its task, it just wants the committed response.

Current power grids are still organized in ways that would be very familiar to a mechanic or power engineer of the early 1900s. They have moved on a little, since some of the abstraction above has already been partially implemented in grid-operator dispatch systems. Unfortunately, other elements of a universal model are still anathema to these same operators because they interpret them as a loss of control on their part over key aspects of their responsibility to maintain reliability. However, energy parks by their very nature will challenge that paradigm and force a reckoning with more modern methods of organizing large numbers of interacting machines in a resilient and reliable way.[30] Those responsible for the health of the bulk power grid will face the choice of evolving their framework in order to capture the techno-economic potential of new grid-participating energy parks with co-located loads, or see these resources either fail to appear or retreat to a siloed mode of operation at a loss to society if their contributions to grid reliability are not appreciated and used. This conundrum has tremendous implications for norms, laws, and regulations that touch on the power grid.

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[28] This is analogous to the software concept called "object-oriented programming" crucial to the development of modern software and the creation of Arpanet (the precursor to the internet). For a compact history of the subject see "The Forgotten History of OOP" at https://medium.com/javascript-scene/the-forgotten-history-of-oop-88d71b9b2d9f.

[29] When there is a sudden change in the balance of generation and load, the grid frequency will change in ways that are problematic beyond an allowed range. Resources that provide frequency response help grid operators manage this over small timescales like seconds (or less).

[30] A subsequent ESIG blog by Ahlstrom argued that even without supporting the fully parameterized approach of the universal participation model, similar results could be obtained by fully embracing a flexible energy storage market participation model (but system operators have also resisted this for similar reasons). Since an energy storage resource can both inject power like a generator and extract power like a load, it follows that a flexible energy storage model could be used for market participation by more general energy parks. See https://www.esig.energy/why-storage-might-solve-really-big-problems-but-different-ones-than-you-think/.

CHALLENGES TO ENERGY PARKS FROM MONOPOLIES FOR DISTRIBUTION AND RETAIL SALES OF ELECTRICITY

Outside of grid connection and market participation issues, energy parks may also face challenges concerning the rights of monopoly utilities to be the exclusive provider of power to consumers in each service territory. Energy parks provide energy on-site to storage and potentially loads, with further potential to interact with the grid. They may be co-owned, or could be owned by different entities in ways that more fairly distribute operational and financial risk. These new configurations raise novel questions about what counts as a "wholesale" versus "retail" electricity sale, and therefore whether and how different energy park configurations may conflict with existing monopoly jurisdiction.

Problem: Retail Sales Monopolies

Under the FPA, FERC regulates the interconnection of resources into the grid and wholesale sales of power. FERC decisions have held that transmission operators must provide open access to wholesale generators, allowing those generators to own and operate infrastructure that connects the generator to the bulk electricity system. States regulate retail sales to end-use customers, as well as the distribution systems that represent low-voltage poles and wires that connect customers with the bulk electricity system. Regulated monopolies, be they full-service electricity or just "poles and wire" suppliers, have a fair amount of discretion in implementing FERC's rules. There is also a lot of deference to states on how best to weigh the benefits of protecting the natural monopoly versus subjecting it to competitive forces—even in this context. For example, even though utilities must open their transmission systems to independent power producers, state jurisdiction over retail sales means incumbent utilities are under no obligation to procure that power or facilitate access to customers.

Energy parks raise novel issues when it comes to monopoly utility regulation when they involve both generation and load on-site that use local networks behind the POI. Intuitively, parks such as hydrogen electrolyzers paired with generators involve the sale of energy to a retail customer—something that has historically fallen under the purview of an incumbent retail monopoly. An argument could be made that the distribution of electricity between generator and load also constitutes distribution infrastructure—another facet of electricity service that likely falls under exclusive monopoly rights. In practice, this means an energy park faces the risk that its design will require the involvement and service provision of the monopoly utility—increasing project complexity, extending development timelines, and subjecting it to the oversight of both the utility and state regulators. However, this construct presumes a sale between distinct entities. Today, energy parks are practically forced to get around this patchwork of state and federal regulatory concerns about electricity sales between separate entities by having the whole project owned by the same entity, where there is technically no buying or selling. This strategy is inefficient, as it tends to increase financing costs with no particular benefit to the public.

Problem: Internal Networks and Power Distribution Monopolies

Any energy park with clean energy resources of significant size will involve building new poles and wires connecting the energy park over significant distances. For traditional generation or generation/storage hybrids, these "gen-tie" lines are considered part of the private asset, and ownership of these lines does not interfere with the distribution utility's monopoly. However, once co-located load is part of the internal network behind the POI,

private ownership of the internal network may run into issues with state-granted utility power distribution monopoly franchises and new transmission right of first refusal.

Structures like the PUNs in Texas exemplify both how prospective energy parks might navigate this space, and the need for further reforms. ERCOT defines PUNs as "an electric network connected to the ERCOT Transmission Grid that contains Load that is not directly metered by ERCOT (i.e., Load that is typically netted with internal generation)." These PUNs may engage in net energy metering with ERCOT, but arrangements like energy parks risk violation of Texas utility law. PUNs are also subject to Texas regulation, which requires that only a retail electric provider may provide retail electric service.[xxvii] PUNs are allowed to construct and maintain their own distribution infrastructure because Texas law (ERCOT rules and state legislation) grants exemptions to state jurisdiction when PUNs demonstrate self-service or co-ownership between generator and load, or if the generation facility is a "qualified facility" under the Public Utility Regulatory Policies Act (PURPA). However, for more complex multi-party transactions, utility law is somewhat unclear, and recent litigation has left unresolved the matter of whether energy park infrastructure would constitute an unregistered public utility under Texas law.[xxviii] The Texas model shows that it's possible to work around or provide meaningful exceptions to utility monopoly jurisdiction, though the larger and more complex these projects become, the more likely it is they will run afoul of narrow exemptions under existing utility codes. Therefore, much more work can be done to reduce barriers to energy park development.

Given the potential benefits of energy parks and the leeway allowed states under the FPA, it would be worthwhile for legislatures to pass laws allowing private ownership of power lines behind a single POI, ideally with diverse ownership models that promote efficient development and financing of energy parks.

Solution: Reduce Utility Power

One solution to get around various utility franchise rights is to co-opt the utility: let utilities own the internal poles and wires and meter the internal sales with some compensation. The issue is that this compensation will need to be light for the financials of the energy park to make sense. Additionally, any utility cost recovery for service constitutes a new tariff that needs to be developed through stakeholder engagement and regulatory processes, then approved by the appropriate regulator (e.g., the PUC or a municipal utility's governing body). Other stakeholders may object to what they see as preferential treatment for one customer class, especially if they avoid some of the charges that account for the current gap between wholesale rates and retail industrial rates. But regulators could spell out the conditions under which other customers would be unaffected and bake those conditions into new participation rules.

Still, the utility's involvement is not a necessary condition for energy parks and policymakers should question the wisdom of extending traditional regulatory frameworks to this model, which is limited to sophisticated buyers and sellers. Requiring a monopoly distribution or retail utility's involvement may disrupt energy parks' development by subjecting these innovative new configurations to lengthy regulatory processes and oversight. Meanwhile it is not clear that regulating parts of energy parks as public utilities is justified by the same principles that demand regulation of monopoly distribution and retail utilities.. Texas PUNs provide an example of proactive wholesale market regulation that works with existing state

regulations to create exemptions that energy parks can navigate. At the very least, it is timely now for state regulators to examine the issues raised by large generators and co-located loads in order to develop policy positions that anticipate the coming wave of energy park proposals.

Solution: New State Legislation

Another solution is for state legislatures to get involved and pass a special law that amends their utility codes to allow energy parks to evade the monopoly retail and distribution rights of incumbent utilities (within limits). State legislatures need not necessarily reach into the regulatory arena with specific changes to the utility code. Instead, they can require PUCs to examine whether exemptions to monopoly regulation and oversight are appropriate, and what measures would protect customers and maintain the preferred scope of utility monopoly. However, this takes what might have been a contentious process with the utility regulator and places the same stakeholder tensions (are the energy park rules "fair" to other consumers?) in an outright political context.

APPENDIX 2: HISTORICAL EXAMPLES OF ENERGY PARKS

In this appendix, we provide more detailed information on the examples given in the main text of historical energy parks.

EXAMPLE 1: SOLAR STAR

One of the largest solar farms currently in operation in the U.S. is the Solar Star farm, a pair of projects in the Antelope Valley of California. This is a single axis tracking solar farm with a 776 MW_{DC} capacity[xxix] but only 585 MW_{AC} of grid-interconnected capacity.[31] Its ILR is 776 divided by 585, or an ILR of roughly 1.32.

There are two ways to look at this kind of project: either as an AC-connected solar farm with extra DC panels backing it up (how much value is gained from increasing DC power for a fixed AC amount), or as a clipped DC solar farm (how much value is gained from decreasing AC capacity for a fixed DC amount). The first way is how the grid sees this asset in practice, but the second is important to understanding the financial rationale for a larger ILR.

The financial logic for a 1.32 ILR like that seen at the Solar Star farm is simple. While some revenue will be lost when power is clipped (about 1 percent), the inverters that convert the DC power to AC power are a relatively expensive part of the overall power plant, and oversizing the DC solar panels ensures sufficient power to use the inverters more fully (e.g., providing additional power during the "shoulders" of the solar day), savings from use of smaller inverters and other AC equipment, and potentially lower interconnection upgrade costs because the maximum power injection is smaller. The ILR that a developer chooses is determined by balancing these financial flows: lost revenues against reduced cost. However, while the reduced cost—dominated by the reduced capital expense in inverter equipment—is easy to estimate, the lost revenue estimate is a bit trickier.

[31] EIA 860 Net Summer capacity.

Calculating lost revenue comes in two steps. The first step is to figure out how many megawatt-hours the project can expect to lose to clipping; the second is to figure out how much that clipped energy is likely to be worth. For the Solar Star farm, clipped energy typically comes when the entire California market is flush with solar power and prices are lower, so the lost revenue will be lower than average market prices. On the other hand, even if much of the clipping happens during the low-value hours of the spring when noon-time peaks are driven by clear skies and more ideal outside temperatures, some clipping still takes place during some of the higher-value hours of summer, so there is still a financial opportunity cost to clipping power. Today this opportunity cost (likely significantly lower than 1 percent of annual revenues) typically balances with equipment savings at an ILR around 1.3. Any more clipping and a project forgoes too much revenue, any less and it is spending too much on DC/AC conversion equipment. Using a variety of assumptions for financing costs and the market value for the clipped power, we found that the revenue loss from clipping balances out with savings from avoiding 200 MW of additional AC conversion costs around the stated ILR of 1.32. This tipping point matches up well with estimates of $10-30 per kW_{AC} for avoided inverter capacity. Modeling with higher discount rates or increased hardware prices (decreasing the net present value of forgone revenues relative to equipment savings) implies that even higher ILRs might be coming.

EXAMPLE 2: CALIFORNIA SOLAR BATTERY HYBRIDS

Starting in the mid-2010s, some developers began combining solar projects with on-site batteries. This was triggered by further cost reductions, this time in battery energy storage systems. Furthermore, for developers interested in batteries, a 30 percent federal investment tax credit was available for projects integrated in a solar farm and charging on solar power (they can now earn the credit as a stand-alone facility), so there was a big tax advantage to including them in a hybrid configuration. Solar battery hybrids, typically with about four hours of storage capacity, were also able to sell a firm capacity product to interested customers like utilities. Solar battery hybrids are especially popular in markets like California with significant solar penetration—97 percent of the solar capacity in CAISO's queue at the end of 2022 was paired with a battery.[32]

As developers gained experience with solar-plus-battery systems, the control systems evolved over time, leading to significant balance of system (BOS) cost reductions, inclusive of interconnection costs. One big differentiator was between AC-coupled system, where the PV system and battery system are connected via an AC bus (despite being native DC), and DC-coupled systems, where the two communicate over a DC bus. The former is generally cheaper and more modular, and a battery can be added on later, while the latter offers the possibility of further efficiency (fewer losses going back and forth through inverters) and the possibility of larger inverter-loading ratios. A 2017 National Renewable Energy Laboratory (NREL) study[xxx] estimated a reduction (relative to separate solar and storage projects) of $118/kW (30 percent savings on BOS costs) for AC-coupled hybrids, and a reduction of $158/kW (40 percent of BOS) for DC-coupled hybrids (average total costs for a hybrid are around $2,000/kW per the 2023 NREL Annual Technology Baseline).

[32] EIA 860 Net Summer capacity.

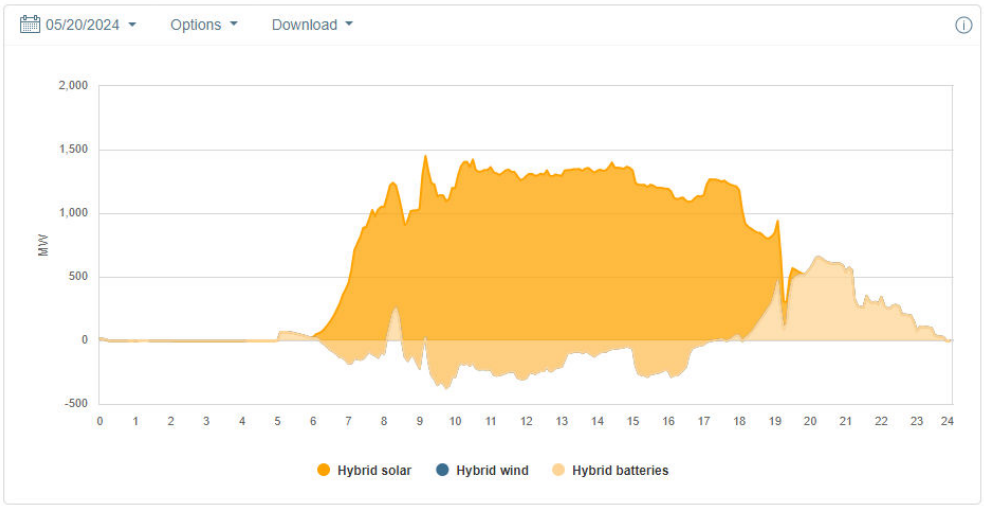
The IRA made the investment tax credit (ITC) available for stand-alone storage, removing charging from solar energy as a condition for receiving the ITC. Despite this, strong interest in hybrids remains. According to U.S. Energy Information Administration (EIA) data, there are 31 GW(AC) of proposed battery projects across the U.S., with 42 percent of that capacity in hybrids (a handful with wind) by 2030. We also see 82 GW(AC) of solar projects, with a quarter in solar-battery hybrids.[33]

With their new dispatchability, solar-storage hybrids opened new perspectives on what grid participation models should look like for modern generators. A report from an ESIG task force titled *Hybrid Power Plants – Flexible Resources to Simplify Markets and Support Grid Operations*[xxxi] suggests that future deployment of energy resources on the electric power system will increasingly take the form of "hybrid resources." The report defines a hybrid resource as "a combination of multiple technologies that are physically and electronically controlled by an owner/operator ('hybrid owner/operator') behind the POI and offered to the market or system operator ('market/system operator') as a single resource at that POI." In the case of a higher ILR (step 1 above), the AC inverter was a passive bridge to the POI, but can become a more active "intelligent agent" approach whereby the hybrid owner/operator manages the characteristics of the components behind the POI and offers energy, ancillary services, and resource adequacy capacity at the POI in the same way as a conventional dispatchable thermal or hydro resource, albeit still an energy limited one. While in theory the report's definition of a hybrid resource could encompass all that is meant in this paper as energy park, we will use the term to represent a subset of the energy park concept: a complex resource solely dedicated to producing energy and services for the grid at the POI.

These hybrid resources are not just using batteries to smooth output and extend generation further into the day—they are also quite responsive to control signals from the grid operator and will adjust their output quickly to local and regional conditions. Figure A2 displays the combined solar + battery output of the CAISO solar hybrid fleet on a 5-minute schedule on Monday May 20, 2024. Note how much the battery component adjusts dispatch during the day.

Figure A2. Combined output of solar + battery hybrids on CAISO system on May 20, 2024 (5-minute resolution)

[33] The Lawrence Berkeley National Laboratory 2024 *Queued Up* report (https://emp.lbl.gov/sites/default/files/2024-04/Queued%20Up%202024%20Edition_1.pdf) points to >1 TW of solar, >1 TW of batteries, and >360 GW of wind in interconnection queues nationwide, but observes, "Only ~19% of projects (14% of capacity) requesting interconnection from 2000-2018 reached commercial operations by the end of 2023."

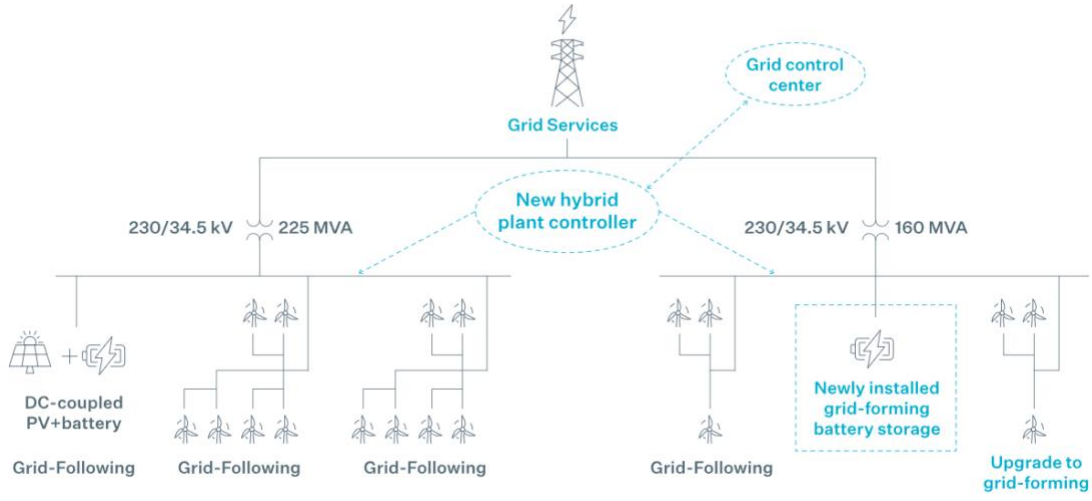


Source: CAISO, 2024

EXAMPLE 3: THE WHEATRIDGE HYBRID RENEWABLE ENERGY FACILITY

The Wheatridge Hybrid Renewable Energy facility in Oregon is North America's first energy park to combine wind (200 MW), solar (50 MW), and energy storage systems (4-hour 30 MW battery) in one location (with 200 MW more wind generation planned for 2025). It is at the cutting edge of hybrid resources, with planned upgrades to include extra controls and grid-forming inverters, with a recent $4.5 million grant from the DOE's Solar Energy Technology Office. Figure A3 provides a schematic of the project structure:

Figure A3. Wheatridge Hybrid Renewable Energy Facility



Source: Portland General Electric

There are a couple interesting takeaways from the Wheatridge energy park's line diagram:

1. The solar facility is DC-coupled to a battery, with a common DC bus that then connects via a shared inverter to a local AC bus. Such batteries are becoming a more and more common add-on to solar PV projects.

2. The upgraded project will have more than one battery, with both DC and AC coupling at different locations. Batteries can serve multiple functions inside an energy park.
3. The energy park shares two common 34.5 kV local AC buses, which then connect to the higher-voltage transmission system. Multiple resources on the local AC bus can share the transformer that accomplished this. Also, 34.5 kV is of the right scale for large commercial and industrial loads.
4. The addition of grid-forming inverters allows this hybrid resource to provide grid services to the broader bulk power grid. Other grid-forming inverters (which come in many flavors) could also be used to island a project like this if there were co-located load.

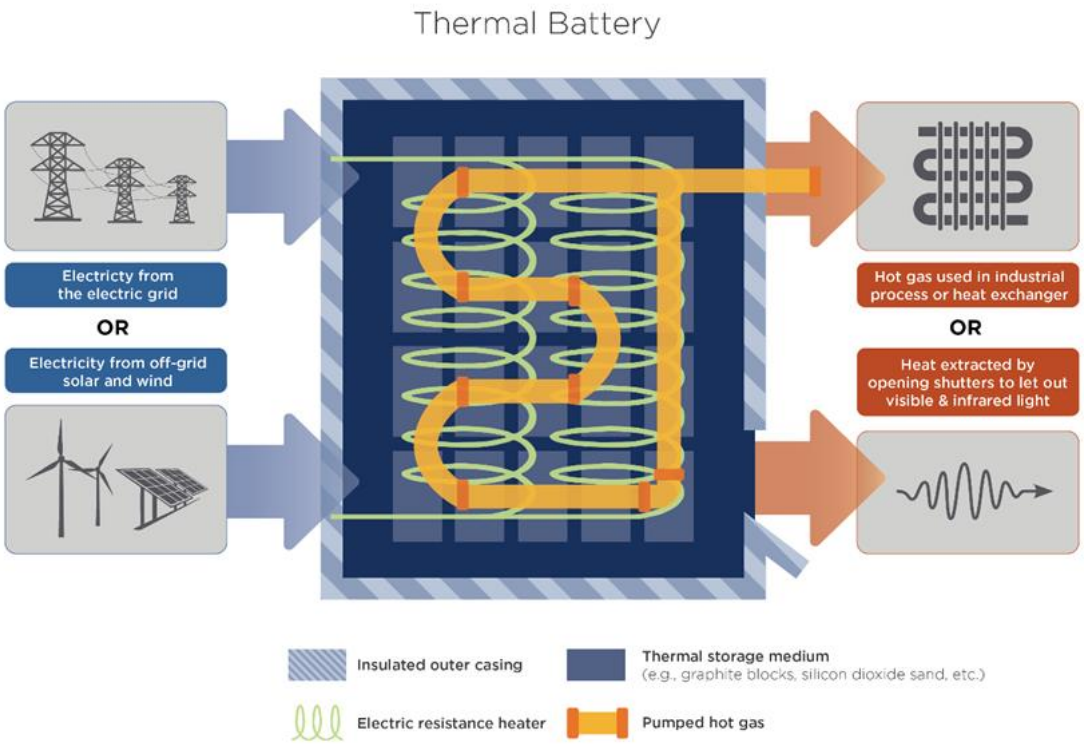
The Wheatridge energy park is an example of the kind of hybrid resource anticipated by the authors of the ESIG paper on hybrid resources. It reflects a growing sophistication and value proposition associated with hosting multiple technologies behind a common POI to provide more value to the electricity grid, whether that's energy, capacity, or ancillary services. This work, which involves generation and demand in the form of storage, has laid a foundation for expanding this model to load-generation hybrids.

APPENDIX 3: EXAMPLE FUTURE DIRECTIONS FOR ENERGY PARKS

Example 4: Industrial Thermal Battery

In a July 2023 report, *Industrial Thermal Batteries*, Energy Innovation explored the concept of thermal batteries, also called heat batteries. These batteries convert electricity into heat, store the heat for hours or days, and release it when needed.[xxxii] They consist of a large quantity of thermal storage material, such as bricks or graphite, enclosed in an insulating shell that minimizes heat loss. Electrical resistance heaters inside the battery convert the electricity to heat. When the heat is needed, it can be extracted by pumping a gas through the storage material and into the industrial facility or by opening shutters in the battery's outer casing to emit visible and infrared light. The battery can deliver heat at 1,500 to 1,700°C, hot enough to meet at least 93 percent of the industrial heat demand by combustible fuels in the U.S. (see Figure A4). This market is substantial: theoretically, thermal batteries could supply 11,600 petajoules per year in the U.S., or 75 percent of industrial non-feedstock energy demand. This is the equivalent of over 3,000 TWh per year (at 100 percent conversion efficiency) or 75 percent of all U.S. electricity consumption!

Figure A4. Thermal Batteries as Energy Parks



Source: Rissman and Gimon, "Industrial Thermal Batteries: Decarbonizing U.S. Industry While Supporting a High-Renewables Grid." Energy Innovation. 2024.

The report considered two scenarios for supplying the electricity to a thermal battery: directly from the bulk power grid and from a siloed (off-grid) solar/wind energy park. In the first scenario, the thermal battery leverages its demand flexibility and multi-day storage capacity to consume electricity during times of the lowest prices (price-hunting). In the second scenario, this flexibility is used to accommodate the variable output from the dedicated energy park generation along with some curtailment (generation-following). In the second scenario, the energy park is siloed so cannot lean on the bulk power grid for help, but it still maintains strong (95 percent to 99.9 percent availability) reliability targets.

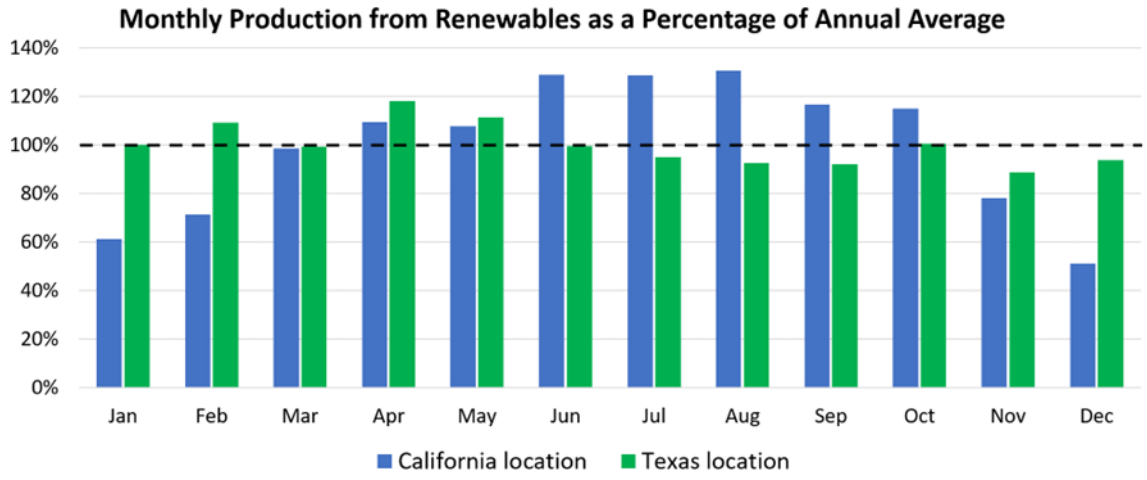
A siloed (fully off-grid) hybrid project is potentially economically viable but leaves value on the table. In this basic setup, the park operates simply: using wind/solar to generate electricity that charges the battery if it isn't full, and otherwise curtailing the excess generation. A small, on-site backup boiler ensures 24/7 reliability by covering the last 1 percent of hours when renewable generation and stored energy are insufficient. The operator primarily needs to decide when to run the backup boiler, manage the battery's charge to minimize thermal losses, and schedule maintenance during periods of low battery charge. It also helps if the thermal customer can adjust its seasonal demand to better fit the generation profile.

Things become more complex when the energy park starts to export power to the grid. Consider a large California-based solar farm paired with an 84-hour thermal battery, which is explored in detail in Energy Innovation's thermal batteries report mentioned above. Here, the energy park is powered solely by solar energy, while the thermal load remains constant throughout the year. To ensure adequate supply during winter (see Figure A5), the solar farm

must generate significantly more energy than necessary during summer and shoulder seasons, leading to almost half of the solar power being curtailed. This almost doubles the input power cost for the project, although high natural gas prices in California still make the project viable.

A siloed configuration of this energy park wastes vast amounts of power, while an export option offers the opportunity to sell otherwise curtailed power on the open market. This export option entails significant incremental costs and hassle to interconnect with the grid, but in return these power sales can provide a substantial additional income stream. A simple analysis of the same battery case with 2023 modeled production shows that sales of otherwise curtailed power[34] with no change in the dispatch between grid and thermal battery completely offsets the cost of all the power produced by the solar farm (assuming the same 2021 installed cost of solar as the original paper).

Figure A5. Comparison of monthly production from a solely solar project in California with a mix of solar and wind in Texas balanced for more steady production across the year



Further financial gains can be achieved by optimizing solar dispatch to feed the load or the grid based on wholesale prices. For example, if the thermal battery is relatively full and the solar farm is producing more daily output than needed, the operator can lean on its multi-day thermal storage to adjust the day-to-day amount of solar output sold to the grid based on daily price fluctuations, maximizing revenue while maintaining the same level of service to the co-located heat customer. This flexibility allows an energy park with a thermal battery to behave similarly to a solar-battery hybrid during solar production windows, including providing ancillary services like regulation, even though it doesn't necessarily have the option to reconvert heat to electricity. However, it differs in that it cannot produce power when the sun is down and it has a stronger seasonal skew in energy availability.

The unique ability of the 84-hour thermal battery in this energy park to bank or loan out daily solar energy output between days or even weeks offers significant advantages over

[34] (At conservative SP15 trading hub hourly day-ahead prices.)

conventional solar-battery hybrids.[35] This makes it an asset for both the economics and reliability of the bulk power grid, providing complementary dispatchability at a lower cost of capital.

Another benefit of going from a siloed energy park to one with export capabilities has to do with the U.S. federal tax structure. Due to changes in the IRA, solar power plants can now choose between claiming the ITC and the PTC. In some cases, especially with high-capacity-factor solar farms, PTC is preferable, but siloed projects may make the PTC inaccessible, as there may be concerns that a significant amount of the curtailed power would not qualify for this credit (with large financial impact). Exporting energy parks with greater production optimization and lower curtailment bring the PTC back into play.

We will skip summarizing the complexity and downside of grid interface here, as we cover that topic below. For early deployment projects, where simplicity is at a premium when deploying a new technology and first-mover customers can be chosen with heat demand that most closely matches available generation, a siloed project may make sense. However, we believe that in most cases, while transitioning a solar-plus-thermal-battery project from a siloed energy park to one that can also export significantly increases operational complexity, it is likely worthwhile.

To optimally dispatch exports from an energy park with a thermal-battery-served load, the operator must monitor current solar production, the thermal battery's state of charge, forecasted solar production, and wholesale price forecasts. Additionally, the operator can adjust the thermal load and use a backup boiler[36] not only for reliability but also to supply extra electricity to the grid. To grow into this complexity, projects will likely evolve from simpler configurations and operating models to more sophisticated arrangements over time. A further step in this evolution may include a bi-directional interface with the bulk power system (open hybrid), allowing occasional draws on wholesale grid power when it is very cheap, providing additional backup options, and further optimizing internal production for later use. The owner could also choose to add an electric battery for more operational and trading flexibility. In all cases, the planning and operations of a thermal battery load-generation hybrid will depend significantly on the regulatory and tariff environment.

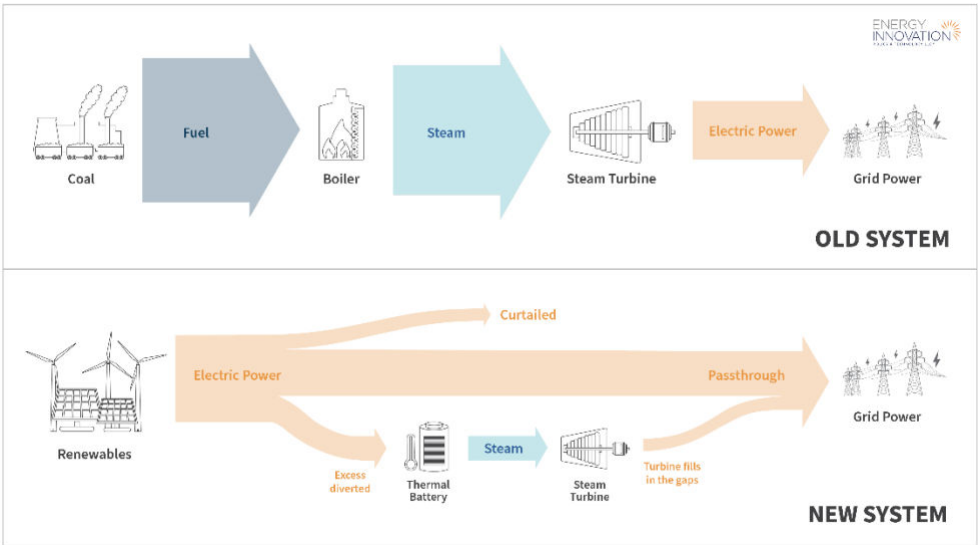
Coda: Coal plant replacement with thermal battery/renewable energy combo

Some energy parks with thermal batteries could also reconvert heat to electricity: pulling back some of the electricity the co-located load consumed via a reverse process at some efficiency cost but at a later, more valuable time. This is typically not possible for a co-located load that makes generic things, but many loads that are flexible enough to be attractive in an energy park context will involve intermediate energy-intensive steps (like heat and hydrogen) that involve energy carriers that can be stored. Many of these can be re-converted to electricity.

Figure A6. Coal Plant Replacement with Clean Energy Portfolio and Thermal Battery

[35] Electrical batteries can export power outside the solar production window but have a limited duration and tend to operate on a daily cycle. Also, the thermal battery supplying an energy park has a much better round-trip efficiency when acting as a virtual electrical battery this way because it is just deferring deliveries to the thermal load, not reconverting thermal energy into electricity.

[36] Here, a backup boiler provides extra heat to make up for any shortfall in electric heat or to supplement it. Because the boiler's primary purpose is providing heat, in this supplementary mode the net effect is like 100 percent conversion of heat to electricity.



An especially promising place for reconversion at an energy park is to transform coal or gas steam boiler-based electric generation plants that have recently retired or are about to retire into re-powered clean dispatchable generation resources. Many of these coal or gas plant sites can host local renewable generation nearby,[37] and the existing interconnection infrastructure can be recycled. If the intermediate energy medium is heat, it can be used to make steam that can drive an existing turbine—the reconversion equipment is already there. This type of arrangement is illustrated in Figure A6. It returns the load-generation hybrid in example 3 back into a generation-only hybrid resource—although some waste heat could be recovered in a combined heat and power-like arrangement to serve thermal loads.

For thermal batteries as an intermediate storage, the round-trip efficiency is competitive with closed-loop long duration systems being proposed today and offers even higher end-use efficiency in a combined heat and power configuration. The opportunity set is huge: hundreds of gigawatts of U.S. steam generator fossil plants that have already retired or could retire make good candidates for this kind of repowering.

EXAMPLE 5: ELECTROLYSIS OF HYDROGEN FROM WATER

In the previous example, a thermal battery was used within an energy park to convert inexpensive electricity from variable renewable generation into a steady supply of industrial heat. Another method of transforming electricity into useful industrial products is through electrolysis, which involves using DC electric current to drive non-spontaneous chemical reactions. Electrolysis has the potential to revolutionize industrial decarbonization, particularly in applications such as cement production[38] (responsible for about 7 percent of global carbon emissions) and the direct reduction of iron[39] (iron and steel account for 8 percent of global carbon emissions). Still, the most well-known, or at least well-publicized,

[37] One estimate is 250 GW of potential (including battery storage) using generator replacement and surplus interconnection processes already in place. The actual potential is much higher: https://rmi.org/wp-content/uploads/dlm_uploads/2024/01/clean_repowering_web_deck_new.pdf.
[38] For an example of cement from electrolysis, see https://sublime-systems.com/.
[39] For some examples of steel from electrolysis, see https://www.electra.earth/media/ or https://www.bostonmetal.com/.

application of electrolysis today is the electrolysis of water using clean electricity to produce green hydrogen.

Hydrogen primarily serves as an energy intermediary or carrier, used as a feedstock or fuel. Several large new energy parks focused on hydrogen production have been announced. These include Intersect Power's Meitner Project in Gray County, Texas, which combines 340 MW of solar with 460 MW of wind to power 400 MW of on-site electrolyzers for producing sustainable aviation fuel and the HyStor energy park in Mississippi, which will supply hydrogen to SSAB's green steel project..

Production of materials via electrolysis at the scale of modern economies takes a tremendous amount of electricity.[xxxiii] For example, the DOE's June 2023 National Clean Hydrogen Strategy and Roadmap envisages 10 million metric tons of new production of hydrogen per year by 2030 from various sources including electrolysis. If it were all produced at current efficiency levels of around 50 kWh of electricity per kg of hydrogen produced from electrolysis, it would take 500 TWh per year of new electricity supply, equivalent to about 12 percent of all U.S. electricity demand today. On a unit basis, the cost of electricity to make hydrogen is also an important factor. At the efficiency level mentioned above, every $20 on the price of a megawatt-hour increases the cost of produced hydrogen by $1/kg. For context, the DOE's "Hydrogen Shot" target is $1/kg hydrogen through net-zero-carbon pathways by 2031. With its huge need for new electricity and high price sensitivity, hydrogen production at energy parks should be a great fit.

One major obstacle to using energy parks for producing hydrogen via electrolysis from clean electricity, so-called "green hydrogen," is the capital cost of the equipment: paying for the electrolyzer stack and the balance of system (pumps, compressors, etc.). While the equipment to convert electricity into heat (before storage) in the thermal battery example above was around $100 per kW, the all-in conversion capital cost for hydrogen production is around $1,500 per kW. This incentivizes running the facility around the clock to keep down the capital expenditure per unit of produced hydrogen. However, cheap, round-the-clock clean energy sources are hard to find. Because of their price sensitivity, electrolyzer load-generation hybrid energy parks make the most sense if the co-located load is flexible.

Fortunately for those interested in kick-starting the green hydrogen industry, the IRA provides for up to $3/kg in PTCs over 10 years for low-emission hydrogen (the equivalent of a $60 per MWh subsidy for the input electricity, if it is deemed clean enough). This is meant to get the industry started while capital costs go down the learning curve. It also creates a world of two eras for green hydrogen projects—the tax-subsidized era, and the post-subsidy era.[xxxiv] In the first era, a project with an offtake price of $1 per kg can afford to pay up to $80 per MWh for electricity with the tax credit so long as it's clean, helping it to run more of the year (70 percent+) to cover capital expenses for the electrolyzer and some hydrogen storage. In the second era, after the tax credit runs out, a lot of the capital expenses will have been paid off and the electrolysis stack replaced with something cheaper and more efficient, leaving a lot less need to pay off capital expenditures. The project now runs much less of the year (less than 30 percent) because it can only afford to buy power under $15-20 per MWh if it still wants to sell hydrogen around $1 per kg. Projects coming online after the expiration of tax credits (in 2032) face more challenging economics from the get-go that require flexible hydrogen production and access to cheap, clean electricity from the start.

Energy parks are perfectly positioned to operate in both eras—in the first era, because they directly provide clean energy that will easily qualify for the tax credit on an emissions basis, and in the second era because they directly provide electricity cheap enough to produce competitively priced hydrogen. In both cases, the electrolysis load needs to be flexible.

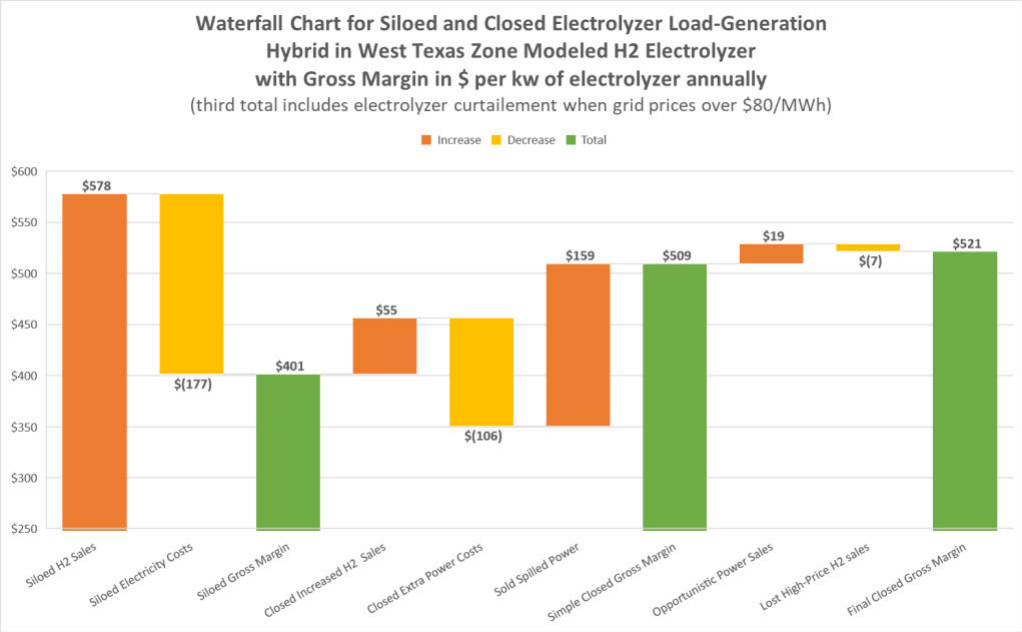
In more detail, for the first era, having co-located variable renewables or other clean generation resources guarantees local provenance for green power, and if the park is built all together there are no questions of additionality. The electrolyzers can ramp up and down, matching the generation profile, and can provide a steady supply of hydrogen if there is storage capacity. Given the high fixed costs (mostly capital) that must be recovered, it still makes sense to keep utilization as high as possible. The key is to locate the energy park where there are plentiful good new wind and solar resources (with perhaps a smidge of clean firm sources like geothermal) whose complementary profile helps provide a reasonably constant supply.

To better understand this dynamic, we modeled a wind and solar project making hydrogen in West Texas. Starting with a siloed configuration, we found using modeled 2020 weather data that 180 MW of solar and 150 MW of wind could feed 100 MW of electrolyzers at 82 percent of capacity. Assuming $16.2/MWh and $/19.2 MWh for co-located solar and wind (using 2021 NREL Annual Technology Baseline capital costs), 20 kg of hydrogen per MWh, a tax credit of $3/kg, and an offtake price of $1/kg, the project returned $401 per kW-year of hydrogen capacity. For context, a reasonable measure of annual fixed costs for a project with a $1,500 per kW electrolyzer is around $300 per kW, so this first pass leaves plenty of room for a healthy profit margin (although this is wiped out if we add $5/MWh to the solar and wind costs).

Going to a closed load-generation hybrid model adds more room for profit. With the possibility of selling excess power to the grid, it makes sense to oversize the generation in the energy park by another 60 percent (288 MW of solar and 240 MW of wind) for some incremental utilization of the electrolyzer (now 90 percent). The diminishing return on electrolyzer load factor means that this project will make $55/kW in extra revenue in hydrogen sales at the cost of $106/kW in extra power purchases (see Figure A7). However, if we choose a simple model for selling power to the grid—just sell the excess—then even in a low market price year for wholesale power in the West Texas trading hub (2020), the project makes an extra $159/kW in revenue from power sales, bringing the gross margin to $509/kW. Figure A7 also shows how by forgoing some hydrogen production when prices are high, even more profits can be achieved.[40]

Figure A7. Gross Margin per kW of Electrolyzer for a Modeled System in West Texas

[40] We have assumed here that the electrolyzer can be turned down to zero, but typically there is a minimum turndown during regular operations, e.g., the electrolyzer must continue to consume 10-20 percent of max power.



Even though the closed hybrid model means extra delays to get through interconnection and requires nearby transmission, the extra profit (along with the potential tax benefits of a PTC) appear to justify it.

In fact, for the early proposed hydrogen mega-project mentioned above, the closed hybrid model is essentially mandatory for financial viability. Given the billions of dollars in capital expenditure involved, almost no developers can afford to build these energy parks using their own capital—they will need to borrow money. However, because wind and solar projects are a known quantity, financiers are much more comfortable funding this side of the load-generation hybrid. They will want assurances that there is still a path to market for hundreds of megawatts of wind and solar if somehow the load side of the hybrid falls and any associated offtake contracts fall through.

These market access considerations are also important for the project's second era, when much more of the generated power from the energy park will be intended for market (with the electrolyzer providing a price floor for about 20-30 percent of hours).

There is also the question of how much grid access capacity will satisfy the financiers, and how this impacts the interconnection costs the generation-load hybrid must pay. In the closed hybrid configuration modeled above, the mix is optimized to provide for a 100 MW electrolyzer at a 90 percent load factor. However, the combined wind and solar plant can produce as much as 476 MW peak power and, net of load, the maximum output to the grid for the load-generation hybrid is 411 MW. To save some on equipment (as in our first example) the hybrid might want to limit itself to a grid-tie capacity of 400 MW (1-2 percent clipping for a worst case with no electrolyzer) or 350 MW (1-2 percent clipping with native load), but ultimately the grid-tie sizing will depend on how much capital and interconnection costs, as well as interconnection study delays, rise with requested interconnection capacity.

Adding a 100 MW/MWh battery could eliminate most shortfall of supply to the electrolyzer and significantly improve wholesale revenues while reducing the grid-tie capacity needs. It could help condition power to the electrolyzer, maintain minimum input levels, and even

island the park in case of bulk power system failures.[41] From the wholesale market point of view, the battery could also supply regulation, fast response services, and other ancillary services like voltage support, as well as black start and short-current strength (if combined with a grid-forming inverter).

Another way for the hydrogen energy park to cover gaps in production for the electrolyzer is to adopt an open hybrid model—occasionally buying some power from the grid when the electrolyzer is not at full capacity. In the first era, it might need to purchase some green certificates to do so, and in the second era it will want to do this when prices are below a certain threshold (in 2020, it could do this for about 80 percent of the missing MWhs with a max purchase price of $20 per MWh).

Finally, with a hydrogen energy park there is the possibility of reconverting hydrogen back to power for sale on the open market when prices are high and the electrolyzer is turned down by installing a hydrogen turbine or fuel cell in the park that could draw from the on-site hydrogen storage to supplement output during high wholesale price periods.[42] Again, this introduces additional complexity from the grid interconnection side if additional generation resources are added to the mix.

Planning and sizing the various components of a hydrogen energy park will be a sophisticated endeavor, but not all components will need to be in place at the start if developers adopt a modular approach: install the basics first and then add more hardware as they gain experience.

APPENDIX 4: GENERAL CONSIDERATIONS RELATING TO ENERGY PARKS

In today's financial markets, participants trade many assets on public markets and thus create public prices for various stocks, bonds, and commodities. There are also so-called "derivatives" of these underlying asset prices: financial instruments that provide the option, but not always the obligation, for buyers to exercise the right to buy or sell tangible assets and stocks at set prices. The very existence of such products—the fact that options have value at all—reflects the uncertainty of future outcomes. Through sophisticated models, this option value is made tangible—it exists on balance sheets all over the world. Hence, to understand the case for energy parks, and generation-load hybrids in particular, it is important to understand how they derive value for their investors not just by converting capital and inputs into returns under one given set of conditions, but by offering choices under multiple future scenarios. These can be grouped under three broad categories:

- Price choice
- Quantity choice
- Capital investment choice

[41] For islanding, the storage inverter would have to be grid-forming.
[42] Theoretically, with the PTC in place there are wholesale price levels where it makes sense to both produce hydrogen from electricity and consume electricity for power exports at the same time. We assume the IRS will disallow tax credits under these conditions.

Each of these sources of option value will depend on expectations for weather, economic conditions, policy context, market rules, and grid operator behavior.

PRICE CHOICE

Traditional fossil generators have implicit price option value through the choice of whether to generate. In an electricity market, they express their preferences by providing offers to generate to the market mostly based on marginal costs—the cost of fuel and incremental maintenance costs of running the plant. If market prices are too low, their offers will not clear the market and they don't dispatch; otherwise they do. Crudely speaking, to market traders these generators are derivatives—a financial option to convert fuel to electricity (engendering terms of art like "spark spread"). Variable energy resources like wind and solar, on the other hand, are price takers with little option value. They produce what they produce based on weather and sunshine regardless of grid prices. Energy parks with co-located loads allow their owners more choices on what prices they are paid—or pay—for electricity.

In the special case of a generation-battery hybrid (example 2), the battery is typically sized to take advantage of otherwise spilled energy that otherwise will not go out to the grid. In this regard, it is effectively a price taker for the energy it stores unless it chooses to draw even more energy from its generation partner when market prices are especially low. Where this hybrid has choice, within its physical limits, is with regard to when it sells back its stored energy to the grid: it has the choice to wait for peak prices later in the day. This choice is limited, however, as the battery must discharge eventually to make room for more inputs from its generation partner and its fortunes are still completely tied to the price dynamics of the grid. Energy parks with an import capability offer a bit more choice, in that they can choose to draw cheap power from the grid if the timing is right, but they still face many of the limitations of their export-only cousins.

Connecting a captive load to the generation load increases price choice. The captive load is like a "put" option in finance—a guaranteed floor value for the generator's output. For example, if a hydrogen electrolyzer has a guaranteed offtaker at $4/kg (selling for $1/kg with the tax credit), this price floor will be at $80/MWh, but once the hydrogen PTC expires this floor might drop to $20/MWh or follow the price of hydrogen on the market. Load-generation hybrids create optionality by connecting the electricity market to whatever industry (widgets, commodities, computation, etc.) is served by the captive load, much like fossil generators connect a fuel market and the electricity market. If the generation-load hybrid also includes a battery, it can choose whether to direct its generated electricity directly to the grid, to the battery, or to the captive load based on comparative price considerations. If grid prices are high, it will maximize its output to the grid, save the rest to sell later with the battery, and whatever is left can go to the captive load. With lower external prices it might dispatch differently, and if they are especially low then the captive load provides a useful sink for production.

QUANTITY CHOICE

Variable energy resources like wind and solar produce power on nature's schedule. In a plain vanilla project, the maximum quantity the operator can generate from available wind or

insolation is exactly what it will offer to the market—no more, no less (setting aside congestion-driven curtailment). Similarly, a clean firm resource like a geothermal project, which does not burn fuel and has scant variable costs, will want to run 24/7 to maximize return on investment.[43] In a generation-load hybrid, having a flexible captive load allows a project choice in the quantity (and timing) of electricity it offers. When demand on the grid is high, it transmits as much as it can through its POI, while if demand is low or generation is being curtailed it can redirect energy to its captive load. Of course, similar considerations apply for the connected market served by the co-located load.

In an efficient market, supply-demand dynamics are tightly connected to prices, so quantity choice is intimately tied to price choice. The advantage of load-generation hybrids is their ability to supply the grid with more elasticity of supply through the internal elasticity of flexible co-located loads. On the flip side, if a project is set up to create a dedicated source of clean but variable power to a dedicated load with a relatively constant demand profile, the ability to siphon off some of its output for sale to the grid provides a valuable source of demand elasticity for that surplus.

Creating more elasticity of supply can be especially valuable to clean grids over longer time scales as they incorporate fewer and fewer fuel-based resources. For example, in California today, hydropower can provide 5 to 15 percent of total supply each year, depending on winter rainfall. It would not be economical to overbuild solar and wind farms for the worst years of hydropower production, but the main work of buffering these natural variations goes to natural gas-fired generators which can adjust how much fuel (much of it from out-of-state sources) they choose to buy every year. In a 100 percent carbon-free grid, unabated gas cannot play this role. With adjustable captive loads, the opportunity costs of production (i.e., the maximum price they are willing to pay for electricity inputs) become an effective proxy for fuel costs. For example, a hydrogen electrolyzer might produce much more quantity of hydrogen in a high hydro year than in a low hydro year because doing so is profitable during the lower prices that a hydro glut produces. However, the viability of this mechanism depends on a fairly liquid market for hydrogen, where hydrogen or hydrogen-derived products can be exported or imported to adjust for varying production costs.

CAPITAL INVESTMENT CHOICE

Capital investment choice is the freedom that developers have to size their initial investment to today's market conditions while preserving the possibility of further investment as market conditions change. This is facilitated by the inherent nature of load-generation hybrids as synthetic resources. "Synthetic," here, refers to the grid operator interacting at the POI with not just a single machine but the controlled output of a combined set of resources, effectively a mini grid. Once this mini grid is in place to facilitate energy flow behind the POI, new resources can be added to or removed from it. So long as these don't break the conditions under which interconnection and/or capacity value are assessed at the POI with the grid, there is no necessary reason why upgrades in the mini grid should require any extra permitting, interconnection studies, transmission upgrades, etc. With the construction of a

[43] Apparently, this is not entirely true, as geothermal projects can make use of in-reservoir energy storage. See https://zenodo.org/record/6385742#.Ymm888jMKUk.

load-generation hybrid, the owners acquire the option to invest more capital with minimal headache.

One example illustrates the capital optionality value: battery storage developers in Texas are choosing to build shorter-duration batteries (less than two hours at max output) while making sure to purchase enough nearby space nearby for more batteries, allowing them to increase duration in the future without changing the power ratings of the facility. This reflects current market conditions where shorter-duration batteries make more sense, but longer-duration batteries are expected to become advantageous as penetration of wind and solar resources in the Texas grid continues.

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2023 EEI ESG/Sustainability Report

TVA TENNESSEE VALLEY AUTHORITY

2024-1204 0724

TENNESSEE VALLEY AUTHORITY

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Tennessee Valley Authority

September 2024

Introduction and Purpose

The Tennessee Valley Authority (TVA) provides the people of the Tennessee Valley with affordable and reliable energy while maintaining a healthy environment and prosperous economy – without compromising the ability of future generations to do the same. The three Es — energy, environmental stewardship, and economic development — continue to drive everything TVA does to sustain our seven-state service area. TVA's mission to "serve the people to make life better" is as relevant today as it was when TVA was established in 1933.

At TVA, creating a sustainable future for the Valley is engrained in our mission, serves as the foundation of our climate strategy, and underpins our approach to environmental, social and governance practices. We are pursuing innovative solutions, from building the energy system of the future to working with leading-edge partners as we aspire to reach net-zero carbon emissions. This report provides key sustainability metrics for voluntary use and is consistent with the sustainability reporting template developed by the Edison Electric Institute.

ESG / Sustainability Governance at TVA

Our governance structure is critical to driving sustainability performance. TVA's nine-member Board of Directors (the Board) serves as the governing body for TVA. As provided by the TVA Act and the TVA Bylaws, the principal responsibilities of the Board are to establish broad strategies, goals and objectives; set long-range plans and policies; and ensure their implementation by the TVA staff under the leadership of the Chief Executive Officer (CEO). Board members are nominated by the President of the United States and confirmed by the Senate, and Board terms are for five years.

The Board has established two separate councils — the Regional Resource Stewardship Council and the Regional Energy Resource Council — created under the Federal Advisory Committee Act to advise TVA on its stewardship activities and energy resource activities in the Tennessee Valley. These councils focus on decisions and performance to foster a sustainable environment in the Tennessee Valley.

Led by the CEO, TVA's Enterprise Leadership Team drives business strategy, including decisions relating to sustainability and risk management. In leading the nation's largest public power supplier and one of the top producers of electricity, TVA's leadership team sets the strategy, vision and operational direction for the enterprise.

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“TVA reduced carbon emissions intensity by 53% against 2005 baseline and aspires to achieve net-zero emissions by 2050.”

TVA has appointed a Chief Sustainability Officer (CSO) who provides sustainability governance and oversight across TVA’s business units. TVA’s CSO oversees an enterprise-wide Environment Executive Council and Sustainability Steering Committee. TVA has also appointed a Chief Risk Officer, who oversees TVA’s enterprise risk management function to help ensure all significant internal and external risks are identified and fully integrated into strategic and business planning. Both the sustainability officer and the risk officer are members of the Risk Management Steering Committee. The risk officer reports to the Enterprise Risk Council.

Adapting to the Changing Business Environment

TVA reduced carbon emissions intensity by 53% against 2005 baseline and aspires to achieve net-zero emissions by 2050. This reduction was accomplished primarily by incorporating renewable energy assets, replacing aging plants and expanding the nuclear energy program.

By investing in emissions reduction technology, TVA has reduced sulfur dioxide (SO2) emissions by 99% since 1977. TVA has reduced nitrogen oxide (NOx) emissions by 97% since 1995. From 1970 to 2023, TVA spent $6.8 billion to reduce emissions from its power plants, including $25 million in 2023 on clean air controls.

TVA’s power system portfolio has evolved significantly over the past decade and a half, and we have seen a substantial reduction in TVA’s carbon footprint. In 2023, 55% of TVA’s total power supply came from carbon-free sources. TVA has nearly 9,000 MW of renewable energy in 2023, which includes solar capacity totaling almost 3,200 MW either operating, committed to come online, or TVA self-directed, pending environmental review, working toward an aspiration of 10,000 MW of solar by 2035. TVA has a diverse generation mix that provides reliable and affordable energy and positions TVA well for the future.

TVA is actively reducing carbon emissions with the investments through renewable energy expansion, power grid modernization and exploring other decarbonization technologies.

As TVA strives to reach net zero carbon emissions, we are evaluating technologies such as advanced nuclear, long-duration energy storage, advanced hydro generation technologies, carbon-capture technologies and alternative fuels such as hydrogen, with an eye on commercial-scale production at a cost that enables their deployment. Ultimately, TVA aspires to achieve net-zero carbon emissions by 2050 and to support broader national efforts to decarbonize the economy. TVA seeks to follow the principles below to help further reduce emissions.

- Prioritizing the needs of Valley stakeholders
- Using best-available science and supporting research and policies that further carbon-free dispatchable technologies
- Partnering with customers and others to support economy-wide decarbonization through electrification and efficiency efforts
- Maintaining nuclear generation, hydro generation and a strong transmission grid as key enabling assets
- Being transparent with stakeholders in measuring and sharing our progress
- Adapting new technologies and changing policies to achieve deeper carbon reduction

TVA is also identifying strategic possibilities, such as working with state agencies, local power companies and third-party charging developers to create the Fast Charge Network, a network of public fast-charging sites located at

“TVA is actively engaged in several business and industry groups to help identify and manage ESG/sustainability risks and capitalize on opportunities arising from regulation, customer trends, and research and development.”

least every 50 miles along interstates and major highways across our seven-state service area.

Managing and Adapting to Future ESG/Sustainability Risks and Opportunities

TVA is actively engaged in several business and industry groups to help identify and manage ESG/sustainability risks and capitalize on opportunities arising from regulation, customer trends, and research and development. In addition to its Edison Electric Institute membership, TVA is a member of the Electric Power Research Institute, the North American Energy Standards Board, and the Business Council on Sustainable Electricity, among others.

As a federal agency, TVA is required to comply with the National Environmental Policy Act, and is guided by Executive Orders (EO), such as EO 14008 on Tackling the Climate Crisis at Home and Abroad, EO 14057 on Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, and the remaining sections of EO 13834 on Efficient Federal Operations. TVA has developed a Strategic Sustainability Plan that follows EO 14057 and 14008 guidance for TVA buildings and its vehicle fleet. As part of this plan, TVA has established annual sustainability objectives in accordance with the Office of Management and Budget’s federal scorecard targets. TVA works to integrate its federal goals for implementing EO 14008 and EO 14057 and the remaining sections of EO 13834 into existing business operations.

TVA has several key programs and initiatives that support its sustainability strategy, such as “The Climate Action Adaptation and Resiliency Plan,” which guides TVA’s planning process to include a long-range view of climate impacts on TVA’s system. TVA also manages the Tennessee River system and associated public lands to reduce flood damage, maintain navigation, support power production and recreational uses, improve water and air quality, and protect shoreline resources. TVA will continue to manage the natural resources of the Tennessee Valley using the Natural Resource Plan.

TVA’s Sustainability Report includes annual progress on TVA’s energy system, environmental stewardship, economic impact, social responsibility and governance. TVA uses narratives and metrics aligned with industry standards, such as the Global Reporting Initiative (GRI) and the United Nations Sustainable Development Goals, to disclose annual sustainability performance data.

TVA also released its Diversity, Equity, Inclusion, and Accessibility (DEIA) report that builds upon TVA’s transparency efforts by providing insight into initiatives in this vital area. It details TVA’s progress to advance DEIA both internally and externally in the communities we serve.

TVA

Topic Areas	Link
ESG Page for Investors	**TVA - Environmental, Social, & Governance Reports** https://tva.q4ir.com/esg/
Carbon Emission Aspirations	**Sustainability Report** https://www.tva.com/environment/environmental-stewardship/sustainability/sustainability-report
TVA's Decarbonization Journey	**Carbon Report** https://www.tva.com/environment/environmental-stewardship/sustainability/carbon-report
Integrated Resource Plan (IRP)	**IRP** https://www.tva.com/environment/integrated-resource-plan
Natural Resource Plan (NRP)	**Natural Resource Plan** https://www.tva.com/environment/environmental-stewardship/environmental-reviews/natural-resource-plan
Climate Action Adaptation and Resiliency Plan	**Climate Action Adaptation and Resiliency Plan** https://www.tva.com/about-tva/guidelines-and-reports/federal-sustainability-plans-and-performance
Strategic Intent and Guiding Principles	**Strategic Intent and Guiding Principles** https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/about-tva/board-of-directors/may-6-2021/strategic-plan-documentc67079e2-d479-4f3d-a13b-1fa6fd714cde.pdf?sfvrsn=bc7bb2e8_7
Diversity, Equity, Inclusion and Accessibility (DEIA) Report	**Diversity, Equity, Inclusion and Accessibility (DEIA) Report** https://www.tva.com/careers/diversity-inclusion/diversity-report
TVA's Federal Infrastructure Reporting	**Federal Sustainability Report and Implementation Plan** https://www.tva.com/about-tva/guidelines-and-reports/federal-sustainability-plans-and-performance

This document contains forward-looking statements relating to future events and future performance. All statements other than those that are purely historical may be forward-looking statements. In certain cases, forward-looking statements can be identified by the use of words such as "may," "will," "should," "expect," "anticipate," "believe," "intend," "project," "plan," "predict," "assume," "forecast," "estimate," "objective," "possible," "probably," "likely," "potential," "speculate," the negative of such words, or other similar expressions. Although TVA believes that the assumptions underlying the forward-looking statements are reasonable, TVA does not guarantee the accuracy of these statements. Numerous factors could cause actual results to differ materially from those in the forward-looking statements. For a discussion of these factors, please see the annual, quarterly, and periodic reports that TVA files with the Securities and Exchange Commission. New factors emerge from time to time, and it is not possible for management to predict all such factors or to assess the extent to which any factor or combination of factors may impact TVA's business or cause results to differ materially from those contained in any forward-looking statement. TVA undertakes no obligation to update any forward-looking statement to reflect developments that occur after the statement is made.

This report is intended to provide highlighted information of interest about TVA's business and operations during its fiscal year ended Sept. 30, 2023. This report should be read in conjunction with TVA's Form 10-K Annual Report for the year ended Sept. 30, 2023, filed with the Securities and Exchange Commission.

2024-1204 0724

TVA

Electric Company ESG/Sustainability Quantitative Information

Parent Company: *Tennessee Valley Authority*
Operating Company(s): *Tennessee Valley Authority*
Business Type(s): *Generation & Transmission*
State(s) of Operation: *Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, Virginia*
Report Date: *Sept 2024*

Ref. No.	Refer to the 'EEI Definitions' tab for more information on each metric	Baseline 2005	Last Year 2022	Current Year 2023	Comments, Links, Additional Information, and Notes
	Data is reported on a fiscal year basis, unless otherwise noted as Calendar Year (CY).				
	Portfolio				
1	**Owned Nameplate Generation Capacity at end of year (MW)**	30,644	32,012	32,139	*TVA-Operated Summer Net Capability for 2022 and 2023; Winter Net Capability for 2005*
1.1	Coal	15,075	6,580	5,815	*Caledonia Combined Cycle Plant is currently a leased facility operated by TVA; Includes natural gas facilities operated by TVA, subject to leaseback and long-term lease agreements.*
1.2	Natural Gas	4,662	11,777	12,638	
1.3	Nuclear	5,790	8,232	8,232	
1.4	Petroleum	13	9	9	
1.5	Total Renewable Energy Resources	5,104	5,409	5,440	
1.5.1	Biomass/Biogas	0	0	0	
1.5.2	Geothermal	0	0	0	
1.5.3	Hydroelectric	5,104	5,408	5,439	
1.5.4	Solar	0	1	1	
1.5.5	Wind	0	0	0	
1.6	Other	0	5	5	
2.i	**Owned Net Generation for the data year (MWh)**	159,896,000	135,667,000	135,528,000	*Raccoon Mountain Pumped-Storage Plant net generation is allocated against each TVA-operated generation facility and purchased power type for 2022 and 2023.*
2.1.i	Coal	98,404,000	20,999,000	20,896,000	
2.2.i	Natural Gas	595,000	36,259,000	34,467,000	
2.3.i	Nuclear	45,156,000	64,475,000	67,102,000	
2.4.i	Petroleum	0	0	0	
2.5.i	Total Renewable Energy Resources	15,723,000	13,934,000	13,063,000	
2.5.1.i	Biomass/Biogas	0	0	0	
2.5.2.i	Geothermal	0	0	0	
2.5.3.i	Hydroelectric	15,723,000	13,934,000	13,063,000	
2.5.4.i	Solar	0	0	0	
2.5.5.i	Wind	0	0	0	
2.6.i	Other	18,000	0	0	
2.ii	**Purchased Net Generation for the data year (MWh)**	16,637,000	29,789,000	24,263,000	
2.1.ii	Coal		2,753,000	2,722,000	
2.2.ii	Natural Gas		18,352,000	13,703,000	
2.3.ii	Nuclear				
2.4.ii	Petroleum				
2.5.ii	Total Renewable Energy Resources		8,684,000	7,838,000	
2.5.1.ii	Biomass/Biogas				
2.5.2.ii	Geothermal				
2.5.3.ii	Hydroelectric		2,543,000	1,591,000	
2.5.4.ii	Solar				
2.5.5.ii	Wind				
2.5.6.ii	Other		6,141,000	6,247,000	
2.6.ii	Other				
3	**Capital Expenditures and Energy Efficiency (EE)**				
3.1	Total Annual Capital Expenditures (nominal dollars)	$1,339,000,000	$2,361,000,000	$2,526,000,000	*Construction Expenditures based on Statement of Cash Flows.*
3.2	Incremental Annual Electricity Savings from EE Measures (MWh) (CY)		37,708	133,896	
3.3	Incremental Annual Investment in Electric EE Programs (nominal dollars) (CY)		$33,296,000	$39,105,000	
4	**Retail Electric Customer Count (at end of CY)**				
4.1	Commercial		16	17	
4.2	Industrial		45	44	
4.3	Residential		0	0	

Electric Company ESG/Sustainability Quantitative Information

Parent Company: *Tennessee Valley Authority*
Operating Company(s): *Tennessee Valley Authority*
Business Type(s): *Generation & Transmission*
State(s) of Operation: *Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, Virginia*
Report Date: *Sept 2024*

Ref. No.	Refer to the 'EEI Definitions' tab for more information on each metric	Baseline 2005	Last Year 2022	Current Year 2023	Comments, Links, Additional Information, and Notes
	Data is reported on a fiscal year basis, unless otherwise noted as Calendar Year (CY).				
	Emissions (CY)				
5	**GHG Emissions: Carbon Dioxide (CO2) and Carbon Dioxide Equivalent (CO2e)**				
	Note: The alternatives available below are intended to provide flexibility in reporting GHG emissions, and should be used to the extent appropriate for each company.				
5.1	**Owned Generation**				
5.1.1	Carbon Dioxide (CO2)				
5.1.1.1	Total Owned Generation CO2 Emissions (MT)	95,787,664	38,929,981	36,261,940	*Updated 2022 value, aligned with Sustainability Report includes <25 MW units, does not include leased generation assets. EPA Clean Air Markets Program Data (CAMPD) w/o Caledonia and including <25 MW = 38,929,981. Sustainability Report = 38,966,496. Changes are allowed within EPA after Sustainability Report was published.*
5.1.1.2	Total Owned Generation CO2 Emissions Intensity (MT/Net MWh)	0.599	0.287	0.268	
5.1.2	Carbon Dioxide Equivalent (CO2e)				
5.1.2.1	Total Owned Generation CO2e Emissions (MT)		41,008,045	38,026,818	*For power block only. (Aligned with EPA eGGRT) TVA's Sustainability Report provides Total Owned Generation CO2e Emissions for power block. This number includes leased generation TVA operates, less than 25MW units and owned assets.*
5.1.2.2	Total Owned Generation CO2e Emissions Intensity (MT/Net MWh)		0.302	0.281	
5.2	**Purchased Power**				
5.2.1	Carbon Dioxide (CO2)				
5.2.1.1	Total Purchased Generation CO2 Emissions (MT)		9,883,774	8,113,999	*Includes leased assets*
5.2.1.2	Total Purchased Generation CO2 Emissions Intensity (MT/Net MWh)		0.332	0.334	
5.2.2	Carbon Dioxide Equivalent (CO2e)				
5.2.2.1	Total Purchased Generation CO2e Emissions (MT)				
5.2.2.2	Total Purchased Generation CO2e Emissions Intensity (MT/Net MWh)				
5.3	**Owned Generation + Purchased Power**				
5.3.1	Carbon Dioxide (CO2)				
5.3.1.1	Total Owned + Purchased Generation CO2 Emissions (MT)		48,813,755	44,375,939	*Amount reported in SEC financial statements for 2022 and 2023 CO2 emissions was 54 million tons and 49 million tons, respectively, and is based on rounded short tons. The conversion factor used for this template was 1 MT = 1.1023 short tons.*
5.3.1.2	Total Owned + Purchased Generation CO2 Emissions Intensity (MT/Net MWh)		0.295	0.278	
5.3.2	Carbon Dioxide Equivalent (CO2e)				
5.3.2.1	Total Owned + Purchased Generation CO2e Emissions (MT)				
5.3.2.2	Total Owned + Purchased Generation CO2e Emissions Intensity (MT/Net MWh)				
5.4	**Non-Generation CO2e Emissions of Sulfur Hexafluoride (SF6)**				
5.4.1	Total CO2e emissions of SF6 (MT)		62,133	81,236	
5.4.2	Leak rate of CO2e emissions of SF6 (MT/Net MWh)				
6	**Nitrogen Oxide (NOx), Sulfur Dioxide (SO2), Mercury (Hg)**				
6.1	Generation basis for calculation				
6.2	**Nitrogen Oxide (NOx)**				
6.2.1	Total NOx Emissions (MT)	173,538	15,270	13,221	
6.2.2	Total NOx Emissions Intensity (MT/Net MWh)	0.001085	0.000113	0.000098	
6.3	**Sulfur Dioxide (SO2)**				
6.3.1	Total SO2 Emissions (MT)	417,339	22,331	17,736	
6.3.2	Total SO2 Emissions Intensity (MT/Net MWh)	0.002610	0.000165	0.000131	
6.4	**Mercury (Hg)**				
6.4.1	Total Hg Emissions (kg)		39.2	47.4	
6.4.2	Total Hg Emissions Intensity (kg/Net MWh)		0.0000003	0.0000004	

Note: Emissions intensity calculations are estimated by dividing calendar year emissions data by applicable fiscal year net generation data in the Portfolio section.

Electric Company ESG/Sustainability Quantitative Information

Parent Company: *Tennessee Valley Authority*
Operating Company(s): *Tennessee Valley Authority*
Business Type(s): *Generation & Transmission*
State(s) of Operation: *Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, Virginia*
Report Date: *Sept 2024*

Ref. No.	Refer to the 'EEI Definitions' tab for more information on each metric	Baseline 2005	Last Year 2022	Current Year 2023	Comments, Links, Additional Information, and Notes
	Data is reported on a fiscal year basis, unless otherwise noted as Calendar Year (CY).				
	Resources				
7	**Human Resources**				
7.1	Total Number of Employees (end of fiscal year)	12,703	10,390	10,901	
7.2	Percentage of Women in Total Workforce		21%	21 %	
7.3	Percentage of Minorities in Total Workforce		12%	13 %	
7.4	Total Number on Board of Directors/Trustees	3	5	9	
7.5	Percentage of Women on Board of Directors/Trustees	33%	20%	33 %	
7.6	Percentage of Minorities on Board of Directors/Trustees	— %	— %	— %	
7.7	Employee Safety Metrics				
7.7.1	Recordable Incident Rate		0.44	0.26	*Revised due to reclassifications.*
7.7.2	Lost-time Case Rate		0.07	0.05	*Revised due to reclassifications.*
7.7.3	Days Away, Restricted, and Transfer (DART) Rate		0.17	0.03	
7.7.4	Work-related Fatalities		1	1	
8	**Fresh Water Resources used in Thermal Power Generation Activities**				
8.1	Water Withdrawals - Consumptive (Millions of Gallons) (CY)		25,007	25,691	
8.2	Water Withdrawals - Non-Consumptive (Millions of Gallons) (CY)		8,276,721	3,198,897	
8.3	Water Withdrawals - Consumptive Rate (Millions of Gallons/Net MWh) (CY/FY)		0.00018433	0.00018956	*CY gallons divided by FY net mwh*
8.4	Water Withdrawals - Non-Consumptive Rate (Millions of Gallons/Net MWh) (CY/FY)		0.06100762	0.02360322	*CY gallons divided by FY net mwh*
9	**Waste Products**				
9.1	Amount of Hazardous Waste Manifested for Disposal (MT) (CY)		32.00	127.00	
9.2	Percent of Coal Combustion Products Beneficially Used (CY)		82%	87%	

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Applicability	Baseline Year	Target Year	Reduction Plan Description (Short)	Source (URL)
Tennessee Valley Authority	2005	2050	Aspiration to achieve net-zero carbon by 2050	FY 2023 Sustainability Report

Notes

1. Additional information on the emissions plans listed above, including how they will be achieved, can be found in the Qualitative section.
2. Information on the type of emissions (e.g., carbon, methane, CO2e, etc.) and which scope(s) of emissions apply — based on the WRI GHG Reporting Protocol, TCR Reporting Protocol(s), or other acceptable reporting procedures — should be included in the plan description. Emissions reported in the Quantitative section are not based on a Scope 1, 2 or 3 methodology.
3. Applicability refers to the entity to which the plan applies (e.g., parent company, operating company, electic or gas utility, etc.).

From: Wufoo
To: nepa
Subject: Resilience 360° Program Draft PEA [#4]
Date: Wednesday, April 16, 2025 10:28:14 PM

This is an EXTERNAL EMAIL from outside TVA. THINK BEFORE you CLICK links or OPEN attachments. If suspicious, please click the "Report Phishing" button located on the Outlook Toolbar at the top of your screen.

Name	Joe and Sally Schiller
City	Clarksville
State	Tennessee
Organization	Brokenpoint Farm
Email	[redacted]
Phone Number	[redacted]

Please provide your comments by uploading a file or by entering them below. *

Carol Butler Freeman
NEPA Project Manager
400 West Summit Hill Drive
WT 11B
Knoxville, TN 37902

RE: Comments on Draft Programmatic Environmental Assessment for Resilience 360° Program

Dear Ms. Freeman:

My wife and I are retired professors of biology now farming in Montgomery County, TN. We have lived in an off-grid solar home in Montgomery County Tennessee since 1996. We have acquired considerable firsthand experience with solar energy and storage systems and confidence in their capabilities. Thus, we find it odd that the proposed TVA 360 deg. Resilience Program seems to target only distributed methane gas generation and no other energy sources such as solar and storage as a resilience strategy. There are numerous problems with such a strategy.

One problem is that if these systems are to be reliable they will have to be run briefly at regular intervals to be sure they are functioning when they are really needed. This means the owner will incur some cost and impacts even when the system is not needed for resilience. Another problem is these systems will generate emissions whenever they run, but TVA's assumption that these systems will not create significant emissions impacts because they will be widely distributed overlooks the local impacts on the employees of the business operating them and any employees of nearby businesses. Having worked for an institution that required backup power for critical materials preservation I can attest to the fact that when these backup systems run, they have noticeable adverse effects on the local environment.

Solar combined with storage, by contrast, is not only affordable and reliable it offers ongoing benefits to businesses that install it. It can reliably provide resilience during grid emergencies but

can also offset purchased energy and provide other benefits on an ongoing basis 365 days a year. This can be an especially compelling economic incentive for businesses that are subject to regular capacity pricing costs. The battery components of such solar and storage systems also provide continuous grid services such as capacity, load shifting, and frequency regulation. Taken together the bundle of services provided by solar and storage offer a much more attractive business case to the host business while providing grid resilience TVA seeks—not just during grid emergencies, but 365 days a year!

We sincerely hope TVA will reconsider the narrow focus on fossil methane gas the draft Programmatic EA considers and expands it to evaluate a range of distributed energy technologies. We believe a more technology agnostic strategy that compares costs and impacts of a variety of distributed generation technologies that meet a specified set of resilience criteria will provide more affordable, more effective, and less harmful solutions to the resilience goals TVA seeks.

Sincerely,

Joe and Sally Schiller, Broken Point Farm

From: Wufoo
To: nepa
Subject: Resilience 360° Program Draft PEA [#5]
Date: Thursday, April 17, 2025 2:10:08 PM

This is an EXTERNAL EMAIL from outside TVA. THINK BEFORE you CLICK links or OPEN attachments. If suspicious, please click the "Report Phishing" button located on the Outlook Toolbar at the top of your screen.

Name	Emma Bartolo
City	Chattanooga
State	Tennessee
Organization	Tennessee Department of Environment and Conservation
Email	emma.bartolo@tn.gov
Phone Number	(432) 480-2250

Please provide your comments by uploading a file or by entering them below. *

Dear Ms. Butler Freeman:

The Tennessee Department of Environment and Conservation (TDEC) appreciates the opportunity to provide comments on the Tennessee Valley Authority (TVA)'s Draft Programmatic Environmental Assessment (PEA) for the Resilience 360° program. The Resilience 360° program is a "commercial resiliency" program that seeks to partner with vendors and TVA customers to improve and enhance resiliency during events that challenge the transmission of power to the grid. This effort would entail entering into a single Power Purchase Agreement (PPA) with vendors to have control or dispatch rights to the units when not in use for a qualifying resiliency event. Each host site would contain natural gas units or battery energy storage system (BESS) that would generate about 100 kilowatts (kW) up to 25 megawatts (MW) of power.

The PEA evaluates the environmental impacts associated with the following two alternatives:

Alternative A, No Action Alternative – TVA would not establish the proposed Resilience 360° program and instead continue to provide generation through alternative methods.

Alternative 2, Resilience 360° Program –TVA would partner with Qualified Resilience vendors to provide backup generation in the form of onsite modular natural gas units or BESS to improve resiliency for qualified customers. TVA would also enter into a single PPA with the vendor to have control or dispatch rights to these units to support demand.

TDEC is the environmental and natural resource regulatory agency in Tennessee with delegated responsibility from the U.S. Environmental Protection Agency (EPA) to regulate sources of air pollution; solid and hazardous waste; underground storage tanks; and water resources. TDEC has reviewed the PEA and offers the following comments regarding the proposed project:

Division of Air Pollution Control

Air Quality Impacts: Several actions could negatively impact air quality on a short-term basis. TDEC recommends that TVA evaluate such potential impacts prior to any clearing, demolition, or construction. Such impacts may include, but are not limited to, air pollution from construction equipment, open burning associated with land clearing activities, and fugitive dust. Local air quality conditions are available online at https://www.airnow.gov/.

Prevention of Significant Deterioration (PSD) and Nonattainment New Source Review (NNSR): PSD applies to new major sources or major modifications at existing sources for pollutants where the area the source is located is in attainment or unclassifiable with the National Ambient Air Quality Standards (NAAQS). PSD requires installation of Best Available Control Technology (BACT), an air quality analysis, an additional impacts analysis, and public participation in the permitting process. NNSR applies to new major sources or major modifications at existing sources for pollutants where the area the source is located is not in attainment with the NAAQS. NNSR requirements are customized for the nonattainment area, but all NNSR permits require the installation of the lowest achievable emission rate (LAER) controls, emission offsets, and public participation in the permitting process. Compliance with applicable PSD or NNSR regulations would be the responsibility of the site owner/operator, but TDEC recommends that TVA consider the applicability of the preconstruction programs in the siting of any new or modified emission source.

New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP): Certain source categories, including combustion turbines, are subject to federal NSPS and NESHAP standards, which are codified at 40 CFR Part 60 and 40 CFR Part 63, respectively. Compliance with applicable NSPS or NESHAP regulations would be the responsibility of the site owner/operator, but TDEC recommends that TVA consider the applicability of these standards in the siting of any new or modified emission source.

Idling: Truck traffic associated with construction projects generate emissions of PM, CO, NO2, SO2, VOC, and CO2, and TDEC recommends the operation of trucks with up-to-date emission control technologies and proper maintenance to minimize vehicle and equipment emissions. The Department also recommends the adoption of best practices to minimize vehicle idling to minimize the impact of mobile source emissions on ambient air quality.

Open Burning: If disposal of trees or vegetation is necessary during construction, TDEC recommends the evaluation of alternatives to open burning. Tennessee's open burning regulations can be found at https://publications.tnsosfiles.com/rules/1200/1200-03/1200-03-04.pdf.

Fugitive Dust: If fugitive dust will be generated from construction activities, TDEC recommends the use of wet suppression or other measures to minimize the generation of fugitive dust.

Construction and Operating Permit: For air contaminant sources not subject to PSD or NNSR, the Tennessee Air Pollution Control Regulations require certain sources to obtain permits prior to commencing construction or operation. Additional information is available online at https://www.tn.gov/content/tn/environment/permit-permits/air-permits/construction.html.

Hazardous Air Pollutants: Page 3-41 of the draft PEA identifies methane and carbon dioxide as hazardous air pollutants (HAPs), but neither pollutant is a HAP.

Fire Protection: Battery storage facilities would presumably operate with no emissions during normal operation, but lithium ion battery fires, such as the recent Moss Landing fire in California, may generate substantial quantities of criteria pollutants, HAPs, or other pollutants. TDEC recommends

that TVA consider these impacts, as well as appropriate hazard mitigation, if siting of battery storage units is required.

TDEC appreciates the opportunity to provide comment on the PEA. Please note that these comments are not indicative of approval or disapproval of the proposed projects or activities contained within. Please contact me should you have any questions regarding these comments.

Sincerely,

Emma Bartolo
Policy Analyst
Office of Policy and Planning
Emma.Bartolo@tn.gov

Upload File #1



tdec_nepa_comments_tva_resilience_360.pdf
123.19 KB • PDF

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-0435

DAVID W. SALYERS, P.E.
COMMISSIONER

BILL LEE
GOVERNOR

April 17, 2025

Via Online Submission to Resilience 360° Program Draft PEA.

Carol Butler Freeman, PG
NEPA Project Manager
Cfreeman2@tva.gov
400 West Summit Hill Drive, WT 11B
Knoxville, TN 37902

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- **Prevention of Significant Deterioration (PSD) and Nonattainment New Source Review**

(NNSR): PSD applies to new major sources or major modifications at existing sources for pollutants where the area the source is located is in attainment or unclassifiable with the National Ambient Air Quality Standards (NAAQS). PSD requires installation of Best Available Control Technology (BACT), an air quality analysis, an additional impacts analysis, and public participation in the permitting process. NNSR applies to new major sources or major modifications at existing sources for pollutants where the area the source is located is not in attainment with the NAAQS. NNSR requirements are customized for the nonattainment area, but all NNSR permits require the installation of the lowest achievable emission rate (LAER) controls, emission offsets, and public participation in the permitting process. Compliance with applicable PSD or NNSR regulations would be the responsibility of the site owner/operator, but TDEC recommends that TVA consider the applicability of the preconstruction programs in the siting of any new or modified emission source.

- **New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP):** Certain source categories, including combustion turbines, are subject to federal NSPS and NESHAP standards, which are codified at 40 CFR Part 60 and 40 CFR Part 63, respectively. Compliance with applicable NSPS or NESHAP regulations would be the responsibility of the site owner/operator, but TDEC recommends that TVA consider the applicability of these standards in the siting of any new or modified emission source.
- **Idling:** Truck traffic associated with construction projects generate emissions of PM, CO, NO_2, SO_2, VOC, and CO_2, and TDEC recommends the operation of trucks with up-to-date emission control technologies and proper maintenance to minimize vehicle and equipment emissions. The Department also recommends the adoption of best practices to minimize vehicle idling to minimize the impact of mobile source emissions on ambient air quality.
- **Open Burning:** If disposal of trees or vegetation is necessary during construction, TDEC recommends the evaluation of alternatives to open burning. Tennessee's open burning regulations can be found at https://publications.tnsosfiles.com/rules/1200/1200-03/1200-03-04.pdf.
- **Fugitive Dust:** If fugitive dust will be generated from construction activities, TDEC recommends the use of wet suppression or other measures to minimize the generation of fugitive dust.
- **Construction and Operating Permit:** For air contaminant sources not subject to PSD or NNSR, the Tennessee Air Pollution Control Regulations require certain sources to obtain permits prior to commencing construction or operation. Additional information is available online at https://www.tn.gov/content/tn/environment/permit-permits/air-permits/construction.html.
- **Hazardous Air Pollutants:** Page 3-41 of the draft PEA identifies methane and carbon dioxide as hazardous air pollutants (HAPs), but neither pollutant is a HAP.
- **Fire Protection:** Battery storage facilities would presumably operate with no emissions during normal operation, but lithium ion battery fires, such as the recent Moss Landing fire in California, may generate substantial quantities of criteria pollutants, HAPs, or other pollutants. TDEC recommends that TVA consider these impacts, as well as appropriate hazard mitigation, if siting of battery storage units is required.

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-0435

DAVID W. SALYERS, P.E.
COMMISSIONER

BILL LEE
GOVERNOR

TDEC appreciates the opportunity to provide comment on the PEA. Please note that these comments are not indicative of approval or disapproval of the proposed projects or activities contained within. Please contact me should you have any questions regarding these comments.

Sincerely,

Emma Bartolo (Apr 17, 2025 13:04 CDT)

Emma Bartolo
Policy Analyst
Office of Policy and Planning
Emma.Bartolo@tn.gov

From: Leah McCord
To: nepa
Subject: TVA Resilience 360 PEA comment from CleanUpTVA
Date: Thursday, April 17, 2025 4:45:37 PM
Attachments: TVA 360 Resilience comment CUTVA.pdf

You don't often get email from leah@appvoices.org. Learn why this is important

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Hello!

Please see attached a comment from the CleanUpTVA coalition in response to the PEA for the TVA Resilience 360 program.

Thank you.

Leah McCord, MSW (she/her)
CleanUpTVA Facilitator, Knoxville, TN
leah@appvoices.org 865-433-0917
cleanuptva.org

April 17, 2025

Via TVA online portal and electronic mail to nepa@tva.gov

Carol Butler Freeman
NEPA Project Manager
400 West Summit Hill Drive
WT 11B
Knoxville, TN 37902

RE: Comments on Draft Programmatic Environmental Assessment for Resilience 360° Program

Dear Ms. Freeman:

The CleanUpTVA Coalition submits these comments regarding the Tennessee Valley Authority's Draft Programmatic Environmental Assessment (PEA) for TVA's Resilience 360° Program. While the organizations within our coalition believe strongly in the potential benefits of distributed energy resources (DERs), we have grave concerns about a proposal that intends to incentivize methane gas facilities in an already burdened region.

The members of the CleanUpTVA coalition have long supported a system that incorporates more DERs to increase reliability and flexibility. The 2019 IRP, as well as the 2025 draft IRP, showed that DERs are a cost effective, low risk way to address load demand increases and seasonal power demand fluctuations.

The PEA for the Resilience 360° Program states that TVA "would not consider generation resources that are inconsistent with its Integrated Resource Plan,"[1] but it does exactly that by specifically choosing methane gas turbines as one of two options under the program. The 2019 IRP includes "solar, storage, combined heat and power, energy efficiency, and demand response"[2] as sources of DER; it did not include methane gas turbines as DERs.

TVA's assertions that "the geographic separation between sites would minimize the project's contribution to regional air quality conditions"[3] cannot be validated without site-specific environmental impact assessments. Redesigning the program to promote renewable DERs, however, would greatly reduce the potential environmental impacts and would not raise concerns over close siting in existing industrialized areas.

The Resilience 360° Program should remove the methane gas turbines in the proposal and replace them with solar, storage, and non-fossil fuel based combined heat and power. In this way,

[1] Draft Programmatic EA at 1-2.
[2] *See* 2019 IRP at 7-12 ("Promote DER focuses on increasing the pace of DER adoption by incenting distributed solar and storage, combined heat and power, energy efficiency and demand response.").
[3] Draft Programmatic EA at 3-42.

TVA can quickly bring critically needed clean energy online, in alignment with the Board's current strategic direction, benefiting everyone in the Tennessee Valley.

Sincerely,

Leah McCord

Leah McCord
Facilitator
CleanUpTVA Coalition
https://cleanuptva.org/
leah@appvoices.org

From: Mohsen Raissy
To: nepa
Subject: Open for Public Comment
Date: Thursday, April 17, 2025 11:26:03 AM
Attachments: image001.png
April 17 VoltaGrid.pdf

You don't often get email from mohsen.raissy@voltagrid.com. Learn why this is important

This is an EXTERNAL EMAIL from outside TVA. THINK BEFORE you CLICK links or OPEN attachments. If suspicious, please click the "Report Phishing" button located on the Outlook Toolbar at the top of your screen.

Greetings,

We are pleased to participate in the public comment about your 360 Resiliency Program. VoltaGrid is an Energy as a service provider. We utilize all Natural Gas, Hydrogen ready assets. We have modular designs that can deploy quickly. We provide all necessary assets for generation, synchronization, controls and distribution and protection. We own and operate and maintain the assets. Where gas may not be available, VoltaGrid has a Compressed Natural Gas (CNG) business which can deliver gas to the sites.

Our assets are all generating at 15KV and are available in 2.5MW, 3.5MW and 4.5MW units all having a very low heat rate of about 7.9MMBtu/MWHr. We also have some gas turbines 25MW each, We would like to offer TVA a set of assets to be strategically located on the system for support of the program. Although we have not specifically selected a site for attached questionnaire, we are sensitive to the compliance requirements.

We would love the opportunity to present our capabilities for your consideration.

Regards,

Mohsen Raissy
Sr. Applications Engineer
Utility and Micro Grid
mohsen.raissy@voltagrid.com
+1-505-620-7219



Book time with Mohsen Raissy

Resilience 360° Environmental Screening Checklist

The goal of this program is to improve and enhance resiliency during events that challenge the transmission of power on the grid. TVA will review this checklist and follow up with the Program Participant as appropriate, in accordance with TVA's legal and policy requirements associated with this program.

Please provide the following information to TVA program management staff via email (Resilience360@tva.gov) at least 6 months before any ground disturbing activities are scheduled to begin. TVA's final environmental review and site approval must be completed before any construction activities begin. Review and approval could take approximately 6 weeks and up to 6 months.

In general, if the proposed Resilience 360° site is located within previously developed areas, such as: parking lots, recently graded land, sites situated on fill material, sites situated on high ground relative to the remainder of the property, or other similar low impact situations; and associated activities such as installation of signage, construction of new utility distribution poles or underground utilities, etc. are completely within previously disturbed areas, reviews should be more expeditious.

1.0 General Project Description

Program Participant (name): VoltaGrid

Proposed Customer Facility: TBA, we propose TVA substations or other sites based on capacity

Proposed Site Address (or lat/long): TBA

Property Landowner: _____

2.0 Project Attachments

Attach/submit the following to/with this checklist:

- ☐ Labeled pictures showing the proposed project location and surrounding environment including:
  - from a variety of angles (at a minimum of four photos looking in each of the cardinal directions)
  - any structures proposed for modification or demolition
  - any vegetation proposed for clearing (from multiple angles)
  - tops of nearby utility poles, lights, or other tall structures adjacent to the proposed site
  - any visible nests
  - any areas where water ponds frequently
  - interconnection point to existing transmission
  - interconnection point to existing gas supply
- ☐ Aerial map/diagram of the proposed site with an imposed project footprint identifying (including shapefiles, kmz, and/or CAD files):
  - the project location
  - laydown area(s)

- nearest gas pipeline access point/existing lines
- access route(s) to the project location
- the associated facility (including but not limited to gas units, BESS, proposed utilities, parking, grading, excavation, storage sheds, tanks, and fill)
- interconnection point(s) to existing transmission
- interconnection point(s) to existing gas supply

☐ Any documentation showing past disturbance at the proposed site (previous construction maps, grading diagrams, historic photographs, survey reports, etc.) including any evidence of the depth of previous disturbance

☐ Phase I Environmental Site Assessment(s) if available

☐ Attachments associated with the checklist in Section 4.0:

- 4.2 Land Use: National Wild and Scenic River System | Rivers.gov (https://www.rivers.gov/)
- 4.2 Land Use: Nationwide Rivers Inventory - Rivers (U.S. National Park Service) (https://www.nps.gov/subjects/rivers/nationwide-rivers-inventory.htm
- 4.2 Land Use: USGS PAD-US Data Explorer (https://maps.usgs.gov/padusdataexplorer/
- 4.2 Land Use: as applicable any documentation of known state, local, or TVA managed and natural areas
- 4.3 Water Resources: Wetlands Mapper | U.S. Fish & Wildlife Service (https://www.fws.gov/program/national-wetlands-inventory/wetlands-mapper)?
- 4.4 Floodplains: FEMA Flood Insurance Rate Maps (https://msc.fema.gov/portal/home)
- 4.4 Floodplains: Reservoir Land Management Plans (https://www.tva.com/environment/environmental-stewardship/land-management/reservoir-land-management-plans
- 4.5 Ecology & Natural Resources: US Fish and Wildlife Service Information for Planning and Consultation (IPaC: Home - https://ipac.ecosphere.fws.gov/)
- 4.6 Air Quality & Climate: US Environmental Protection Agency Green Book Current Nonattainment Area Counties for All Criteria Pollutants | US EPA (https://www3.epa.gov/airquality/greenbook/astate.html
- 4.6 Air Quality & Climate: US Environmental Protection Agency List of Areas Protected by the Regional Haze Program | US EPA (https://www.epa.gov/visibility/list-areas-protected-regional-haze-program

3.0 Project Characteristics

Project Characteristic	**Site-Specific Detail**
Facility land use (i.e. commercial, industrial, medical, etc.)	TBA
Facility function (i.e. water treatment, server farm, chemical manufacturing, etc.)	
Resilience 360 Unit Generation Type (Gas or BESS)	Natural Gas, 2.5MW to 100MW
Minimum generation at the site	from 2.5MW to 100 MW in modular form
Maximum generation at the site	
Maximum disturbance area (including laydown up to 2 acres)	100'X20; for 2.5MW and 2 acres for 100 MW
Anticipated facilities included (e.g. buildings, tanks, storage, parking, new utility poles, etc.)	Pre fabricated modulesType text here

Project Characteristic	**Site-Specific Detail**
Total number of natural gas/battery units at the site	1-30, units are 2.5,3.5 or 4.5 MW
Maximum height of facilities (including any new utility poles)	20'
Maximum emissions for all relevant criteria pollutants (in pounds per Megawatt hour [lb/MWh]), *not applicable for BESS units*	NOx – 0.04 CO – 0.18 VOC – 0.02 PM – 0.00 SO2 – 0.01
Foundation Characteristics	Style (pad, piers, piles, etc.) – Depth of foundation - units are trailer mounted
Anticipated required permits	Air quality permit
New transmission line requirements	if existing sub station nonew lines
Anticipated construction duration (including anticipated construction start)	units can be mobilized in 2 weeks
Anticipated daily construction truck traffic needs (not including worker vehicles)	Only if we provide CNG
Anticipated types of construction equipment (particularly consider whether pile drivers or other higher decibel equipment may be needed)	Possible leveling off of the site
Approximate maximum number of construction workers expected to be needed	minimal, however local operation and maintennace people will be hired
Approximate maximum number of full-time employees during operations	from 2-10
Anticipated commencement of operations date	Can mobilize quickly. within 30-60 days

4.0 Project Checklist

If the answer to any question below is *YES*, TVA subject matter experts (SMEs) will review the specific resources potentially affected. Based on the SME review(s), further review of environmental impacts by TVA or by the Program Participant, as directed by TVA (such as site visits and/or field surveys), or specific best management practices (BMPs), may be required. If the answer to any question is *YES*, consider reconfiguring the site or locating another site that avoids these potential impacts and reach out to TVA to understand additional review responsibilities, potential longer review times, and costs.

Consider the entire site footprint/disturbance area, including laydown areas and interconnection points, when answering the questions below.

4.1 General	
□ Yes ☒ No	Will the installation (including the interconnect to utility/gas] or operation of the proposed unit(s) require ground disturbance? If yes, what is the maximum depth of excavation? no excavation feet below ground surface and identify excavation areas on the provided maps/diagrams
□ Yes ☒ No	If yes to the above question, will the ground disturbance affect previously undisturbed soils/areas? If yes, show the area including undisturbed soils on the attached aerial map(s).
□ Yes ☒ No	Will the installation of the unit(s) require the demolition or alteration of any structure or building? If yes, list/describe the affected structures:
□ Yes ☒ No	Will drilling, blasting, or pile driving be required? If yes, describe the planned actions including anticipated duration:
□ Yes ☒ No	Will offsite borrow material be required? If yes, what is the maximum that would be needed and from where will this material be procured:
□ Yes ☒ No	Will soil/rock be removed from the site to an offsite disposal area? If yes, why and where would this material be disposed:
☒ Yes □ No	Would all equipment and facilities be removed upon future decommissioning? If no, what facilities or structures would need to be left in place?

4.2 Land Use (including Managed and Natural Areas)	
□ Yes ☒ No	Is the project located within 0.25 mile of a National Wild and Scenic River System | Rivers.gov (https://www.rivers.gov/)? Attach the National Wild and Scenic River information to this checklist.
□ Yes ☒ No	Is the project located within 0.25 mile of a Nationwide Rivers Inventory - Rivers (U.S. National Park Service) (https://www.nps.gov/subjects/rivers/nationwide-rivers-inventory.htm stream? Attach the Nationwide Rivers Inventory information to this checklist.
□ Yes ☒ No	Is the project located within 0.25 miles of protected areas per the USGS PAD-US Data Explorer (https://maps.usgs.gov/padusdataexplorer/)? Attach the PAD map to this checklist.
□ Yes ☒ No	Is the project located within 0.25 mile of a known state, local, or TVA managed/natural area? If yes, identify the site(s) and attach any applicable documentation (which could include maps, photos, reports, etc.) to this checklist.
4.2 Water Resources (including Wetlands)	
□ Yes ☒ No	Will development of the site require work within 50 feet of the boundary of wetlands, streams, rivers, reservoirs, or regulated aquatic features within any regulatory buffer that exceeds 50 feet, per the Wetlands Mapper | U.S. Fish & Wildlife Service (https://www.fws.gov/program/national-wetlands-inventory/wetlands-mapper)? Attach wetlands map to this checklist. (Please note that the Wetlands Mapper may not identify all wetlands on the site.)
□ Yes ☒ No	Will development of the site require disturbance to wetlands, streams, rivers, reservoirs, or jurisdictional features?
□ Yes ☒ No	Is the proposed site located within 0.25 mile of a body of water (ditch, detention/retaining pond, creek, stream, pond, river, lake)?
□ Yes ☒ No	Is there a Stormwater Pollution Prevention Plan (SWPPP) in place? In no, describe the onsite stormwater management system in relation to the proposed action.
4.3 Floodplains	
□ Yes ☒ No	Is the proposed site (including any gas units, BESS, temporary and/or permanent laydown areas, buildings, enclosed sheds, tanks, storage areas, as well as fill for any of these facilities) located within the 100-year floodplain or floodway as shown on FEMA Flood Insurance Rate Maps (https://msc.fema.gov/portal/home) OR below the 100-year flood elevation at the proposed site (if the 100-year flood elevation is known)? Attach a FEMA FIRMette Map to this checklist.
□ Yes ☒ No	Would new transmission line interconnection equipment be located within the 100-year floodplain or floodway as shown on FEMA Flood Insurance Rate Maps? (If Yes, Further review is needed and transmission line construction must follow the TVA Subclass Review Criteria for Transmission Line Location in Floodplains)

□ Yes ☒ No	Would new access roads be located within the 100-year floodplain or within the floodway as shown on FEMA Flood Insurance Rate Maps (FIRMs)? If yes, confirm acceptance of the following conditions: If Yes within floodplain (solid blue area on FIRM), roads in the floodplain portion would be constructed in such a manner that upstream flood elevations would not be increased by more than 1.0 foot _____ If Yes within floodway (striped area on FIRM), to prevent an obstruction in the floodway portion of the access road(s): (1) any fill, gravel or other modifications in the floodway that extend above the pre-construction road grade would be removed after completion of the project; (2) this excess material would be spoiled outside of the published floodway; and (3) the area would be returned to its pre-construction condition. _____
□ Yes ☒ No	Is the proposed site located within the 500-year floodplain of a TVA reservoir, or where TVA owns property or a flowage easement per TVA Reservoir Land Management Plans (https://www.tva.com/environment/environmental-stewardship/land-management/reservoir-land-management-plans)? Attach the Reservoir Land Management Plan map to this checklist. Coordination with TVA Natural Resources may be required.
4.4 Ecological Resources	
□ Yes ☒ No	Will removal of trees with a trunk diameter greater than 3 inches at breast height be necessary? If so, how many trees or acres of trees will be cleared? _____ trees/acres If yes, how will the cleared trees be disposed (i.e. sold, hauled offsite, mulched, burned, etc.): _____
□ Yes ☒ No	Can the project commit to tree clearing only within a winter window (approximately October 15-March 31 dates may vary depending on site location)?
□ Yes ☒ No	Are there any visible caves, rock ledges, overhangs, sinkholes in view of the host site?
□ Yes ☒ No	Have any species with federal status been identified within the potential project vicinity based on the US Fish and Wildlife Service Information for Planning and Consultation process (IPaC: Home - https://ipac.ecosphere.fws.gov/)? Attach the IPaC form to this checklist.
4.5 Cultural Resources	
□ Yes ☒ No	Will the installation of the unit(s) require the demolition or alteration of any structure or building greater than 50 years of age?
□ Yes ☒ No	Is the site ***not*** located within an existing industrial facility; within an existing parking structure; or collocated with other existing mechanical systems (i.e., heating, ventilation, air filtration, boilers, etc.) in a location not easily visible from the primary right of way or façade (front) of the facility?

4.6 Air Quality and Climate	
□ Yes ☒No	Are the new generation units replacing older generation units? If yes, describe the older units:
□ Yes ☒No	Is the site located in a county that is in a non-attainment status for any criteria pollutant per the US Environmental Protection Agency Green Book Current Nonattainment Area Counties for All Criteria Pollutants | US EPA (https://www3.epa.gov/airquality/greenbook/astate.html)? Attach the state nonattainment areas report to this checklist.
□ Yes ☒No	Is this site located within 0.5 mile of a Class I area per the US Environmental Protection Agency List of Areas Protected by the Regional Haze Program | US EPA (https://www.epa.gov/visibility/list-areas-protected-regional-haze-program)? Attach the Class I areas list to this checklist.
4.7 Health and Safety	
□ Yes ☒ No	Is the edge of the facility property located more than 0.1 miles from a gas supply line? If yes, provide the distance from the facility boundary to the interconnection point and the landownership/easement information necessary to access that interconnection point.
□ Yes ☒No	Has there been prior contamination at the proposed site, or is there potential for contamination? (ex. previously used for other industry, disturbance, or fill issues on-site). If yes, provide applicable documentation along with the Phase I Environmental Site Survey in the attachments.

This form must be completed and signed by an authorized representative or agent for the Program Participant, an individual who can certify, under penalty of law, and based on information and belief formed after reasonable inquiry and appropriate training or licensing, that the statements and information contained in this Environmental Screening Checklist are true, accurate and complete.

Program Participant Representative (Signature): Mohsen Raissy Date: April 17, 2025
(or Designated Agent)

Program Participant Representative (Name, Title): Sr.Application Engineer
(or Designated Agent)

5.0 TVA Acceptance Review

TVA subject matter experts reviewed the material presented in this checklist. Documentation of their review is attached.

In accordance with the National Environmental Policy Act (NEPA), TVA must evaluate and document whether the proposed action described within this document is already covered under an existing NEPA review. The following questions record the evaluation of four criteria for making this determination.

Determination of NEPA Adequacy	
□ Yes □ No	Is the site-specific proposed action bounded by the proposed action as analyzed in the Resilience 360° Programmatic Environmental Assessment (PEA)? If no, describe:
□ Yes □ No	Are there significant circumstances or information relevant to site-specific environmental concerns that would substantially change the analysis in the Resilience 360° PEA? If yes, describe:
□ Yes □ No	Are there effects that would result from the site-specific proposed action that were not addressed in the Resilience 360° PEA? If yes, describe:
□ Yes □ No	Is additional site-specific NEPA necessary? If yes, explain:

Based on the evaluation documented herein, I conclude that the Resilience 360 Programmatic Environmental Assessment (PEA) and Finding of No Significant Impact (FONSI) fully covers the proposed site-specific action and constitutes TVA's compliance with the requirements of NEPA. The site-specific project does not present significant changes to the proposed action or significant new circumstances or information relevant to environmental concerns that would require supplemental analysis. Impacts associated with the proposed action would be minor to moderate and are bounded by the conclusions of the Final PEA and FONSI. This form documents TVA's compliance with the National Environmental Policy Act for this site-specific action.

_____ _____

NAME
Manager, NEPA Program
Project Support
Tennessee Valley Authority

Date Signed

The statements and information in this form have been reviewed and verified.

_____ _____

NAME
TITLE, Resilience 360° Program
Commercial Energy Solutions
Tennessee Valley Authority

Date Signed