~~Proprietary Information and Critical Energy Infrastructure Information~~
~~Withhold from Public Disclosure Under 10 CFR 2.390~~
This letter is decontrolled when separated from Enclosures 1, 2, 3, and 8

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-16-091

May 27, 2016

10 CFR 50.90

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Units 1, 2, and 3
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Proposed Technical Specifications (TS) Change TS-505 - Request for License Amendments - Extended Power Uprate (EPU) - Supplement 18, Responses to Requests for Additional Information and Updates Associated with Interconnection System Impact Study Modifications**

References:

1. Letter from TVA to NRC, CNL-15-169, "Proposed Technical Specifications (TS) Change TS-505 - Request for License Amendments - Extended Power Uprate (EPU)," dated September 21, 2015 (ML15282A152)

2. Letter from NRC to TVA, "Browns Ferry Nuclear Plant, Units 1, 2, and 3 - Request for Additional Information Related to License Amendment Request Regarding Extended Power Uprate (CAC Nos. MF6741, MF6742, and MF6743)," dated April 4, 2016 (ML16064A286)

3. Letter from TVA to NRC, CNL-16-075, "Proposed Technical Specifications (TS) Change TS-505 - Request for License Amendments - Extended Power Uprate (EPU) - Supplement 13, Responses to Requests for Additional Information," dated April 22, 2016

4. Letter from TVA to NRC, CNL-15-261, "Proposed Technical Specifications (TS) Change TS-505 - Request for License Amendments - Extended Power Uprate (EPU) - Supplement 3, Interconnection System Impact Study Information," dated December 18, 2015 (ML15355A413)

5. Letter from TVA to NRC, CNL-16-023, "Proposed Technical Specifications (TS) Change TS-505 - Request for License Amendments - Extended Power Uprate (EPU) - Supplement 4, Response to Requests for Additional Information," dated February 16, 2016 (ML16049A248)

By the Reference 1 letter, Tennessee Valley Authority (TVA) submitted a license amendment request (LAR) for the Extended Power Uprate (EPU) of Browns Ferry Nuclear Plant (BFN) Units 1, 2 and 3. The proposed LAR modifies the renewed operating licenses to increase the maximum authorized core thermal power level from the current licensed thermal power of 3458 megawatts to 3952 megawatts. During their technical review of the LAR, the Nuclear Regulatory Commission (NRC) identified the need for additional information. The Reference 2 letter provided NRC Requests for Additional Information (RAI) related to the environmental review of the BFN EPU LAR. The Reference 3 letter provides the responses to the RAIs included in the Reference 2 letter, with the exception of the responses to NRC RAIs RERP-GE-RAI 2 and RERP-GE-RAI 4. NRC RAIs RERP-GE-RAI 2 and RERP-GE-RAI 4 involve providing environmental information associated with transmission system upgrades identified in the interconnection system impact study (SIS). However, due to changes in the modifications associated with these transmission system upgrades and the time needed to achieve alignment and agreement among TVA stakeholders regarding these changes to the modifications, the due date for the responses to NRC RAIs RERP-GE-RAI 2 and RERP-GE-RAI 4 and the other revised portions of the BFN EPU LAR impacted by the changes to the transmission system upgrades was extended to June 10, 2016, per communication with the NRC Project Manager.

TVA performed an interconnection SIS for the EPU of all three BFN units that was submitted to the NRC on December 18, 2015 (Reference 4). This interconnection SIS identified the need to replace six breaker failure relays at BFN, install 774 megavolt-ampere reactive (MVAR) capacitor banks in four locations throughout the TVA transmission system, and construct a new 500 kilovolt (kV) transmission line. Further study and evaluation of the transmission system modifications and alternatives resulted in a revision of the interconnection SIS. The revised interconnection SIS identifies the need to replace six breaker failure relays, install 764 MVAR capacitor banks in five locations throughout the TVA transmission system, and modify the excitation system of all three BFN main generators. Therefore, the new 500 kV transmission line will no longer be required to support BFN EPU and the impact of a new excitation system will be addressed in this BFN EPU LAR supplement in lieu of the transmission line.

Enclosure 1 of this letter provides Revision 1 of the interconnection SIS. Enclosure 1 supersedes and replaces the interconnection SIS submitted by the Reference 4 letter, dated December 18, 2015.

Enclosure 2 of this letter provides the updated BFN EPU Transmission System Stability Evaluation that has been revised to reflect the modifications resulting from the final interconnection SIS provided in Enclosure 1 of this letter. The BFN EPU Transmission System Stability Evaluation study evaluates the effect of BFN operation at EPU conditions with respect to continued compliance with 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 17, Electric Power Systems. Enclosure 2 supersedes and replaces Attachment 43 of the BFN EPU LAR submitted by the Reference 4 letter, dated December 18, 2015.

Enclosure 3 of this letter provides the updated response (Revision 1) to the NRC RAI EEEB-RAI 1. The update has been made to reflect the changes to the transmission system upgrades included in Revision 1 of the interconnection SIS. Enclosure 4 of this letter provides a public version of Revision 1 of NRC RAI EEEB-RAI 1 and updated response, with critical energy infrastructure information removed. Enclosures 3 and 4 of this letter supersede and replace Enclosures 3 and 4 of the Reference 5 letter, dated February 16, 2016.

Enclosure 5 of this letter provides the responses to NRC RAIs RERP-GE 2 and RERP-GE-4. Enclosure 5 of this letter also provides the updated response (Revision 1) to NRC RAI RERP-GE 3. The update has been made to reflect the changes to the transmission system upgrades included in Revision 1 of the interconnection SIS. Revision 1 of NRC RAI RERP-GE 3 response provided in Enclosure 5 of this letter supersedes and replaces the response to NRC RAI RERP-GE 3 provided in the Reference 3 letter, dated April 22, 2016.

Enclosure 6 of this letter provides Revision 1 to the BFN EPU Supplemental Environmental Report. The revised BFN EPU Supplemental Environmental Report reflects the transmission system upgrades included in Revision 1 of the interconnection SIS. Enclosure 6 supersedes and replaces Attachment 42 of the BFN EPU LAR (Reference 1), dated September 21, 2015.

Enclosure 7 of this letter provides a supplement to the BFN EPU Probabilistic Risk Assessment. This supplement to the BFN EPU Probabilistic Risk Assessment addresses the effect of the main generator excitation system upgrade included in Revision 1 of the interconnection SIS. Enclosure 7 supplements, but does not supersede, Attachment 44 of the BFN EPU LAR (Reference 1), dated September 21, 2015.

Enclosure 8 of this letter provides a supplement to Section 2.5.1.2.2 of the Power Uprate Safety Analysis Report (PUSAR) (NEDC-33860P, Revision 0). The supplement addresses the effect of the main generator excitation system upgrade included in Revision 1 of the interconnection SIS. Enclosure 9 of this letter provides a public version of the supplement to Section 2.5.1.2.2 of the Power Uprate Safety Analysis Report (PUSAR) (NEDO-33860, Revision 0). Enclosures 8 and 9 supersede and replace Section 2.5.1.2.2 of Attachments 6 and 7, respectively, of the BFN EPU LAR (Reference 1), dated September 21, 2015.

Enclosure 10 of this letter provides Revision 1 to the BFN EPU List and Status of Plant Modifications. The BFN EPU List and Status of Modifications is revised to reflect the main generator excitation system upgrade included in Revision 1 of the interconnection SIS and modifications that have been completed since the BFN EPU LAR was submitted. Enclosure 10 supersedes and replaces Attachment 47 of the BFN EPU LAR (Reference 1), dated September 21, 2015.

Enclosures 1, 2, and 3 contain critical energy infrastructure information that is considered sensitive, unclassified (non-safeguard) information. As a result, TVA requests that

Enclosures 1, 2, and 3 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390(d)(1).

As stated above, Enclosure 8 to this letter provides a supplement to the PUSAR. GE-Hitachi Nuclear Energy Americas LLC (GEH) consider portions of the information provided in Enclosure 8 of this letter to be proprietary and, therefore, exempt from public disclosure pursuant to 10 CFR 2.390, Public inspections, exemptions, requests for withholding. An affidavit for withholding information, executed by GEH, is provided in Enclosure 11. Enclosure 9 is a non-proprietary version of the supplement to the PUSAR provided in Enclosure 8. Therefore, on behalf of GEH, TVA requests that Enclosure 8 be withheld from public disclosure in accordance with the GEH affidavits and the provisions of 10 CFR 2.390.

TVA has reviewed the information supporting a finding of no significant hazards consideration and the environmental consideration provided to the NRC in the Reference 1 letter. The supplemental information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the supplemental information in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed license amendment. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter, without the critical energy infrastructure information or proprietary information, to the Alabama State Department of Public Health.

There are no new regulatory commitments associated with this submittal. If there are any questions or if additional information is needed, please contact Edward D. Schrull at (423) 751-3850.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 27th day of May 2016.

Respectfully,

J. W. Shea
Vice President, Nuclear Licensing

Enclosures

cc: See Page 5

Enclosures:

1. Interconnection System Impact Study, Revision 1: Browns Ferry Nuclear Plant Extended Power Uprate (Critical Energy Infrastructure Information)
2. BFN EPU LAR, Attachment 43, Transmission System Stability Evaluation, Revision 2 (Critical Energy Infrastructure Information)
3. Response to NRC Request for Additional Information EEEB-RAI 1, Revision 1 (Critical Energy Infrastructure Information)
4. Response to NRC Request for Additional Information EEEB-RAI 1, Revision 1 (Without Critical Energy Infrastructure Information)
5. Response to NRC Request for Additional Information RERP-GE 2, RERP-GE 3, Revision 1, and RERP-GE 4
6. BFN EPU LAR, Attachment 42, Supplemental Environmental Report, Revision 1
7. Supplement to BFN EPU LAR, Attachment 44, Probabilistic Risk Assessment
8. Supplement to BFN EPU LAR, Attachment 6, NEDC-33860P, Safety Analysis Report for Browns Ferry Nuclear Plant Units 1, 2, and 3 Extended Power Uprate, Section 2.5.1.2.2 (Proprietary version)
9. Supplement to BFN EPU LAR, Attachment 6, NEDO-33860, Safety Analysis Report for Browns Ferry Nuclear Plant Units 1, 2, and 3 Extended Power Uprate, Section 2.5.1.2.2 (Non-proprietary version)
10. BFN EPU LAR, Attachment 47, List and Status of Plant Modifications, Revision 1.
11. GE Hitachi Nuclear Energy Affidavit for NEDC-33860P, Revision 0

cc:

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant
State Health Officer, Alabama Department of Public Health (w/o Enclosures 1, 2, 3, and 8)

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ENCLOSURE 1

Interconnection System Impact Study, Revision 1: Browns Ferry Nuclear Plant Extended Power Uprate

(Critical Energy Infrastructure Information)

~~Withhold from Public Disclosure Under 10 CFR 2.390~~

ENCLOSURE 2

BFN EPU LAR, Attachment 43, Transmission System Stability Evaluation, Revision 2

(Critical Energy Infrastructure Information)

~~Withhold from Public Disclosure Under 10 CFR 2.390~~

ENCLOSURE 3

Response to NRC Request for Additional Information EEEB-RAI 1, Revision 1

(Critical Energy Infrastructure Information)

ENCLOSURE 4

Response to NRC Request for Additional Information EEEB-RAI 1, Revision 1

(Without Critical Energy Infrastructure Information)

ENCLOSURE 4

EEEB-RAI-1

In Section 3.0 of Attachment 43, the licensee states:

> *The [TSS] study evaluated the performance of the 500 kV [kilovolt] and 161 kV offsite power systems during a DBE [design-basis event] under EPU [extended power uprate] conditions. Bus voltages observed during the simulation are compared to acceptance criteria to determine adequacy of the offsite power supply. The TSS considered a loss of the largest single supply to the grid, loss of the largest single load, loss of the nuclear unit, and loss of each bulk transmission line in the TVA transmission system, including all the lines coming into the BFN switchyard. The study used base cases from both 2015 (pre-EPU) and 2019 (post-EPU) to address the load flow analysis at EPU conditions.*

A. Provide acceptable voltage range of BFN 500 kV and 161 kV offsite power acceptance criteria. Also, clarify whether the voltage criteria corresponding to post EPU conditions has been agreed upon by the transmission system operator.

B. Provide summary of cases studied with diagrams to verify that the voltage criteria is met under the following post-EPU conditions:

i. loss of the largest load (identify the load),

ii. loss of the largest generator (identify the generator), and

iii. loss of the most critical transmission line (identify the line).

TVA Response:

ENCLOSURE 4

ENCLOSURE 4

Figure 1 - Interconnection Map

ENCLOSURE 4

Figure 2 - Interconnection Arrangement

ENCLOSURE 4

Figure 3 - BFN 161 kV Substation

ENCLOSURE 5

Response to NRC Request for Additional Information
RERP-GE 2, RERP-GE 3, Revision 1, and RERP-GE 4

(Response to RERP-GE 2 includes Attachments 1, 2, and 3)

ENCLOSURE 5

RERP-GE-RAI 2

By letter dated December 18, 2015 TVA submitted to the NRC copies of an Interconnection System Impact Study and a Transmission System Stability Evaluation as the supplements to the proposed EPU. The Interconnect System Impact Study concludes that the proposed EPU will require the replacement of six breaker failure relays at BFN, the installation of 774 megavolt-ampere reactive (MVAR) of capacitors at four locations throughout the TVA transmission system, and the construction of a Limestone-East Point 500-kilovolt (kV) transmission line.

For each of these three upgrades, describe the affected environment, environmental consequences of and any mitigating actions related to construction and implementation of the upgrades for each environmental resource that would be affected. The environmental resources that may be affected and should be described include: land use, visual resources, air quality, noise, geologic environment, surface water resources, groundwater resources, terrestrial resources, aquatic resources, special status species and habitats, historic and cultural resources, socioeconomics, environmental justice, human health, and waste management. For each upgrade, please also describe the projected timeline for completion of the upgrade, whether the upgrade will require the use of construction equipment, the amount of natural habitats that would be disturbed (if applicable), the amount of offsite land that would be disturbed (if applicable), and descriptions of any best-management practices, procedures, or other guidelines that workers would follow to minimize impacts to cultural resources or sensitive species and habitats, if present. For the new 500- kV transmission line, describe the length of the new line, the anticipated origin and terminus of the line, the planned regional study area, possible routes for the line and preferred alternative (if known at this time), and whether the new line would share an existing right-of-way or require a new right-of-way.

TVA Response:

TVA performed an Interconnection System Impact Study (SIS) for the extended power uprate (EPU) of all three Browns Ferry Nuclear Plant (BFN) units. The Interconnection SIS documents transmission system and BFN main generator excitation system upgrades required to support the BFN EPU. Revision 1 of the Interconnection SIS identified replacing six 500 kilovolt (kV) breaker failure relays, installing 764 megavolt-ampere reactive (MVAR) capacitor banks in five locations throughout the TVA transmission system, and modifying the excitation system of all three BFN main generators. Therefore the new 500 kV transmission line will no longer be required to support BFN EPU. The environmental impact of a new excitation system will be addressed in this response in lieu of a new transmission line. For each upgrade, the environmental reviews are being performed by TVA and the results to date are discussed in Attachment 1, Supplemental Environmental Information for Transmission System and BFN Main Generator Upgrades.

<u>Breaker Failure Relay Replacement</u>

As discussed in the TVA response to RERP-GE-RAI 3, all six breaker failure relays will be replaced prior to the first unit uprate (Unit 3) in the Spring of 2018. The physical work to replace the 500 kV breaker failure relays will be performed within the existing structure of the BFN control building. The work will not require construction equipment or involve use of previously undisturbed land. The environmental review of the breaker failure relay replacements is discussed in Attachment 1. Because all the work to replace the six breaker failure relays occurs within existing BFN structures and does not involve the use of additional undisturbed land, there are no best-management practices (BMPs), guidelines, or procedures beyond the normal BFN site work procedures that workers would follow to minimize impacts to cultural resources or sensitive species and habitats.

Main Generator Excitation System Modification

Replacement of the BFN main generator excitation system is in the preliminary phase of the design change notice development and therefore no specific timeline for implementation has been developed. The projected completion for Unit 1 is Fall 2020, and in 2023 and 2024 respectively for Units 2 and 3. The modification will occur within existing BFN structures and does not require construction equipment or involve use of previously undisturbed land. The environmental review of the main generator excitation systems modifications is discussed in Attachment 1. Because all the work to upgrade the BFN main generator excitation systems occurs within existing BFN structures and does not involve the use of additional undisturbed land, there are no best-management practices (BMPs), guidelines, or procedures beyond the normal BFN site work procedures that workers would follow to minimize impacts to cultural resources or sensitive species and habitats identified or required.

Capacitor Banks

As discussed in the TVA response to RERP-GE-RAI 3, the preliminary estimated completion of the final capacitor bank is Spring of 2019. The proposed locations are the Clayton Village Substation located in Oktibbeha County, Mississippi, Holly Springs Substation located in Marshall County, Mississippi, Corinth Substation located in Alcorn County, Mississippi, East Point Substation located in Cullman County, Alabama, and the Wilson Substation located in Wilson County, Tennessee. The environmental review for each substation is discussed in Attachment 1. Construction equipment, land that would be disturbed, and descriptions of any BMP, procedures, or other guidelines that workers would follow to minimize impacts to cultural resources or sensitive species and habitats are also discussed in Attachment 1. Note that Attachment 2 and Attachment 3 are letters to the State Historic Preservation Office for the states of Tennessee and Mississippi.

GE-3

On page 12 of the Interconnection System Impact Study, TVA estimates that transmission-related upgrades and modifications would be completed 7 to 10 years after TVA receives authorization to begin work. Given this timeline and assuming the EPU is approved, would BFN be able to operate at EPU levels prior to the transmission upgrades being completed? If not, please provide revised estimates of when each unit would begin operating at EPU levels, included revisions to the EPU outage schedules, if applicable.

TVA-BFN Response

a. The Interconnection System Impact Study (SIS) identified six breaker failure relays requiring upgrade. Installation of relay upgrades will not preclude or delay the Browns Ferry Nuclear Plant (BFN) operating at extended power uprate (EPU) conditions. All six relays must be upgraded prior to BFN operating at EPU conditions. All six relays are scheduled to be replaced prior to the first unit uprate (Unit 3) in the Spring of 2018. Therefore, the relay replacement schedule will not affect the EPU schedule.

b. The Interconnection SIS determined that the TVA transmission system would require incremental installation of 764 megavolt-amp reactive (MVAR) capacitor banks in five locations throughout the TVA transmission system. The proposed locations are the Clayton Village Substation located in Oktibbeha County Mississippi, Holly Springs Substation located in Marshall County Mississippi, Corinth Substation located in Alcorn County Mississippi, East Point Substation located in Cullman County, Alabama, and the Wilson Substation located in Wilson County Tennessee. The preliminary estimated completion of the final capacitor bank is Spring of 2019. TVA's transmission system operator does not preclude BFN operating at EPU levels during the capacitor bank installations. Therefore, the EPU schedule will not be affected by the MVAR capacitor bank installation.

c. The revised Interconnection SIS determined that the BFN main generator excitation system would require modification to support the EPU of all three BFN units. The excitation system modifications mitigates a transient stability issue that could arise if a 3-phase fault develops while one of the four 500 kV lines specified in the Interconnection SIS is out of service and BFN is operating at EPU conditions. BFN can operate at EPU conditions before the main generator excitation system is modified. In the interim, TVA will issue a detailed temporary operating guide that provides mitigation for transient stability issues during outages at any of the four identified 500 kV lines. Therefore, the excitation system modification schedule will not affect the EPU schedule.

RERP-GE-RAI 4

Will TVA be conducting its own environmental review, pursuant to National Environmental Policy Act (NEPA) for the proposed transmission line construction and other transmission system upgrades? If so, describe TVA's projected timeline for the NEPA review and whether TVA anticipates issuing an environmental assessment (EA), environmental impact statement (EIS) or supplement to a previous EA or EIS.

TVA Response:

TVA performed an Interconnection System Impact Study (SIS) for the extended power uprate (EPU) of all three Browns Ferry Nuclear Plant (BFN) units. Revision 1 of the Interconnection SIS identified replacing six 500 kilovolt (kV) breaker failure relays, installation of 764 megavolt-ampere reactive (MVAR) capacitor banks in five locations throughout the TVA transmission system, and modifying the excitation system of all three BFN main generators. Therefore the new 500 kV transmission line will no longer be required to support BFN EPU and the environmental impact of a new excitation system will be addressed in lieu of the transmission line. As a federal agency subject to the requirements of the National Environmental Policy Act (NEPA), TVA evaluates the effects on the environment of these proposed upgrades. TVA's evaluation of the environmental effects of proposed upgrades is discussed in the response to RERP-GE-RAI-2. TVA does not anticipate issuing an environmental assessment (EA), or environmental impact statement (EIS), or supplement to existing EAs or EISs. Categorical Exclusion Checklists (CECs) are being performed for each of the upgrade projects. RERP-GE-RAI-4 Table 1 below lists these proposed transmission system and main generator upgrades, the anticipated level of NEPA review, and the projected date for closure of these CECs.

RERB-GE-RAI-4 Table 1

Upgrade	Anticipated Environmental Review Documentation	Estimated Closure Date
500 kV BKR Failure Relay Replacements		
West Point TL (BKR 5208)	CEC	Closed 8/27/2015
West Point TL (BKR 5204)	CEC	Closed 8/27/2015
Maury (BKR 5258)	CEC	01/27/2017
Maury (BKR 5254)	CEC	01/27/2017
Union (BKR 5278)	CEC	01/27/2017
Union (BKR 5274)	CEC	01/27/2017
Capacitor Banks		
Wilson 500 kV	CEC	06/22/2017
Clayton Village 161 kV	CEC	08/31/2016
Holly Springs 161 kV	CEC	11/18/2016
Corinth 161 kV	CEC	11/18/2016
East Point 161 kV	CEC	04/04/2017
Modify Excitation System		
BFN Main Generator Excitation System	CEC	Closed 05/11/2016

Browns Ferry Nuclear Plant

RERP - RAI - GE-2 Response, Attachment 1

Supplemental Environmental Information for Transmission System and BFN Main Generator Upgrades

RERP - RAI - GE-2 Response, Attachment 1

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RERP - RAI - GE-2 Response, Attachment 1

1.0 Executive Summary

Tennessee Valley Authority (TVA) performed an Interconnection System Impact Study (SIS) for the extended power uprate (EPU) of all three Browns Ferry Nuclear Plant (BFN) units. The Interconnection SIS documents transmission system and BFN main generator excitation system upgrades required to support the BFN EPU. Specifically, the Interconnection SIS identified replacement of six 500 kilovolt (kV) breaker failure relays, installation of 764 megavolt-ampere reactive (MVAR) capacitor banks in five locations throughout the TVA transmission system, and upgrades to all three BFN main generator excitation systems. As a federal agency subject to the requirements of the National Environmental Policy Act (NEPA), TVA is evaluating the effects on the environment of these proposed upgrades. The intent of this report is to document TVA's assessment of environmental impacts.

2.0 Introduction

TVA has proposed to uprate each BFN unit from the current licensed thermal power (CLTP) to approximately 120 percent of the original licensed thermal power (OLTP). The material modification will uprate each BFN unit electrical output by approximately 155 megawatts (MW). In May 2016, TVA revised the Interconnection SIS that evaluated the proposed material modification to the existing BFN units. The revised Interconnection SIS identified some deficiencies that would require transmission stability upgrades in order to support the planned BFN unit uprates.

The Interconnection SIS identified six 500 kV breakers in the BFN switchyard which have inadequate critical clearing time for a stuck 500 kV breaker coincident with a single line to ground fault event. These 500 kV breakers require upgrades to the breaker failure relays. The breaker failure relays are located in the BFN control building.

The Interconnection SIS also identified an issue with the BFN main generators when one of four specific 500 kV transmission lines are out of service coincident with a three phase fault. To mitigate this issue the excitation system of each of the BFN main generators will need to be upgraded.

TVA imposes applicable FERC requirements on all generation projects. New generation must have the capability to operate at a power factor of 0.95 at the point of interconnection. The Interconnection SIS determined that the BFN reactive power capability after uprate would be deficient 764 MVAR for the additional power. To fulfill FERC requirements TVA identified installation of a total of 764 MVAR capacitor banks in five locations throughout the TVA transmission system.

TVA is evaluating the environmental effects for each of these proposed Interconnection SIS upgrades. TVA's procedures that implement NEPA regulations include a categorical exclusion suitable for use on this project. Therefore, categorical exclusion checklists (CECs) will be completed for each of the upgrade projects. This report summarizes the environmental impact information collected for these environmental review.

3.0 Purpose of and Need For Action

3.1 The Proposed Action

TVA proposes to upgrade six 500 kV breaker failure relays, install 764 MVAR capacitor banks in five locations throughout the TVA transmission system, and upgrade the BFN main generators excitation system.

3.2 Need for TVA Action

BFN EPU will increase the electrical output of each BFN unit by approximately 155 megawatts (MW). TVA conducted an Interconnection SIS to evaluate the material modification to the existing BFN units. The Interconnection SIS identified some transmission system impacts that will require modifications and upgrades in order to support the planned BFN unit uprates.

3.3 Alternatives to the Proposed Action

There are no viable alternatives identified in the Interconnection SIS for upgrading the six breaker failure relays.

There are three options for capacitor bank installations. The first option is to install 774 MVAR capacitor banks distributed across four existing locations throughout the TVA transmission system. The second preferred alternative is to install 764 MVAR capacitor banks distributed across five existing locations throughout the TVA transmission system. The third option is to uprate the BFN main generator stator to 1375 mega volt-amperes (MVA) thereby reducing the MVAR requirement to 252 MVAR of capacitor banks distributed across three existing locations throughout the TVA transmission system. Based on cost and technical issues with this third option, BFN EPU project management determined this option would not meet the needs of the EPU project. TVA's Transmission Power Supply (TPS) organization determined that better grid reliability and operational control would result from 764 MVAR capacitor banks distributed across five locations.

A new 500 kV transmission line between the Limestone and East Point Substations was considered as an alternative to the BFN main generator excitation system upgrade. BFN EPU project management, in conjunction with TPS, determined that the BFN main generator excitation system upgrades would be the preferred alternative, based on cost, schedule, and environmental considerations.

4.0 Overview of Operational And Equipment Changes - Project Characteristics

TVA proposes to upgrade the 500 kV breaker failure relays for breakers 5204, 5208, 5254, 5258, 5274, and 5278. The relays are physically located in panels in the relay room inside the BFN control building and do not involve use of additional undisturbed land. The relays are being upgraded to mitigate potential transmission system issues resulting from specific fault events on the transmission system and will have no operational impact on BFN. Relay replacement is considered to be routine maintenance.

TVA proposes to install 764 MVAR capacitor banks in five locations in the TVA transmission system. The proposed locations are the Clayton Village 161 kV Substation located in Oktibbeha County, Mississippi; the Holly Springs 161 kV Substation located in Marshall County, Mississippi; the Corinth 161 kV Substation located in Alcorn County, Mississippi; the East Point 161 kV Substation located in Cullman County, Alabama; and the Wilson 500 kV Substation located in Wilson County, Tennessee. The capacitor banks are intended to address MVAR deficiencies associated with the additional BFN generation and will have no operational impact on BFN. Two of the five capacitor bank installations will be within existing substation boundaries. Three of the five proposed capacitor bank installations will require expansion (small amount of land) of the existing substation footprint. The capacitor bank installations are considered to be a minor system upgrade.

BFN will replace the BFN main generator Alterrex excitation system with a bus-fed static excitation system. The static excitation system consists of a 3-phase power potential transformer (PPT), an automatic voltage regulator (AVR), and a power section. The modification will occur within existing BFN structures and does not involve use of additional undisturbed land.

5.0 Socioeconomic and Environmental Justice Considerations

5.1 Socioeconomic

All physical work related to the 500 kV breaker failure relay and BFN main generator exciter upgrades will be performed within existing BFN structures and will not impact highway or railroad travel, will not interfere with river use or navigation, will not interfere with recreational or educational use of facilities remote to BFN, will not create public health effects, or increase the potential for accidents affecting the public. These projects will not cause the displacement or relocation of businesses, residences, cemeteries, or farms. Relay replacements are not expected to require significant additional labor resources. The BFN main generator exciter upgrades will involve additional supplemental staffing (contractor and vendor resources) during the associated installation outage. However, BFN does not anticipate this additional supplemental staffing to significantly deviate from the typical outage workforce size. These upgrades will not, by themselves, increase power sales or change the book value of BFN and therefore will not impact TVA's payment in lieu of taxes payments or distributions.

All physical work related to installation of the capacitor banks will take place at locations distant to BFN. The work will be performed by a combination of TVA personnel and vendor supplied resources. Given the widespread nature of the work, no single construction site will be significantly impacted. For each of the capacitor bank sites, installation will not impact highway or railroad travel, will not interfere with river use or navigation, will not interfere with recreational or educational use of facilities remote to BFN, will not create public health effects, or increase the potential for accidents affecting the public. These projects will not cause the displacement or relocation of businesses, residences, cemeteries, or farms. The components and equipment installed will be inorganic inanimate objects and therefore will not contain genetically engineered organisms or materials. The capacitor banks will not, by themselves, increase power sales or change the book value of BFN and therefore will not impact TVA's payment in lieu of taxes payments or distribution.

5.2 Environmental Justice

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and will not impact the surrounding general population. Two of the capacitor bank installation sites will be within existing substation boundaries. Three of the five sites (Holly Springs, Corinth, and Wilson substations) will require expansion (small amount of land) of the existing substation footprint and additional grading and clearing. TVA's best management practices (BMPs) and specifications will apply throughout construction activities. The proposed upgrades will improve the TVA transmission system reliability. Improved transmission system reliability results in fewer unplanned power losses and therefore the surrounding population will benefit from the upgrades.

6.0 Cost Benefit Analysis

TVA performed analysis to study the cost effectiveness of implementing EPUs at the BFN site. The proposed EPUs provide additional supply of approximately 155 MW per unit (465 MW total) capacity and approximately 4 terawatt-hours (TWh) per year of reliable, carbon-free energy to the TVA system. The EPU project is expected to be economically beneficial by $450 million through the end of the current operating licenses at Browns Ferry.

Based on TVA's load forecast, capacity plans have shown TVA would need to purchase market capacity and employ new generation without the uprates in order to satisfy firm requirements. Detailed model simulations were completed to estimate the capacity and energy (mostly fuel) cost impacts. The capacity savings from the EPU project are largely driven by deferring or reducing the need for new capacity. The low variable cost of the additional nuclear generation delivers significant fuel savings by offsetting more expensive coal generation, gas generation, and the need for market purchases. This also includes reduced carbon emissions. TVA projects the total cost of the project to be $479 million which includes transmission expenses.

An Interconnection SIS was also conducted to determine all adverse system impacts on TVA's transmission system caused by the EPUs at BFN. Several projects are required to mitigate the identified adverse system impacts and the estimated cost of these projects is $45.5 million. The cost and timeframe for these required projects is significantly reduced from the prior study because TVA plans to modify the excitation system for all three units at BFN instead of building a new 500 kV transmission line. While the transmission related expense lowers the economic benefit, it is still highly positive.

7.0 Environmental Effects

7.1 Terrestrial Effects

7.1.1 Land Use, Wetlands, and Natural Areas

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and do not involve use of additional undisturbed land. Therefore there is no potential to take prime or unique farmland out of production. These upgrades will not affect ecologically critical areas, wetlands, park land (federal, state, or local), national or state forests, wilderness areas, scenic areas, wildlife management areas, recreational areas, greenways, or trails.

The capacitor bank installations will take place at locations distant to BFN. Two of the capacitor bank installation sites will be within existing substation boundaries. Three of the five sites (Holly Springs, Corinth, and Wilson substations) will require expansion (small amount of land) of the existing substation footprint and additional grading and clearing. TVA expects to purchase approximately 3.5 acres of land and disturb approximately 3 acres for the Corinth substation expansion. TVA expects to purchase approximately 2.5 acres of land and disturb approximately 2.25 acres for the Holly Springs substation expansion. TVA owns the land required for the Wilson substation expansion and estimates it will disturb approximately five acres. No prime or unique farmland will be taken out of production. There are no ecologically critical areas, wetlands, park land (federal, state, or local), national or state forests, wilderness areas, scenic areas, wildlife management areas, recreational areas, greenways, or trails within the proposed project footprints or within three miles for the five substation sites.

7.1.2 Cultural Resources

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and therefore do not affect historic structures, historic sites, Native American religious or cultural properties, or archeological sites. Two of the capacitor bank installation sites occur within existing substation boundaries and therefore will not affect historic structures, historic sites, Native American religious or cultural properties, or archeological sites. TVA retained the service of a qualified vendor to conduct a Phase 1 archaeological and historic cultural resource survey for the expansion area of the other three affected substations. The archaeological area of potential effects (APE) encompasses the new areas of land disturbance. The historic APE for each substation was defined to be a 0.5 mile radius surrounding the substation site from which unobstructed views of the project area would be possible. The results and conclusions of the vendor research for each substation are described below:

- Corinth: Background research performed prior to the field survey indicated no previously identified archaeological sites in the APE. The field study identified no archaeological sites. Background research identified 14 previously inventoried historic architectural properties in the 0.5-mile radius. Of these, one is non-extant and one is located outside the viewshed. TVA has determined that the remaining 13 previously-recorded architectural resources are ineligible for inclusion in the National Register of Historic Places (NRHP). The study also identified six previously unrecorded historic architectural resources. Based on the study results, and pending agreement by the Mississippi State Historic Preservation Office (SHPO), TVA finds that the proposed undertaking would not be within a direct line of sight to either historic district, and so would have no effect.
- Holly Springs: Background research performed prior to the field survey indicated no previously identified archaeological sites in the APE. The field study identified no archaeological sites. The architectural survey identified 14 previously unrecorded historic architectural properties in the 0.5-mile radius. Based on the field survey, TVA has determined that all 14 properties lack architectural and historic significance and are

ineligible for inclusion in the NRHP. The study also investigated two previously unrecorded historic districts within the above-ground APE, the Depot-Compress Historic District and the East Holly Springs Historic District. Based on the study results, and the pending agreement by the Mississippi SHPO, TVA finds that the proposed undertaking would not be within a direct line of sight to either historic district, and so would have no effect.

- Wilson: Background research performed prior to the field survey indicated no previously identified archaeological sites in the APE. The field study identified no archaeological sites. Based on the study results, and pending agreement by the Tennessee SHPO, TVA finds that the proposed undertaking would not affect any archaeological sites included or eligible for inclusion in the NRHP.

7.1.3 Transmission Facilities, Electric Shock, and Electromagnetic Fields.

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures. Due to the isolation of these components, they do not have the potential to create an electric shock or electromagnetic field hazard to the public. The capacitor banks will be installed at existing TVA substations. Design criteria that limit hazards to human health from steady-state currents are based on the National Electric Safety Code (NESC). TVA designs transmission systems to exceed requirements given in the NESC. The substations have barrier fences that separate the general public from hazardous electrical components. Because substations already contain multiple high voltage and high current components, addition of the new capacitor banks does not significantly alter the electric shock or electromagnetic field hazard.

7.1.4 Noise, Odor, Microbiological, and Visual Aesthetics

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and therefore do not generate noise or odor, or produce light with off-site impacts. These upgrades will not produce visual contrast or visual discord and do not involve external structures over 200 feet above ground level. These upgrades will not introduce, or promote the growth of, thermophilic microorganisms and therefore do not affect microbiological hazards to human health.

Capacitor bank installations will generate transient noise during construction activity. Noise control and suppression during construction activity will be in accordance with the TVA's BMPs and specifications. Specific noise control and suppression measures are discussed in section 9.0; Best Management Practices, and Environmental Quality Protection Specifications of this attachment. Installation of capacitor banks does not create a potential to produce odors with off-site impacts. Installation of new capacitor banks may require new light sources. TVA will adhere to the requirements in the TVA Substation Lighting Guidelines to ensure light disturbance from the new capacitor banks is small. Lighting guidelines include design controls that address luminaire optical properties, light levels, neighboring property uses, physical security and surveillance requirements, mounting height and location, terrain, and substation safety. New capacitor banks will not produce visual contrast or visual discord and do not involve external structures over 200 feet above ground level. New capacitor banks will not introduce, or promote the growth of, thermophilic microorganisms and therefore do not affect microbiological hazards to human health.

7.1.5 Air Impacts

For relay upgrades and BFN main generator upgrades there is no potential to release air pollutants and air permits are not required. For capacitor bank installations, there may be small impacts from construction vehicle emissions and fugitive dust from ground disturbance and vehicle travel on unpaved roads. These impacts are small, temporary, and controlled with TVA BMPs.

7.1.6 Terrestrial Biota and Habitat

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and do not affect unique or important terrestrial habitat. The breaker failure relay upgrades and the BFN main generator exciter will not contribute to the spread of exotic or invasive species and have no potential to affect migratory bird populations.

The capacitor bank installations will take place at locations distant to BFN. Two of the capacitor bank installation sites will be within existing substation boundaries. All work at these two sites will occur on previously disturbed land and no additional clearing is required. Therefore, there is no potential at these two sites to affect unique or important terrestrial habitat, contribute to the spread of exotic or invasive species, or affect migratory bird populations. Three of the five sites (Holly Springs, Corinth, and Wilson substations) will require expansion (small amount of land) of the existing substation footprint and additional grading and clearing. These sites likely contain sizeable proportion of non-native, invasive botanical species. Because these non-native, invasive, botanical species are widely distributed throughout the region, and the area of disturbance is small, installation of the capacitor banks at these substations will not adversely affect the percentage of this type of habitat in the area. Because TVA's BMPs require the use of native plants and non-invasive species for landscaping, the installation of the capacitor banks will not significantly contribute to the spread of invasive or exotic botanical species. No wading bird colonies, heronries, or aggregations of migratory birds have been documented within three miles of the project footprint and none were observed during field reviews. Therefore, activities associated with the proposed capacitor banks would not affect wading bird colonies or other aggregations of migratory birds.

7.1.7 Non-Radiological Waste Streams and Potential for Pollutant Generation

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and are therefore subject to BFN waste management procedures. These upgrades will not generate water pollutants or create new waste water streams, cause soil erosion, or involve dredged or fill materials. They will not generate or release hazardous waste, universal or special waste, or used oil. These upgrades will not generate or release toxic substances. No materials involved in these upgrade projects will require special handling. The upgrade projects may generate small quantities of solvents for cleaning purposes. Chemicals brought on the BFN site require the approval of the Chemical Traffic Control (CTC) Coordinator. Retired relays are collected and evaluated for reuse or disposal. Relays identified for reuse are entered into inventory and then properly stored. Relays identified for disposal are collected in a properly marked, and Department of Transportation approved, container. Solid waste generated during the upgrade projects will be collected, stored, and disposed of per BFN site procedures. Retired equipment may be retained for spare inventory or scrapped/recycled. The upgrade projects at BFN will not release, or otherwise use substances on the publicly available Toxic Release Inventory (TRI) list. Components and materials removed from the BFN Radiologically Controlled Area (RCA) will be surveyed prior to removal. If radioactive contamination is found, the material will require disposal as low level radioactive waste. These upgrades will not introduce new or different radiological release pathways and will not alter the onsite or offsite dose rates. Therefore, these upgrades will not alter the BFN radiological hazard to human health.

The capacitor bank installation projects will occur outdoors at five substations remote to BFN. Standard TVA BMPs and proper containment, treatment, and disposal of wastewaters, storm-water runoff, wastes and potential pollutants will be implemented to control potential surface water impacts. The capacitor bank projects will not produce point source or non-point source wastewater discharge. Soil erosion impacts will be small with implementation of standard TVA BMPs. A state construction storm-water permit will be required for disturbance at the Holly Springs and Corinth substations. At the Wilson Substation, a state construction general storm-water permit and a Wilson County Land Disturbance permit (Municipal Separate Storm Sewer, or MS4) will be required. In addition, an Aquatic Resource Alteration Permit (ARAP) is required at the Wilson Substation (i.e., in Tennessee) if waters of the state will be impacted. Any fill material for the substation expansions would be obtained from an approved borrow pit. Any spoil accumulated from grading, trenching, or digging for new foundations would be placed in a permitted spoil area on the substation property, or spread back onsite. The disturbed areas would be re-graveled and/or re-surfaced. If any spoil is taken off site, it would be tested and disposed. Any solid waste generated at the substations will be scrapped/recycled when feasible. These capacitor bank installations will not generate or release radioactive contamination, hazardous waste, universal or special waste, or used oil. Substations are not radiologically controlled and do not represent a radiological hazard to human health. Capacitor bank installations will not generate or release toxic substances. No materials involved in these upgrade projects will require special handling. Capacitor bank installation involves new equipment. No existing equipment that could contain PCBs, solvents, asbestos, sandblasting material, mercury, lead, or paints will be disturbed. Capacitor bank installation will not release, or otherwise use substances on the TRI list.

7.1.8 Geological Environment

The BFN area is underlain by flat-lying, under-formed limestone of the Mississippian age. The site lies on the southeastern flank of the Nashville structural dome where it merges into the foreland slope of the Appalachian geosyncline. The seismic hazard is small at BFN in comparison to most other areas in the United States. No active faults showing recent surface displacement are known within a 200-mile radius of the site. The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and are bounded by existing geologic and seismic analysis.

RERP - RAI - GE-2 Response, Attachment 1

The Clayton Village project area is located in the East Gulf Coast Section of the Coastal Plain Physiographic Province and is underlain by Upper Cretaceous age sediments. Available mapping indicates the site is underlain by the Selma Group and locally by the Prairie Bluff chalk formation. The New Madrid seismic area of west Tennessee, the highest risk seismic zone in the region, is located approximately 250 miles north-northwest of the Clayton Village project site. According to the 2014 Seismic Probabilistic Hazard Map published by United States Geologic Survey (USGS), the project area is located in a risk zone with a hazard rating of 2 percent probability of 0.1 – 0.14 g peak acceleration in 50 years. While there is a very slight carbonate component to the chalky bedrock underlying the project area, the site poses a very small risk for the development of karstic features. There are no known rare or unique geologic resources located on or adjacent to the subject property.

The Corinth project area is located in the East Gulf Coast Section of the Coastal Plain Physiographic Province and is underlain by Upper Cretaceous age sediments. Available mapping indicates the site is underlain by units of the Selma Group and locally by the Demopolis chalk. The New Madrid seismic area of west Tennessee is located approximately 150 miles northwest of the Corinth project site and is the highest risk seismic zone in the region. According to the 2014 Seismic Probabilistic Hazard Map published by USGS, the project area is located in a risk zone with a hazard rating of 2 percent probability of 0.2 – 0.3 g peak acceleration in 50 years. While there is a carbonate component to the chalky bedrock underlying the project area, the site poses a very small risk for the development of karstic features. There are no known rare or unique geologic resources located on or adjacent to the subject property.

The Holly Springs project area is located in the East Gulf Coast Section of the Coastal Plain Physiographic Province and is underlain by Tertiary age sediments. Available mapping indicates the site is underlain by the Wilcox Group and locally by the Hatchetigbee Formation. The New Madrid seismic area of west Tennessee, the highest risk seismic zone in the region, is located approximately 150 miles north-northwest of the Holly Springs project site. According to the 2014 Seismic Probabilistic Hazard Map published by USGS, the project area is located in a risk zone with a hazard rating of 2 percent probability of 0.2 – 0.3 g peak acceleration in 50 years. While there is a slight carbonate component to the sandy bedrock underlying the project area, the site poses a very small risk for the development of karstic features. There are no known rare or unique geologic resources located on or adjacent to the subject property.

The Wilson project area is located in the Central Basin Physiographic Province and is underlain by rock units of the Ordovician age Lebanon Limestone. The project site lies on the flank of the Nashville structural dome which controls the regional geologic structure. The New Madrid seismic area of west Tennessee is approximately 240 miles west of the Wilson Substation site and would be considered the highest risk seismic zone in the region. According to the 2014 Seismic Probabilistic Hazard Map published by USGS, the project area is located in the lowest risk zone in the State of Tennessee with a hazard rating of 2 percent probability of 0.1 - 0.14 g peak acceleration in 50 years. The carbonate bedrock underlying the project area does pose a risk for the development of karstic features such as sinkholes and caves at the site. These factors should be considered during site development.

The East Point project area is located in the Appalachia Plateau (Cumberland Plateau) Physiographic Province and is underlain by upper members of the Pottsville Formation which is comprised of relatively flat lying interbedded dark gray shale, siltstone, medium gray sandstone, conglomeratic sandstone and bituminous coal in cyclic sequences. The New Madrid seismic area of west Tennessee, the highest risk seismic zone in the region, is located approximately 250 miles northwest of the project site. The site is also located approximately 175 miles southwest of the East Tennessee Seismic Zone. According to the 2014 Seismic Probabilistic Hazard Map published by USGS, the project area is located in a risk zone with a hazard rating of 2 percent probability of 0.1 – 0.14 g peak acceleration in 50 years. The bedrock underlying the project site is siliceous in nature and lacks a carbonate component. The site poses a very small risk for the development of karstic features. There are no known rare or unique geologic resources located on or adjacent to the subject property.

7.2 Hydrology and Aquatic Ecology Effects

7.2.1 Aquatic Resources-Rivers, Streams, and Reservoirs

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and will not adversely affect wild and scenic rivers or their tributaries. The work has no potential to affect a stream on the National River Inventory list or impact the 100 year flood plain. The work has no potential to affect water flow, stream banks, or stream channels. These upgrade projects will not affect operation of the Tennessee River or require special water elevations or flow conditions, involve water withdrawal from the Tennessee River, and will not affect any unique or important aquatic habitat.

The capacitor bank installations will take place at locations distant to BFN. Two of the capacitor bank installation sites will be within existing substation boundaries. All work at these two sites will occur on previously disturbed land and therefore have no potential to affect wild and scenic rivers or their tributaries, or a stream on the National River Inventory list. Activities at these two sites will not impact the 100 year and 500 year flood plains and have no potential to affect water flow, stream banks, or stream channels. Three of the five sites (Holly Springs, Corinth, and Wilson substations) will require expansion (small amount of land) of the existing substation footprint. There are no wild or scenic rivers/tributaries or streams on the National River Inventory list at or adjacent to these substations and therefore the proposed actions will not affect these types of waterways. The proposed project at Holly Springs and Corinth substations will not involve construction within the 100 year flood plain. A small area within the proposed expanded footprint of the Wilson substation lies within the 100 year flood plain. No construction activities will occur in this area. A review of the Wilson and Holly Springs substations identified no intermittent or perennial streams and one wet weather conveyance (ephemeral stream) in the project area. A review of the Corinth substation identified no watercourses that could be affected. Ground disturbance will be minimized and all work done in accordance with applicable TVA BMPs and specifications. With proper implementation of specifications and BMPs, minimal impacts to water flow, stream channels, or stream banks would occur. No federally designated critical habitat occurs within the potentially affected Cumberland River watershed, the Bridge Creek-Tuscumbia River Canal watershed, or the Big Spring Creek-Little Tallahatchie River and Byhalia Creek Canal-Pigeon Roost Creek watersheds. Therefore, no impacts to unique or important aquatic habitats would occur. For all five substations, capacitor bank installation will not require water withdrawal from any river or reservoir.

7.2.2 Groundwater

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and will not affect groundwater resources.

All construction activities at the Clayton Village and East-Point substations occur on previously disturbed TVA property and will not affect groundwater resources.

The Holly Springs and Corinth project areas are located in the East Gulf Coast Section of the Coastal Plain Physiographic Province and are underlain by Cretaceous age sediments. The Southeastern Coastal Plain aquifer system is the principal aquifer in the proposed project areas and is predominantly comprised of interbedded sand and gravel, deltaic sand, silt, and clay. These rock units are not prone to solution weathering; therefore, the development of karstic features is not anticipated. Project activity could cause soil erosion resulting in the movement of sediment into groundwater infiltration zones. Spills or leaks by construction equipment is possible and could impact groundwater. Standard construction TVA BMPs will be implemented to avoid contamination of groundwater by surface activity in the project area. Potential impacts to groundwater as a result of this project will be small.

The Wilson substation project area is underlain by Ordovician Age rocks of the Central Basin Physiographic Province. These rock units may contain karstic features such as sinkholes, springs, and caves. Public water is available for residents in the project area but private water wells and springs may exist near the project site. Project activity could potentially cause erosion resulting in the movement of sediment into groundwater infiltration zones. Standard construction TVA BMPs will be implemented to avoid contamination of groundwater by surface activity in the project area. Potential impacts to groundwater as a result of this project would be small.

7.2.3 Surface Water

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and will not affect surface water resources.

The Corinth substation project potentially affects the Bridge Creek-Tuscumbia River Canal watershed. According to a table top review by TVA Aquatics and Surface Water staff, no streams are located within the proposed project footprint. Bridge Creek which is a tributary of the Tuscumbia River Canal, an unnamed tributary of Bridge Creek, Railroad Branch, and Elam Creek are located in the vicinity of the project, but not within the project footprint. The Tuscumbia River Canal is listed on Mississippi's list for impaired waters, as required by the US Clean Water Act, section 303(d), due to pH issues. A total maximum daily load (TMDL) has been completed for the Tuscumbia River Canal. The primary designation for the streams listed in this project vicinity is for fish and wildlife use. With proper implementation of standard TVA BMPs and proper containment/treatment/disposal of wastewaters, storm-water runoff, wastes, and potential pollutants, surface water impact would be small.

The Holly Springs substation project potentially affects the Big Spring Creek-Little Tallahatchie River and Byhalia Creek Canal-Pigeon Roost Creek watersheds. According to a desktop review by TVA Aquatics and Surface Water staff, no perennial streams and one ephemeral stream (wet weather conveyance) were located within the proposed project footprint. Big Spring Creek which is a tributary of the Cold Water River, an unnamed tributary of Big Spring Creek, and Nunnally Creek are located in the vicinity of the project, but not within the project footprint. None of the streams are listed as impaired on Mississippi's 303(d) list. The primary designation for the streams listed in this project vicinity is for fish and wildlife use. With proper implementation of standard TVA BMPs and proper containment/treatment/disposal of wastewaters, storm-water runoff, wastes, and potential pollutants, surface water impact would be small.

At the Clayton Village, Wilson, and East Point Substations, with proper implementation of standard TVA BMPs and proper containment/treatment/disposal of wastewaters, storm-water runoff, wastes and potential pollutants, surface water impact would be small.

7.2.4 Drinking Water

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and are therefore will not affect drinking water resources.

Installation of the capacitor banks at all five locations will not require water withdrawal and thus will not affect drinking water supply.

7.3 Endangered, Threatened, or Special Status Species

The breaker failure relay upgrades and the BFN main generator exciter upgrades occur within existing BFN structures and will not affect endangered, threatened, or special status species.

Work at the Clayton Village and East-Point substations occurs on previously disturbed TVA property and inside existing fences and will not affect endangered, threatened, or special status species.

7.3.1 Aquatic

<u>Holly Springs:</u> A query of the TVA Regional Natural Heritage database on April 11, 2016, for records of listed aquatic animal species indicated no federally protected species are present within the potentially affected Big Spring Creek-Little Tallahatchie River and Byhalia Creek Canal-Pigeon Roost Creek watersheds. There are three state-listed fish (spotfin shiner, steelcolor shiner, and yazoo darter) present within the potentially affected Big Spring Creek-Little Tallahatchie River and Byhalia Creek Canal-Pigeon Roost Creek watersheds. An April 2016 desktop review of the proposed project identified no intermittent or perennial streams and one wet weather conveyance (ephemeral stream). Therefore, no impacts to these aquatic endangered or special status species could occur.

Wilson: A query of the TVA Regional Natural Heritage database April 12, 2016, for records of listed aquatic animal species indicated no federally protected species are present in this locality. There are three state-listed fish (blackfin sucker, slenderhead darter, and lake sturgeon) within the potentially affected Cumberland River watershed. An April 2016 desktop review of the proposed project identified no intermittent or perennial streams and one wet weather conveyance (ephemeral stream). Therefore, no impacts to these state-listed species could occur.

Corinth: A query of the TVA Regional Natural Heritage database April 12, 2016, for records of listed aquatic animal species indicated two state-listed species (northern madtom and suckermouth minnow) are present within the potentially affected Bridge Creek-Tuscumbia River Canal watershed encompassing the proposed project area. An April 2016 desktop review documented no streams within the proposed project footprint. Ground disturbance activities associated with construction work could result in increased suspended solids entering nearby watercourses from surface water runoff. In order to eliminate potential impacts to sensitive aquatic life outside the project footprint, ground disturbance will be minimized, and all work will be conducted according to applicable TVA BMPs, with emphasis on preventing waste materials associated with construction from entering adjacent watercourses. These BMPs are designed in part to minimize erosion and subsequent sedimentation in streams. Therefore, with proper implementation of TVA BMPs, no impacts to these state-listed species could occur as a result of the proposed project.

7.3.2 Terrestrial -Botany

Holly Springs: A query of the TVA Natural Heritage Database March 31, 2016, indicated that no federally listed and one state-listed plant species, Lovage (Lisgusticum canadense), are known from within five miles of the proposed project. No federally listed plant species are known from Marshall County, Mississippi, where the project would be located. Desktop evaluation of the project area, including a review of TVA's Regional Natural Heritage database, on-site photos, and topographic maps, indicates that no habitat capable of supporting state or federal listed plant species occurs in the project area. The proposed action would not affect federal or state-listed plant species.

Wilson: A query of the TVA Natural Heritage Database March 31, 2016, indicated that no federally listed and two state-listed plant species are known from within five miles of the proposed project. Three federally listed plant species are known from Wilson County, Tennessee, where the project would be located. Desktop evaluation of the project area, including a review of TVA's Natural Heritage database, on-site photos, and topographic maps, indicates that no habitat capable of supporting state or federal listed plant species occurs in the project area. The proposed action would not affect federal or state-listed plant species.

Corinth: A query of the TVA Natural Heritage Database March 31, 2016, indicated that no federally listed and no state-listed plant species are known from within five miles of the proposed project. One proposed threatened federally listed plant species, White Fringeless Orchid (Platanthera integrilabia), is known from Alcorn County, Mississippi, where the project would be located. Desktop evaluation of the project area, including a review of TVA's Natural

Heritage database, on-site photos, and topographic maps, indicates that no habitat capable of supporting state or federal listed plant species occurs in the project area. The proposed action would not affect federal or state-listed plant species.

7.3.3 Terrestrial - Zoology

Holly Springs: A query of the TVA Natural Heritage database on April 15, 2016, indicated one federally listed species (American burying beetle) and no state-listed terrestrial animal records within three miles of the project area. No additional federally listed terrestrial animal species are known from Marshall County, Mississippi. The US Fish and Wildlife Service (USFWS) has determined that the federally listed Indiana bat, northern long-eared bat, and wood stork have the potential to occur in Marshall County. Although no records of these species are known from Marshall County, habitat suitability and potential impacts to these species are addressed below.

American burying beetles are scavengers, feeding on carrion. They can occur in a wide variety of vegetative habitats, where populations still exist. This species is thought to be extirpated from the state of Mississippi. One record of this species occurs approximately 0.6 miles from the project footprint. However, this record is likely historical since this species is only known to have extant populations in two northeastern US states and six mid-western states. The proposed actions would not affect American burying beetle.

Wood storks are wading birds known to inhabit freshwater wetlands as well as brackish wetlands in natural and man-made impoundments adjacent to streams and shallow lakes. They nest in large rookeries in the canopies of trees such as cypress, in mangroves, or in snags. No records of wood storks are known from Marshall County. No habitat for wood stork occurs within the project area. Wood storks would not be impacted by the proposed actions.

Indiana bats inhabit caves during winter and migrate to roost under exfoliating bark and within cavities of trees (typically greater than or equal to 5 inches in diameter) during summer. Foraging occurs along riparian areas and along the tops of trees, forested edges, and tree lines. Some habitat requirements overlap between the Indiana bat and the northern long-eared bat (NLEB), which roosts in caves or cave-like structures in winter, and utilizes cave-like structures as well as live and dead trees with exfoliating bark and crevices in the summer. There are no known records of either bat species from Marshall County, Mississippi. Per communication with the US Fish and Wildlife Service, Mississippi Field Office, impacts to Indiana bats and NLEBs should be reviewed in the northern counties of the state, therefore it must be assumed that these species have the potential to occur in the project area. There are no documented caves within three miles of the project area. Field reviews on April 12, 2016 determined that no caves, other potential winter roosting structures, or summer roosting structures/trees occur within the project footprint. Foraging habitat for the Indiana bat and the NLEB exists over one ephemeral stream within the project footprint. TVA BMPs would be used around this ephemeral stream, thereby minimizing impacts to this small amount of seasonal foraging habitat. Indiana bats and northern long-eared bats would not be impacted by the proposed actions.

Wilson: A query of the TVA Natural Heritage Database on April 15, 2016, indicated no state or federally listed species within three miles of the project footprint. Three federally listed species (gray bat, Indiana bat, and northern long-eared bat) have been documented in Wilson County, Tennessee.

Gray bats are associated with caves year-round, roosting in different caves throughout the year. Bats disperse from colonies at dusk to forage along waterways. The nearest gray bat record is from a cave approximately 7.8 miles away from the project footprint. No caves have been reported within 3 miles of the project footprint, and no caves were observed within the project footprint during field review on April 3, 2016. The proposed actions would not impact any known cave habitat. Suitable foraging habitat does exist over one ephemeral stream within the project footprint. TVA BMPs will be used around this ephemeral stream to ensure there are no impacts to hydrology and water quality and that this foraging habitat is still available to gray bat. With the implementation of TVA BMPs during proposed project activities, gray bats would not be impacted by the proposed actions.

The closest records of the Indiana bat are summer maternity roosts approximately 14.6 miles from the project footprint. The closest records of NLEBs in Wilson County are also summer maternity roosts approximately 21.85 miles from the project footprint. Closer summer survey records of NLEB do exist from Rutherford County approximately 14.3 miles away. No caves have been reported within 3 miles of the project footprint, and no caves or other winter roosting habitat were observed within the project footprint during field reviews on April 3, 2016. The proposed actions would not impact any known winter roosting habitat. Suitable foraging habitat does exist over an ephemeral stream and forested tree lines within the project footprint. TVA BMPs will be used around this ephemeral stream to ensure there are no impacts to hydrology and that these foraging habitats are still available to foraging bats. Similarly suitable forested tree lines are available in the surrounding area. Removal of this small amount of foraging habitat would have no measurable effect on foraging bats. No suitable summer roosting habitat for either species was observed within the project footprint. The proposed actions would not impact the Indiana bat or the northern long-eared bat.

<u>Corinth:</u> A query of the TVA Natural Heritage Database on April 15, 2016, indicated one state-listed species (red salamander) and no federally listed terrestrial animal records within three miles of the project area. No federally listed terrestrial animal species are known from Alcorn County, Mississippi. The USFWS has determined that the federally listed Mitchell's satyr butterfly, Indiana bat, northern long-eared bat, and wood stork have the potential to occur in Alcorn County. Although no records of these species are known from Alcorn County, habitat suitability and potential impacts to these species are addressed below.

Red salamanders are found in forested wetlands and riparian areas along cold, clear, rocky streams and springs. The closest record of this species is a historical record approximately 2.1 miles from the project footprint. Suitable habitat for red salamander does not occur within the project area. Red salamander would not be impacted by the proposed actions.

Mitchell's satyr butterfly is one of the most geographically restricted eastern butterflies. It occurs in wetlands where low nutrient systems receive carbonate-rich ground water from seeps and springs. In Mississippi, Mitchell's satyr has been found in small upland wetlands created by beaver dams and in wetlands formed by road culverts. No records of this species are known from Alcorn County. Suitable habitat for Mitchell's satyr does not exist within the project footprint. Proposed actions are not likely to affect Mitchell's satyr.

No records of wood storks are known from Alcorn County. No habitat for wood stork occurs within the project area. Wood storks would not be impacted by the proposed actions.

There are no known records of the Indiana bat or NLEB species from Alcorn County, Mississippi. Per communication with the US Fish and Wildlife Service- Mississippi Field Office, impacts to Indiana bats and NLEBs should be reviewed in the northern counties of the state; therefore, it must be assumed that these species have the potential to occur in the project area. There are no documented caves within three miles of the project area. Field review on April 12, 2016, determined that no caves or other potential winter roosting structures occur within the project footprint. The only tree with exfoliating bark documented in the project area is a sycamore tree. Live, healthy, sycamores are not thought to be used for roosting by the Indiana bat or the NLEB due to the thin bark and small size of bark flakes. Therefore, no suitable summer roosting habitat occurs in the project footprint or would be impacted by the proposed actions. Foraging habitat for the Indiana bat and the NLEB exists over two forested areas within the project footprint (totaling less than 1 acre). Removal of this small amount of foraging habitat would have no measurable effect on foraging bats. Indiana bats and NLEBs would not be impacted by the proposed actions.

7.4 Compliance, Permits, and Reporting

BFN Site: Chemicals used during performance of work on the BFN site (oils, solvents) will be approved by the CTC Site Coordinator prior to use. Only quantities required to complete the work will be brought on site. The safety data sheets (SDSs) for all products brought on BFN site are provided to, and approved by, the BFN site environmental contact prior to being brought on site. Work performed at BFN will not require modification to existing environmental permits or to existing equipment with an environmental permit. Installation of new equipment will not require new environmental permits. Equipment installed will be contained within existing BFN structures and would therefore not require Federal Aviation Administration (FAA) notification for structures greater than 200 feet.

Substations: The SDSs for all products are provided to, and approved by, the TVA environmental support personnel prior to chemicals being brought on site. The *Spill Prevention Control and Countermeasures Plan* for each substation will be revised as needed, to reflect the equipment changes at the substations. Installation of new equipment will not require new environmental permits. Equipment installed will be similar to existing equipment at the substation and would therefore not require FAA notification for structures greater than 200 feet.

8.0 Results and Conclusion Summary

TVA performed an Interconnection SIS for the EPU of all three BFN units. The Interconnection SIS documents transmission stability upgrades required for the TVA transmission system in order to support the BFN EPU. Specifically, the Interconnection SIS identified replacing six 500 kV breaker failure relays, installing 764 MVAR capacitor banks in five locations throughout the

TVA transmission system, and upgrading all three BFN main generator excitation systems. As a federal agency subject to the requirements of NEPA, TVA evaluates the effects on the environment of these proposed upgrades. The non-radiological environmental impacts for the transmission stability upgrades has been reviewed and assessed. This review did not identify moderate or large environmental impacts from installation of the proposed upgrades. TVA anticipates that installation of the proposed upgrades will not affect human health or the environment.

9.0 Best Management Practices, and Environmental Quality Protection Specifications

TVA's BMPs, in conjunction with specifications, are used to manage the environmental impact from construction activities. Each project/site is individually evaluated environmentally. Specific environmental protection BMPs and environmental quality specifications for each project are identified as applicable in the environmental review package for each project. TVA environmental quality specifications and BMPs are effective methods for ensuring that TVA's construction activities contribute to a high standard of water quality throughout the Tennessee River Watershed and the TVA Power Service Area. The TVA BMPs are chosen to minimize erosion or control sedimentation and other pollutants from land disturbances and land management activities. When properly applied, TVA BMPs help protect the quality of surface waters and ground waters.

TVA and/or the assigned contractor and subcontractors plan, coordinate, and conduct transmission construction activities in a manner that protects the quality of the environment and complies with TVA's environmental expectations. TVA environmental quality specifications contains provisions that are considered in all TVA and contract construction, clearing, and grading activities at these sites. At all site perimeters, structure, foundation, conduit, grounding, fence, drainage ways, etc., appropriate protective measures to prevent erosion or release of contaminants are taken. Those protective measures are inspected and maintained throughout construction. Additional TVA specifications are used for projects requiring clearing and/or grading.

Table RERP-RAI-GE-2-1, TVA Specifications for Transmission Substation Construction and/or Site Clearing and Grading, summarizes the TVA specifications to be used for construction, clearing, and grading activities at the substations. Table RERP-RAI-GE-2-2, TVA Best Management Practices, summarizes the TVA BMPs used for construction activities at the substations. Breaker failure relay upgrades and BFN main generator excitation system upgrades occur within existing BFN structures.

RERP - RAI - GE-2 Response, Attachment 1

Table RERP-RAI-GE-2-1
TVA Specifications for Transmission Substation Construction and/or Site Clearing and Grading

Specifications	Substation Applicability	Description
Regulations	All Five Substations	Compliance with all applicable federal, state, and local environmental and antipollution laws, regulations, and ordinances related to environmental protection and prevention, control, and abatement of all forms of pollution.
	Holly Springs, Corinth, and Wilson	All applicable federal, state, and local environmental and antipollution laws, regulations, and ordinances are complied with, including without limitation, all air, water, solid and hazardous waste, noise, and nuisance laws, regulations, and ordinances.
Land and Landscape Preservation	All Five Substations	Care is exercised to preserve the natural landscape in the entire construction area as well as use areas, in or outside of the ROW, and on or adjacent to access roads.
	Holly Springs, Corinth, and Wilson	TVA or contract personnel exercises care to preserve the condition of cleared soils by avoiding as much compacting and deep scarring as possible in areas not to be developed for buildings, structures, or foundations. As soon as possible after initial disturbance of the soil and in accordance with any permit(s) or other state or local environmental regulatory requirements, cover material is placed to prevent erosion and sedimentation of water bodies or conveyances to surface water or groundwater.
Sensitive Area Preservation	All Five Substations	Certain areas along the access and/or the ROW may be designated by the specifications as environmentally sensitive. These areas include, but are not limited to, areas classified as erodible, geologically sensitive, scenic, historical and archeological, fish and wildlife refuges, endangered species habitat, water supply watersheds, and public recreational areas. Crews take all necessary actions to avoid adverse impacts to these sensitive areas and their adjacent buffer zones.

RERP - RAI - GE-2 Response, Attachment 1

Table RERP-RAI-GE-2-1
TVA Specifications for Transmission Substation Construction and/or Site Clearing and Grading

	Holly Springs, Corinth, and Wilson	If prehistoric or historic artifacts or features that might be of archaeological or historical significance are discovered during clearing, grading, borrow, or fill operations, the activity immediately ceases within a 100-foot radius, and a TVA project manager, an environmental specialist, and the TVA Cultural Resources program manager is notified. The site is protected and left as found until a determination about the resources, their significance, and site treatment is made by TVA's Cultural Resources Program.
Water Quality Control	All Five Substations	Activities are performed by methods that prevent entrance or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into flowing caves, sinkholes, streams, dry watercourses, lakes, ponds, and underground water sources. Erected erosion and/or sedimentation controls are maintained.
	Holly Springs, Corinth, and Wilson	Clearing, grading, borrow and fill, and/or disposal activities are performed using BMPs that will prevent erosion and entrance of spillage, contaminants, debris, and other pollutants or objectionable materials into drainage-ways, surface waters, or groundwater. Special care is exercised in refueling equipment to prevent spills. Fueling areas are remote from any sinkhole, crevice, stream, or other water body. BMPs, such as silt fences, on steep slopes and adjacent to any steam, wetland, or other water body. BMPs are inspected by the TVA field engineer or other designated personnel routinely and at least as frequently as required by the permit or good management practices and during periods of high runoff; any necessary repairs are made as soon as practicable.
Turbidity and Blocking of Streams	All Five Substations	Activities in or near streamside management zones or other bodies of water are controlled to prevent the water turbidity from exceeding state or local water quality standards for that stream. All conditions of a general storm water permit, aquatic resource alteration permit, or site specific permit are met.

RERP - RAI - GE-2 Response, Attachment 1

Table RERP-RAI-GE-2-1
TVA Specifications for Transmission Substation Construction and/or Site Clearing and Grading

	Holly Springs, Corinth, and Wilson	If temporary clearing, grading, borrow, or fill activities must interrupt natural drainage, appropriate drainage facilities and erosion/sediment controls are provided to avoid erosion and siltation of streams and other water bodies or water conveyances. Turbidity levels in receiving waters or at storm water discharge points are monitored, documented, and reported if required by the applicable permit. Erosion and sediment control measures such as silt fences, water bars, and sediment traps are installed as soon as practicable after initial access, site, borrow, fill, or right-of-way disturbance and after sequential disturbance of stabilized areas due to stepwise construction requirement in accordance with applicable permit or regulatory requirements.
Streamside Management Zones (SMZs)	Holly Springs, Corinth, and Wilson	Clearing and/or grading activity leaves as many rooted ground cover plants as possible in buffer zones along streams and other bodies of water or wet-weather conveyances thereto. Cutting of trees within SMZs is accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. Only approved herbicides are used, and herbicide application is conducted by certified applicators from the Transmission Operations and Maintenance (TOM) organization after initial clearing and construction. Disturbed soils in SMZs are stabilized by appropriate methods immediately after the access or site is cleared. Stabilization occurs within the time frame specified in applicable storm water permits or regulations.

RERP - RAI - GE-2 Response, Attachment 1

Table RERP-RAI-GE-2-1
TVA Specifications for Transmission Substation Construction and/or Site Clearing and Grading

Wetlands	Holly Springs, Corinth, and Wilson	In forested wetlands, tall trees are cut near the ground, leaving stumps and roots in place. Cutting of trees within wetlands is accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The cambium may be treated with herbicides applied by certified applicators from the TOM organization to prevent regrowth. Understory trees that must be initially cut and removed may be allowed to grow back or may be treated with tree growth regulators selectively to slow growth and increase the reclearing cycle. The decision is situationally made based on existing ground cover, wetland type, and tree species, since tall tree removal may “release” understory species and allow them to quickly grow to “electrical clearance problem” heights. In many circumstances, herbicides labeled for water and wetland use may be used in reclearing.
Floodplain Evaluation	All Five Substations	During the planning and design phase, floodplain information is obtained to avoid locating flood damageable facilities in the 100 year floodplain. If the preferred site is located within a floodplain area, alternative sites are evaluated and documentation prepared to support a determination of “no practicable alternative.” Steps taken to minimize adverse impacts are documented.
Clearing	All Five Substations	No activities may clear additional site or ROW vegetation or disturb remaining vegetation, stumps, or regrowth at locations other than the substation or access thereto. Appropriate erosion or sediment controls for areas disturbed are established as soon as practicable after disturbance.
Brush and Timber Disposal	Holly Springs, Corinth, and Wilson	For initial clearing, trees are commonly part of the contractor’s contract to remove as they wish. Trees may be removed from the site for lumber or pulpwood, or they may be chipped or stacked and burned. All such activities are coordinated with the TVA field engineer and the open burning permits; notifications and regulatory requirements are met. On ROW, trees may be cut and left in place only in areas specified by TVA and approved by appropriate regulatory agencies. These areas may include sensitive wetlands or SMZs where tree removal would cause excessive ground disturbance or in very rugged terrain where windrowed trees are used as sediment barriers along the edge of the right-of-way, site, or access.

RERP - RAI - GE-2 Response, Attachment 1

Table RERP-RAI-GE-2-1
TVA Specifications for Transmission Substation Construction and/or Site Clearing and Grading

Air Quality Control	All Five Substations	Crews take appropriate actions to minimize the amount of air pollution created by construction activities.
	Holly Springs, Corinth, and Wilson	Appropriate actions are taken to limit the amount of air emissions created by clearing and disposal operations to be well within the limits of clearing or burning permits and/or forestry or local fire department requirements. All operations are conducted in a manner that prevents nuisance conditions or damage to adjacent land, crops, dwellings, highways, or people.
Dust and Mud Control	All Five Substations	Activities are conducted to minimize the creation of dust. This may require limitations as to types of equipment, allowable speeds, and routes utilized. Water, straw, wood chips, dust palliative, gravel, combinations of these, or similar controls may be used subject to TVA approval.
	Holly Springs, Corinth, and Wilson	Clearing, grading, borrow, fill, or transport activities are conducted in a manner that minimizes the creation of fugitive dust. This may require limitations as to type of equipment, allowable speeds, and routes utilized. Control measures such as water, gravel, etc., or similar measures may be used subject to TVA approval.
Sanitation	All Five Substations	Sanitary chemical toilets convenient to all principal points of operation are provided for every working party and at each construction step. The facilities comply with applicable federal, state, or local health laws and regulations.
	Holly Springs, Corinth, and Wilson	Sanitation facilities are not located closer than 100 feet to any stream or tributary or to any wetland.
Use Areas	All Five Substations	Use areas include but are not limited to site office, shop, maintenance, parking, storage, staging, assembly areas, utility services, and access roads to the use areas.
Damage Prevention	All Five Substations	Movement of construction equipment is conducted in a manner that causes as little intrusion and damage as possible to property features and vegetation.
Equipment	All Five Substations	All major equipment and proposed methods of operation are subject to the approval of TVA. The use or operation of heavy equipment in areas outside the right-of-way (ROW), access routes, or site will not be permitted without permission from the TVA inspector or field engineer. Steps are taken to limit ground disturbance caused by heavy equipment.

RERP - RAI - GE-2 Response, Attachment 1

Table RERP-RAI-GE-2-1
TVA Specifications for Transmission Substation Construction and/or Site Clearing and Grading

Refuse Disposal	All Five Substations	Designated personnel are responsible for daily inspection, cleanup, proper labeling, storage, and disposal of all refuse and debris.
Vehicle Exhaust	All Five Substations	Crews maintain and operate equipment to limit vehicle exhaust emissions.
Vehicle Servicing	All Five Substations	Routine maintenance of personal vehicles is not performed on the ROW or access route to the site. Heavy equipment is not serviced on site except adjacent to or in designated areas. TVA properly maintains these vehicles with approved spill protection controls and countermeasures.
Smoke and Odors	All Five Substations	Combustible and volatile materials that could create objectionable smoke, odor, or fumes are properly stored and handled. Personnel do not burn oil or refuse that includes trash, rags, tires, plastics, or other manufactured debris.
Noise Control	All Five Substations	Measures are taken to avoid the creation of noise levels that are considered nuisances, safety, or health hazards for employees, the public, or the site and adjacent property owners. Critical areas including, but not limited to, residential areas, parks, public use areas, and some ranching areas require special considerations. Concentration of individual noisy pieces as well as the hours and locations of operation are considered.
Noise Suppression	All Five Substations	All internal combustion engines are properly equipped with mufflers. The equipment and mufflers are maintained at peak operating efficiency. Air compressors and other noisy equipment may require sound reducing enclosures.
Burning	All Five Substations	Permits are obtained and notification provided as required to state forestry offices and/or local fire departments. Burning complies with requirements of state and local air pollution control and is only allowed in approved locations and during appropriate hours and weather conditions.

RERP - RAI - GE-2 Response, Attachment 1

Table RERP-RAI-GE-2-1
TVA Specifications for Transmission Substation Construction and/or Site Clearing and Grading

Site Restoration	All Five Substations	Disturbed areas are stabilized in the following manner unless another method is previously specified. • Subsoil is loosened to minimum depth of six inches and worked to remove unnatural ridges/depressions. • Appropriate soil amendments are added as needed. • Disturbed areas are initially seeded with temporary ground cover. Final restoration and final seeding is performed when construction is completed. • TVA holds the option, depending on time of year and weather conditions, to delay or withdraw the requirement of seeding until more favorable planting conditions are certain. • The site is protected from species designated by the Federal Invasive Species Council and equipment being transported from location to location is inspected to ensure removal and destruction of live material.
Final Site Cleanup and Inspection	All Five Substations	All construction related debris, products, materials, and wastes are properly handled, labeled as required, and removed from the site. Upon completion, the designated TVA person walks down the site and completes an approval inspection.

RERP - RAI - GE-2 Response, Attachment 1

Table RERP-RAI-GE-2-2
TVA Best Management Practices

BMP	Substation Applicability	Description
Sediment and Erosion Control	All Five Substations	a. Limit the amount of vegetation disturbed and the exposure of soil to erosive elements. b. Plan clearing, grading and construction to minimize the area and duration of soil exposure. c. Minimize disturbance of natural contours and drains. d. When possible, operate on dry soils when they are least susceptible to structural damage and erosion. e. Divert runoff away from disturbed areas. f. Provide for dispersal of surface flow that carry sediment into undisturbed surface zones that have high infiltration capacity and ground cover conditions. g. Prepare drainage ways and outlets to handle runoff. h. Minimize length and steepness of slopes. Interrupt long slopes frequently. i. Maintain runoff velocities low. j. Trap sediment on-site. k. Inspect and maintain control measures on a regular basis and after significant rainfall events. l. Revegetate and mulch disturbed areas as soon as practical after each disturbance.
Preconstruction Planning	All Five Substations	Prior to ground disturbing activity, a plan is developed to address erosion, sediment, and storm water control issues. A copy of the plan is kept on-site. Field changes to the plan are communicated to the plan preparer.

RERP - RAI - GE-2 Response, Attachment 1

Table RERP-RAI-GE-2-2
TVA Best Management Practices

Clearing Practices	Holly Springs, Corinth, and Wilson	Clearing operations are conducted in a manner that prevents unnecessary destruction, scarring, or defacing of natural vegetation. In sensitive public or environmental areas, appropriate buffer zones are observed and methods of clearing modified to protect the buffer zone and the sensitive area. The following BMPs use TVA specifications described in Table RERP-RAI-GE-2-1 above to implement the environmental protective element. a. Streamside Management Zones b. Wetlands c. Historic Area Preservation d. Water Quality Control e. Air Quality Control f. Dust Control g. Brush and Timber Disposal
Construction Site Measures	All Five Substations	a. When possible, large construction projects are staged/phased to minimize exposure time of cleared soil. b. Grading activities are avoided during months of highly erosive rainfall. c. Initial erosion and sediment control measures are in place and functional prior to earth moving operations. d. Construction debris is kept from entering surface waters, wetlands, wet weather conveyances, or other access points to existing bodies of water. e. Stockpiled soils are located far enough from streams, wetlands, and drainage ways so runoff cannot carry sediment downstream or into adjacent wetlands.
Good House Keeping	All Five Substations	Proper application of good housekeeping prevent pollutants and sediment from reaching runoff or floodwaters.

Table RERP-RAI-GE-2-2
TVA Best Management Practices

Waste Disposal	All Five Substations	Solid Waste: Trash and construction debris is hauled to an approved landfill. No solid waste is buried or burned on site. Clearing debris (brush and timber) may be burned on-site in accordance with the TVA specification described in Table RERP-RAI-GE-2-1 above. Hazardous Waste: Hazardous waste generation is not anticipated for these projects. If hazardous waste is generated, all waste is properly collected, managed, and disposed of in accordance with governing regulation. Sanitary Waste: Sanitary waste is handled in accordance with the applicable TVA specification described in Table RERP-RAI-GE-2-1 above. Concrete Waste: Concrete that is delivered to the site but remains unused is transported offsite by the concrete vendor. Concrete trucks use designated washout area to clean the mixer chute. Concrete wash is not permitted to be discharged directly onto the ground in areas within 50 feet of streams, storm drains, or areas with potential for runoff directly into streams and/or storm drains.
Herbicide Use	Holly Springs, Corinth, and Wilson	Herbicide applicators must be trained and licensed; and follow manufacturers' label instructions, EPA guidelines, and respective state/local regulations including NPDES pesticide general permit requirements. Herbicide equipment is properly maintained and adjusted to prevent spillage. Herbicide equipment is never cleaned near streams, water bodies, or infiltration zones.
Storm Water Discharge Management	All Five Substations	All potential sources of pollution that could affect storm water discharge quality are identified and appropriate control measures implemented.
Inspection, Recordkeeping and Reporting	All Five Substations	Control measures are routinely checked and repaired as necessary. Inspection are performed during dry periods and after rainfall events. Records are kept on all inspections and repairs to erosion and sediment control measures. Records are maintained on-site or at a nearby office.
Sensitive Resources and Buffer Zones	Holly Springs, Corinth, and Wilson	a. SMZs: In conjunction with the specification described in Table RERP-RAI-GE-2-1 above, establish standard SMZ controls along each intermittent and perennial stream and perennial water body. b. Wetlands: The most desirable BMP pertaining to wetlands is avoidance and leaving natural wetland buffers intact.

RERP - RAI - GE-2 Response, Attachment 1

Table RERP-RAI-GE-2-2
TVA Best Management Practices

Structural Controls, Standards, and Specifications	All Five Sites	Temporary sediment barriers such as straw bales, straw waffles, mulch berms, silt fences, check dams, rock filter dams, diversions, and riprap are used, as appropriate, to capture sediment by slowing and filtering construction storm water. Temporary stabilization of access roads and parking areas with stone is used to reduce erosion of temporary roadbeds caused by construction traffic. Water turnouts dissipate water energy near roads and ditches. Water bars intercept and divert surface water off the access road to minimize erosion.
Seeding and Stabilization	All Five Sites	In conjunction with site restoration specification described in Table RERP-RAI-GE-2-1 above, disturbed areas are seeded and stabilized to minimize soil erosion. Mulch is applied to disturbed land to reduce erosion, maintain soil moisture, moderate soil temperature, and to promote seed germination. Fast growing temporary vegetation is sewn on disturbed sites to reduce erosion when it is not possible or appropriate (construction delays or season unsuitable) to establish permanent vegetation.

Browns Ferry Nuclear Plant

RERP - RAI - GE-2 Response, Attachment 2

TVA letter to the Tennessee State Historic Preservation Office - TVA, Wilson Tennessee 500-Kilovolt (KV) Substation Expansion Project, Phase I Cultural Resources Survey, Wilson County, Tennessee

TVA

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

May 20, 2016

Mr. E. Patrick McIntyre, Jr.
Executive Director
Tennessee Historical Commission
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

TENNESSEE VALLEY AUTHORITY (TVA), WILSON TENNESSEE 500-KILOVOLT (KV) SUBSTATION EXPANSION PROJECT, PHASE I CULTURAL RESOURCES SURVEY, WILSON COUNTY, TENNESSEE

As part of a larger effort to meet increasing demands for bulk power, TVA is preparing to request approval of a license amendment from the Nuclear Regulatory Commission (NRC) to increase the electrical output of Units 2 and 3 at Browns Ferry Nuclear Plant. In order to facilitate the Browns Ferry Nuclear (BFN) Extended Power Uprate (EPU) project, TVA proposes to expand the capacity of three substations, including Wilson Substation in Wilson County, Tennessee. This work would involve adding capacitor banks at the substation, which will require expansion of the existing footprint and grading. TVA has determined that this proposed substation expansion project is an undertaking (as defined at 36 CFR § 800.16(y)) that has the potential to cause effects on historic properties. We are initiating consultation under Section 106 of the National Historic Preservation Act for the Wilson Substation Expansion project (“undertaking”).

TVA has determined the area of potential effects (APE) for archaeological resources as the circa 6.2-acre parcel that would be affected by substation expansion. TVA has determined the APE for above-ground (historic architectural) resources as areas within a one-half mile radius of the archaeological APE, from which unobstructed views to the new capacitor banks would be possible. TVA contracted with Tennessee Valley Archaeological Research (TVAR) to perform a Phase I cultural resources survey of the APE. Enclosed are two bound copies of the draft report, titled *A Phase I Cultural Resources Survey of the Wilson Substation Expansion Project in Wilson County, Tennessee*, along with two CDs containing digital copies of the report.

TVAR’s background study, conducted prior to the field study, indicated that no properties listed in the National Register of Historic Places (NRHP) and no previously recorded archaeological sites are located in the APE. The archaeological survey did not identify any archaeological sites. Three historic architectural properties have been inventoried previously within the APE for above-ground properties. TVAR’s survey noted that two of these are no longer extant. The survey investigated previously inventoried property WI-2212 (Scott Farm). Based on the results of the survey, TVAR recommends that this property meets the eligibility requirements of the Historic Family Farms in Middle Tennessee Multiple Property Nomination and is eligible for inclusion in the NRHP under Criterion C for its local significance as a representative example of a mid-nineteenth-century historic farm complex.

The substation expansion would be located approximately 0.17 miles west of WI-2212 and would be in view of the property. TVAR recommends that the project would have an indirect (visual) effect on this property. However, TVAR also recommends that, due to modern development, the historic integrity of the property's viewshed has been compromised, and the undertaking would not result in additional damage to its integrity. Therefore, the effect would be non-adverse.

TVA has reviewed the enclosed report and agrees with the findings and recommendations of the authors. Based on the survey, TVA has determined that the Wilson 500-kV Substation Expansion project would have no adverse effect on historic properties.

Pursuant to 36 CFR Part 800.4(d)(1), we are seeking your concurrence with TVA's findings and determinations.

Should you have any questions or comments, please contact Richard Yarnell in Knoxville at wryarnell@tva.gov or (865) 632-3463.

Sincerely,

Clinton E. Jones
Manager, Biological and Cultural Compliance
Safety, River Management and Environment
WT11C-K

SCC:CSD
Enclosures
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Tennessee Division of Archaeology
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A Phase I Cultural Resources Survey of the Wilson Substation Expansion Project in Wilson County, Tennessee

Tennessee Valley Archaeological Research

A PHASE I CULTURAL RESOURCES SURVEY OF THE WILSON SUBSTATION EXPANSION PROJECT IN WILSON COUNTY, TENNESSEE

by
Ted Karpynec, Heidi Rosenwinkel, Meghan Weaver, Katherine Wright, and Elin Crook

Prepared for:
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Hunter B. Johnson
Principal Investigator

May 2016

ABSTRACT

Under contract with the Tennessee Valley Authority (TVA), Tennessee Valley Archaeological Research (TVAR) conducted a Phase I cultural resources survey to document and assess resources located within the area of potential effects (APE) associated with TVA's planned Wilson substation expansion project in Wilson County, Tennessee. The APE for the archaeological survey consisted of the 2.5 ha (6.2-acre) parcel on which the work is to be conducted. The architectural APE consisted of the archaeological APE, in addition to any areas visually connected to it via viewsheds to and from the project area, located with a 0.8 km (0.5 mi) radius surrounding the tract. Areas within the architectural survey radius that were determined not to be within view of the substation due to terrain, vegetation, and/or modern built environments were not considered part of the APE.

TVAR's architectural survey did not identify any previously undocumented resources within the APE; however, the investigation revisited three previously documented architectural resources (WI-984, 2210, and 2212) within the survey radius. Of the three previously documented architectural resources, only one, WI-2212, is extant and located within the architectural APE. TVAR recommends previously documented architectural resource WI-2212 eligible for the NRHP under Criteria A and C for its historical and architectural significance. The recommended NRHP boundary for WI-2212 includes the house, associated outbuildings, and the 52.8-acre parcel on which they are located. As a result of its architectural survey, it is the opinion of TVAR that the proposed undertaking will result in a visual effect to property WI-2212; however, the effect will not be adverse due to modern development immediately northwest and southeast of the property, which has compromised its historic setting. Consequently, TVAR recommends no additional investigation of above-ground resources in connection with the proposed project.

TVAR's archaeological survey identified one isolated find. The resource lacks the potential to significantly contribute to research concerning the prehistory or history of the region and is therefore recommended not eligible for listing on the NRHP. No further archaeological investigations of the APE are recommended in connection with the proposed project.

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CHAPTER 1. INTRODUCTION

Under contract with the Tennessee Valley Authority (TVA), Tennessee Valley Archaeological Research (TVAR) conducted a Phase I cultural resources survey to document and assess resources located within the area of potential effects (APE) associated with TVA's planned Wilson substation expansion project in Wilson County, Tennessee. No known Traditional Cultural Properties were located within the project area. The APE for the archaeological survey consisted of the 2.5 ha (6.2-acre) parcel on which the work is to be conducted. The architectural APE consisted of the archaeological APE, in addition to any areas visually connected to it via viewsheds to and from the project area, located with a 0.8 km (0.5 mi) radius surrounding the tract. Areas within the architectural survey radius that were determined not to be within view of the substation due to terrain, vegetation, and/or modern built environments were not considered part of the APE (Figure 1.1).

The purpose of the investigation was to assist TVA in its Section 106 compliance and to provide an inventory of cultural resources within the project area, descriptions of the current conditions at each resource identified, and National Register of Historic Places (NRHP) eligibility recommendations for each resource. The survey was consistent with the Secretary of the Interior's *Standards and Guidelines for Identification* (National Parks Service [NPS] 1983) and met the requirements established by the Tennessee Historical Commission (THC) (Tennessee Department of State [TDS] 2009).

TVAR's architectural survey was conducted on April 4, 2016 under the supervision of Ted Karpynec with the assistance of Meghan Weaver. The survey did not identify any previously undocumented resources within the APE; however, the investigation revisited three previously documented architectural resources (WI-984, 2210, and 2212) within the survey radius. Of the three previously documented architectural resources, only one, WI-2212, is extant and located within the architectural APE. TVAR recommends previously documented architectural resource WI-2212 eligible for the NRHP under Criteria A and C for its historical and architectural significance. The recommended NRHP boundary for WI-2212 includes the house, associated outbuildings, and the 52.8-acre parcel on which they are located. As a result of its architectural survey, it is the opinion of TVAR that the proposed undertaking will result in a visual effect to property WI-2212; however, the effect will not be adverse due to modern development immediately northwest and southeast of the property, which has compromised its historic setting. Consequently, TVAR recommends no additional investigation of above-ground resources in connection with the proposed project.

TVAR's archaeological survey was conducted on April 6, 2016 under the supervision of Kate Manning with the assistance of Whitney Hasie and Weston Vawter. Katherine Wright supervised laboratory processing, and Hunter B. Johnson, Principal Investigator, supervised all field and laboratory procedures. The archaeological survey resulted in the identification of one isolated find. The resource lacks the potential to significantly contribute to research concerning the prehistory or history of the region and is therefore recommended not eligible for listing on the NRHP. No further archaeological investigations of the APE are recommended in connection with the proposed project.

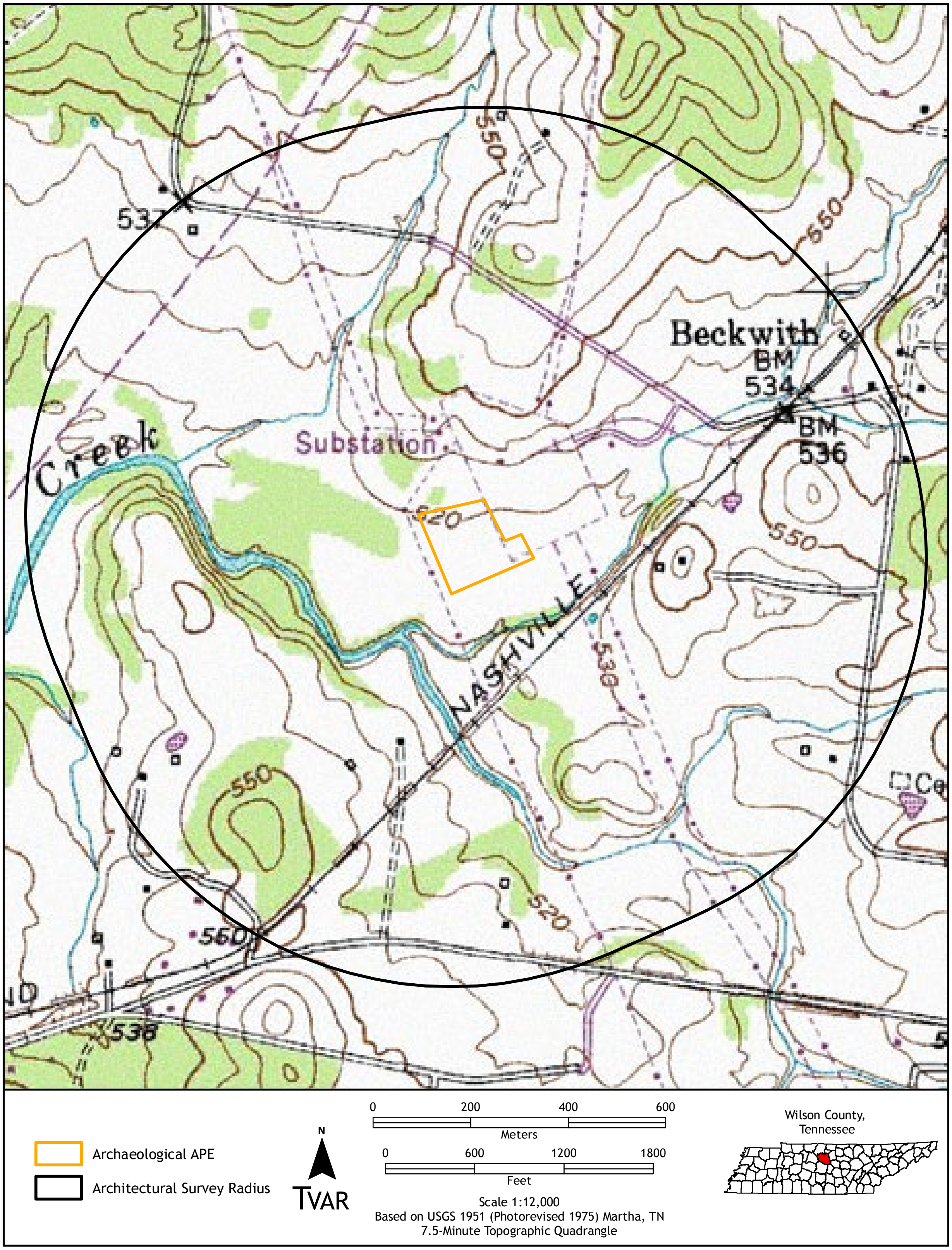

Figure 1.1. Project location map.

CHAPTER 2. ENVIRONMENT

The project area is located in western Wilson County, within the Lower Cumberland-Old Hickory Lake watershed. Cedar Creek, a tributary of the Cumberland River, is 100 m to the southwest of the APE. The project area is located in the Inner Nashville Basin Level IV ecoregion, part of the larger Interior Plateau Level III ecoregion (Figure 2.1). The Interior Plateau extends from southern Indiana and Ohio to northern Alabama and is characterized by land forms including open hills, irregular plains, and tablelands. Vegetation primarily consists of oak-hickory forests, but also includes some areas of bluestem prairie and cedar glades (Griffith et al. 2001).

The Inner Nashville Basin ecoregion is characterized by open hills and highly dissected escarpments. Karst topography, such as sinkholes, caves, and streams, typifies much of the landscape. A large sinkhole is located 45 m to the south of the eastern end of the APE, and another is situated 255 m to the southeast of the same point. Native vegetation consists of oak-hickory forests and cedar glades comprised of poverty grass, red cedar, winged elm, hackberry, and oaks. Land within the Inner Nashville Basin is used for cattle pasture and the cultivation of hay, corn, and small grains. Other areas are characterized by mixed woodlands, stands of red cedar, and urban and residential development (Griffith et al. 2001).

Soils mapped within the APE include Arents silt loam (AnC), Capshaw silt loam (CaB), Nesbitt silt loam (NeB), and Tupelo silt loam (Tu). Arents soils, which make up the majority of the APE, are somewhat poorly drained and generally associated with commercial development. They are found on hillslopes ranging between 2 and 15 percent. Capshaw soils are moderately well drained and formed in loess or old alluvium. Capshaw silt loam (CaB) is found on terraces on slopes between 2 and 5 percent. Nesbitt soils are moderately well drained and formed in loess or alluvium and limestone residuum. Nesbitt silt loam (NeB) is found on hillslopes ranging between 2 and 5 percent. Finally, Tupelo soils are somewhat poorly drained and formed in clayey or silty alluvium. Tupelo silt loam (Tu) is found on terraces on slopes ranging between 2 and 5 percent (NRCS 2016; SSURGO 2016).

The underlying geology of the project area primarily consists of Ordovician-age deposits associated with the Stones River and Nashville groups (USGS 2014). Knappable materials are available in proximity to the project area are produced by the underlying Mississippian Fort Payne formation, in addition to the Bangor and Monteagle limestone units, which crop out throughout Middle Tennessee.

Fort Payne chert is ubiquitous in artifact assemblages throughout the Southeast (Futato 1999:44; Meeks 1999:31; Walling et al. 2000:302). Outcrops of the formation in Tennessee are located between the Sequatchie Valley and Highland Rim. Fort Payne chert varies regionally, and in proximity to the project area, the material ranges in color between brown, black, and gray (Milici et al. 1979:11; Parish 2009:32; Walling et al. 2000:298). The fine-grained, cryptocrystalline nature of the chert causes it to fracture easily, making it an ideal material for tool manufacture (Marcher 1962:13; Parish 2009:32). Bangor chert, from Bangor limestone, is another material commonly found in prehistoric assemblages in throughout the Southeast, and a fossiliferous variant is found near the Highland Rim (Futato 1999:47). The Bangor limestone unit near the project area ranges between 24 and 152 m in thickness and consists of medium-gray to medium-dark-gray and brownish gray limestone (Milici et al. 1979:17). The chert it produces is usually gray, black, or tan, but due to the inclusion of fossils, is often of low quality for knapping purposes (Futato 1999:47).

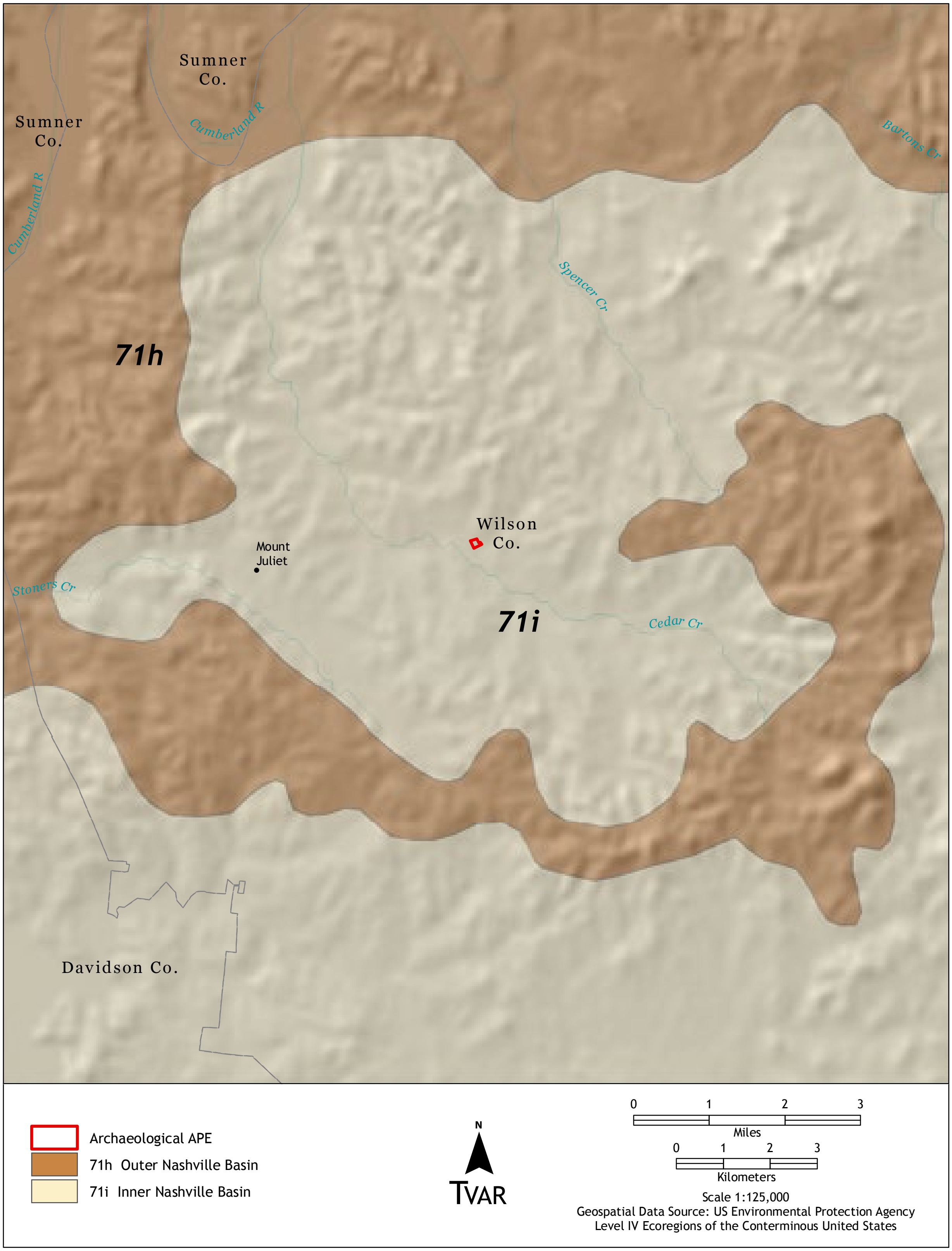

Figure 2.1. Project location within the Inner Nashville Basin Level IV ecoregion.

The APE was situated in a grassy field, and as indicated by the presence of Arents soil within the project area, much of the land had been previously altered. The northeastern boundary of the APE was defined by artificial terracing and a chain-link and barbed wire fence, which surrounded the existing substation (Figures 2.2 and 2.3). A tree-lined, cut drainage was located in the northwestern corner of the APE (Figure 2.4).

Figure 2.2. Artificial terracing along the eastern boundary of the APE (view to the west).

Figure 2.3. Chain-link and barbed wire fence surrounding the existing substation (view to the northwest).

Figure 2.4. Tree-lined drainage in the northwestern portion of the APE (view to the west).

CHAPTER 3. CULTURAL CONTEXT

Context for this study is provided in part by the following overview.[1] Admittedly, these summary sketches are overly simplified and not meant to replace more thorough research. Additional detail is provided in the following chapter in the archaeological background literature and records search.

Paleoindian

Although there is some debate regarding the possible presence of earlier occupations (see Goodyear 2005), archaeologists generally agree that by ca. 11,500 B.C. southeastern North America was inhabited by nomadic hunter-gatherers that manufactured distinctive lanceolate-shaped hafted bifaces. The earliest of these Paleoindian populations hunted Pleistocene megafauna species such as mammoth and giant bison. Evidence of human megafauna interactions in middle Tennessee were documented at the Coats-Hines site (40WM31), a nominated NRHP site in Williamson County. (Miller et al. 2015).

Walthall (1998) noted a dramatic increase in the use of caves and rockshelters in Late Paleoindian times. He attributed the shifting settlement pattern to increased populations and changes in mobility ranges and subsistence activities linked to broad environmental changes accompanied by extinctions of several Pleistocene faunal species hunted by earlier Paleoindian groups. Meeks and Anderson (2012) further advanced these arguments with hafted biface data indicative of a population increase during Late Paleoindian times.

Chronologically diagnostic hafted biface types provide a basis for a tripartite Paleoindian sequence dating between 11,500 and 9200 cal B.C. (Anderson et al. 1996; Sherwood et al. 2004). Early Paleoindian (ca, 11,500-10,900 cal B.C.) contexts are recognized by the presence of fluted and unfluted Clovis hafted bifaces. Fluted and unfluted lanceolate bifaces with broad blades and constricted hafts, such as Beaver Lake, Cumberland, and Quad, are considered Middle Paleoindian (10,900-10,000 cal B.C.) diagnostics. Late Paleoindian (10,000-9200 cal B.C.) assemblages are distinguished by the presence of lanceolate forms with side-notched hafts such as Dalton and Hardaway Side Notched. Tennessee has a large number of recorded Paleoindian sites and localities. Two sites (Johnson-Hawkins and Johnson) in the Nashville Basin have dense Paleoindian occupations, where Clovis, Cumberland, and Beaver Lake diagnostic forms were recovered (Broster and Norton 1996).

Archaic

Archaic manifestations in the Southeast are represented by pre-ceramic and early ceramic assemblages dating from approximately 9500 to 800 cal B.C. Based on temporally diagnostic hafted bifaces, stratigraphic contexts, and radiocarbon dates, fairly well-documented Archaic sequences have been developed throughout the region: Early Archaic (9200-6900 cal B.C.), Middle Archaic (6900-3700 cal B.C.), and Late Archaic (3700-800 cal B.C.).[2]

[1] Portions of the summaries are extracted verbatim, or nearly so, from previous TVAR reports without further citation (e.g., Little et al. 2012; Little et al. 2016).
[2] These generalized date ranges vary somewhat from one locality to another.

The settlement system of Early Archaic groups appears to represent a continuum of that employed in earlier Late Paleoindian times with occupations of caves, rockshelters, and open-air sites. Walthall (1980) suggested that population size continued to increase during this period.

The Early Archaic is chronologically ordered by diagnostic hafted biface types (Anderson et al. 1994; Sherwood et al. 2004). The sequence begins with side-notched types such as Big Sandy, Bolen, and Taylor. The Edgefield scraper is another likely constituent of the earliest Early Archaic assemblages. These assemblages date from about 9200 to 8500 cal B.C. Corner-notched types, such as Kirk Corner Notched and Palmer Corner Notched, were manufactured from approximately 8500 to 7800 cal B.C., while bifurcated types, including Lecroy, MacCorkle, and St. Albans, were made from about 7800 to 6600 cal B.C. Stratigraphic contexts at sites, such as the Stanfield-Worley bluff shelter site and Dust Cave site in the Tennessee Valley and the Hardaway site in the Carolina Piedmont, reveal side-notched forms occurring in earlier layers than corner-notched and later stemmed bifaces (Coe 1964:70-72; DeJarnette et al. 1962:82; Driskell 1994:24-31). The Lower Cumberland Archaeological Project (Nance 1987a; 1987b) was an important project for defining the Archaic period in the Cumberland River valley. Work conducted in the middle and northern portions of Tennessee focused primarily on components associated with Kirk Corner Notched bifaces, and the final report included a detailed comparison between Kirk and Palmer corner-notched points.

The Middle Archaic period coincides closely with the Hypsithermal climate interval during the Middle Holocene. As McNutt (2008:54-56) indicated, Hypsithermal climate conditions varied significantly across the landscapes of the Southeast, and Sassaman (2001) argued that there were marked sociocultural differences, as well. Along the South Atlantic Slopes settlements were concentrated in upland environments, while west of the Appalachians riverine settings were important to Middle Archaic populations (Dye 1996; Sassaman 2001). Sites marked by large accumulations of freshwater mollusk shells begin to appear in the archaeological record in the Tennessee Valley (Lewis and Lewis 1961; Walthall 1980:62). Middle Archaic populations also occupied caves and rockshelters in the Tennessee Valley (e.g., Cambron and Waters 1961; DeJarnette et al. 1962; Hollingsworth 1991; Ingmanson and Griffin 1994; Little et al. 2013; Sherwood et al. 2004). Bense (1994:78) pointed out that human burials are sparsely represented in the archaeological record prior to the Middle Archaic. However, there is ample evidence of Middle Archaic burials (DeJarnette et al. 1962:80; Dowd 1989; Lewis and Lewis 1961; Walthall 1980:61-65). There is also evidence of interpersonal conflict during the Middle Archaic (Walthall 1980:64). Near the end of the period, extensive exchange networks developed in the region (Jefferies 1996; Johnson and Brookes 1989), and construction possibly began on some of the earliest mounds in the Southeast (Russo 1996; Saunders 1994).

A Middle Archaic hafted biface chronology has been established for a broad region across the Southeast. The earliest Middle Archaic manifestations are marked by the presence of Kirk Stemmed, Kirk Serrated, and Stanley Stemmed bifaces between 6900 and 6300 cal B.C. Later in the sequence, from approximately 6300 to 5400 cal B.C., Eva and Morrow Mountain hafted bifaces were constituents of Middle Archaic lithic toolkits. Numerous Morrow Mountain projectile points were recovered from the Anderson site in Williamson County (Kerr 2010:8). Middle Archaic assemblages dating to 5400-4300 cal B.C. are marked by the presence of Sykes/White Springs and Guilford hafted bifaces. Benton bifaces are diagnostic of terminal Middle Archaic (4500-3700 cal B.C.) occupations in the Midsouth Tennessee-Tombigbee region of Alabama, Mississippi, and Tennessee (McNutt 2008; Meeks 1999).

The Late Archaic is marked by several technological developments. Perhaps foremost of these was the domestication of several plant species in eastern North America around 5000-3800 B.P. (Smith 2011; Smith and Yarnell 2009). These domesticates are sometimes referred to collectively as the "eastern agricultural complex," which consisted of squash, sunflower, marshelder, and chenopod. Other plants such as erect knotweed, little barley, and maygrass do not appear to have been domesticated but were in all probability deliberately planted.

In addition, fiber-tempered pottery and steatite vessels first appeared in the Coastal Plain of the Southeast during the Late Archaic (Sassaman 1993; Walthall and Jenkins 1976). Jenkins and Krause (1986:36-37) suggested that soapstone vessels are horizon markers for terminal Late Archaic assemblages. Truncer's (2004:507) study of steatite vessel chronology concluded that steatite vessels were produced for almost 2000 years before they peaked "clearly and strongly around 1500 cal B.C., a peak that accounts for the general success of the horizon-marker use." Sassaman (2006:151) disputed Truncer's chronology and alternatively argued that there is insufficient evidence for presuming that steatite vessels predate 3700 radiocarbon years B.P.

During the ending centuries of the Late Archaic, the well-known Poverty Point earthworks also were constructed (Kidder 2002; Gibson 2000, 2007, 2010; Ortmann 2010). The Poverty Point site has yielded large inventories of artifacts made of exotic stones such as soapstone, greenstone, galena, copper, hematite, magnetite, crystal quartz, novaculite, fluorite, obsidian, Fort Payne chert, Dover chert, and Pickwick chert (Gibson 2000:172-173). These nonlocal materials constitute good evidence for panregional exchange. The site has been widely recognized as a material manifestation of a conspicuous development in sociopolitical complexity, although the composition and inner workings of the Late Archaic society is a subject of supposition and debate (e.g., Gibson 2007; Sassaman 2005).

By Late Archaic times, the regionalized hafted biface sequences that characterized the Early and Middle Archaic periods were replaced by more localized temporal trajectories of mostly stemmed bifaces. For instance, Savannah River Stemmed was widely distributed along the South Atlantic Slopes, while early in the sequence, Ledbetter and Pickwick were disbursed in an area extending from the southwestern slopes of the Appalachians into the Coastal Plain of Tennessee, Mississippi, and Alabama. Near the end of the Late Archaic in the westerly region, a multitude of other stemmed types were manufactured including Cotaco Creek, Flint Creek, Little Bear Creek, McIntire, Motley, and Wade.

Woodland

The Woodland stage is perhaps best known for the Adena and Hopewell earthworks and mortuary practices in the Ohio Valley and widespread exchange networks in which exotic artifacts and raw materials were distributed across much of eastern North America during the Early and Middle periods of the stage. There is evidence that cultivation of some of the plants domesticated in eastern North America became an important subsistence pursuit in the Ohio Valley (Wymer 1996) and other areas of the East (Yarnell 1993). While less numerous and spectacular than those of the Ohio Valley, Middle Woodland platform mounds and linear earthen embankments (Keith 2010; Knight 2001; Mainfort 1989), piled-stone structures (i.e., mounds, effigies, and linear "wall-like" structures) (Faulkner 1996; Holstein et al. 1995; Jefferies and Fish 1978; Keith 2010), and burial mounds (Cole

1981; Jefferies 1976; Jenkins and Krause 1986; Walthall 1980; Waring 1945; Wimberly and Tourtelot 1941) are fairly widespread across various landscapes in the Southeast. Woodland mound burials sometimes were accompanied by nonlocal materials such as marine shell, copper, galena, and mica, to name but a few. During the Late Woodland, there was an obvious reduction in both earthworks and distributions of exotic materials in some areas of the Southeast, though this pattern does not hold throughout the region (Anderson and Mainfort 2002:15-19). A major technological change is signaled by the introduction of bow-and-arrow technology into the region during the Late Woodland (Blitz 1988).

Although pottery appears in earlier contexts, the beginning of the Woodland period is associated with the widespread use of ceramics (Anderson and Mainfort 2002:4-9). Middle and East Tennessee Early Woodland assemblages are typically characterized by fabric-marked quartz- or quartzite-tempered pottery, including Swannanoa and Watts Bar types, while fabric impressed and cord-marked vessels tempered with sand are dominate attributes of west Tennessee assemblages (Faulkner and McCollough 1974:324-326; Keel 1976:230; Lafferty 1981:305; Lewis and Kneberg 1957). Many of the biface types found in Late Archaic assemblages continue into Early Woodland times, including Gary, Wade, Little Bear Creek, and Motley, while Adena Stemmed bifaces are diagnostic solely to Early Woodland sites in Tennessee, such as the Duncan Tract Site (McNutt and Weaver 1983).

Middle Woodland diagnostic bifaces throughout Tennessee include the Lanceolate Expanded Stem Cluster and medium to large triangular forms (Bentz 1995:86-89; Faulkner and McCollough 1982; Keel 1976:131). Limestone-tempered pottery, including Wright Check Stamped, Bluff Creek Simple Stamped, and Mulberry Creek Plain is associated with Middle Woodland assemblages in middle Tennessee (Faulkner and McCollough 1974:326-337).

Diagnostic bifaces recovered from Tennessee Late Woodland contexts include Jack's Reef Pentagonal, Jack's Reef Corner Notched, and small triangular forms like Hamilton, Madison, and Fort Ancient (Justice 1987:224-229). The limestone-tempered ceramic tradition continued into the Late Woodland in the eastern portion of the middle Tennessee River valley with brushed, plain, and cord-marked types, while sand-tempered Connestee series ceramics were made in eastern Tennessee (Faulkner and Graham 1966:131; Keel 1976:219; Little et al. 2012:109; Schroedl 1978:226-231). Lower Tennessee River valley Late Woodland sites yield grog-tempered Baytown Plain and Mulberry Creek Cord Marked ceramics (McCulloch 1982).

Mississippian

Many, if not most, current researchers concur that populations associated with Mississippian stage manifestations throughout southeastern North America were set aside from earlier ones by the development of institutionalized social inequality (Smith 1990). Maize agriculture appears to have been an important subsistence component for most Mississippian societies (Scarry 1993). Pole-framed public and domestic structures were often rectangular (sometimes circular) and sometimes employed wattle-and-daub wall construction. A central plaza surrounded by mounds and public and domestic structures characterized some of the larger Mississippian communities (Lewis and Stout 1998). Some Mississippian sites also were fortified with palisade walls and bastions and sometimes defensive ditches or moats, as well (e.g., Knight and Steponaitis 1998; Larson 1972; Schroedl 1998). Regional settlement studies typically reflect a site hierarchy consisting of mound centers and outlying nonmound sites (e.g., Anderson 1994; Blitz and Lorenz 2006; Hally 1993; Steponaitis 1978). Specially crafted artifacts often made of extralocal materials furnish evidence of widespread interregional exchange (Brown 2004). The existence of far-reaching Mississippian alliances in the interior Southeast was documented at the time of initial European contact.

The Mississippian emergence in Tennessee is recognized by the occurrence of shell-tempered pottery, often in contexts with earlier Woodland types. Shell- and grog-tempered ceramics occur in Early Mississippian contexts in west Tennessee, while shell- and limestone-tempered pottery are found in Early Mississippian contexts of eastern Tennessee (Garland 1992:63; Kimball 1985:147-148). The Spencer phase is associated with Early Mississippian contexts in the Cumberland River drainage, and ceramic assemblages have mixed shell-and grog-tempered pottery (Faulkner and McCollough 1982:6; Walling et al. 2000:52). Bifaces recovered from Early Mississippian contexts throughout Tennessee include small triangular forms including Hamilton and Madison.

Middle Mississippian (ca. 900-650 B.P.) settlements increased in size and sometimes included earthen platform mounds and burial mounds surrounding a central plaza and structures located outside of the plaza area (Braly et al. 2015). Middle Mississippian manifestations in middle Tennessee, often referred to as the Middle Cumberland culture, include the Dowd phase of the middle Cumberland River drainage. Sites include centralized small villages with a single platform mound, farmsteads, and hamlets dispersed throughout the Cumberland Valley (Walling et al. 2000:54-55). A common mortuary practice of the Middle Cumberland culture is the interment of human remains in stone box graves lined with limestone, slate, or shale (Moore 2005; Moore and Smith 2009:208; Walling et al. 2000:54-55).

Late Mississippian (ca. 650-500 B.P.) manifestations are confined mostly to eastern Tennessee. Throughout much of the central Mississippi Valley, including western and portions of middle Tennessee, Mississippian settlements appear to have been abandoned during late Mississippian times. This large area is often referred to as the "Vacant Quarter" (Cobb and Butler 2002). Considered factors for the vacant quarter mainly focus on unfavorable environmental conditions associated with the onset of the Little Ice Age, especially prolonged drought. These environmental changes increased the potential for agricultural failure, fostering political conflict and warfare, and leading to the collapse of Mississippian societies in the area (Anderson 2001; Meeks and Anderson 2013). This concept is reinforced by the Thurston phase in the Nashville Basin, which shows evidence of a decline in regional centers and an increase in fortified towns and villages (Moore 2005:274; Moore and Smith 2001:222). Radiocarbon dates obtained during investigations at the Brentwood Library site (40WM210) in Williamson County indicate a Mississippian occupation during the Thruston phase (Moore 2005:274).

Historic Native American

Although earlier there were sporadic European contacts with Native Americans along the Gulf and Atlantic coasts and failed colonial attempts by both the Spanish and French, the Spanish expedition of Hernando de Soto (1539-1543) represents the earliest recorded European contact with native populations in the interior of southeastern North America. In the 1560s, the Tristan de Luna and Juan Pardo expeditions revisited some of the areas in the interior traversed by the earlier Soto entrada. By almost all archaeological accounts, widespread and extensive depopulation followed in the wake of the sixteenth-century Spanish incursions into the Southeast, and there was a concomitant disintegration of Mississippian polities accompanied by migrations and coalescence of native groups throughout much of the region (Hoffman 1993; Jeter 2002; Knight 1994; Little 2008; Morse and Morse 1983:313-315; Regnier 2014; Smith 1987, 2006). Hudson and Tesser (1994) pointed out that these years have been largely neglected by historians and referred to them as the forgotten centuries. Robbie Ethridge (2009) has subsequently illuminated some of these shadowy times with her conception of the Mississippian shatter zone, i.e., a region of widespread social and political transformations of native groups, presumably related to internecine warfare and slave trade with Europeans.

In the late seventeenth and early eighteenth centuries, the British, French, and Spaniards competed for control over broad regions of the Southeast. Increasing participation in nascent European capitalist markets through deerskin and peltry trade contributed to extensive transformations of native groups during the colonial era (Braund 1993; Waselkov 1988; White 1983), and by the mid-1800s, the United States government had exiled most of the remaining Southeastern groups to Oklahoma.

Local History

Wilson County, located in Middle Tennessee, was established on October 26, 1799 by the Tennessee General Assembly. European movement in the area had begun thirty years prior, with the arrival of a group of French fur trappers in the 1760s (Burns 2010). The first European settlers to the county made their home at Hickory Ridge in 1794, west of present-day Lebanon. Named for Major David Wilson, a North Carolina-born Revolutionary War veteran, the county was formed from a portion of nearby Sumner County. In 1801, Lebanon was chosen as the county seat and so remains today (Burns 2010). Other early communities in the county included Baird's Mill, Centreville, Gladeville, Mount Juliet, Norene, and Tucker's Cross Roads.

The county saw a sizable increase in population from 1820 to 1850, when the number of individuals jumped from 18,736 (14,724 white, 3,844 enslaved and 162 free colored) to 27,443 (19,913 white, 7,127 enslaved, and 403 free colored) (United States Census Bureau 1872: 61-63). Enslaved Africans and African-Americans were present in Middle Tennessee from the earliest years of American exploration and settlement, and the institution of slavery had a strong influence on social and economic development in the region. The common figure cited for the proportion of white families owning slaves in the South is 1 in 4, and the average holding was 12.7 in the Deep South (Stampp 1956:30–31, based on the 1860 federal census). Although a number of white families in the region did not own slaves, all saw slavery as part of the accepted social order and as the necessary means for both producing wealth and as a marker of social achievement. Enslaved blacks increased in number to 7,964 by 1860. During the same period, the population of free blacks sank to 321 (U.S. Census Bureau 1872).

The onset of the Civil War brought great upheaval and loss to the region. Wilson County residents suffered from economic hardships through the destruction of the Southern economy and the death of men who served in Tennessee units. County residents joined numerous regiments of the Tennessee Infantry, comprised much of the Fourth and Fifth Regiments of the Tennessee Cavalry, and Company C First Tennessee Heavy Artillery (Goodspeed 1886). The spring of 1862 saw an invasion of Union troops on Lebanon, led by Colonel Monday. Union forces held the city for three months, using buildings on the campus of Cumberland University as their headquarters. Following the departure of the Union troops, the city of Lebanon was occupied by a Confederate cavalry led by General John Morgan. Learning of Morgan's occupation of Lebanon, Union forces returned and the ensuing skirmish resulted in casualties on both sides and the retreat of Confederate troops from Lebanon (Goodspeed 1886).

Agriculture was the economic foundation of Wilson County in the early nineteenth century, and the county was the top producer of wheat, sorghum and butter in the state. By the middle of the century residents were exploiting the county's numerous creeks to power water-driven mills (Burns 2010). The first mills produced textiles, flour and paper. Additionally, the abundant cedar forests created a profitable lumber export industry. The construction of rail lines in 1869 facilitated the import and export of goods throughout the county and the rest of the state (Burns 2010). A sharecropping economy arose in the postbellum period, lasting from about 1870 to the 1930s.

In the early twentieth century, advances in transportation greatly changed the county landscape, bringing with it a large network of paved roads, and easier access to job opportunities. A network of turnpikes radiated from Lebanon to neighboring communities, as seen in Figure A. The completion of the Tennessee and Pacific Railroad, running from Nashville to Lebanon, facilitated the transport of both passengers and goods between the two cities (Drake 1879). Industrial development in the county included the construction of blanket, clothing, and pencil factories. Other new developments were the widespread integration of electrical and water services into county homes (Burns 2010). The Castle Heights Military Academy was founded in 1902 in Lebanon as a military preparatory school and is listed on the NRHP (Castle Heights National Alumni Association 2014). The academy reportedly housed 45 visiting Mussolini-sent fascist cadets in 1931 (Becks n.d.; Burns 2010).

The resident population of Wilson County decreased slightly in the early twentieth century, from 27,078 to 23,929 between 1900 and 1930, respectively (United States Census Bureau 2014). During World War II, headquarters for the Second Army Maneuvers were located in the county (outside the project area) and are documented as archaeological site 40WI191. From this post, "800,000 troops were supervised during the Tennessee Maneuvers (1942-44) in preparation for service in Europe" (Burns 2010). The Second Army was responsible for the training of combat troops and chose Middle Tennessee to host war exercises due to the terrain's similarities with Western Europe (Nance 2007: 45). The Second Army took over many of Cumberland University's buildings, using residence halls for officer housing, and others as barracks, a central venereal disease clinic, an infirmary, Red Cross headquarters, and a USO headquarters (Nance 2007: 46). Following the war, resident population saw a spike in the late twentieth century, doubling from 27,668 in 1960 to 56,064 in 1980. In the early twenty-first century, the population has continued to rise, totaling 88,809 persons in 2000 and 113,993 (United States Census Bureau 2014).

CHAPTER 4. ARCHITECTURAL SURVEY

On April 4, 2016, TVAR conducted the survey of the architectural APE, which revisited three previously documented architectural resources located within the architectural survey radius. The following chapter provides the historic context of the project area, a background literature and records review of information relevant to the project area, a discussion of the field methods employed during the survey, descriptions of the architectural resources identified, and recommendations regarding their NRHP eligibility.

Architectural Survey Methods

The architectural survey was conducted in accordance with guidelines contained in National Register Bulletin 24, *Guidelines for Local Surveys: A Basis for Preservation Planning* (Derry et al. 1985) and the requirements of the THC, as specified in its *Tennessee's Historical and Architectural Survey Manual* (THC 1991) and *Reporting Standards Checklist* document (THC n.d.). Federal regulations define the APE as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist" (CFR 2013a). The architectural APE for the project consisted of the immediate project area, in addition to any areas visually connected to it via viewsheds to and from the project area, located within a 0.8 km (0.5 mi) survey radius surrounding the planned project area. Areas within the survey radius that were not within view of the planned project area due to obstructed lines-of-sight (e.g., terrain, vegetation, and/or modern built environments) were not considered part of the architectural APE.

To consider potential line-of-sight obstructions from architectural resources 50 years of age or older back to the footprint of the project area, TVAR staff drove accessible paved and gravel roads within the architectural survey radius (Figure 4.1). All architectural resources that met the age criterion and fell within visual line-of-sight to the project area were plotted on the applicable USGS quadrangle map and photographed with a digital camera. The construction dates of the buildings identified in this study were derived from reviewing United States Geological Survey (USGS) topographical maps of the survey radius found online at the USGS Historical Topographical Map Explorer, architectural stylistic evidence of each documented architectural resource, and information provided in THC survey forms. Survey information maintained throughout the course of the inventory included field notes, sketch maps, and photographs.

To aid in the architectural field assessment, TVAR performed a viewshed analysis of the area within a 0.8 km (0.5 mi) radius surrounding the proposed project area using the Viewshed tool in the Spatial Analyst extension in ArcGIS 10.3. The assessment used the USGS National Elevation Dataset 10 m (NED10) digital elevation model (DEM), land use classification data from the USDA Cropland Data Layer (CDL), and an estimation of the average forest canopy height for the area from the NASA Forest Canopy Height dataset. TVAR processed the CDL land use classification data to reassign all forested classes to the average forest canopy height of 18 m (60 ft) and all other land use classes to a height of zero. This dataset was then added to the DEM to produce a digital surface model (DSM), accounting for both elevation and forest canopy height. Finally, points along the proposed substation boundary served as the observer points and were assigned a height of 30.48 m (100 ft) to account for the height of the substation. Using these inputs, the Viewshed tool analyzed each cell of the elevation model to assess its visibility from the observer points (see Figure 4.1).

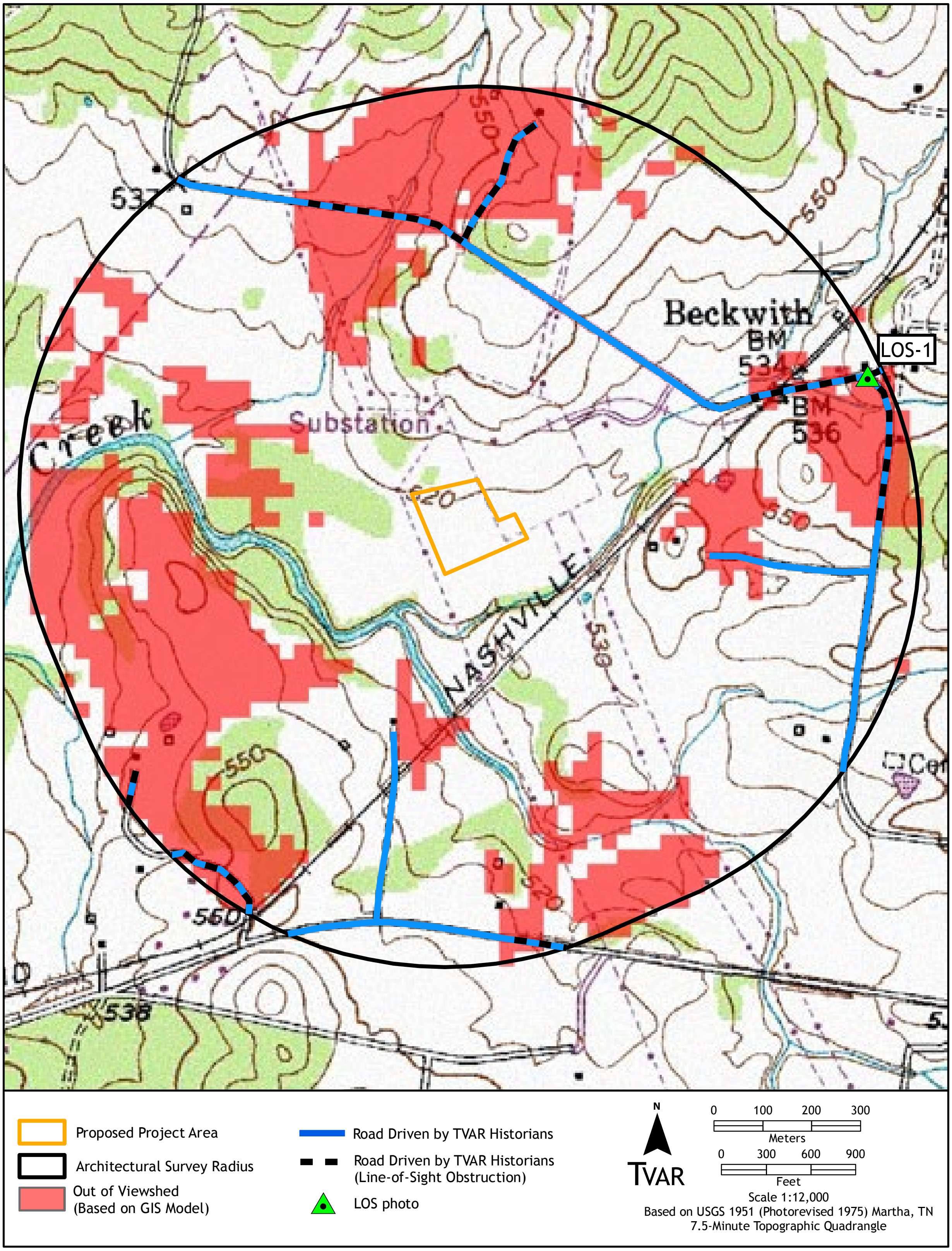

Figure 4.1. Excerpt of the USGS Martha, TN topographic quadrangle showing viewshed analysis results, roads driven by TVAR historians, and locations of line-of-sight photos.

National Register of Historic Places Eligibility Criteria

Sufficient data were compiled to make recommendations regarding eligibility for listing on the NRHP for each architectural resource addressed during this study. According to 36 CFR §60.4, cultural resources eligible for listing on the NRHP are defined as buildings, structures, objects, sites, and districts that have "integrity," and that meet one or more of the criteria outlined below (CFR 2013b; NRHP 2002).

- Criterion A (Event). Association with one or more events that have made a significant contribution to the broad patterns of national, state, or local history.

- Criterion B (Person). Association with the lives of persons significant in the past.

- Criterion C (Design/Construction). Embodiment of distinctive characteristics of a type, period, or method of construction; or representation of the work of a master; or possession of high artistic values; or representation of a significant and distinguishable entity whose components may lack individual distinction.

- Criterion D (Information Potential). Properties that yield, or are likely to yield, information important in prehistory or history. Criterion D is most often (but not exclusively) associated with archaeological resources. To be considered eligible under Criterion D, sites must be associated with specific or general patterns in the development of the region. Therefore, sites become significant when they are seen within the larger framework of local or regional development.

As a general rule, the criteria exclude birthplaces and graves of historical figures, cemeteries, religious properties, moved buildings, reconstructions, commemorative properties, and properties less than 50 years old. However, per the regulations set forth in 36 CFR §60.4 and addressed in National Register Bulletin 15, *How to Apply the National Register Criteria for Evaluation*, resources that fall under these categories may be eligible for the NRHP if they meet Criteria Considerations A-F (NRHP 2002). "Integrity" is perhaps the paramount qualification of NRHP eligibility and can be related to location, design, setting, materials, workmanship, feeling, and/or association (NRHP 2002).

Architectural Background Literature and Records Search

On April 4, 2016, prior to fieldwork, TVAR reviewed Wilson County architectural survey files and NRHP listings at the THC in Nashville. Based on information at the THC, three previously documented architectural resources (WI-984, 2210, and 2212) fall within a 0.8-km (0.5-mi) radius surrounding the proposed substation expansion site. THC records indicate that none of the previously recorded properties have been formally evaluated for inclusion on the NRHP by the THC or by a federal agency. Additionally, no original survey photographs of WI-984 were available at the THC.

Architectural Survey Results

TVAR conducted its architectural assessment of the survey radius surrounding the proposed project area on April 4, 2016 (Figures 4.2-4.7). As a result of the survey, TVAR identified no previously undocumented architectural resources within the project APE. However, TVAR's survey revisited three previously documented architectural resources (WI-984, 2210, and 2212) within the survey radius (see Figure 4.2). Of the three previously documented architectural resources, only one, WI-2212, is extant and located within the architectural APE (Figures 4.8-4.10). TVAR recommends previously documented architectural resource WI-2212 eligible for the NRHP under Criteria A and C for its historical and architectural significance. The recommended NRHP boundary for WI-2212 includes the house, associated outbuildings, and the 52.8-acre parcel on which they are located. As a result, it is the opinion of TVAR that the proposed undertaking will result in a visual effect to property WI-2212; however, the effect will not be adverse due to modern development immediately northwest and southeast, which has compromised the historic setting of the property. Consequently, TVAR recommends no additional investigation of above-ground resources in connection with the proposed project.

Table 4.1. Previously Recorded Architectural Resources Within the Survey Radius.

Survey Number/ Property Name	Architectural Style	NRHP Recommendation	Effect
WI-984	unknown	Destroyed	None
WI-2210	Ca. 1940 side-gabled house	Destroyed	None
WI-2212	Ca. 1860 central-hall plan house	Eligible	Visual/Not Adverse

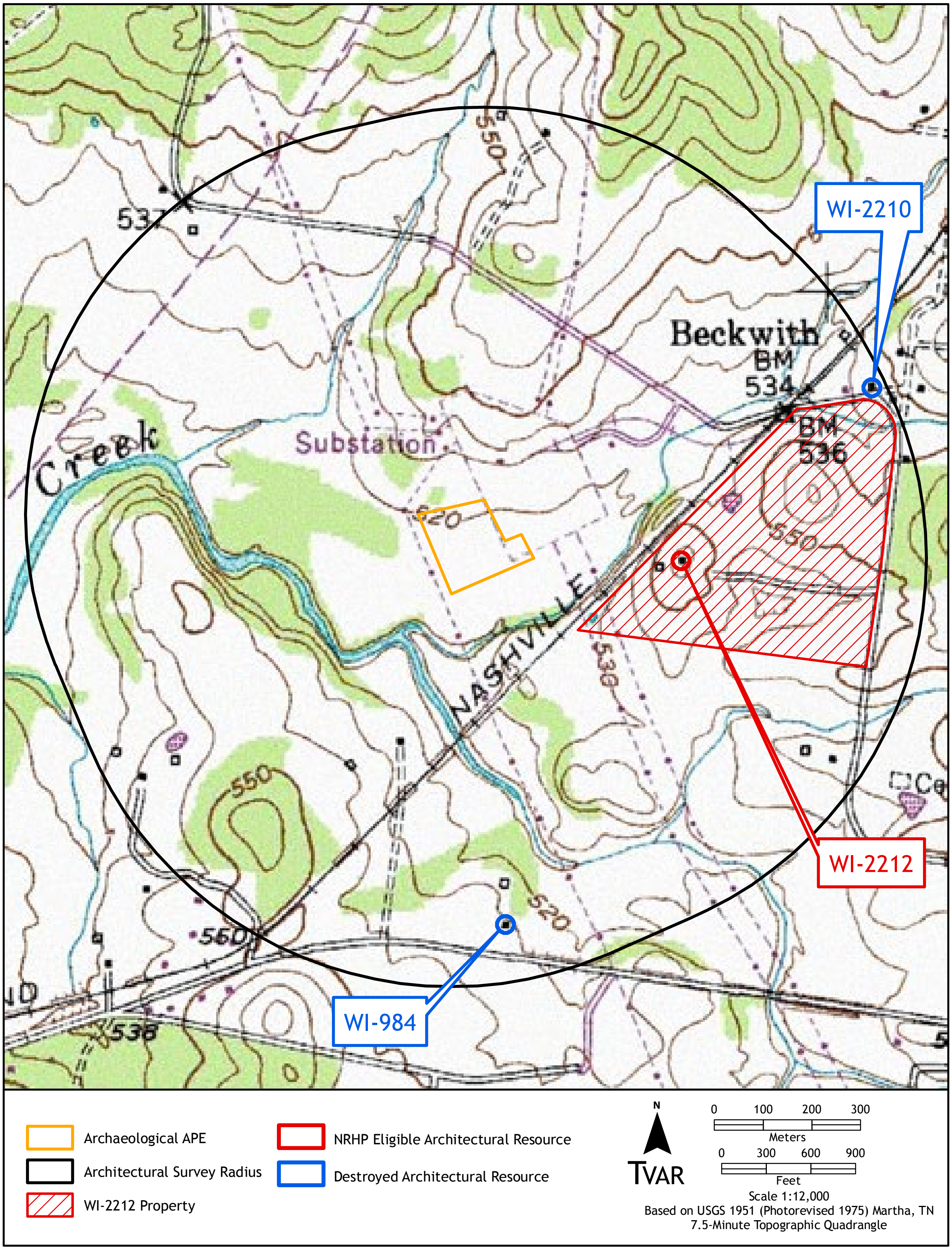

Figure 4.2. Excerpt of the USGS Martha, TN 7.5-minute quadrangle showing the proposed project area, survey radius, and location of previously recorded architectural resources.

Figure 4.3. Project area; view is north.

Figure 4.4. Project area; view is east.

Figure 4.5. Project area; view is south.

Figure 4.6. Project area; view is west.

Figure 4.7. LOS-1; view is southwest.

Figure 4.8. Former location of property WI-984.

Figure 4.9. Property WI-2210 ca. 1991 (Photo image courtesy of the THC).

Figure 4.10. Former location of property WI-2210.

Previously Recorded Architectural Resource

WI-2212 (Scott Farm)

Located approximately 0.17 miles east of the project area at 2808 Beckwith Road, property WI-2212 (Scott Farm) is an inactive farmstead anchored by a one-story central hall-plan house with Greek Revival detailing that is reported to have been constructed ca. 1860 (THC 2001) (see Figures 4.2; 4.11-4.26). The property includes 52.8 acres, which have been associated with the farm since 1910.

The land containing property WI-2212 is situated within two early North Carolina land grants (Figure 4.11). The westernmost parcel was comprised of 640 acres granted to Alexander Ewing in May of 1793 (Grant #2147) as an assignee to the heirs of John Manning. Surveyed by John Donelson, the parcel was bisected by Cedar Lick Creek, a southern branch of the Cumberland River (Figure 4.12). Adjacent to the east, a 640-acre land grant (Grant #3349) issued to Ambrose Jones, who is identified as an assignee of the heirs of Aron Neusbam (Masters and Puryear 2011) (Figure 4.13). On August 19, 1807, Jones (described in the deed as a resident of Greenville, North Carolina) sold the entirety of the parcel to Stephen Brooks for 100 pounds in North Carolina Currency (Works Progress Administration [WPA] 1939:13). Likewise, Ewing sold 104 acres of Grant #2417 to Newt Drew on June 1, 1807 for $200. An additional two hundred acres were sold to John Hays, who in turn sold the land to Drew on September 28, 1807 at a price of $400 (WPA 1939:18, 69).

According to information provided by the WI-2212 Historical and Architectural Resource form, the property reportedly came to be owned by Sam Davis (not, however, the Sam Davis famously known as the 'Boy Hero of the Confederacy'). TVAR's historical research failed to link the property to a "Sam Davis", yet did identify an Isham "Sham" Davis connected to the property. Just prior to the Civil War, the Davis household included Isham (age 60 and a Kentucky native), his wife Sarah (age 58), and son Richard T. (age 17). Also living in the home were Wilson Bradshaw (a 61-year-old farmer), his wife Nancy D., their seven children, and Elvira Mitchell, a 79 year-old woman (Ancestry.com 2009a). The agricultural census reveals that Isham owned 400 acres of improved farmland in Wilson County and raised swine, sheep, and mules. He cultivated corn, wheat, and tobacco. The farm's income was supplemented by the production of butter and wool (Ancestry.com 2010a). By 1860, Davis owned 24 slaves (up from 16 in 1850), ranging in age from 8 months to 47 years. The slaves lived together in three dwellings on the property (Ancestry.com 2004; 2010b).

Following emancipation, eight black servants remained in the Davis home and are named in the 1870 census for the first time. All given the last name Davis, they included: Jack (age 35 and a farm laborer), Ann (age 24 and a domestic), Maggie (age 1), Willie (age 2), Handy (age 27 and a male farm laborer), Low (age 20 and a female domestic), Mollie (age 1), and Henry (age 22 and a farm laborer). Jack, Ann, Handy, and Henry were described within the census as "deaf and dumb, blind, insane, or idiotic". A household of black individuals lived next door to the Davis's and likely worked on the Davis farm. They were J.J. Davis, a 34-year-old black laborer, Maggie Davis (age 23 and a housekeeper), Nancy Davis (age 56), Caroline Davis (age 20), Nathan Davis (age 18), and Andy Thomps (age 80). J.J., Nancy, Caroline, and Andy were also listed as "deaf and dumb, blind, insane, or idiotic" on the census (Ancestry.com 2009b).

Upon his death in 1880, Isham willed the Cedar Lick Creek property, which then included approximately 183 acres, to his son Richard T. In addition to the property, Richard was also left "five hundred dollars the value of a Negro boy (Bob)". Although the will was written in 1878, 15 years after the Emancipation Proclamation, it also describes the transfer of another "Negro boy" and "two Negroes" to Isham's other children (FamilySearch.org 2016).

At the end of the nineteenth century, the property consisted of 180 acres and remained occupied by Richard T. Davis and his wife, Rachel. In 1880, Richard worked as a farmer, but was listed as disabled on the census due to an engorged liver. His household also included two of the couple's daughters, Ovie and Alice, as well as a 21-year-old boarder named Filmore Winter (Ancestry.com 2010). By the turn of the century, Richard became a school director for the 34th school district of Wilson County. He, along with J.E. Moore and A.F. Eatherly, were deeded one acre of land for the construction of a school to teach white children. In addition, the school house was "used to teach a Sabath school in, and also ... by the Baptists, Methodists, Presbyterians, and Christians, but by no Mormons or Seventh Day Adventists" (Wilson County Register of Deeds 1899 DB57:37).

In 1900, Richard continued to farm the property, and in addition to Rachel, Ovie, and Alice, the household included Alice's husband John O. Sumly (a 22-year-old express agent) (Ancestry.com 2004). Renting the adjacent house was a black family headed by E.S. Cunningham, a 22-year-old farm laborer who likely worked on the Davis farm. The Cunningham household also included E.S.' wife Sarah (age 19), their daughter Mary (age 8 months), E.S.' sister Mary (age 25), and her daughter Susie (age 6) (Ancestry.com 2004). On October 9, 1909, the Davis' sold the 180-acre property containing WI-2212 to W.S. Haley and his wife Cara (Wilson County Register of Deeds 1909 DB 67:468).

In October of 1910, the Haleys sold a 52-acre portion of the property, which contained WI-2212, to Hiram H. Singleton, his brother William L. Singleton, and son Fred H. Singleton (Wilson County Register of Deeds 1910 DB 70:134). The 1920 federal census shows Hiram, then a 61-year-old widower, living on the property with Fred (age 32), who worked as a farmer, Fred's wife Annie (age 32), and their children Eva Mae (age 8), Fred Jr. (age 3), and Haston (age 4 months) (Ancestry.com 2010c). In 1923, the property was sold by the Singletons. A half-interest in the land went to Dave and Mattie Dukes, and the other half to Tommie [also known as John T.] and Sallie Lee (the Dukes' daughter) Walker (Wilson County Register of Deeds 1923 DB87:552). The Dukes and Walkers lived on the property and continued to farm the land into the 1930s. Census data from 1930 indicates that John T. Walker was employed as a carpenter with the Nashville Sash and Door Company and he and Sallie had two young children, Thomas D. (aged 5) and David W. (aged 3) (Ancestry.com 2002).

On May 7, 1947, John T. and Sallie Walker, et al., sold the 52-acre parcel containing property WI-2212 to Thomas P. and Mable C. Hall (Wilson County Register of Deeds 1947 DB 123:487). Following Thomas' death, Mable Hall sold the property to Lewis Scott in April of 1953 for the sum of $10 (Wilson County Register of Deeds 1953 DB 137:288). Scott conveyed the property to his wife, Mildred Louise Scott, in July of 1961, and she remains the current owner (Wilson County Register of Deeds 1961 DB 158:166).

Architecturally, the main farmhouse is a frame building that features a side-gabled roof covered with standing seam metal, two interior end brick chimneys, an exterior clad with a combination of weatherboard and vinyl siding, and a continuous foundation composed of roughly coursed fieldstone. Attached to the north elevation of the building is a one-story, wood-framed wing that reportedly functioned as a schoolhouse. TVAR's research failed to determine the construction date of the "schoolhouse" section, or when it was attached to the main block. Additionally, the house includes a one-story rear ell that appears to date to the original construction of the house. Facing east, the façade reveals a central door that is accompanied by flanking sidelights and topped by a rectangular-shaped transom containing a single light. Access to the façade door is achieved via a center bay porch. The porch features a wood deck on a roughly coursed fieldstone foundation, and two columns that support a projecting gabled roof. Each square-shaped column is composed of wood and rests on a plinth block composed of roughly coursed fieldstone. Overall, the porch exhibits Greek Revival detailing as evidenced by the closed pediment and dentil molding found on the roof. In addition, the porch is marked with paneled columns and pilasters that are consistent with Greek Revival architecture. Beyond the porch, other Greek Revival detailing on the house includes the wide band trim along the façade and cornice returns found at the gable ends. Interestingly, the house is further adorned with decorative brackets that are positioned at the entablature of the porch roof and along the band trim. As this architectural ornamentation is typically associated with Italianate and Folk Victorian architecture, it is likely that the house was updated at a later time to keep up with prevailing architectural trends.

Positioned north of the porch is a band of three windows containing four-over-four, double-hung wood sashes. This window arrangement appears to have been added to the house in the late nineteenth century, replacing an original window opening. Located south of the porch is a three-part window that appears to have been added to the house ca. 1950. The window includes a central single-pane, fixed wood sash that is flanked by two-over-two, double-hung wood sash windows.

The south elevation of the house includes a door that is positioned within a ca. 1955 carport attached to the main block. The single bay carport is composed of wood framing and includes a low brick wall and five wood posts that support a shed roof. Attached to the west elevation of the carport is a shed roof addition that appears to date to the construction of the carport. The addition features a continuous brick foundation, an exterior clad with vinyl siding, and a hipped roof covered with standing seam metal. Window fenestration on the addition consists of a series of five window openings containing paired vinyl casement sashes. The east elevation of the addition, which comprises the interior wall of the carport, includes a door and a pair of one-over-one, double-hung vinyl sashes.

Attached to the north elevation of the house is a one-story wing that is reported to have functioned as a schoolhouse. The "schoolhouse" section consists of a wood-frame building that rests on a continuous foundation composed of roughly coursed fieldstone. Additionally, the building is clad with weatherboard siding and is capped with a side-gabled roof covered with standing seam metal. The roof of the "schoolhouse" section includes a centrally placed interior brick chimney. A door positioned on the west elevation, which currently leads to a stoop composed of fieldstone, may have served as the original entrance to the schoolhouse. An additional door is positioned on the west elevation, which currently leads to a porch attached to the rear of the main house. Window fenestration on the "schoolhouse" section consists of a six-over-one and a one-over-one, double-hung wood sash window located on the east and west elevations, respectively. An additional window opening covered with a plywood board is positioned on the north elevation.

Attached to the west (rear) elevation of the house is a one-story gabled-roof extension that appears to date to the original construction of the house. The extension rests on a roughly coursed fieldstone foundation and features an exterior clad with weatherboard siding, a roof covered with standing seam metal, and an interior brick chimney. Located along the north elevation of the extension are two doors and four windows that contain horizontal two-over-two, double-hung wood sashes. Access to the doors is achieved via an L-shaped porch that extends along the length of the rear extension to the main block. The porch is integral with the main roof of the house and features a wood deck that rests on a brick foundation. A series of wood posts are used to support the porch roof. TVAR did not have access to the interior of the house at the time of its survey.

Associated outbuildings and structures include:

- A ca. 1860 privy. Composed of roughly coursed fieldstone, the structure features a gabled roof covered with standing seam metal and a door opening on the east elevation (see Figure 4.19);

- A ca. 1860 storage shed. Composed of roughly coursed fieldstone, the structure features a gabled roof covered with standing seam metal and a door opening on the north elevation (see Figure 4.20);

- A modern garage building. The prefabricated metal building features a side-gabled roof and an exterior covered with metal. Facing south, the building includes an off-centered vehicle bay containing an overhead metal door. Flanking the vehicle bay to the east is a six-over-six, double-hung vinyl sash window. Positioned west of the vehicle bay is a metal paneled door that contains nine lights in its upper portion (see Figure 4.21);

- A ca. 1970 multi-bay vehicle storage shed. The frame structure is capped with a shed roof covered with standing seam metal and features an exterior clad with metal siding (see Figure 4.21);

- A modern vehicle barn. The concrete block structure is capped with a gambrel roof covered with standing seam metal and includes three vehicle bays along the east elevation (see Figure 4.22);

- A ca. 1930 storage shed. The frame structure features a front-gabled roof covered with standing seam metal and an exterior clad with board-and-batten-siding. Facing east, the building contains a door that is partly shielded by a front-gabled canopy (see Figure 4.23);

- A ca. 1930 livestock barn. The frame structure features a gambrel roof covered with standing seam metal and an exterior clad with vertical wood boards. The barn includes a central bay marked by a pair of swinging wood doors, above which is an opening for loft access. Attached to the north and south elevations of the barn are shed-roof extensions that appear to have been used to store farm equipment and machinery (see Figure 4.24);

- Dry stack limestone fences. The property is highlighted by two segments of dry stack limestone fences that appear to date to the mid-nineteenth century. One segment extends approximately 1,309 feet from the stone storage building to Beckwith Road. The second segment begins at the driveway entrance to the property on Beckwith Road and extends roughly 483 feet to the south (Figures 4.20; 4.25).

- Agricultural fields. Associated with the property are 52.8 acres of farmland that were used as pasture for livestock. The fields are partly boarded by dry stack limestone fencing along Beckwith Road. TVAR's research has found that the present 52.8 acres corresponds to the same acreage associated with the property during the 1950s (Figures 4.25-4.26).

NRHP Assessment

The Scott Farm is a representative example of a mid-twentieth-century farm complex anchored by a central hall-plan house embellished with Greek Revival detailing. The central hall plan, or central-passage plan, emerged as one of the leading forms of vernacular architecture in Tennessee beginning in the late eighteenth century. As the name implies, central hall plan houses are defined by a central hall that is flanked on either side by a room, and are typically one room in depth. Unlike in modern houses of today, in which the main hall serves as a reception and pass-through to other rooms, the characteristically wide halls in central hall plan houses were often utilized as both a reception area and living space for families. As such, one of the rooms flanking the central hall served as a visiting parlor for guests, while the other room functioned as a private living/sleeping quarters for the family (Stager 2010). Central hall plan houses in Middle Tennessee typically featured one story with an attic used for storage. The symmetrical layout of the interior floor plan continued to the exterior of the house through the placement of windows that flanked a central entrance and corresponding end chimneys, as exhibited in WI-2212.

Architecturally, central hall plan houses are the descendants of the Tidewater-type cottages built during the late seventeenth century by English colonists in Maryland and Virginia (Gamble 1990:33). Surviving examples of Tidewater-type cottages include the ca. 1650 Adam Thoroughgood House and the ca. 1700 Adam Keeling House, both located in Virginia Beach, Virginia (Figures 4.27-4.28). According to architectural historian Robert S. Gamble, modified forms of the Tidewater-type cottage spread inland with the arrival of settlers from the Southern coastal states to the Tennessee Valley during the 1820s and 1830s. Compared to their seventeenth century antecedents, early nineteenth century Tidewater-type cottages featured less pronounced chimneys, shallower roof pitches, and a strict adherence to symmetry and proportion (Gamble 1990:33). Despite these modifications, the overall appearance and plan of the Tidewater-type cottages constructed in the Tennessee Valley remained largely unchanged as it was passed down from multiple generations of master builders to their apprentices (Gamble 1990:33). By the mid-nineteenth century, the popularity of Greek Revival architecture led to the application of subtle Classical elements to existing and newly constructed central hall plan houses. Characteristics of this trend included primary façade entrances accented with flanking sidelights and topped with a rectangular-shaped transom (Stager 2010).

The rise in the popularity of the Greek Revival style was sparked by a renewed interest in the Classical style, which dominated American domestic architecture between ca. 1830 and ca. 1860. Serving as a catalyst in popularizing interest in the style was Greece's struggle for independence (1821-1830), which was followed closely by a sympathetic American populace who held fresh memories of their own battle for independence against a ruling empire. Additionally, lingering American bitterness toward the British following the War of 1812 led to a rejection of the prevailing Adam style, which was heavily influenced by British domestic architecture. In response, builders and homeowners embraced the Greek Revival style in an effort to establish a wholly American style of architecture free from British influences (McAlester and McAlester 1990:183-184).

Architecturally, the Scott House is a good local example of a central hall plan house with Greek Revival embellishments. This is evidenced through the symmetrical placement of the interior end chimneys and the location of the windows in relation to the façade door. Additionally, the main façade features a single-bay pedimented entry porch that is accented with square panel columns and dentil molding that extends along the base of the pediment. Additional Greek Revival detailing is exhibited on the façade door surround, which features flanking sidelights and a rectangular-shaped transom. Lastly, the gable ends are adorned with cornice returns, which are also characteristic of Greek Revival architecture.

Overall, the Scott Farm largely retains its mid-twentieth-century appearance through the retention of the principal farmhouse, associated agricultural outbuildings, stone fences, and fields. The ca. 1860 farmhouse has been altered since its original date of construction, most notably through the construction of a single-bay carport on the south elevation, the attachment of the "schoolhouse" addition to the north elevation, and the modification of the façade window openings. However, these alterations are considered historic, as they are reflective of the adaptability of previous owners to changes and improvements in technologies associated with domestic residential architecture in the mid-twentieth century. Additionally, the farm complex retains a strong collection of historic agricultural-related resources that contribute to the architectural significance of the property. These include the ca. 1860 stone privy, ca. 1860 stone storage shed, ca. 1930 livestock barn, ca. 1930 frame storage shed, the two segments of dry stack stone fences, and the 52.8 acres of pasture land that have been associated with the property since 1910. Non-contributing buildings include the modern vehicle barn, ca. 1970 vehicle storage shed, and modern garage.

Consequently, it is the opinion of TVAR that WI-2212 (Scott Farm) meets the eligibility requirements of the *Historic Family Farms in Middle Tennessee* Multiple Property Nomination and is recommended eligible for the NRHP under Criterion C for its local significance as a representative example of a mid-nineteenth-century historic farm complex (West 1994:F-IV). Taken collectively, the Scott Farm, centered on the Greek Revival-influenced central hall plan farmhouse, features a strong collection of agricultural-related buildings and structures constructed between ca. 1860 and ca. 1930. The period of significance for the property extends from ca. 1860, when the principal farmhouse was reportedly constructed, and ends in 1965, to include changes to the property that were made during the intervening 105 years. The proposed NRHP boundary of the Scott Farm includes the 52.8 acres historically associated with the property, as detailed in the accompanying Wilson County tax map (Figure 4.29).

Assessment of Potential Effects

The Scott Farm is located approximately 0.17 miles east of the project area at 2808 Beckwith Road. Based on the results of TVAR's in-field assessment, direct visual lines-of-sight to the project area are unobscured and the proposed project will be visible from various points within the property's NRHP boundaries. However, existing modern development associated with TVA's Wilson substation west of the property and modern residential development located on the east side of Beckwith Road has already diminished the historic setting of the Scott Farm (Figures 4.31-4.33). Based on project plans, the proposed undertaking will not be located within the recommended NRHP boundary of the Scott Farm, nor will it result in the demolition of any contributing resources associated with the property. The project will not compromise the integrity of the Scott Farm or diminish its architectural significance, for which it is recommended eligible or the NRHP. For these reasons, TVAR recommends that the proposed project will result in a visual effect to the Scott Farm, but the effect will not be adverse.

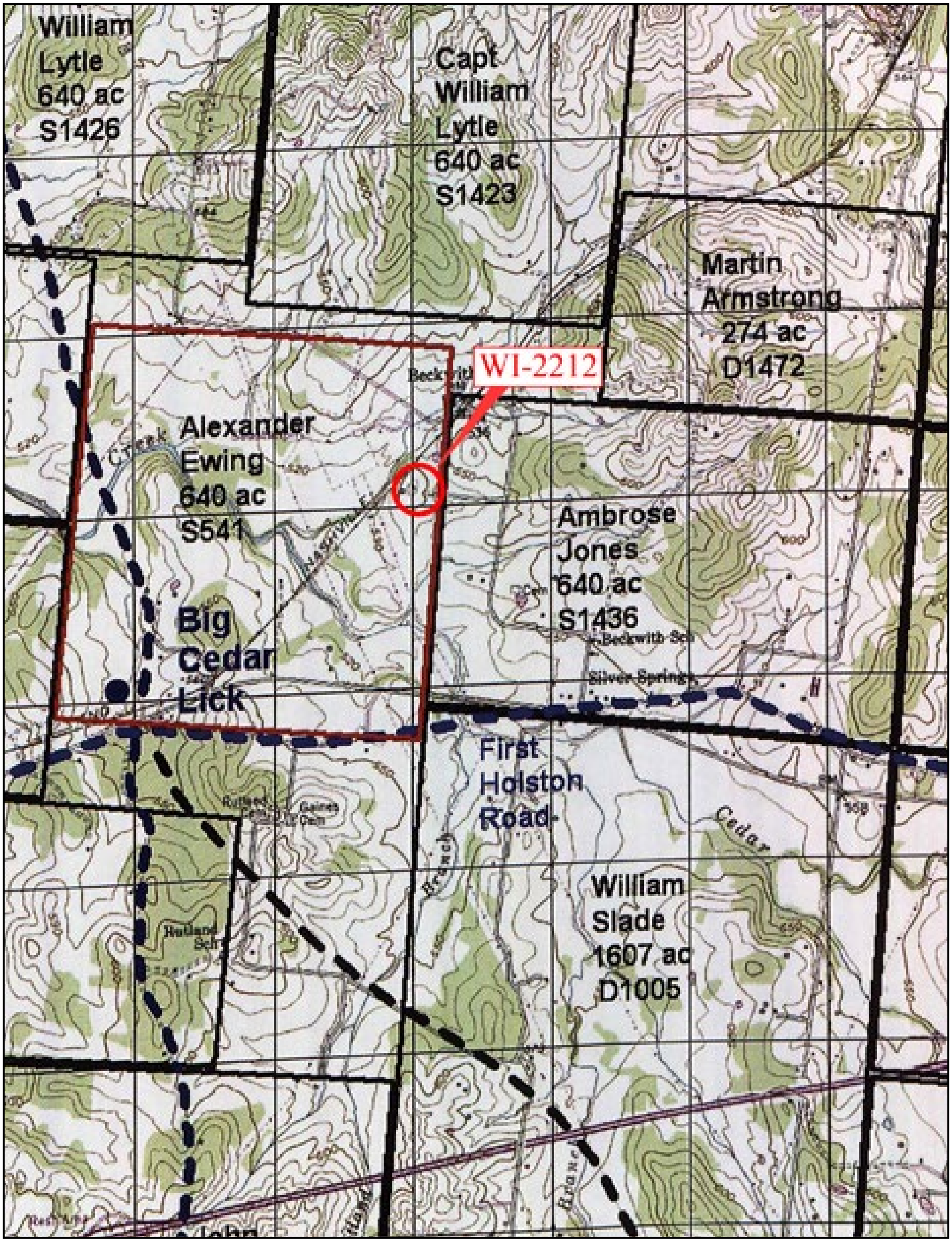

Figure 4.11. Early land grants containing property WI-2212 (Masters and Puryear 2011).

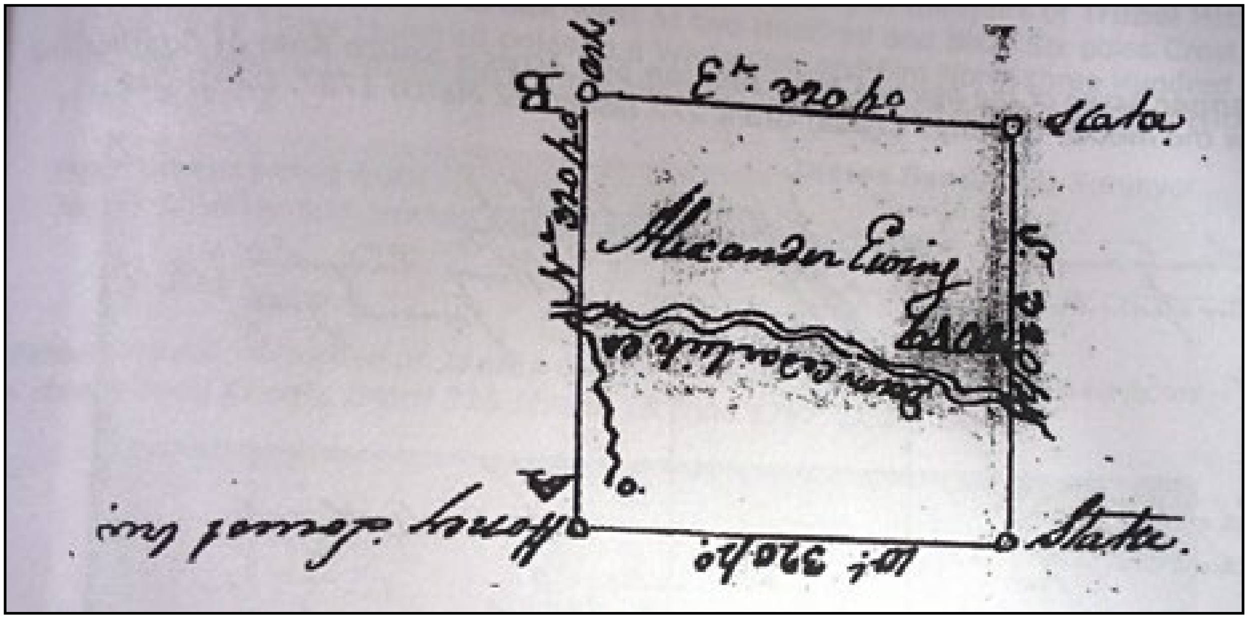

Figure 4.12. Original survey sketch map of Grant #2147 (Masters and Puryear 2011).

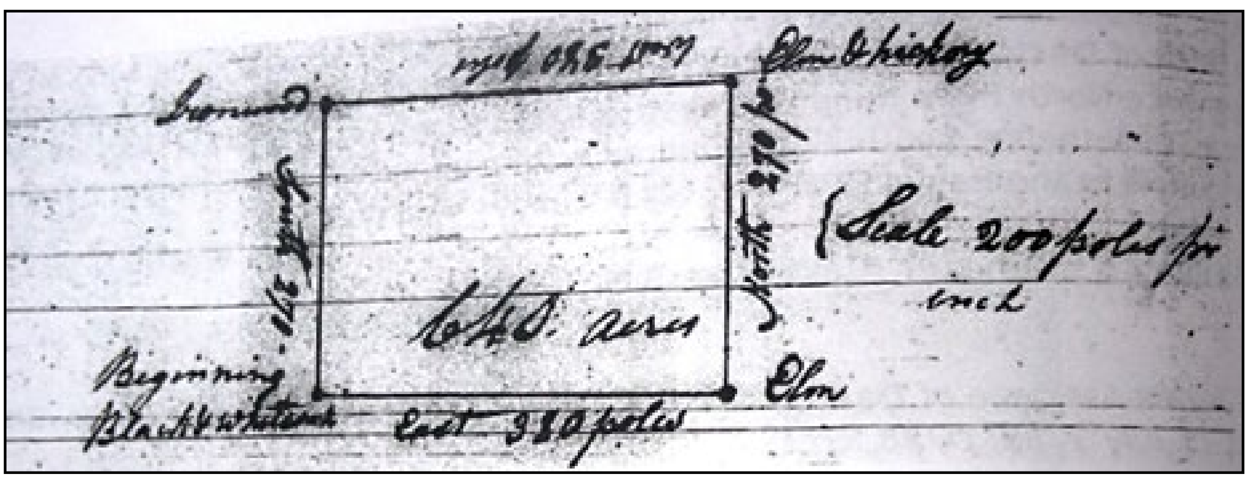

Figure 4.13. Original survey sketch map of Grant #3349 (Masters and Puryear 2011).

Figure 4.14. Property WI-2212 (Scott Farm); view is west featuring the farmhouse façade.

Figure 4.15. Property WI-2212 (Scott Farm); view is southeast featuring the north and west (rear) elevations of the farmhouse.

Figure 4.16. Property WI-2212 (Scott Farm); view is southwest featuring the “schoolhouse” addition to the north elevation.

Figure 4.17. Property WI-2212 (Scott Farm); view is northwest featuring the façade and south elevation of the farmhouse.

Figure 4.18. Property WI-2212 (Scott Farm); view is east featuring the west (rear) elevation.

Figure 4.19. Property WI-2212 (Scott Farm); view is southwest featuring the ca. 1860 stone privy.

Figure 4.20. Property WI-2212 (Scott Farm); view is west featuring the ca. 1860 stone storage shed.

Figure 4.21. Property WI-2212 (Scott Farm); view is north featuring the modern garage building and ca. 1970 multi-bay vehicle storage shed.

Figure 4.22. Property WI-2212 (Scott Farm); view is northwest featuring the modern vehicle barn.

Figure 4.23. Property WI-2212 (Scott Farm); view is southwest featuring the ca. 1930 storage shed.

Figure 4.24. Property WI-2212 (Scott Farm); view is southeast featuring the ca. 1930 livestock barn.

Figure 4.25. Property WI-2212 (Scott Farm); view is southeast featuring the east-west stone fence and associated agricultural fields.

Figure 4.26. Property WI-2212 (Scott Farm); view is west featuring the associated agricultural fields and modern transmission line development within view of the property.

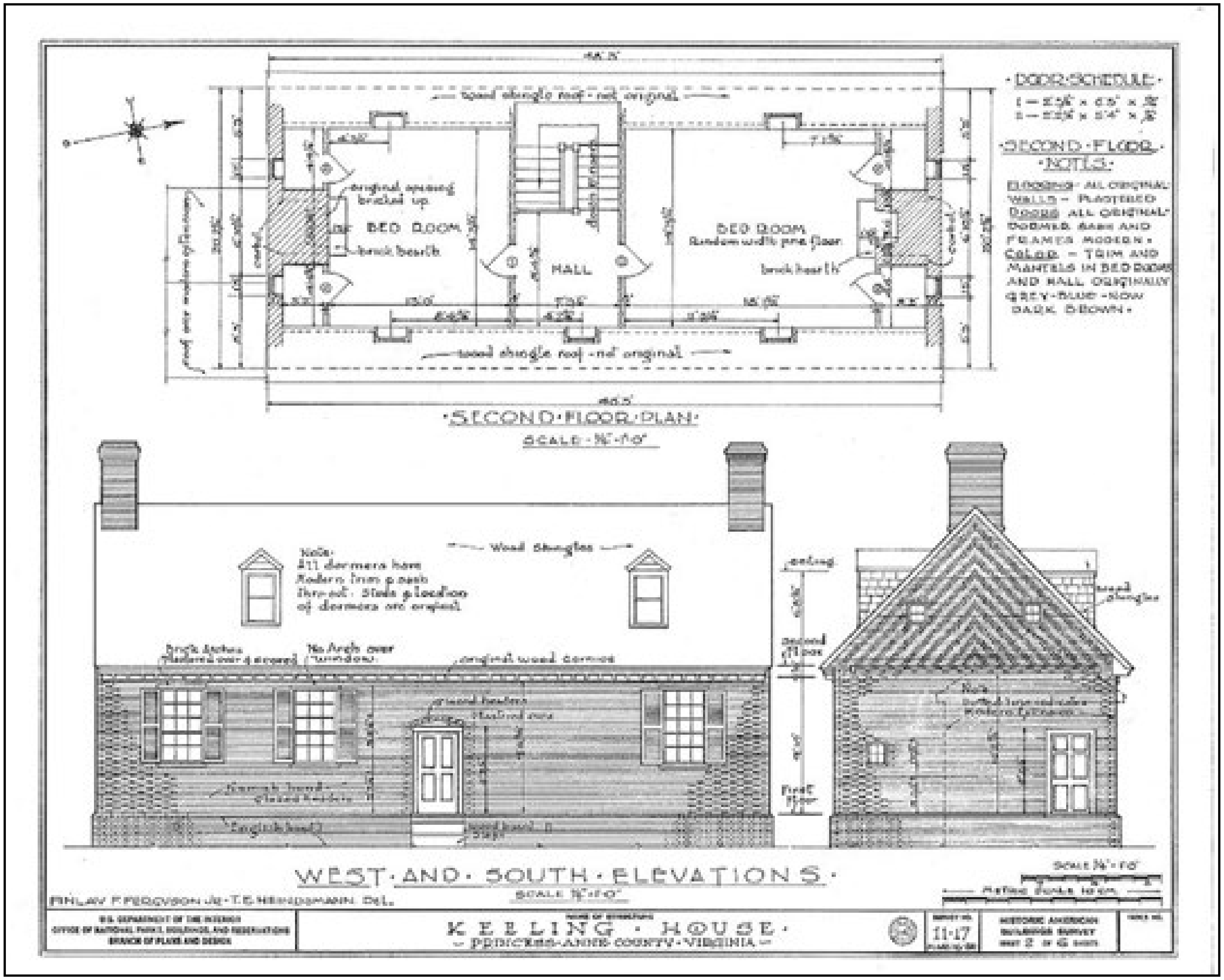

Figure 4.27. Historic American Building Survey drawings of the ca. 1700 Adam Keeling House, Virginia Beach, Virginia (Ferguson, Jr. 1934).

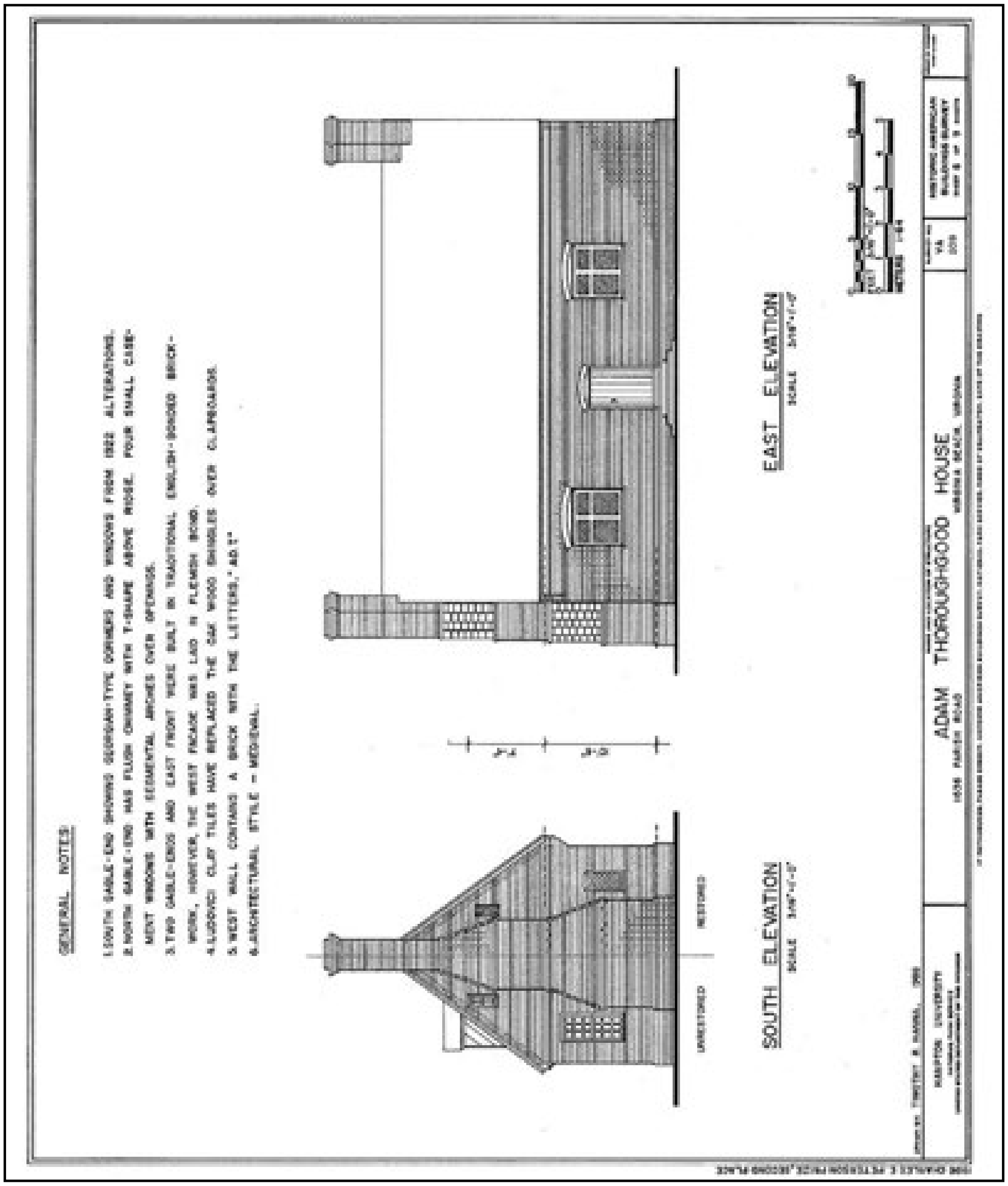

Figure 4.28. Historic American Building Survey drawings of the ca. 1650 Adam Thoroughgood House, Virginia Beach, Virginia (Hanna 1996).

Figure 4.29. Wilson County tax map illustrating the recommended NRHP boundary of WI-2212 (Scott Farm) (Courtesy of State of Tennessee Comptroller of the Treasury).

Figure 4.30. Existing TVA Wilson County Substation visible from Property WI-2212 (Scott Farm); view is west.

Figure 4.31. Modern residential development along Beckwith Road visible from Property WI-2212 (Scott Farm); view southeast.

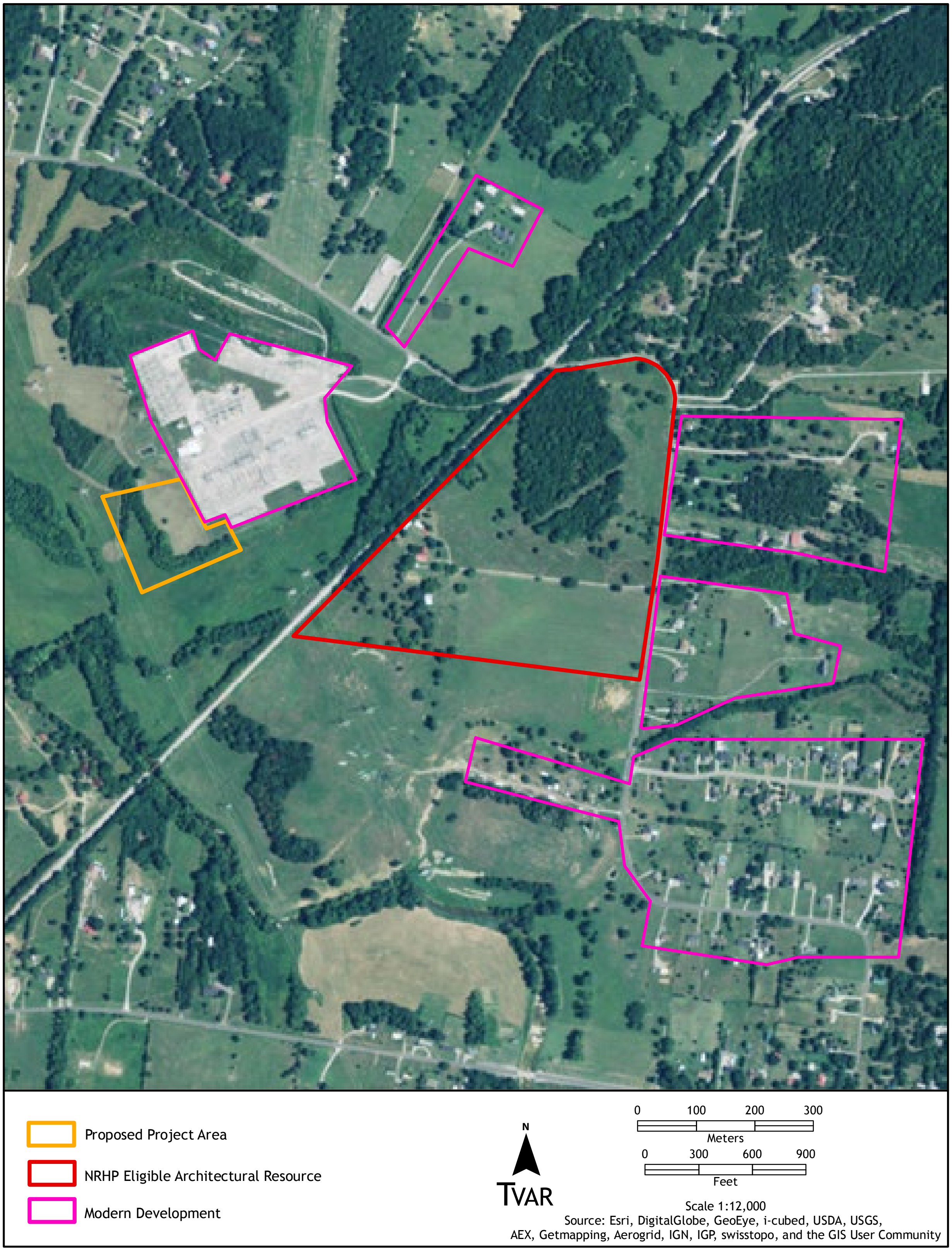

Figure 4.32. Current aerial imagery of the project area depicting modern development adjacent to WI-2212 (Scott Farm).

CHAPTER 5. ARCHAEOLOGICAL SURVEY

Under contract with TVA, TVAR conducted a Phase I cultural resources survey to document and assess resources located within the APE associated with TVA's planned Wilson substation expansion project in Wilson County, Tennessee. The APE for the archaeological survey consisted of the 2.5 ha (6.2-acre) parcel on which the work is to be conducted. The purpose of the investigation was to assist TVA in its Section 106 compliance and to provide an inventory of cultural resources within the project area, descriptions of the current conditions at each resource identified, and NRHP eligibility recommendations for each resource. The survey was consistent with the Secretary of the Interior's *Standards and Guidelines for Identification* (NPS 1983) and met the requirements established by the THC (TDS 2009).The archaeological survey resulted in the identification of one isolated find. The following provides a review of background information relevant to the project area, a description of the resource identified, and a recommendation regarding its NRHP eligibility.

Archaeological Background Literature and Records Search

In March of 2016, TVAR consulted with the Tennessee Division of Archaeology (TDOA) in Nashville to conduct a background literature and records search in order to identify documented archaeological sites and previous cultural resources surveys within the project area. The background study area was defined as a 0.8 km (0.5 mi) radius surrounding the APE (Figure 5.1). In addition to the information obtained at the TDOA, TVAR reviewed numerous cartographic and ethnohistoric databases including the NRHP, University of Alabama Historical Map Archive, and U.S. Geological Survey (USGS) Earth Explorer data portal. The USGS 1951 Martha 7.5-minute topographic quadrangle, which was photorevised in 1975, was especially used in this research.

Background research indicated that there are 24 NRHP-listed properties in Wilson County, but none are located within the background study area (NRHP 2014). Additionally, no historic cemeteries, Traditional Cultural Properties, or archaeological sites were identified within the APE or background study area. TVAR's research at the TDOA identified one previous cultural resources survey within the background study area, but it does not overlap with the current APE. The survey was conducted by Zada L. Law Archaeological Consulting and investigated five proposed commuter railway station sites along the route of the proposed Regional Commuter Rail east corridor from Nashville to Lebanon, totaling 32 acres. The investigation resulted in the identification of two early twentieth-century historic sites (40WI166 and 40WI167), neither of which were recommended as eligible for listing on the NRHP (Law 1999).

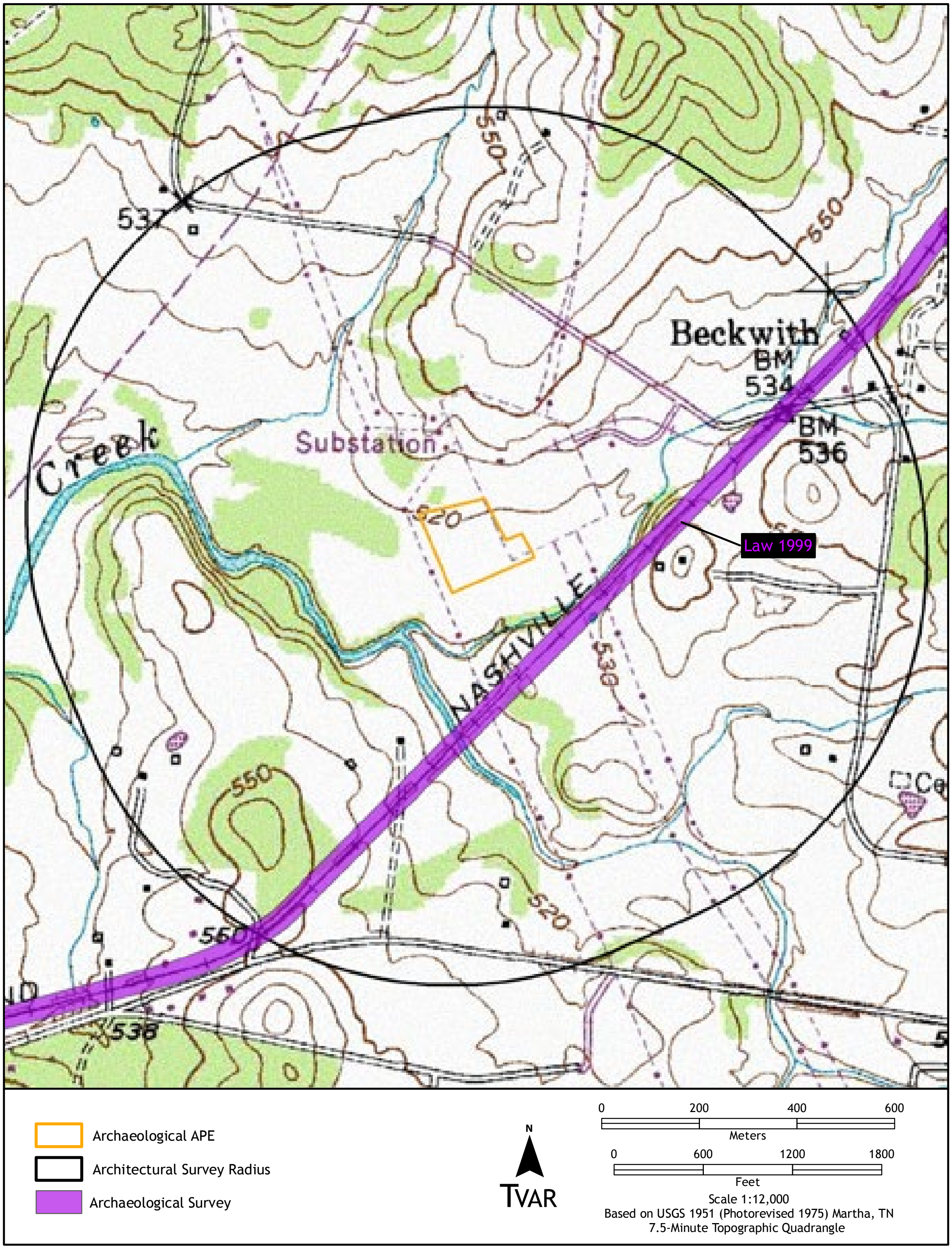

Figure 5.1. Background study area map.

Methods of Investigation

The Phase I investigation included pedestrian reconnaissance of the APE with a combination of shovel testing and surface inspection as the basis for the identification and delineation of archaeological resources. Systematic shovel testing (herein referred to as planned shovel test locations) was conducted at 30 m intervals. Shovel tests were 30-x-30 cm square units and excavated to a depth of 70 cm below surface (cmbs), or until the water table or sterile subsoil were encountered. Test soils were passed through 1/4-inch hardware mesh to recover cultural materials. Artifacts recovered in the screen were bagged and labeled by the provenience, including a shovel test number and a temporary site number. Systematic shovel testing was complemented with visual inspection of exposed ground surfaces, root balls, and rodent burrows, when possible. Planned shovel test locations that fell within areas where TVAR was denied access were recorded as "no-dig points."

When archaeological resources were identified during the survey, TVAR implemented a close interval (10 m) shovel testing program to delineate both the horizontal and vertical boundaries of the resources within the archaeological APE. Shovel testing at 10 m intervals was conducted in an opportunistic manner depending on the landform and orientation of the APE. Close interval shovel testing continued within the APE until two sequential negative tests were completed. All excavated deposits were passed through 1/4-inch mesh screen. Artifacts recovered in the screen were bagged and labeled by provenience, including a shovel test number and a temporary site number.

All locations investigated during the survey were recorded using a field computer (Topcon GRS-1) with a global positioning system (GPS) receiver with sub-meter precision and specialized data-capturing software tailored to archaeological surveying. The combination of hardware and software provided for real time data acquisition and visualization while furnishing important information to the field crews, including the locations of archaeological sites, environmental features, and survey boundaries. Using software developed by TVAR, detailed information such as soil descriptions, landscape features, and photographic information was recorded at the time of observation and linked via geographic coordinates.

Results of the Survey

A total of 34 planned shovel test locations were visited during the survey. Of the 34 planned locations, 32 were excavated, including one that was positive for cultural material. The remaining two planned shovel tests were not excavated (no-dig points), as TVAR was denied access to the area containing the test locations. Finally, five locations were investigated during the delineation of an archaeological resources, but none produced artifacts. The survey resulted in the identification of one isolated find within the APE. Figure 5.2 depicts the locations of all shovel tests conducted, and detailed shovel test roster is provided in Appendix A. All pertinent project records and materials will be curated at the Erskine Ramsay Archaeological Repository at Moundville Archaeological Park (Appendix B). The following provides a description of the resource identified during TVAR's survey and recommendations regarding its NRHP eligibility.

Figure 5.2. Shovel test map.

Isolated Find

The isolated find was identified in the southwestern corner of the APE, 95 m northeast of Cedar Creek (Figure 5.3). No structures were depicted in proximity to the resource on the USGS 1951 Martha 7.5-minute topographic quadrangle, and there was no indication any structure had been extant at that location at the time of TVAR's survey. Shovel testing in proximity to the resource produced a general profile (witnessed in Shovel Test 26) consisting of a dark grayish brown (10YR 4/2) silty clay (0 to 5 cmbs) underlain by a brown (10YR 4/3) silty clay (5 to 14 cmbs) (Figure 5.4). The artifacts recovered are detailed below.

Shovel Test 1 (0-10 cmbs)

1	0.12 g	<1/4-inch debitage, chert (Fort Payne)
1	7.92 g	ferrous metal possible ball bearing

In sum, the isolated find was identified during TVAR's systematic investigation of the APE. The resource is comprised of two artifacts that were recovered in the upper 10 of the same shovel test. Due to the shallow nature of the deposit, in combination with the minimal recovery and inability to associate the ball bearing with a non-extant structure, it is the opinion of TVAR that the isolated find is not eligible for listing on the NRHP and that no further archaeological investigations of the resource are necessary in connection with the proposed project.

Figure 5.3. View of the APE in proximity to the isolated find (view to the east).

Figure 5.4. Northern profile of Shovel Test 26.

CHAPTER 6. MATERIALS RECOVERED

Field notes, maps, artifacts, photos, and pertinent records generated during this Phase I survey were transported to the TVAR laboratory in Huntsville, Alabama. At the laboratory facilities, artifacts and other associated materials recovered during the survey were thoroughly washed and allowed to air dry. Provenience information was verified for accuracy at this stage, and all materials were accounted for by a physical inventory. All items were assigned unique catalog numbers and placed in 4 mil polypropylene resealable bags. Prior to entering the material data into a relational database, a final check of provenience and material data was performed. The data were then entered into the database, and both query-driven and physical data checks were used to verify the accuracy of the entries. All materials and documents generated during this Phase I study will be curated at the Erskine Ramsay Archaeological Repository located at Moundville Archaeological Park (Appendix C). This facility meets U. S. Department of Interior 36 CFR § 79 guidelines. Materials collected during the current survey are summarized below.

Lithic Debitage

Debitage is the byproduct of lithic reduction activities, i.e., flintknapping. Specimens were classified in accordance with Ahler's (1989) aggregate analysis methods, in which recorded attributes include raw material type, size grade, and presence of cortex. One piece of <1/4-inch Ft. Payne chert was recovered from the isolated find.

Other Artifacts

Also recovered from the isolated find was a ferrous metal spherical object. It is possible this artifact is a ball from a bearing, based on the size and material.

CHAPTER 7. SUMMARY AND RECOMMENDATIONS

Under contract with TVA, TVAR conducted a Phase I cultural resources survey to document and assess resources located within the APE associated with TVA's planned Wilson substation expansion project in Wilson County, Tennessee. The APE for the archaeological survey consisted of the 2.5 ha (6.2-acre) parcel on which the work is to be conducted. The architectural APE consisted of the archaeological APE, in addition to any areas visually connected to it via viewsheds to and from the project area, located with a 0.8 km (0.5 mi) radius surrounding the tract. Areas within the architectural survey radius that were determined not to be within view of the substation due to terrain, vegetation, and/or modern built environments were not considered part of the APE.

The purpose of the investigation was to assist TVA in its Section 106 compliance and to provide an inventory of cultural resources within the project area, descriptions of the current conditions at each resource identified, and NRHP eligibility recommendations for each resource. The survey was consistent with the Secretary of the Interior's *Standards and Guidelines for Identification* (NPS 1983) and met the requirements established by the THC (TDS 2009).

TVAR's architectural survey did not identify any previously undocumented resources within the APE; however, the investigation revisited three previously documented architectural resources (WI-984, 2210, and 2212) within the survey radius. Of the three previously documented architectural resources, only one, WI-2212, is extant and located within the architectural APE. TVAR recommends previously documented architectural resource WI-2212 eligible for the NRHP under Criteria A and C for its historical and architectural significance. The recommended NRHP boundary for WI-2212 includes the house, associated outbuildings, and the 52.8-acre parcel on which they are located. As a result of its architectural survey, it is the opinion of TVAR that the proposed undertaking will result in a visual effect to property WI-2212; however, the effect will not be adverse due to modern development immediately northwest and southeast of the property, which has compromised its historic setting. Consequently, TVAR recommends no additional investigation of above-ground resources in connection with the proposed project.

TVAR's archaeological survey resulted in the identification of one isolated find. The resource lacks the potential to significantly contribute to research concerning the prehistory or history of the region and is therefore recommended not eligible for listing on the NRHP. No further archaeological investigations of the APE are recommended in connection with the proposed project.

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APPENDIX A:
SHOVEL TEST ROSTER

Unit Type	Test	Status	TN State Plane Easting	TN State Plane Northing	Site	Shovel Test Depth (cmbs)	Auger Test Depth (cmbs)
Shovel Test	1	positive	1830729.766947	680872.666917	Isolated Find	0-28	
Shovel Test	2	negative	1830827.190512	680914.786088		0-40	
Shovel Test	3	negative	1830699.045818	680955.194338		0-21	
Shovel Test	4	negative	1830790.762767	680988.216791		0-22	
Shovel Test	5	negative	1830659.235831	681047.912788		0-16	
Shovel Test	6	negative	1830736.52886	681088.38972		0-23	
Shovel Test	7	negative	1830612.226628	681141.596885		0-20	
Shovel Test	8	negative	1830719.556487	681172.756154		0-19	
Shovel Test	9	negative	1830593.060727	681228.650135		0-20	
Shovel Test	10	negative	1830681.973772	681263.355949		0-39	
Shovel Test	11	negative	1830553.07852	681321.258665		0-16	
Shovel Test	12	negative	1830640.068139	681364.963793		0-34	
Shovel Test	13	negative	1830919.567903	681473.123065		0-12	
Shovel Test	14	negative	1830831.380115	681421.660293		0-10	
Shovel Test	15	negative	1830954.441147	681377.837343		0-10	
Shovel Test	16	negative	1830861.017042	681343.340767		0-13	
Shovel Test	17	negative	1830993.905317	681286.564761		0-13	
Shovel Test	18	negative	1831025.820551	681194.366279		0-11	
Shovel Test	19	negative	1830896.9642	681255.936418		0-12	
Shovel Test	20	negative	1830919.869457	680951.20886		0-17	
Shovel Test	21	negative	1830884.52631	681044.009216		0-22	
Shovel Test	22	negative	1830840.70061	681127.440545		0-25	
Shovel Test	23	negative	1830818.427229	681219.388703		0-21	
Shovel Test	24	negative	1830775.914128	681313.319607		0-8	

Unit Type	Test	Status	TN State Plane Easting	TN State Plane Northing	Site	Shovel Test Depth (cmbs)	Auger Test Depth (cmbs)
Shovel Test	25	negative	1830735.98851	681401.91757		0-12	
Shovel Test	26	negative	1830767.223494	680871.71338		0-14	
Shovel Test	27	negative	1830793.626715	680887.645567		0-17	
Shovel Test	28	negative	1830722.503036	680902.034286		0-19	
Shovel Test	29	negative	1830709.156355	680934.256451		0-15	
Shovel Test	30	negative	1830765.462385	680936.942994		0-17	
No Dig Point	31	no dig - no access, most likely disturbed	1831241.135039	681188.209339			
No Dig Point	32	no dig - no access, most likely disturbed	1831146.459621	681149.45015			
Shovel Test	33	negative	1831063.138859	681109.792548		0-11	
Shovel Test	34	negative	1830935.443414	681163.134542		0-13	
Shovel Test	35	negative	1830970.058454	681072.343134		0-12	
Shovel Test	36	negative	1831107.137615	681014.870583		0-22	
Shovel Test	37	negative	1831191.132919	681054.065964		0-24	
Shovel Test	38	negative	1831007.358509	680981.264821		0-36	
Shovel Test	39	negative	1831283.870353	681087.746839		0-22	

APPENDIX B:
CURATION LETTER

University of Alabama Museums
Office of Archaeological Research

THE UNIVERSITY OF
ALABAMA
MUSEUMS

May 6, 2016

Hunter Johnson
Tennessee Valley Archaeological Research
2211 Seminole Drive, Suite 302
Huntsville AL 35805

Dear Hunter:

As per your request, this letter is to establish an agreement with you to provide curation services to Tennessee Valley Archaeological Research on an as-needed basis. We are recognized by a variety of Federal agencies as a repository meeting the standards in 36 CFR Part 79 and have formal agreements to provide curation under these guidelines to agencies such as the Department of Defense, National Park Service, U.S. Fish and Wildlife Service, U.S. Soil Conservation Service, U.S. Army Corps of Engineers, Tennessee Valley Authority, National Forest Service, etc.

Please be advised that once a year we must be notified of all reports in which we were named as the repository. Project collections must be submitted within one calendar year of completion. Small projects may be compiled for periodic submission. For Alabama, the AHC survey policy specifies which materials must be curated (Administrative Code of Alabama, Chapter 460-X-9). Archaeological documentation must be curated even if no artifacts are recovered. Renewal of this agreement is contingent upon compliance.

We appreciate having the opportunity to assist you with curation services and look forward to working with you in the future.

Sincerely,

Eugene Futato

Eugene M. Futato RPA
Deputy Director

13075 Moundville
Archaeological Park
Moundville, Alabama 35474
(205) 371-2266
FAX (205) 371-2494

Browns Ferry Nuclear Plant

RERP - RAI - GE-2 Response, Attachment 3

TVA letter to the Mississippi State Historic Preservation Office - TVA, Corinth and Holly Springs Substations Expansion Project, Phase I Cultural Resources Survey, Alcorn and Marshall Counties, Mississippi

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

May 20, 2016

Mr. Jim Woodrick, Director
Mississippi Department of Archives and History
Historic Preservation Division
Post Office Box 571
Jackson, Mississippi 39205-0521

Dear Mr. Woodrick:

TENNESSEE VALLEY AUTHORITY (TVA), CORINTH AND HOLLY SPRINGS SUBSTATIONS EXPANSION PROJECT, PHASE I CULTURAL RESOURCES SURVEY, ALCORN AND MARSHALL COUNTIES, MISSISSIPPI

As part of a larger effort to meet increasing demands for bulk power, TVA proposes to request approval of a license amendment from the Nuclear Regulatory Commission (NRC) to increase the electrical output of Units 2 and 3 at Browns Ferry Nuclear Plant. In order to facilitate the Browns Ferry Nuclear (BFN) Extended Power Uprate (EPU) project, TVA proposes to expand the capacity of three substations, including the Corinth Substation in Alcorn County and the Holly Springs Substation in Marshall County. This work would involve adding capacitor banks at each substation, which will require expansion of the existing footprints, and grading. TVA has determined that this proposed substation expansion project is an undertaking (as defined at 36 CFR § 800.16(y)) that has the potential to cause effects on historic properties. We are initiating consultation under Section 106 of the National Historic Preservation Act for this undertaking.

TVA has determined an area of potential effects (APE) for this undertaking that is divided into two parts, one for each of the substations. For the Corinth Substation expansion, TVA has determined the APE for archaeological resources as the circa 6-acre footprint of the proposed substation expansion; the archaeological APE for the Holly Springs substation is the circa 3-acre expansion footprint. TVA has determined the APE for above-ground (historic architectural) resources as areas within a one-half mile radius of each part of the archaeological APE, from which unobstructed views to the new capacitor banks would be possible.

TVA contracted with Tennessee Valley Archaeological Research (TVAR) to perform a Phase I cultural resources survey of the APE. Enclosed are three bound copies of the draft report, titled *A Phase I Cultural Resources Survey of Tennessee Valley Authority's Corinth and Holly Springs Substation Expansions in Alcorn and Marshall Counties*, along with three CDs containing digital copies of the report.

TVAR's background study, conducted prior to the field study, indicated that no properties listed in the National Register of Historic Places (NRHP) and no previously recorded archaeological sites are located in either part of the APE. The archaeological survey identified one archaeological site, 22AL726, located in the Corinth Substation portion of the archaeological APE. TVAR recommends that the site is ineligible for inclusion in the NRHP.

TVAR's background study noted that 14 historic architectural properties have been inventoried previously within the APE for the Corinth Substation Expansion. Of these, TVAR recommends that one is outside the viewshed of the planned substation expansion, and 13 are ineligible for inclusion in the NRHP. The survey recorded eight previously unrecorded properties in this part of the APE, which they have designated IS-1 through IS-8. TVAR recommends all eight of these properties as ineligible for the NRHP, due to a lack of architectural and historic significance.

The architectural survey of the Holly Springs portion of the APE revisited two NRHP-listed historic districts, the Depot-Compress Historic District and the East Holly Springs Historic District, both of which are partially within the half-mile radius. Based on the results of the survey, both of these historic districts are located outside the viewshed to the project area, and neither would be affected by the undertaking. The survey identified 11 previously unrecorded, above-ground properties (IS-9 through IS-19). TVAR recommends all of these properties ineligible for the NRHP due to a lack of architectural and historic significance.

TVA has reviewed the enclosed report and agrees with the findings and recommendations of the authors. Based on the survey, TVA has determined that the Corinth and Holly Springs Substations Expansion project would affect no historic properties.

Pursuant to 36 CFR Part 800.4(d)(1), we are seeking your concurrence with TVA's findings and determinations.

Should you have any questions or comments, please contact Richard Yarnell in Knoxville at wryarnell@tva.gov or (865) 632-3463.

Sincerely,

Clinton E. Jones
Manager, Biological and Cultural Compliance
Safety, River Management and Environment
WT11C-K

SCC:CSD
Enclosures

INTERNAL COPIES:

Amy Henry, WT11D-K
Susan Jacks, WT11C-K
Todd Liskey, MR 4G-C
Emily Willard, MR 4G-C
Richard Yarnell, WT11D-K
ECM, WT CA-K

Phase I Cultural Resources Surveys of Tennessee Valley Authority's Corinth and Holly Springs Substation Expansions in Alcorn and Marshall Counties, Mississippi

Tennessee Valley Archaeological Research

PHASE I CULTURAL RESOURCES SURVEYS OF TENNESSEE VALLEY AUTHORITY'S CORNITH AND HOLLY SPRINGS SUBSTATION EXPANSIONS IN ALCORN AND MARSHALL COUNTIES, MISSISSIPPI

by
Ted Karpynec, Heidi Rosenwinkel, Meghan Weaver, Katherine Wright, and Elin Crook

Prepared for:
Tennessee Valley Authority
400 W. Summit Hill Drive
Knoxville, TN 37902

Prepared by:
Tennessee Valley Archaeological Research
2211 Seminole Drive, Suite 302
Huntsville, Alabama 35805

Hunter B. Johnson
Principal Investigator

May 2016

ABSTRACT

Under contract with the Tennessee Valley Authority (TVA), Tennessee Valley Archaeological Research (TVAR) conducted Phase I cultural resources surveys to document and assess cultural resources with the area of potential effects (APE) associated with the Corinth and Holly Springs substation expansions projects in Alcorn and Marshall Counties, Mississippi. The APE for the archaeological survey consisted of the footprints of the Corinth (2.42 ha [5.98 acres]) and Holly Springs (1.21 ha [2.98 acres]) substation expansions. The architectural APE consisted of a 0.8 km (0.5 mi) radius surrounding the substation footprints. Areas within the architectural survey radii that were determined not to be in view of the substations due to terrain, vegetation, and/or modern built environments were not considered as part of the architectural APE.

TVAR's architectural assessment of the survey radius surrounding the proposed Corinth substation expansion resulted in the revisitation of 14 previously documented architectural resources (003-COR-1249, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, and 1263). Of the 14 previously documented architectural resources, 13 (003-COR-1249, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, and 1263) are extant and located within the architectural APE. TVAR recommends these architectural resources not eligible for the National Register of Historic Places (NRHP) due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage. TVAR's survey noted previously recorded property 003-COR-1251 is located outside the viewshed of the proposed project area. In addition, TVAR's survey of the APE associated with the Corinth substation identified six resources (IS-1-IS-6) within the survey radius, none of which are recommended as eligible for listing on the NRHP due to their lack of architectural and historic significance. Consequently, TVAR recommends no additional investigation of above-ground resources in connection with the proposed Corinth substation expansion project.

TVAR's architectural assessment of the survey radius surrounding the proposed Holly Springs substation expansion revisited two NRHP-listed historic districts, the Depot-Compress Historic District and the East Holly Springs Historic District, within the survey radius. Based on the results of TVAR's architectural survey, the two historic districts are located outside the viewshed to the project area and will not be affected by the proposed undertaking. In addition, TVAR's survey resulted in the identification of 14 resources (IS-1-IS-14) within the survey radius, none of which are recommended as eligible for listing on the NRHP due to their lack of architectural and historic significance. Consequently, TVAR recommends no additional investigation of above-ground resources in connection with the Holly Springs substation expansion project.

TVAR's archaeological survey resulted in the identification of one site (22AL726) within the APE associated with the Corinth substation expansion, but it lacks the potential to significantly contribute to research concerning the prehistory of the region. Consequently, TVAR recommends that the site is not eligible for listing on the NRHP. No resources were identified during TVAR's survey of the APE associated with the Holly Springs substation expansion. No further archaeological investigations are recommended in connection with either of the proposed projects.

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CHAPTER 1. INTRODUCTION

Under contract with the Tennessee Valley Authority (TVA), Tennessee Valley Archaeological Research (TVAR) conducted a Phase I cultural resources survey to document and assess cultural resources located within the area of potential effects (APE) associated with the Corinth and Holly Springs substation expansion projects in Alcorn and Marshall Counties, Mississippi. The project area falls within Township 2 South, Range 7 East, Section 13 and Township 4 South, Range 2 West, Section 5. The APE for the archaeological survey consisted of the footprints of the Corinth (2.42 ha [5.98 acres]) and Holly Springs (1.21 ha [2.98 acres]) substation expansion areas. The architectural APE consisted of a 0.8 km (0.5 mi) radius surrounding the substation footprints. Areas within the architectural survey radii that were determined not to be in view of the substations due to terrain, vegetation, and/or modern built environments were not considered as part of the architectural APE (Figures 1.1 and 1.2).

The purpose of the investigation was to assist TVA in its Section 106 compliance and to provide an inventory of cultural resources within the project area, descriptions of the current conditions at each resource identified, and National Register of Historic Places (NRHP) eligibility recommendations for each resource. The survey was consistent with the Secretary of the Interior's *Standards and Guidelines for Identification* (National Parks Service [NPS] 1983) and met the requirements established by the Mississippi Department of Archives and History (MDAH).

TVAR's architectural assessment of the survey radius surrounding the proposed Corinth substation expansion was conducted on April 7, 2016 and resulted in the revisitation of 14 previously documented architectural resources (003-COR-1249, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, and 1263). Of the 14 previously documented architectural resources, 13 (003-COR-1249, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, and 1263) are extant and located within the architectural APE. TVAR recommends these architectural resources not eligible for the National Register of Historic Places (NRHP) due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage. TVAR's survey noted previously recorded property 003-COR-1251 is located outside the viewshed of the proposed project area. In addition, TVAR's survey of the APE associated with the Corinth substation identified six resources (IS-1-IS-6) within the survey radius, none of which are recommended as eligible for listing on the NRHP due to their lack of architectural and historic significance. Consequently, TVAR recommends no additional investigation of above-ground resources in connection with the proposed Corinth substation expansion project.

TVAR's architectural assessment of the survey radius surrounding the proposed Holly Springs substation expansion, which was conducted on April 11, 2016, revisited two NRHP-listed historic districts, the Depot-Compress Historic District and the East Holly Springs Historic District, within the survey radius. Based on the results of TVAR's architectural survey, the two historic districts are located outside the viewshed to the project area and will not be affected by the proposed undertaking. In addition, TVAR's survey resulted in the identification of 14 resources (IS-1-IS-14) within the survey radius, none of which are recommended as eligible for listing on the NRHP due to their lack of architectural and historic significance. Consequently, TVAR recommends no additional investigation of above-ground resources in connection with the Holly Springs substation expansion project.

TVAR's archaeological survey was conducted on April 7, 2016 under the supervision of Monica Warner with the assistance of Nicholas Simpson, Matt Sullivan, and Brady Swilley and resulted in the identification of one site within the APE associated with the Corinth substation expansion, but it lacks the potential to significantly contribute to research concerning the prehistory of the region. Consequently, TVAR recommends that the site is not eligible for listing on the NRHP. No resources were identified during TVAR's survey of the APE associated with the Holly Springs substation expansion. No further archaeological investigations are recommended in connection with the proposed projects.

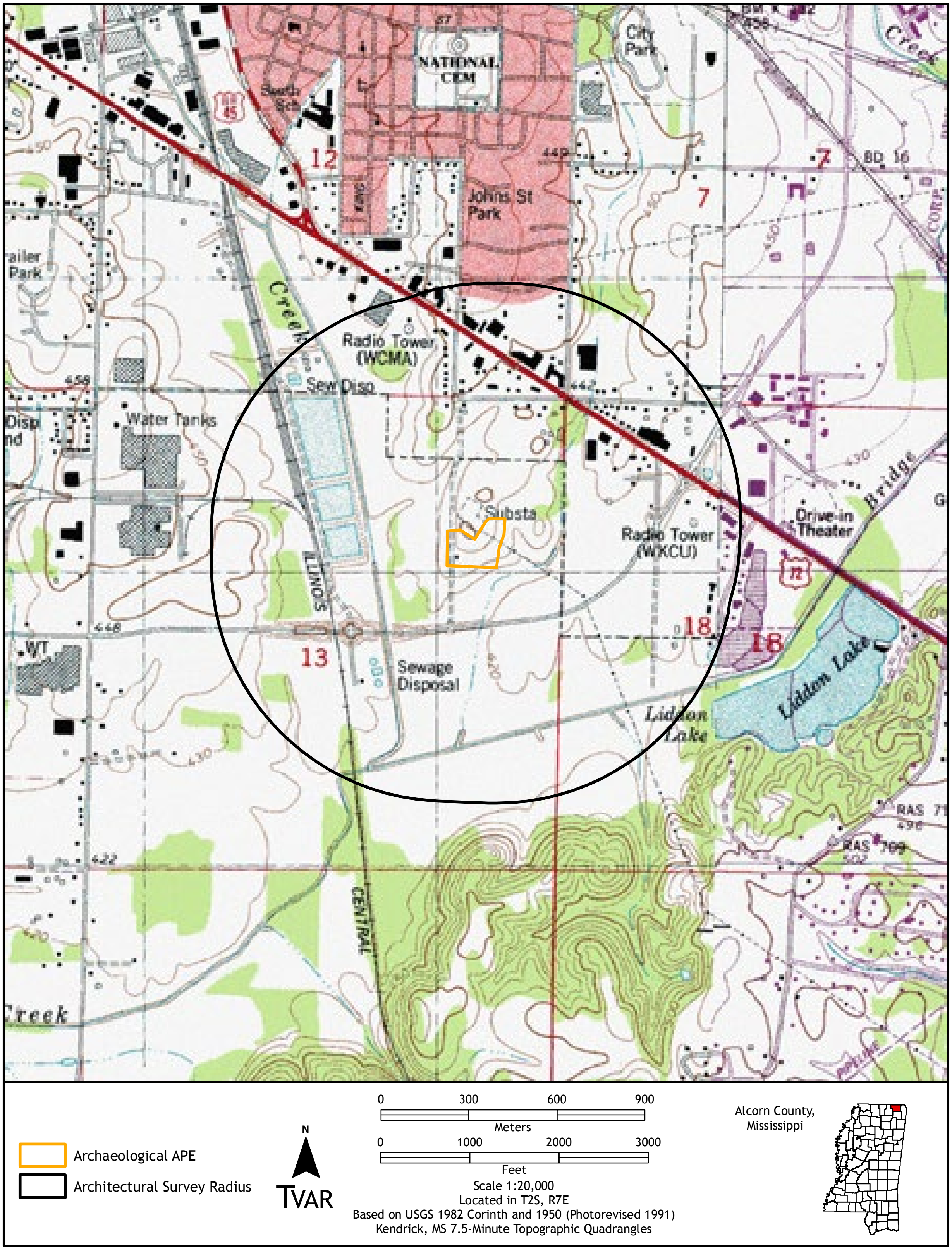

Figure 1.1. Project location map of Corinth substation expansion.

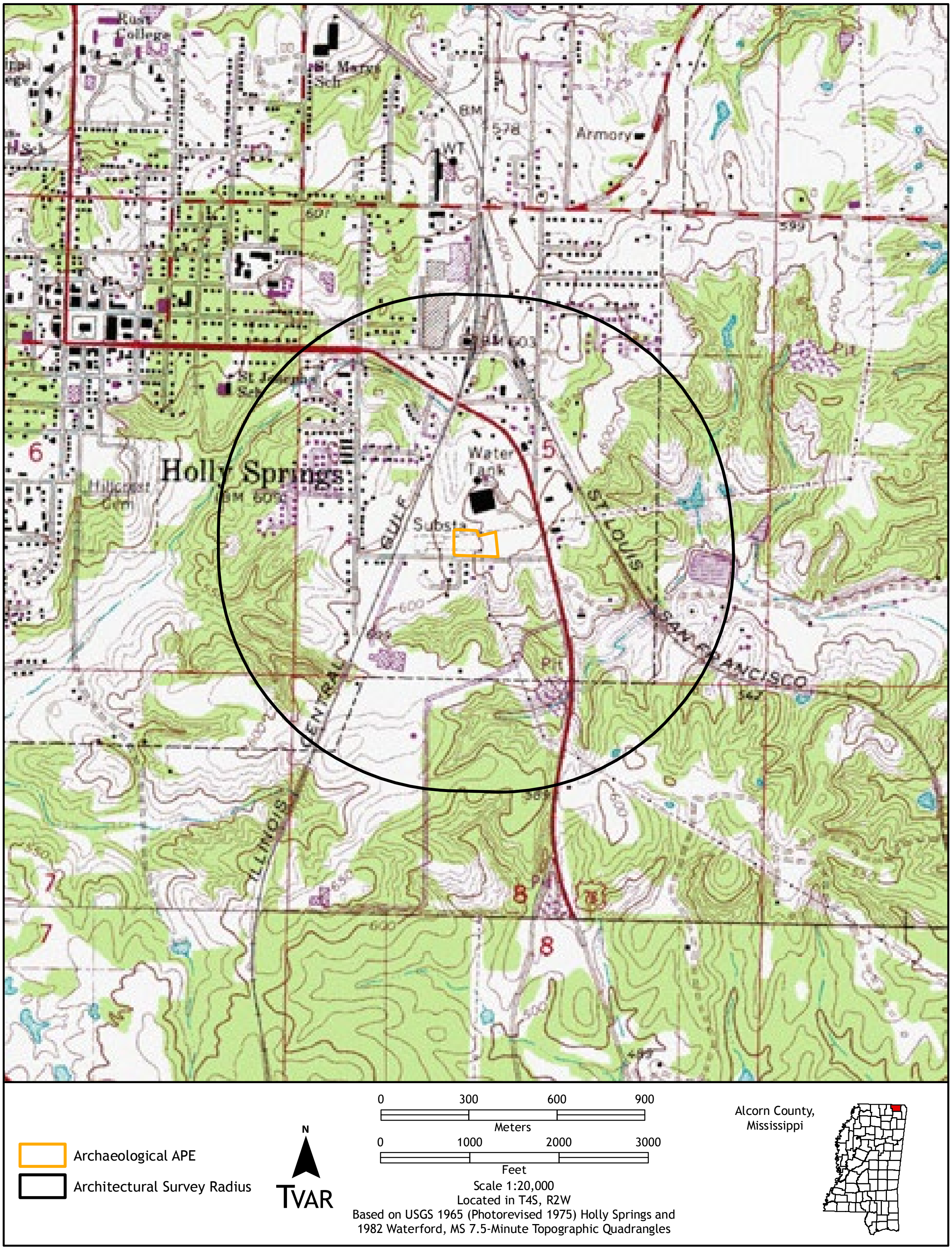

Figure 1.2. Project location map of Holly Springs substation expansion.

CHAPTER 2. ENVIRONMENT

The Corinth substation expansion project area is located in central Alcorn County, within the Upper Hatchie watershed. A canalized portion of Elam Creek associated with nearby sewage disposal and industrial waste facilities is 250 m to the west of the APE. The project area falls within Southeastern Plains Level III ecoregion. The Southeastern Plains is characterized by irregular plains predominantly covered by longleaf pine forests (Chapman et al. 2004). Within the Southeastern Plains, the project area is encompassed by the Blackland Prairie Level IV ecoregion (Figure 2.1).

The Blackland Prairie is comprised of undulating irregular plains that are dissected by low gradient streams. Vegetation native to the ecoregion includes blackbelt oak-cedar forests of chinkapin, blackjack, and post oaks; eastern redcedar; sweetgum; and hackberry. Additionally, patches of bluestem prairies of little bluestem, yellow Indiangrass, prairie rosinweed, and prairie coneflower are found throughout. The land is currently used for pasture, pond-raised catfish production, and cropland associated with the cultivation of hay, soybeans, corn, and cotton (Chapman et al. 2004).

The soil series mapped within the APE include Paden (PaB) and Providence (PdB3 and PdC3). Paden soils are well drained and formed in silty material and underlying alluvium. Paden silt loam (PaB) is found on stream terraces slopes between 2 and 5 percent. Providence soils are well drained and formed in a mantle of silty materials and underlying sandy and loamy sediments. Providence silt loam, severely eroded (PdB3) is found on terrace slopes between 2 and 5 percent, and Providence silt loam, severely eroded (PdC3) is found on terrace slopes ranging between 5 and 8 percent (NRCS 2016; SSURGO 2016). The underlying geology of the project area primarily consists of Cretaceous materials from the Demopolis chalk and Coffee sand units, and knappable chert gravel is produced by the nearby Tuscaloosa unit. (Futato 1999:47; O'Hear et al. 1985:7-8; Pettry 1983:3.1; USGS2014a). In addition, Fort Payne chert from the Fort Payne formation, which outcrops in neighboring northwestern Alabama, was accessible to prehistoric populations for tool manufacture (Johnson and Meeks 1994:67; O'Hear et al. 1985:7; Randall 2000:60).

Tuscaloosa gravel is readily available for collection in exposed gravel bars throughout the region (Bense 1983a:23; Ensor 1981:7-8; O'Hear et al. 1985:8). The chert is derived from Devonian and Mississippian geologic units, and after eroding from its parent formations, was fluvially transported and redeposited to form the Tuscaloosa formation (Bense 1983b:IIIF.1; Ensor 1981:8). The material ranges in color between yellow, white, and tan, and research has demonstrated that the gravel takes on a pinkish or red hue with heat treatment(Bense 1983a:23; Ensor 1981:8; Futato 1999:47). Fort Payne chert is formed in nodules or beds within the Fort Payne limestone, and some research indicates that it occurred in gravel bars in antiquity (Bense 1983a:23; 1983b:IIIF.1; Johnson and Meeks 1994:67; Randall 2000:58, 60). Fort Payne chert is generally gray to white with bluish mottling, and the texture distinctively granular, but the material varies widely from region to region (Ensor 1981:10; Futato 1999:47; Johnson and Meeks 1994:67).

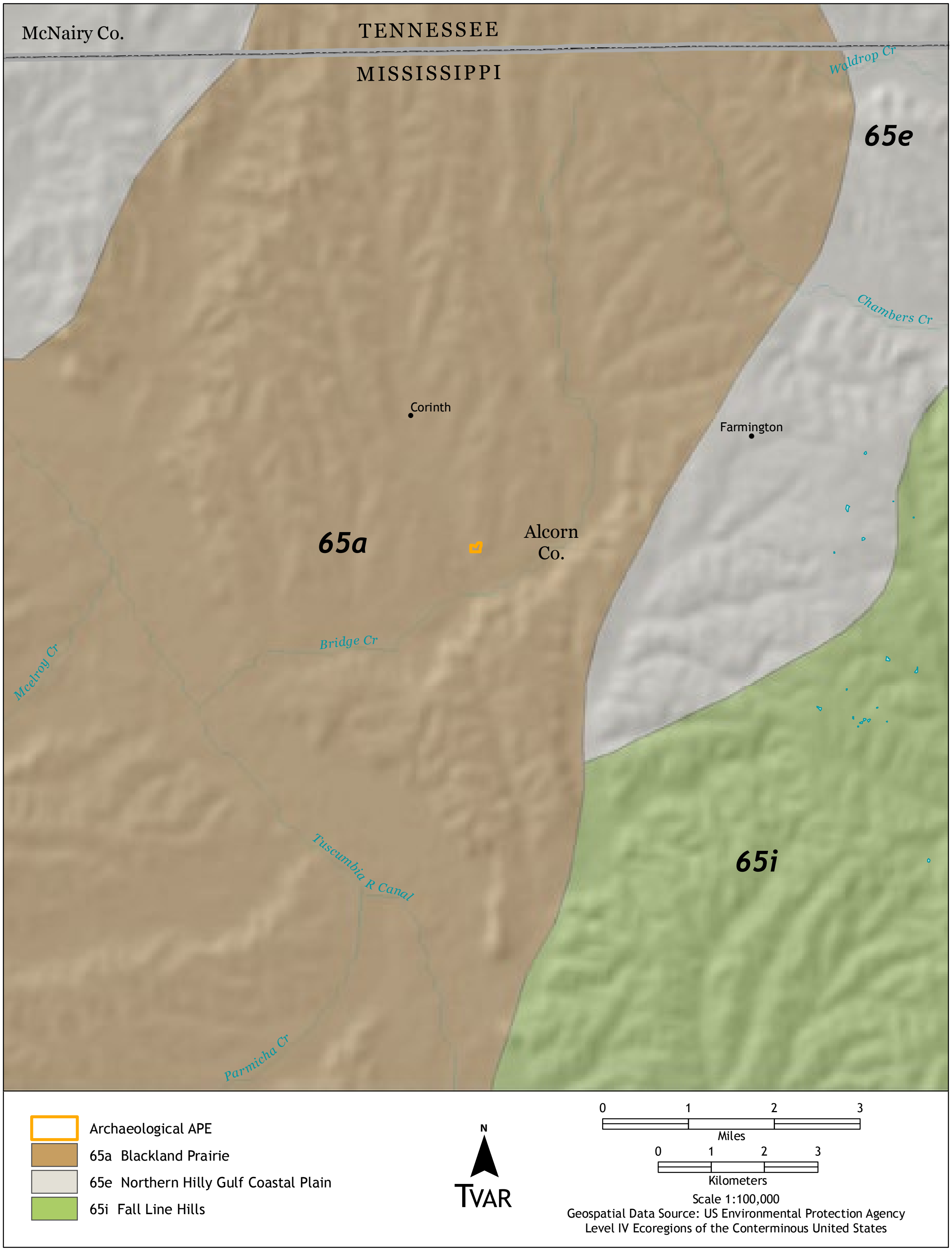

Figure 2.1. Corinth substation expansion project location within the Blackland Prairie Level IV ecoregion.

The Holly Springs substation expansion project area is located in central Marshall County, within the Coldwater watershed. Although no major natural water sources are located in proximity to the project area, numerous unnamed, spring-fed streams have been impounded throughout the region. The project area is located in the Loess Plains Level IV ecoregion, part of the larger Mississippi Valley Loess Plains Level III ecoregion (Figure 2.2). The Mississippi Valley Loess Plains extend from the Ohio River in western Kentucky to Louisiana and are comprised of irregular plains, hills, and river bluffs along the Mississippi River. The landscape is formed by thick layers of loess, and vegetation native to the ecoregion consists of primarily of hickory and oak-hickory-pine forests (Chapman et al. 2004).

The Loess Plains Level IV ecoregion is comprised of gently rolling to irregular plains with thinning layers of loess. Erosional activity throughout the region has resulted in wide, flat floodplains and increased silty and sandy substrates in stream bottoms. Vegetation native to the Loess Plains includes oak-hickory and oak-hickory-pine forests of white, post, southern red, blackjack oaks, mockernut and pignut hickory, shortleaf and loblolly pine, beech, and blackgum; southern floodplain forests of bald cypress and water tupelo; and bottomland hardwood forests of overcup, swamp chestnut, and water oak; water hickory, red maple, and green ash. The landwithin the Loess Plains is used primarily for agriculture and tree farming. Croplands are used to cultivate soybeans, cotton and corn (Chapman et al. 2004).

The soils mapped within the APE associated with the Holly Springs substation expansion include Lexington silt loam, severely eroded (LeC3) and Memphis silt loam, eroded (MeB2). Lexington soils are well drained and formed in mantles of loess. Lexington silt loam, severely eroded (LeC3) is found on hillslopes ranging between 5 and 8 percent. Memphis soils are well drained and formed in loess deposits over 122 cm thick. Memphis silt loam, eroded (MeB2) is found on summit slopes ranging between 2 and 5 percent (NRCS 2016; SSURGO 2016).

The underlying geology of the Holly Springs substation project area is comprised of materials from the Kosciusko and Tallahatta formations and Neshoba sand, all of the Claiborne group. The Kosciusko formation consists of irregularly bedded sand, clay, and quartzite, and the Tallahatta formation includes clay, claystone, and lenses of sand with some sandstone (USGS 2014b). The Kosciusko formation outcrops in an irregular belt through Mississippi's central and eastern counties, and the quartzite contained in the formation's distinctive ledges and boulders is sporadically found in prehistoric assemblages from counties along the state's northern border. Kosciusko quartzite is usually gray or brown in color, and is quite brittle, making it an excellent material for tool manufacture. Heat treatment improves the quartzite's knappability, although it does not generally change its color. In Mississippi, the material predominately appears in assemblages associated with the Early Archaic and transitional Woodland-Mississippian periods (Lehman 1982:15; McGahey 1999:2). Siliceous stone materials from the Tallahatta formation, which comprises the bulk of the area surrounding the APE, include chalcedony and orthoquartzite (USGS 2014b). Tallahatta orthoquartzite, also called buhrstone, occurs near the base of the formation. It varies in appearance, depending on the degree to which the material is weathered, beginning as a translucent bluish or greenish gray and weathering to a more opaque tan or brown (Adams et al. 1926:269; Lloyd 1983:126).

Figure 2.2. Holly Springs substation expansion project location within the Loess Plains Level IV ecoregion.

At the time of TVAR's survey, much of the project area associated with the expansion of the Corinth substation fell within fallow agricultural fields, and some wooded patches of secondary growth were found near the APE's northeastern corner (Figures 2.3 and 2.4). The existing substation was located to the north of the APE, and a maintained gravel road was also observed across the project area (Figures 2.5 and 2.6). The project area associated with the Holly Springs substation expansion primarily fell within a manicured grass field (Figure 2.7). The existing substation was located to the APE's west, and residential development was observed to the south of the project area across Neely Road (Figures 2.8 and 2.9).

Figure 2.3. Fallow agricultural field within the APE associated with the Corinth substation expansion (view to the west).

Figure 2.4. Wooded area within the APE associated with the Corinth substation expansion (view to the west).

Figure 2.5. Existing Corinth substation (view to the west).

Figure 2.6. Gravel road traversing the Corinth substation expansion project area (view to the north).

Figure 2.7. Manicured grass field comprising the APE associated with the Holly Springs substation expansion (view to the east).

Figure 2.8. Existing Holly Springs substation (view to the northwest).

Figure 2.9. Residential development across from the Holly Springs substation (view to the southwest).

CHAPTER 3. CULTURAL CONTEXT

Context for this study is provided in part by the following overview.[1] These summary sketches are simplified and not meant to replace more thorough research. Additional details are provided in the following Architecture and Archaeology chapters.

Paleoindian

Although there is some debate regarding the possible presence of earlier occupations (see Goodyear 2005), archaeologists generally agree that by ca. 11,500 B.C. southeastern North America was inhabited by nomadic hunter-gatherers that manufactured distinctive lanceolate-shaped hafted bifaces. The earliest of these Paleoindian populations hunted Pleistocene megafauna species such as mammoth and giant bison.

Walthall (1998) noted a dramatic increase in the use of caves and rockshelters in Late Paleoindian times. He attributed the shifting settlement pattern to increased populations and changes in mobility ranges and subsistence activities linked to broad environmental changes accompanied by extinctions of several Pleistocene faunal species hunted by earlier Paleoindian groups. Meeks and Anderson (2012) further advanced these arguments with hafted biface data indicative of a population increase during Late Paleoindian times.

Chronologically diagnostic hafted biface types provide a basis for a tripartite Paleoindian sequence dating between 11,500 and 9200 cal B.C. (Anderson et al. 1996; Sherwood et al. 2004). Early Paleoindian (ca, 11,500-10,900 cal B.C.) contexts are recognized by the presence of fluted and unfluted Clovis hafted bifaces. Fluted and unfluted lanceolate bifaces with broad blades and constricted hafts, such as Beaver Lake, Cumberland, and Quad, are considered Middle Paleoindian (10,900-10,000 cal B.C.) diagnostics. Late Paleoindian (10,000-9200 cal B.C.) assemblages are distinguished by the presence of lanceolate forms with side-notched hafts such as Dalton and Hardaway Side Notched. Clovis and Cumberland fluted points, primarily knapped from Fort Payne chert, have been recovered in northeast Mississippi. The Hester site, located in Monroe County, is a multicomponent site with Late Paleoindian Quad and Dalton components underlying a distinct Early Archaic deposit (Little et al. 2016:367).

Archaic

Archaic manifestations in the Southeast are represented by preceramic and early ceramic assemblages dating from approximately 9500 to 800 cal B.C. Based on temporally diagnostic hafted bifaces, stratigraphic contexts, and radiocarbon dates, fairly well-documented Archaic sequences have been developed throughout the region: Early Archaic (9200-6900 cal B.C.), Middle Archaic (6900-3700 cal B.C.), and Late Archaic (3700-800 cal B.C.).[2]

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[1] Portions of the summaries are extracted verbatim, or nearly so, from previous TVAR reports without further citation (e.g., Little et al. 2012; Little et al. 2016).
[2] These generalized date ranges vary somewhat from one locality to another.

The settlement system of Early Archaic groups appears to represent a continuum of that employed in earlier Late Paleoindian times with occupations of caves, rockshelters, and open-air sites. Walthall (1980) suggested that population size continued to increase during this period. Early Archaic is chronologically ordered by diagnostic hafted biface types (Anderson et al. 1994; Sherwood et al. 2004). The sequence begins with side-notched types such as Big Sandy, Bolen, and Taylor. The Edgefield scraper is another likely constituent of the earliest Early Archaic assemblages. These assemblages date from about 9200 to 8500 cal B.C. Corner-notched types, such as Kirk Corner Notched and Palmer Corner Notched, were manufactured from approximately 8500 to 7800 cal B.C., while bifurcated types, including Lecroy, MacCorkle, and St. Albans, were made from about 7800 to 6600 cal B.C.

The Middle Archaic period coincides closely with the Hypsithermal climate interval during the Middle Holocene. As McNutt (2008:54-56) indicated, Hypsithermal climate conditions varied significantly across the landscapes of the Southeast, and Sassaman (2001) argued that there were marked sociocultural differences, as well. Along the South Atlantic Slopes settlements were concentrated in upland environments, while west of the Appalachians riverine settings were important to Middle Archaic populations (Dye 1996; Sassaman 2001). Sites marked by large accumulations of freshwater mollusk shells begin to appear in the archaeological record in the Tennessee Valley (Lewis and Lewis 1961; Walthall 1980:62). Middle Archaic populations also occupied caves and rockshelters in the Tennessee Valley (e.g., Cambron and Waters 1961; DeJarnette et al. 1962; Hollingsworth 1991; Ingmanson and Griffin 1994; Little et al. 2013; Sherwood et al. 2004). Bense (1994:78) pointed out that human burials are sparsely represented in the archaeological record prior to the Middle Archaic. However, there is ample evidence of Middle Archaic burials (DeJarnette et al. 1962:80; Dowd 1989; Lewis and Lewis 1961; Walthall 1980:61-65). There is also evidence of interpersonal conflict during the Middle Archaic (Walthall 1980:64). Near the end of the period, extensive exchange networks developed in the region (Jefferies 1996; Johnson and Brookes 1989), and construction possibly began on some of the earliest mounds in the Southeast (Russo 1996; Saunders 1994).

A Middle Archaic hafted biface chronology has been established for a broad region across the Southeast. The earliest Middle Archaic manifestations are marked by the presence of Kirk Stemmed, Kirk Serrated, and Stanley Stemmed bifaces between 6900 and 6300 cal B.C. Later in the sequence, from approximately 6300 to 5400 cal B.C., Eva and Morrow Mountain hafted bifaces were constituents of Middle Archaic lithic toolkits. Middle Archaic assemblages dating to 5400-4300 cal B.C. are marked by the presence of Sykes/White Springs and Guilford hafted bifaces. Benton bifaces are diagnostic of terminal Middle Archaic (4500-3700 cal B.C.) occupations in the Tennessee-Tombigbee region of Alabama, Mississippi, and Tennessee (McNutt 2008; Meeks 1999). Middle Archaic sites in northeast Mississippi are represented mostly from midden mounds, sites such as Moore's Creek (22AL521) and Mann (22TS565) (Penman 1975; Meeks 1999).

The Late Archaic is marked by several technological developments. Perhaps foremost of these was the domestication of several plant species in eastern North America around 5000-3800 B.P. (Smith 2011; Smith and Yarnell 2009). These domesticates are sometimes referred to collectively as the "eastern agricultural complex," which consisted of squash, sunflower, marshelder, and chenopod. Other plants such as erect knotweed, little barley, and maygrass do not appear to have been domesticated but were in all probability deliberately planted.

In addition, fiber-tempered pottery and steatite vessels first appeared in the Coastal Plain of the Southeast during the Late Archaic (Sassaman 1993; Walthall and Jenkins 1976). Jenkins and Krause (1986:36-37) suggested that soapstone vessels are horizon markers for terminal Late Archaic assemblages. Truncer's (2004:507) study of steatite vessel chronology concluded that steatite vessels were produced for almost 2000 years before they peaked "clearly and strongly around 1500 cal B.C., a peak that accounts for the general success of the horizon-marker use." Sassaman (2006:151) disputed Truncer's chronology and alternatively argued that there is insufficient evidence for presuming that steatite vessels predate 3700 radiocarbon years B.P.

During the ending centuries of the Late Archaic, the well-known Poverty Point earthworks also were constructed (Kidder 2002; Gibson 2000, 2007, 2010; Ortmann 2010). The Poverty Point site has yielded large inventories of artifacts made of exotic stones such as soapstone, greenstone, galena, copper, hematite, magnetite, crystal quartz, novaculite, fluorite, obsidian, Fort Payne chert, Dover chert, and Pickwick chert (Gibson 2000:172-173). These nonlocal materials constitute good evidence for panregional exchange. The site has been widely recognized as a material manifestation of a conspicuous development in sociopolitical complexity, although the composition and inner workings of the Late Archaic society is a subject of supposition and debate (e.g., Gibson 2007; Sassaman 2005).

By Late Archaic times, the regionalized hafted biface sequences that characterized the Early and Middle Archaic periods were replaced by more localized temporal trajectories of mostly stemmed bifaces. For instance, Savannah River Stemmed was widely distributed along the South Atlantic Slopes, while early in the sequence, Ledbetter and Pickwick were disbursed in an area extending from the southwestern slopes of the Appalachians into the Coastal Plain of Tennessee, Mississippi, and Alabama. Near the end of the Late Archaic in the westerly region, a multitude of other stemmed types were manufactured including Cotaco Creek, Flint Creek, Little Bear Creek, McIntire, Motley, and Wade. Diagnostics including Pickwick, Ledbetter, Gary, Elora and Little Bear Creek points, were used to identify the Late Archaic component at the Kellogg Village Site (22CL527) in northeast Mississippi (Atkinson et al. 1980).

Woodland

The Woodland stage is perhaps best known for the Adena and Hopewell earthworks and mortuary practices in the Ohio Valley and widespread exchange networks in which exotic artifacts and raw materials were distributed across much of eastern North America during the Early and Middle periods of the stage. There is evidence that cultivation of some of the plants domesticated in eastern North America became an important subsistence pursuit in the Ohio Valley (Wymer 1996) and other areas of the East (Yarnell 1993). While less numerous and spectacular than those of the Ohio Valley, Middle Woodland platform mounds and linear earthen embankments (Keith 2010; Knight 2001; Mainfort 1989), piled-stone structures (i.e., mounds, effigies, and linear "wall-like" structures) (Faulkner 1996; Holstein et al. 1995; Jefferies and Fish 1978; Keith 2010), and burial mounds (Cole 1981; Jefferies 1976; Jenkins and Krause 1986; Walthall 1980; Waring 1945; Wimberly and Tourtelot 1941) are fairly widespread across various landscapes in the Southeast. Woodland mound burials sometimes were accompanied by nonlocal materials such as marine shell, copper, galena, and mica, to name but a few. During the Late Woodland, there was an obvious reduction in both earthworks and distributions of exotic materials in some areas of the Southeast, though this pattern does not hold throughout the region (Anderson and Mainfort 2002:15-19). A major technological change is signaled by the introduction of bow-and-arrow technology into the region during the Late Woodland (Blitz 1988).

The Middle Woodland Stage in northeast Mississippi is generally defined by the Miller I and II sequences from archaeological work primarily conducted in the Tombigbee River drainage for the Tenn-Tom Waterway (Jenkins 1979). Miller sequences are defined by ceramic diagnostics, sand-tempered forms representing the earlier Miller I phase and grog-tempered defining the later division III (Johnson 1988). Miller I is characterized by the presence of sand tempered fabric marked (Saltillo Fabric Marked), cordmarked (Furrs Cordmarked), and plain (Baldwin Plain) ceramics. Furrs Cord marked pottery generally increases and Saltillo Fabric Marked pottery decreases to almost absence in the Miller II phase. Sedentary settlement patterns become more dominant in the Middle Woodland, which is evident by large round-to-oval postmold patterns excavated at the Bynum site (Bohannon 1972). The Bynum site also yielded non-local materials, including copper spools, some of which were filled with galena, rolled sheet copper objects, galena, greenstone celts, and Busycon shell fragments.

The Late Woodland Stage corresponds to Miller III in northeast Mississippi. Grog tempered ceramics dominate with Baytown Plain and Mulberry Creek Cordmarked varieties, and Fabric Marked, Wheeler Check Stamped, and Alligator Incised occurring in smaller quantities. Lithic technologies are primarily represented by locally available chert sources that were commonly heat treated. Small triangular projectile or arrow points, such as Madison and Hamilton, have been recovered from Miller III contexts. These triangular diagnostics have been attributed to large fauna subsistence, such as deer (Jackson and Scott 2002). All three Miller phases were represented by that sites that were excavated by TVAR along Chickasawhay Creek between 2012 and 2013 (Little et al. 2016:385).

Mississippian

Many, if not most, current researchers concur that populations associated with Mississippian stage manifestations throughout southeastern North America were set aside from earlier ones by the development of institutionalized social inequality (Smith 1990). Maize agriculture appears to have been an important subsistence component for most Mississippian societies (Scarry 1993). Pole-framed public and domestic structures were often rectangular (sometimes circular) and sometimes employed wattle-and-daub wall construction. A central plaza surrounded by mounds and public and domestic structures characterized some of the larger Mississippian communities (Lewis and Stout 1998). Some Mississippian sites also were fortified with palisade walls and bastions and sometimes defensive ditches or moats, as well (e.g., Knight and Steponaitis 1998; Larson 1972; Schroedl 1998). Regional settlement studies typically reflect a site hierarchy consisting of mound centers and outlying nonmound sites (e.g., Anderson 1994; Blitz and Lorenz 2006; Hally 1993; Steponaitis 1978). Specially crafted artifacts often made of extralocal materials furnish evidence of widespread interregional exchange (Brown 2004). The existence of far-reaching Mississippian alliances in the interior Southeast was documented at the time of initial European contact. The Lyon's bluff site located in northeast Mississippi is characteristic of the Mississippian stage manifestations identified at Moundville in western Alabama. Moundville ceramics, such as Mississippi Plain, Bell Plain, Moundville Incised, Cartage Incised, and Moundville Engraved, have been found at Lyon's Bluff (Atkinson 1986).

Historic Native American

Although earlier there were sporadic European contacts with Native Americans along the Gulf and Atlantic coasts and failed colonial attempts by both the Spanish and French, the Spanish expedition of Hernando de Soto (1539-1543) represents the earliest recorded European contact with native populations in the interior of southeastern North America. In the 1560s, the Tristan de Luna and Juan Pardo expeditions revisited some of the areas in the interior traversed by the earlier Soto entrada. By almost all archaeological accounts, widespread and extensive depopulation followed in the wake of the sixteenth-century Spanish incursions into the Southeast, and there was a concomitant disintegration of Mississippian polities accompanied by migrations and coalescence of native groups throughout much of the region (Hoffman 1993; Jeter 2002; Knight 1994; Little 2008; Morse and Morse 1983:313-315; Regnier 2014; Smith 1987, 2006). Hudson and Tesser (1994) pointed out that these years have been largely neglected by historians and referred to them as the forgotten centuries. Robbie Ethridge (2009) has subsequently illuminated some of these shadowy times with her conception of the Mississippian shatter zone, i.e., a region of widespread social and political transformations of native groups, presumably related to internecine warfare and slave trade with Europeans.

In the late seventeenth and early eighteenth centuries, the British, French, and Spaniards competed for control over broad regions of the Southeast. Increasing participation in nascent European capitalist markets through deerskin and peltry trade contributed to extensive transformations of native groups during the colonial era (Braund 1993; Waselkov 1988; White 1983), and by the mid-1800s, the United States government had exiled most of the remaining Southeastern groups to Oklahoma.

Alcorn County History

Located in northeastern Mississippi, Alcorn County is bordered by the state of Tennessee to the north, Tishomingo County to the east, Prentiss County to the south, and Tippah County to the west. Named for Governor James L. Alcorn, Alcorn County was established on April 15, 1870, and formed from portions of Tippah and Tishomingo Counties. The county encompasses 402 square miles. Corinth was established as the county seat in 1853 and remains so today (MSGenWeb 2015). From 1798 to 1812, the population of the Mississippi Territory grew at a steady, yet moderate pace, however in the years following the War of 1812, as historian Robert V. Haynes explains, "[the] Territory experienced a population explosion or 'fever' as the phenomenon was then called. The period from 1800 to 1819 became known as the 'The Great Migration,' when thousands of pioneers crossed the mountains and settled the Old Southwest and Northwest" (Haynes 2010:133). Despite laws that prohibited the settlement of Chickasaw and Choctaw lands, the westward progression of Euro-American migration led to the taking of land by squatters and the establishment of businesses along the Natchez Trace (Figures 3.1-3.2) (Haynes 2010:203).

The Mississippi Territory was established by Congress on April 7, 1798, and on December 10, 1817, Mississippi became the twentieth state admitted to the Union (Hoseman 2012:743). At that time, immigrants to Mississippi could only legally settle in three areas: on a strip of land in the southern part of the state, east of the Tombigbee along the Alabama line, or in the Natchez District (Clark and

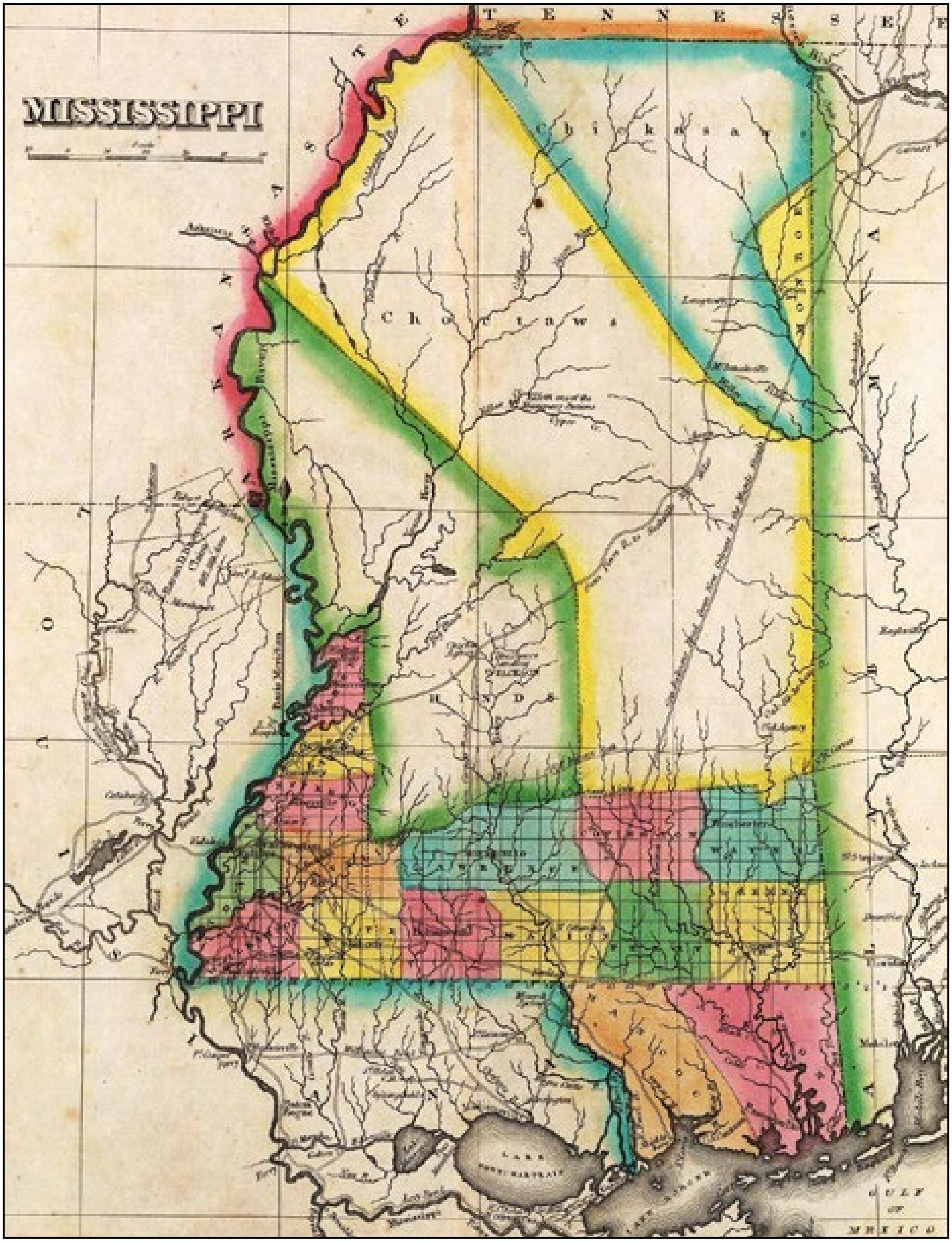

Figure 3.1. 1822 map of Mississippi showing native-held lands and early counties.

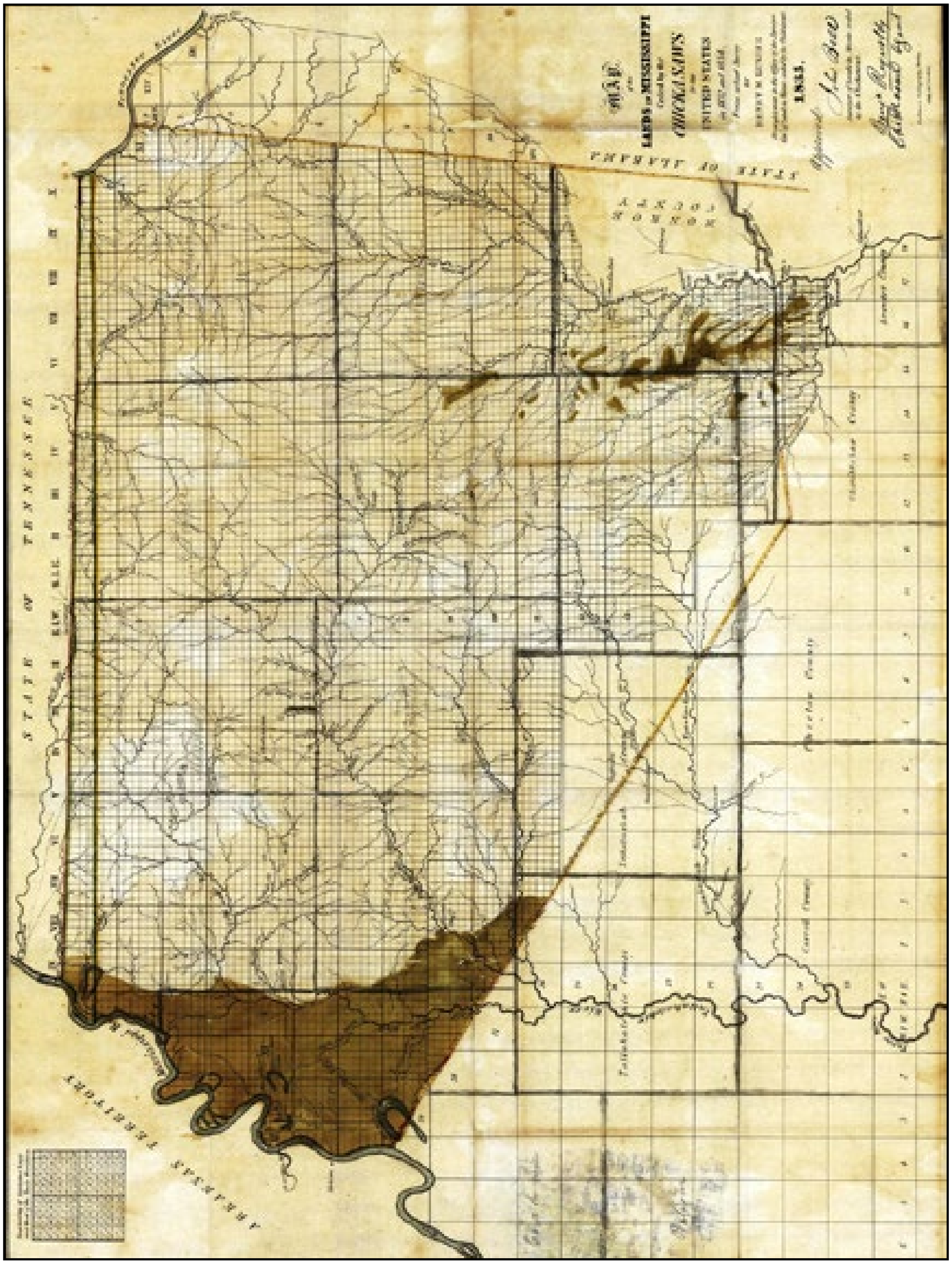

Figure 3.2. 1835 map of lands ceded by the Chickasaws to the United States.

Guice 1989:165). Approximately 75,500 people lived in Mississippi by 1820, and 44 percent of the population was enslaved (Westley 2005:67). In northeastern Mississippi, an influx of traders and settlers increased the white population in the area to between 4,000 and 5,000 people. Tensions escalated between the Chickasaws and the settlers, primarily due to land disputes caused by the setters' use of Chickasaw land for cultivation and livestock pasturing. The federal government cited these tensions during treaty negotiations with the Chickasaw, and declared immediate removal to be in their best interest (Franks 2009). One of Andrew Jackson's campaign promises from the presidential election of 1828 was the removal of the Southeastern tribes to lands west of the Mississippi River. True to his word, following his election, President Jackson appointed two commissioners to expedite the process and provided them with the simple instructions that they "fail not to make a treaty" for the remaining Choctaw lands in Mississippi (Elliott and Barnes 1996:13; Halbert 1902:375).

The majority of the area's early settlers arrived from the Carolinas, Georgia, and Alabama. Early settlements in the county included Corinth, Danville, Glendale, Kossuth, and Rienzi (Lowry and McCardle 1891:439). By 1840, the population of Tippah and Tishomingo Counties included 16,125 residents (U.S. Census Bureau 1872:42-43). The Hatchie and Tuscumbia rivers and their tributaries allowed for the early movement of goods to market. Corinth, located at the intersection of the Memphis & Charleston and Mobile & Ohio railroads, was founded in 1853 and grew into a major commercial hub due to ready rail access to Memphis (Rowland 1907:61; 565-566).

Lying within the Northeastern Prairie and Limestone Formation regions, the area features timbered, gently rolling topography with river and creek bottom lands that provided an excellent environment for agriculture and the raising of livestock (Rowland 1907:61). The typical antebellum Tishomingo or Tippah County farmer raised cattle, horses, sheep, and swine, as well as corn, oats, potatoes, tobacco, and cotton (DeBow 1853:456-460). Market products such as wool, flax, butter, and cheese supplemented a farmer's income. The county's location within the soil-rich region of north Mississippi lent itself to large plantations commonly found in the Lower South. As a result, farms were generally large-sized operations. In 1850, the counties contained 162,220 improved acres of farmland (DeBow 1853:456). By 1860, improved acreage had surged to 248,805 acres (Kennedy 1864:84).

The surge of tobacco and cotton as major cash crops drove the establishment of larger plantations throughout the region, often depending on enslaved Africans and African-descended peoples to provide labor for the county's farmers. Although a number of white families in the county did not own slaves, slavery was seen as part of the accepted social order and as the necessary means for producing wealth and marking social achievement. Slaves comprised approximately 19 percent (or 6,889 individuals) of Tippah and Tishomingo Counties' total population of 36,231 in 1850. By 1860, slaves constituted 24.1 percent of the counties' total population. During the same period, the number of 'free colored' individuals in the area was low; only seven persons were counted in 1850 and 22 in 1860 (United States Census Bureau 1872:41-43).

The onset of the Civil War brought great upheaval and loss to the region and county residents. On January 9, 1861, Mississippi became the second Southern state to secede from the Union, and Tippah and Tishomingo Counties raised 15 Confederate regiments for the Mississippi Infantry, Mississippi Cavalry, and Mississippi Partisans (FamilySearch.org 2016a; 2016b). Major battles in Tishomingo

County took place in Corinth (April 29-June 10, 1862 and October 3, 1862) and Iuka (September 19, 1862) (Figures 3.3-3.4). Corinth's pivotal location at the rail junction made it an important supply center for the Confederacy. The Siege of Corinth began following the Union victory at Shiloh. Under the command of Major General Henry Halleck, Union forces began their advance on the city and by May 25, 1862, were close enough to begin their bombardment. The Confederate troops, led by General Pierre G. T. Beauregard, fled Corinth for Tupelo (Rowland 1907:153-154). The Union forces occupied Corinth through July of that year, until a large contingency marched toward Chattanooga. Troops remaining behind in Corinth were commanded by General William S. Rosecrans (Rowland 1907:153-154).

In an attempt to prevent Rosecrans from encroaching into Middle Tennessee, the Confederate Army of the West, led by General Sterling Price, marched into Iuka on September 14, 1862. The battle resulted in the deaths of 86 Confederate and 790 Union men (Rowland 1907:949-950). Remaining soldiers with the Army of the West retreated and rejoined General Earl Van Dorn for an assault on Corinth. The second battle in Corinth took place on October 3, 1862, when General Van Dorn led the Army of West Tennessee in an attack on General Rosecrans' Union troops. After three separate assaults, the Union drove back the Confederates, and in the process, captured 2,268 rebel prisoners. The battle ultimately resulted in 505 casualties, 2,150 wounded, and 2,183 missing for the Confederacy and 355 casualties, 1,841 wounded, and 324 missing for the Union (Rowland 1907:567-570).

As with most of the rural South, northeastern Mississippi had grown as an agricultural region, suffered during the Civil War and Reconstruction, and reclaimed its agrarian economy after the war. A sharecropping economy arose in the postbellum period, lasting from about 1870 to the 1930s. The end of the war also brought about the reorganization of northern Mississippi counties, resulting in the formation of Alcorn County in April 1870. At that time, the county's population included 10,431 individuals, 26.5 percent of whom were described as 'free colored' (U.S. Census Bureau 1872:42). Corinth was quickly established as the county seat and was originally named Cross City. Large plantations in the region dwindled, and the amount of improved acreage in Alcorn County included only 41,300 acres in 1870 (U.S. Census Bureau 1872:184). Farmers primarily raised swine, sheep, and cattle, and cultivated corn, wheat, and potatoes. Butter, milk, wool, and cane molasses were staple farm-to-market products for the Alcorn County farmer (U.S. Census Bureau 1872:184-187).

In the late nineteenth century, Alcorn County's economy expanded to include large-scale commercial and industrial enterprises, which were primarily centered around Corinth (Figure 3.5). As one of the most important manufacturing centers in Mississippi, Corinth housed clothing, iron, and lumber mills, as well as a number of cotton gins. The city became a center for finance, with the opening of the Tishomingo Savings Institution, the Bank of Corinth, and the Citizens Savings Bank (Rowland 1907:566). The early twentieth century saw the construction of an improved road network and the development of municipal infrastructure, particularly in Corinth. By the early 1900s, the city was equipped with a sewage system, electric lighting, and a water works system (Rowland 1907:566).

While Alcorn County has remained largely agricultural throughout its history, the twentieth and early twenty-first centuries saw an increase in large-scale manufacturers. Alcorn County's workforce is largely employed within the manufacture of paper and fiber products, industrial equipment, and vinyl products, as well as construction, health-care services, and machining. Major corporations including

Figure 3.3. 1862 map of Confederate and Union entrenchments in the vicinty of Corinth, from May to June.

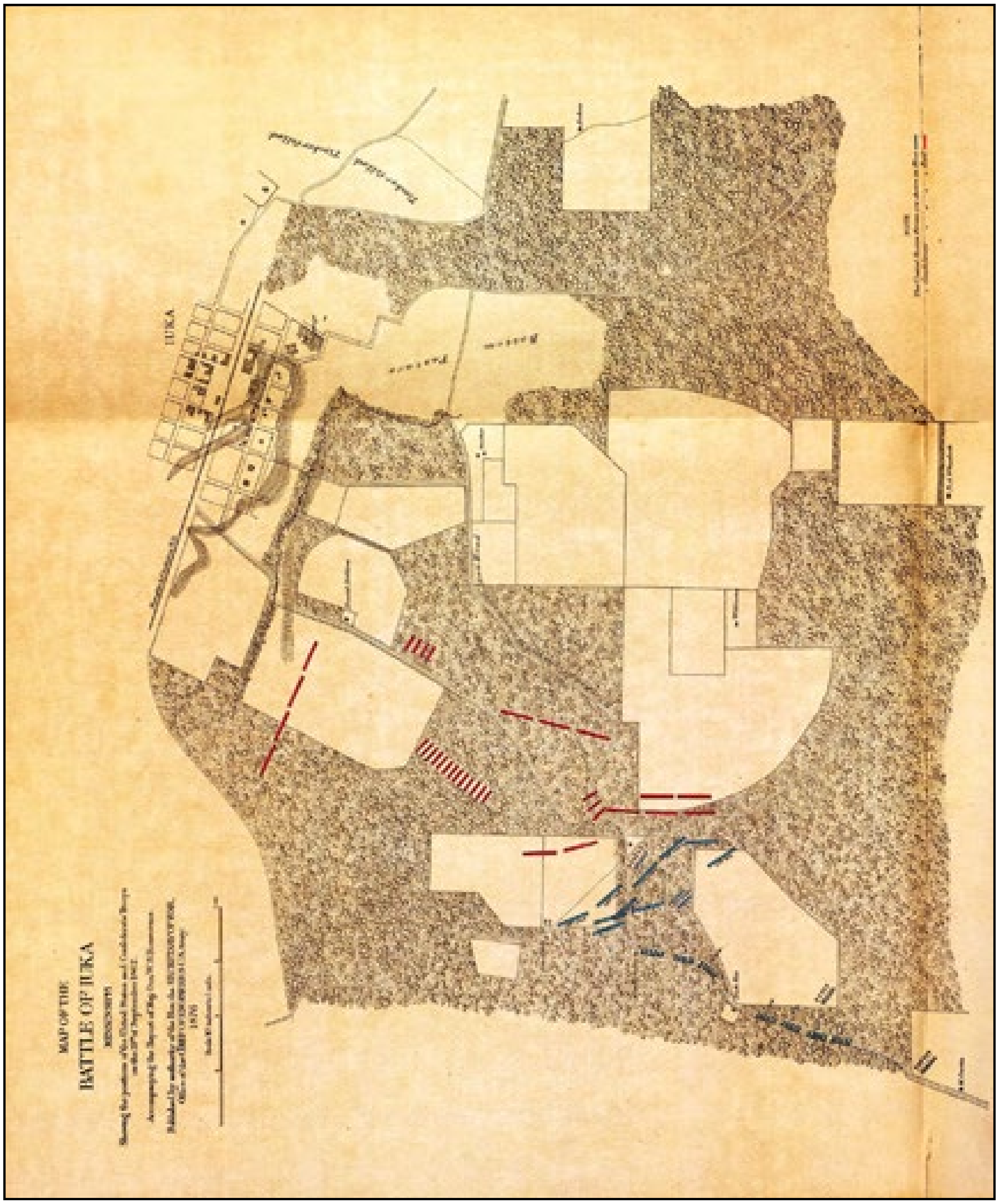

Figure 3.4. 1876 map of the Battle of Iuka.

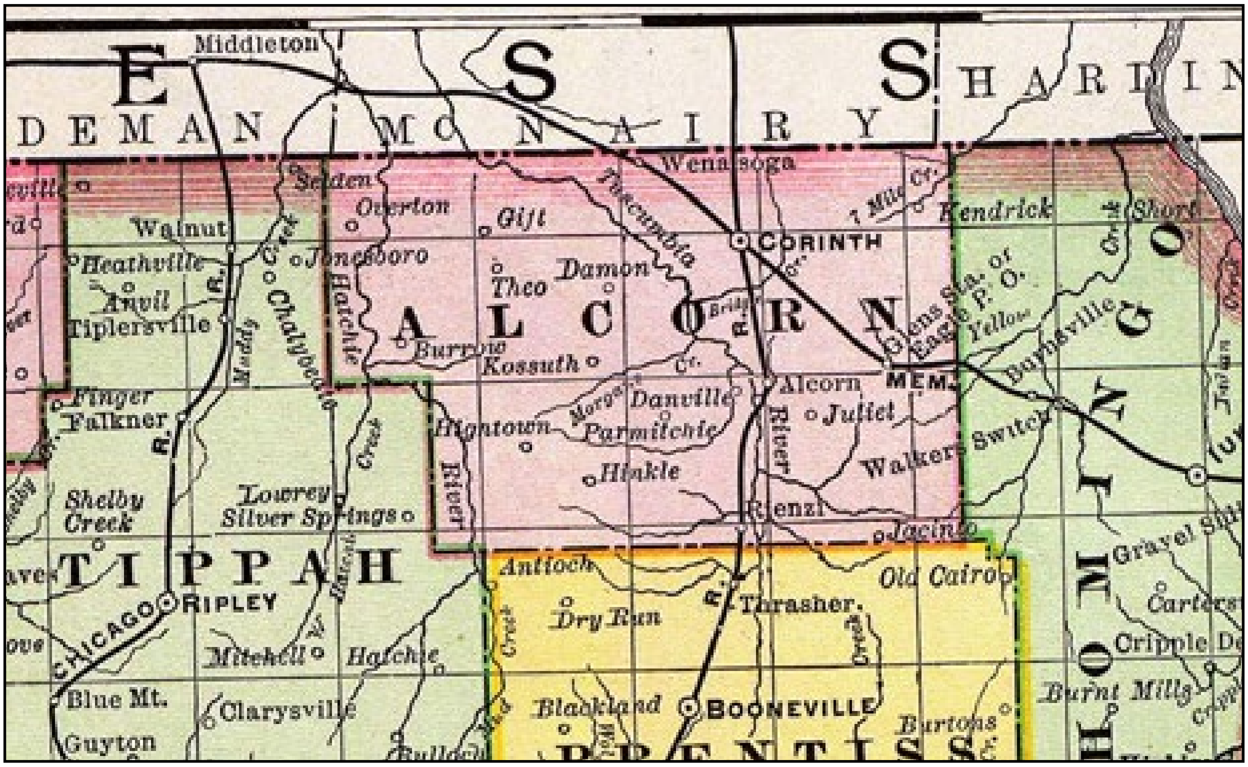

Figure 3.5. 1897 Rand McNally map of Alcorn County.

Caterpillar, Inc., Avectus Healthcare Solutions, Kimberly-Clark Corporation, and Corinthian, Inc. currently maintain office, manufacturing, or distribution centers in Alcorn County. The Magnolia Regional Health Center and Northeast Mississippi Community College are also major employers (The Alliance 2016). As of 2012, 505 farms remained in Alcorn County, encompassing 93,578 acres. The average farm size is 185 acres. Alcorn County farms primarily derive their income from soybeans, hay, corn, and cattle (United States Census Bureau 2012a). The county's population in 2010 consisted of 37,057 persons (U.S. Census Bureau 2016a).

Marshall County History

Located in northern Mississippi, Marshall County is bordered by the state of Tennessee to the north, Benton County to the east, Lafayette to the south, and Desoto and Tate Counties to the west. Marshall County comprises 706 square miles with a total population of 37,144 (United States Census Bureau 2015). Named for Supreme Court Chief Justice John Marshall, Marshall County was established on February 9, 1836 from the Chickasaw cession of 1832 (see Figures 3.1-3.2). At the time of its formation, Marshall County encompassed 828 square miles, including portions of present-day Benton and Tate Counties (Rowland 1907:172). Holly Springs was established as the county seat in 1837 and remains so today.

From 1798 to 1812, the population of the Mississippi Territory grew at a steady, yet moderate pace, however in the years following the War of 1812, as historian Robert V. Haynes explains, "[the] Territory experienced a population explosion or 'fever' as the phenomenon was then called. The period from 1800 to 1819 became known as the 'The Great Migration,' when thousands of pioneers crossed the mountains and settled the Old Southwest and Northwest" (Haynes 2010:133). Despite laws that prohibited the settlement of Chickasaw and Choctaw lands, the westward progression of Euro-American migration led to the taking of land by squatters and the establishment of businesses along the Natchez Trace (Haynes 2010:203).

The Mississippi Territory was established by Congress on April 7, 1798, and on December 10, 1817, Mississippi became the twentieth state admitted to the Union (Hoseman 2012:743). At that time, immigrants to Mississippi could only legally settle in three areas: on a strip of land in the southern part of the state, east of the Tombigbee along the Alabama line, or in the Natchez District (Clark and Guice 1989:165). Approximately 75,500 people lived in Mississippi by 1820, and 44 percent of the population was enslaved (Westley 2005:67). In northeastern Mississippi, an influx of traders and settlers increased the white population in the area to between 4,000 and 5,000 people. Tensions escalated between the Chickasaws and the settlers, primarily due to land disputes caused by the setters' use of Chickasaw land for cultivation and livestock pasturing. The federal government cited these tensions during treaty negotiations with the Chickasaw, and declared immediate removal to be in their best interest (Franks 2009). One of Andrew Jackson's campaign promises from the presidential election of 1828 was the removal of the southeastern tribes to lands west of the Mississippi River. True to his word, following his election, President Jackson appointed two commissioners to expedite the process and provided them with the simple instructions that they "fail not to make a treaty" for the remaining Choctaw lands in Mississippi (Elliott and Barnes 1996:13; Halbert 1902:375).

The majority of Marshall County's early settlers arrived from the Carolinas, Georgia, and Alabama. By 1840, the county's population included 17,500 residents and four early settlements: Holly Springs, Hudsonville, Tallaloosa, and Waterford (Rowland 1907:173). Holly Springs, located at the intersection of the Illinois Central and the Kansas City, Memphis, and Birmingham rail lines, grew into the county's major commercial hub due to ready rail access and proximity to markets in Memphis. The community was home to a dairy, several factories, and numerous pottery works. In addition, local residents engaged in market gardening (Rowland 1907:173). An early center for education in the region, Holly Springs was the home of the Holly Springs Female Institute, Holly Springs Literary Institution (later the University of Holly Springs), Mississippi Synodical College, North Mississippi Experiment Station, and Rust University. The town's reputation for high-quality education attracted wealthy families from around the region (Rowland 1907:874).

The typical antebellum Marshall County farmer raised corn, cotton, rice, tobacco, sheep, cattle, horses, and hogs (DeBow 1853:456-458). In 1850, Marshall County was the highest producer of cotton and butter, and was the third-highest producer of tobacco in the state. The county's location within the soil-rich region of north Mississippi lent itself to large plantations commonly found in the Lower South. As a result, farms were generally large-sized operations. In 1850, the county contained 180,980 improved acres of farmland, ranking it first in the state.

The surge of tobacco and cotton as major cash crops drove the establishment of larger plantations throughout the region, often depending on enslaved Africans and African-descended peoples to provide labor for the county's farmers. Although a number of white families in the county did not own slaves, slavery was seen as part of the accepted social order and as the necessary means for producing wealth and marking social achievement. Enslaved individuals comprised approximately 51.9 percent of Marshall County's population in 1850. By 1860, slaves constituted 60.5 percent of the county's total population (United States Census Bureau 1872:41-42). During the same period, the number of free colored individuals in the county was extremely low; only a single person was counted in 1850 and eight individuals in 1860.

The onset of the Civil War brought great upheaval and loss to the region and county residents. On January 9, 1861, Mississippi became the second Southern state to secede from the Union, and Marshall County raised 11 companies for the Confederate army and cavalry (FamilySearch.org 2015). Holly Springs became occupied by General Ulysses S. Grant and his army during their 1861-1862 campaign towards Vicksburg, when Union forces established an important supply and munitions depot in the community. During this time, Grant and his wife resided at Walter Place (also known as Airliewood), in Holly Springs (Semmes and Nolen 2013:2). As described by historians Ryan Semmes and David Nolen, "Because of the supplies for Grant's advancing forces stored at Holly Springs, the town became a perfect target for Confederate troops intent on stopping –or at least slowing down – the Union campaign against Vicksburg" (2013:3). A December 1862 raid on the city by Confederate General Earl Van Dorn, resulted in the seizure of Union supplies and the burning of much of Holly Springs. Subsequent battles took place in the city on May 24 and August 27-28 of 1864 (Rowland 1907; Semmes and Nolen 2013).

Following the Civil War, large plantations dwindled, and the amount of improved acreage in Marshall County fell by 12 percent by 1870 (Kennedy 1864; U.S. Census Bureau 1872). Animal husbandry in the region continued to focus on cattle, hogs, and sheep. Tobacco production in Marshall County increased by 366 percent, and the county was the fourth-highest producer of tobacco in the state in 1870. At the same time, cotton production fell by 62.8 percent (U.S. Census Bureau 1872:184-186). As with most of the rural South, Marshall County had grown as an agricultural region, suffered during the Civil War and Reconstruction, and later reclaimed its agrarian economy, particularly through cotton, corn, oats, sweet potatoes and wheat (U.S. Census Bureau 1872:184-186).

A sharecropping economy arose during the postbellum period, lasting from about 1870 to the 1930s. The early twentieth century saw the construction of an improved road network and the development of municipal infrastructure, particularly in Holly Springs. By the turn of the century, the city was equipped with a sewage system, electric lighting, and a water works system (Rowland 1907:874). The early twentieth century also saw a diversification of economic activities in Marshall County including "two potteries, a large cotton-seed oil mill, a cotton compress, two gins and grist mills, and ice factory and bottling works, a steam laundry, extensive marble works, a brick plant, four hotels and three livery barns (Rowland 1907:876). Three banking institutions managed the county's finances: the Bank of Holly Springs, the Merchants and Farmers Bank, and the Peoples Bank.

As of 2012, 573 farms remained in Marshall County focusing on soybean, hay, corn, and cattle production. The average farm size is 355 acres (United States Census Bureau 2012b). While Marshall

County remained largely agricultural throughout history, the twentieth and early twenty-first centuries saw an increase in large-scale manufacturers such as Ashley Furniture Industries, Thomas and Betts Corporation, and Volvo Group (NMIDA 2015). The county's population in 2010 consisted of 37,144 persons (U.S. Census Bureau 2016b).

CHAPTER 4. ARCHITECTURAL SURVEY

In April and May 2016, TVAR conducted a survey of the architectural APEs of the proposed Corinth and Holly Springs substation expansion projects. As part of the architectural survey, TVAR revisited 17 previously recorded architectural resources and documented 19 newly recorded architectural resources within the architectural APEs. Based on the results of its architectural survey, it is the opinion of TVAR that the proposed undertaking will have no effect on historic architectural resources. TVAR recommends no additional investigation of above-ground resources in connection with the proposed project. The following chapter provides a background literature and records review of information relevant to the project area, a discussion of the field methods employed during the survey, descriptions of the architectural resources identified, and recommendations regarding their NRHP eligibility.

Architectural Survey Methods

The architectural survey was completed using the guidelines contained in National Register Bulletin 24, *Guidelines for Local Surveys: A Basis for Preservation Planning* (Derry et al. 1985) and the requirements provided by MDAH's *Survey Inclusion Guidelines and Survey Standards* (MDAH 2008 and 2011). The purpose of the architectural survey was to identify properties within the project APEs that are listed, or eligible for listing, in the NRHP. Federal regulations define an APE as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist" (CFR 2013a). The architectural APEs for this study consisted of each subject parcel, in addition to any areas visually connected to them via viewsheds to and from the project areas, located within a 0.8 km (0.5 mi) survey radius. Areas within the survey radius that were not within view of the subject parcel due to obstructed lines-of-sight (e.g., terrain, vegetation, and/or modern built environments) were not considered part of the architectural APE.

TVAR's architectural survey consisted of driving all accessible roads within the architectural APEs in order to identify architectural resources that appear to be 50 years old or older and visually connected to the project area. All architectural resources that met the age criterion and that fell within visual line of sight to the project area were plotted on the applicable USGS quadrangle map and photographed with a digital camera. The construction dates of the buildings discussed in this study were derived from reviewing United States Geological Survey (USGS) topographical maps of the survey radius found online at the USGS Historical Topographical Map Explorer, and through stylistic evidence displayed by each documented architectural resource. Survey information maintained throughout the course of the inventory included field notes, sketch maps, and photographs. For the purposes of this report, TVAR has identified newly recorded properties with the prefix "IS" to denote an "Inventoried Structure." For properties that had not been previously documented, a Mississippi Historic Resources Inventory form was completed (Appendix A).

To aid in the architectural field assessment, TVAR performed a viewshed analysis of the 0.8 km (0.5 mi) survey radius surrounding the proposed project areas using the Viewshed tool in the Spatial

Analyst extension in ArcGIS 10.3. The assessment used the USGS National Elevation Dataset 10 m (NED10) digital elevation model (DEM), land use classification data from the USDA Cropland Data Layer (CDL), and an estimation of the average forest canopy height for the area from the NASA Forest Canopy Height dataset. TVAR processed the CDL land use classification data to reassign all forested classes to the average forest canopy height of 19 m (62 ft) and all other land use classes to a height of zero. This dataset was then added to the DEM to produce a digital surface model (DSM), accounting for both elevation and forest canopy height. Finally, points along the proposed substation boundary served as the observer points and were assigned a height of 30.5 m (100 ft) to account for the height of the substation. Using these inputs, the Viewshed tool analyzed each cell of the elevation model to assess its visibility from the observer points (Figure 4.1-4.2).

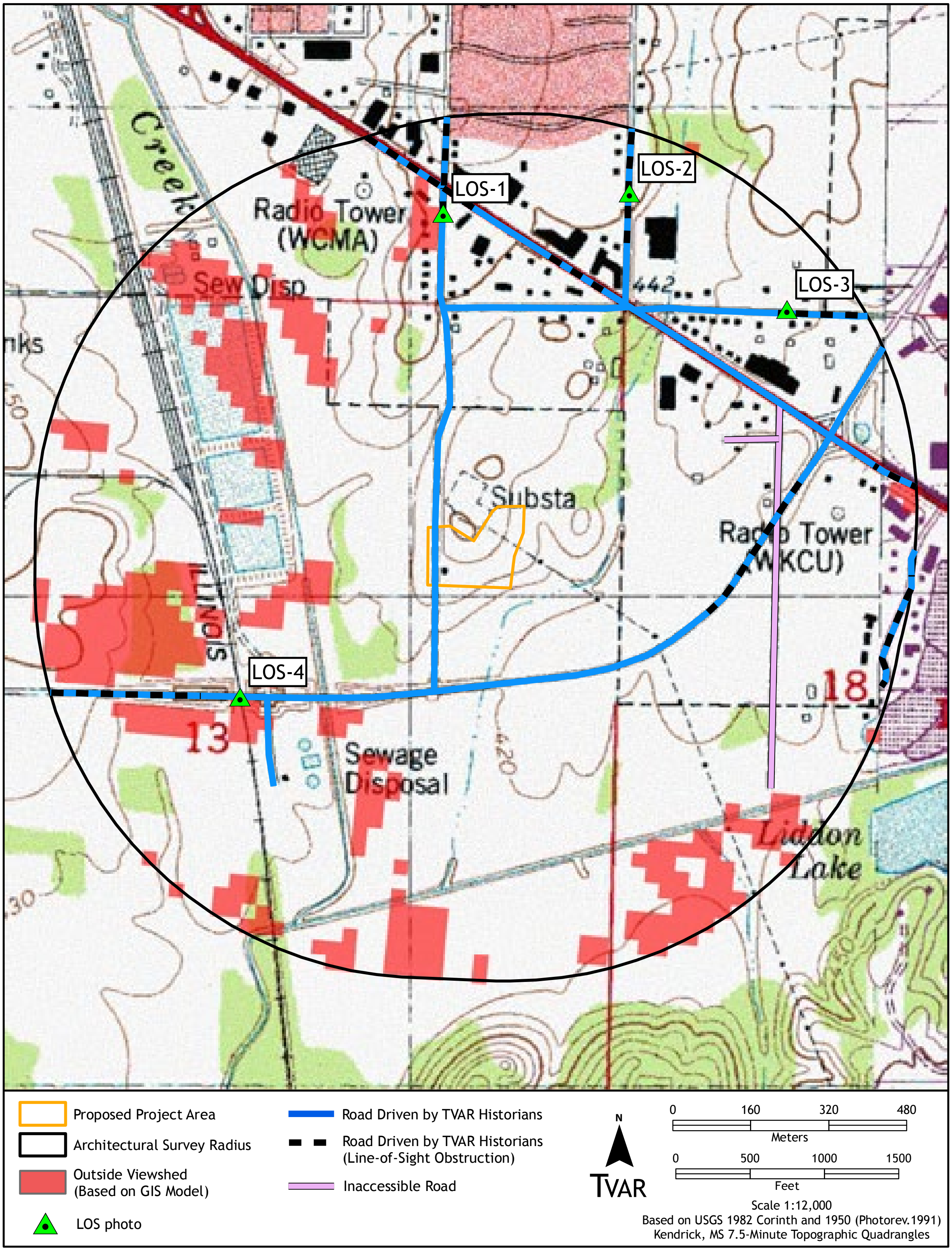

Figure 4.1. Excerpts of the USGS Corinth and Kendrick, MS quadrangles with viewshed analysis results, roads driven by TVAR historians, and locations of line-of-sight photos in the Corinth survey radius.

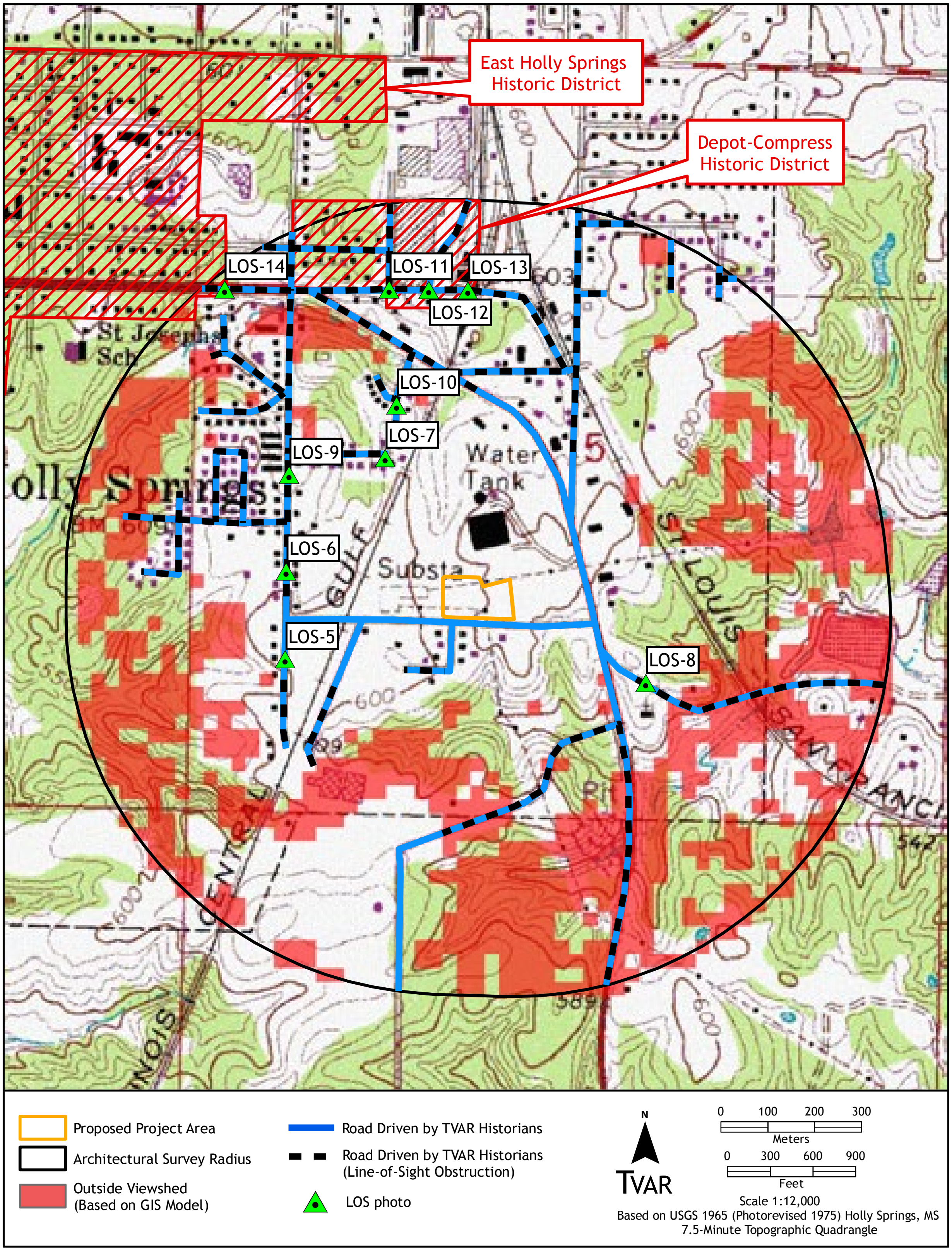

Figure 4.2. Excerpt of the USGS Holly Springs, MS quadrangle with viewshed analysis results, roads driven by TVAR historians, and locations of line-of-sight photos in the Holly Springs survey radius.

National Register of Historic Places Eligibility Criteria

Sufficient data were compiled to make recommendations regarding eligibility for listing on the NRHP for each architectural resource addressed during this study. According to 36 CFR §60.4, cultural resources eligible for listing on the NRHP are defined as buildings, structures, objects, sites, and districts that have "integrity," and that meet one or more of the criteria outlined below (CFR 2013b; NRHP 2002).

- Criterion A (Event). Association with one or more events that have made a significant contribution to the broad patterns of national, state, or local history.
- Criterion B (Person). Association with the lives of persons significant in the past.
- Criterion C (Design/Construction). Embodiment of distinctive characteristics of a type, period, or method of construction; or representation of the work of a master; or possession of high artistic values; or representation of a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D (Information Potential). Properties that yield, or are likely to yield, information important in prehistory or history. Criterion D is most often (but not exclusively) associated with archaeological resources. To be considered eligible under Criterion D, sites must be associated with specific or general patterns in the development of the region. Therefore, sites become significant when they are seen within the larger framework of local or regional development.

As a general rule, the criteria exclude birthplaces and graves of historical figures, cemeteries, religious properties, moved buildings, reconstructions, commemorative properties, and properties less than 50 years old. However, per the regulations set forth in 36 CFR §60.4 and addressed in National Register Bulletin 15, *How to Apply the National Register Criteria for Evaluation*, resources that fall under these categories may be eligible for the NRHP if they meet Criteria Considerations A-F (NRHP 2002). "Integrity" is perhaps the paramount qualification of NRHP eligibility and can be related to location, design, setting, materials, workmanship, feeling, and/or association (NRHP 2002).

Architectural Background Literature and Records Search

Prior to initiating fieldwork, TVAR reviewed the MDAH's online Historic Resources Inventory Database (HRID) for an inventory of Alcorn and Marshall County architectural resources that have been previously recorded and those resources that are listed on or that have been determined eligible for inclusion in the NRHP. Based on the information provided in the HRID, 15 previously recorded architectural resources (003-COR-1249, 003-COR-1250, 003-COR-1251, 003-COR-1252, 003-COR-1253, 003-COR-1254, 003-COR-1255, 003-COR-1256, 003-COR-1257, 003-COR-1258, 003-COR-

1259, 003-COR-1260, 003-COR-1261, 003-COR-1262, and 003-COR-1263) are located within the architectural survey radius of the proposed TVA Corinth substation expansion project area. According to HRID records, none of these properties have been officially evaluated for inclusion on the NRHP by either the MDAH or a federal agency.

For the proposed TVA Holly Springs substation project, HRID records indicate that portions of two previously documented architectural resources, the NRHP-listed Depot-Compress Historic District and the NRHP-listed East Holly Springs Historic District, are located within the architectural survey radius.

Architectural Survey Results

The architectural survey of the APEs was conducted by TVAR personnel on April 7 and May 4 and 6, 2016 under the direction of Sr. Preservation Planner Ted Karpynec and Preservation Planner Meghan Weaver. As this report addresses the planned expansion of two separate substations, the results of the architectural survey are presented accordingly.

TVA Corinth Substation

TVAR's architectural survey of the proposed expansion of the TVA Corinth substation revisited 15 previously documented architectural resources (003-COR-1249, 003-COR-1250, 003-COR-1251, 003-COR-1252, 003-COR-1253, 003-COR-1254, 003-COR-1255, 003-COR-1256, 003-COR-1257, 003-COR-1258, 003-COR-1259, 003-COR-1260, 003-COR-1261, 003-COR-1262, and 003-COR-1263) that are located within the architectural survey radius. Based on the results of its survey, it is the opinion of TVAR that previously recorded properties 003-COR-1251, 003-COR-1252, 003-COR-1253, 003-COR-1254, 003-COR-1255, 003-COR-1256, 003-COR-1257, 003-COR-1258, 003-COR-1259, 003-COR-1260, 003-COR-1261, and 003-COR-1262 are not eligible for the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage resulting from neglect. TVAR's survey found that previously recorded architectural resources 003-COR-1249, 003-COR-1250, and 003-COR-1263 are located outside the viewshed to the project area (see Figure 4.1; Figures 4.3-4.19).

Additionally, TVAR's architectural survey resulted in the identification of eight previously undocumented architectural resources, IS-1-IS-8, which fall within the architectural APE of the proposed project area. Based on the results of its survey, it is the opinion of TVAR that properties IS-1-IS-8 are not eligible for the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations. Based on the results of the architectural survey, it is the opinion of TVAR that no historic properties will be affected by the proposed expansion of the TVA Corinth substation. TVAR recommends no additional investigation of above-ground resources in connection with the proposed project.

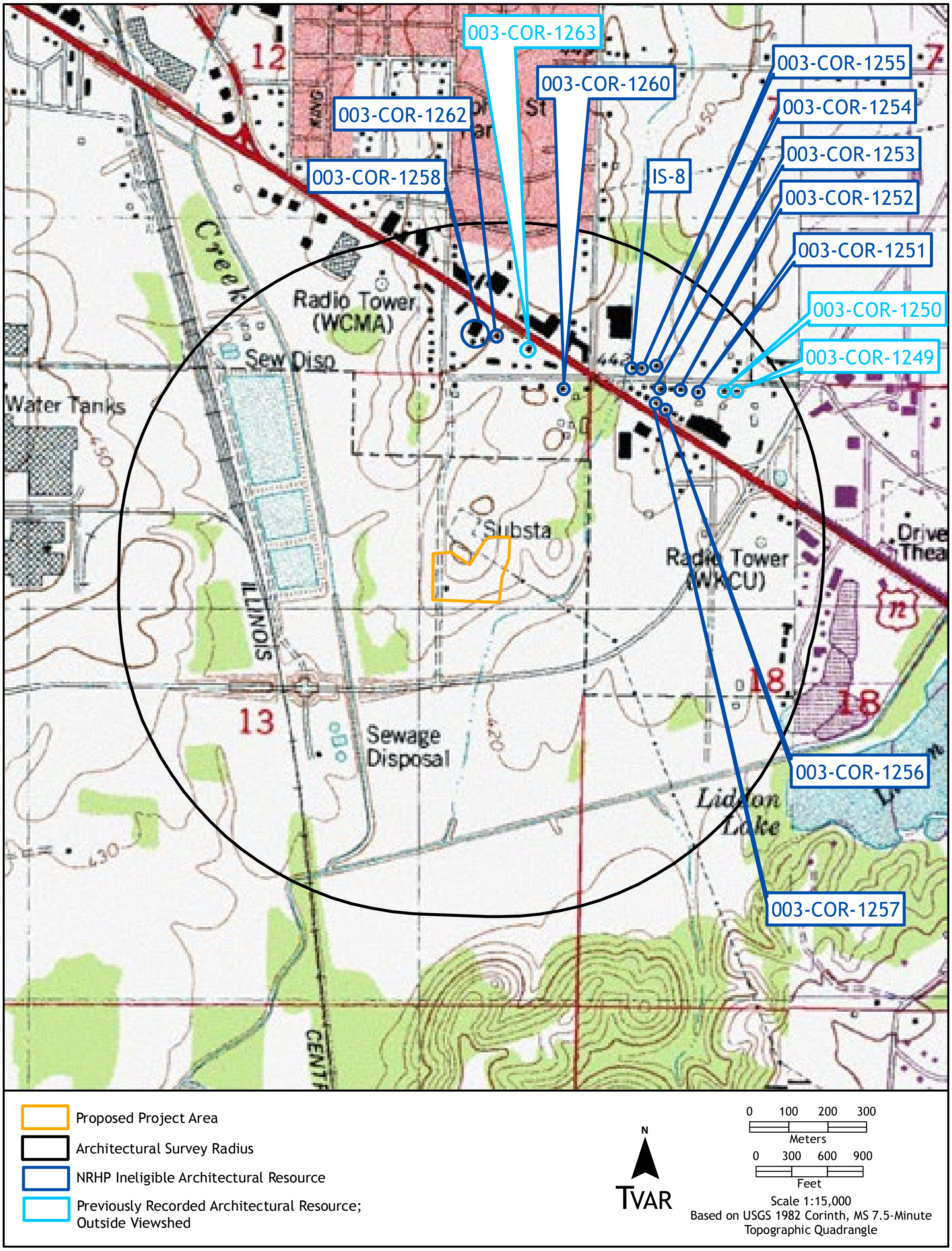

Figure 4.3. Map 1 of 2 showing the proposed project area, survey radius, and location of previously and newly recorded architectural resources.

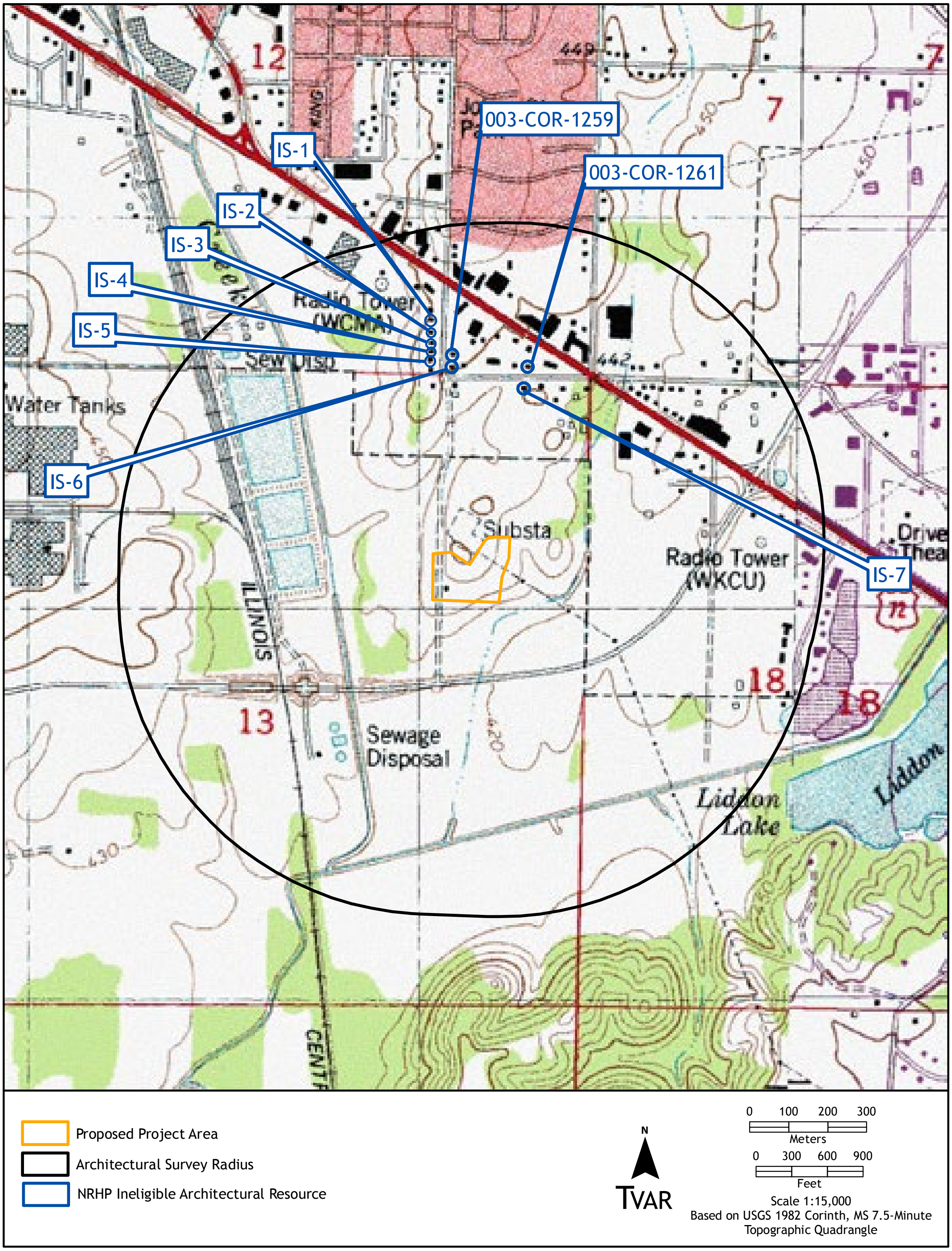

Figure 4.4. Map 2 of 2 showing the proposed project area, survey radius, and location of previously and newly recorded architectural resources.

Figure 4.5. TVA Corinth substation expansion project area; view is north.

Figure 4.6. TVA Corinth substation expansion project area; view is east.

Figure 4.7. TVA Corinth substation expansion project area; view is south.

Figure 4.8. TVA Corinth substation expansion project area; view is west.

Figure 4.9. LOS-1; view is south.

Figure 4.10. LOS-2; view is southwest.

Figure 4.11. LOS-3; view is southwest.

Figure 4.12. LOS-4; view is northeast.

Figure 4.13. Property 003-COR-1249; view is southwest.

Figure 4.14. Property 003-COR-1249; view is southwest looking toward the project area.

Figure 4.15. Property 003-COR-1250; view is southeast.

Figure 4.16. Property 003-COR-1250; view is southwest looking toward the project area.

Figure 4.17. Property 003-COR-1263; view is southeast.

Figure 4.18. Property 003-COR-1263; view is south looking toward the project area.

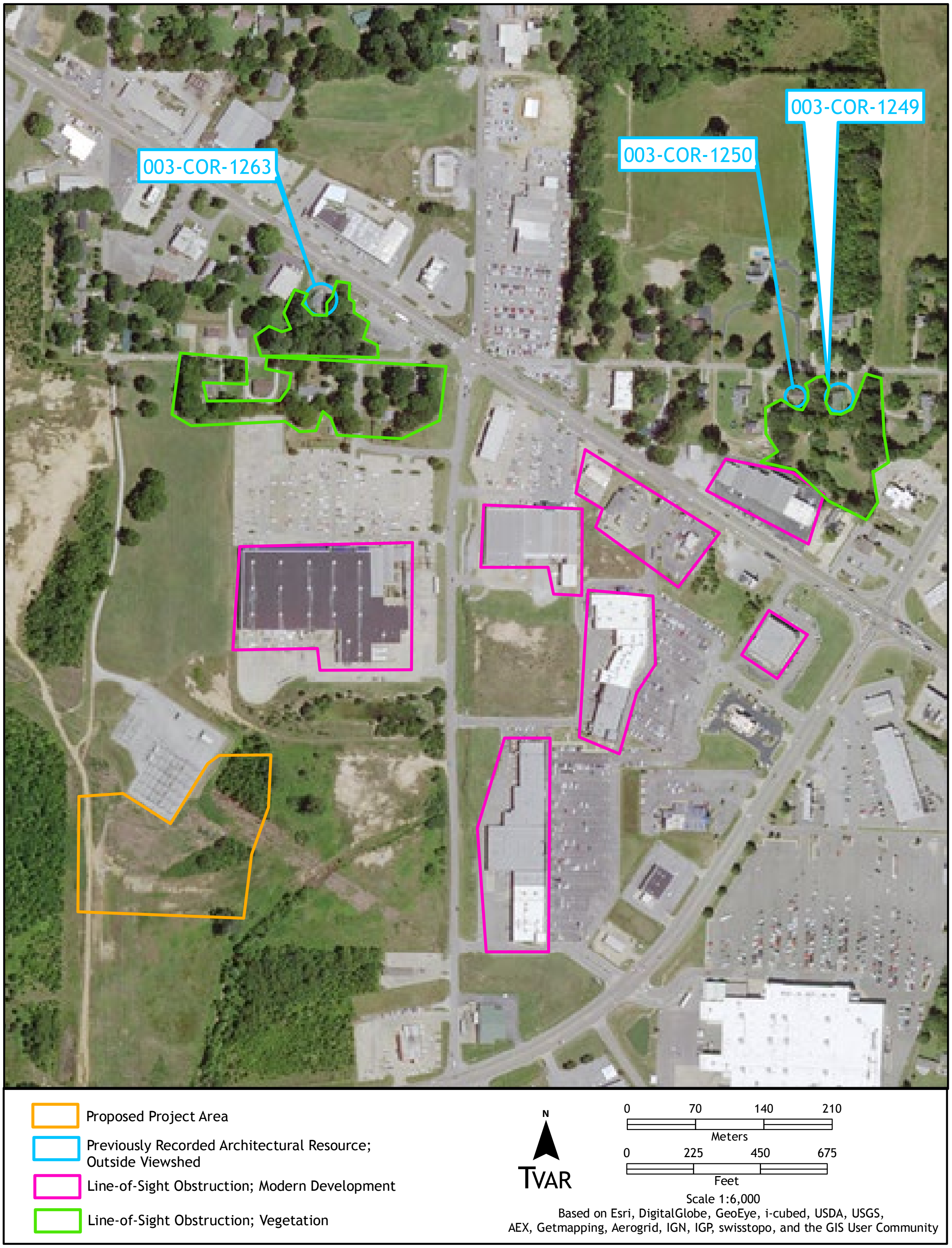

Figure 4.19. Current aerial imagery of the project area illustrating line-of-sight obstructions to architectural resources 003-COR-1249, 003-COR-1250, and 003-COR-1263.

Previously Recorded Architectural Resources

003-COR-1251

Located approximately 0.38 miles northeast of the project area at 2014 Liddon Lake Road, property 003-COR-1251 is an irregularly-shaped, one-story bungalow style house that appears to have been constructed ca. 1930 (see Figure 4.3; Figures 4.20-4.27). The frame building features a hipped roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Additionally, the gable ends of the house each feature a square-shaped attic vent that is boarded over with wood and is centrally positioned within a gable field clad with stucco and half-timbered detailing. Facing north, the façade reveals a centrally placed door that is flanked on either side by a pair of one-over-one, double-hung vinyl sash windows. Access to the façade door is achieved via a full-width porch that extends to the east beyond the main block to form a double-bay porte cochere. The porch features a concrete slab deck and a series of brick columns that support a side-gabled roof which is connected to the house. Modern alterations to the porch include the application of vinyl siding along the frieze and soffits, and the enclosure of the porch openings with wood lattice work and metal screens.

The east elevation of the house is marked by a projecting gabled bay that contains an exterior end brick chimney which has been terminated below the roof line. Flanking the chimney are two window openings containing one-over-one, double-hung vinyl sashes. Positioned south of the projecting gabled bay are two pairs of windows containing one-over-one, double-hung vinyl sashes. Additional fenestration consists of a single window opening containing a four-light wood casement sash located near the southeast corner of the main block. Attached to the east elevation near the southeast corner is a modern, single-bay addition capped with a gabled roof, which projects from the main block. The addition contains a door and two one-over-one, double-hung vinyl sash windows on its south elevation. A similar window is located on the north elevation of the projecting bay. Additionally, the projecting bay is highlighted by a modern exterior brick chimney which is positioned in the ell created by the projecting gabled bay and a rear addition.

The west elevation of the house features a centrally placed projecting gabled bay that is pierced by a pair of one-over-one, double-hung vinyl sash windows. In addition, single one-over-one, double-hung vinyl sash windows are located on the north and south elevations of the projecting bay. Flanking the central bay to the north is a pair of one-over-one, double-hung vinyl sash windows. This sash type is repeated on a single window and a paired window positioned south of the projecting bay. Attached to the south (rear) elevation is a modern one-story, gabled-roof addition. The addition features a roof covered with asphalt shingles, an exterior clad with vinyl siding, and a continuous brick foundation. The addition includes a door on the south elevation and a pair of six-over-six, double-hung vinyl sash windows on the west elevation.

Associated outbuildings include:

- A modern gazebo. The frame structure rests on a concrete slab foundation and is composed of a series of wood posts that support a pyramidal roof covered with asphalt shingles (see Figure 4.25);

- A modern utility shed. The frame structure features a side-gabled roof covered with asphalt shingles, an exterior clad with wood panel siding, and a concrete slab foundation. Facing north, the shed includes two pairs of metal panel doors and two windows containing four-over-four, double-hung vinyl sashes (see Figure 4.26);

- A ca. 1930 storage shed. Resting a concrete slab foundation, the wood frame structure features a front-gabled roof covered with asphalt shingles and an exterior clad with a brick veneer. A door is positioned on the north elevation (see Figure 4.27).

NRHP Assessment

Property 003-COR-1251 is a typical example of a ca. 1930 bungalow style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the application of vinyl siding on the porch, the enclosure of the façade porch with metal screening and wood lattice, the replacement of the original window sashes, the truncation of the east elevation chimney, and the construction of the one-story addition to the rear elevation. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-1251 is not eligible for the NRHP.

Figure 4.20. Property 003-COR-1251; view is southeast featuring the façade and west elevation.

Figure 4.21. Property 003-COR-1251; view is southwest featuring the carport.

Figure 4.22. Property 003-COR-1251; view is west featuring the east elevation.

Figure 4.23. Property 003-COR-1251; view is northeast featuring the south (rear) and west elevations.

Figure 4.24. Property 003-COR-1251; view is northeast featuring the modern addition and chimney attached to the south (rear) elevation.

Figure 4.25. Property 003-COR-1251; modern gazebo; view is southwest.

Figure 4.26. Property 003-COR-1251; modern utility building; view is southeast.

Figure 4.27. Property 003-COR-1251; ca. 1930 storage shed; view is southwest.

003-COR-1252

Located approximately 0.36 miles northeast of the project area at 2010 Liddon Lake Road, property 003-COR-1252 is a one-and-one-half-story bungalow style house that appears to have been constructed ca. 1930 (see Figure 4.3; Figures 4.28-4.33). The frame building features a side-gabled roof covered with asphalt shingles, an exterior clad with weatherboard siding, and a continuous brick foundation. Facing north, the façade reveals a centrally placed door that is flanked on either side by a pair of one-over-one, double-hung vinyl sashes. Access to the façade door is achieved via a partial-width porch that extends beyond the main block to the east, forming a porte cochere. The porch features a concrete slab deck on a brick foundation and a pair of tapered wood columns that support a projecting gabled entry roof. Connected to the west slope of the entry roof is a side-gabled roof that forms the porte cochere. This section of the porch roof is highlighted by exposed rafter ends and is supported by three tapered wood columns, two of which rest on brick plinth blocks.

Both the east and west elevations of the house are pierced by a single window and a paired window on the first story that contain one-over-one, double-hung vinyl sashes. Situated in the half story is a rectangular-shaped window containing a single-pane vinyl sash. The south (rear) elevation includes a shed-roof addition that appears to have been constructed ca. 2000. The addition is clad with modern wood drop siding and rests on a concrete block foundation. Connected to the addition is a wood deck that provides access to a centrally placed door. Flanking the door to the east is a pair of one-over-one, double-hung vinyl sash windows. In addition, a window containing a pair of two-light, sliding vinyl sash windows are positioned west of the door.

Associated outbuildings and structures include:

- An underground tornado shelter that appears to date to the mid-twentieth century. Located northwest of the house, the shelter is cast in concrete and includes a vent pipe and bulkhead entrance covered with sheets of corrugated metal (see Figure 4.31);

- A modern prefabricated storage shed. The frame structure is capped with a front-gabled roof covered with metal sheeting and features an exterior clad with wood panel siding. A pair of swinging wood doors are located on the west elevation (see Figure 4.32);

- A concrete block storage shed that appears to date to ca. 1960. The structure is capped with a pyramidal roof covered with asphalt shingles and includes a door on the east elevation (see Figure 4.33).

NRHP Assessment

Property 003-COR-1252 is a typical example of a ca. 1930 bungalow style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of the original window sashes and the construction of the one-story shed-roof addition and wood deck to the rear elevation. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-1252 is not eligible for the NRHP.

Figure 4.28. Property 003-COR-1252; view is south featuring the façade.

Figure 4.29. Property 003-COR-1252; view is southwest featuring the east elevation.

Figure 4.30. Property 003-COR-1252; view is northeast featuring the south (rear) and west elevations.

Figure 4.31. Property 003-COR-1252; view is southwest featuring the tornado shelter.

Figure 4.32. Property 003-COR-1252; view is east featuring the modern storage shed.

Figure 4.33. Property 003-COR-1252; view is southwest featuring the concrete block storage shed.

003-COR-1253

Located approximately 0.34 miles northeast of the project area at 2006 Liddon Lake Road, property 003-COR-1253 is a ca. 1930, one-story Craftsman/bungalow style house with an original gabled roof rear extension (see Figure 4.3; Figures 4.34-4.37). The frame building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing north, the façade reveals a centrally placed door that is flanked on either side by a pair of one-over-one, double-hung vinyl sash windows. Access to the façade door is achieved via a central-bay porch. The porch features a concrete slab deck on a brick foundation and two tapered wood posts atop brick plinth blocks that support a projecting gabled roof. The gable field of the porch roof is clad with stucco and is pierced by a wood louvered vent.

The east elevation of the house is marked by an exterior end brick chimney that has been truncated at the roof line. Flanking the chimney to the north is a single window containing one-over-one, double-hung vinyl sashes. This sash type is repeated in a paired window positioned south of the chimney. Located at the attic level are two wood louvered vents that flank the chimney. Located south on the gabled-roof extension is a door and a band of five windows containing one-over-one, double-hung vinyl sashes.

The west elevation of the house is marked by an exterior end brick chimney that has also been truncated at the roof line. Flanking the chimney to the north is a one-over-one, double-hung vinyl sash window. Located to the south on the gabled-roof extension are two pairs of windows containing one-over-one, double-hung vinyl sashes. This sash arrangement is repeated on the south (rear) elevation of the gabled-roof extension, which also includes a centrally placed wood louvered vent within the gable field and an interior brick chimney.

NRHP Assessment

Property 003-COR-1253 is a typical example of a ca. 1930 Craftsman/bungalow style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of the original window sashes and the truncation of the exterior end chimneys located on the east and west elevations. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-1253 is not eligible for the NRHP.

Figure 4.34. Property 003-COR-1253; view is southwest featuring the façade and east elevation.

Figure 4.35. Property 003-COR-1253; view is southeast featuring the west elevation.

Figure 4.36. Property 003-COR-1253; view is northeast featuring the south (rear) and west elevations.

Figure 4.37. Property 003-COR-1253; view is northwest featuring the east and south (rear) elevations.

003-COR-1254

Located approximately 0.36 miles northeast of the project area at 2007 Liddon Lake Road, property 003-COR-1254 is a one-story Craftsman/bungalow style house that appears to have been constructed ca. 1930 (see Figure 4.3; Figures 4.38-4.43). The frame building features a side-gabled roof covered with asphalt shingles, an exterior clad with vinyl siding, and a continuous brick foundation. Facing south, the façade reveals a centrally placed door that is flanked on either side by a pair of one-over-one, double-hung vinyl sash windows. Access to the façade door is achieved via a partial-width porch. The porch features a concrete slab deck set on a brick foundation and a series of non-original, square columns used to support a projecting gabled roof. As with the main block, the gable field of the roof is clad with vinyl siding. Located west of the porch is a side-gabled wing that is pierced by a pair of one-over-one, double-hung vinyl sash windows.

The east elevation of the main block includes two one-over-one, double-hung metal sash windows. Positioned to the north and attached to the main block is a hipped-roof extension that continues to the north (rear) elevation of the house. The extension includes a door on its south elevation. An additional door on the east elevation is flanked by a one-over-one, double-hung wood sash window. Attached to the east elevation of the house is a modern, single-bay carport featuring a flat roof supported by a series of wood posts. The west elevation of the house includes two window openings on the side-gabled wing that contain one-over-one, double-hung wood sashes. The north (rear) elevation of the house is marked by two windows containing one-over-one, double-hung wood sashes, and a pair of two-over-two, double-hung wood sash windows. Positioned on the hipped-roof extension is a band of four windows containing four-over-four, double-hung wood sashes.

Associated outbuildings include:

- A modern prefabricated metal storage shed. The south elevation includes a central door that is flanked on either side by a pair of sliding metal sash windows (see Figure 4.42);

- A ca. 1930 utility building. The frame building features a front-gabled roof covered with asphalt shingles, an exterior clad with weatherboard siding, and a continuous foundation composed of brick and concrete blocks. Overall, the building includes a door on the east and south elevations, four windows containing one-over-one, double-hung wood sashes, and a six-over-six, double-hung vinyl sash window on the south elevation (see Figure 4.43).

NRHP Assessment

Property 003-COR-1254 is a typical example of a ca. 1930 Craftsman/bungalow style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of some of the original window sashes, the application of vinyl siding, the replacement of the original porch columns, and the construction of the modern carport along the east elevation. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-1254 is not eligible for the NRHP.

Figure 4.38. Property 003-COR-1254; view is northwest featuring the façade and east elevation.

Figure 4.39. Property 003-COR-1254; view is northeast featuring the façade and west elevation.

Figure 4.40. Property 003-COR-1254; view is southwest featuring the east and north (rear) elevations.

Figure 4.41. Property 003-COR-1254; view is south featuring the north (rear) elevation.

Figure 4.42. Property 003-COR-1254; view is north featuring the prefabricated metal storage shed.

Figure 4.43. Property 003-COR-1254; view is northeast featuring the ca. 1930 utility building.

003-COR-1255

Located approximately 0.34 miles northeast of the project area at 2005 Liddon Lake Road, property 003-COR-1255 is a one-story side-gabled house that appears to have been constructed ca. 1930 (see Figure 4.3; Figures 4.44-4.46). The frame building features a roof covered with asphalt shingles, an exterior clad with a combination of vinyl and weatherboard siding, and a covered pier foundation. Facing south, the façade reveals a central door that is flanked on either side by a six-over-six, double-hung vinyl sash window. Access to the façade door is achieved via a modern stoop featuring a wood deck. The east elevation of the house is pierced by two windows containing vertical three-over-one, double-hung wood sashes. This sash type is repeated on an additional window located to the north on a rear shed-roof extension. The west elevation of the house is marked by two window openings containing six-over-six, double-hung vinyl sashes. Attached to the north (rear) elevation is a shed-roof extension that is clad with plywood sheets. The extension includes a pair of window openings that are boarded over with wood.

NRHP Assessment

Property 003-COR-1255 is a typical example of a ca. 1930 side-gabled house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of some of the original window sashes, the application of vinyl siding, the replacement of the original façade porch, and the construction of the rear extension. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-1255 is not eligible for the NRHP.

Figure 4.44. Property 003-COR-1255; view is northwest featuring the façade and east elevation.

Figure 4.45. Property 003-COR-1255; view is northeast featuring the façade and west elevation.

Figure 4.46. Property 003-COR-1255; view is south featuring the north (rear) elevations.

003-COR-1256

Located approximately 0.32 miles northeast of the project area at 1905 Highway 72 East, property 003-COR-1256 is a one-story Minimal Traditional style house that appears to have been constructed ca. 1945 (see Figure 4.3; Figures 4.47-4.50). The former residence has been converted to business use and currently serves as a beauty salon. The frame building features a side-gabled roof covered with asphalt shingles, an exterior clad with asbestos shingle siding, and a continuous brick foundation. Facing south, the façade reveals a central door that is flanked on either side by a six-over-six, double-hung wood sash window. Access to the façade door is achieved via a partial-width porch that is integral with the main roof. The porch features a concrete slab deck on a brick foundation. A single wood post atop a brick plinth block supports the porch roof. Located east of the porch is a projecting gabled bay that is pierced by a six-over-six, double-hung wood sash window.

The east elevation of the house is pierced by three single windows and a paired window that contain six-over-six, double-hung wood sashes. Highlighting the west elevation of the main block is a projecting gabled bay that is pierced by a pair of six-over-six, double-hung wood sash windows and a modern door that provides access to a modern side-gabled addition. Located north of the projecting gabled bay is an additional door and a pair of six-over-six, double-hung, wood sash windows. Attached to the west elevation is a modern side-gabled addition enclosed with a four-light glass wall. The addition provides interior access to an attached garage. The garage appears to date to ca. 1930 and features a pair of swinging wood doors on the south elevation. The north (rear) elevation of the house is pierced by a single window and a paired window that each contain six-over-six, double-hung wood sashes.

NRHP Assessment

Property 003-COR-1256 is a typical example of a ca. 1945 Minimal Traditional style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the installation of a modern door and side-gabled addition on the west elevation. In addition, the historic function of the house has changed from residential to commercial use, which likely resulted in alterations to the interior of the building to accommodate its present use as a beauty salon. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-1256 is not eligible for the NRHP.

Figure 4.47. Property 003-COR-1256; view is north featuring the façade.

Figure 4.48. Property 003-COR-1256; view is northwest featuring the façade and east elevation.

Figure 4.49. Property 003-COR-1256; view is east featuring the west elevation.

Figure 4.50. Property 003-COR-1256; view is southeast featuring the north (rear) and west elevations.

003-COR-1257

Located approximately 0.31 miles northeast of the project area at 1903 Highway 72 East, property 003-COR-1257 is a one-story Minimal Traditional style house that appears to have been constructed ca. 1945 (see Figure 4.3; Figures 4.54-4.53). The former residence has been converted to business use and currently serves as an office for an accounting firm. The frame building features a side-gabled roof covered with asphalt shingles, an exterior clad with modern wood panel siding, and a continuous brick foundation. Facing south, the façade reveals a centrally placed door that is flanked on either side by a pair of six-over-six, double-hung vinyl sash windows. Access to the façade door is achieved via a central bay porch. The porch features a concrete slab on a brick foundation and includes two decorative metal posts that are used to support a projecting gabled roof. Additional fenestration along the façade includes a pair of six-over-six, double-hung vinyl sash windows that are positioned on a side-gabled wing attached to the west elevation.

The east elevation of the house is pierced by two windows containing six-over-six, double-hung vinyl sashes. This sash type is repeated on a single window located on the west elevation of the main block and on the side-gabled wing. Additional fenestration found on the west elevation of the side-gabled wing consists of a pair of four-over-four, double-hung vinyl sash windows. The north (rear) elevation of the house includes a modern door that is partly shielded by a projecting gabled canopy. Located east of the door are two pairs of windows and a single window that contain one-over-one, double-hung vinyl sashes.

NRHP Assessment

Property 003-COR-1257 is a typical example of a ca. 1945 Minimal Traditional style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of the original window sashes, the application of modern wood panel siding, the replacement of the original porch columns, and the construction of a handicap access ramp attached to the north elevation. In addition, the historic function of the house has changed from residential to commercial use, which likely resulted in alterations to the interior the building to accommodate its present use as an accounting office. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-1257 is not eligible for the NRHP.

Figure 4.51. Property 003-COR-1257; view is northwest featuring the façade and east elevation.

Figure 4.52. Property 003-COR-1257; view is northeast featuring the façade and west elevation.

Figure 4.53. Property 003-COR-1257; view is southeast featuring the north (rear) and west elevations.

003-COR-1258

Located approximately 0.31 miles north of the project area at 1400 Highway 72 East, property 003-COR-1258 is a vacant, two-story International style commercial building that appears to have been constructed ca. 1950 (see Figure 4.3; Figures 4.54-4.59). According to the survey form filed with the MDAH the building last functioned as a funeral home. The building features an overhanging flat roof, an exterior clad with a combination of brick and stone veneer, and a continuous brick foundation. Facing north, the asymmetrical façade is marked by a centrally placed exterior stone chimney, which includes a pair of two-light metal casement sash windows on the first story. Flanking the chimney to the east is a glass door; a single pane, fixed sash window; and a pair of windows containing horizontal two-over-two, double-hung metal sashes. Situated west of the chimney are two bands of three windows that contain horizontal two-over-two, double-hung metal sashes. This sash type is repeated on the second story in a paired and a single window located east of the chimney. Positioned west of the chimney on the second story are two bands of three windows that contain horizontal two-over-two, double-hung metal sashes. Unlike the other elevations of the building, this section of the second story is clad with wood panel siding.

The façade is further marked by a one-story, stone veneer extension which includes a door flanked on either side by a horizontal two-over-two, double-hung metal sash window. In addition, the extension includes a pair of horizontal four-light, fixed wood sash windows positioned east of the door. This sash type is repeated on a one-story, brick veneer-clad extension that is attached to the east elevation of the building. Each door located along the main entrance is shielded by a modern metal canopy that is supported by a series of metal posts.

The west elevation of the building is marked by two pairs of doors that are covered by a metal awning supported by decorative metal posts. Located along the second story are five windows that contain horizontal two-over-two, double-hung metal sashes. The east elevation of the building includes a door, a single and a paired window containing one-over-one, double-hung metal sashes, and a horizontal two-over-two, double-hung metal sash window. Situated on the second story of the main block are five window openings containing horizontal two-over-two, double-hung metal sashes. The south (rear) elevation of the building includes two pairs of glass doors that are shielded by a metal canopy that is supported by metal posts. In addition, the rear elevation includes a single wood door, and a window opening containing two-light metal casement sashes positioned on a one-story brick addition.

Associated outbuildings include:

- A modern garage. The prefabricated metal building includes a low-pitch side-gabled metal roof and an exterior clad with metal siding. Facing east, the garage includes four vehicle bays that contain overhead metal doors. A metal pedestrian door is positioned on the north elevation (see Figure 4.58);

- A ca. 1950 garage. The building includes a low-pitch side-gabled metal roof, an exterior clad with a brick veneer, and a concrete block foundation. Facing east, the garage includes multiple vehicle bays that contain sliding metal doors. Window fenestration on the garage includes a series of horizontal two-over-two, double-hung metal sashes (see Figure 4.59).

NRHP Assessment

Property 003-COR-1258 is a typical example of a ca. 1950 International style commercial building that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the building that have diminished its architectural integrity include the construction of metal canopies along the façade, east and north elevations. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-1258 is not eligible for the NRHP.

Figure 4.54. Property 003-COR-1258; view is south featuring the façade.

Figure 4.55. Property 003-COR-1258; view is southwest featuring the east elevation.

Figure 4.56. Property 003-COR-1258; view is northeast featuring the west and south elevations.

Figure 4.57. Property 003-COR-1258; view is northwest featuring the east and south (rear) elevations.

Figure 4.58. Property 003-COR-1258; view is southwest featuring the modern garage.

Figure 4.59. Property 003-COR-1258; view is south featuring the ca. 1950 garage.

003-COR-1259

Located approximately 0.3 miles north of the project area at 1803 South Johns Street, property 003-COR-1259 is a one-story side-gabled house that appears to have been constructed ca. 1910 (see Figure 4.4; Figures 4.60-4.62). The building features a roof covered with asphalt shingles, an exterior clad with wood drop siding, and a continuous concrete block foundation. Facing west, the façade reveals an off-centered door that is flanked on either side by a four-over-four, double-hung wood sash window. According to the property owner, the façade originally included an additional door which was later removed and the opening concealed by wood siding. Access to the façade door is through a full-width porch that is integral with the main roof. The porch features a wood deck on a concrete block foundation, modern wood balustrades, and a series of modern wood posts that are used to support the porch roof. The north elevation of the house includes two windows containing one-over-one, double-hung wood sashes. Situated along the south elevation is a one-over-one and a four-over-four, double-hung wood sash window. The east (rear) elevation of the house includes a recessed center bay that includes a door. Located east of the central bay is a six-light wood sash window. Situated north of the central bay is a shed-roof extension that contains a door and a six-over-six, double-hung wood sash window.

NRHP Assessment

Property 003-COR-1259 is a typical example of a ca. 1910 side-gabled house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of the original porch columns, the addition of a modern balustrade on the porch, and the enclosure of the second façade door. In addition, the current owner has initiated plans to extensively remodel the exterior and interior of the house. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-1259 is not eligible for the NRHP.

Figure 4.60. Property 003-COR-1259; view is east featuring the façade.

Figure 4.61. Property 003-COR-1259; view is southeast featuring the façade and north elevation.

Figure 4.62. Property 003-COR-1259; view is northwest featuring the south and east (rear) elevations.

003-COR-1260

Located approximately 0.25 miles north of the project area on the south side of Hinton Street, property 003-COR-1260 is a one-and-one-half-story Minimal Traditional style house that appears to have been constructed ca. 1940 (see Figure 4.3; Figures 4.63-4.66). At the time of TVAR's survey, the house was in the process of being demolished by the current owner. The building features a side-gabled roof covered with asphalt shingles, an exterior partly clad with the remains of a brick veneer, and a continuous brick foundation. Facing north, the façade reveals a partial-width porch situated within a projecting gabled bay that has been enclosed with jalousie windows and single-pane fixed sash windows. A modern storm door located on the projecting bay provides access to the porch. Located on the porch's south and west interior walls, respectively, are a pair of one-over-one, double-hung wood sash windows and a door. A louvered wood attic vent is situated within the gable field of the projecting bay. Positioned west of the projecting bay are two window openings on the main block that contain one-over-one, double-hung wood sashes.

The east elevation of the house is pierced by four windows on the first story and a single window in the half story that each contain one-over-one, double-hung wood sashes. This sash type is repeated along the west elevation in two paired and two single windows. A window opening in the half story contains no sashes. The south (rear) elevation features a projecting gabled bay that is marked by a band of three windows containing two-light wood casement sashes. Additionally, a door is positioned on the east elevation of the projecting bay. Located to the east on the main block is a one-over-one, double-hung wood sash window. This sash type is repeated in a window situated in the half story. Attached to the south elevation of the house is a modern carport which is composed of a flat metal roof supported by a series of metal posts.

NRHP Assessment

Property 003-COR-1260 is a typical example of a ca. 1940 Minimal Traditional style house that fails to exhibit unique features of its architectural style or workmanship. In addition, the integrity of the property is poor due to current efforts to demolish the building. At the time of TVAR's survey, much of the original brick veneer had been pulled off the building and stacked on pallets for resale. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-1260 is not eligible for the NRHP.

Figure 4.63. Property 003-COR-1260; view is south featuring the façade.

Figure 4.64. Property 003-COR-1260; view is southwest featuring the façade and east elevation.

Figure 4.65. Property 003-COR-1260; view is southeast featuring the façade and west elevation.

Figure 4.66. Property 003-COR-1260; view is northwest featuring the east and south (rear) elevations.

003-COR-1261

Located approximately 0.27 miles north of the project area at 1611 Hinton Street, property 003-COR-1261 is a one-story side-gabled house that appears to have been constructed ca. 1920 (see Figure 4.4; Figures 4.67-4.70). Based on physical evidence, it is the opinion of TVAR that the building was originally constructed as a front-gabled house with the main entrance located on the west elevation (see Figure 4.67). The house appears to have been modified in the mid-twentieth century, with the re-orientation of the main entrance to the south elevation. The building features a gabled roof covered with asphalt shingles, an exterior clad with weatherboard siding, and a brick pier foundation. Facing south, the façade reveals an off-centered door that is flanked to the east by a three-part picture window containing horizontal two-over-two, double-hung wood sashes. Located east of this window arrangement is a pair of one-over-one, double-hung metal sash windows. Positioned west of the door is a one-over-one, double-hung wood sash window. The east elevation of the house includes a shed-roof extension that contains a door and a series of five windows containing six-over-six, double-hung wood sashes. This sash type is repeated on a single window located on the main block. The west elevation of the house, which appears to have served as the original façade, features a projecting gabled bay. The gabled bay is pierced by three windows that contain horizontal two-over-two, double-hung wood sashes. Attached to the west elevation is a projecting gabled roof that shielded a porch which is no longer extant. The roof is supported by three wood posts atop brick plinth blocks. The north (rear) elevation is marked by a paired and a single window that contain horizontal two-over-two, double-hung wood sashes. An additional window opening on the elevation has been concealed with a wood board.

NRHP Assessment

Property 003-COR-1261 is a typical example of a ca. 1920 side-gabled house that fails to exhibit unique features of its architectural style or workmanship. It is TVAR's opinion that the building appeared to have been originally constructed as a front-gabled house with the main entrance located on the west elevation. During the mid-twentieth century, the location of the main entrance was moved to the south elevation within a shed-roof addition that was attached to the main block. Additional alterations that have diminished the architectural integrity of the resource include the removal of the west elevation porch deck. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-1261 is not eligible for the NRHP.

Figure 4.67. Property 003-COR-1261; view is northeast featuring the west (former primary façade) and south elevations.

Figure 4.68. Property 003-COR-1261; view is northwest featuring the east and south elevations.

Figure 4.69. Property 003-COR-1261; view is southwest featuring the north and west (former primary façade) elevations.

Figure 4.70. Property 003-COR-1261; view is southwest featuring the north elevation.

003-COR-1262

Located approximately 0.32 miles north of the project area at 1504 Highway 72 East, property 003-COR-1262 is a one-and-one-half-story Minimal Traditional style house that appears to have been constructed ca. 1950 (see Figure 4.3; Figures 4.71-4.74). The former residence has been converted to business use and currently serves as dental offices. The building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing north, the façade reveals an off-centered door that is flanked to the east by an oval-shaped window containing a single-light wood sash. Access to the façade door is achieved via a concrete handicap access ramp that is bordered with metal railings. The door is partly shielded by a modern, projecting gabled entry roof, which is supported by two columns composed of synthetic materials. Located west of the door, on a slightly projecting bay, is a band of three windows containing five-light metal casement sashes. Additional fenestration positioned to the west includes a pair of three-light metal casement sashes.

The east elevation of the house is accented with a curvilinear bay that contains a band of four horizontal two-over-two, double-hung metal sash windows. An additional window filled with glass blocks is positioned to the south. Attached to the west elevation is a former garage wing that has been converted for office use. The garage includes a modern door and sliding glass patio doors to the west that are positioned within the original vehicle bay. Additionally, a six-over-six, double-hung metal sash window is located on the west elevation of the garage wing. Fenestration on the main block includes a pair of three-light metal casement sashes.

The south (rear) elevation features a modern central bay addition that projects slightly from the main block. Topped with a shed roof, the addition is clad with vinyl siding and includes a door and two window openings containing six-over-six, double-hung vinyl sashes. Located east of the central bay is a six-over-six, double-hung metal sash window, a pair of three-light metal casement sash windows, and a window opening filled with glass blocks. Positioned west of the central bay is a pair of six-over-six, double-hung metal sash windows.

Located south of the building is a modern storage shed. The prefabricated wood-frame structure features a side-gabled roof covered with asphalt shingles, an exterior clad with wood panel siding, and a concrete block pier foundation. The north elevation includes a door and a one-over-one, double-hung vinyl sash window (see Figure 4.74).

NRHP Assessment

Property 003-COR-1262 is a typical example of a ca. 1950 Minimal Traditional style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the renovations to the rear addition, the replacement of some of the original window sashes, and the reconstruction of the façade entry porch. Lastly, the historic function of the house has changed from residential to commercial use, which likely resulted in alterations to the interior the building to accommodate its present use as a dental office. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that 003-COR-12562 is not eligible for the NRHP.

Figure 4.71. Property 003-COR-1262; view is southeast featuring the façade and the west elevation garage wing.

Figure 4.72. Property 003-COR-1262; view is southwest featuring the façade and east elevation.

Figure 4.73. Property 003-COR-1262; view is northwest featuring the east and south (rear) elevations.

Figure 4.74. Property 003-COR-1262; view is southwest featuring the modern storage shed.

Newly Recorded Architectural Resources

IS-1

Located approximately 0.37 miles north of the project area at 1704 South Johns Street, property IS-1 is a Ranch style house that appears to have been constructed ca. 1955 (see Figure 4.4; Figures 4.75-4.76). The building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing east, the façade reveals a centrally placed door that is flanked to the north by a band of three windows containing two-over-one, double-hung metal sashes. Located south of the door is a picture window with nine lights set within a metal sash and a single window opening containing horizontal two-over-two, double-hung metal sashes. Attached to the north elevation of the building is a single-bay carport that is capped with a side-gabled roof covered with asphalt shingles. The carport roof is supported by three decorative metal posts. The interior west wall of the carport has been partially enclosed to increase the square footage of the interior living space. The altered section of the carport is clad with vinyl siding and includes a door and two windows containing four-over-four, double-hung vinyl sashes. Situated along the north interior wall of the carport is a pair of two-over-one, double-hung metal sash windows. The south elevation of the house is pierced by two window openings that contain horizontal two-over-two, double-hung metal sashes. The west (rear) elevation of the house was not accessible at the time of TVAR's survey.

NRHP Assessment

Property IS-1 is a typical example of a ca. 1955 Ranch style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the alterations made to the carport. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-1 is not eligible for the NRHP.

Figure 4.75. Property IS-1; view is southwest featuring the façade and the north elevation garage wing.

Figure 4.76. Property IS-1; view is northwest featuring the façade and south elevation.

IS-2

Located approximately 0.34 miles north of the project area at 1706 South Johns Street, property IS-2 is a Ranch style house that appears to have been constructed ca. 1955 (see Figure 4.4; Figures 4.77-4.78). The building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing east, the façade reveals a recessed central bay that includes a door and a band of three windows containing horizontal two-over-two, double-hung wood sashes. Access to the façade door is through the center bay porch that is integral with the main roof. Flanking either side of the central bay are projecting bays that are each pierced with a window opening containing horizontal two-over-two, double-hung wood sashes. Attached to the north elevation of the building is a single-bay carport that is capped with a side-gabled roof covered with asphalt shingles. The carport roof is supported by a metal post at the northeast corner of the building. The interior north wall of the carport includes a door and a pair of horizontal two-over-two, double-hung wood sashes. This sash type is repeated on two windows that pierce the south elevation. The west (rear) elevation of the house was not accessible at the time of TVAR's survey.

NRHP Assessment

Property IS-2 is a typical example of a ca. 1955 Ranch style house that fails to exhibit unique features of its architectural style or workmanship. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-2 is not eligible for the NRHP.

Figure 4.77. Property IS-2; view is southwest featuring the façade and the north elevation carport wing.

Figure 4.78. Property IS-2; view is northwest featuring the façade and south elevation.

IS-3

Located approximately 0.33 miles north of the project area at 1708 South Johns Street, property IS-3 is a Ranch style house that appears to have been constructed ca. 1955 (see Figure 4.4; Figures 4.79-4.80). The building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing east, the façade reveals an off-centered door that is flanked to the north by a pair of horizontal two-over-two, double-hung wood sash windows. This sash type is repeated on a picture window and a paired window located south of the door. Access to the façade door is achieved via a single-bay concrete stoop. The stoop features a concrete slab deck that is partly shielded by a fabric awning. Attached to the north elevation of the building is a single-bay carport that is capped with a flat roof. The carport roof is partly supported by a decorative metal post at the northeast corner of the building. The interior of the carport has been altered to include a screened-in porch that provides access to a door located on the north elevation of the building. Situated east of the door is a pair of horizontal two-over-two, double-hung wood sash windows. This sash type is repeated on three windows located along the south elevation. The west (rear) elevation of the house was not accessible at the time of TVAR's survey.

NRHP Assessment

Property IS-3 is a typical example of a ca. 1955 Ranch style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the construction of the screened-in porch within the carport. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-3 is not eligible for the NRHP.

Figure 4.79. Property IS-3; view is west featuring the façade and the north elevation carport wing.

Figure 4.80. Property IS-3; view is northwest featuring the façade and south elevation.

IS-4

Located approximately 0.32 miles north of the project area at 1800 South Johns Street, property IS-4 is a Ranch style house that appears to have been constructed ca. 1955 (see Figure 4.4; Figures 4.81-4.82). The building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing east, the façade reveals an off-centered door that is flanked to the south by a paired window and two single windows that each contain six-over-six, double-hung vinyl sashes. Access to the façade door is achieved via a single bay concrete stoop. The stoop features a concrete slab deck on a brick foundation. Attached to the north elevation of the building is a single-bay carport that is integral with the main roof. The carport roof is partly supported by two decorative metal posts. The north interior wall of the carport includes a door and a six-over-six, double-hung vinyl sash window. Located along the south elevation is a horizontal two-over-two, double-hung wood sash window and a six-over-six, double-hung vinyl sash window. The west (rear) elevation of the house was not accessible at the time of TVAR's survey, however, an extension to the house containing a one-over-one, double-hung vinyl window was noted from the street.

NRHP Assessment

Property IS-4 is a typical example of a ca. 1955 Ranch style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of the original window sashes. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-4 is not eligible for the NRHP.

Figure 4.81. Property IS-4; view is southwest featuring the façade and the north elevation carport wing.

Figure 4.82. Property IS-4; view is northwest featuring the façade and south elevation.

IS-5

Located approximately 0.31 miles north of the project area at 1802 South Johns Street, property IS-5 is a Ranch style house that appears to have been constructed ca. 1955 (see Figure 4.4; Figures 4.83-4.84). The building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing east, the façade reveals a centrally placed door that is flanked to the north by a pair of one-over-one, double-hung vinyl sash windows. This sash type is repeated in two single windows positioned south of the main entrance. Access to the façade door is achieved via a partial-width porch. The porch features a concrete slab deck on a brick foundation and a series of decorative metal posts that are used to support a shed roof, which is integral with the main roof of the house. Attached to the north elevation of the building is a single-bay carport that is integral with the main roof. The carport roof is partly supported by three decorative metal posts. The north interior wall of the carport includes a door that provides access to the house. In addition, another door is positioned on the west interior wall, which provides access to a storage closet. Located along the south elevation are two windows containing one-over-one, double-hung vinyl sashes. The west (rear) elevation of the house was not accessible at the time of TVAR's survey.

NRHP Assessment

Property IS-5 is a typical example of a ca. 1955 Ranch style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of the original window sashes. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-5 is not eligible for the NRHP.

Figure 4.83. Property IS-5; view is southwest featuring the façade and the north elevation carport wing.

Figure 4.84. Property IS-5; view is northwest featuring the façade and south elevation.

IS-6

Located approximately 0.31 miles north of the project area at 1805 South Johns Street, property IS-6 is a Ranch style house that appears to have been constructed ca. 1955 (see Figure 4.4; Figures 4.85-4.86). The building features a side-gabled roof covered with standing seam metal, an interior brick chimney, an exterior clad with a brick veneer, and a continuous brick foundation. Facing west, the façade reveals a centrally placed projecting gabled bay that includes a door which is flanked to the north by a pair of six-over-six, double-hung vinyl sash windows. This sash type is repeated in a pair of windows positioned north of the projecting bay. Access to the façade door is achieved via a concrete stoop. Additional fenestration along the façade includes a picture window containing a central fixed vinyl sash with 12-lights, flanked by four-over-four, double-hung vinyl sash windows. Attached to the north elevation of the building is a carport wing that has been enclosed and converted into a single-bay garage. The exterior of this section of the house is clad with vinyl siding and includes an overhead metal door, which provides access to the garage. The north elevation of the house includes a door and a six-over-six, double-hung vinyl sash window that is accessible through a modern side porch. The porch is partially enclosed with metal screens and includes a storm door on the west elevation. Situated along the south elevation (former carport wing) is a six-over-six, double-hung vinyl sash window. Highlighting the east (rear) elevation of the house are five window openings containing six-over-six, double-hung vinyl sashes.

Located in front of the house is a modern carport. The prefabricated metal structure features a front-gabled roof that is supported by a series of metal posts (see Figure 4.86).

NRHP Assessment

Property IS-6 is a typical example of a ca. 1955 Ranch style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of the original window sashes, the construction of the north elevation porch, and the enclosure of the carport wing. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-6 is not eligible for the NRHP.

Figure 4.85. Property IS-6; view is east featuring the façade and modern carport.

Figure 4.86. Property IS-6; view is northwest featuring the east (rear) elevation.

IS-7

Located approximately 0.22 miles north of the project area at 1614 Hinton Street, property IS-7 is a Ranch style house that appears to have been constructed ca. 1960 (see Figure 4.4; Figures 4.87-4.88). The building features a side-gabled roof covered with asphalt shingles, an interior brick chimney, an exterior clad with a brick veneer, and a continuous brick foundation. Facing north, the façade reveals a central bay marked with a door that is flanked to the east by a 20-light wood sash picture window. The central bay also includes a covered porch featuring a concrete slab deck on a brick foundation and four rounded wood columns that are used to support a projecting gabled roof. The gable field of the porch roof is clad with vinyl siding. Additional fenestration along the façade includes a window east of the central bay and two windows west of the central bay that contain six-over-six, double-hung wood sashes. Attached to the east elevation of the building is a single-bay carport wing. The carport roof is supported by a wall on the north elevation that is pierced by two six-over-six, double-hung wood sash windows. Additional support is provided by two rounded wood columns that support the south slope of the roof. The west interior wall of the carport includes a door, which provides access to the main block. The west elevation of the house is pierced by two windows containing six-over-six, double-hung wood sashes. This sash type is repeated on four windows located along the south (rear) elevation of the house, which also includes a modern sliding patio door.

NRHP Assessment

Property IS-7 is a typical example of a ca. 1960 Ranch style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the application of vinyl siding along the gable fields of the porch roof and main block. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-7 is not eligible for the NRHP.

Figure 4.87. Property IS-7; view is south featuring the façade.

Figure 4.88. Property IS-7; view is northwest featuring the south (rear) elevation and carport wing attached to the east elevation.

IS-8

Located approximately 0.22 miles north of the project area at 2003 Liddon Lake Road, property IS-8 is a Ranch style house that appears to have been constructed ca. 1965 (see Figure 4.3; Figures 4.89-4.92). The building features a side-gabled roof covered with asphalt shingles, an exterior clad with a combination of vinyl siding and brick veneer, and a continuous concrete block foundation. Facing south, the façade reveals an off-centered door that is flanked to the east by a three-part picture window containing a central single-pane, fixed wood sash that is flanked by four-over-four, double-hung wood sashes. Located west of the door are two windows containing six-over-six, double-hung wood sashes. Attached to the east elevation of the building is a single-bay carport. The carport is integral with the main roof and is partially supported by two metal posts. The interior east wall of the carport includes a door that provides access to the house. An additional door is positioned on the interior north wall that provides access to a storage closet. The west elevation of the house is pierced by two windows containing six-over-six, double-hung wood sashes. The north (rear) elevation of the house is dominated by a modern one-story addition featuring a gabled roof covered with asphalt shingles, an exterior clad with vinyl siding, and a concrete block foundation. The addition includes an exterior end chimney that is flanked on either side by a single-pane fixed wood sash. Situated on the west elevation of the addition are two one-over-one, double-hung wood sash windows. A sliding patio door is positioned on the north (rear) elevation of the addition. Located on the main block are three windows containing six-over-six, double-hung wood sashes.

North of the house is a ca. 1970 utility shed. The frame structure features a front-gabled roof covered with standing seam metal, an exterior clad with board-and-batten wood siding, and a covered pier foundation. Facing south, the shed includes a pair of swinging wood doors that are flanked on either side by a horizontal two-over-two, double-hung metal sash window (see Figure 4.92).

NRHP Assessment

Property IS-8 is a typical example of a ca. 1965 Ranch style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the application of vinyl siding and the construction of the rear elevation addition. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-8 is not eligible for the NRHP.

Figure 4.89. Property IS-8; view is north featuring the façade.

Figure 4.90. Property IS-8; view is southwest featuring the modern addition attached to the north (rear) elevation.

Figure 4.91. Property IS-8; view is southeast featuring the west elevation of the main block.

Figure 4.92. Property IS-8; view is north featuring the ca. 1970 storage shed.

TVA Holly Springs Substation

TVAR's architectural survey of the proposed expansion of the TVA Holly Springs substation revisited two previously documented architectural resources, the NRHP-listed East Holly Springs and Depot-Compress historic districts. Portions of each historic district are located within the architectural survey radius, but lie outside the APE. Based on the results of TVAR's architectural survey, each of the historic districts are located outside the viewshed to the project area (see Figure 4.2; Figures 4.93-4.110). At their nearest points, the East Holly Springs Historic District and the Depot-Compress Historic District are located 0.48 and 0.36 miles away from the project area, respectively. TVAR's in-field assessment observed that direct visual lines-of-sight to the project area from each of the NRHP-listed historic districts are completely obscured by a combination of rolling terrain and mature tree growth (see Figures 4.104-4.110). In the opinion of TVAR, the proposed undertaking will not compromise the integrity or diminish the historical and architectural significance for which either the East Holly Springs Historic District or the Depot-Compress Historic District were listed on the NRHP. For these reasons, TVAR recommends that the proposed project will have no effect on the NRHP-listed East Holly Springs or Depot-Compress historic district.

Additionally, TVAR's architectural survey resulted in the identification of 11 previously undocumented architectural resources, IS-9-IS-19, which fall within the architectural APE of the proposed project area. Based on the results of its survey, it is the opinion of TVAR that properties IS-9-IS-19 are not eligible for the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations. Based on the results of the architectural survey, it is the opinion of TVAR that no historic properties will be affected by the proposed expansion of the TVA Holly Springs substation. TVAR recommends no additional investigation of above-ground resources in connection with the proposed project.

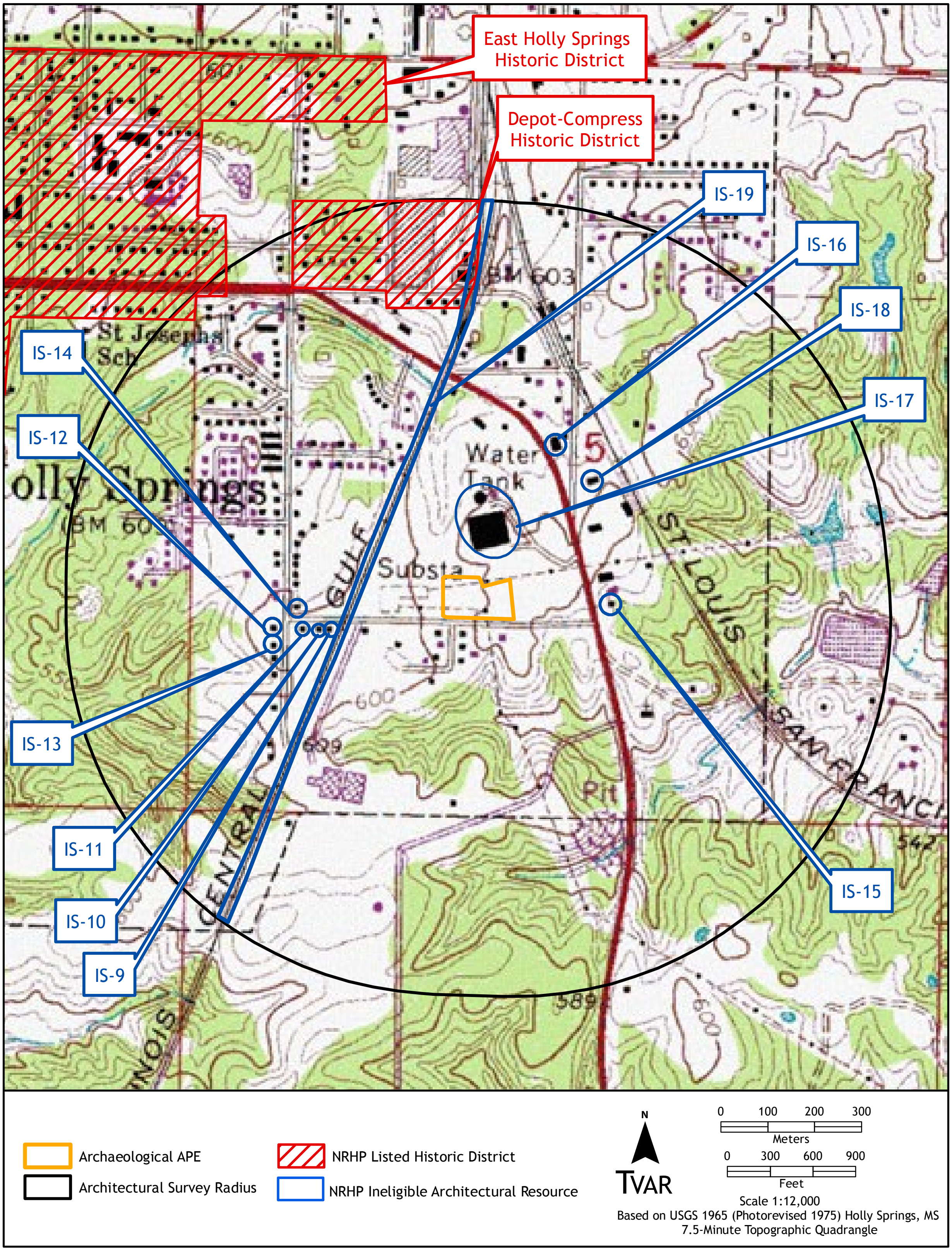

Figure 4.93. Excerpt of the USGS Holly Springs, MS topographic quadrangle showing the proposed project area, survey radius, and location of previously and newly recorded architectural resources.

Figure 4.94. TVA Holly Springs substation expansion project area; view is north.

Figure 4.95. TVA Holly Springs substation expansion project area; view is east.

Figure 4.96. TVA Holly Springs substation expansion project area; view is south.

Figure 4.97. TVA Holly Springs substation expansion project area; view is west.

Figure 4.98. LOS-5; view is northeast.

Figure 4.99. LOS-6; view is east.

Figure 4.100. LOS-7; view is southeast.

Figure 4.101. LOS-8; view is northwest.

Figure 4.102. LOS-9; view is southeast.

Figure 4.103. LOS-10; view is southeast.

Figure 4.104. LOS-11; Depot-Compress Historic District; view is south from the intersection of S. Compress Street and E. Van Dorn Avenue looking toward the project area.

Figure 4.105. LOS-12; Depot-Compress Historic District; view is south from the intersection of S. Bethlehem Street and E. Van Dorn Avenue looking toward the project area.

Figure 4.106. LOS-13; Depot-Compress Historic District; view is south from E. Van Dorn Avenue looking toward the project area.

Figure 4.107. Holly Springs substation project area; view is north looking toward the Depot-Compress Historic District.

Figure 4.108. LOS-14; East Holly Springs Historic District; view is southeast looking toward the project area.

Figure 4.109. Holly Springs substation project area; view is northwest looking toward the East Holly Springs Historic District.

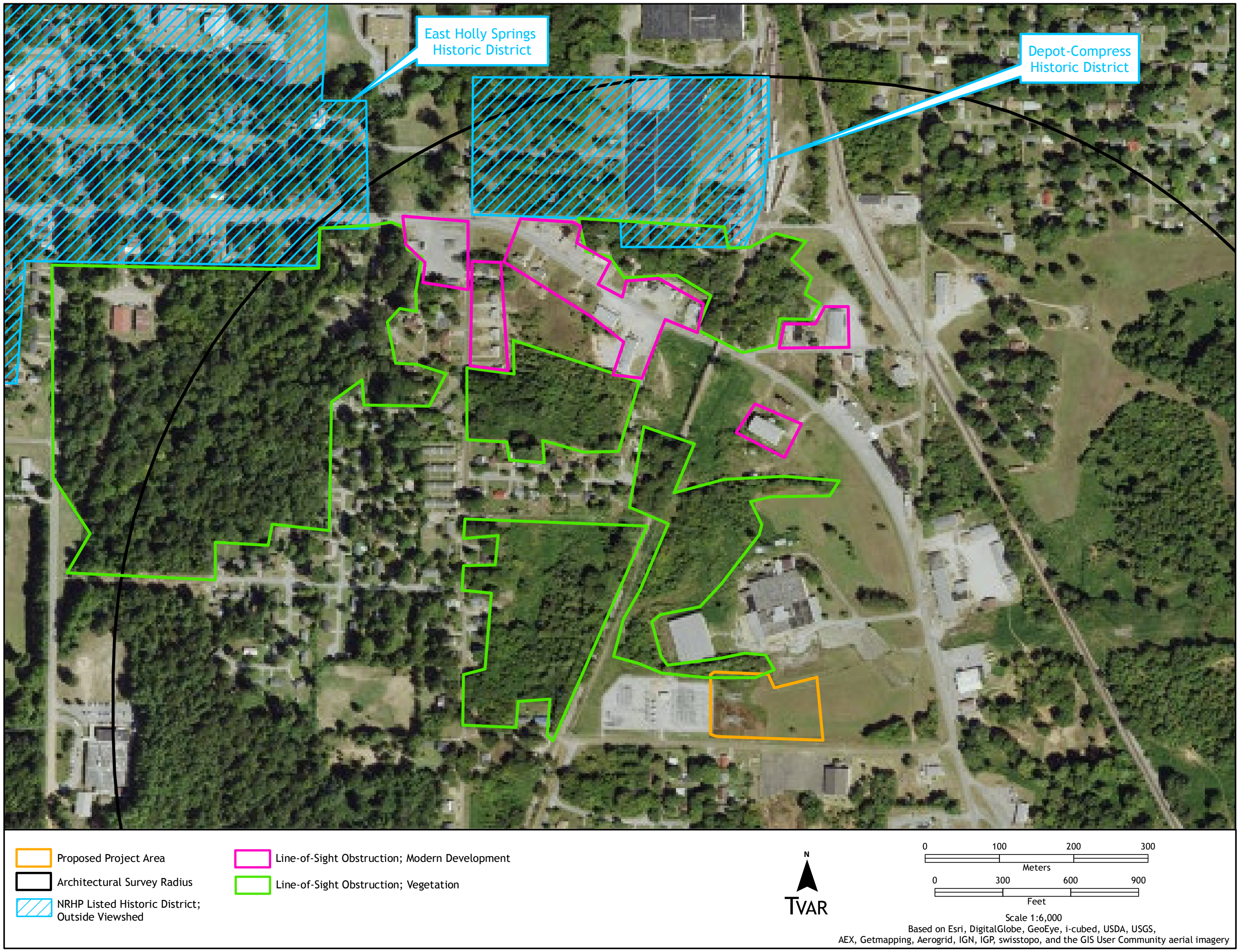

Figure 4.110. Current aerial imagery of the project area illustrating line-of-sight obstructions to the NRHP-listed Depot-Compress and East Holly Springs historic districts.

Newly Recorded Architectural Resources

IS-9

Located approximately 0.18 miles west of the project area at 449 Neely Avenue, property IS-9 is a one-story pyramidal-roof house that appears to have been constructed ca. 1920 (see Figure 4.93; Figures 4.111-4.112). The building features a roof covered with asphalt shingles, an exterior clad with asbestos shingle siding, and a covered pier foundation. Facing north, the façade reveals a central door that is flanked on either side by a six-over-six, double-hung wood sash window. Access to the façade door is achieved via a full-width porch. The porch features a wood deck on a concrete block pier foundation and four non-original wood posts that are used to support a hipped roof. The east elevation of the house is pierced by a six-over-six, double-hung wood sash window and a horizontal two-over-two, double-hung metal sash window. Positioned on a rear shed extension is a six-light wood casement sash window. The west elevation of the house is marked by two windows that contain six-over-six, double-hung wood sashes and a single six-light wood casement sash window set in a rear shed extension. Highlighting the south (rear) elevation is a recessed central bay that includes a door and a six-over-six, double-hung wood sash window. Access to the door is through a center bay porch that is formed by flanking shed extensions. The porch includes a wood deck and two modern wood posts that help support the roof. In addition, a six-light wood casement sash window is located on the interior east wall of the porch. Each extension is clad with modern fiberboard siding.

NRHP Assessment

Property IS-9 is a typical example of a ca. 1920 pyramidal-roof house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the application of fiberboard siding and the replacement of the columns associated with the façade and rear elevation porches. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-9 is not eligible for the NRHP.

Figure 4.111. Property IS-9; view is southwest featuring the façade and east elevation.

Figure 4.112. Property IS-9; view is northeast featuring the south (rear) and west elevations.

IS-10

Located approximately 0.19 miles west of the project area at 435 Neely Avenue, property IS-10 is a one-story hipped-roof house that appears to have been constructed ca. 1920 (see Figure 4.93; Figures 4.113-4.114). The concrete block building features a roof covered with asphalt shingles, an interior brick chimney, an exposed concrete block exterior, and a continuous concrete block foundation. Facing north, the façade reveals a central door that is flanked on either side by a six-over-six, double-hung vinyl sash window. Access to the façade door is achieved via a full-width porch. The porch features a wood deck on a concrete block foundation and four non-original wood posts that are used to support a flat roof. The east elevation of the house is pierced by two six-over-six, double-hung vinyl sash windows. This sash type is repeated on three windows located along the west elevation. Attached to the rear elevation is a full-width shed-roof extension. Composed of concrete blocks, the extension includes a centrally placed door that is flanked to the east by a six-over-six, double-hung vinyl sash window.

NRHP Assessment

Property IS-10 is a typical example of a ca. 1920 hipped-roof house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of the original porch columns and window sashes. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-10 is not eligible for the NRHP.

Figure 4.113. Property IS-10; view is southeast featuring the façade and west elevation.

Figure 4.114. Property IS-10; view is northwest featuring the east and south (rear) elevations.

IS-11

Located approximately 0.19 miles west of the project area at 445 Neely Avenue, property IS-11 is a one-story hipped-roof house that appears to have been constructed ca. 1920 (see Figure 4.93; Figures 4.115-4.116). The frame building features a roof covered with asphalt shingles, two interior brick chimneys, an exterior clad with weatherboard siding, and a continuous concrete block foundation. Facing north, the façade reveals a central door that is flanked on either side by a four-over-four, double-hung wood sash window. Access to the façade door is achieved via a full-width porch. The porch features a wood deck on a concrete block foundation and four non-original wood posts that are used to support a hipped roof. Both the east and west elevations of the house are pierced by a single and a paired window that each contain four-over-four, double-hung wood sashes. Located to the south, on the east and west elevations of a rear shed extension, is a six-over-six, double-hung wood sash window. Attached to the south (rear) elevation of the house is a full-width shed-roof extension that includes a centrally placed door. Flanking the door to the east is a paired window and to the west is a band of three windows that each contain six-over-six, double-hung wood sashes.

NRHP Assessment

Property IS-11 is a typical example of a ca. 1920 hipped-roof house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of the original porch columns. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-11 is not eligible for the NRHP.

Figure 4.115. Property IS-11; view is southwest featuring the façade and east elevation.

Figure 4.116. Property IS-11; view is northeast featuring the south (rear) and west elevations.

IS-12

Located approximately 0.23 miles west of the project area at 370 South Chesterman Street, property IS-12 is a one-story hipped-roof house that appears to have been constructed ca. 1920 (see Figure 4.93; Figures 4.117-4.120). The frame building features a roof covered with asphalt shingles, an interior brick chimney, an exterior clad with weatherboard siding, and a brick pier foundation infilled with concrete blocks. Facing east, the façade reveals a central door that is flanked on either side by a pair of one-over-one, double-hung wood sashes. Access to the façade door is achieved via a full-width porch that is integral with the main roof. The porch features a concrete slab deck on a concrete block foundation and four non-original decorative metal posts, which are used to support the roof. The north elevation of the house is marked by a non-original exterior chimney and by three window openings containing one-over-one, double-hung wood sashes. This sash type is repeated on two windows located along the south elevation. Additional fenestration consists of a horizontal two-over-two, double-hung metal sash window. Attached to the west (rear) elevation is a ca. 1955 gabled-roof addition. The addition is clad with wood drop siding and features a concrete block foundation. Fenestration on the rear addition includes two paired windows and a single window that each contain horizontal two-over-two, double-hung metal sashes. Lastly, the rear addition includes a door located within a recessed corner porch.

Associated outbuildings include:

- A ca. 1950 storage shed. The frame structure features a shed roof covered with standing seam metal and an exterior clad with vertical wood boards. A door is positioned on the north elevation (see Figure 4.119);

- A ca. 1970 carport/garage. The frame building features a front-gabled roof covered with asphalt shingles and an exterior clad with vertical wood boards. Facing east, the building includes a single-bay that contains an overhead metal door. Additionally, the south elevation includes an exterior brick chimney and a window opening containing horizontal two-over-two, double-hung metal sashes (see Figure 4.120).

NRHP Assessment

Property IS-12 is a typical example of a ca. 1920 hipped-roof house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the construction of the north elevation chimney and the replacement of the original porch columns. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-12 is not eligible for the NRHP.

Figure 4.117. Property IS-12; view is southwest featuring the façade and north elevation.

Figure 4.118. Property IS-12; view is northeast featuring the south and west (rear) elevations.

Figure 4.119. Property IS-12; view is west featuring the ca. 1950 storage shed.

Figure 4.120. Property IS-12; view is north featuring the ca. 1970 carport/garage building.

IS-13

Located approximately 0.27 miles southwest of the project area at 396 South Chesterman Street, property IS-13 is a one-story side-gabled house that appears to have been constructed ca. 1920 (see Figure 4.93; Figures 4.121-4.122). Based on physical evidence, it is the opinion of TVAR that the building was originally constructed as a front-gabled house with the main entrance located on the east elevation, fronting South Chesterman Street. Within the past ten years, the house appears to have been modified with the reorientation of the main entrance to the south elevation. The building features a gabled roof covered with standing seam metal, an interior brick chimney, an exterior clad with weatherboard siding, and a brick pier foundation infilled with concrete blocks. Facing south, the façade reveals an off-centered door that is flanked to the west by a four-over-four, double-hung vinyl sash window. The east elevation of the house, which appears to have served as the original façade, features a modern projecting gabled bay. The gabled bay is clad with drop wood siding and is pierced by a single window containing six-over-six, double-hung vinyl sashes. The west elevation of the house includes a shed-roof extension marked by a modern two-light, sliding vinyl sash window and a door. Positioned south of the extension is a six-over-over-six, double-hung vinyl sash window. Two windows containing four-over-four, double-hung vinyl sashes are located on the north elevation.

NRHP Assessment

Property IS-13 is a typical example of a ca. 1920 side-gabled house that fails to exhibit unique features of its architectural style or workmanship. It is TVAR's opinion that the building appeared to have been originally constructed as a front-gabled house with the main entrance located on the east elevation. Recently, the location of the main entrance was moved to the south elevation. Additional alterations that have diminished the architectural integrity of the resource include the construction of the projecting gabled addition on the east elevation and the replacement of the original window sashes. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-13 is not eligible for the NRHP.

Figure 4.121. Property IS-13; view is northeast featuring the west elevation and the south elevations.

Figure 4.122. Property IS-13; view is southwest featuring the east (former primary façade) and north elevations.

IS-14

Located approximately 0.24 miles west of the project area at 440 Neely Avenue, property IS-14 is a one-story hipped-roof house that appears to have been constructed ca. 1920 (see Figure 4.93; Figures 4.123-4.124). The frame building features a roof covered with asphalt shingles, an interior brick chimney, an exterior clad with asbestos shingle siding, and a covered pier foundation. Facing south, the façade reveals a central door that is flanked on either side by a six-over-six, double-hung vinyl sash window. Access to the façade door is achieved via a full-width porch. The porch features a wood deck on a concrete block foundation and four non-original wood posts that are used to support a hipped roof. The east elevation of the house is marked by an exterior end brick chimney, two windows containing six-over-six, double-hung vinyl sashes and a paired window containing the same sash type. Situated along the west elevation are three window openings containing six-over-six, double-hung vinyl sashes. The north (rear) elevation includes a centrally placed door that is flanked to the west by a six-over-six, double-hung vinyl sash window. A partial-width hipped-roof porch provides access to the rear elevation door. The porch features a wood deck on a concrete block foundation and four non-original wood posts that support a hipped roof. Positioned east of the porch is a shed-roof extension pierced with a six-over-six, double-hung vinyl sash window.

NRHP Assessment

Property IS-14 is a typical example of a ca. 1920 hipped-roof house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of the original façade and rear elevation porch columns and the replacement of the original window sashes. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-14 is not eligible for the NRHP.

Figure 4.123. Property IS-14; view is northwest featuring the façade and east elevation.

Figure 4.124. Property IS-14; view is southeast featuring the north (rear) and west elevations.

IS-15

Located approximately 0.1 mile east of the project area at 850 State Route 178, property IS-15 is a one-story Minimal Traditional style house that appears to have been constructed ca. 1940 (see Figure 4.93; Figures 4.125-4.128). The frame building features a roof covered with asphalt shingles, an exterior clad with asbestos shingle siding, and a covered pier foundation. Facing west, the façade reveals a central door that is flanked to the north by a modern window opening containing a 12-light, fixed vinyl sash. Located south of the door is a pair of six-over-six, double-hung vinyl sash windows. Access to the façade door is through a central bay porch. The porch features a concrete slab deck on a brick foundation and two non-original wood posts atop brick plinth blocks that support a projecting gabled roof. The north elevation of the house is pierced with two windows containing six-over-six, double-hung vinyl sashes and an additional window containing four-over-four, double-hung vinyl sashes. The south elevation of the house is marked by a pair of six-over-six, double-hung vinyl sashes and a single window containing one-over-one, double-hung vinyl sashes. Attached to the east (rear) elevation is a gabled-roof extension that is clad with asbestos shingle siding and rests on a covered pier foundation. The extension includes two six-over-six, double-hung vinyl sash windows on the east elevation and a door positioned on the south elevation. Lastly, a six-over-six, double-hung vinyl sash window is located on the main block.

Located east of the house is a storage shed that appears to date to the mid-twentieth century. The frame structure features a side-gabled roof covered with corrugated metal sheets and an exterior clad with vertical wood boards. A door is positioned on the west elevation (see Figure 4.128).

NRHP Assessment

Property IS-15 is a typical example of a ca. 1940 Minimal Traditional style house that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the house that have diminished its architectural integrity include the replacement of the original porch columns and the replacement of the original window sashes. Based upon the lack of architectural merit, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-15 is not eligible for the NRHP.

Figure 4.125. Property IS-15; view is east featuring the façade.

Figure 4.126. Property IS-15; view is southeast featuring the north (rear) and west elevations.

Figure 4.127. Property IS-15; view is northwest featuring the east (rear) and south elevations.

Figure 4.128. Property IS-15; view is east featuring the storage shed.

IS-16

Located approximately 0.2 miles northeast of the project area on the east side of State Route 178, property IS-16 is a vacant one-story commercial plaza that appears to have been constructed ca. 1960 (see Figure 4.93; Figures 4.129-4.132). The concrete block building features a flat roof, an exterior clad with a brick veneer, and a concrete block foundation. Facing west, the façade is divided into ten storefront entrances that contain glass doors flanked by single and multi-pane plate glass windows. The façade is largely accented by a non-original wood awning that appears to have been added to the building in the 1980s. The awning features Classical detailing including a decorative entablature with dentil molding, which is supported by a series of Tuscan-style wood columns. TVAR's assessment of the east (rear) elevation noted at least two steel doors that provided access to the northern section of the building. However, a full assessment of the rear elevation could not be conducted due to heavy vegetation that obscures much of the building (see Figure 4.131).

NRHP Assessment

Property IS-16 is a typical example of a mid-twentieth century commercial plaza that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the building that have diminished its architectural integrity include the replacement of the windows and the construction of the ca. 1980 awning along the length of the façade. In addition, the integrity of the building is poor due to neglect. Based upon the lack of architectural merit, as well as the inability to associate the building and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-16 is not eligible for the NRHP.

Figure 4.129. Property IS-16; view is southeast featuring the northern portion of the plaza façade.

Figure 4.130. Property IS-16; view is north featuring the southern portion of the plaza façade.

Figure 4.131. Property IS-16; view is northwest featuring the east (rear) and south elevations.

Figure 4.132. Property IS-16; view is southwest featuring the east (rear) and elevation.

IS-17

Located less than 0.1 mile north of the project area on the west side of State Route 178, property IS-17 is a vacant manufacturing plant once operated by Thompson Industries (see Figure 4.93; Figures 4.133-4.142). The complex is anchored by a square-shaped, steel-frame building that features a flat roof, an exterior clad with a brick veneer, and a concrete slab foundation. Based on physical evidence, the original manufacturing building has been altered over time through the construction of an office wing on the east elevation and a series of storage bays on the west and north elevations. These sections stand out from the original building core through their contrasting exterior finishes such as metal mansard roofs and unfinished concrete block walls.

The primary façade of the manufacturing plant faces south and includes a centrally placed door opening containing a pair of swinging metal doors. Situated east of the door are a single-pane, fixed sash window and a band of five modern windows containing a lower metal awning sash topped by a single-pane fixed sash. Flanking the door to the west are two pairs of windows that contain six-light metal awning sashes. This portion of the façade is shielded by a metal canopy that is supported by a series of metal posts. Attached to the east elevation of the building is a one-story office wing that appears to have been added to the building in the mid-1980s. The office wing is clad with a brick veneer and features a mansard roof covered with metal siding. A glass door located within a recessed entry porch appears to have served as the main entrance for visitors to the plant. Fenestration on the office wing consists of two pairs of windows and two bands of three windows containing single-pane fixed metal sashes.

The west elevation of the manufacturing plant is dominated by a one-story warehouse that is clad with a brick veneer and includes an original loading bay containing an overhead metal door. An additional bay entrance located to the west has been infilled with brick and altered to include a pedestrian door. Connected to the south elevation of the warehouse section is a modern addition clad with metal siding and featuring a truck loading bay containing an overhead metal door. Attached to the west elevation of the warehouse is an open vehicle storage bay that is comprised of a flat metal roof supported by a series of steel columns. The north (rear) elevation of the plant is characterized by an assortment of vehicle bays for loading and off loading materials and goods.

Associated buildings and structures include:

- A modern warehouse. The steel-frame structure is located west of the main plant and features a low-pitch metal gabled roof and an exterior clad with metal siding. Facing east, the building includes three vehicle bays marked with overhead metal doors. In addition, two centrally placed metal pedestrian doors are also located along the east elevation (see Figure 4.137);

- A water tower that appears to date to the original construction of the plant. Located north of the main plant, the steel-frame structure is supported by four legs reinforced with X-bracing (see Figure 4.138);

- A modern pole shed. Located north of the main plant, the pole shed features a concrete slab base and a flat metal roof supported by a series of metal poles (see Figure 4.139);

- A modern concrete block garage. Located north of the main plant, the partially dismantled garage features the remains of a flat metal roof, an exposed concrete block exterior, and a concrete slab foundation. Two open vehicle bays are positioned along the north elevation (see Figure 4.140);

- A modern storage building. Located north of the main plant, the metal-frame structure features a low-pitch metal gabled roof and an exterior clad with metal siding. Facing south, the building contains a centrally placed door opening with a pair of swinging metal doors (see Figure 4.141);

- A modern utility shed. Located north of the main plant, the wood-frame building features a front-gabled roof covered with asphalt shingles, an exterior clad with vinyl siding, and a concrete slab foundation. A door opening is located on the south elevation (see Figure 4.141);

- A one-story manufacturing building. Located north of the main plant, the steel-frame building features a low-pitch metal gabled roof, an exterior clad with metal siding, and a raised concrete foundation. The building is pierced by a series of window openings that contain nine-light metal awning sashes (see Figure 4.142).

NRHP Assessment

Property IS-17 is a typical example of a mid-twentieth century manufacturing plant that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the building that have diminished its architectural integrity include the construction of the office wing and warehouse additions to the east and west elevations. In addition, the integrity and historic setting of the complex has been compromised due to neglect and the construction of modern auxiliary buildings throughout the plant grounds. Based upon the lack of architectural merit, as well as the inability to associate the building and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that IS-17 is not eligible for the NRHP.

Figure 4.133. Property IS-17; view is north featuring the main façade of the original plant building.

Figure 4.134. Property IS-17; view is northwest featuring the office wing attached to the east elevation of the original manufacturing building.

Figure 4.135. Property IS-17; view is northeast featuring the west elevation warehouse.

Figure 4.136. Property IS-17; modern concrete block warehouse addition attached to the west elevation; view is east.

Figure 4.137. Property IS-17; modern warehouse building; view is west.

Figure 4.138. Property IS-17; original water tower; view is northeast.

Figure 4.139. Property IS-17; modern pole shed; view is north.

Figure 4.140. Property IS-17; modern concrete block garage building; view is southeast.

Figure 4.141. Property IS-17; view is northeast featuring the modern storage building and utility shed.

Figure 4.142. Property IS-17; view is southeast featuring the manufacturing building.

IS-18

Located approximately 0.17 miles northeast of the project area on the east side of Highway 178, property IS-18 is a one-story hipped-roof commercial building that appears to have been constructed ca. 1955 and is currently vacant (see Figure 4.93; Figures 4.143-4.144). The building is composed of brick laid in a common bond, and features a roof covered with asphalt shingles and a continuous brick foundation. Facing west, the façade reveals an exterior clad with a brick veneer and an off-center glass and metal door that is shielded by a flat metal canopy. The door is flanked on each side by a window opening containing a two-light lower awning metal sash topped by a four-light fixed metal sash. An additional window opening north of this arrangement has been bricked in. The south elevation is marked by two overhead bay doors, three bricked-in window openings, and a window containing a two-light lower awning metal sash topped by a four-light fixed sash. A concrete block addition is attached to the east (rear) elevation and features a shed roof covered with metal sheeting and two open bays on its south elevation. The north elevation was inaccessible at the time of TVAR's survey due to heavy vegetation.

NRHP Assessment

Property IS-18 is a typical example of a ca. 1955 hipped-roof commercial building that fails to exhibit unique features of its architectural style or workmanship. Modern alterations to the building that have diminished its architectural integrity include the enclosure of original window openings and the construction of the east elevation addition. Based upon the lack of architectural merit, as well as the inability to associate the building and/or its original owner(s) with an important historical event or series of events, it is the opinion of TVAR that property IS-18 is not eligible for the NRHP.

Figure 4.143. Property IS-18; view is northeast and features the façade and south elevation.

Figure 4.144. Property IS-18; view is northwest and features the east and south elevations.

IS-19/ Mississippi Central Railroad

Located approximately 0.12 miles west of the project area, property IS-19 consists of a one-mile-long segment of the Mississippi Central Railroad (also once known as the Illinois Central Gulf Railroad), that crosses within the APE (see Figure 4.93; Figures 4.145-4.148). Actively operated by Pioneer Railcorp, the railroad segment features a raised embankment covered with ballast that supports a modern track composed of wood cross ties and steel rails. The segment located within the project APE is situated within a tree-lined corridor and extends through a combination of light industrial and residential development. A number of at-grade crossings are located along the segment. Due to the heavy vegetation that lines the rail corridor, the crossing at Neely Avenue is the only portion of the segment that has a direct visual line-of-sight to the project area.

At Holly Springs, construction on the rail line began in 1852 and was completed in 1856, connecting the city with New Orleans (Guren 1980). During the Civil War the railroad was extensively used by both the Confederate and Union troops for the movement of supplies and men. Damaged during various raids on Holly Springs, the railroad was rebuilt during the Reconstruction period. It was purchased by the Chicago, St. Louis, and New Orleans Railroad in 1878 and then by the Illinois Central Railroad in 1882 (Guren 1980). Overall, the entire Mississippi Central Railroad stretches 51 miles from Oxford, Mississippi to Grand Junction, Tennessee. An additional line runs from Corinth, Mississippi to Red Bay, Alabama. Today used primarily for freight, the main products shipped along the Mississippi Central Railroad are animal feed ingredients, fertilizer, and wood (Pioneer Railcorp 2015).

NRHP Assessment

Property IS-19/Mississippi Central Railroad is a segment of a mid-nineteenth century railroad that has been continuously altered through routine maintenance over a 150-year period. As an actively managed rail line, the railroad bed has received regular repairs which has resulted in the replacement of the original tracks, cross-ties, and ballast. As such, no materials associated with the original construction of the railroad remain, diminishing its architectural integrity. Moreover, modern industrial and residential development in the area has comprised the railroad's historic setting. For these, reasons it is the opinion of TVAR that property IS-19/Mississippi Central Railroad is not eligible for the NRHP.

Figure 4.145. Property IS-19; view is west and features the at-grade crossing at Neely Avenue.

Figure 4.146. Property IS-19; view is east and features the at-grade crossing at Neely Avenue.

Figure 4.147. Property IS-19; view is northeast from Neely Avenue.

Figure 4.148. Property IS-19; view is southwest from Neely Avenue.

CHAPTER 5. ARCHAEOLOGICAL SURVEY

Under contract with TVA, TVAR conducted a Phase I cultural resources survey to document and assess cultural resources located within the APE associated with the Corinth and Holly Springs substation expansion projects in Alcorn and Marshall Counties, Mississippi. The APE for the archaeological survey consisted of the footprints of the Corinth (2.42 ha [5.98 acres]) and Holly Springs (1.21 ha [2.98 acres]) substation expansion areas. The purpose of the investigation was to assist TVA in its Section 106 compliance and to provide an inventory of cultural resources within the project area, descriptions of the current conditions at each resource identified, and NRHP eligibility recommendations for each resource. The survey was consistent with the Secretary of the Interior's *Standards and Guidelines for Identification* (NPS 1983) and met the requirements established by the MDAH.TVAR's archaeological survey resulted in the identification of one site (22AL726) within the APE associated with the Corinth substation expansion. No resources were identified within the APE associated with the Holly Springs substation expansion. The following provides a review of background information relevant to the project area, descriptions of the resource identified, and a recommendation regarding its NRHP eligibility.

Archaeological Background Literature and Records Search

In March of 2016, TVAR consulted the MDAH Historic Resources Inventory Database (HRID) to conduct a background literature and records search to identify documented archaeological sites and previous archaeological investigations within the project area. The background study area was defined as a 0.8 km radius surrounding each of the project areas comprising the archaeological APE (Figures 5.1 and 5.2). To supplement the information obtained from the MDAH HRID, TVAR also reviewed numerous cartographic and ethnohistoric databases including the NRHP, University of Alabama Historic Maps Archive, Dave Rumsey Map Collection (DRMC), Library of Congress Map Archive, and U.S. Geological Survey (USGS) Earth Explorer data portal. Cartographic research associated with the Corinth substation expansion utilized the 1950 Corinth 15-minute topographic quadrangle, a 1921 soil survey map of Alcorn County, an 1862 map entitled "Topographic sketch of Corinth, Mississippi and its environs: showing the enemy entrenchments, and the approach of the U.S. forces" (Michler and Weyss 1862), an 1862 map entitled "Map of the Country Between Monterey, Tenn. & Corinth, Miss." (Matz 1862), an 1875 map entitled "Environs de Corinth" (Vorzet, Ed. Dumas; Le Comte de Paris 1875), and an 1895 map entitled "Plan of the Battle of Corinth," (Rosencrans 1895). Maps referenced during research for the Holly Springs substation expansion included the USGS 1953 15-minute and 1965 Holly Springs 7.5-minute topographic quadrangles. A Bureau of Land Management, General Land Office Records (BLM, GLO) search was conducted for all land parcels encompassed by the APE, and the original land patents are included in Appendix B.

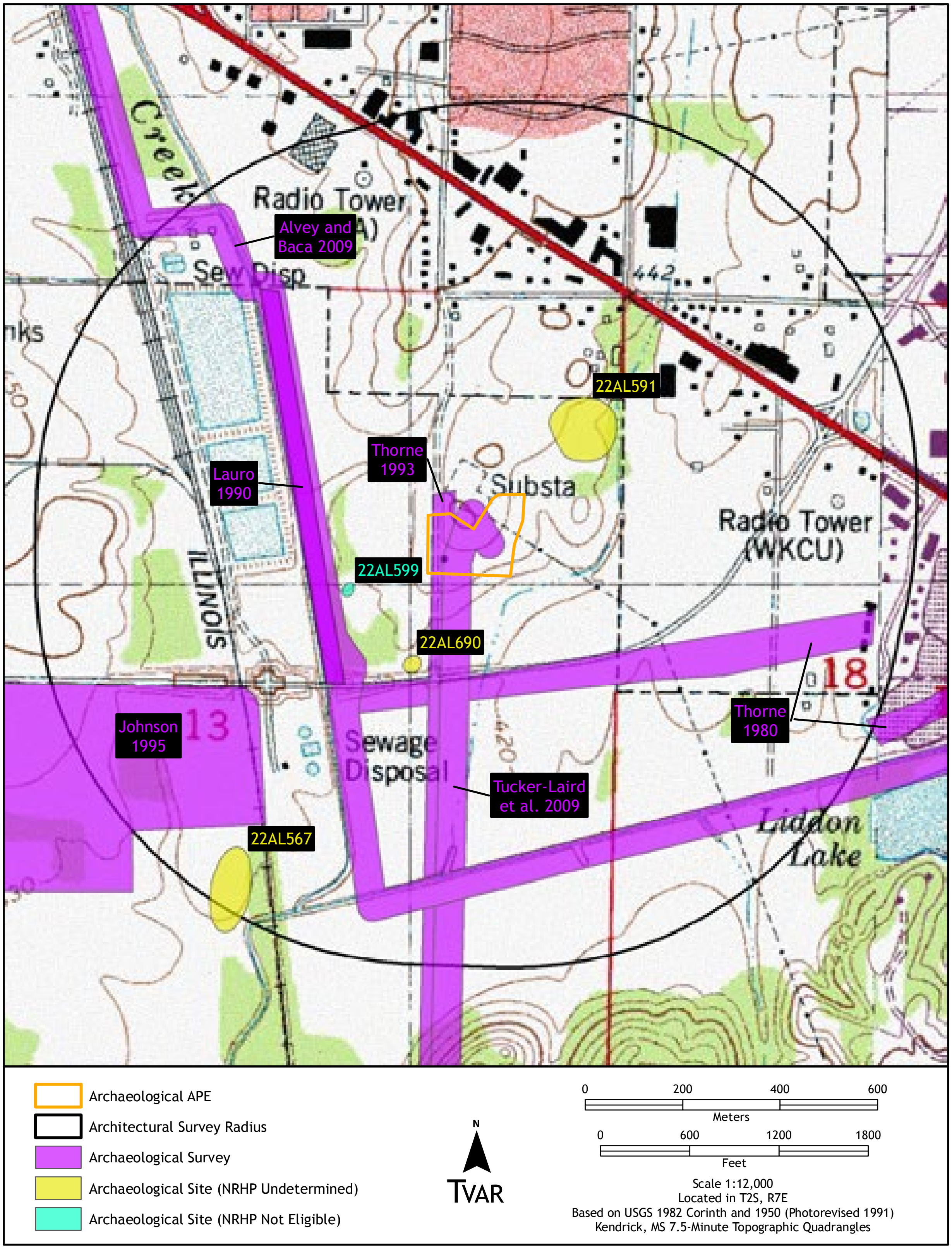

Figure 5.1. Background study area associated with the Corinth substation expansion.

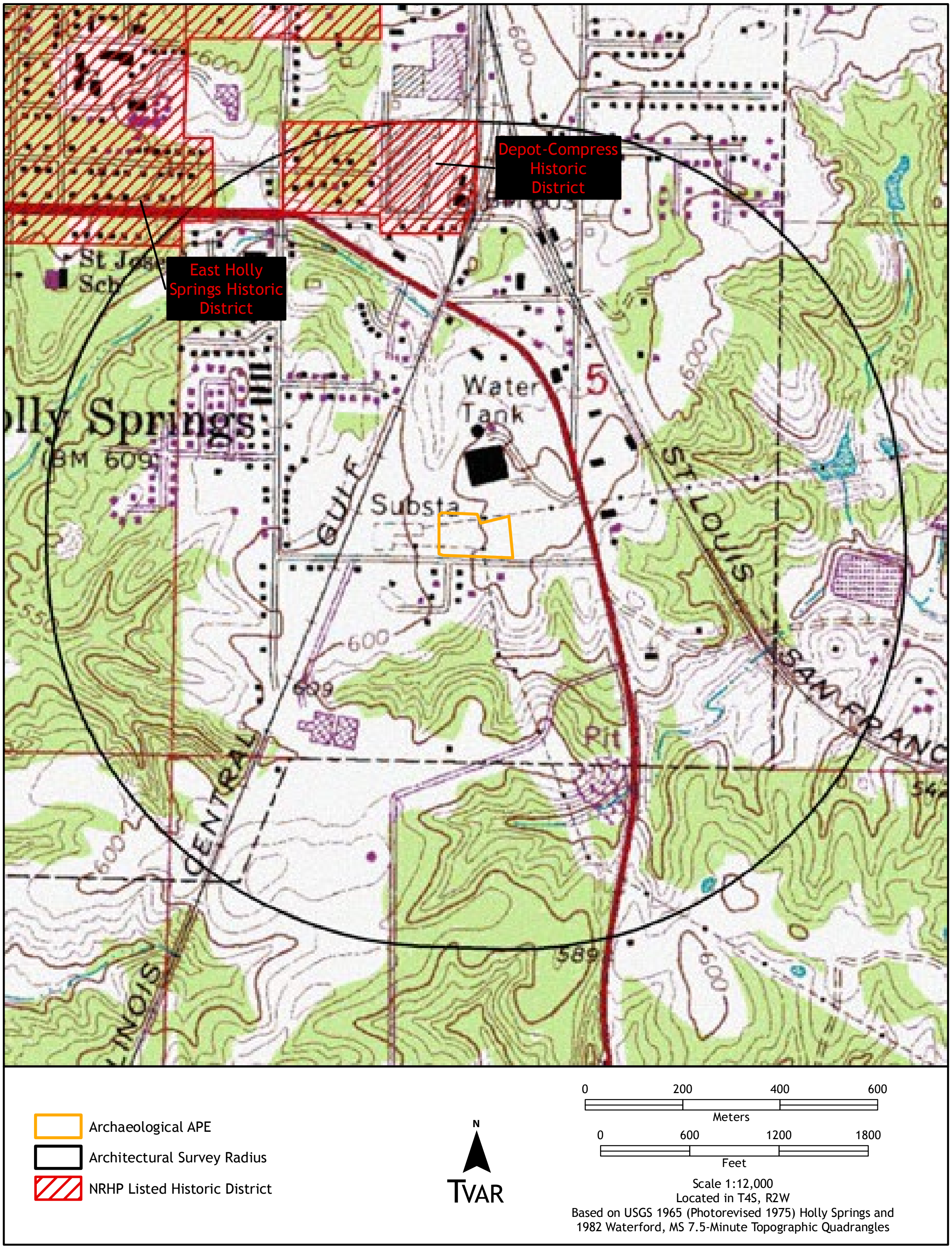

Figure 5.2. Background study area associated with the Holly Springs substation expansion.

The NRHP lists 20 properties in Alcorn County and another 20 in Marshall County. None of the Alcorn County properties fall within the background study area or APE associated with the Corinth substation expansion project, but two of the Marshall County NRHP-listed properties, the Depot-Compress Historic District and the East Holly Springs Historic District, fall within the background area associated with the Holly Springs substation expansion project. The properties are discussed in greater detail in the previous chapter of this report. No Traditional Cultural Properties or historic cemeteries were identified in either background study area.

TVAR's research using the MDAH HRID identified four archaeological sites within the background study area associated with the Corinth substation expansion, but none were recorded within the APE (Table 5.1). No archaeological sites fell within the background study area or APE associated with the Holly Springs substation expansion. In addition the MDAH HRID identified six previously conducted cultural resources survey in within the background study area associated with the Corinth substation expansion, two of which overlapped with the current APE (Table 5.2). No previously conducted cultural resources surveys fell within the background study area or APE associated with the Holly Springs substation expansion.

Table 5.1. Archaeological Sites Within the Background Study Area.

Site Number	Temporal Affiliation	NRHP Status	Reference
22AL567	Early-Late Archaic; Middle-Late Woodland	Undetermined	Atkinson 1987
22AL591	Late Archaic; Mississippian	Undetermined	MDAH
22AL599	Unknown Aboriginal	Ineligible	MDAH
22AL690	Unknown Aboriginal	Undetermined	MDAH

Table 5.2. Previous Cultural Resources Surveys Within the Background Study Area.

Project Description	Level of Investigation	Survey Area (ha)	Survey Dimensions	Overlap with Current APE (Acres)	Archaeological Resources	Reference
Sewer treatment plant and wasterwater collection	Survey	Unknown	Unknown	N/A	Unknown	Thorne 1980
Corinth Sewage Lagoon	Survey	0.4	2,500 ft by 20 ft tract	N/A	None	Lauro 1990
TVA ROW from Ripley to Corinth	Survey	137.59	28 mi with 100 ft ROW	1.35	None	Thorne 1993
Improvements to South Corinth Industrial Park	Survey	30.35	75 acres	N/A	None	Johnson 1995
Water Line Route in Corinth	Survey	25.14	8,380 m long, 30 m wide corridor	N/A	22AL689	Alvey and Baca 2009
Corinth-Biggersville Transmission Line	Survey	44.42	9.2 mi long, 30 m wide corridor	2.44	None	Tucker-Laird et al. 2009

Methods of Investigation

The Phase I survey included pedestrian reconnaissance of the APE with a combination of shovel testing and surface inspection as the basis for the identification and delineation of archaeological resources. Systematic shovel testing (herein referred to as planned shovel test locations) was conducted at 30 m intervals within the archaeological APE. Shovel tests were 30-x-30 cm square units and excavated to a depth of 70 centimeters below surface (cmbs), or until the water table or sterile subsoil was encountered. Test soils were passed through 1/4-inch hardware mesh to recover cultural materials. Artifacts recovered in the screen were bagged and labeled by provenience, including a shovel test number and a temporary site number. Systematic shovel testing was complemented with visual inspection of exposed ground surfaces, root balls, and rodent burrows, when possible. Lastly, TVAR conducted judgmental shovel tests within the archaeological APE to investigate any area that fell outside the planned 30 m shovel test interval but was considered a high probability location for archaeological resources.

When archaeological resources were identified during the survey, TVAR implemented a close interval (10 m) shovel testing program to delineate both the horizontal and vertical boundaries of the resources within the archaeological APE. Shovel testing at 10 m intervals was conducted in an opportunistic manner depending on the landform and orientation of the APE. Close interval shovel testing continued within the APE until two sequential negative tests were completed. All excavated deposits were passed through 1/4-inch mesh screen. Artifacts recovered in the screen were bagged and labeled by provenience, including a shovel test number and a temporary site number.

All locations (planned, judgmental, and resource delineation) investigated during the survey were recorded using a field computer (Topcon GRS-1) with a global positioning system (GPS) receiver with sub-meter precision and specialized data-capturing software tailored to archaeological surveying. The combination of hardware and software provided for realtime data acquisition and visualization while furnishing important information to the field crews, including the locations of archaeological sites, environmental features, and survey boundaries. Using software developed by TVAR, detailed information, such as soil descriptions, artifact locations, landscape features, and photographic information, was recorded at the time of observation and linked via geographic coordinates. All pertinent project records and materials will be curated at the Erskine Ramsay Archaeological Repository at Moundville Archaeological Park (Appendix C).

Results of the Corinth Substation Expansion Survey

One site (22AL726) was identified during the survey of the APE associated with the Corinth substation expansion. No linear resources were identified. A total of 25 planned shovel test locations were visited during the survey, one of which was positive for cultural material. In addition, one judgmental shovel test was conducted in the southwestern portion of the APE, but it did not produce any artifacts. Finally, nine shovel tests were conducted during the delineation of 22AL726, which is discussed in greater detail below. The locations of all shovel tests are depicted in Figure 5.3, a shovel test roster is included in Appendix D, and the completed MDAH site form for 22AL726 is provided in Appendix E.

Figure 5.3. Shovel test locations within the APE associated with the Corinth substation expansion.

22AL726

Site 22AL726 is a 1,493 m², low-density prehistoric pottery scatter with a historic isolate. It is located on the summit and shoulder of a northeast-southwest trending ridge and 130 m northwest of an unnamed tributary of Bridge Creek. At the time of TVAR's survey, the site was situated in a field of tall grass and briars less than 10 m southeast of the existing substation (Figure 5.4).

BLM, GLO records indicate that the parcel encompassing 22AL726 was originally registered to Mul La Le Tubby, a Chickasaw Indian, through the 1832 Treaty of Pontotoc (see Appendix B). The USGS 1950 15-minute and 1982 7.5-minute Corinth topographic quadrangle maps depict a structure 100 m to the southwest of the site, but no structure was observed at that location during the current survey; thus, the structure must have been demolished sometime after 1982.

A total of 12 shovel tests were conducted during TVAR's investigation of the site, including three that produced artifacts (n=5) from a maximum depth of 25 cmbs (Figure 5.5). A general representative profile was witnessed in Shovel Test 27 and consisted of a brown (7.5YR 5/4) silty clay loam (0 to 20 cmbs) underlain by a strong brown (7.5YR 5/6) silty clay (20 to 29 cmbs) (Figure 5.6). Artifacts recovered are listed below.

Shovel Test 27 (0-14 cmbs)
- 2 2.34 g coarse sand tempered sherdlet

Shovel Test 29 (18-25 cmbs)
- 1 0.83 g coarse sand tempered sherdlet

Shovel Test 64 (0-11 cmbs)
- 1 0.45 g 1/4-inch debitage, chert (undifferentiated)
- 1 6.53 g brick fragment

In sum, 22AL726 is a low-density prehistoric pottery scatter northwest of a tributary of Bridge Creek. The artifact assemblage recovered during TVAR's investigation of the site was primarily comprised of coarse sand-tempered ceramics, which could indicate a Woodland occupation at the site. Additionally, a historic brick fragment was found, but it can not be precisely dated to the time during which a structure was extant near the site. Due to the sparse nature of the artifact distribution, location of artifacts within the plowzone, and the inability to associate the assemblage with a more specific prehistoric time period or historic structure, it is the opinion of TVAR that 22AL726 lacks the potential to significantly contribute to research concerning the prehistory or history of the region. As such, TVAR recommends that the site is not eligible for listing on the NRHP and that no further archaeological investigations of 22AL726 are necessary in connection with the proposed project.

Figure 5.4. Briars and tall grass at 22AL726.

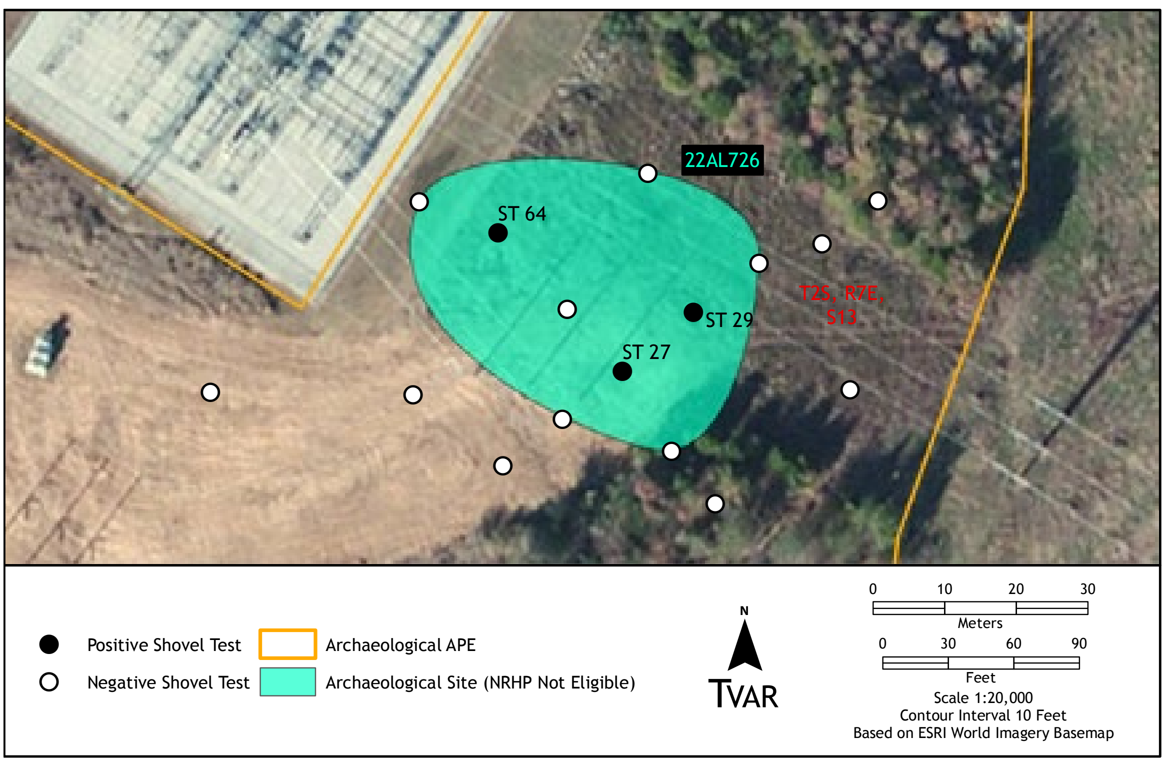

Figure 5.5. Map of 22AL726

Figure 5.6. West profile of Shovel Test 27 at 22AL726.

Results of the Holly Springs Substation Expansion Survey

No archaeological or linear resources were identified during TVAR's survey of the APE associated with the Holly Springs substation expansion project. A total of 15 planned shovel test locations were visited during the survey, none of which were positive for archaeological cultural material (Figure 5.7; see Appendix D). The project area fell within a manicured grass field (Figure 5.8), and shovel testing produced a general profile (witnessed in Shovel Test 13) consisting of a dark grayish brown (10YR 4/2) silty clay loam (0 to 10 cmbs) underlain by a mottled yellowish brown (10YR 5/4) silty clay loam (10 to 34 cmbs). The bottommost stratum observed was a mottled yellowish brown (10YR 5/6) silty clay (34 to 41 cmbs) (Figure 5.9).

Figure 5.7. Shovel test locations within the APE associated with the Holly Springs substation expansion.

Figure 5.8. Manicured grass comprising the Holly Springs substation expansion project area (view of the northwest).

Figure 5.9. Southwest profile of Shovel Test 13 within the APE associated with the Holly Springs substation expansion.

CHAPTER 6. MATERIALS RECOVERED

Field notes, maps, artifacts, photos, and pertinent records generated during this Phase I survey were transported to the TVAR laboratory in Huntsville, Alabama. At the laboratory facilities, artifacts and other associated materials recovered during the survey were thoroughly washed and allowed to air dry. Provenience information was verified for accuracy at this stage, and all materials were accounted for by a physical inventory. All items were assigned unique catalog numbers and placed in 4 mil polypropylene resealable bags. Prior to entering the material data into a relational database, a final check of provenience and material data was performed. The data were then entered into the database, and both query-driven and physical data checks were used to verify the accuracy of the entries. All materials and documents generated during this Phase I study will be curated at the Erskine Ramsay Archaeological Repository located at Moundville Archaeological Park. This facility meets U. S. Department of Interior 36 CFR § 79 guidelines. Materials collected during the current survey are summarized below.

Sherdlet

Sherdlet represents a <1/2-inch size-grade category of ceramics. Specimens this size typically are regarded as too small for accurately discerning surface treatment and/or temper. Consequently, sherdlets are not placed into any chronological type. However, whenever possible, temper and/or surface treatment is recorded for specimens recovered from proveniences containing only sherdlets or for unique specimens within a provenience. Three coarse sand-tempered sherdlets were recovered from 22AL726. Sand-tempered pottery is typically associated with Gulf Formational and Woodland assemblages in northern Mississippi (Jenkins 1981:15-29; Rafferty 1990).

Lithic Debitage

Debitage is the byproduct of lithic reduction activities, i.e., flintknapping. Specimens were classified in accordance with Ahler's (1989) aggregate analysis methods, in which recorded attributes include raw material type, size grade, and presence of cortex. All debitage was size graded through nested 1-inch, 1/2-inch, and 1/4-inch screens. One piece of 1/4-inch debitage knapped from undifferentiated chert was recovered from 22AL726.

Brick

Bricks are produced from tempered clay which is formed in a mold or cut into a rectangular block and fired in a kiln. The manufacturing of brick in the United States began soon after European colonists arrived. Machine-made bricks began replacing hand-made bricks throughout the nineteenth century and became the primary method of brick production in the late nineteenth century (Holly 2009). Site 22AL726 yielded one brick fragment.

CHAPTER 7. SUMMARY AND RECOMMENDATIONS

Under contract with TVA, TVAR conducted a Phase I cultural resources survey to document and assess cultural resources located within the APE associated with the Corinth and Holly Springs substation expansion projects in Alcorn and Marshall Counties, Mississippi. The APE for the archaeological survey consisted of the footprints of the Corinth (2.42 ha [5.98 acres]) and Holly Springs (1.21 ha [2.98 acres]) substation expansion areas. The architectural APE consisted of a 0.8 km (0.5 mi) radius surrounding the substation footprints. Areas within the architectural survey radii that were determined not to be in view of the substations due to terrain, vegetation, and/or modern built environments were not considered as part of the architectural APE.

The purpose of the investigation was to assist TVA in its Section 106 compliance and to provide an inventory of cultural resources within the project area, descriptions of the current conditions at each resource identified, and NRHP eligibility recommendations for each resource. The survey was consistent with the Secretary of the Interior's *Standards and Guidelines for Identification* (NPS 1983) and met the requirements established by the MDAH.

TVAR's architectural assessment of the survey radius surrounding the proposed Corinth substation expansion resulted in the revisitation of 14 previously documented architectural resources (003-COR-1249, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, and 1263). Of the 14 previously documented architectural resources, 13 (003-COR-1249, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1258, 1259, 1260, 1261, 1262, and 1263) are extant and located within the architectural APE. TVAR recommends these architectural resources not eligible for the National Register of Historic Places (NRHP) due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage. TVAR's survey noted previously recorded property 003-COR-1251 is located outside the viewshed of the proposed project area. In addition, TVAR's survey of the APE associated with the Corinth substation identified six resources (IS-1-IS-6) within the survey radius, none of which are recommended as eligible for listing on the NRHP due to their lack of architectural and historic significance. Consequently, TVAR recommends no additional investigation of above-ground resources in connection with the proposed Corinth substation expansion project.

TVAR's architectural assessment of the survey radius surrounding the proposed Holly Springs substation expansion revisited two NRHP-listed historic districts, the Depot-Compress Historic District and the East Holly Springs Historic District, within the survey radius. Based on the results of TVAR's architectural survey, the two historic districts are located outside the viewshed to the project area and will not be affected by the proposed undertaking. In addition, TVAR's survey resulted in the identification of 14 resources (IS-1-IS-14) within the survey radius, none of which are recommended as eligible for listing on the NRHP due to their lack of architectural and historic significance. Consequently, TVAR recommends no additional investigation of above-ground resources in connection with the Holly Springs substation expansion project.

TVAR's archaeological survey resulted in the identification of one site (22AL726) within the APE associated with the Corinth substation expansion, but it lacks the potential to significantly contribute to research concerning the prehistory of the region. Consequently, TVAR recommends that the site is not eligible for listing on the NRHP. No resources were identified during TVAR's survey of the APE associated with the Holly Springs substation expansion. No further archaeological investigations are recommended in connection with either of the proposed projects.

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APPENDIX A:
ARCHITECTURAL FORMS

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
1704 South Johns Street

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use
Residence

5. Present use
Residence

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
Ranch-style house. The frame building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing east, the façade reveals a centrally placed door that is flanked to the north by a band of three windows containing 2/1, double-hung metal sashes. Located south of the door is a picture window with nine lights set within a metal sash and a single window opening containing horizontal 2/2, double-hung metal sashes. Attached to the north elevation of the building is a single-bay carport that is capped with a side-gabled roof covered with asphalt shingles. The carport roof is supported by three decorative metal posts. The interior west wall of the carport has been partially enclosed to increase the square footage of the interior living space. The altered section of the carport is clad with vinyl siding and includes a door and two windows containing 4/4, double-hung vinyl sashes.

9. Outbuildings or secondary elements (if significant, use separate form)

10. County
Alcorn

11. City or Town
Corinth
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed?
No

14. Survey seq. no.
1

15. USGS quadrangle map
Corinth

16. UTM reference (if required—see instructions)

17. Date of construction
ca. 1955
☒ estimated
☐ documented

18. Integrity
☐ very intact ☐ deteriorated
☒ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☒ enlarged/altered ca. 2000
☐ artificial siding
☐ replaced windows/doors
☐ enclosed/altered porch
☐ storefront alterations

20. Architectural character or style
Ranch

Attach photograph here

THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 4, 2016

30. Inventory form completed by (name and organization)
Ted Karpynec
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth-Holly Springs Substation Expansion Project

32. Date form completed
May 16, 2016

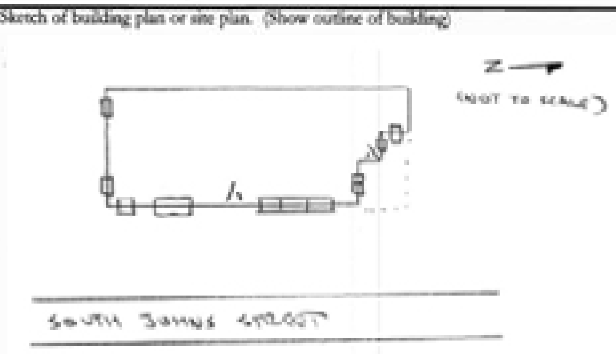
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

10. County
Alcorn

11. City or Town
Corinth
☐ vicinity of

2. Property address/descriptive location
1706 South Johns Street

12. Owner's name and address

3. Legal description (and acreage, if required—see instructions)

13. Was interior surveyed?
No

14. Survey seq. no.
2

15. USGS quadrangle map
Corinth

4. Former/historic use
Residence

5. Present use
Residence

16. UTM reference (if required—see instructions)

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

17. Date of construction
ca. 1955
☒ estimated
☐ documented

8. Brief description
Ranch-style house. The frame building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing east, the façade reveals a recessed central bay that includes a door and a band of three windows containing horizontal 2/2, double-hung wood sashes. Access to the façade door is through the center bay porch that is integral with the main roof. Flanking either side of the central bay are projecting bays that are each pierced with a window opening containing horizontal 2/2, double-hung wood sashes. Attached to the north elevation of the building is a single-bay carport that is capped with a side-gabled roof covered with asphalt shingles. The carport roof is supported by a metal post at the northeast corner of the building. The interior north wall of the carport includes a door and a pair of horizontal 2/2, double-hung wood sashes.

18. Integrity
☒ very intact ☐ deteriorated
☐ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☐ artificial siding
☐ replaced windows/doors
☐ enclosed/altered porch
☐ storefront alterations

9. Outbuildings or secondary elements (if significant, use separate form)

20. Architectural character or style
Ranch

Attach photograph here

THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 4, 2016

30. Inventory form completed by (name and organization)
Ted Karpynec
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth-Holly Springs Substation Expansion Project

32. Date form completed
May 16, 2016

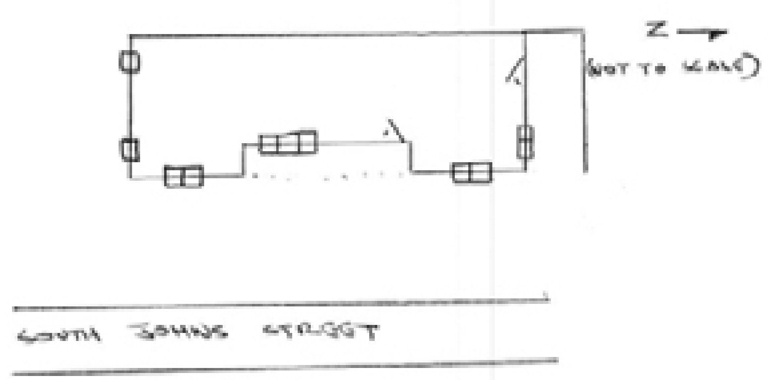
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
1708 South Johns Street

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use: Residence

5. Present use: Residence

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
Ranch-style house. The frame building features features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing east, the façade reveals an off-centered door that is flanked to the north by a pair of horizontal 2/2, double-hung wood sash windows. This sash type is repeated on a picture window and a paired window located south of the door. Access to the façade door is achieved via a single-bay concrete stoop. The stoop features a concrete slab deck that is partly shielded by a fabric awning. Attached to the north elevation of the building is a single-bay carport that is capped with a flat roof. The carport roof is partly supported by a decorative metal post at the northeast corner of the building. The interior of the carport has been altered to include a screened-in porch that provides access to a door located on the north elevation of the building..

9. Outbuildings or secondary elements (if significant, use separate form)

10. County: Alcorn

11. City or Town: Corinth
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed? No

14. Survey seq. no. 3

15. USGS quadrangle map: Corinth

16. UTM reference (if required—see instructions)

17. Date of construction: ca. 1955
☒ estimated
☐ documented

18. Integrity
☐ very intact ☐ deteriorated
☒ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☒ enlarged/altered ca. 2000
☐ artificial siding
☐ replaced windows/doors
☐ enclosed/altered porch
☐ storefront alterations

20. Architectural character or style: Ranch

Attach photograph here

This section for MDAH use only

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 4, 2016

30. Inventory form completed by
(name and organization)
Ted Karpynec
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth-Holly Springs Substation Expansion Project

32. Date form completed
May 16, 2016

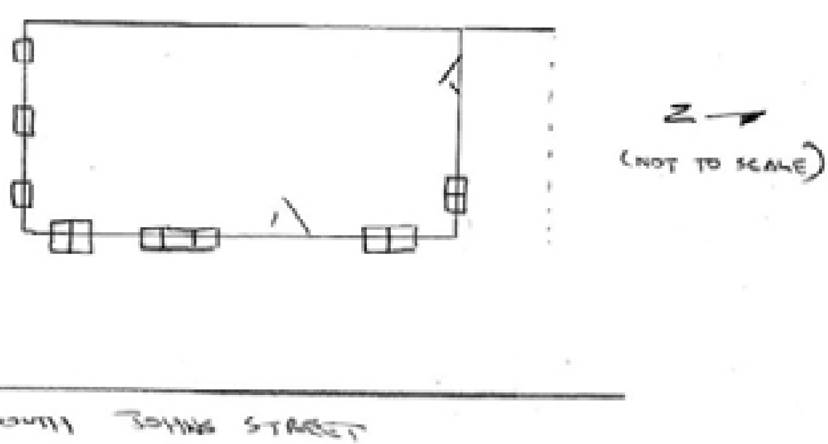
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
1800 South Johns Street

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use: Residence

5. Present use: Residence

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
Ranch-style house. The frame building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing east, the façade reveals an off-centered door that is flanked to the south by a paired window and two single windows that each contain 6/6, double-hung vinyl sashes. Access to the façade door is achieved via a single bay concrete stoop. The stoop features a concrete slab deck on a brick foundation. Attached to the north elevation of the building is a single-bay carport that is integral with the main roof. The carport roof is partly supported by two decorative metal posts. The north interior wall of the carport includes a door and a 6/6, double-hung vinyl sash window. Located along the south elevation is a horizontal 2/2, double-hung wood sash window and a six-over-six, double-hung vinyl sash window.

9. Outbuildings or secondary elements (if significant, use separate form)

10. County: Alcorn

11. City or Town: Corinth
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed? No

14. Survey seq. no. 4

15. USGS quadrangle map: Corinth

16. UTM reference (if required—see instructions)

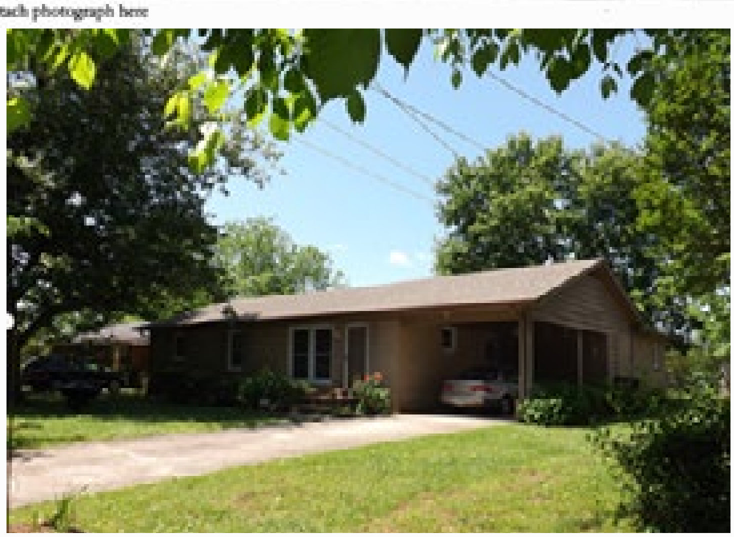
17. Date of construction: ca. 1955
☒ estimated
☐ documented

18. Integrity
☒ very intact
☐ some changes
☐ extensive changes
☐ deteriorated
☐ ruins
☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☐ artificial siding
☒ replaced windows/doors ca.2000
☐ enclosed/altered porch
☐ storefront alterations

20. Architectural character or style: Ranch

Attach photograph here



THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 4, 2016

30. Inventory form completed by (name and organization)
Ted Karpynec
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth-Holly Springs Substation Expansion Project

32. Date form completed
May 16, 2016

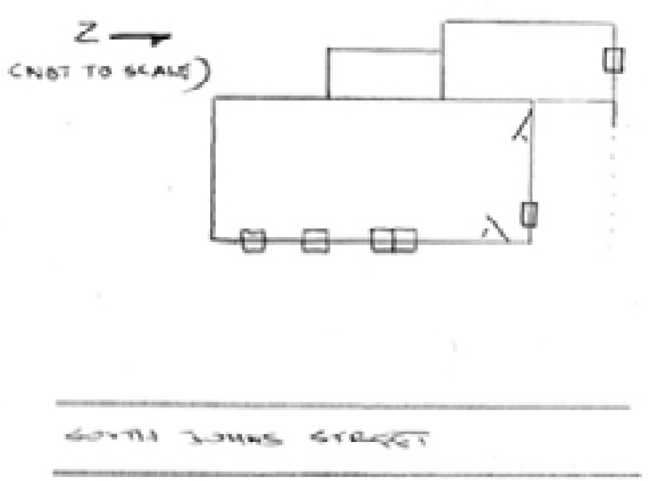
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
1802 South Johns Street

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use
Residence

5. Present use
Residence

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
Ranch-style house. The frame building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing east, the façade reveals a centrally placed door that is flanked to the north by a pair of 1/1, double-hung vinyl sash windows. This sash type is repeated in two single windows positioned south of the main entrance. Access to the façade door is achieved via a partial-width porch. The porch features a concrete slab deck on a brick foundation and a series of decorative metal posts that are used to support a shed roof, which is integral with the main roof of the house. Attached to the north elevation of the building is a single-bay carport that is integral with the main roof. The carport roof is partly supported by three decorative metal posts. The north interior wall of the carport includes a door that provides access to the house.

9. Outbuildings or secondary elements (if significant, use separate form)

10. County
Alcorn

11. City or Town
Corinth
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed?
No

14. Survey seq. no.
5

15. USGS quadrangle map
Corinth

16. UTM reference (if required—see instructions)

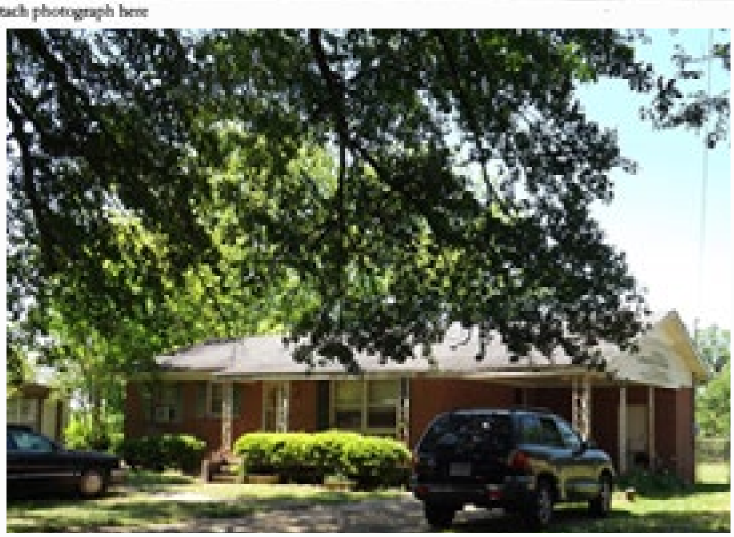
17. Date of construction
ca. 1955
☒ estimated
☐ documented

18. Integrity
☒ very intact ☐ deteriorated
☐ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☐ artificial siding
☒ replaced windows/doors ca.2000
☐ enclosed/altered porch
☐ storefront alterations

20. Architectural character or style
Ranch

Attach photograph here



THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 4, 2016

30. Inventory form completed by (name and organization)
Ted Karpynec
Tennessee Valley Archaeological Research

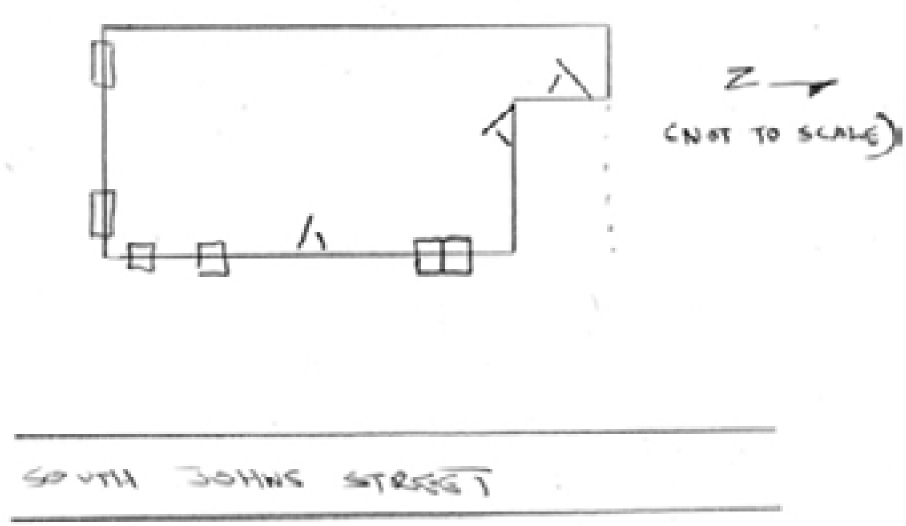
31. Survey project name
TVA Corinth-Holly Springs Substation Expansion Project

32. Date form completed
May 16, 2016

THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility
a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information
b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

10. County
Alcorn

11. City or Town
Corinth
☐ vicinity of

2. Property address/descriptive location
1802 South Johns Street

12. Owner's name and address

3. Legal description (and acreage, if required—see instructions)

13. Was interior surveyed?
No

14. Survey seq. no.
6

15. USGS quadrangle map
Corinth

4. Former/historic use
Residence

5. Present use
Residence

16. UTM reference (if required—see instructions)

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

17. Date of construction
ca. 1955
☒ estimated
☐ documented

8. Brief description
Ranch-style house. The frame building features a side-gabled roof covered with asphalt shingles, an exterior clad with a brick veneer, and a continuous brick foundation. Facing east, the façade reveals a centrally placed door that is flanked to the north by a pair of 1/1, double-hung vinyl sash windows. This sash type is repeated in two single windows positioned south of the main entrance. Access to the façade door is achieved via a partial-width porch. The porch features a concrete slab deck on a brick foundation and a series of decorative metal posts that are used to support a shed roof, which is integral with the main roof of the house. Attached to the north elevation of the building is a single-bay carport that is integral with the main roof. The carport roof is partly supported by three decorative metal posts. The north interior wall of the carport includes a door that provides access to the house.

18. Integrity
☒ very intact ☐ deteriorated
☐ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☐ artificial siding
☒ replaced windows/doors ca.2000
☒ enclosed/altered porch ca. 2000
☐ storefront alterations

9. Outbuildings or secondary elements (if significant, use separate form)

20. Architectural character or style
Ranch

Attach photograph here

THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 4, 2016

30. Inventory form completed by (name and organization)
Ted Karpynec
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth-Holly Springs Substation Expansion Project

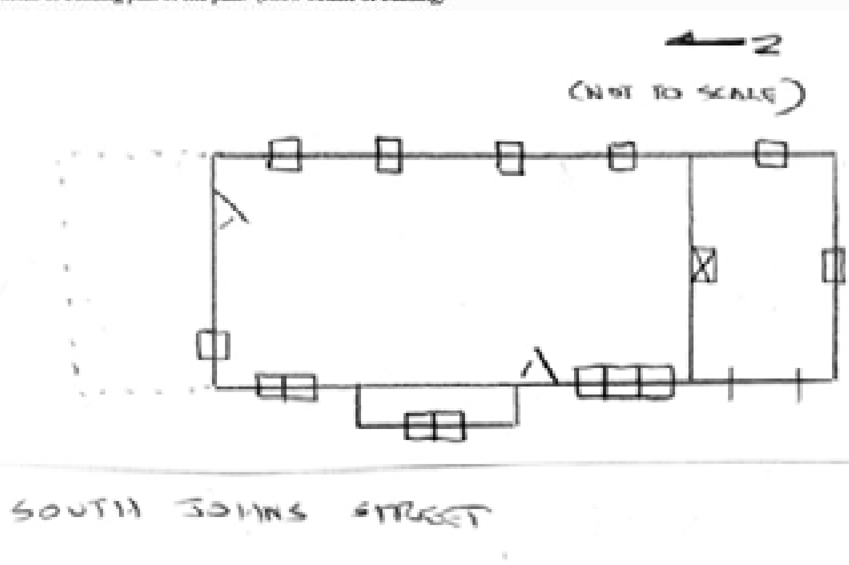
32. Date form completed
May 16, 2016

THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility
a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
1614 Hinton Street

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use: Residence

5. Present use: Residence

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
Ranch-style house. The frame building features a side-gabled roof covered with asphalt shingles, an interior brick chimney, an exterior clad with a brick veneer, and a continuous brick foundation. Facing north, the façade reveals a central bay marked with a door that is flanked to the east by a 20-light wood sash picture window. The central bay also includes a covered porch featuring a concrete slab deck on a brick foundation and four rounded wood columns that are used to support a projecting gabled roof. The gable field of the porch roof is clad with vinyl siding. Additional fenestration along the façade includes a window east of the central bay and two windows west of the central bay that contain 6/6, double-hung wood sashes. Attached to the east elevation of the building is a single-bay carport wing. The carport roof is supported by a wall on the north elevation that is pierced by two 6/6, double-hung wood sash windows.

9. Outbuildings or secondary elements (if significant, use separate form)

10. County: Alcorn

11. City or Town: Corinth
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed? No

14. Survey seq. no. 7

15. USGS quadrangle map: Corinth

16. UTM reference (if required—see instructions)

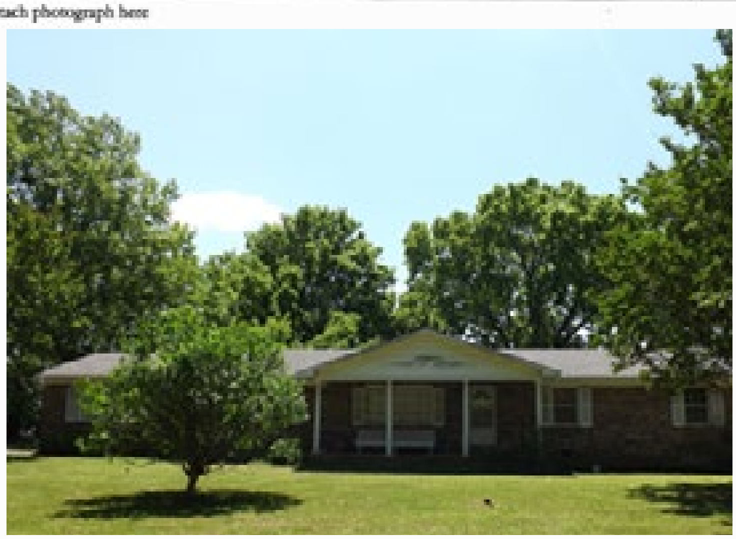
17. Date of construction: ca. 1960
☒ estimated
☐ documented

18. Integrity
☒ very intact ☐ deteriorated
☐ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☒ artificial siding ca. 2000
☐ replaced windows/doors
☐ enclosed/altered porch
☐ storefront alterations

20. Architectural character or style: Ranch

Attach photograph here



THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 4, 2016

30. Inventory form completed by
(name and organization)
Ted Karpynec
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth-Holly Springs Substation Expansion Project

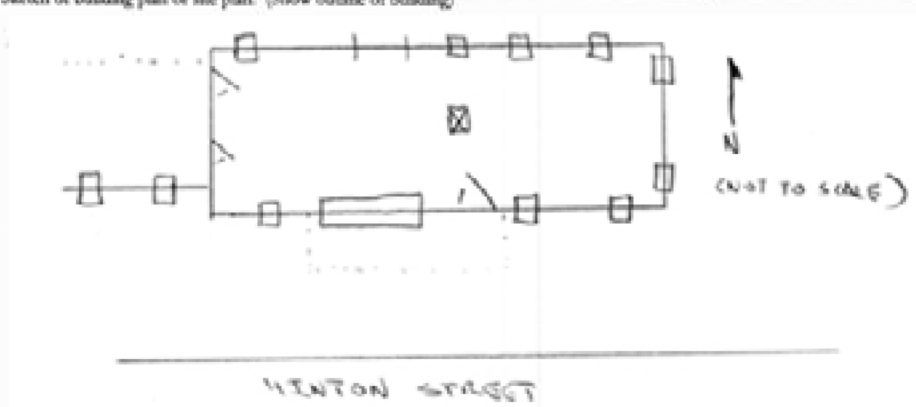
32. Date form completed
May 16, 2016

THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility
a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

10. County
Alcorn

11. City or Town
Corinth
☐ vicinity of

2. Property address/descriptive location
2003 Liddon Lake Road

12. Owner's name and address

3. Legal description (and acreage, if required—see instructions)

13. Was interior surveyed?
No

14. Survey seq. no.
8

15. USGS quadrangle map
Corinth

4. Former/historic use
Residence

5. Present use
Residence

16. UTM reference (if required—see instructions)

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

17. Date of construction ca. 1965
☒ estimated
☐ documented

8. Brief description
Ranch-style house. The frame building features a side-gabled roof covered with asphalt shingles, an exterior clad with a combination of vinyl siding and brick veneer, and a continuous concrete block foundation. Facing south, the façade reveals an off-centered door that is flanked to the east by a three-part picture window containing a central single-pane, fixed wood sash that is flanked by 4/4, double-hung wood sashes. Located west of the door are two windows containing 6/6, double-hung wood sashes. Attached to the east elevation of the building is a single-bay carport. The carport is integral with the main roof and is partially supported by two metal posts. The interior east wall of the carport includes a door that provides access to the house. An additional door is positioned on the interior north wall that provides access to a storage closet. The west elevation of the house is pierced by two windows containing 6/6, double-hung wood sashes. Rear modern addition.

18. Integrity
☐ very intact ☐ deteriorated
☐ some changes ☐ ruins
☒ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☒ enlarged/altered ca. 2000
☒ artificial siding ca. 2000
☐ replaced windows/doors
☐ enclosed/altered porch
☐ storefront alterations

9. Outbuildings or secondary elements (if significant, use separate form)

20. Architectural character or style
Ranch

Attach photograph here

THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 4, 2016

30. Inventory form completed by
(name and organization)
Ted Karpynec
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth-Holly Springs Substation Expansion Project

32. Date form completed
May 16, 2016

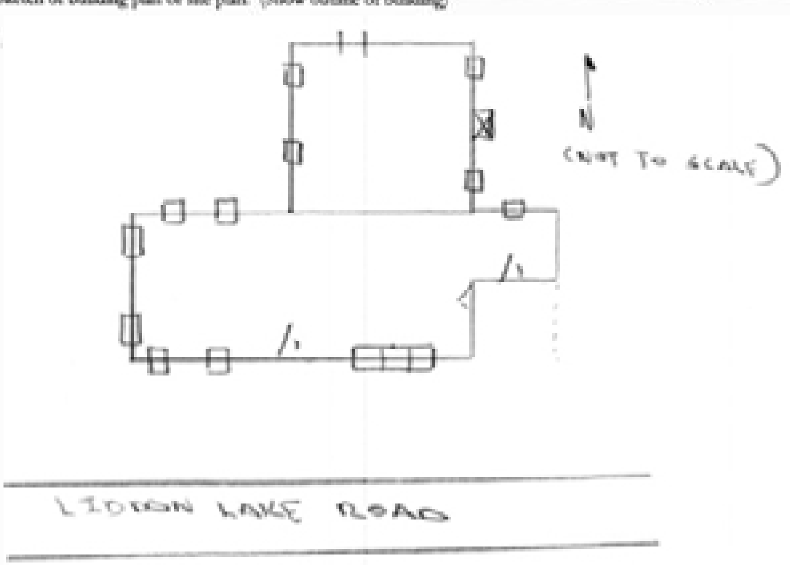
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
449 Neely Avenue

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use
Residence

5. Present use
Residence

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
A one-story pyramidal roof house that appears to have been constructed ca. 1920. The building features a roof covered with asphalt shingles, an exterior clad with asbestos shingle siding, and a covered pier foundation. Facing north, the façade reveals a central door that is flanked on either side by a six-over-six, double-hung wood sash window. Access to the façade door is achieved via a full-width porch. The porch features a wood deck on a concrete block pier foundation and four non-original wood posts that are used to support a hipped roof. The east elevation of the house is pierced by a six-over-six, double-hung wood sash window and a horizontal two-over-two, double-hung metal sash window. Positioned on a rear shed extension is a six-light wood casement sash window. Highlighting the south (rear) elevation is a recessed central bay porch that includes a door and a six-over-six, double-hung wood sash window. The center bay porch is formed by flanking shed extensions.

9. Outbuildings or secondary elements (if significant, use separate form)

10. County
Marshall

11. City or Town
Holly Springs
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed?
No

14. Survey seq. no.
9

15. USGS quadrangle map
Holly Springs

16. UTM reference (if required—see instructions)

17. Date of construction
ca. 1920
☒ estimated
☐ documented

18. Integrity
☐ very intact ☐ deteriorated
☒ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☒ artificial siding ca. 1985
☐ replaced windows/doors
☒ enclosed/altered porch ca. 1990
☐ storefront alterations

20. Architectural character or style

Attach photograph here

This section for MDAH use only

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 6, 2016

30. Inventory form completed by (name and organization)
Meghan Weaver
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth and Holly Springs Substation Expansion

32. Date form completed
May 16, 2016

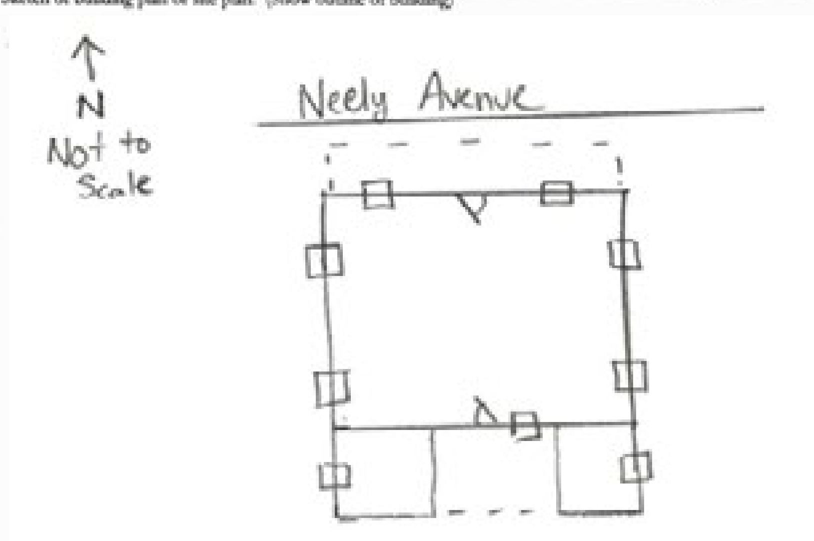
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
435 Neely Avenue

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use
Residence

5. Present use
Residence

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
A one-story hipped-roof house that appears to have been constructed ca. 1920. The concrete block building features a roof covered with asphalt shingles, an interior brick chimney, an exposed concrete block exterior, and a continuous concrete block foundation. Facing north, the façade reveals a central door that is flanked on either side by a six-over-six, double-hung vinyl sash window. Access to the façade door is achieved via a full-width porch. The porch features a wood deck on a concrete block foundation and four non-original wood posts that are used to support a flat roof. The east elevation of the house is pierced by two six-over-six, double-hung vinyl sash windows. This sash type is repeated on three windows located along the west elevation. Attached to the rear elevation is a full-width shed-roof extension. Composed of concrete blocks, the extension includes a centrally placed door that is flanked to the east by a six-over-six, double-hung vinyl sash window.

9. Outbuildings or secondary elements (if significant, use separate form)

10. County
Marshall

11. City or Town
Holly Springs
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed?
No

14. Survey seq. no.
10

15. USGS quadrangle map
Holly Springs

16. UTM reference (if required—see instructions)

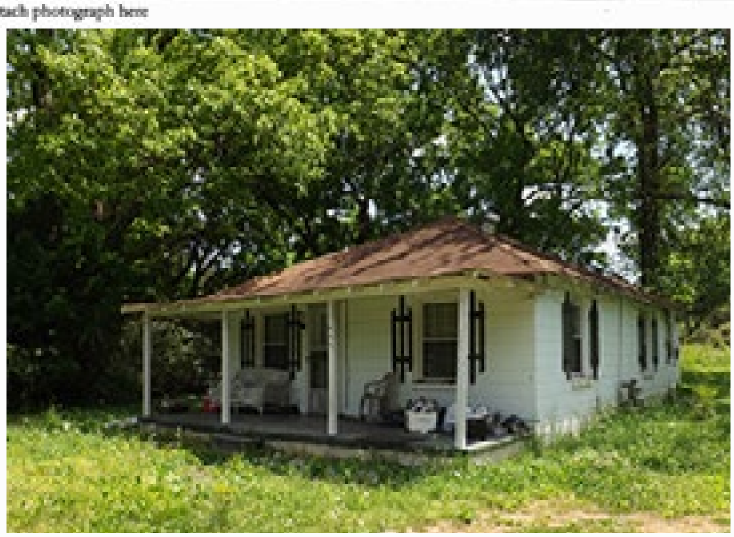
17. Date of construction
ca. 1920
☒ estimated
☐ documented

18. Integrity
☐ very intact ☐ deteriorated
☒ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☐ artificial siding
☒ replaced windows/doors ca. 2000
☒ enclosed/altered porch ca. 1990
☐ storefront alterations

20. Architectural character or style

Attach photograph here



THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 6, 2016

30. Inventory form completed by
(name and organization)
Meghan Weaver
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth and Holly Springs Substation Expansion

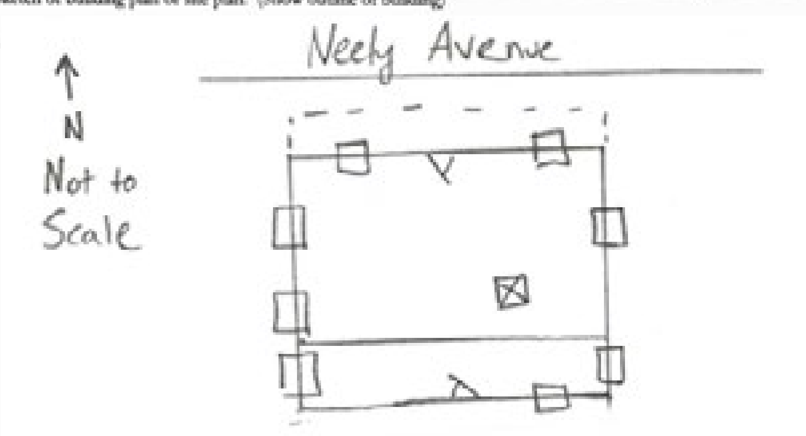
32. Date form completed
May 16, 2016

THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility
a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
445 Neely Avenue

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use
Residence

5. Present use
Residence

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
A one-story hipped-roof house that appears to have been constructed ca. 1920. The frame building features a roof covered with asphalt shingles, two interior brick chimneys, an exterior clad with weatherboard siding, and a continuous concrete block foundation. Facing north, the façade reveals a central door that is flanked on either side by a four-over-four, double-hung wood sash window. Access to the façade door is achieved via a full-width porch. The porch features a wood deck on a concrete block foundation and four non-original wood posts that are used to support a hipped roof. Both the east and west elevations of the house are pierced by a single and a paired window that each contain four-over-four, double-hung wood sashes. Attached to the south (rear) elevation of the house is a full-width shed-roof extension that includes a centrally placed door.

9. Outbuildings or secondary elements (if significant, use separate form)

10. County
Marshall

11. City or Town
Holly Springs
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed?
No

14. Survey seq. no.
11

15. USGS quadrangle map
Holly Springs

16. UTM reference (if required—see instructions)

17. Date of construction
ca. 1920
☒ estimated
☐ documented

18. Integrity
☐ very intact ☐ deteriorated
☒ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☐ artificial siding
☐ replaced windows/doors
☒ enclosed/altered porch ca. 2000
☐ storefront alterations

20. Architectural character or style

Attach photograph here

THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 6, 2016

30. Inventory form completed by (name and organization)
Meghan Weaver
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth and Holly Springs Substation Expansion

32. Date form completed
May 16, 2016

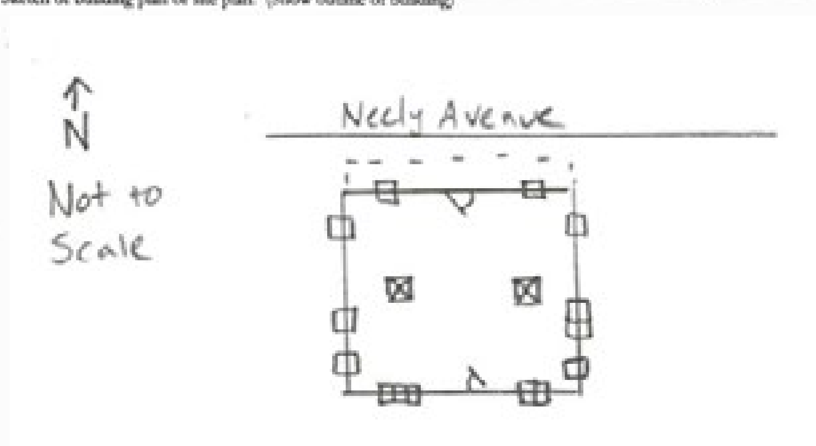
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
370 South Chesterman Street

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use
Residence

5. Present use
Residence

6. Architect

☐ documented ☐ attributed

7. Builder/contractor

☐ documented ☐ attributed

8. Brief description
A one-story hipped-roof house that appears to have been constructed ca. 1920. The frame building features a roof covered with asphalt shingles, an interior brick chimney, an exterior clad with weatherboard siding, and a brick pier foundation infilled with concrete blocks. Facing east, the façade reveals a central door that is flanked on either side by a pair of one-over-one, double-hung wood sashes. Access to the façade door is achieved via a full-width porch that is integral with the main roof. The porch features a concrete slab deck on a concrete block foundation and four non-original decorative metal posts, which are used to support the roof. The north elevation of the house is marked by a non-original exterior chimney and by three window openings containing one-over-one, double-hung wood sashes. This sash type is repeated on two windows located along the south elevation. Attached to the west (rear) elevation is a ca. 1955 gabled-roof addition.

9. Outbuildings or secondary elements (if significant, use separate form)
1-ca. 1950 storage shed, 1- ca. 1970 garage

10. County
Marshall

11. City or Town
Holly Springs
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed?
No

14. Survey seq. no.
12

15. USGS quadrangle map
Holly Springs

16. UTM reference (if required—see instructions)

17. Date of construction
ca. 1920
☒ estimated
☐ documented

18. Integrity
☐ very intact ☐ deteriorated
☒ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☐ artificial siding
☐ replaced windows/doors
☒ enclosed/altered porch ca. 2000
☐ storefront alterations

20. Architectural character or style

Attach photograph here

This section for MDAH use only

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 6, 2016

30. Inventory form completed by (name and organization)
Meghan Weaver
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth and Holly Springs Substation Expansion

32. Date form completed
May 16, 2016

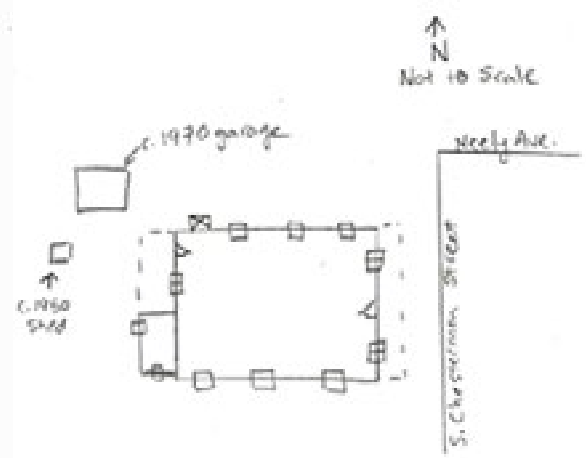
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
396 South Chesterman Street

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use
Residence

5. Present use
Residence

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
A one-story side-gabled house that appears to have been constructed ca. 1920. Based on physical evidence, it is the opinion of TVAR that the building was originally constructed as a front-gabled house with the main entrance located on the east elevation, fronting South Chesterman Street. Within the past ten years, the house appears to have been modified with the reorientation of the main entrance to the south elevation. The building features a gabled roof covered with standing seam metal, an interior brick chimney, an exterior clad with weatherboard siding, and a brick pier foundation infilled with concrete blocks. Facing south, the façade reveals an off-centered door that is flanked to the west by a four-over-four, double-hung vinyl sash window. The east elevation of the house, which appears to have served as the original façade, features a modern projecting gabled bay. The gabled bay is clad with drop wood siding and is pierced by a 6/6, double-hung vinyl sash window.

9. Outbuildings or secondary elements (if significant, use separate form)

10. County
Marshall

11. City or Town
Holly Springs
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed?
No

14. Survey seq. no.
13

15. USGS quadrangle map
Holly Springs

16. UTM reference (if required—see instructions)

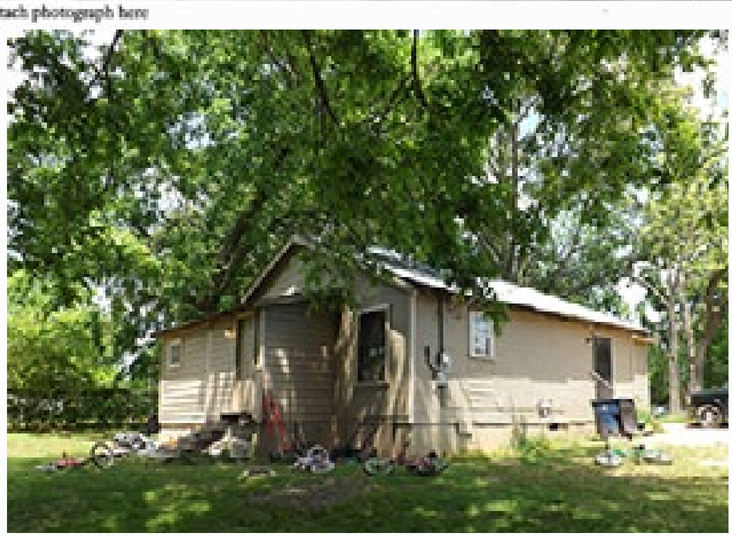
17. Date of construction
ca. 1920
☒ estimated
☐ documented

18. Integrity
☐ very intact ☐ deteriorated
☐ some changes ☐ ruins
☒ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☒ enlarged/altered ca. 2005
☐ artificial siding
☒ replaced windows/doors ca. 2005
☒ enclosed/altered porch ca. 2005
☐ storefront alterations

20. Architectural character or style

Attach photograph here



THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 6, 2016

30. Inventory form completed by
(name and organization)
Meghan Weaver
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth and Holly Springs Substation Expansion

32. Date form completed
May 16, 2016

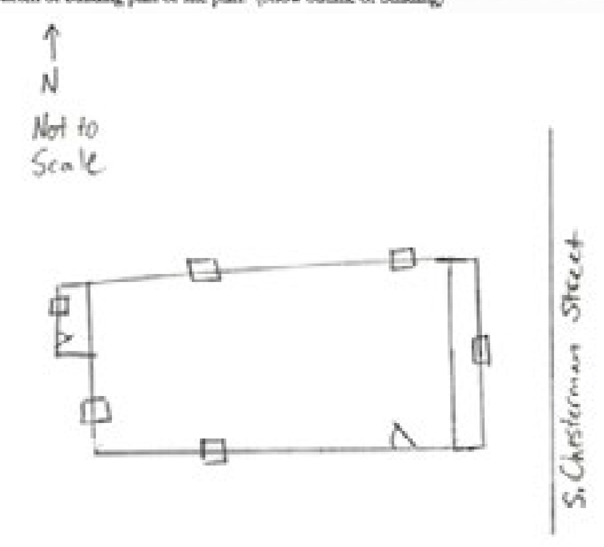
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

10. County
Marshall

11. City or Town
Holly Springs
☐ vicinity of

2. Property address/descriptive location
440 Neely Avenue

12. Owner's name and address

3. Legal description (and acreage, if required—see instructions)

13. Was interior surveyed?
No

14. Survey seq. no.
14

15. USGS quadrangle map
Holly Springs

4. Former/historic use
Residence

5. Present use
Residence

16. UTM reference (if required—see instructions)

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

17. Date of construction
ca. 1920
☒ estimated
☐ documented

8. Brief description
A one-story hipped-roof house that appears to have been constructed ca. 1920. The frame building features a roof covered with asphalt shingles, an interior brick chimney, an exterior clad with asbestos shingle siding, and a covered pier foundation. Facing south, the façade reveals a central door that is flanked on either side by a six-over-six, double-hung vinyl sash window. Access to the façade door is achieved via a full-width porch. The porch features a wood deck on a concrete block foundation and four non-original wood posts that are used to support a hipped roof. A partial-width hipped-roof porch provides access to the rear elevation door. The porch features a wood deck on a concrete block foundation and four non-original wood posts that support a hipped roof. Positioned east of the porch is a shed-roof extension pierced with a six-over-six, double-hung vinyl sash window.

18. Integrity
☐ very intact ☐ deteriorated
☒ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☒ artificial siding ca. 1975
☒ replaced windows/doors ca. 2000
☒ enclosed/altered porch ca. 1990
☐ storefront alterations

9. Outbuildings or secondary elements (if significant, use separate form)

20. Architectural character or style

Attach photograph here

THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 6, 2016

30. Inventory form completed by (name and organization)
Meghan Weaver
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth and Holly Springs Substation Expansion

32. Date form completed
May 16, 2016

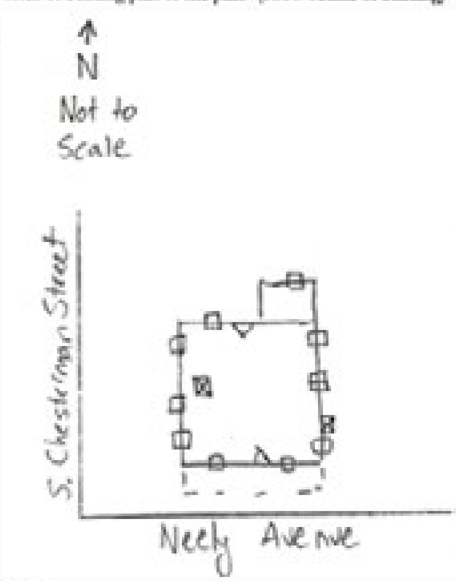
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
850 Highway 178 East

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use
Residence

5. Present use
Residence

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
A one-story Minimal Traditional style house that appears to have been constructed ca. 1940. The frame building features a roof covered with asphalt shingles, an exterior clad with asbestos shingle siding, and a covered pier foundation. Facing west, the façade reveals a central door that is flanked to the north by a modern window opening containing a 12-light, fixed vinyl sash. Located south of the door is a pair of six-over-six, double-hung vinyl sash windows. Access to the façade door is through a central bay porch. The porch features a concrete slab deck on a brick foundation and two non-original wood posts atop brick plinth blocks that support a projecting gabled roof. Attached to the east (rear) elevation is a gabled-roof extension that is clad with asbestos shingle siding and rests on a covered pier foundation.

9. Outbuildings or secondary elements (if significant, use separate form)
1- mid. 20th century storage shed

10. County
Marshall

11. City or Town
Holly Springs
☐ vicinity of

12. Owner's name and address
John S. Huey
850 Highway 178 East
Holly Springs, MS 38635

13. Was interior surveyed?
No

14. Survey seq. no.
15

15. USGS quadrangle map
Holly Springs

16. UTM reference (if required—see instructions)

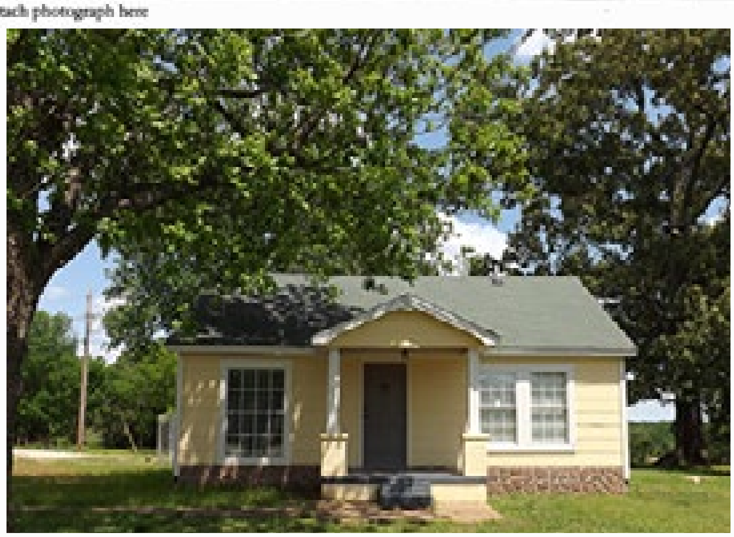
17. Date of construction
ca. 1940
☒ estimated
☐ documented

18. Integrity
☐ very intact
☒ some changes
☐ extensive changes
☐ deteriorated
☐ ruins
☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☒ artificial siding ca. 1975
☒ replaced windows/doors ca. 2000
☒ enclosed/altered porch ca. 2000
☐ storefront alterations

20. Architectural character or style
Minimal Traditional style

Attach photograph here



This section for MDAH use only

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 6, 2016

30. Inventory form completed by (name and organization)
Meghan Weaver
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth and Holly Springs Substation Expansion

32. Date form completed
May 16, 2016

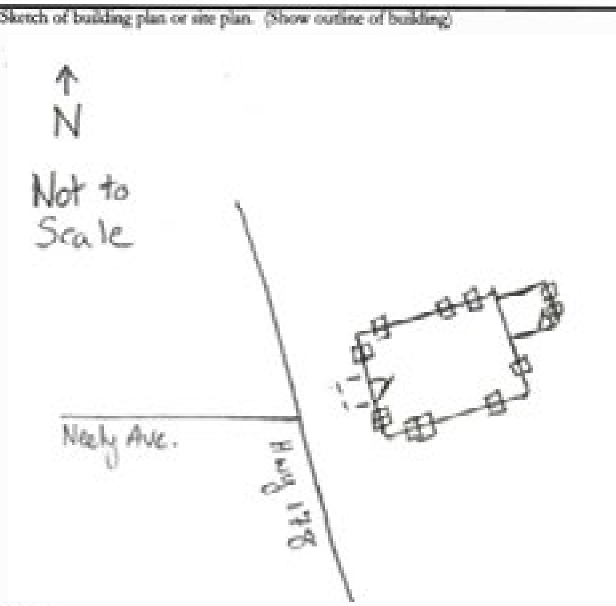
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
East side of State Route 178

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use
Commercial

5. Present use
Vacant

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
A vacant one-story commercial plaza that appears to have been constructed ca. 1960. The concrete block building features a flat roof, an exterior clad with a brick veneer, and a concrete block foundation. Facing west, the façade is divided into ten storefront entrances that contain glass doors flanked by single and multi-pane plate glass windows. The façade is largely accented by a non-original wood awning that appears to have been added to the building in the 1980s. The awning features Classical detailing including a decorative entablature with dentil molding, which is supported by a series of Tuscan-style wood columns. Assessment of the east (rear) elevation noted at least two steel doors that provided access to the northern section of the building. However, a full assessment of the rear elevation could not be conducted due to heavy vegetation that obscures much of the building.

9. Outbuildings or secondary elements (if significant, use separate form)

10. County
Marshall

11. City or Town
Holly Springs
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed?
No

14. Survey seq. no.
16

15. USGS quadrangle map
Holly Springs

16. UTM reference (if required—see instructions)

17. Date of construction
ca. 1960
☒ estimated
☐ documented

18. Integrity
☐ very intact
☒ some changes
☐ extensive changes
☒ deteriorated
☐ ruins
☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☐ artificial siding
☐ replaced windows/doors
☐ enclosed/altered porch
☒ storefront alterations ca. 1980

20. Architectural character or style
mid-20th century commercial

Attach photograph here

THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 6, 2016

30. Inventory form completed by
(name and organization)
Meghan Weaver
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth and Holly Springs Substation Expansion

32. Date form completed
May 16, 2016

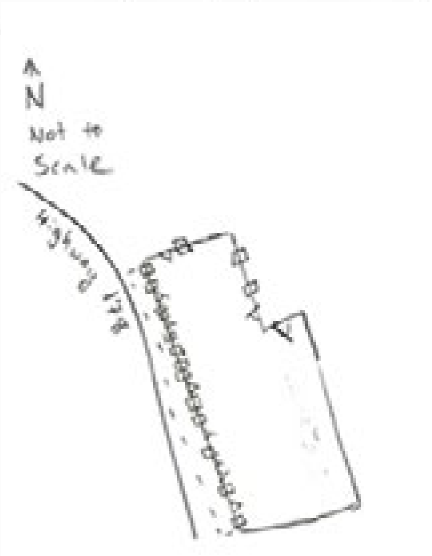
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

10. County
Marshall

11. City or Town
Holly Springs
☐ vicinity of

2. Property address/descriptive location
West side of State Route 178

12. Owner's name and address

3. Legal description (and acreage, if required—see instructions)

13. Was interior surveyed?
No

14. Survey seq. no.
17

15. USGS quadrangle map
Holly Springs

4. Former/historic use
Industrial

5. Present use
Industrial

16. UTM reference (if required—see instructions)

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

17. Date of construction mid-20th century
☒ estimated
☐ documented

8. Brief description
Manufacturing complex anchored by a square-shaped, steel-frame building that features a flat roof, an exterior clad with a brick veneer, and a concrete slab foundation. Based on physical evidence, the original manufacturing building has been altered over time through the construction of an office wing on the east elevation and a series of storage bays on the west and north elevations. These sections stand out from the original building core through their contrasting exterior finishes such as metal mansard roofs and unfinished concrete block walls. The primary façade of the manufacturing plant faces south and includes a centrally placed door opening containing a pair of swinging metal doors. Situated east of the door are a single-pane, fixed sash window and a band of five modern windows containing a lower metal awning sash topped by a single-pane fixed sash.

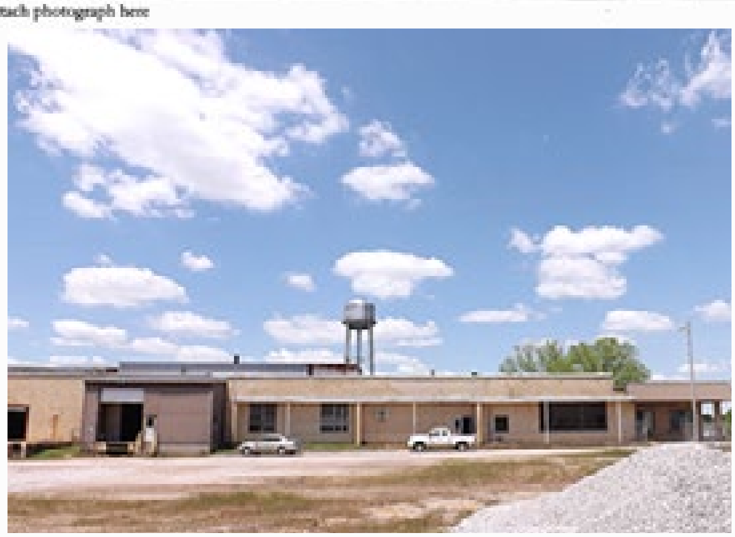
18. Integrity
☐ very intact ☒ deteriorated
☒ some changes ☐ ruins
☐ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☒ enlarged/altered ca. 1985
☐ artificial siding
☐ replaced windows/doors
☐ enclosed/altered porch
☐ storefront alterations

9. Outbuildings or secondary elements (if significant, use separate form)
Original: water tower. Modern: warehouse, storage sheds, garage, pole shed, manufacturing building

20. Architectural character or style

Attach photograph here



THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 6, 2016

30. Inventory form completed by (name and organization)
Meghan Weaver
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth and Holly Springs Substation Expansion

32. Date form completed
May 16, 2016

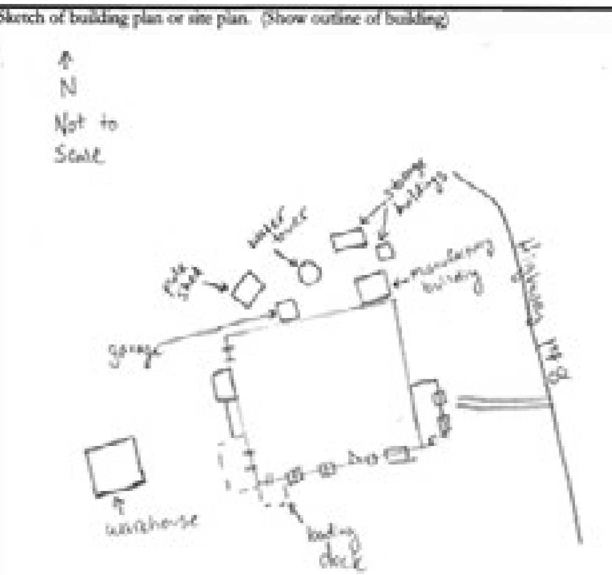
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic

b. Property name, other

2. Property address/descriptive location
East side, Highway 178

3. Legal description (and acreage, if required—see instructions)

4. Former/historic use
Commercial

5. Present use
Vacant

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

8. Brief description
A one-story commercial building that appears to have been constructed ca. 1955 and is currently vacant. The building is composed of brick laid in a common bond, and features a hipped roof covered with asphalt shingles and a continuous brick foundation. Facing west, the façade reveals an exterior clad with a brick veneer and an off-center glass and metal door that is shielded by a flat metal canopy. The door is flanked on each side by a window opening containing a two-light lower awning metal sash topped by a four-light fixed metal sash. An additional window opening north of this arrangement has been bricked in. The south elevation is marked by two overhead bay doors, three bricked-in window openings, and a two-light lower awning metal sash topped by a four-light fixed metal sash. A concrete block addition is attached to the east elevation and features a shed roof covered with metal sheeting and two open bays on its south elevation.

9. Outbuildings or secondary elements (if significant, use separate form)

10. County
Marshall

11. City or Town
Holly Springs
☐ vicinity of

12. Owner's name and address

13. Was interior surveyed?
No

14. Survey seq. no.
18

15. USGS quadrangle map
Holly Springs

16. UTM reference (if required—see instructions)

17. Date of construction
ca. 1955
☒ estimated
☐ documented

18. Integrity
☐ very intact
☒ some changes
☐ extensive changes
☒ deteriorated
☐ ruins
☐ no visible remains

19. Dates of changes, if any
☐ moved
☒ enlarged/altered ca. 1985
☐ artificial siding
☐ replaced windows/doors
☐ enclosed/altered porch
☐ storefront alterations

20. Architectural character or style

Attach photograph here

THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

24. Additional remarks or continuation of other sections

25. Sources of information

27. Photographer or photo source
Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date
May 6, 2016

30. Inventory form completed by (name and organization)
Meghan Weaver
Tennessee Valley Archaeological Research

31. Survey project name
TVA Corinth and Holly Springs Substation Expansion

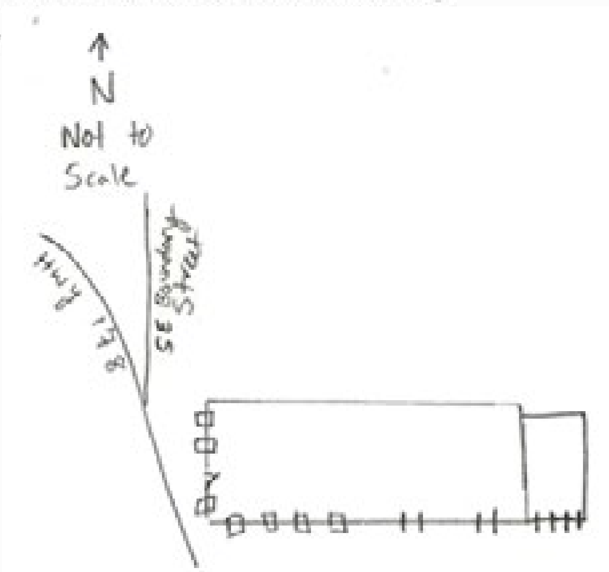
32. Date form completed
May 16, 2016

THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility
a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

State of Mississippi
Department of Archives and History
P.O. Box 571
Jackson, MS 39205

HISTORIC RESOURCES INVENTORY

1. a. Property name, historic
Mississippi Central Railroad

b. Property name, other

10. County
Marshall

11. City or Town
Holly Springs
☐ vicinity of

2. Property address/descriptive location
1 mile segment running in a southwest/northeasterly direction, from 0.43 miles southwest of Neely Avenue to 0.1 mile north of East Van Dorn Avenue

12. Owner's name and address
Pioneer Railcorp
1318 S Johanson Rd, Peoria, IL 61607

3. Legal description (and acreage, if required—see instructions)

13. Was interior surveyed?
No

14. Survey seq. no.
19

15. USGS quadrangle map
Holly Springs

4. Former/historic use
Railroad

5. Present use
Railroad

16. UTM reference (if required—see instructions)

6. Architect
☐ documented ☐ attributed

7. Builder/contractor
☐ documented ☐ attributed

17. Date of construction
1852-1856
☐ estimated
☒ documented

8. Brief description
Actively operated by Pioneer Railcorp, the railroad segment features a raised embankment covered with ballast that supports a modern track composed of wood cross ties and steel rails. The segment is situated within a tree-lined corridor and extends through a combination of light industrial and residential development. A number of at-grade crossings are located along the segment. As an actively managed rail line, the railroad bed has received regular repairs which has resulted in the replacement of the original tracks, cross-ties, and ballast; no original construction materials remain.

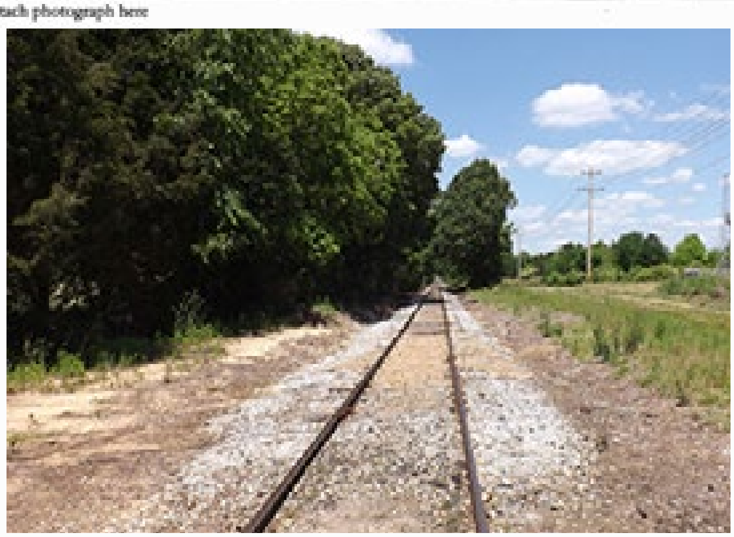
18. Integrity
☐ very intact ☐ deteriorated
☐ some changes ☐ ruins
☒ extensive changes ☐ no visible remains

19. Dates of changes, if any
☐ moved
☐ enlarged/altered
☐ artificial siding
☐ replaced windows/doors
☐ enclosed/altered porch
☐ storefront alterations

9. Outbuildings or secondary elements (if significant, use separate form)

20. Architectural character or style

Attach photograph here



THIS SECTION FOR MDAH USE ONLY

21. Registration status
☐ NHL
☐ listed NR
☐ in NR district
☐ Mississippi landmark
☐ local landmark/local district

22. If located in historic district
a. Name of district

b. Rating
☐ contributing
☐ previously listed
☐ noncontributing

c. District element number

MDAH Inventory Code

MISSISSIPPI HISTORIC RESOURCES INVENTORY
Page 2

23. Historical information

At Holly Springs, construction on the rail line began in 1852 and was completed in 1856, connecting the city with New Orleans (Guren 1980). During the Civil War the railroad was extensively used by both the Confederate and Union troops for the movement of supplies and men. Damaged during various raids on Holly Springs, the railroad was rebuilt during the Reconstruction period. It was purchased by the Chicago, St. Louis, and New Orleans Railroad in 1878 and then by the Illinois Central Railroad in 1882 (Guren 1980). Overall, the entire Mississippi Central Railroad stretches 51 miles from Oxford, Mississippi to Grand Junction, Tennessee. An additional line runs from Corinth, Mississippi to Red Bay, Alabama. Today used primarily for freight, the main products shipped along the Mississippi Central Railroad are animal feed ingredients, fertilizer, and wood.

24. Additional remarks or continuation of other sections

25. Sources of information

Guren, Pamela
1980 Depot-Compress Historic District. National Register of Historic Places nomination form.

Pioneer Railcorp
2015 Mississippi Central Railroad Co. Electronic document, http://www.pioneer-railcorp.com/MSCI.html, accessed May 12, 2016.

27. Photographer or photo source

Meghan Weaver
Tennessee Valley Archaeological Research

28. Photo roll and frame number(s)

29. Photo date

May 6, 2016

30. Inventory form completed by (name and organization)

Meghan Weaver
Tennessee Valley Archaeological Research

31. Survey project name

TVA Corinth and Holly Springs Substation Expansion

32. Date form completed

May 16, 2016

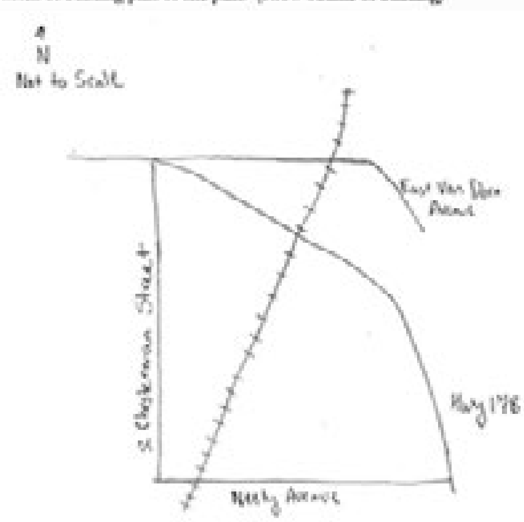
THIS SECTION FOR MDAH USE ONLY

33. Evaluation of National Register eligibility

a. ☐ already listed (see front of form)
☐ appears individually eligible
☐ potentially eligible if restored
☐ would contribute to district
☐ does not appear eligible
☐ insufficient information

b. Evaluated by/date

26. Sketch of building plan or site plan. (Show outline of building)



Draw north arrow here.

(12-2005)

APPENDIX B:
LAND PATENTS

[illegible]

THE UNITED STATES OF AMERICA.

To all to whom these presents shall come, Greeting:

Whereas [illegible] CITY OF WASHINGTON [illegible]

UNITED STATES [illegible]

[illegible] **Whereas the President of the United States** [illegible]

[illegible]

NOW KNOW YE, [illegible]

United States of America [illegible]

[illegible]

In Testimony Whereof, I, MARTIN VAN BUREN,

PRESIDENT OF THE UNITED STATES OF AMERICA [illegible]

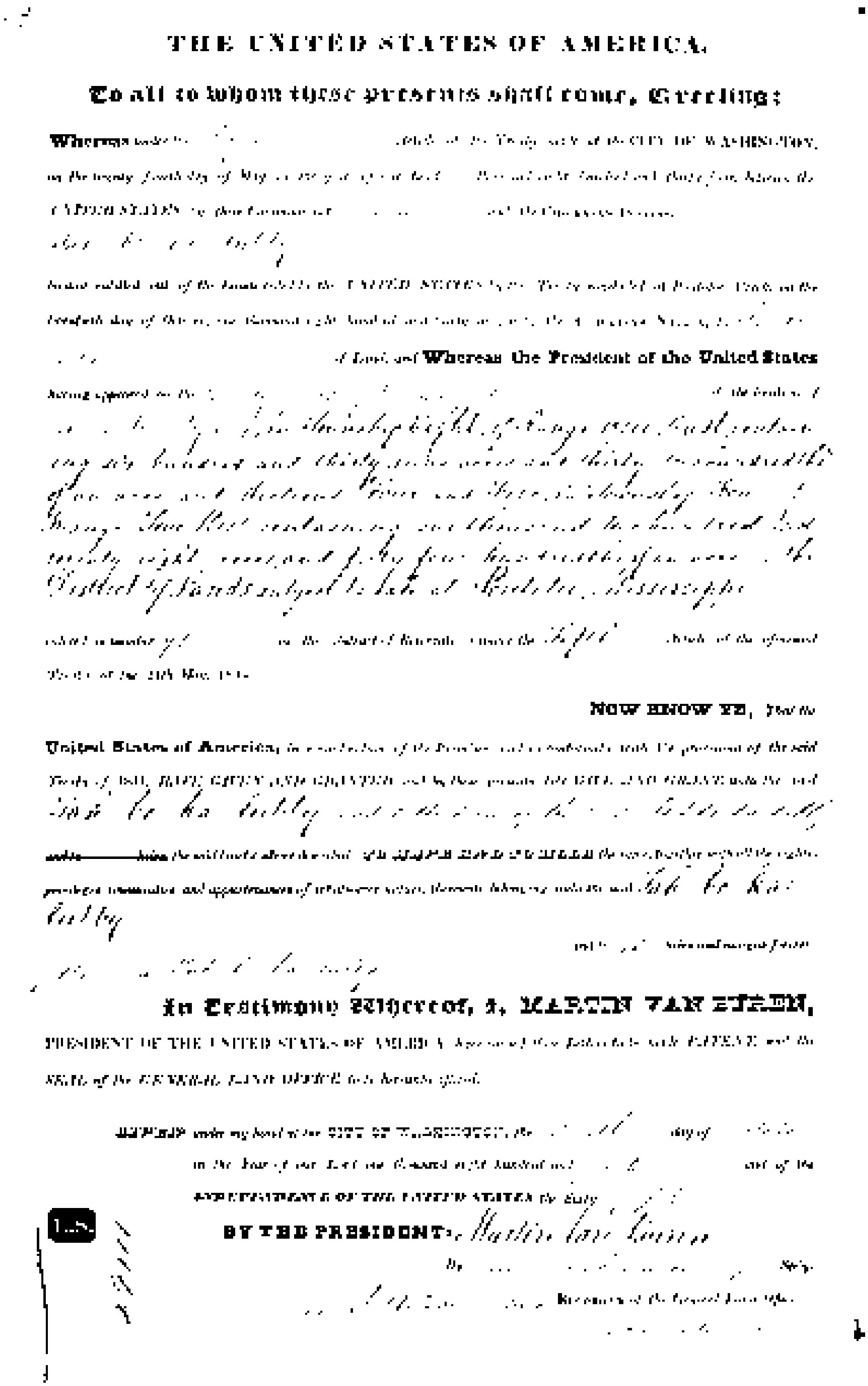
GIVEN under my hand, at the CITY OF WASHINGTON, [illegible]

[illegible]

L.S.

BY THE PRESIDENT: [illegible]

[illegible]



THE UNITED STATES OF AMERICA,

To all to whom these presents shall come, Greeting:

Whereas ... CITY OF WASHINGTON, ...

... Whereas the President of the United States ...

NOW KNOW YE, ...

United States of America, ...

In Testimony Whereof, I, MARTIN VAN BUREN,

PRESIDENT OF THE UNITED STATES OF AMERICA ...

L.S.

BY THE PRESIDENT: Martin Van Buren

... Recorder of the General Land Office.

APPENDIX C:
CURATION LETTER

University of Alabama Museums
Office of Archaeological Research

THE UNIVERSITY OF
ALABAMA
MUSEUMS

May 6, 2016

Hunter Johnson
Tennessee Valley Archaeological Research
2211 Seminole Drive, Suite 302
Huntsville AL 35805

Dear Hunter:

As per your request, this letter is to establish an agreement with you to provide curation services to Tennessee Valley Archaeological Research on an as-needed basis. We are recognized by a variety of Federal agencies as a repository meeting the standards in 36 CFR Part 79 and have formal agreements to provide curation under these guidelines to agencies such as the Department of Defense, National Park Service, U.S. Fish and Wildlife Service, U.S. Soil Conservation Service, U.S. Army Corps of Engineers, Tennessee Valley Authority, National Forest Service, etc.

Please be advised that once a year we must be notified of all reports in which we were named as the repository. Project collections must be submitted within one calendar year of completion. Small projects may be compiled for periodic submission. For Alabama, the AHC survey policy specifies which materials must be curated (Administrative Code of Alabama, Chapter 460-X-9). Archaeological documentation must be curated even if no artifacts are recovered. Renewal of this agreement is contingent upon compliance.

We appreciate having the opportunity to assist you with curation services and look forward to working with you in the future.

Sincerely,

Eugene Futato

Eugene M. Futato RPA
Deputy Director

13075 Moundville
Archaeological Park
Moundville, Alabama 35474
(205) 371-2266
FAX (205) 371-2494

APPENDIX D:
SHOVEL TEST ROSTER

Unit Type	Test	Status	NAD 27 Easting	NAD 27 Northing	Site	Shovel Test Depth (cmbs)	Auger Test Depth (cmbs)
Shovel Test	1	modern discarded	277243.700764	3849084.584552		0-70	
Shovel Test	2	modern discarded	277272.023444	3849083.87128		0-35	
Shovel Test	3	negative	277302.122674	3849083.562129		0-41	
Shovel Test	4	negative	277332.468698	3849082.761991		0-45	
Shovel Test	5	negative	277361.238592	3849084.311887		0-29	
Shovel Test	6	negative	277244.915284	3849139.168348		0-47	
Shovel Test	7	negative	277269.916456	3849141.458257		0-35	
Shovel Test	8	negative	277302.282961	3849143.752345		0-33	
Shovel Test	9	modern discarded	277330.823275	3849140.992125		0-34	
Shovel Test	10	negative	277362.599223	3849143.957575		0-34	
Shovel Test	11	negative	277242.64652	3849112.004963		0-70	
Shovel Test	12	negative	277272.642461	3849112.983337		0-54	
Shovel Test	13	negative	277301.045225	3849114.341631		0-41	
Shovel Test	14	negative	277333.494018	3849114.980979		0-37	
Shovel Test	15	negative	277362.052446	3849114.153885		0-30	
Shovel Test	16	modern discarded	362054.701653	3864141.322436		0-34	
Shovel Test	17	negative	362050.406337	3864113.846376		0-27	
Shovel Test	18	negative	362046.638636	3864083.521087		0-24	
Shovel Test	19	negative	362054.872868	3864055.198358		0-35	
Shovel Test	20	negative	362083.331333	3864053.899483		0-28	
Shovel Test	21	negative	362066.729726	3864062.149791		0-34	
Shovel Test	22	negative	362084.339605	3864084.074711		0-70	
Shovel Test	23	negative	362113.693037	3864082.526868		0-51	
Shovel Test	24	negative	362142.98422	3864082.879734		0-27	

Unit Type	Test	Status	NAD 27 Easting	NAD 27 Northing	Site	Shovel Test Depth (cmbs)	Auger Test Depth (cmbs)
Shovel Test	25	negative	362144.064502	3864139.338753	22AL726	0-30	
Shovel Test	26	negative	362174.989885	3864176.700824		0-28	
Shovel Test	27	positive	362172.358766	3864115.717232	22AL726	0-29	
Shovel Test	28	negative	362164.711374	3864124.400165	22AL726	0-28	
Shovel Test	29	positive	362182.296051	3864123.94496	22AL726	0-32	
Shovel Test	30	negative	362191.478018	3864130.796497	22AL726	0-34	
Shovel Test	31	negative	362200.291986	3864133.54484		0-31	
Shovel Test	32	negative	362164.005883	3864109.033329	22AL726	0-34	
Shovel Test	33	negative	362155.689489	3864102.578719		0-41	
Shovel Test	34	negative	362179.254751	3864104.573923	22AL726	0-35	
Shovel Test	35	negative	362185.376175	3864097.234404		0-27	
Shovel Test	50	negative	362084.035908	3864112.878789		0-24	
Shovel Test	51	negative	362114.878516	3864112.776614		0-22	
Shovel Test	52	negative	362083.265857	3864142.878055		0-23	
Shovel Test	53	negative	362113.851914	3864054.240685		0-34	
Shovel Test	54	negative	362145.10149	3864053.438134		0-28	
Shovel Test	55	negative	362143.183964	3864112.435315		0-51	
Shovel Test	56	negative	362175.957055	3864143.322651	22AL726	0-30	
Shovel Test	57	negative	362174.964671	3864080.523375		0-27	
Shovel Test	58	negative	362173.97643	3864057.636616		0-27	
Shovel Test	59	negative	362204.4893	3864054.179242		0-32	
Shovel Test	60	negative	362197.631169	3864083.195957		0-28	
Shovel Test	61	negative	362204.116324	3864113.159418		0-33	
Shovel Test	62	negative	362208.045625	3864139.576407		0-32	

Unit Type	Test	Status	NAD 27 Easting	NAD 27 Northing	Site	Shovel Test Depth (cmbs)	Auger Test Depth (cmbs)
Shovel Test	63	negative	362207.212475	3864167.224102		0-40	
Shovel Test	64	positive	362155.03965	3864135.042515	22AL726	0-29	

APPENDIX E:
SITE FORM

Mississippi Department of Archives and History

SITE NAME: ______ SITE NO: 22AL726 OTHER NOS: ______ 7.5 QUAD: Corinth

COUNTY: Alcorn SEC: 13 TWN: 2S RNG: 7E UTM DATA: zone 16N E 362172.42679 N 3864117.0553

OWNERSHIP: private [ ] state [ ] county [ ] city [ ] federal [X]

NAME OF OWNER: TVA RECORDER TVAR DATE: 4/20/2016

NATIONAL REGISTER POTENTIAL: eligible [ ] ineligible [X] unknown [ ] NATURAL SETTING: bluff [ ] bluff shelter [ ] chenier [ ] dune [ ] floodplain [ ] first terrace [ ] knoll on terrace [ ] upland (ridge) [X] estuary [ ] natural levee [ ] backswamp [ ]

VEGETATION COVER: active cultivation [ ] fallow field [ ] pasture [ ] orchard [ ] pine forest [ ] hardwood forest [ ] denuded [ ] garden [ ] other [X]

ESTIMATION OF GROUND COVER: (estimate %) 90 DEGREE OF DISTURBANCE (estimate %) 50

TYPE OF DISTURBANCE: cultivation [ ] natural [X] scientific excavation [ ] unscientific excavation [ ] extensively collected [ ] construction [ ] land levelled [ ] buried site [ ] redeposited site [ ] forestry [ ] periodic flooding [ ] indefinitely flooded [ ] unknown [ ] other [ ]

SOIL TYPE: Providence silt loam SOIL CODE: PdC3

ARTIFACT DENSITY: heavy [ ] medium [X] light [ ] single artifact [ ]

INSTITUTION WHERE ARTIFACTS CURATED: Erskine Ramsay Repository

SURFACE AREA(sq.m.): 1493 max length 51 max width 37 ELEVATION (ft): 440

DEPOSIT DEPTH (m.): .25 CHRONOLOGY: Paleo Indian [ ]

Archaic [ ] early [ ] middle [ ] late [ ] Woodland [X] early [ ] middle [ ] late [ ] Miss. [ ] early [ ] middle [ ] late [ ] Historic Indian [ ]

Contact Indian [ ] Unknown Aboriginal [ ] Historic [ ]

REPORT REFERENCE: Phase I Cultural Resources Surveys of Tennessee Valley Authority's Corinth and Holly Springs Substation Expansions in Alcorn and Marshall Counties, Mississippi

MDAH REPORT NO: ______ USE REVERSE SIDE FOR ADDITIONAL INFORMATION

Place Quad Xerox Here

Mounds

\# conical [ ]

\# pyramidal [ ]

\# indeterminate [ ]

earthworks [ ]

material identified:

3 coarse sand sherdlets, 1 undifferentiated debitage, 1 brick fragment

component – diagnostics

coarse sand sherdlet: Woodland

comments:

This site is a small prehistoric and historic artifact scatter encompassing 1,493 m^2 (16,078 ft^2) located on a northeast-southwest trending ridge 130 m northwest of an unnamed tributary of Bridge Creek. At the time of TVAR's survey, the site was situated in a disturbed area consisting primarily of tall grass and briar's and approximately 7 m southeast of an existing substation.

One structure, located 100 m to the southwest of the site, was present on the USGS 1950 Corinth 15-minute and the 1982 Corinth 7.5-minute topographic quadrangle maps, but that building was not present at the time of this survey. Therefore, it was built sometime before 1950 and destroyed sometime after 1982.

A total of 12 shovel tests were conducted during TVAR's investigation of the site, three of which yielded artifacts (n=5) from maximum depth of 25 cmbs. Shovel testing at the site produced a general profile consisting of a brown (7.5YR 5/4) silty clay loam (0 to 20 cmbs) underlain by a strong brown (7.5YR 5/6) silty clay (20 to 29 cmbs). Soil profiles show that the site is heavily disturbed. Coarse sand tempered sherdlets indicate a post Archaic occupation of the site, and although one historic brick fragment was recovered, it cannot be precisely dated to the time in which a structure was extant near the site.

TVAR recommends this site as not eligible for inclusion in the NRHP.

MDAH USE ONLY

Physiographic Region:

YB[ ], LH[ ], FW[ ], PR[ ], BP[ ], TH[ ], JP[ ], LLPR[ ], CPM[ ], NCH[ ]

National Register Status: NRL [ ], date ______, criteria ______

DOE [ ], date ______, criteria ______

NHL [ ], date ______, criteria ______

Mississippi Landmark [ ], date ______

ENCLOSURE 6

BFN EPU LAR, Attachment 42, Supplemental Environmental Report, Revision 1

ATTACHMENT 42

SUPPLEMENTAL ENVIRONMENTAL REPORT

Revision 1

Pages changed by Revision 1 are as follows:

Table of Contents, Section 5.0 Page Numbers,
List of Acronyms, Abbreviations, and Symbols,
Page 42-1, Section 1.0, Executive Summary,
Page 42-2, Section 2.0, Introduction,
Page 42-5, Related Power Uprate Submittals and NEPA Documentation,
Page 42-11, Section 4.0, Overview of Operational and Equipment Changes,
Page 42-15, Section 6.0, Cost Benefit Analysis,
Page 42-16, Section 7.1.1.1, Land Use, Wetlands, and Natural Areas,
Page 42-29, Section 7.1.2, Transmission Facilities
Pages 42-46 and 42-52, Section 7.2.3, Impact on Discharge, changed by response to RERP-SW-RAI-1, Attachment 1.

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List of Acronyms, Abbreviations, and Symbols

Acronym	Definition
°F	degrees Fahrenheit
ADEM	Alabama Department of Environmental Management
AEC	U.S. Atomic Energy Commission
ALARA	as low as reasonably achievable
ATL	alternate thermal limits
APE	area of potential effects
AST	alternative source term
BFN	Browns Ferry Nuclear Plant
BIP	Balanced Indigenous Populations
BLEU	blended low enriched uranium
BWR	boiling water reactor
CCW	condenser circulating water
cfs	cubic feet per second
CLTP	current licensed thermal power
CPPU	constant pressure power uprate
CT	cooling tower
CWA	Clean Water Act
dBA	decibels A-weighted scale
DBA	design basis accident
DO	dissolved oxygen
DOE	U.S. Department of Energy
EA	environmental assessment
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency
EPU	extended power uprate
ER	environmental report
ERM	Elk River Mile
FES	final environmental statement

FICON	Federal Interagency Committee on Noise
FONSI	finding of no significant impact
FSEIS	final supplemental environmental impact statement
FY	fiscal year
GEIS	generic environmental impact statement
gpm	gallons per minute
GWh	gigawatt-hour
GWPP	groundwater protection program
HEU	highly enriched uranium
hp	horsepower
IRP	Integrated Resource Plan
ISFSI	independent spent fuel storage installation
kV	kilovolt
L_{dn}	day/night sound level
L_{eq}	equivalent sound level
LEU	low enriched uranium
LLRW	low-level radioactive waste
LRA	license renewal application
MGD	million gallons per day
MW	megawatt
MWd/MTU	megawatt-days per metric ton of uranium
MWt	megawatts thermal
MVAR	mega volt-ampere reactive
NEI	Nuclear Energy Institute
NESC	National Electrical Safety Code
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NPG	Nuclear Power Group (TVA)
NRC	U.S. Nuclear Regulatory Commission

NRHP	National Register of Historic Places
ODCM	Offsite Dose Calculation Manual
OLTP	original licensed thermal power
PFOS	perfluorooctane sulfonate
PUSAR	Power Uprate Safety Analysis Report
QA	quality assurance
RBI	Reservoir Benthic Index
RCRA	Resource Conservation and Recovery Act
REMP	Radiological Environmental Monitoring Program
RFAI	Reservoir Fish Assemblage Index
ROD	record of decision
RWCU	reactor water cleanup system
SEIS	supplemental environmental impact statement
SHPO	State Historic Preservation Officer
TLTP	target licensed thermal power
TRM	Tennessee River Mile
TVA	Tennessee Valley Authority
TWh	terawatt-hours
UFSAR	Updated Final Safety Analysis Report
USACE	U.S. Army Corps of Engineers
WMA	wildlife management area

1.0 EXECUTIVE SUMMARY

This supplemental environmental report (ER) contains the Tennessee Valley Authority's (TVA's) assessment of the environmental impacts of a proposed output power increase for Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3. Each unit was originally licensed to operate at 3,293 megawatts thermal (MWt). The proposed increase is from the current operating limit of 105 percent of the original licensed thermal power (OLTP), or 3,458 MWt, to 120 percent OLTP, or 3,952 MWt, for each unit. The increase to 105 percent OLTP was termed a "stretch" uprate, and the increase to 120 percent OLTP is termed an extended power uprate (EPU). The intent of this supplemental ER is to provide information needed by the U.S. Nuclear Regulatory Commission (NRC) to evaluate the environmental impact of the power uprate in accordance with 10 CFR Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.

EPU for BFN Units 1, 2, and 3 does not require extensive changes to plant systems that directly or indirectly interface with the environment. With the exception of capacitor bank installations at five substation locations distant from BFN, all other modifications will be in or on existing BFN structures; none will involve disturbing additional land or constructing new facilities outside the existing plant areas. There will be no increase in condenser circulation (cooling) water, and BFN will maintain compliance with its National Pollutant Discharge Elimination System (NPDES) permit through use of the cooling towers or, if needed, by derating. The rate of low-level radioactive waste (LLRW) generation would increase slightly compared to the current rate, but would still be bounded by the BFN environmental licensing basis; this is also true for gaseous radiological emissions. Offsite radiation doses will remain small and within applicable regulatory limits. The number of dry storage casks of spent fuel would also increase.

As a federal agency subject to the requirements of the National Environmental Policy Act (NEPA), TVA evaluates the effects on the environment of all proposed actions. The environmental impacts of operating BFN Units 1, 2, and 3 at 120 percent OLTP are bounded by the impacts described in this supplemental ER, the response to NRC request for additional information (RAI) RERP-RAI-GE-2, and previous BFN environmental reviews and are appropriately constrained by applicable regulatory limits. TVA also concludes that human health and the environment would not be significantly affected.

2.0 INTRODUCTION

TVA operates BFN Units 1, 2, and 3 in Limestone County, Alabama, consistent with its broad responsibilities for the natural and social well-being of the Tennessee Valley Region as charged under the Tennessee Valley Authority Act of 1933. TVA is committed to operating BFN in a manner that will protect the environment and preserve natural resources while producing safe, reliable, and economical electric power. In keeping with this charge, TVA is requesting a license amendment to allow BFN Units 1, 2, and 3 to operate at up to 120 percent OLTP, deemed an EPU. As discussed in Section 2.2, the units have already been uprated by 5 percent, thus, the remaining power increase being requested is approximately a 15-percent increase for each BFN unit.

In June 2004, TVA submitted two license amendment requests for increasing the output power level of the three BFN units to 120 percent OLTP. One submittal addressed EPU of Units 2 and 3, and the other submittal addressed EPU of Unit 1. On September 22, 2006, TVA submitted a supplement to the application for EPU of BFN Unit 1 that requested interim operation at 105 percent OLTP. On March 6, 2007, NRC issued Amendment No. 269 to Renewed Facility Operating License No. DPR-33 for BFN Unit 1, allowing an operating power increase of Unit 1 from 3,293 to 3,458 MWt. TVA subsequently withdrew the 2004 EPU license amendment requests and corresponding ERs on September 18, 2014.

This revised supplemental ER, which addresses the environmental impacts of EPU for all three units, replaces the ER for Unit 1 and the ER for Units 2 and 3 that were submitted in June 2004. As a supplemental ER, this document supplements the NEPA documentation currently in place for previous licensing actions, as discussed in Section 2.2 and summarized in Table 2.2-1, and is intended as input for NRC's NEPA review of the requested EPU at BFN Units 1, 2, and 3.

2.1 Browns Ferry Nuclear Plant History and Background

BFN is located on an 840-acre tract located on the north shore of Wheeler Reservoir at Tennessee River Mile (TRM) 294 in Limestone County, Alabama, approximately 10 miles northwest of Decatur, Alabama, and 10 miles southwest of Athens, Alabama. TVA began major construction on BFN in 1967.

As a federal agency subject to the requirements of NEPA, enacted in 1969, TVA evaluated the effects on the environment of construction and operation of BFN in a three-volume document entitled *Final Environmental Statement, Browns Ferry Nuclear Plant, Units 1, 2, and 3* (FES), and dated September 1, 1972. The U.S. Atomic Energy Commission (AEC) participated in the preparation of the FES as a cooperating agency. The AEC concluded on August 28, 1972, that the FES was adequate to support the proposed license to operate the plant. The FES was sent to the Council on Environmental Quality and made available to the public on September 1, 1972.

BFN has three General Electric boiling water reactors (BWRs) and associated turbine generators that can produce more than three billion watts of power. Each of BFN's three nuclear reactors is connected to its own dedicated generator. Unit 1 began commercial operation in August 1974, Unit 2 in 1975, and Unit 3 in 1977. A fire shut down BFN Unit 1 in 1975 for over a year. All three units were taken off line in 1985 when TVA idled its nuclear fleet. After an extended shutdown to review the TVA nuclear power program and to correct significant weaknesses, TVA returned Unit 2 to service in May 1991, Unit 3 in November 1995 and, following extensive repairs and refurbishment, Unit 1 came back on line in May 2007. In 1998, BFN completed an Integrated Plant Improvement Project for Units 2 and 3 which, among other improvements, resulted in an NRC-approved 5-percent uprate of OLTP for each unit. The cooling towers serving Units 1, 2, and 3 have also undergone replacement in the past years with the last two of the original six cooling towers being currently planned for replacement in fiscal year (FY) 18 and FY19. To increase total plant cooling capacity, a new and larger cooling tower was constructed in May 2012.

TVA submitted a license renewal application (LRA) to the NRC in December 2003 for renewal of the facility operating licenses for each BFN unit. The NRC issued *Supplement 21 Regarding Browns Ferry Nuclear Plant Units 1, 2, and 3* to the Generic EIS for License Renewal of Nuclear Plants (NUREG-1437) in June 2005. NRC issued the renewed operating licenses for Units 1, 2, and 3 in May 2006, allowing continued operation of the three BFN units until 2033, 2034, and 2036, respectively.

2.2 Related Power Uprate Submittals and NEPA Documentation

As mentioned above, the BFN FES was prepared by TVA with the AEC as a cooperating agency to assess the effects on the environment of construction and operation of BFN and was issued in 1972.

To support a 5-percent uprate of OLTP for Units 2 and 3, termed a "stretch uprate", TVA prepared an environmental assessment (EA) dated August 1997, and a finding of no significant impact (FONSI) was issued by TVA on August 28, 1997. In response to TVA's application of October 1, 1997, for the 5-percent uprate on Units 2 and 3, the NRC issued an EA and FONSI of its own on August 26, 1998, and an amendment to the BFN operating licenses for Units 2 and 3 was approved by the NRC for the 5-percent uprate on September 8, 1998. Later, on March 6, 2007, the NRC approved an amendment to the BFN Unit 1 operating license allowing the same 5-percent "stretch" operating power increase (3,293 MWt to 3,458 MWt) as for Units 2 and 3.

Following review of licensing topical reports NEDC-32424P-A, "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate," dated February 1999, and NEDC-32523P-A, "Generic Evaluations of General Electric Boiling Water Reactor Extended Power Uprate," dated February 1999, the NRC concluded that the reports provided an acceptable methodology to uprate the power output of BWRs, such as the BFN units, up to 120 percent OLTP. Subsequent to these NRC's reviews, TVA initially pursued EPUs for Units 2 and 3.

TVA completed the *Browns Ferry Nuclear Plant Extended Power Uprate for Units 2 and 3 Environmental Assessment* in March 2001. This assessment described the potential environmental effects of increasing thermal output power from BFN Units 2 and 3 from 105 percent to 120 percent OLTP. A FONSI was issued for the proposed project contingent upon certain mitigation measures for rendering increased thermal loads to surface waters insignificant. At that time, thermal impact mitigation measures included construction of a new 16-cell cooling tower and the use of existing cooling towers. Following completion of this EA, on April 18, 2001, the TVA Board approved the EPU project for BFN Units 2 and 3.

After the Units 2 and 3 EPU FONSI was issued, additional technical analyses completed in late 2001 predicted that without the new cooling tower the plant would need to derate for no more than 183 hours in a 10-year period to stay in compliance with thermal limits. Subsequent refinements of the modeling effort in the summer of 2003, using 16 years of data, predicted that operation of the BFN Units 2 and 3 at 120 percent OLTP without the proposed new cooling tower was projected to need no more than 128 hours of derating in a 16-year period. Further economic analysis indicated that due to transmission system improvements, the cost of replacement power for 128 hours over a 16-year period would not be enough to justify construction of a new cooling tower as a part of the EPU project for Units 2 and 3. Based upon these modeling refinements, on August 7, 2003, TVA issued a new EA and FONSI for the Units 2 and 3 EPU project. This EA and FONSI concluded that implementation of EPU using the existing five cooling towers would not have a significant impact on the quality of the environment, contingent upon derating as necessary to remain compliant with NPDES permit discharge temperature limits and continuation of aquatic monitoring programs for 3 years after EPU.

In June 2004, TVA submitted two license amendment requests to the NRC for increasing the output power level of the three BFN units to 120 percent OLTP. One submittal addressed EPU of Units 2 and 3, and the other submittal addressed EPU of Unit 1 separately because, unlike the other two units, it had not undergone the 5-percent “stretch” uprate and was therefore seeking approval to go directly to 120 percent OLTP. On September 22, 2006, TVA submitted a supplement to the application for EPU of BFN Unit 1 that requested interim operation at 105 percent OLTP until certain steam dryer analyses could be completed. On March 6, 2007, NRC issued Amendment Number 269 to Renewed Facility Operating License No. DPR-33 for BFN Unit 1, allowing an operating power increase to 3,458 MWt. Subsequently, TVA withdrew the 2004 EPU license amendment requests on September 18, 2014.

To support a separate licensing action, application for renewal of BFN Units 1, 2, and 3 operation licenses, TVA completed work in March 2002 on *Final Supplemental Environmental Impact Statement for Operating License Renewal of the Browns Ferry Nuclear Plant in Athens, Alabama* (FSEIS), which also included an assessment of the impact of recovering and restarting Unit 1. Renewal of the operating licenses of all three units would allow operation to continue for an additional 20 years past the original 40-year operating license terms, which expired or will expire in 2013, 2014, and 2016 for Units 1, 2, and 3, respectively. A Record of Decision (ROD) was approved by the TVA Board in May 2002 and published in the June 18, 2002 *Federal Register*. The FSEIS and ROD acknowledge that restart of Unit 1 and operation of all three units at EPU up to 120 percent of the originally licensed power level would require additional cooling tower capacity beyond what was available at that time (2002). Therefore, the preferred alternative, as stated in the FSEIS and confirmed in the ROD, included the addition of a new 20-cell mechanical draft cooling tower to replace cooling tower 4 which was destroyed by fire in 1986.

As discussed in Section 2.1, TVA submitted an LRA to the NRC in December 2003 for renewal of the operating licenses for each BFN unit. The LRA contained an extensive ER, which updated analyses in some subject matter areas presented in the FSEIS, including thermal discharge (i.e., main condenser cooling water effluent temperatures and mixing characteristics); however, the basic conclusions of the FSEIS remained unaltered. A notice of receipt and availability of the application was published in the *Federal Register* on March 10, 2004 (69 FR 11462). The NRC issued *Supplement 21 Regarding Browns Ferry Nuclear Plant Units 1, 2, and 3,* to the Generic EIS for License Renewal of Nuclear Plants (NUREG-1437) in June 2005. The renewed operating licenses for Units 1, 2, and 3 were issued in May 2006, allowing continued operation of the three BFN units until 2033, 2034, and 2036, respectively.

During the summer of 2010, derates to below 50 percent power were required at BFN for several days in July and about half of August to meet the NPDES permit maximum allowable cooling water discharge temperature. To provide more efficient cooling and additional capacity needed for current operations and future uprates, TVA pursued replacement of four original cooling towers (CTs 1, 2, 5, and 6) with larger towers and the construction of an additional, much larger mechanical draft cooling tower (CT 7). In October 2010, TVA issued an EA and a FONSI for the *Browns Ferry Nuclear Plant Cooling Towers Addition and Replacements*. In addition, to support replacement of CT 3 with a more modern tower, TVA completed a supplemental EA and a FONSI in December 2012.

Currently, all but two of the six original cooling towers have been replaced and upgraded. CTs 1 and 2 are currently planned for replacement in FY18 and FY19. With the addition of CT 7, the current fleet of seven cooling towers is sufficient to maintain NPDES permit compliance. Details of current cooling tower characteristics are described in Table 7.2-1, BFN Cooling Tower Characteristics, October 2014.

TVA performed an Interconnection System Impact Study (SIS) to evaluate the impact of the additional power from the proposed BFN EPU on the TVA transmission system. The Interconnection SIS identified transmission system and BFN main generator excitation system upgrades needed to support the planned BFN unit uprates. The environmental reviews of the transmission system and BFN main generator excitation system upgrades are described in the response to NRC RERP-RAI-GE-2.

2.2.1 References

69 FR 11462. Tennessee Valley Authority, Browns Ferry Nuclear Plant, Units 1, 2, and 3; Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process. *Federal Register* 69:11462 (March 10, 2004).

ADEM (Alabama Department of Environmental Management). 2002. "Final listing decision for Wheeler Reservoir on the Tennessee River waterbody identification number AL/Wheeler_Res01 pH temperature/thermal modification."

Table 2.2-1: BFN NEPA Documentation[1]

NEPA Document	Decision
Operation of BFN	
Final Environmental Statement, Browns Ferry Nuclear Plant, Units 1, 2, and 3, August 1972 Prepared by TVA to evaluate the effects on the environment of construction and operation of BFN. The U.S. Atomic Energy Commission participated in the preparation of the FES as a cooperating agency.	ROD issued August 28, 1972
Final Supplemental Environmental Impact Statement for Operating License Renewal of the Browns Ferry Nuclear Plant in Athens, Alabama, March 2002 Prepared by TVA to seek extension of NRC licenses for BFN Units 1 through 3 at 120 percent OLTP for an additional 20 years beyond the original 40-year operating license terms. Mitigation measures for increased thermal loads to surface waters included use of existing cooling towers, construction of a new cooling tower, and derating the plant as necessary.	ROD issued May 16, 2002
License Renewal Application for Browns Ferry Nuclear Plant Units 1, 2, and 3, December 2003 Prepared by TVA to apply for renewal of BFN's operating licenses for an additional 20 years.	December 2003
Supplement 21 Regarding Browns Ferry Nuclear Plant Units 1, 2, and 3 to the Generic EIS for License Renewal of Nuclear Plants (NUREG-1437), June 2005 Prepared by NRC to evaluate the continued operation of BFN Units 1, 2, and 3 during a 20-year renewed license term at OLTP or at EPU of 120 percent.	June 2005
Power Uprates	
Browns Ferry Nuclear Plant Units 2 and 3 Power Uprate Project EA, August 1997. TVA prepared the EA to pursue action to request license amendment from NRC to increase BFN Units 2 and 3 maximum power level to 105 percent OLTP.	FONSI issued August 28, 1997
NRC-issued EA and FONSI NRC prepared this EA to support an amendment to the BFN operating licenses for Units 2 and 3 for a 5-percent uprate on September 8, 1998.	August 26, 1998

NEPA Document	Decision
Browns Ferry Nuclear Plant Extended Power Uprate for Units 2 and 3 Environmental Assessment, March 2001 This assessment described the potential environmental effects of increasing thermal output power from BFN Units 2 and 3 from 105 percent to 120 percent OLTP. A FONSI was issued for the proposed project contingent upon certain mitigation measures for rendering increased thermal loads to surface waters insignificant. At that time, thermal impact mitigation measures included construction of a new 16-cell cooling tower and the use of existing cooling towers.	FONSI issued March 15, 2001
Browns Ferry Nuclear Plant Extended Power Uprate for Units 2 and 3 EA, August 2003 Based on new technical and economic analyses, TVA prepared this new EA and FONSI. It concluded that implementation of EPU using the existing five cooling towers would not have a significant impact on the quality of the environment, contingent upon derating as necessary to remain compliant with NPDES permit discharge temperature limits and continuation of aquatic monitoring programs for three years after EPU.	FONSI issued August 7, 2003
Cooling Tower Replacement and Upgrades	
Final Environmental Assessment Browns Ferry Nuclear Plant Cooling Towers Addition and Replacements, October 2010 To provide more efficient cooling and additional capacity needed for current operations and future uprates, TVA prepared this EA for replacement of CTs 1, 2, 5, and 6 and a new CT 7.	FONSI issued October 28, 2010
Browns Ferry Nuclear Plant Cooling Tower 3 Replacement Supplemental EA, December 2012 In July 2012, CT 3 partially collapsed. To support its replacement with a more modern tower that included larger fan motors and a larger cold water basin, TVA prepared this supplemental EA.	FONSI issued December 6, 2012

1. Listing of BFN NEPA documentation pertinent to power uprates.

3.0 PURPOSE OF AND NEED FOR ACTION

3.1 The Proposed Action

In response to the increasing (continuing) demands for bulk power, TVA is requesting a license amendment for EPUs to increase the reactor thermal power for BFN Units 1, 2, and 3 such that each unit can be operated at 120 percent OLTP (3,293 MWt) or 3,952 MWt. Use of existing facilities to the greatest extent possible has the three-fold benefit of assuring future power supplies, avoiding the large capital outlays associated with new construction, and avoiding the environmental impacts from siting and constructing a new power generating facility.

Under the current schedule, EPU would be implemented at Unit 1 during the scheduled refueling outage in fall 2018 (Refueling Outage—Unit 1 Cycle 12), at Unit 2 in spring 2019 (Refueling Outage—Unit 2 Cycle 20), and at Unit 3 during spring 2018 (Refueling Outage—Unit 3 Cycle 18). Upon approval of the EPU by the NRC, each unit would begin operating at the uprated power level following the outages identified above.

3.2 Need for TVA Action

Determination of a need for power begins with long-term forecasts of the growth in demand for electricity, both in terms of peak demand and energy sales to the end-user. TVA estimates that energy consumption will increase at a compound annual growth rate of 1.2 percent from 2015 to 2020, with moderate growth continuing beyond 2020. The total firm capacity of existing resources decreases over time primarily due to retirement of coal-fired units and the expiration of existing power purchase agreements.

Watts Bar Unit 2 is anticipated to be operational by the end of 2015 and will add approximately 1,150 MW of nearly zero carbon emission generating capacity to the system. However, by spring 2016, five coal units totaling more than 1,000 MW will be idled or retired. Since 2011, TVA has retired, or plans to retire by 2019, more than 6,500 MW (net dependable capacity) of coal-fired generation.

TVA estimates that, with current resources and those planned to be available, when compared to the demand forecast, additional capacity and energy of 2,400 MW and almost 10,000 GWh will be needed in 2020. The BFN EPUs would offer lower-cost, nearly zero carbon emission base-load power without the high capital cost typical of most nuclear power additions.

3.3 Alternatives to the Proposed Action

TVA considered various alternatives to the proposed action. If the proposed action is not undertaken, TVA would need to supply system energy and capacity needs from other resources.

In the “No Action” alternative, where the BFN EPU project is not approved, TVA would need to purchase market capacity and/or employ new gas generation without the uprates in order to satisfy firm requirements. Both of these actions raise system fixed and capital costs relative to the proposed action. Energy requirements would need to be met with coal and gas generating resources and spot energy purchases resulting in higher system operational costs.

4.0 OVERVIEW OF OPERATIONAL AND EQUIPMENT CHANGES

Increasing the electrical output of a BWR power plant is accomplished primarily by generating higher steam flow in the reactor and supplying it to the turbine generator. The activities needed to produce thermal power increases are a combination of those that directly produce more power and those that will accommodate the effects of the power increase. The additional reactor energy requirements for extended power are accomplished by increasing the reload fuel batch size, changing the fuel loading pattern, and changing the planned deployment of fuel enrichment and burnable poison. This is operationally accomplished by enhancements to core management throughout the fuel cycle. These enhancements address both control rod pattern and core flow management. Collectively, the core design and operational enhancements that achieve the increase in core thermal power result in a more uniform power distribution. Therefore, operating at EPU conditions will not challenge fuel design limits.

As part of the EPU project, plant systems have been analyzed to determine modifications required to support changes in system operation. The majority of these modifications are to address the increase to reactor steam and feedwater flow. A complete list of planned modifications is provided in Attachment 47. A representative list, but not all inclusive of the modifications to plant equipment necessary for EPU implementation, is as follows:

- Modifications to the high-pressure turbine
- Replacement of reactor feedwater pumps
- Installation of higher capacity condensate booster pumps and motors
- Modifications to the condensate demineralizer system
- Modifications to the feedwater heaters
- Replacement of the reactor pressure vessel steam dryers
- Upgrades of miscellaneous instrumentation, setpoint changes, and software modifications
- Modifications to the main generator excitation systems

All onsite modifications will be within the existing structures, buildings, and fenced equipment yards that currently house the major unit components. The project will make use of existing parking lots, road access, laydown areas, offices, workshops, warehouses, and restrooms located in previously disturbed surface areas at BFN. Transmission Planning has conducted an Interconnection SIS and identified transmission system upgrades that are required for EPU. These upgrades include installation of 764 megavolt-ampere reactive (MVAR) capacitor banks at five substation locations distant from BFN and upgrading six 500 kilovolt (kV) breaker failure relays, and modifying the main generator excitation systems.

All deliveries of materials to support the work identified above will be by truck. Equipment will be unloaded on site with equipment typical to material receipt and construction activities and will be temporarily stored in existing storage buildings and laydown areas. Existing land uses will not be altered.

5.0 SOCIOECONOMIC AND ENVIRONMENTAL JUSTICE CONSIDERATIONS

5.1 Socioeconomics

BFN is located in Limestone County, Alabama, which is part of the Huntsville Metropolitan Area. The population of Limestone County in 2010 was 82,782. The primary labor market area for the plant consists of three metropolitan areas: Huntsville (Limestone and Madison counties), Decatur (Lawrence and Morgan counties), and Florence (Colbert and Lauderdale counties). The 2010 population of these three metropolitan areas combined was 718,559. (USCB 2010) Based on 2013 data, the labor force in Limestone County was 40,640; the primary labor market area had a labor force of 351,412. The unemployment rate in 2013 was 5.5 percent in Limestone County, while the average in the primary labor market area was 5.8 percent. Both Limestone County and the labor market area had lower unemployment rates than did the state (7.2 percent) and the nation (7.4 percent). (BLS 2013)

5.1.1 Payments in Lieu of Taxes

TVA does not pay property taxes; however, in accordance with federal law, Section 13 of the TVA Act, 16 U.S.C. §8311, it makes payments in lieu of taxes to states and counties in which its power operations are carried on and in which it has acquired properties previously subject to state and local taxation. Under Section 13, TVA pays 5 percent of its gross power revenues to such states and counties. Only a very small share of the payments is paid directly by TVA to counties; most is paid to the states, which use their own formulas for redistribution of some or all of the payments to local governments. TVA's payments in lieu of taxes are apportioned among the state and counties according to the state's allocation formula but, in general, half of the payment is apportioned based on power sales and half is apportioned based on the "book" value of TVA power property. Therefore, for a capital improvement project such as EPU, the in-lieu-of-tax payments are affected in two ways: (1) as power sales increase, the total amount of the in-lieu-of-tax payment to be distributed increases, and (2) the increased "book" value of BFN causes a greater proportion of the total payment to be allocated to Limestone County. The state's general fund, as well as all counties in Alabama that receive TVA in-lieu-of-tax distributions from the State of Alabama, benefit under this method of distribution. In 2014, TVA's payments in lieu of taxes to Alabama were approximately $104 million. Limestone County's share was approximately $8.3 million, largely because of the TVA fixed assets (BFN) in the county.

5.1.2 Project Employment

Under the current EPU schedule, implementation would occur at Unit 1 during the scheduled refueling outage in fall 2018 (Refueling Outage—Unit 1 Cycle 12), at Unit 2 in spring 2019 (Refueling Outage—Unit 2 Cycle 20), and at Unit 3 during spring 2018 (Refueling Outage—Unit 3 Cycle 18). Typically, the increased staffing for an outage is 800–1,200 supplemental workers for an average of 1,000. Supplemental staffing ramps up 2 to 3 weeks prior to the outage start with maximum staffing reached at about Day 3 of the outage and continuing until Day 21 to 28 when ramping down usually begins, whereby normal staffing is reached 1 week after the end of the outage. TVA's current business plan outage duration is 35 days or less. BFN typically targets 25- to 30-day durations.

The EPU work will be coordinated with other outage activities and completed by workers who have other outage duties as well. An estimated 10 percent or less of the average supplemental workforce of 1,000 will be dedicated to the EPU portion of the outage work. The maximum employment level for all outage work would represent about 2.5 percent of the current labor force of Limestone County and about 0.3 percent of the labor force in the primary labor market area.

5.1.3 Impacts on the Area

In addition to the areas included in the primary labor market area, the Birmingham, Alabama, and Nashville, Tennessee, areas are sources of workers for the proposed activity. Workers from these areas generally would commute rather than relocate for the relatively short duration of the proposed activity. TVA experience at BFN suggests that it is likely that less than half of all the workers hired for outage activities would move into the primary labor market area. The remaining workers generally would already reside within the primary labor market area or locations, such as the Birmingham or Nashville areas, close enough to commute on a temporary basis. Based on this, it is anticipated that the maximum impact from workers moving into the area would be about 400 to 450 workers, not all resulting from this proposed action. Because of the very short-term nature of the work, about five weeks, and the short duration of the maximum employment level, very few workers who do move in are expected to bring families with them. It is not likely that the increased population in the area due to all outage activities would exceed about 450 persons. However, it is possible that the demand for the required skills would make recruiting difficult, resulting in a somewhat larger number of workers moving temporarily into the local area.

Due to the short duration of the project, the total impact on annual earnings and income in Limestone County and in the labor market area would be very small and insignificant. Impacts on community services such as police, fire, and medical would also be very small and insignificant because of the small size of the impact on population, dispersal of the workers who move within the labor market area, and the short duration of the maximum workforce.

After it is implemented, the EPU project is not expected to affect the size of the BFN permanent workforce and would not have a material effect on the labor force required for future plant outages; however, there would be some continuing positive benefits to the local economy. Capitalization of some costs associated with the EPU would increase the "book" value of BFN and thereby result in a small increase in the in-lieu-of-tax payments received by Limestone County. EPU would also have a positive impact on the long-term viability of BFN as described in Chapter 6.0 (Cost-Benefit Analysis) of this report.

5.2 Environmental Justice

The population of Limestone County is 21.3 percent minority (non-white), well below both the state of Alabama (33.0 percent) and the nation (36.3 percent) (USCB 2010). The labor market area has a higher minority population share (26.5 percent), still well below the state and national levels. The "below the poverty threshold rate" in Limestone County is 13.3 percent, lower than both the state average of 18.1 percent and the national average of 14.9 percent. The poverty rate in the labor market area is 14.1 percent, higher than Limestone County, but still lower than the state and the nation. (USCB 2012) Almost all of the activity associated with the proposed action would occur inside the plant, further removing it from the population in the surrounding area. Also, no significant negative impacts to the environment are expected if the proposed action occurs. Therefore, no disproportionate negative impacts to disadvantaged populations are expected.

5.3 Conclusion

The favorable cost effectiveness of the EPU project compared with that for any other means of new generation, and the associated reduction in incremental operating costs, make the project economically attractive; this, in turn, allows it to contribute to keeping BFN a competitive electric power producer for years to come. Maintaining BFN as a reliable equal opportunity employer, in-lieu-of-tax provider, and source of reliable and clean electric power contributes a measure of stability and prosperity to the local social structure.

5.4 References

BLS (U.S. Bureau of Labor Statistics). 2013. U.S. Bureau of Labor Statistics 2013 Annual Data.

USCB (U.S. Census Bureau). 2010. Census of Population, 2010 and American Fact Finder.

USCB. 2012. American Fact Finder 2012 Alabama Poverty Data, 2012 USA Poverty Data, U.S. Bureau of the Census, American Community Survey.

6.0 COST-BENEFIT ANALYSIS

TVA performed analysis to study the cost effectiveness of implementing EPUs at the BFN site. The proposed EPUs provide additional supply of approximately 155 MW per unit (465 MW total) capacity and approximately 4 terawatt-hours (TWh) of reliable energy to the TVA system. The EPU project is expected to be economically beneficial by $450 million through the end of the current operating licenses at Browns Ferry.

Based on TVA's load forecast, capacity plans have shown TVA would need to purchase market capacity and/or employ new generation without the uprates in order to satisfy firm requirements. Detailed model simulations were completed to estimate the capacity and energy (mostly fuel) cost impacts. The capacity savings from the EPU project are largely driven by deferring or reducing the need for new capacity. The low variable cost of the additional nuclear generation delivers significant fuel savings by offsetting more expensive coal generation, gas generation, and the need for market purchases. This also includes reduced carbon emissions. TVA projects the total cost of the project to be $479 million which includes transmission system upgrades.

An Interconnection SIS was also conducted to determine all adverse system impacts on TVA's transmission system caused by the EPUs at BFN. Several projects are required to mitigate the identified adverse system impacts and the estimated cost of these projects is $45.5 million. The cost and timeframe for these required projects is significantly reduced from the prior study because TVA plans to modify the excitation system for all three units at BFN instead of building a new 500 kV transmission line. While the transmission system upgrade expense lowers the economic benefit, it is still highly positive.

7.0 NONRADIOLOGICAL ENVIRONMENTAL IMPACTS

7.1 Terrestrial Effects

7.1.1 BFN Site and Surroundings

7.1.1.1 Land Use, Wetlands, and Natural Areas

The changes associated with EPU are within the existing structures, buildings, and fenced equipment yards housing the major unit components at the 840-acre BFN site. The project will make use of existing parking lots, road access, laydown areas, offices, workshops, warehouses, and restrooms located in previously disturbed surface areas at BFN. No other changes to BFN properties or immediately surrounding environs are expected. The only potential land use changes are associated with upgrades to the power transmission system distant from BFN.

Site surveys conducted in 2003 (TVA 2003) indicated approximately 12 acres of wetlands present on the BFN site meet the U.S. Army Corps of Engineers (USACE) wetland parameters for federal jurisdictional wetlands which may be regulated under the Clean Water Act (CWA). However, no wetlands are present within areas proposed for construction activities associated with the proposed EPU. Therefore, the project would have no impacts or effects upon wetlands.

The TVA Natural Heritage database indicated on May 12, 2015, that two natural areas occur within a 6-mile vicinity of the project area. The Mallard-Fox Creek Wildlife Management Area (WMA) and the Swan Creek WMA. The Mallard-Fox Creek WMA is located across the Tennessee River from the BFN site. Swan Creek WMA is located approximately 5.2 miles upstream from the BFN site. The proposed EPU of BFN Units 1, 2, and 3 would not affect either WMA because, with the exception of installation of capacitor banks at five locations distant from BFN, construction work would occur within the boundaries of the BFN site. No offsite impacts from operation are expected at that location.

7.1.1.2 Cultural Resources and Visual Aesthetics

TVA complies with Section 106 of the National Historic Preservation Act (NHPA) for every TVA undertaking that has the potential to affect properties included or eligible for inclusion in the National Register of Historic Places (NRHP). TVA's practice includes identifying historic properties, evaluating project effects, and resolving any adverse effects to historic properties, in consultation with the appropriate parties including State Historic Preservation Officer(s) (SHPO) and tribal governments, pursuant to the procedures stipulated by 36 CFR 800.3-800.13. In addition, for any actions requiring compliance with NEPA, TVA considers the action's possible effects on historic structures, Native American religious or cultural properties, and archaeological sites.

In 2001, TVA conducted a Phase I archaeological survey during the preparation of the BFN Operating License Renewal Supplemental Environmental Impact Statement (SEIS) on three areas within the BFN site that were proposed for use as disposal areas for soil that could be removed for some of the potential cooling tower expansion alternatives being considered in the

SEIS (Gage 2001). Two historic properties were identified. One was an Early to Middle Woodland (600 B.C. to 1000 A.D.) occupation considered eligible for listing on the NRHP; the other was the Cox Cemetery, which was relocated during construction of BFN. Neither of these resources is located within the area of potential effects (APE) for the current EPU undertaking. The APE consists of the areas where ground-disturbing actions could occur as part of the undertaking. The current APE's potential to contain intact archaeological sites is low; native soils and sediments throughout most of the APE were destroyed during plant construction. However, photographs of plant construction taken in November 1968 and March 1969 (TVA 1968, 1969) indicate that the wooded hill along the southern border of the APE was not disturbed and could contain archaeological sites. Although facilities were added in that area at a later date, there remain approximately 4 acres of wooded area within the 840-acre BFN site that contain intact soils and sediments. No modern archaeological surveys have taken place in those areas and the presence or absence of archaeological sites there would have to be determined should TVA, in the future, propose an undertaking that would affect the wooded area and be subject to NEPA or NHPA Section 106.

BFN is considered by TVA to be eligible for listing in the NRHP under Criterion A (association with events that have made a significant contribution to the broad patterns of our history), based on an in-house assessment. Contributing resources include the powerhouse, water intake and skimmer, cooling towers, and the Aquatic Research Center. TVA found that the cooling tower replacements and addition of CT 7 would not appreciably alter the existing silhouette of BFN and would therefore have no visual effect. The Alabama SHPO agreed with this finding (Section 7.1.1.3).

Due to the time elapsed between that finding and the current ER, TVA researched current historic property records for aboveground resources at the Alabama Historical Commission, in order to verify whether the APE contained any recently identified properties. Figure 7.1-1 shows all previously identified above-ground properties within a 6-mile radius of BFN. No architectural resources included or eligible for inclusion in the NRHP have been recorded within 3 miles of BFN. The nearest such resource is the Burt Cemetery, located approximately 3.5 miles southeast of the plant on the opposite side of the Tennessee River.

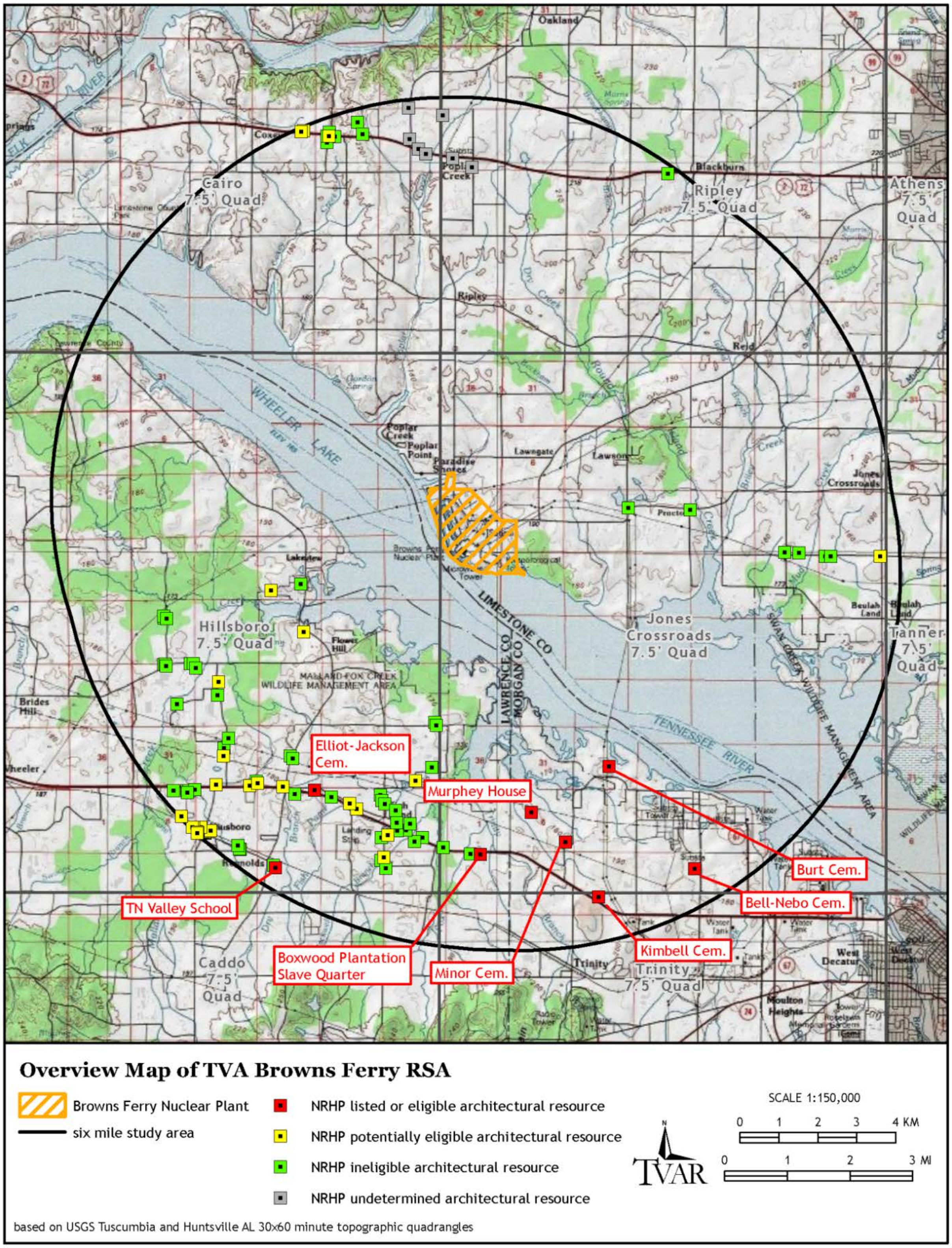

Figure 7.1-1: Recorded Architectural Resources Within 6 Miles of BFN, Coded by NRHP Status

7.1.1.3 Written Communications

To support a NEPA review of previously proposed construction activities by TVA for replacement of CTs 1, 2, 5, and 6 and construction of an additional cooling tower, CT 7, TVA consulted with the Alabama SHPO and federally recognized Indian tribes. TVA determined that no below-ground archaeological resources would be affected by the undertaking and the Alabama SHPO agreed. No tribes objected to the undertaking. The SHPO and tribal correspondence is included below.

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

September 24, 2010

Ms. Stacye Hathorn
Alabama Historical Commission
468 South Perry Street
Montgomery, Alabama 36130-0900

Dear Ms. Hathorn:

BROWNS FERRY NUCLEAR (BFN) POWER PLANT COOLING TOWER ADDITIONS, LIMESTONE COUNTY, ALABAMA

The Tennessee Valley Authority (TVA) proposes to replace four of six existing cooling towers (Towers 1, 2, 5, and 6) with larger units and construct one additional 25–30 cell linear mechanical draft cooling tower site at BFN (Figures 1 and 2). The four existing cooling towers would be demolished and rebuilt within the existing footprint. In 2001, TVA consulted with your office regarding the Environmental Impact Statement (EIS) for the relicensing of Units 1, 2, and 3 and additional cooling towers for BFN (AHC 2001-1439). Your office concurred with TVA that there would be no effect provided that 1LI535 could be avoided. The EIS did not include the currently proposed new cooling tower (Tower 7).

Tower 7 would be located along the east side of Shaw Road at the location of an existing perimeter ditch and includes the installation of a new pumping station, a cold water discharge canal, lift pumps and piping, and two new transformers (Figure 2). A portion of the ditch would be relocated directly northeast of proposed Tower 7 to maintain a perimeter ditch north of the new cooling tower. In addition, the cold water discharge canal is proposed between the north end of the spoil pile and the existing western perimeter ditch, and approximately a five-acre construction staging area is necessary.

TVA considers the archaeological area of potential effect (APE) to be the footprint where ground disturbance would take place (1LI535 is outside of the APE). TVA finds the proposed undertaking would not appreciably add to the existing silhouette of BFN and there would be no visual effect.

The archaeological APE has been extensively disturbed with the construction of BFN, such that no intact archaeological deposits would be present. It is TVA's finding that no cultural resources potentially eligible for the National Register of Historic Places (NRHP) would be affected by the proposed undertaking and no further investigations are recommended. Pursuant to 36 CFR Part 800, we are seeking your concurrence with TVA's findings and recommendations.

Pursuant to 36 CFR Part 800.3(f)(2), TVA is consulting with federally recognized Indian tribes regarding properties within the proposed project's APE that may be of religious and cultural significance and eligible for the NRHP.

Ms. Stacye Hathorn
Page 2
September 24, 2010

If you have any questions or comments, please call me or Richard Yarnell at telephone (865) 632-3463 or by e-mail at wryarnell@tva.gov.

Sincerely,

A. Eric Howard
Federal Preservation Officer
Manager (Acting), Cultural Compliance
WT 11D-K

MH:RY:IKS
Enclosures
cc: Cynthia M. Anderson, LP 5D-C
Brenda E. Brickhouse, LP 5U-C
Ruth M. Horton, WT 11D-K
Susan J. Kelly, LP 5U-C
Khurshid K. Mehta, WT 6A-K
EDMS, WT 11D-K

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

September 24, 2010

To those listed:

BROWNS FERRY NUCLEAR (BFN) POWER PLANT COOLING TOWER ADDITIONS, LIMESTONE COUNTY, ALABAMA

The Tennessee Valley Authority (TVA) proposes to replace four of six existing cooling towers (Towers 1, 2, 5, and 6) with larger units and construct one additional 25–30 cell linear mechanical draft cooling tower site at BFN (Figures 1 and 2). The four existing cooling towers would be demolished and rebuilt within the existing footprint.

The new cooling tower (Tower 7) would be located along the east side of Shaw Road at the location of an existing perimeter ditch and includes the installation of a new pumping station, a cold water discharge canal, lift pumps and piping; and two new transformers (Figure 2). A portion of the ditch would be relocated directly northeast of proposed Tower 7 to maintain a perimeter ditch north of the new cooling tower. In addition, the cold water discharge canal is proposed between the north end of the spoil pile and the existing western perimeter ditch, and an approximate five-acre construction staging area is necessary.

TVA considers the archaeological area of potential effect (APE) to be the footprint where ground disturbance would take place. The majority of the BFN reservation has been previously disturbed by construction of the power plant and associated infrastructure. The majority of the land not disturbed by construction of BFN was surveyed in 2001 as part of the BFN relicensing and expansion Environmental Impact Statement. The survey identified one historic property, Site 1LI535, an Early to Middle Woodland period occupation that is considered potentially eligible for the National Register of Historic Places (NRHP) and is outside of the APE. The APE for the proposed undertaking has been extensively disturbed with the construction of BFN. It is TVA's findings that no cultural resources would be affected by the proposed undertaking.

TVA is consulting with the following federally recognized Indian tribes regarding properties within the proposed project's APE that may be of religious and cultural significance to them and eligible for the NRHP: Cherokee Nation, Eastern Band of Cherokee Indians, United Keetoowah Band of Cherokee Indians in Oklahoma, The Chickasaw Nation, Muscogee (Creek) Nation of Oklahoma, Alabama-Coushatta Tribe of Texas, Alabama-Quassarte Tribal Town, Kialegee Tribal Town, Poarch Band of Creek Indians, Thlopthlocco Tribal Town, Seminole Nation of Oklahoma, Seminole Tribe of Florida, Absentee Shawnee Tribe of Oklahoma, Eastern Shawnee Tribe of Oklahoma, and the Shawnee Tribe.

By this letter, TVA is providing notification of these findings and is seeking your comments regarding this undertaking and any properties that may be of religious and cultural significance and may be eligible for the NRHP pursuant to 36CFR § 800.2 (c)(2)(ii), 800.3 (f)(2), and 800.4 (a)(4)(b).

Those listed
Page 2
September 24, 2010

If you have any questions, please contact me by telephone at (865) 632-6461 or by e-mail at pbezzell@tva.gov. Please respond within 30 days of receipt of this letter, if you have any comments on the proposed undertaking.

Sincerely,

Pat Bernard Ezzell

Pat Bernard Ezzell
Tribal Liaison and Corporate Historian
Federal Determinations
WT 11D-K

MH:RY:PBE:IKS
Enclosures
cc: Cynthia M. Anderson, LP 5D-C
Brenda E. Brickhouse, LP 5U-C
Ruth M. Horton, WT 11D-K
Susan J. Kelly, LP 5U-C
Khurshid K. Mehta, WT 6A-K
EDMS, WT 11D-K

THOSE LISTED:

Dr. Richard Allen
Policy Analyst
Cherokee Nation
Post Office Box 948
Tahlequah, Oklahoma 74465

Governor Bill Anoatubby
The Chickasaw Nation
Post Office Box 1548
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Ms. Augustine Asbury
Cultural Preservation Coordinator
Alabama Quassarte Tribal Town
Post Office Box 187
Wetumka, Oklahoma 74883

Mr. Bryant Celestine
Tribal Historic Preservation Officer
Alabama-Coushatta Tribe of Texas
571 State Park Rd. 56
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Mr. Charles Coleman
NAGPRA Representative
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Route 1, Box 190-A
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Ms. Natalie Deere
Tribal Historic Preservation Officer
Seminole Nation of Oklahoma
Post Office Box 1498
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Ms. Robin DuShane
Cultural Preservation Director
Eastern Shawnee Tribe of Oklahoma
127 West Oneida
Seneca, Missouri 64865

Mr. Henry Harjo
Environmental Director
Kialegee Tribal Town
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Mr. Tyler Howe
Historic Preservation Specialist
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Post Office Box 455
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cc: Mr. Russ Townsend
Tribal Historic Preservation Officer
Eastern Band of the Cherokee Indians
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Cherokee, North Carolina 28719

Mr. Ted Isham
Manager
Cultural Preservation
Muscogee (Creek) Nation
Post Office Box 580
Okmulgee, Oklahoma 74447

Ms. Karen Kaniatobe
Tribal Historic Preservation Officer
Absentee Shawnee Tribe of Oklahoma
2025 S. Gordon Cooper
Shawnee, Oklahoma 74801

Ms. Lisa C. LaRue
Director, Language, History and Culture &
Acting Tribal Historic Preservation Officer
United Keetoowah Band
of Cherokee Indians in Oklahoma
Post Office Box 746
Tahlequah, Oklahoma 74464

Mr. Kirk Perry
Administrator
Division of Policy and Standards
The Chickasaw Nation
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Ada, Oklahoma 72821-1548

Ms. Jennifer Pietarila
Archaeological Data Analyst
Seminole Tribe of Florida
Ah-Tah-Thi-Ki Museum
HC-61 Box 21-A
Clewiston, Florida 33440

cc: Ms. Anne Mullins
Project Coordinator
Seminole Tribe of Florida
Ah-Tah-Thi-Ki Museum
HC-61, Box 21-A
Clewiston, Florida 33440

cc: Mr. Willard Steele
Tribal Historic Preservation Officer
Seminole Tribe of Florida
Ah-Tah-Thi-Ki Museum
HC-61, Box 21-A
Clewiston, Florida 33440

the Chickasaw Nation

Bill Anoatubby, Governor
Jefferson Keel, Lt. Governor

Headquarters

October 4, 2010

Ms. Patricia B. Ezzell
Tribal Liaison and Corporate Historian
Federal Determinations
WT 11D-K
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902-1499

Dear Ms. Ezzell:

Thank you for your letter of notification regarding your proposal to replace four of six existing cooling towers with larger units and construct one additional 25-30 cell linear mechanical draft cooling tower site at Browns Ferry Nuclear Power Plant in Limestone County, Alabama. We accept your finding that no cultural resources will be affected by this proposed undertaking.

This area is located within the aboriginal lands of the Chickasaw Nation and is an important area to us. We are unaware of any specific historic properties or traditional cultural, religious and/or sacred sites at this time. However, in the event of inadvertent discoveries, we expect all construction activities to cease and we be notified according to all applicable state and federal laws.

If you have any questions, please contact Ms. Gingy Nail, historic preservation officer at (580) 559-0817, gingy.nail@chickasaw.net or Ms. Julie Ray, historic preservation and repatriation manager at (580) 559-0825, julie.ray@chickasaw.net.

Sincerely,

Jefferson Keel

Jefferson Keel, Lt. Governor
The Chickasaw Nation

jar

Arlington at Mississippi · Post Office Box 1548 · Ada, OK 74821-1548 · 580-436-2603 · www.chickasaw.net

UNITED WE THRIVE

SEMINOLE TRIBE OF FLORIDA
TRIBAL HISTORIC PRESERVATION OFFICE

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AH-TAH-THI-KI MUSEUM

34725 WEST BOUNDARY ROAD
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PHONE: (863) 983-6549
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TRIBAL OFFICERS

CHAIRMAN
MITCHELL CYPRESS

VICE CHAIRMAN
RICHARD BOWERS JR.

SECRETARY
PRISCILLA D. SAYEN

TREASURER
MICHAEL D. TIGER

Pat Bernard Ezzell
Tennessee Valley Authority
400 W. Summit Hill Drive
Knoxville, TN 37902

THPO#: 006967

October 20, 2010

Subject: Browns Ferry Nuclear Power Plant Cooling Tower Additions, Limestone County, Alabama

Dear Ms. Ezzell,

The Seminole Tribe of Florida's Tribal Historic Preservation Office (STOF-THPO) has received the Tennessee Valley Authority's correspondence concerning the aforementioned project. The STOF-THPO has no objection to your findings at this time. However, the STOF-THPO would like to be informed if cultural resources that are potentially ancestral or historically relevant to the Seminole Tribe of Florida are inadvertently discovered during the construction process. We thank you for the opportunity to review the information that has been sent to date regarding this project. Please reference ***THPO-006967*** for any related issues.

We look forward to working with you in the future.

Sincerely,

Willard Steele
Tribal Historic Preservation Oficer
Seminole Tribe of Florida

Direct routine inquiries to:

Anne Mullins
Compliance Review Supervisor
annemullins@semtribe.com

JLP:am

STATE OF ALABAMA
ALABAMA HISTORICAL COMMISSION
468 SOUTH PERRY STREET
MONTGOMERY, ALABAMA 36130-0900

FRANK W. WHITE
EXECUTIVE DIRECTOR

TEL: 334-242-3184
FAX: 334-240-3477

October 25, 2010

Eric Howard
TVA
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

Re: AHC 10-1306
Cooling Tower Additions
Browns Ferry Nuclear Plant
Cooling Tower Additions
Limestone County, Alabama

Dear ~~Mr. Howard:~~ Eric:

Upon review of the information forwarded by your office, we have determined the proposed action should have no effect on significant cultural resources provided archaeological site 1Li535 is avoid, as stated in your letter.

We appreciate your efforts on this project. Should you have any questions, please contact Greg Rhinehart at (334) 230-2662. Please have the AHC tracking number referenced above available and include it with any correspondence.

Truly yours,

Elizabeth Ann Brown
Deputy State Historic Preservation Officer

EAB/LAW/GCR/gcr

7.1.2 Transmission Facilities

TVA owns, operates, and maintains the electrical transmission grid to which BFN is connected. The proposed uprate would contribute more power to the TVA transmission grid. An Interconnection SIS was performed to evaluate the impact of the additional power from BFN on the TVA transmission system. The Interconnection SIS identified transmission system and BFN main generator excitation system upgrades needed to support the planned BFN unit uprates.

The Interconnection SIS identified six 500 kV breakers in the BFN switchyard which have inadequate critical clearing time for a stuck 500 kV breaker coincident with a single line to ground fault event. The breaker failure relays in these six 500 kV breakers require upgrading. Because the 500 kV breakers are located in the BFN Control Building, replacement of the relays will not require additional land disturbance. The environmental review of the breaker failure relay upgrades is described in the response to NRC RERP-RAI-GE-2.

The Interconnection SIS also identified an issue with the BFN main generators when one of four specific 500 kV transmission lines is out of service coincident with a three-phase fault. To mitigate this issue the excitation system of each of the BFN main generators will need to be upgraded. Because the BFN main generator exciters are located in an existing BFN structure, the upgrade will not require additional land disturbance. The environmental review of the BFN main generator excitation system upgrade is described in the response to NRC RERP-RAI-GE- 2.

The Interconnection SIS determined that the BFN reactive power capability after uprate would require an additional 764 MVAR to satisfy TVA's interconnection requirements. This reactive power will be added by the installation of 764 MVAR capacitor banks in five locations throughout the TVA transmission system. The capacitor bank installations occur on sites distant from BFN. Two of the capacitor bank installation sites will remain within existing substation boundaries. The three remaining sites will require expansion of the existing substation footprint and additional grading and clearing. The environmental review of the capacitor bank installations is described in the response to NRC RERP-RAI-GE-2.

7.1.3 Electric Shock and Electromagnetic Field

Design criteria that limit hazards from steady-state currents are based on the National Electrical Safety Code (NESC), which requires that transmission lines are designed to limit the short-circuit current to ground produced from the largest anticipated vehicle to less than 5 milliamperes. TVA has designed transmission lines to exceed the requirements given in the NESC at the time the lines were constructed. As a general rule, TVA's transmission lines are upgraded consistent with current codes when work such as re-conductoring or re-sagging is performed on the lines, or the land use has changed under or around the line to cause a clearance problem.

TVA performs transmission line inspections to identify defects that could cause an interruption or an unsafe condition for employees or the public. Inspections are also used to plan maintenance activities and to protect TVA's easement rights. Typically, aerial patrol (i.e., usually helicopter fly-by) inspections are conducted every 6 months, and foot patrol (i.e., walking inspection of the entire transmission line and a visual inspection of the conductors, structures, and right-of-way) inspections are conducted every 4 years. If the land use under or adjacent to the line has changed causing a clearance problem, steps are taken to correct it such as removing the encroachment or adjusting line height.

A study documented in the 2003 BFN LRA ER concluded that the vertical clearances of all transmission lines built to connect BFN to TVA's transmission system met or exceeded the vertical clearance requirements of the 2002 Edition of the NESC. In January 2015, TVA analyzed the modifications that have occurred to each BFN transmission line since the 2003 license renewal study, and concluded that no modifications have been made since the 2003 study that would result in noncompliance with the vertical clearance and electric field requirements of the current NESC (2012 edition). It was concluded in 2003, and it remains a valid conclusion in 2015, that all BFN transmission lines have sufficient clearance to limit the steady-state current due to electrostatic effects to 5 milliamperes, should the largest anticipated truck, vehicle, or equipment under the line be short-circuited to ground.

TVA Transmission and Power Supply is cognizant of current findings of research into the health effects of electromagnetic fields (EMF) via literature and publications. EPU at BFN will increase line currents accordingly, which will result in higher magnetic fields. However, in 1999 the National Institute of Environmental Health Science concluded that the scientific evidence suggesting that EMF exposure poses any health risk is weak. The United States does not have national guidelines for exposure to power frequency EMF.

7.1.4 Non-Radiological Waste Streams

BFN generates four categories of non-radiological solid waste. These categories are:

1. General plant solid waste consisting of paper, cardboard, wood, metals, and garbage,
2. Recycled solid waste such as office paper, cardboard, wood pallets, scrap metal, aluminum cans, plastic bottles, and batteries,
3. Construction and demolition debris associated with site activities,
4. Universal Waste and Hazardous Waste as defined under the Resource Conservation and Recovery Act (RCRA).

7.1.4.1 Solid Waste

BFN generates municipal solid waste commonly known as "trash" or "garbage" which consists of food waste, plastic film, paper waste, and food product packaging waste. General plant trash is collected as part of routine plant operation activities and is managed through TVA Long-term Valley Wide Contract 4394 with Republic Service. Waste material is collected in dumpsters and transported to a state-licensed regional landfill permitted to accept waste materials. BFN uses Morris Farms Landfill in Lawrence County, Alabama, which is owned and operated by BFI Waste Systems of America. Generation rates for BFN are approximately 1.6 tons per day.

7.1.4.2 Recycled Solid Waste

BFN has an active recycling program that segregates and recycles scrap metal, cardboard, office paper, wood pallets, aluminum cans, plastic bottles, and batteries. The segregated materials are accepted for recycling by TVA-approved waste treatment and disposal facilities through contract with C&D Recycling.

7.1.4.3 Construction/Demolition Solid Waste

BFN has a permitted construction/demolition (C and D) landfill that is operated under ADEM Permit No. 42-02 and is designed to accept C and D waste such as unwanted material produced directly or incidentally by C and D at BFN. This includes material such as non-asbestos insulation, nails, wood, electrical wiring, rebar, bricks, concrete, excavated dirt, tree stumps, and rubble. The BFN C and D landfill is approximately 7.7 acres in size. The BFN Solid Waste Disposal Facility Permit allows a maximum average daily volume of 5 tons per day of C and D waste disposal. BFN can either use its own on-site C and D landfill or contract with local solid waste haulers to dispose of C and D solid waste in permitted local landfills. BFN currently has in place the necessary contracts for proper disposal of C and D wastes. The BFN C and D landfill permit from ADEM expires in September 2015. TVA requested renewal of the BFN five-year C and D landfill permit in March 2015.

7.1.4.4 Hazardous Waste

BFN generates a variety of wastes that are classified as hazardous under RCRA. The majority of the hazardous wastes generated at BFN are from spent solvents used in cleaning and degreasing activities and paint-related wastes from coating activities. In addition to these two major waste streams, BFN generates universal waste such as spent batteries, fluorescent light bulbs, and used oil for recycling.

TVA Nuclear Power Group (NPG) has design change procedures in place to evaluate modifications for potential changes in, or additions to, hazardous waste generation. Some of the plant modifications required to implement the EPU could result in the generation of small amounts of hazardous waste. Neither the types nor amounts of waste generated are expected to be different from those routinely handled at BFN. No new waste streams have been identified due to the uprate activities. The volumes of waste inclusive of the waste attributable to EPU are anticipated to be within the ranges defined by Title 40 of the Code of Federal Regulations for a Small Quantity Hazardous Waste Generator and would not impact site hazardous waste reduction goals. RCRA regulations define a Large Quantity Generator as generating more than 2,200 pounds (i.e., 1,000 kilograms) per month of hazardous waste. Hazardous wastes generated at BFN are managed through the TVA Direct Shipment Program with Waste Management's permitted landfill at Emelle, Alabama. Hazardous waste generation rates for BFN for the past 5 years are presented in Table 7.1-1.

Table 7.1-1: Annual Hazardous Waste Generation

Year	Hazardous Waste Generated at BFN (Pounds)	RCRA Generator Status
2010	1,917	Small Quantity Generator
2011	3,179	Small Quantity Generator
2012	3,601	Small Quantity Generator
2013	4,343	Small Quantity Generator
2014	2,335	Small Quantity Generator

BFN has not generated more than 2,200 pounds in any 1 month in the last 5 years; therefore, BFN is not a Large Quantity Generator.

7.1.4.5 Groundwater

TVA's NPG participates in an active program of groundwater monitoring consistent with the Nuclear Energy Institute's (NEI) guidance given in NEI 07-07, Industry Groundwater Protection Initiative—Final Guidance Document. TVA's NPG meets the requirements of the initiative through implementation of the Groundwater Protection Program (GWPP). The implementation of the GWPP demonstrates a commitment to the control of licensed material through prevention, early detection, and mitigation/remediation of impacts associated with groundwater contamination. TVA's GWPP also includes provisions to monitor, inspect, and improve underground piping and tank integrity to prevent future unintended releases of radiological materials to groundwater. TVA's NPG communicates events involving radiological contaminated spills and leaks to the NRC in accordance with 10 CFR 50.72 (b)(2)(xi) and to other outside agencies as required by the GWPP. The BFN EPU will not impact implementation of this voluntary initiative. No changes to the GWPP are required as a result of EPU implementation.

7.1.5 Noise

The only noise source of any significance from BFN which can periodically be heard off site is from the cooling towers, which operate most frequently during the summer months. After EPU is implemented, the increased discharge temperatures would require some additional cooling tower operation, which would slightly lengthen the duration of noise for residents nearest the cooling towers. There are no federal, State of Alabama, or local municipal noise standards, regulations or ordinances that apply to the action alternatives evaluated in this supplemental ER.

Areas that are potentially affected by environmental noise from typical industrial operations are usually within a 1-mile radius of the noise source(s). However, under special conditions that are favorable to outdoor sound propagation, affected areas can be as much as 2 miles distant. The results of past noise surveys and projections of noise levels indicate that the increase in noise level at the nearest residence to BFN, during cooling tower operation, is minor, and not noticeably altered. Current BFN Communications personnel are not aware of any complaints from area residents regarding noise from BFN operations; their tenure is at least 4 years. Also, a search of news clips by BFN Media Relations personnel for the past 5 years did not find anything about noise complaints. Cooling tower operations at BFN began in 1976 and are not new to the surrounding residents. Figure 7.1-2 shows the residential subdivisions within a 2-mile radius of BFN.

There are waterfront homes upstream and adjacent to BFN property (Pointe Westmoreland and Lookingbill subdivisions), but these residences are more than a mile from the closest cooling towers (CT 1 and CT 6) and there is a small hill and the main plant in between them and the cooling towers. Because of the physical configuration and the lack of favorable conditions for sound propagation in this direction, this residential area is not considered sensitive to environmental noise.

The Lakeview Community is across the river and approximately 8,500 feet from the center of the cooling tower area. It is primarily year-round homes with a few recreational residences. Even though Lakeview is well over a mile from BFN, it could be sensitive to environmental noise because the open pathway across water is favorable to sound propagation. However, BFN cooling tower noise has not been audible in the past at the Lakeview Community.

The older waterfront community of Paradise Shores is situated downstream of BFN and adjacent to the cooling tower area. Paradise Shores is currently a mix of year-round and recreational homes, forming a medium-to high-density suburban area that could be sensitive to environmental noise. There are about 100 residences within 1 mile of the closest cooling towers, and some are as close as 1,500 feet.

Because no physical changes for EPU are being made external to existing buildings, no construction noise is expected which could be heard off site.

The U.S. Environmental Protection Agency's (EPA's) protective noise guideline (EPA 1974) recommends an average annual equivalent day/night sound level (L_{dn}) of 55 decibels A-weighted scale (dBA) to protect the health and well-being of the public with an adequate margin of safety. TVA uses the EPA guideline of 55 dBA L_{dn} as a design goal, when feasible, if the nearest receptor is residential. For industrial and commercial areas, TVA uses the equivalent sound level (L_{eq}) of 60 dBA at the property line. In addition, TVA uses the Federal Interagency Committee on Noise (FICON) recommendation that a 3-decibel increase in L_{dn} indicates possible impact and the need for further analysis when the background is 60 dBA or less (FICON 1992). There are no federal, State of Alabama, or local municipal noise standards, regulations, or ordinances that apply to the action alternatives evaluated in this supplemental ER.

An environmental sound pressure level assessment was performed at BFN on August 8, 2012, while six of the seven cooling towers were in operation. From this 24-hour ambient noise sample, the L_{dn} was calculated at 61.9 dBA. A second 24-hour ambient noise sample was collected on September 6, 2012, while none of the cooling towers were operating; the calculated L_{dn} for this sample was 59.7 dBA. Both noise sample sets were collected at the location of the nearest residence to BFN, which is in the Paradise Shores community, located approximately 1,500 feet from the BFN property boundary. The measured 2012 background or ambient baseline noise levels without operation of the cooling towers exceeded the 55 dBA guideline for residential areas, but the FICON guideline of an allowable 3-decibel increase in L_{dn} at residences and exterior plant boundaries was met during cooling towers operation.

Since the August/September 2012 sound level measurements, CTs 3, 5, and 6 have been replaced. CT 4 had been replaced earlier in 2007, and CT 7 was constructed in 2011. Currently, work on all but two BFN cooling towers (CTs 1 and 2) of the seven BFN cooling towers is complete, and replacement of CTs 1 and 2 is scheduled for completion in FY 2018 and FY 2019. Additional sound monitoring is planned to be conducted following replacement of CTs 1 and 2. Sound level measurements will also be taken at the subdivisions within a 2-mile radius of BFN.

TVA will continue to meet FICON guidelines by working with the selected cooling tower vendor to ensure noise attenuating features are incorporated as required, such as low-noise fans, lower speed fans, and sound attenuators. Operational noise levels will be verified by a qualified acoustical engineer to ensure that noise levels comply with applicable guidelines and are consistent with previous commitments. In the event that the resulting noise levels are found to exceed the FICON guidelines, TVA would develop and implement additional acoustical mitigation such as modifications to fans and motors, or the installation of barriers. On site, TVA will continue to comply with Occupational Safety and Health Administration regulations to protect worker health.

The area around the cooling towers has been an industrialized area for more than 40 years, and wildlife species commonly observed in the area include those species that are less sensitive to human disturbance and common in the region. The noise produced during cooling tower operation is a combination of low-frequency steady humming produced by the cooling tower fans and sounds associated with the water cascading through the cooling tower fill. Under normal operation, there are no high-pitched sounds or intermittent loud noises that would serve to disrupt local wildlife. Onsite observations indicate that the wildlife in the area has adapted to the industrial noise of the site, and there is no indication that operation of the cooling towers disturbs the wildlife in the area. There are no state-protected or federally listed terrestrial animal species within 3 miles of the BFN site, which is well beyond the audible range of noises associated with cooling tower operation.

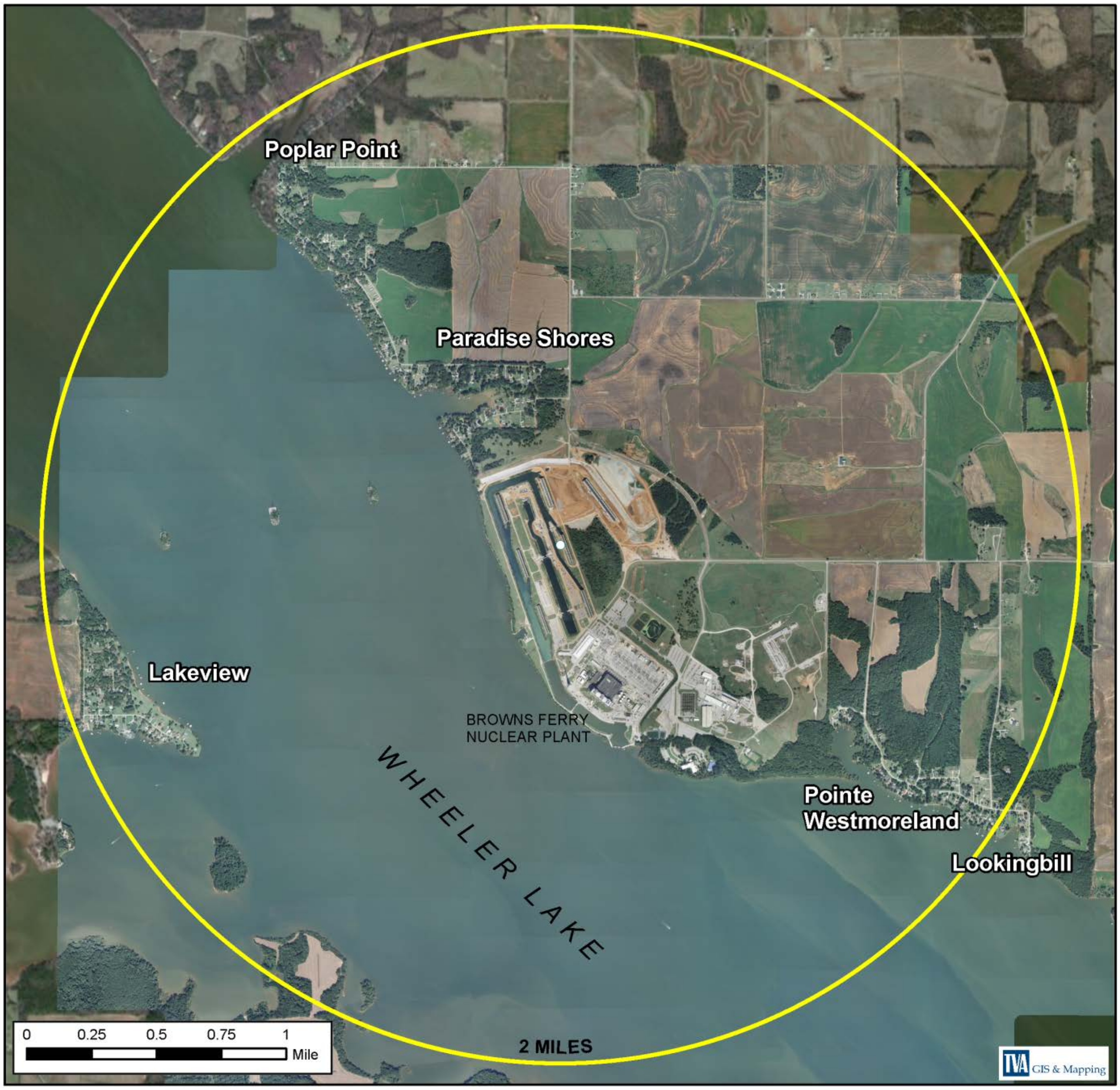

Figure 7.1-2: Residential Subdivisions Within 2-Mile Radius of BFN

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7.1.6 Terrestrial Biota

7.1.6.1 Terrestrial Biota—Animals

The BFN site is a heavily disturbed area and provides limited wildlife habitat. Due to the lack of features that provide high-quality wildlife habitats, such as streams, springs, caves, rock bluffs, and moist forested habitats, the overall diversity of wildlife at BFN is not uncommon from a local, state, or regional perspective. Terrestrial wildlife species found among upland habitats on the BFN site are generally common and have widespread distributions. No uncommon wildlife communities, important terrestrial habitats such as caves, or wading bird colonies occur within 6 miles of BFN. Proposed actions would not impact unique or important terrestrial habitats or populations of migratory birds.

The TVA Natural Heritage database indicated on September 23, 2014, the presence of one federally listed species and no state-listed species within 6 miles of the BFN EPU project footprint. One federally listed species with partial status (hellbender) and one federally listed endangered species (gray bat) have been recorded within Limestone County, Alabama. The federally listed endangered Indiana bat and federally listed threatened northern long-eared bat also have the potential to exist across the known range for these species (Pruitt and TeWinkel 2007; USFWS 2014a; USFWS 2015). Although these bat species have not yet been reported from Limestone County, Alabama, they are thought to have the potential to occur across the northern portion of Alabama (Pruitt and TeWinkel 2007; USFWS 2014a; USFWS 2015). Table 7.1-2 provides a summary of federally listed and state-listed as protected terrestrial animals reported, or with the potential to occur, in Limestone County, Alabama. Thus, impacts to these species will also be evaluated.

Hellbenders are generally found in clear, rocky creeks and rivers where water temperatures are typically less than 20°C. They are associated with large shelter rocks and submerged logs (Hammerson 2005). This species has been reported approximately 15.4 miles away from the project footprint and is known to occur in the Tennessee River. Proposed actions would not increase temperature or flow rates of discharged water beyond permitted NPDES limits. Suitable habitat for this species is also plentiful along the Tennessee River and its tributaries. Hellbenders would not be impacted by the proposed EPU.

Bald eagles are protected under the Bald and Golden Eagle Protection Act (USFWS 2013). This species is associated with larger mature trees capable of supporting its massive nests. These are usually found near larger waterways where the eagles forage on fish (USFWS 2007). The TVA Natural Heritage database indicated that the nearest bald eagle nest is approximately 5.4 miles away from BFN. Proposed modifications actions would occur in or on existing BFN structures and no tree removal would occur in association with this project. Proposed actions are not expected to adversely impact the fish community of Wheeler Reservoir either (see Sections 7.2.4 and 7.2.6). Nesting and foraging habitat for the bald eagle would not be impacted by the proposed actions, thus bald eagles would not be impacted by the proposed actions.

Table 7.1-2: Federally Listed and State-Listed as Protected Terrestrial Animals Reported From or With Potential to Occur in Limestone County, Alabama

Common Name	Scientific Name	Status	
		Federal	State (Rank)
Amphibians			
Hellbender	*Cryptobranchus alleganiensis*	PS	PROT(S2)
Birds			
Bald eagle	*Haliaeetus leucocephalus*	DM	NMGT(S3)
Mammals			
Gray bat	*Myotis grisescens*	LE	END(S2)
Northern long-eared bat	*Myotis septentrionalis*	LT	NMGT(S4)
Indiana bat	*Myotis sodalis*	LE	END(S1)

Source: TVA Natural Heritage database.

Federal Status Abbreviations: DM = Delisted; Recovered but Monitored; LE = Listed Endangered; LT = Listed Threatened; PS = Partial Status.

State Status Abbreviations: END = Endangered; NMGT = In need of management; PE = Proposed Endangered; PROT = Protected;

State Rank Information:

S1 = Critically Imperiled
S2 = Imperiled
S3 = Vulnerable
S4 = Apparently Secure

Gray bats roost in caves year-round and migrate between summer and winter roosts during spring and fall (Brady et al. 1982; Tuttle 1976). Bats disperse over bodies of water at dusk where they forage for insects emerging from the surface of the water (Harvey 1992). The TVA Natural Heritage database on September 23, 2014, indicated two gray bat caves have been recorded, approximately 9.5 and 13.7 miles away from the project footprint. There are no caves that occur on or immediately adjacent to BFN property. Gray bats foraging habitat exists over Wheeler Reservoir; however, proposed actions would not impact foraging bats. Gray bats would not be impacted by the proposed project.

Indiana bats inhabit caves during winter and migrate to roost under exfoliating bark and within cavities of trees (typically greater than or equal to 5 inches in diameter) during summer (USFWS 2014b; Pruitt and TeWinkel 2007; Kurta et al. 2002). Foraging occurs along riparian zones, above the tops of forests, and along forested edges and tree lines (Pruitt and TeWinkel 2007). Some habitat requirements overlap between the Indiana and northern long-eared bat, which roosts in caves or cave-like structures in winter, and utilizes cave-like structures as well as live in dead trees with exfoliating bark and crevices in the summer (USFWS 2014a). There are no known records of the northern long-eared bat within Limestone County, Alabama or within 10 miles of the project footprint. The nearest known Indiana bat record is from a hibernaculum approximately 9.5 miles from BFN in Lauderdale County, Alabama. Both species are thought to occur throughout northern Alabama, thus both have the potential to occur in the area (Pruitt and TeWinkel 2007; USFWS 2014a; USFWS 2015). However, no suitable habitat for either bat species would be impacted by the proposed actions. There is no tree clearing occurring in association with this project nor are any caves known on or within 6 miles of BFN property. Proposed actions would not impact bats foraging over Wheeler Reservoir. Proposed actions would not impact the Indiana bat. The northern long-eared bat has recently been federally listed as threatened, and interim measures for their conservation were issued by the USFWS (USFWS 2015). In the interim, federal action agencies are required to make determinations with respect to whether proposed actions would result in jeopardy to the species based on guidance provided by the USFWS on January 6th, 2014 (USFWS 2014a; USFWS 2015). Based on the nature and scope of the project, the proposed actions are not likely to jeopardize the continued existence of the northern long-eared bat.

7.1.6.2 Terrestrial Biota—Plants

Threatened and Endangered Species and Terrestrial Ecology (Plants)

The TVA Natural Heritage Database indicated that no federally listed or state-listed plant species have been previously reported from within a 6-mile radius of the project area. No federally listed plant species or designated critical habitat for plant species occur in Limestone County, Alabama.

The proposed EPU of BFN Units 1, 2, and 3 would not affect federally listed or state-protected plant species, because all work would occur in areas that have been heavily impacted by previous construction, operation, and maintenance of the facility. These areas are incapable of supporting rare species or habitats and do support a large component of nonnative, invasive species indicative of disturbed sites.

7.1.7 Air Impacts

The remaining BFN EPU construction and equipment installation would occur during the refueling outages between now and EPU implementation. During those outages, additional air emissions will be from the increased workforce driving to and from the site. As described in Section 5.1, the increased staffing for an outage is 800 to 1,200 supplemental workers. Staffing ramps up 2 to 3 weeks prior to the outage start. Staffing begins to ramp down 21 to 28 days from the start of the outage. TVA's current business plan outage duration is 35 days or less. For the EPU outages, TVA estimates that 10 percent or less of the supplemental work force will be dedicated to the EPU portion of the outage. The short-term impacts on air emissions would be commensurate with the increased supplemental staffing. The major equipment and materials to support the EPU outages will mostly be supplied and stored on site well before the start of the outage period. Most of the smaller EPU supplies will be delivered on trucks that routinely supply similar tools and materials to support plant operations. Therefore, temporary increases in air emissions prior to and during EPU outages are expected to be minor.

The emergency diesel generators are operated under a Synthetic Minor Source Air Operating Permit. The BFN EPU will not increase the frequency or duration of the emergency diesel generator surveillance test and the future operation of the diesel generators will be in accordance with the requirements of the air permit. Therefore, no increase in emissions from this source is anticipated.

7.1.8 References

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7.2 Hydrology and Aquatic Ecology Effects

7.2.1 Wheeler Reservoir

BFN is located on the north shore of Wheeler Reservoir at TRM 294. Wheeler Reservoir extends from TRM 274.9 to TRM 349. For orientation, TRM 0.0 is downstream where the Tennessee River joins the Ohio River in Paducah, Kentucky. Wheeler Dam is downstream of BFN at TRM 274.9, and Guntersville Dam lies upstream at TRM 349.0.

Wheeler Reservoir was created in 1936 and has an area of 67,070 acres and a volume of 1,050,000 acre-feet at the normal summer pool elevation of 556 feet mean sea level. Most of Wheeler Reservoir is classified by ADEM for use as public water supply, swimming and other whole-body water-contact sports, and fish and wildlife. Although the area of the reservoir immediately upstream and downstream of BFN is not currently classified for public water supply, it potentially could be if a municipal water intake was sited there in the future. Water quality is generally good in Wheeler Reservoir, but nutrient loads are a concern. The reservoir is on the 2014 Alabama 303(d) list as partially supporting its designated uses due to excess nutrients attributed to agricultural sources (ADEM 2014).

Fish consumption advisories have also been issued for certain areas of the reservoir. The State of Alabama recommends (1) limiting consumption of largemouth bass from TRM 296.0 to TRM 303.0 and all species of fish from Baker’s Creek embayment because of perfluorooctane sulfonate (PFOS) contamination, and (2) limiting consumption of largemouth bass from Limestone Creek and Round Island Creek embayments because of elevated concentrations of mercury. PFOS is a manmade compound used in a variety of industrial and commercial products. PFOS is no longer manufactured in the United States and its use is being phased out. (EPA 2014a) Mercury occurs naturally in rock and soils but can also originate from other sources, including atmospheric emissions from human activities (fossil fuel combustion, waste incinerations, steel mills) or from natural processes (forest fires, volcanoes) (USGS 2014).

Water temperature patterns in Wheeler Reservoir are constantly changing in response to varying meteorological and flow conditions. Natural water temperatures in the reservoir vary from around 35 degrees Fahrenheit (^{o}F) in January to around 88 to 90^{o}F in July and August. Temperature patterns upstream of BFN are typically well mixed or develop only weak thermal stratification.

There are nine potable water intakes on Wheeler Reservoir withdrawing a total of approximately 216 million gallons per day (MGD) for municipal and industrial use. Wastewater discharges include 13 municipal plants discharging approximately 54 MGD. Eight (non-TVA) industrial entities discharge approximately 146 MGD. The largest withdrawal and discharge by far is cooling water from BFN. In 2010, BFN withdrew approximately 2,750 MGD and returned approximately 2,741 MGD. Consumptive and off-stream water uses do not conflict significantly due to the large volume of reservoir water available, the river flow rate that has 24-hour average minimum flows ranging from 7,000 cubic feet per second (cfs) to 10,000 cfs, and the return of almost all of the water withdrawn.

7.2.2 Impact on Withdrawal

BFN uses a once-through condenser circulating water (CCW) system to dissipate waste heat from the plant steam turbines. The water is withdrawn from the Tennessee River by an intake structure located at about TRM 294.3. For open mode operation, the CCW system is designed to provide a flow of 630,000 gpm for Unit 1 and 675,000 gpm for Unit 2 and Unit 3. For all three units, this suggests a total CCW design flow of 1,980,000 gpm or 4,412 cfs. Due to system upgrades, such as refitting the condensers with larger diameter and lower resistance tubes, the total per-unit condenser circulating water system flow, in general, is now higher than the design values. In addition to flow through the CCW pumps, the plant total intake also includes withdrawals for the emergency equipment cooling water system, the residual heat removal service water system, the fire protection system, and the intake screen wash system. Velocity measurements collected in front of the plant intake in November 2014 suggest a total intake flow on the day of the measurements of about 2,118,300 gpm or 4,720 cfs. No changes are expected for the plant intake systems as a result of the power uprate. That is, the uprate project will not impact the current volume of water withdrawn from Wheeler Reservoir by the plant.

7.2.3 Impact on Discharge

Most of the water withdrawn at the plant intake is returned to the river. Water losses by evaporation and drift (water droplets entrained in airstream passing through tower) will occur for the CCW system when cooling towers are in service. For the other systems, the only loss of water would be comparatively negligible, unquantifiable amounts due to evaporation whenever the water is exposed to air.

The water returned to the river from the plant is accomplished using submerged diffusers situated on the bottom of the river at about TRM 294.0. The diffusers are designed to mix the plant thermal effluent with the water in the river by discharging the effluent through thousands of small outlet ports in the diffuser pipes. In terms of hydrothermal impacts on the Tennessee River, operation of the circulating water system is regulated by the State of Alabama under NPDES Permit No. AL0022080 (ADEM 2012). The permit specifies that the river ambient temperature shall be measured by an upstream monitor located at about TRM 297.8, and that impacts relative to the ambient temperature shall be measured by three downstream monitors located at about TRM 293.5. The upstream monitor is about 3.8 miles upstream of the diffusers, whereas the downstream monitors are located near the end of a mixing zone, which extends 2,400 feet (0.45 miles) downstream of the diffusers. The NPDES permit specifies that at the downstream end of the mixing zone, the operation of the plant shall not cause:

- The measured 1-hour average temperature to exceed 93°F.
- The measured daily average temperature to exceed 90°F.
- The measured daily average temperature rise (relative to ambient) to exceed 10 F°.

Furthermore, if the natural heating of Tennessee River causes the daily average upstream ambient river temperature to exceed 90°F, the daily average downstream temperature may equal, but not exceed, the upstream value. However, in connection with such an event, if the daily average upstream ambient river temperature begins to cool at a rate of 0.5 F° per day or more, the downstream temperature is allowed to exceed the upstream value for that day. In the NPDES permit, the latter occurrence is identified as a cooling anomaly condition.

When plant operating conditions create a river temperature threatening one of the NPDES limits given above, the plant is shifted from open mode operation to helper mode operation, wherein the condenser circulating water is treated (cooled) by cooling towers before it is routed to the river. The amount of water treated by the cooling towers depends on the amount of cooling needed for the plant to remain in compliance with the NPDES limits. The three units can be placed in helper mode individually or collectively (i.e., one, two or all three units). If helper mode operation is not sufficient in keeping the river temperature from threatening an NPDES limit, TVA reduces the thermal power of one or more of the units to maintain regulatory compliance.

Hydrothermal impacts are assessed on the changes in water temperature and other water quality parameters of the Tennessee River as a result of the power uprate. Previous studies of the thermal impacts due to the proposed power uprate are given by TVA (2003) and TVA (2004). The evaluations summarized herein incorporate observations from recent years containing warm and dry meteorology, and recent and planned future changes in the plant cooling system. The plant has seven cooling towers, and the same is expected throughout the life of the power uprate. The current characteristics of the plant cooling towers are summarized in Table 7.2-1. Compared to previous studies, recent changes in the cooling system include the rebuilding of four of the original six cooling towers, and the addition of the new seventh cooling tower. Planned future changes in the cooling system include rebuilding of the two remaining original cooling towers (CTs 1 and 2).

To predict the impact of this additional heat, hydrothermal model simulations were updated from those performed previously (TVA 2003; TVA 2004). The computer simulations were limited to the evaluation of river temperature in the immediate vicinity of the plant as represented by the NPDES mixing zone. It is in this region that the impact of the additional heat is the greatest, and it is in this region that regulatory requirements for river temperature have the greatest influence on the operation of the plant. In previous studies, simulations also were performed to examine impacts reservoir wide and not only for river temperature, but also for algal biomass and dissolved oxygen. In these studies, even in years that were warmer and dryer than normal, the predicted impacts on these parameters were minor, and not noticeably altered. Because the plant cooling tower capacity is now greater than that assumed in the previous studies, reservoir-wide impacts are expected to be bounded by previous studies and therefore reservoir-wide modeling was not repeated in the current evaluations.

It is important to note that in previous studies, the number of cooling towers was insufficient to treat all of the condenser circulating water flowing through the plant when all of the units were operating at the full flow capacity of the individual CCW systems. In contrast, the current number of cooling towers (as summarized in Table 7.2-1) have enough capacity to treat all of the condenser circulating water flowing through the plant.

The dissipation of waste heat from the plant is of greatest concern in the summer, when the largest potential exists for aquatic wildlife to become stressed by high water temperature. TVA classifies summer hydrothermal conditions for the Tennessee Valley based on the average June-July-August air temperature and average June-July-August river flow at Chattanooga (TRM 464). For the available period of record, from 1948 through 2014 (67 years), Figure 7.2-1 summarizes these conditions in a cross plot showing for each year the deviation in average air temperature from the long-term mean at Chattanooga (x-axis), and the deviation in average natural river flow from the long-term mean at Chickamauga Dam (y-axis). The natural river flow is a theoretical discharge based on (1) observed rainfall/runoff upstream of Chickamauga Dam, and (2) no flow regulation by any control structures in the Tennessee River and its tributaries (e.g., dams). The natural flow at Chickamauga Dam (TRM 471) provides a measure of the extent of wet or dry conditions in the eastern part of the Tennessee Valley. The long-term mean air temperature and mean natural river flow are based on the summertime values for the entire 67-year period of record. The cross plot divides summer conditions into one of four quadrants: warm and wet, warm and dry, cool and dry, and cool and wet. For BFN, only summers in the warm and dry quadrant yield conditions that seriously challenge the NPDES limits for river temperature. For the period of record, about 43 percent of years fall in the warm and dry quadrant. However, in the past 10 years (highlighted in Figure 7.2-1), seven have fallen in the warm and dry quadrant.

To mimic a possible future dominated by warm and dry summer meteorology, the simulations presented herein evaluate the plant operation based on river flows and meteorology as observed for the 6-year period from 2007 through 2012 (highlighted in red in Figure 7.2-1). All but one of these years include a warm and dry summer. Summer 2009 was warm and barely wet (average natural flow only 0.5 percent above mean). This 6-year period includes the warmest summer of record, 2010, and extreme drought conditions that occurred in 2007 and 2008.

A detailed description of the hydrothermal model is given by TVA (2005). For the results presented herein, Table 7.2-2 provides a summary of basic model assumptions. In general, the model marches forward in time, computing the NPDES temperatures based on the ambient conditions of the river, the operating conditions of the plant, and meteorology. The model also computes the turbine backpressure for each unit, which also contains an operating limit. Depending on the computed temperatures verses the NPDES limits (or the computed backpressure verses the backpressure limit), the model decides whether or not helper mode operation is needed, and whether or not a derate is needed. In this process, it is important to note that the model examines operating conditions only one hour into the future. Furthermore, to maintain compliance, the model only considers changes in the operating conditions of the plant, not that of the river. In actuality, the TVA process for managing the river and thermal plants examines forecast conditions for up to a week or more into the future, allowing changes to be made perhaps days in advance to avert, defer, or reduce the need for helper mode operation and/or a derate. The process also allows changes in the operation of the river as well as changes in the operation of the plant. The dynamics of the actual process for managing the river and BFN are far too indefinite and complex to be captured in the model. For this reason, model results are considered to represent only a rough order of magnitude estimate of the potential bounding impacts of the power uprate.

For the simulations summarized herein, the results at 105 percent OLTP assume the configuration of cooling towers is the same as that summarized in Table 7.2-1. Results at 120 percent OLTP assume that CTs 1 and 2 are replaced with new cooling towers with design characteristics the same as those for CT 5.

Presented in Table 7.2-3 are the results comparing plant operation at 120 percent OLTP with plant operation at 105 percent OLTP. The table includes four sections: the first summarizes impacts on water temperature, the second summarizes impacts on helper mode operation (i.e., cooling tower operation), the third and fourth summarize impacts on plant electrical generation (i.e., derates and net generation). Notable observations include the following:

- For years with warm summers, the temperature of water exiting the diffusers at 120 percent OLTP, on the average, will be about 2.6 F° warmer than the temperature of water at 105 percent OLTP. For the maximum hourly value, as well as the maximum 24-hour average value, the model results imply a change in the temperature of water exiting the diffusers of 4.7 F° warmer and 3.4 F° warmer, respectively.
- For years with warm summers, the temperature of the river at the compliance depth at the downstream end of the mixing zone at 120 percent OLTP, on the average, will be about 0.6 F° warmer than the temperature at 105 percent OLTP. For the maximum hourly value, as well as the maximum 24-hour average value, the model results imply very subtle changes in the temperature of the river at the compliance depth at the downstream end of the mixing zone (only 0.1 F° cooler). This primarily is due to additional helper mode operation.
- For years with warm summers, the number of days of helper mode operation, on the average, is expected to increase by about 22 days at 120 percent OLTP as compared to 105 percent OLTP. At 120 percent OLTP, the most extreme years are expected to include about 121 days of helper mode operation.
- For years with warm summers the number of summers containing derates is expected to remain at 1 in 6 at EPU conditions. For warm summers containing derates, the maximum number of hours of derate per year is expected to increase by about 28 at 120 percent OLTP with a maximum overall increase in annual hydrothermal derate energy loss of about 20,785 MWh. In derate events, the average amount of derate power loss is expected to increase by about 54 MW at 120 percent OLTP.
- The average annual net generation with the uprate from 105 percent OLTP to 120 percent OLTP is expected to increase by about 4.9×10^6 MWh.

At both 105 percent and 120 percent OLTP, the derate predictions summarized in Table 7.2-3 occurred only for 2010, the warmest summer of record (see Figure 7.2-1). Other notable observations from the hydrothermal simulations include the following:

- In helper mode operation, the model results indicate a water loss due to cooling tower evaporation of about 2.7 percent of the cooling tower flow on average. Berger (1995) suggests that manufacturers strive to limit cooling tower drift to about 0.2 percent of the flow. Thus, during helper mode operation, the combined loss due to evaporation and drift is expected to be roughly 3 percent of the cooling tower flow. If all seven cooling towers are in service, and for the power uprate (i.e., CT 1 and 2 replaced with new cooling towers the same as CT 5), the design flows in Table 7.2-1 suggest the water loss by cooling tower evaporation and drift to be magnitude 60,300 gpm or 134 cfs.

- The hydrothermal derates of Table 7.2-3 include events wherein the downstream temperature challenged the 1-hour average NPDES temperature limit of 93°F. To protect this limit in the hydrothermal model, cooling tower operation and derates were triggered when hourly temperatures reached 92°F. However, if the model predictions emerge as accurate, these events will come as one hour temperature spikes with little or no warning to the plant. In these events, and in contrast to the model, current plant operating procedures do not support such a rapid response for implementing cooling tower operation and derates. In fact, operating limitations of some plant equipment make it impossible to respond to these types of events within one hour. To prepare for such, plant operating procedures will need to be updated to initiate cooling tower operation and derates more conservatively; for example, by specifying a lower value of the measured 1-hour average downstream temperature to trigger changes in helper mode operation and derates. The use of a hydrothermal forecast model (such as the one utilized herein) also may help to identify conditions conducive for potential threats to the 93°F limit.
- At 120 percent OLTP, model predictions for helper mode operation include events to protect the NPDES limit for the maximum instream temperature rise of 10 F°. These events will occur in the cooler months of the year, primarily in the late winter and early spring when river flows are curtailed to allow filling of tributary reservoirs in the eastern part of the Tennessee River watershed. Although such events have occurred for existing plant conditions (e.g., March 2014), the frequency and duration of these events will increase at 120 percent OLTP. That is, cooling tower equipment will need to be prepared for operation during periods outside of the normal period of high readiness in the summer.

The existing protocol between TVA River Operations and BFN Operations ensures that during normal conditions the cooling towers are operated and/or the units are de-rated to comply with the NPDES permit.

In addition to the diffuser discharge, effluent discharges also occur from other plant systems such as yard drainage, station sumps, and sewage treatment. These are not expected to change due to the power uprate, and as such are expected to remain within the bounding conditions established in the NPDES permit for these discharges. Overall, in terms of plant discharges to the river, the power uprate will have minimal impact either individually or cumulatively on the environment.

Table 7.2-1: BFN Cooling Tower Characteristics, October 2014

Tower (1, 2)	Startup	Reference			No. Cells or Fans	Fan hp	No. Pumps	Pump hp	Flow per Pump Max (gpm)	Tower Flow			Capability (%)
		Wet Bulb Temp (°F)	Hot Water Temp (°F)	Cold Water Temp (°F)						Design (gpm)	Min (gpm)(3)	Max (gpm)	
1	1976	78.0(4)	126.7(4)	95.0(4)	16	200	2	3100	145,950	275,000	220,000	291,900(5)	94.0(5)
2	1976	80.0(5)	129.7(5)	98.0(5)	16	200	2	3100	139,800	275,000	220,000	279,600(5)	113.0(5)
3	2013	82.0(6)	118.5(6)	91.6(6)	16	250	2	3100	137,500	265,000(7, 8)	212,000	275,000(7, 8)	102.5(6)
4	2007	80.0(9)	119.2(9)	91.0(9)	16	250	2	3100	140,150	275,000	220,000	280,300(9)	102.0(9)
5	2013	82.0(10)	118.5(10)	90.0(10)	19	250	2	3100	137,500	265,000(8, 11)	212,000	275,000(8,11)	103.9(10)
6	2014	82.0(12)	118.5(12)	91.6(12)	16	250	2	3100	137,500	265,000(8, 13)	212,000	275,000(8, 13)	100.0(12)
7	2012	82.0(14)	118.5(14)	90.0(14)	28	250	4	2700	111,475	410,000(14)	328,000	445,900(14)	103.1(14)

Notes:

1. CT 1 and CT 2 = Ecodyne, Inc. (original towers). CT 3, CT 5, CT 6, and CT 7 = Composite Cooling Solutions, Inc. Tower 4 = Marley, Inc.
2. Cooling towers 1 and 2 are currently planned to be replaced in FY18 and FY19.
3. For BFN forecasting models, assume pumps can be throttled to 80 percent of design flow to balance CCW flow.
4. Reference wet bulb, hot water, and cold water temperatures derived from performance curves of original towers. Design wet bulb, hot water, and cold water temperatures of original towers are 55.0°F, 115.7°F, and 84.0°F, respectively.
5. Thermal Performance Tests, CTI Report No. CA08-13, Rev. 1, 01/21/2009, SPX Cooling Technologies, Inc.
6. Cooling Tower Performance Test At TVA Browns Ferry Nuclear Plant On Cooling Tower #3, BFN-CT3-2013-TEST, Fulkerson and Associates, Inc., September 12, 2013. Entered into TVA EDMS 04/24/2014: Document ID = BFN-CT3-2013-TEST (B41140424001).
7. MDN0000272013000155, Calculation of Flow Rate to New Cooling Tower No. 3.
8. New towers designed for 275,000 gpm, but use of existing/original pumps results in lower flow because new towers are taller than original towers. Notes 9, 10, and 11 are hydraulic analyses supporting the replacement of the cooling towers. The calculated design flows at NORMAL water level in the warm water channel are 265,461 gpm (CT 3), 264,383 gpm (CT 5), and 266,091 gpm (CT 6). The calculated flows at MAXIMUM water level are 274,994 gpm (CT 3), 273,850 gpm (CT 5), and 275,586 gpm (CT 6). The design and maximum flows provided herein, 265,000 gpm and 275,000 gpm, respectively, are assigned as the average of the NORMAL and MAXIMUM calculated flows, respectively (rounded to the nearest 1000 gpm). In tests conducted in the summer 2013, CT 3 and CT 5 provided only 246,725 gpm and 246,329 gpm, respectively. Lift pump flow is a function of the water level in the warm water channel--flows higher than these measured values are expected when the water level in the warm water channel is higher (i.e., lower head to the top of the towers).
9. Thermal Acceptance Tests, T07-08, July 2007, Cooling Tower Test Associated, Inc.
10. Cooling Tower Performance Test At TVA Browns Ferry Nuclear Plant On Cooling Tower #5, BFN-CT5-2013-TEST, Fulkerson and Associates, Inc., October 31, 2013. Entered into TVA EDMS on 04/24/2014. Document ID = BFN-CT5-2013-TEST (B41140424002).

11. MDN0000272013000162, Calculation of Flow Rate to New Cooling Tower No. 5.
12. Results from cooling tower performance tests unknown as of 11/2014--assume 100 percent capability based on performance of other new towers.
13. MDN0000272013000197, Calculation of Flow Rate to New Cooling Tower No. 6.
14. Thermal Performance Tests, Mesa Specification No. 1057004-MS11-002, Calc No. MDN0027201000. Also, Cooling Tower Performance Test At TVA Browns Ferry Nuclear Plant, BFN-CT7-2012-TEST, B41140424003, Fulkerson and Associates, Inc., September 20, 2012.

Table 7.2-2: Basic Assumptions for BFN Hydrothermal Modeling

Unit Operation
All three units operate at full power unless a derate is required. For 120% OLTP, the maximum generation is 1,332 MWe (pf = 1.0) per unit. Unit power level is not reduced until all towers are brought into service, subject to the 80% minimum tower water loading (see below). Unit power level is reduced (derated) when operation at full load causes one or more of the following triggers to be attained: 1-hour downstream temperature = 92.5 (NPDES limit 93°F), 24-hour average downstream temperature = 89.5 (NPDES limit 90°F), 24-hour average temperature rise (ΔT or delta T) = 9.5 (NPDES limit 10 F°), or 1-hour unit backpressure = 5.5 in Hg (i.e., assume limit is 5.5 in Hg). Power reductions are reduced sequentially among the operating units (i.e., one unit at a time). Power is reduced in electric generation amounts equivalent to increments of 50 MWe. If power is reduced on a unit, it must remain at the lowest value for at least 8 hours before initiating recovery. If the equivalent generation on a unit drops below 440 MWe it is shut down.
Condenser Circulating Water (CCW) Operation
Open-mode CCW flows are 276,300; 531,237; 688,776 gpm for 1, 2, and 3 pumps, respectively. The static head on the CCW pumps is increased by 2.63 feet if the unit is operating in helper-mode. Helper-mode CCW flows are 276,300; 519,342; 670,105 gpm for 1, 2, and 3 pumps, respectively. Always operate with 3 CCW pumps. CCW pumps are throttled when specifically needed to balance the plant flow. The condenser cleanliness is 85% for all units.
Cooling Tower Operation
All cooling towers are assumed to be in reliable operating condition. At 105% OLTP all towers are assumed to be those currently existing (2014). At 120% OLTP CTs 1 and 2 are assumed to be replaced by 19 cell towers equivalent to the current (2014) CT 5. Cooling towers are brought into service in order of decreasing rating (best first to worst last). Cooling tower rating is a combination of maximum flow, the design point, and the capability. In this, the tower with the largest flow capacity is not necessarily brought into service first. Cooling towers are brought into service one lift pump at a time until all of the CCW flow is handled or all towers are in service. The last lift pump added can be throttled to 80% flow. Only the last lift pump on a tower may be throttled in order to not exceed the maximum flow for that cooling tower. All but the last tower added will be operated at their individual maximum water loading. If cooling towers are brought into service they must remain in service for at least 8 hours. Helper mode operation is initiated or increased if plant operation causes at least one of the following triggers to be attained: 1-hour downstream temperature of any single unit = 92.0°F (NPDES limit 93°F), 24-hour average downstream temperature = 88°F (NPDES limit 90°F), or 24-hour average temperature rise (ΔT or delta T) = 8 F° (NPDES limit 10 F°). Meteorology for cooling tower operation per historical data recorded at the BFN met station for the period of record 2007 through 2012.

Table 7.2-2: Basic Assumptions for BFN Hydrothermal Modeling

Equipment Service Loads
The service load for the CCW pumps is 1.35 MWe/pump.
The service load is the same for a CCW pump whether it is throttled or not.
The service load for the cooling tower lift pumps is as given in Table 7.2-1.
The service load is the same for a cooling tower lift pump whether it is throttled or not.
The service load for the cooling tower fans is as given in Table 7.2-1.
Plant Water Routing
If a unit is operating in open mode, the water flows from the condenser directly to the diffuser.
All of the water from all units operating in helper mode is fully mixed at the entrance to the cooling tower warm water channel.
The mixed water from all units operating in helper mode is lifted to the cooling towers.
All of the water leaving the cooling towers is mixed and then split evenly among the diffusers of units not operating in open mode. That is, water from the cooling towers is not mixed with water discharged from any unit operating in open mode.
Any water from units operating in helper mode and not flowing through the cooling towers is bypassed to the diffusers.
Bypass water is mixed with cooling tower discharge.
Ambient River Conditions
River flows past BFN computed based on historical operation of Wheeler Dam and Guntersville Dam per TVA Hourly Water Records for the period of record 2007 through 2012.
Ambient river temperature per historical data recorded at BFN Water Station No. 4 for the period of record 2007 through 2012.
Diffuser Mixing
Equivalent diffuser slot width 1.5 feet.
Ambient entrainment coefficients are 1.00 for one-unit operation and 0.25 for two-unit and three-unit operation.
Diffuser re-entrainment coefficient is 0.25.

Table 7.2-3: Summary of BFN Hydrothermal Impacts for Warm, Summer Meteorology

Parameter [1]		0% OLTP [2]	105% OLTP	120% OLTP	Change 105%→120% OLTP
Water Temperature (°F)					
Ambient River Temperature at Compliance Depth	Average	66.5	66.5	66.5	0
	Hourly Max	94.3	94.3	94.3	0
	Hourly Min	37.6	37.6	37.6	0
	24-hr Avg Max	91.5	91.5	91.5	0
	24-hr Avg Min	38.4	38.4	38.4	0
Diffuser Discharge Temperature, Flow-Weighted	Average	NA [4]	86.9	89.5	+2.6 F°
	Hourly Max	NA	112.5	117.2	+4.7 F°
	Hourly Min	NA	60.3	58.0	-2.3 F°
	24-hr Avg Max	NA	107.1	110.5	+3.5 F°
	24-hr Avg Min	NA	60.8	64.3	+3.5 F°
Temperature at Downstream End of Mixing Zone at Compliance Depth	Average	66.5 [3]	70.8	71.4	+0.6 F°
	Hourly Max	94.3 [3]	92.1	92.0	-0.1 F°
	Hourly Min	37.6 [3]	39.8	40.3	+0.5 F°
	24-hr Avg Max	91.5 [3]	89.4	89.3	-0.1 F°
	24-hr Avg Min	38.4 [3]	40.4	41.2	+0.8 F°
Helper Mode Operation					
Max No. days of cooling tower operation per year		NA	82	121	+39
Avg No. days of cooling tower operation per year		NA	66	88	+22
Hydrothermal Derate Operation					
Percent of Summers with Derates		NA	1 in 6	1 in 6	unchanged
Max No. Hours of Derate for Summers with Derate		NA	185	207	+28
Max Derate MWH for Summers with Derate		NA	81065	101850	+20785
Avg Derate MWe for Summers with Derate		NA	438	492	54
Changes in Net Generation (10^6 MWH)					
Maximum Annual Net Generation		NA	29.6	34.5	+4.9
Minimum Annual Net Generation		NA	29.2	34.1	+4.9
Average Annual Net Generation		NA	29.4	34.3	+4.9

Notes:
1. Based on simulations with historical hydrology and meteorology for years 2007-2012.
2. 0% OLTP = no withdrawal from or discharge to the river from BFN.
3. Value assumed to be the same as ambient (i.e., neglects any heat exchange between the reservoir and the atmosphere/riverbed in the reach between the ambient measurement at TRM 297.8 and the downstream end of mixing zone at TRM 293.5).

NA=not applicable.

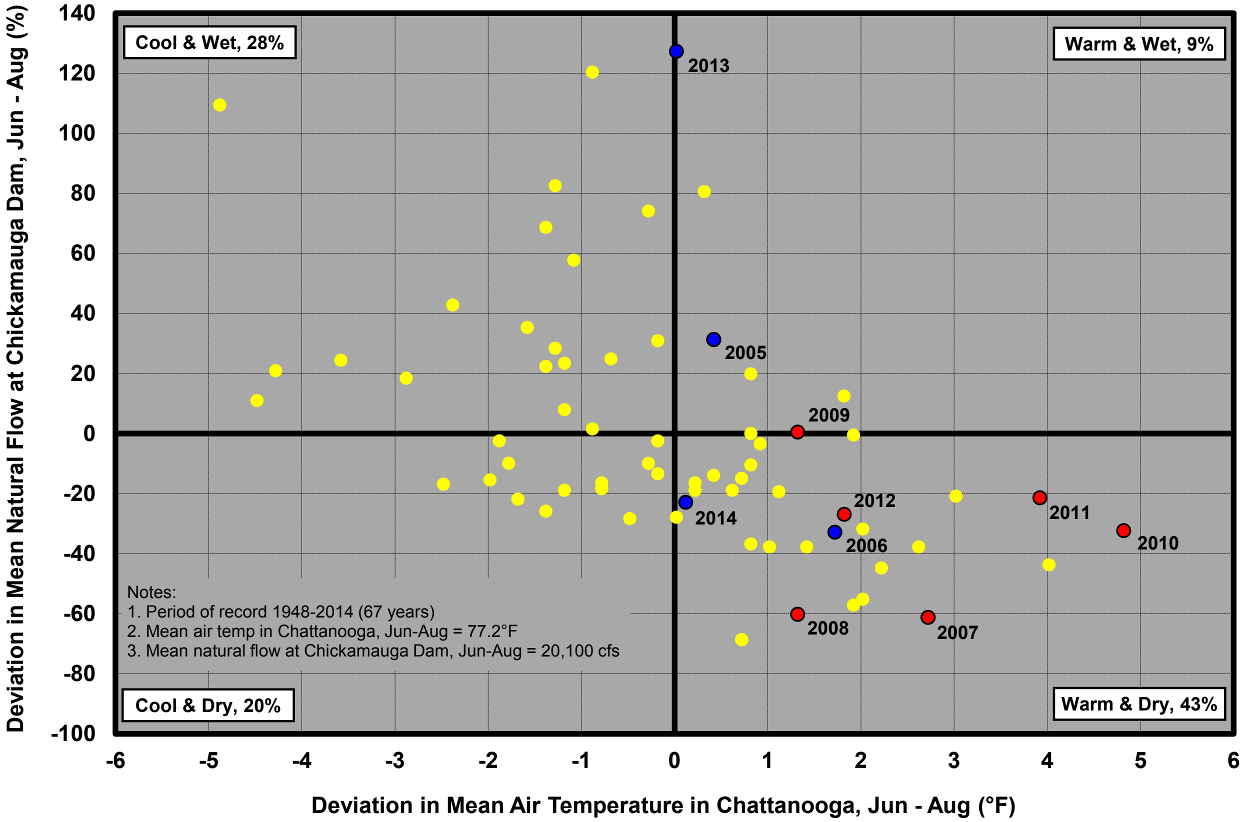

Figure 7.2-1: Classification of Summer Hydrothermal Conditions for the Tennessee River Valley

7.2.4 Fish

Baseline Wheeler Reservoir fish community data include 10 years of reservoir fish standing stock surveys (1949-1954 and 1969-1972), gill and trap net surveys (1968-1972), and ichthyoplankton (larval fish) investigations (1971-1973) (TVA 1978a). Aquatic monitoring continued until 1980 as required by BFN Technical Specifications issued by the NRC (Baxter and Buchanan 1998). In 1981, the NRC eliminated the aquatic monitoring requirement from the BFN Technical Specifications. TVA conducted a three-phase biological monitoring program to evaluate the effects of the BFN thermal discharge on total standing stocks and selected fish species in Wheeler Reservoir during the period 1985 through 1997 (Lowery and Poppe 1992; Buchanan 1990; Baxter and Buchanan 1998). The results were reported to ADEM in 1998 and were provided as part of the NPDES permit renewal application submitted in September 1999 (Baxter and Buchanan 1998; TVA 1999). This study concluded that the operation of BFN under the current permit limitations had not had a significant impact on the aquatic community of Wheeler Reservoir or on the specific species studied.

Section 316(a) of the Clean Water Act (CWA) authorizes alternate thermal limits (ATL) for the control of the thermal component of a point source discharge so long as the limits will assure the protection of Balanced Indigenous Populations (BIP) of aquatic life. The Reservoir Fish Assemblage Index (RFAI) is a measure of quality of the resident fish community in the Wheeler Reservoir in the vicinity of BFN. RFAI sampling in the Wheeler Reservoir was initiated as part of the TVA Vital Signs Monitoring Program. TVA proposed in its 1999 NPDES permit application, use of its RFAI and Reservoir Benthic Index (RBI) methodologies to demonstrate BIP.

From 2000 to 2011, and during 2013, TVA conducted extensive annual sampling of the fish community in the vicinity of BFN and used these methodologies to demonstrate maintenance of BIP in relation to BFN's thermal variance (TVA 2014). Sampling was conducted at two locations each autumn. The upstream station was centered on TRM 295.9 and served as a control station that was completely unaffected by the BFN discharge. The downstream station (TRM 292.5) was centered just downstream of the discharge and represented the potentially thermally affected area. Fish communities are used to evaluate ecological conditions because of their importance in the aquatic food web and because fish life cycles are long enough to integrate conditions over time. The RFAI methodology incorporates fish species richness and composition, trophic composition, and fish abundance and health. It has been thoroughly tested on TVA's reservoirs and other reservoirs and it has been published in peer-reviewed literature (Jennings et al. 1995; Hickman and McDonough 1996; McDonough and Hickman 1999).

TVA's Reservoir Monitoring Program (began in 1993 in Wheeler Reservoir) includes three additional RFAI sampling sites in the reservoir. TVA reservoirs are typically divided into three zones for monitoring: inflow, transition, and forebay. The inflow zone is generally in the upper reaches of the reservoir and is riverine in nature; the transition zone or mid-reservoir is the area where water velocity decreases due to increased cross-sectional area, and the forebay is the lacustrine area near the dam. The Wheeler Reservoir inflow zone sample site is located at TRM 347, the transition zone sample site is located at TRM 295.9 (also serves as BFN upstream control site), and the forebay zone sample site is located at TRM 277. An additional site is located on the Elk River embayment of Wheeler Reservoir at Elk River Mile (ERM) 6. Data from these sites are used to provide additional information about the health of the fish communities throughout Wheeler Reservoir; however, fish communities at these sites are not subject to thermal effects from BFN and are not used in determination of BIPs, as defined by the CWA in relation to the plant.

The RFAI uses 12 fish community metrics from four general categories: species richness and composition; trophic composition; abundance; and fish health. Together, these 12 metrics provide a balanced evaluation of fish community integrity and address all four attributes of a BIP as defined by the CWA. Scoring categories are based on “expected” fish community characteristics in the absence of human-induced impacts other than impoundment of the reservoir. These categories were developed from historical fish assemblage data representative of transition zones from lower main stem Tennessee River reservoirs (Hickman and McDonough 1996). Attained values for each of the 12 metrics were compared to the scoring criteria and assigned scores to represent relative degrees of degradation: least degraded (5); intermediately degraded (3); and most degraded (1).

TVA uses RFAI results to determine maintenance of BIP using two approaches. One is “absolute” in that it compares the RFAI scores and individual metrics to predetermined values. The other is “relative” in that it compares RFAI scores attained downstream to the upstream control site. The “absolute” approach is based on Jennings et al. (1995) who suggested that favorable comparisons of the RFAI score attained from the potential impact zone to a predetermined criterion can be used to identify the presence of normal community structure and function, and hence existence of BIP. For multi-metric indices, TVA uses two criteria to ensure a conservative screening of BIP. First, if an RFAI score reaches 70 percent of the highest attainable score of 60 (adjusted upward to include sample variability as described below), and second, if fewer than half of RFAI metrics receive a low (1) or moderate (3) score, then community structure and function are considered normal, indicating that BIP had been maintained and no further evaluation would be needed.

RFAI scores range from 12 to 60. Ecological health ratings (12-21 “Very Poor”, 22-31 “Poor”, 32-40 “Fair”, 41-50 “Good”, or 51-60 “Excellent”) are then applied to scores. The average variation for RFAI scores in TVA reservoirs is 6 (± 3). Therefore, any location that attains a RFAI score of 45 (75 percent of the highest score) or higher would be considered to have BIP. It must be stressed that scores below this threshold do not necessarily reflect an adversely impacted fish community. The threshold is used to serve as a conservative screening level meaning that any fish community that meets these criteria is not adversely impacted. RFAI scores below this level require a more in-depth look to determine if BIP exists. An inspection of individual RFAI metric results and species of fish used in each metric are an initial step to help identify if operation of BFN is a contributing factor. This approach is appropriate because a validated multi-metric index is being used and scoring criteria applicable to the zone of study are available.

A comparison of RFAI scores from the area downstream of BFN to those from the upstream (control) area is one basis for determining if operation of the plant has had any impacts on the resident fish community. The definition of “similar” is integral to accepting the validity of these interpretations. The Quality Assurance (QA) component of TVA’s Reservoir Monitoring Program deals with how well the RFAI scores can be repeated and is accomplished by collecting a second set of samples at 15 percent-20 percent of the areas each year. Comparison of paired-sample QA data collected over 7 years shows that the difference in RFAI index scores ranges from 0 to 18 points. The mean difference between these 54 paired scores is 4.6 points with 95 percent confidence limits of 3.4 and 5.8. The 75th percentile of the sample differences is 6, and the 90th percentile is 12. Based on these results, a difference of six points or less in the overall RFAI scores is the value selected for defining “similar” scores between upstream and downstream fish communities. That is, if the downstream RFAI score is within six points of the upstream score and if there are no major differences in overall fish community composition, then the two locations are considered similar. It is important to bear in mind that differences greater than six points can be expected simply due to method variation (25 percent of the QA paired sample sets exceeded that value). An examination of the 12 metrics (with emphases on fish species used for each metric) is conducted to analyze any difference in scores and the potential for the difference to be thermally related.

As previously discussed, RFAI scores have an intrinsic variability of ± 3 points. This variability comes from several sources, including annual variations in air temperature and stream flow; variations in pollutant loadings from nonpoint sources; changes in habitat, such as extent and density of aquatic vegetation; natural population cycles and movements of the species being measured (TWRA 2014). Another source of variability arises from the fact that nearly any practical measurement, lethal or non-lethal, of a biological community is a sample rather than a measurement of the entire population (TVA 2014).

A summary of RFAI scores for the sampling sites upstream and downstream of BFN and those from the three other Wheeler Reservoir are shown in Table 7.2-4. Over the 13 sample years (2000 to 2011, 2013), RFAI scores only differed by greater than six points during one year (2005). Long-term averages for these sites are identical (score of 41 “Good”), indicating that no substantial differences in ecological structure or balance between the two communities have persisted and that a BIP has been maintained. Additionally, all other Wheeler Reservoir monitoring sites have averaged a “Good” ecological health rating (Table 7.2-4). Most recent (autumn 2013) fish species collected and corresponding electrofishing and gill net catch per unit effort downstream (TRM 292.5) and upstream (TRM 295.9) of BFN discharge are shown in Tables 7.2-5 and 7.2-6 The EPU is not expected to have significant impacts on the fish communities of Wheeler reservoir in the vicinity of the BFN thermal discharge. TVA concludes that a BIP would continue to be maintained upstream and downstream of the plant through continued compliance with thermal discharge temperature limitations as specified in the NPDES permit.

Table 7.2-4: Summary of Autumn RFAI Scores

Site	Location	1993	1994	1995	1997	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2013	1993-2013 Avg.
Inflow	TRM 348.0	46	48	42	48	36	-	36	40	38	42	44	42	32	38	40	40	46	40	42
Transition BFN Upstream	TRM 295.9	45	43	34	40	30	41	37	43	39	43	46	41	39	42	39	43	40	46	41
Transition BFN Downstream	TRM 292.5	-	-	-	-	-	43	40	41	43	43	36	42	42	45	36	38	38	40	41
Forebay	TRM 277.0	52	44	48	45	42	-	41	45	44	43	45	44	49	46	47	40	46	43	45
Elk River Embayment	ERM 6.0	41	47	36	49	36	-	49	-	44	49	47	-	39	-	42	-	43	39	44

RFAI Scores: 12-21 (“Very Poor”), 22-31 (“Poor”), 32-40 (“Fair”), 41-50 (“Good”), or 51-60 (“Excellent”)

Table 7.2-5: Species Collected Upstream (TRM 295.9) of BFN Discharge—Autumn 2013

Common Name	Scientific Name	Trophic Level	Native Species	Tolerance	Thermally Sensitive Species	Comm. Valuable Species	Rec. Valuable Species	EF Catch Per Run	EF Catch Per Hr	Total Fish EF	GN Catch Per Net Night	Total Fish GN	Total Fish Combined	Percent Composition
Longnose gar	*Lepisosteus osseus*	TC	X	TOL	.	X	.	0.07	0.25	1	0.50	5	6	0.8
Gizzard shad	*Dorosoma cepedianum*	OM	X	TOL	.	X	X	11.73	44.67	176	0.50	5	181	25.4
Common carp*	*Cyprinus carpio*	OM	.	TOL	.	X	.	0.40	1.52	6	.	.	6	0.8
Golden shiner	*Notemigonus crysoleucas*	OM	X	TOL	.	X	X	0.40	1.52	6	.	.	6	0.8
Spotfin shiner	*Cyprinella spiloptera*	IN	X	TOL	.	.	.	1.27	4.82	19	.	.	19	2.7
Redbreast sunfish*	*Lepomis auritus*	IN	.	TOL	.	.	X	0.07	0.25	1	.	.	1	0.1
Green sunfish	*Lepomis cyanellus*	IN	X	TOL	.	.	X	0.80	3.05	12	.	.	12	1.7
Bluegill	*Lepomis macrochirus*	IN	X	TOL	.	.	X	4.73	18.02	71	.	.	71	9.9
Largemouth bass	*Micropterus salmoides*	TC	X	TOL	.	.	X	2.33	8.88	35	0.40	4	39	5.5
White crappie	*Pomoxis annularis*	TC	X	TOL	.	.	X	0.07	0.25	1	.	.	1	0.1
Skipjack herring	*Alosa chrysochloris*	TC	X	INT	.	X	.	.	.	.	0.60	6	6	0.8
Northern hog sucker	*Hypentelium nigricans*	BI	X	INT	.	.	.	0.07	0.25	1	.	.	1	0.1
Spotted sucker	*Minytrema melanops*	BI	X	INT	X	X	.	1.13	4.31	17	0.10	1	18	2.5
Black redhorse	*Moxostoma duquesnei*	BI	X	INT	.	X	.	0.07	0.25	1	.	.	1	0.1
Longear sunfish	*Lepomis megalotis*	IN	X	INT	.	.	X	1.13	4.31	17	.	.	17	2.4
Smallmouth bass	*Micropterus dolomieu*	TC	X	INT	.	.	X	0.60	2.28	9	.	.	9	1.3
Spotted gar	*Lepisosteus oculatus*	TC	X	.	.	X	.	0.33	1.27	5	0.10	1	6	0.8
Threadfin shad	*Dorosoma petenense*	PK	X	.	.	X	X	1.53	5.84	23	.	.	23	3.2
Emerald shiner	*Notropis atherinoides*	IN	X	.	X	.	.	0.07	0.25	1	.	.	1	0.1
Bullhead minnow	*Pimephales vigilax*	IN	X	.	.	.	X	0.47	1.78	7	.	.	7	1.0
Smallmouth buffalo	*Ictiobus bubalus*	OM	X	.	.	X	.	1.87	7.11	28	0.50	5	33	4.6
Black buffalo	*Ictiobus niger*	OM	X	.	.	X	.	0.07	0.25	1	0.20	2	3	0.4

Common Name	Scientific Name	Trophic Level	Native Species	Tolerance	Thermally Sensitive Species	Comm. Valuable Species	Rec. Valuable Species	EF Catch Per Run	EF Catch Per Hr	Total Fish EF	GN Catch Per Net Night	Total Fish GN	Total Fish Combined	Percent Composition
Blue catfish	*Ictalurus furcatus*	OM	X	.	.	X	X	.	.	.	0.40	4	4	0.6
Channel catfish	*Ictalurus punctatus*	OM	X	.	.	X	X	2.73	10.41	41	0.60	6	47	6.6
Flathead catfish	*Pylodictis olivaris*	TC	X	.	.	X	X	0.07	0.25	1	0.10	1	2	0.3
White bass	*Morone chrysops*	TC	X	.	.	.	X	1.07	4.06	16	0.20	2	18	2.5
Yellow bass	*Morone mississippiensis*	TC	X	.	.	X	X	0.67	2.54	10	.	.	10	1.4
Warmouth	*Lepomis gulosus*	IN	X	.	.	.	X	0.07	0.25	1	.	.	1	0.1
Orangespotted sunfish	*Lepomis humilis*	IN	X	.	.	.	X	0.20	0.76	3	.	.	3	0.4
Redear sunfish	*Lepomis microlophus*	IN	X	.	.	.	X	1.73	6.60	26	0.40	4	30	4.2
Hybrid sunfish	Hybrid *Lepomis* sp.	IN	X	.	.	.	.	0.20	0.76	3	.	.	3	0.4
Spotted bass	*Micropterus punctulatus*	TC	X	.	.	.	X	0.07	0.25	1	.	.	1	0.1
Black crappie	*Pomoxis nigromaculatus*	TC	X	.	.	.	X	0.07	0.25	1	.	.	1	0.1
Logperch	*Percina caprodes*	BI	X	.	X	.	.	2.33	8.88	35	.	.	35	4.9
Sauger	*Sander canadensis*	TC	X	.	.	.	X	.	.	.	0.40	4	4	0.6
Freshwater drum	*Aplodinotus grunniens*	BI	X	.	.	X	.	1.27	4.82	19	0.20	2	21	2.9
Mississippi silverside*	*Menidia audens*	IN	.	.	.	X	X	4.47	17.01	67	.	.	67	9.4
Total			**34**		**3**	**17**	**23**	**44.16**	**167.97**	**662**	**5.20**	**52**	**714**	**100.0**
Number Samples								**15**			**10**			
Species Collected								**34**			**15**			

Trophic level: benthic invertivore (BI), herbivore (HB), insectivore (IN), omnivore (OM), planktivore (PK), parasitic (PS), specialized insectivore (SP), top carnivore (TC);
Tolerance: tolerant species (TOL), intolerant species (INT); Comm.-Commercially, Rec.-Recreationally.

*Denotes aquatic nuisance species next to common name. All species are considered representative important species. No species collected are federally listed.

Table 7.2-6: Species Collected Downstream (TRM 292.5) of BFN Discharge—Autumn 2013

Common Name	Scientific Name	Trophic Level	Native Species	Tolerance	Thermally Sensitive Species	Comm. Valuable Species	Rec. Valuable Species	EF Catch Per Run	EF Catch Per Hr	Total Fish EF	GN Catch Per Net Night	Total Fish GN	Total Fish Combined	Percent Composition
Gizzard shad	*Dorosoma cepedianum*	OM	X	TOL	.	X	X	10.40	40.10	156	1.30	13	169	17.4
Common carp*	*Cyprinus carpio*	OM	.	TOL	.	X	.	0.13	0.51	2	0.10	1	3	0.3
Spotfin shiner	*Cyprinella spiloptera*	IN	X	TOL	.	.	.	7.13	27.51	107	.	.	107	11.0
Redbreast sunfish*	*Lepomis auritus*	IN	.	TOL	.	.	X	0.07	0.26	1	.	.	1	0.1
Green sunfish	*Lepomis cyanellus*	IN	X	TOL	.	.	X	2.87	11.05	43	.	.	43	4.4
Bluegill	*Lepomis macrochirus*	IN	X	TOL	.	.	X	2.00	7.71	30	0.20	2	32	3.3
Largemouth bass	*Micropterus salmoides*	TC	X	TOL	.	.	X	1.27	4.88	19	0.10	1	20	2.1
Skipjack herring	*Alosa chrysochloris*	TC	X	INT	.	X	.	.	.	.	1.20	12	12	1.2
Spotted sucker	*Minytrema melanops*	BI	X	INT	X	X	.	0.20	0.77	3	.	.	3	0.3
Black redhorse	*Moxostoma duquesnei*	BI	X	INT	.	X	.	0.07	0.26	1	.	.	1	0.1
Longear sunfish	*Lepomis megalotis*	IN	X	INT	.	.	X	4.00	15.42	60	.	.	60	6.2
Smallmouth bass	*Micropterus dolomieu*	TC	X	INT	.	.	X	1.53	5.91	23	.	.	23	2.4
Spotted gar	*Lepisosteus oculatus*	TC	X	.	.	X	.	.	.	.	0.20	2	2	0.2
Threadfin shad	*Dorosoma petenense*	PK	X	.	.	X	X	0.80	3.08	12	.	.	12	1.2
Emerald shiner	*Notropis atherinoides*	IN	X	.	X	.	.	0.20	0.77	3	.	.	3	0.3
Bullhead minnow	*Pimephales vigilax*	IN	X	.	.	.	.	0.33	1.29	5	.	.	5	0.5
Smallmouth buffalo	*Ictiobus bubalus*	OM	X	.	.	X	.	1.80	6.94	27	0.20	2	29	3.0
Black buffalo	*Ictiobus niger*	OM	X	.	.	X	.	.	.	.	0.10	1	1	0.1
Blue catfish	*Ictalurus furcatus*	OM	X	.	.	X	X	.	.	.	0.20	2	2	0.2
Channel catfish	*Ictalurus punctatus*	OM	X	.	.	X	X	1.40	5.40	21	0.10	1	22	2.3
Flathead catfish	*Pylodictis olivaris*	TC	X	.	.	X	X	.	.	.	0.40	4	4	0.4
Yellow bass	*Morone mississippiensis*	TC	X	.	.	X	X	0.13	0.51	2	0.20	2	4	0.4

Common Name	Scientific Name	Trophic Level	Native Species	Tolerance	Thermally Sensitive Species	Comm. Valuable Species	Rec. Valuable Species	EF Catch Per Run	EF Catch Per Hr	Total Fish EF	GN Catch Per Net Night	Total Fish GN	Total Fish Combined	Percent Composition
Warmouth	*Lepomis gulosus*	IN	X	.	.	.	X	0.13	0.51	2	.	.	2	0.2
Redear sunfish	*Lepomis microlophus*	IN	X	.	.	.	X	0.27	1.03	4	.	.	4	0.4
Hybrid sunfish	Hybrid *Lepomis* sp.	IN	X	.	.	.	.	0.13	0.51	2	.	.	2	0.2
Black crappie	*Pomoxis nigromaculatus*	TC	X	.	.	.	X	.	.	.	0.10	1	1	0.1
Stripetail darter	*Etheostoma kennicotti*	SP	X	.	.	.	.	0.07	0.26	1	.	.	1	0.1
Logperch	*Percina caprodes*	BI	X	.	X	.	.	1.87	7.20	28	.	.	28	2.9
Sauger	*Sander canadensis*	TC	X	.	.	.	X	.	.	.	0.30	3	3	0.3
Freshwater drum	*Aplodinotus grunniens*	BI	X	.	.	X	.	2.93	11.31	44	0.40	4	48	5.0
Mississippi silverside*	*Menidia audens*	IN	.	.	.	X	X	21.47	82.78	322	.	.	322	33.2
Total			**28**		**3**	**15**	**17**	**61.20**	**235.97**	**918**	**5.10**	**51**	**969**	**100**
Number Samples								**15**			**10**			
Species Collected								**24**			**15**			

Trophic level: benthic invertivore (BI), herbivore (HB), insectivore (IN), omnivore (OM), planktivore (PK), parasitic (PS), specialized insectivore (SP), top carnivore (TC);
Tolerance: tolerant species (TOL), intolerant species (INT); Comm.-Commercially, Rec.-Recreationally.

*Denotes aquatic nuisance species next to common name. All species are considered representative important species. No species collected are federally listed.

7.2.5 Benthic Organisms

As briefly mentioned in Section 7.2.4, benthic macroinvertebrate populations are assessed using the RBI methodology to provide additional information on the health of aquatic communities upstream and downstream of the BFN thermal discharge. Because benthic macroinvertebrates are relatively immobile, negative impacts to aquatic ecosystems can be detected earlier in benthic macroinvertebrate communities than in fish communities (TVA 2014).

During autumn 2013, benthic macroinvertebrate data were collected in the transition zone of Wheeler Reservoir along three transects established across the width of the reservoir. The upstream transect (TRM 295.9) was used as a control site to compare to benthic community composition potentially affected by the BFN thermal effluent. One downstream transect (TRM 293.2) was within the thermal plume and one transect (TRM 290.4) was located just below the downstream extent of the plume (TVA 2014). These two sites were established during 2011 to better determine the effect, if any, of the thermal discharge on benthic communities (TVA 2012a). Previously (2000 to 2010), the downstream site consisted of one transect located at TRM 291.7. A Ponar sampler (area per sample 0.06 m^2) was used to collect benthic samples at 10 points equally spaced along each transect. Sediments from each sample were washed on a 533µ screen, and organisms were picked from the screen and any remaining substrate.

Benthic samples are evaluated using seven metrics that represent characteristics of the benthic community (for a more detailed description of metrics and scoring criteria, refer to TVA 2014). Results for each metric were assigned a rating of 1, 3, or 5, based upon comparison to reference conditions developed for TVA's Reservoir Benthic Monitoring transition zone sample sites (Table 7.2-7). For each sample site, the ratings for the seven metrics were then summed to produce an RBI score. Potential RBI scores ranged from 7 to 35. Ecological health ratings derived from the range of potential values (7-12 "Very Poor", 13-18 "Poor", 19-23 "Fair", 24-29 "Good", or 30-35 "Excellent") were then applied to scores.

A similar or higher benthic index score at the downstream sites compared to the upstream site was used as the basis for determining absence of impact on the benthic macroinvertebrate community related to BFN's thermal discharge. The QA component of TVA's Reservoir Benthic Monitoring Program compared benthic index scores from 49 paired sample sets collected over seven years. Differences between these paired sets ranged from 0 to 14 points; the 75th percentile was four, the 90th percentile was six. The mean difference between these 49 paired scores was 3.1 points with 95 percent confidence limits of 2.2 and 4.1. Based on these results, a difference of four points or less was the value selected for defining "similar" scores between upstream and downstream benthic communities. That is, if benthic scores at the downstream sites are within four points of the upstream score, the communities are considered similar. However, differences greater than four points can be expected simply due to method variation (25 percent of the QA paired sample sets exceeded that value). Any difference in scores of greater than four points between communities is examined on a metric-by-metric basis to determine what caused the difference and the potential for the difference to be thermally related.

Similar to RFAI, TVA's Wheeler Reservoir Monitoring Program includes three additional RBI sampling sites, located at the same river miles as the RFAI stations. Data from these sites are used to provide additional information about the health of benthic macroinvertebrate communities throughout Wheeler Reservoir; however, aquatic communities at these sites are not subject to thermal effects from BFN and are not used in determination of BIP in relation to the plant (TVA 2014).

A summary of RBI scores for the sampling sites upstream and downstream of BFN and those from the three other Wheeler Reservoir monitoring stations are shown in Table 7.2-7. Over the 13 sample years (2000 to 2011, 2013), RBI scores only differed by greater than four points during one year (2009). Most recent assessments of the RBI (2013) at the reference station and at the two stations within the BFN thermal plume received "Excellent" ratings (Table 7.2-7). Long-term averages for these sites are within the "Good" to "Excellent" range, indicating that no substantial differences in ecological structure or balance between the two communities have persisted and that a BIP has been maintained. The Wheeler Reservoir inflow site has averaged "Good", while the forebay and Elk River embayment have averaged "Poor". Land use in the lower Elk River basin is predominantly agricultural, and high levels of sediment and nutrient input are most likely suppressing the benthic community. The Elk River discharges into the forebay, which may be a contributor to the low ecological health rating observed in the forebay. Mean density per square meter of benthic taxa collected upstream and downstream of BFN during autumn 2013 are shown in Table 7.2-8. Monitoring results for autumn 2013 support the conclusion that a BIP of benthic macroinvertebrates was maintained downstream of BFN, and the benthic community at the most downstream sampling site was considered similar to the upstream benthic community (2014).

Freshwater mussels are not directly assessed as part of TVA's Reservoir Monitoring Program; however, they are excellent indicators of water quality due to their sessile nature and inability to avoid perturbations impacting water quality. Various post-impoundment mussel surveys in Wheeler Reservoir have documented the occurrence of mussel species (Garner and McGregor 2001). Scruggs (1960) and Isom (1969) documented, as described in Ahlstedt and McDonough (1992), 24 species from various locations surveyed from TRM 275 to TRM 348. During these surveys, it was noted that commercial overharvest and siltation were major factors affecting abundance, recruitment, and survival of many species. Gooch et al. (1979) documented 32 mussel species, 7 of which were not collected during earlier surveys, from TRM 334.3 to TRM 348.4 and in Spring Creek embayment (TRM 283.8). During 1991, 18 live mussel species and 6 species represented by relict shell were documented in Wheeler Reservoir and the mussel fauna consisted of riverine and thin-shelled invader species that have adapted to lake-like conditions and soft bottomed substrates which are now predominate. Half of the species reported from Wheeler Reservoir post impoundment are uncommon or rare and may survive as old, non-reproducing individuals (Ahlstedt and McDonough 1992).

From 1995 to 2000, the Alabama Game and Fish Division (now Alabama Division of Wildlife and Freshwater Fisheries) identified 29 species from upstream of BFN to Guntersville Dam (TRM 294.5 to TRM 349) and 11 species downstream (Garner 2015) (see Table 7.2-9). These freshwater mussel species were collected in Wheeler Reservoir during 5 years of qualitative, non-standardized dives, using an unknown amount of effort, and during various years. There was a substantial difference in bottom time spent at multiple locations in searches for mussels upstream of BFN (63.1 hours) versus at one location, TRM 292, downstream of BFN (16.3 hours). Significant impacts on the benthic communities of Wheeler reservoir in the vicinity of the BFN thermal discharge are not expected due to EPU since BIPs are continually maintained upstream and downstream of the plant. See Section 7.2.7 for additional discussion.

Table 7.2-10 is a list of mussels collected in Ponar dredge samples while sampling reservoir benthic macroinvertebrates near BFN. These were not collected during a mussel-specific survey, but they are the most recent collections available from Wheeler Reservoir near BFN. These records are stored in TVA's reservoir benthic taxa database.

Table 7.2-7: Summary of RBI Scores

Site	Location	1994	1995	1997	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2013	LTA
Inflow	TRM 347	31	21	25	23	---	21	25	31	31	31	33	33	---	31	---	27	31	**28**
BFN Upstream (Transition)	TRM 295.9	33	25	31	31	31	29	31	31	33	31	31	33	25	29	25	27	35	**30**
BFN Downstream (Transition)	TRM 291.7	---	---	---	---	27	31	27	35	33	31	31	29	29	23	23	---	---	**29**
BFN Downstream (Transition)	TRM 293.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	23	35	**N/A**
BFN Downstream (Transition)	TRM 290.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	21	31	**N/A**
Forebay	TRM 277	19	15	23	17	---	17	15	15	19	15	13	13	15	13	---	13	17	**13**
Embayment	ERM 6	15	13	15	15	---	15	---	15	---	17	---	13	---	13	---	13	13	**13**

Reservoir Benthic Index Scores: 7-12 (“Very Poor”), 13-18 (“Poor”), 19-23 (“Fair”), 24-29 (“Good”), 30-35 (“Excellent”)
LTA = Long-term average

Table 7.2-8: Mean Density of Benthic Taxa Upstream and Downstream of BFN, Autumn 2013

Taxa	BFN Downstream TRM 290.4	BFN Downstream TRM 293.2	BFN Upstream TRM 295.9
ANNELIDA			
Hirudinea			
Rhynchobdellida			
Glossiphoniidae			
Actinobdella sp.	---	2	---
Actinobdella inequiannulata	2	---	---
Helobdella elongata	---	---	2
Helobdella stagnalis	7	8	8
Oligochaeta			
Haplotaxida			
Naididae	---	---	2
Tubificinae	30	78	20
Branchiura sowerbyi	3	7	5
Limnodrilus hoffmeisteri	5	7	18
ARTHROPODA			
Crustacea			
Malacostraca			
Amphipoda			
Corophiidae			
Apocorophium lacustre	167	38	282
Gammaridae			
Gammarus sp.	---	2	5
Hexapoda			
Insecta			
Coleoptera			
Elmidae			
Dubiraphia sp.	---	2	---
Diptera			
Ceratopogonidae	2	---	---
Chironomidae			
Orthocladiinae			
Chironominae	---	---	2
Axarus sp.	5	32	45
Chironomus sp.	43	28	70
Cryptochironomus sp.	---	7	5
Dicrotendipes neomodestus	---	---	7

Taxa	BFN Downstream TRM 290.4	BFN Downstream TRM 293.2	BFN Upstream TRM 295.9
Glyptotendipes sp.	---	---	3
Harnischia sp.	---	---	2
Microchironomus sp.	---	2	---
Polypedilum halterale gp.	---	3	2
Stempellina sp.	---	2	---
Xenochironomus xenolabis	---	---	5
Epoicocladius flavens	2	---	---
Thienemanniella lobapodema	---	2	---
Tanypodinae			
Ablabesmyia annulata	33	13	32
Ablabesmyia mallochi	---	---	2
Coelotanypus sp.	97	263	145
Paramerina sp.	---	30	---
Procladius sp.	---	2	7
Ephemeroptera			
Ephemeridae			
Hexagenia sp. <10mm	262	230	163
Hexagenia sp. >10mm	262	213	100
Trichoptera			
Leptoceridae	---	2	---
Oecetis sp.	2	37	28
Polycentropodidae			
Cyrnellus fraternus	18	---	32
MOLLUSCA			
Gastropoda			
Architaenioglossa			
Viviparidae			
Campeloma decisum	---	2	2
Lioplax sulculosa	---	3	3
Viviparus sp.	5	3	12
Neotaenioglossa			
Hydrobiidae			
Amnicola limosa	5	113	53
Somatogyrus sp.	---	3	2
Pleuroceridae			
Pleurocera canaliculata	---	---	3
Bivalvia			
Veneroida			
Corbiculidae			

Taxa	BFN Downstream TRM 290.4	BFN Downstream TRM 293.2	BFN Upstream TRM 295.9
Corbicula fluminea <10mm	263	312	278
Corbicula fluminea >10mm	---	3	40
Sphaeriidae			
Eupera cubensis	5	---	---
Musculium transversum	158	233	85
Pisidium compressum	2	---	---
Unionidae			
Truncilla donaciformis	---	---	3
Utterbackia imbecillis	---	---	2
NEMATODA	---	22	3
PLATYHELMINTHES			
Turbellaria			
Tricladida			
Planariidae			
Dugesia tigrina	3	2	5
Number of samples	**10**	**10**	**10**
Mean-Density per square meter²	**1,380**	**1,703**	**1,482**
Taxa Richness	**21**	**29**	**34**
Sum of area sampled (square meter²)	**0.6**	**0.6**	**0.6**

Note: All taxa listed contributed to individual RBI metrics and total scores.

Table 7.2-9: Mussel Species Collected by Alabama Game and Fish Division Near BFN and Upstream From BFN to Guntersville Dam, 1995–2000

Common Name	Scientific Name
TRM 292 (Total dive bottom time 16.3 hours)	
Washboard	*Megalonaias nervosa*
Pink Heelsplitter	*Potamilus alatus*
Threehorn Wartyback	*Obliquaria reflexa*
Mapleleaf	*Quadrula quadrula*
Threeridge	*Amblema plicata*
Flat Floater	*Anodonta suborbiculata*
Ebonyshell	*Fusconaia ebena*
Fragile Papershell	*Leptodea fragilis*
Giant Floater	*Pyganodon grandis*
Pistolgrip*	*Quadrula verrucosa*
White Heelsplitter	*Lasmigona complanata*
Upstream of BFN (TRM 294.5) to Guntersville Dam (TRM 349) (Total dive bottom time 63.1 hours)	
Washboard	*Megalonaias nervosa*
Pink Heelsplitter	*Potamilus alatus*
Pimpleback	*Quadrula pustulosa*
Threehorn Wartyback	*Obliquaria reflexa*
Threeridge	*Amblema plicata*
Elephantear	*Elliptio crassidens*
White Heelsplitter	*Lasmigona complanata*
Pistolgrip*	*Quadrula verrucosa*
Purple Wartyback	*Cyclonaias tuberculata*
Mapleleaf	*Quadrula quadrula*
Butterfly*	*Ellipsaria lineolata*
Giant Floater*	*Pyganodon grandis*
Pink Papershell*	*Potamilus ohiensis*
Flat Floater*	*Anodonta suborbiculata*
Spectaclecase	*Cumberlandia monodonta*
Spike	*Elliptio dilatata*
Ebonyshell	*Fusconaia ebena*
Yellow Sandshell	*Lampsilis teres*
Pink Mucket	*Lampsilis abrupta*
Fragile Papershell	*Leptodea fragilis*
Monkeyface	*Quadrula metanevra*
Black Sandshell	*Ligumia recta*
Sheepnose*	*Plethobasus cyphyus*
Ohio Pigtoe	*Pleurobema cordatum*
Pyramid Pigtoe	*Pleurobema rubrum*
Kidneyshell*	*Ptychobranchus fasciolaris*

Common Name	Scientific Name
Purple Lilliput	*Toxolasma lividus*
Fawnsfoot	*Truncilla donaciformis*
Paper Pondshell	*Utterbackia imbecillis*

* Collected as dead shells

Table 7.2-10: Mussels Collected in Ponar Dredge Samples

River Mile	Taxa	Count	Date
TRM 290.4	*Megalonaias nervosa*	1	10/3/2011
TRM 291.7	*Utterbackia imbecillis*	1	9/26/2006
TRM 293.2	*Truncilla donaciformi*	1	10/3/2011
TRM 295.9	*Obliquaria reflexa*	1	10/20/2004
TRM 295.9	*Obliqueria reflexa*	2	10/4/2011
TRM 295.9	*Truncilla donaciformis*	2	10/15/2013
TRM 295.9	*Utterbackia imbecillis*	1	10/15/2013

7.2.6 Entrainment and Impingement of Fish

EPA's final rule for CWA Section 316(b) established requirements for cooling water intake structures and procedures for assessing impacts (EPA 2014). Compliance requires the permittee to characterize the aquatic community in the vicinity of the intake structure prior to operation, monitor during normal operation to assess impacts due to entrainment and impingement, and periodically review current operational demands, reservoir operation, and condition of the aquatic community to ensure no significant changes have occurred.

7.2.6.1 Entrainment

Prior to 1980, extensive biological and hydrological studies were conducted to assess the effects of CCW withdrawal on the aquatic community in Wheeler Reservoir (TVA 1978a; TVA 1978b; Buchanan and Barr 1980). Preoperational larval fish studies were conducted during 1971 to 1973 to determine the composition and magnitude of the ichthyoplankton populations in Wheeler Reservoir and to define the seasonal fluctuations and relative abundance of various ichthyoplankton taxa (TVA 1978a). From 1974 to 1977, all three units at BFN became operational. Six years (1974–1979) of entrainment sampling were conducted in the plant intake basin to assess operational effects of BFN on fish eggs and larvae (TVA 1978b; Buchanan and Barr 1980). These studies concluded that estimated plant entrainment under open-cycle, three-unit operation would not add significantly to expected natural mortality of fish eggs and larvae in Wheeler Reservoir (Buchanan and Barr 1980). In 1995, TVA initiated an Integrated Resource Plan (IRP) to assess the most cost effective approach to meeting future power demands (TVA 1995). In concert with the IRP, TVA planned to apply for license renewal and EPU of all units at BFN and as a federal agency subject to NEPA, prepared a FSEIS regarding the decision to pursue license renewal and EPU (TVA 2002). As described in Section 2.1, after an extended shutdown, Unit 2 returned to service in 1991, Unit 3 in 1995, and Unit 1 in 2007. The FSEIS committed to evaluate effects of the 10 percent increase in CCW flow on rate of entrainment of fish eggs and larvae (TVA 2002). As a result, TVA conducted a two-year entrainment study in 2003 and 2004 to evaluate effects of two-unit operation on the fish community and update baseline data prior to the restart of Unit 1 (Baxter et al. 2006). To evaluate the effect of the return of Unit 1 and increased generating levels, TVA conducted additional entrainment monitoring during 2008 and 2009 under the current (105 percent OLTP) three-unit uprated operation (TVA 2012b).

For each of these studies, densities of fish eggs and larvae in the reservoir near the intake and daily volume of water transported past the BFN were compared to daily CCW demand and densities of fish eggs and larvae at the intake skimmer wall to estimate percent entrainment. During 2003 to 2004, freshwater drum eggs comprised 94 percent of the eggs collected and clupeids (shad) comprised 94.5 percent of the larval fish collected (Baxter et al. 2006). During 2008 and 2009, freshwater drum eggs constituted 86.7 percent of the total eggs collected and clupeid eggs made up a majority (13.3 percent) of the remaining eggs collected (TVA 2012b). Clupeid larvae were dominant in samples during 2008 and 2009 (94.6 percent), which was almost identical to collections in 2003 and 2004 (TVA 2012b).

The 2008 and 2009 entrainment estimates (TVA 2012b) and recent fish community assessments (TVA 2014) in Wheeler Reservoir near BFN show no significant impacts from current operation of BFN on the fish community near the plant. Both estimated ichthyoplankton entrainment percentages were comparable to historical levels. Results demonstrate annual variations in the relative abundance and temporal distribution of fish and fluctuations in reservoir flow are common in the vicinity of BFN. Life cycles of the dominant fish species and fluctuation in reservoir flow past BFN are significant factors influencing variations observed in the annual entrainment estimates. Based on the annual RFAI scores for Wheeler Reservoir, a viable and balanced indigenous fish community is present in Wheeler Reservoir in the vicinity of BFN. The proposed EPU will not result in an increase in current intake velocities, therefore future entrainment impacts should be comparable to historical levels after implementation of the EPU.

7.2.6.2 Impingement

Four years (1974-1977) of monitoring were conducted to assess operational effects of BFN on fish impingement (TVA 1978b). During this time, impinged fish were dominated by threadfin shad (76.5 percent) and gizzard shad (12.3 percent). Most species contributed less than 1 percent of total fish impinged (TVA 1978b). These studies concluded that overall impingement did not appear to represent an adverse environmental impact to the Wheeler Reservoir fish community.

TVA conducted a two-year impingement study in 2003 and 2004 to evaluate effects of two unit operation on the fish community and update baseline data prior to the restart of Unit 1 (Baxter et al. 2006). To evaluate the effect of the return of Unit 1 and increased generating levels, TVA conducted additional impingement monitoring from September 2007 to September 2009 (TVA 2010). During 2003 to 2004, impinged fish were dominated by threadfin shad (61 percent), freshwater drum (21.2 percent), and gizzard shad (7.8 percent). During 2007 to 2009, impinged fish were dominated by threadfin shad (96 percent) and gizzard shad (2 percent). These studies also concluded that fish impingement at BFN did not have an adverse effect on the fish community of Wheeler Reservoir.

During historical and most recent impingement studies, threadfin shad was the dominant species impinged. Threadfin shad are highly susceptible to thermal shock during the winter, and when this occurs, they become lethargic and are more susceptible to be drawn into the intake and impinged on the traveling screens (EPRI 2008). Highest impingement rates during historical and more recent studies at BFN occurred during this season. EPRI (2008) provided data indicating that during weather related cold shock events, a substantial proportion of threadfin shad were already dead or moribund before being impinged. McLean et al. (1980) found that even after mass mortality from winter die off and impingement occurred in a Tennessee River reservoir, threadfin shad populations quickly rebounded by autumn of each year. Baxter and Buchanan (1998) noted that in standing stock assessments of Wheeler Reservoir, gizzard shad exhibited the highest biomass, followed by threadfin shad and smallmouth buffalo. This provides additional evidence that two of the species that are most prone to impingement continue to persist in abundance in Wheeler Reservoir. The proposed

EPU will not result in an increase in current intake velocities, therefore future impingement impacts should be comparable to historical levels after implementation of the EPU.

7.2.7 Threatened and Endangered Species – Aquatic

Six federally listed endangered and one federally listed threatened aquatic species are known to occur in the vicinity of BFN (Table 7.2-11). The rough pigtoe (*Pleurobema plenum*), spectaclecase (*Cumberlandia monodonta*), and the pink mucket (*Lampsilis abrupta*) are freshwater mussels that occur in sand, gravel, and cobble substrates in large river habitats in the Tennessee River system. These species are now extremely rare and are primarily found in unimpounded tributary rivers and in the more riverine reaches of the largely impounded main stem Tennessee River. In Wheeler Reservoir, most of the remaining large river habitat occurs upstream of BFN. All recent records of these three species are from upstream of BFN (Ahlstedt and McDonough 1992; Garner 1998 and 2001; Gooch et al. 1979; Henson and Pryor 1982; Yokely 1998).

Three federally listed endangered aquatic snails, armored snail (*Pyrgulopsis [=Marstonia] pachyta*), slender campeloma (*Campeloma decampi*), and Anthony's river snail (*Athearnia anthonyi*), and one federally listed threatened fish, the spring pygmy sunfish (*Elassoma alabamae*), are restricted to tributary streams to Wheeler Reservoir, located upstream from BFN (Haggerty and Garner 2008; Garner and Haggerty 2010; Kuhajda et al. 2009). The federally listed threatened spring pygmy sunfish has designated critical habitat in the Beaverdam creek and Pryor branch systems which are upstream tributaries to Wheeler Reservoir (USFWS 2014). No evidence exists to suggest that populations of these species exist in the main stem of the Tennessee River (Wheeler Reservoir), or in tributary streams downstream of BFN. Biological monitoring data and TVA Natural Heritage database indicated no state or federally listed aquatic species have been collected or are currently known to occur within 0.25 miles of BFN; however, state and federally listed aquatic species have been collected in the Tennessee River and tributaries to Wheeler Reservoir within 10 miles of BFN (Table 7.2-11), (TVA 2014).

TVA concludes that the expected impacts from use of cooling towers in combination with possible derating of BFN on thermal conditions for water quality, reservoir stratification, dissolved oxygen (DO) concentrations, eutrophication, and condition of general reservoir biological communities would be minor, insignificant, and within the bounds of the previously permitted thermal discharge of the plant for three-unit operation. Since no state or federally listed aquatic species have been collected or are currently known to occur within 0.25 miles of BFN, no effects to listed species are expected.

TVA's corporate Environmental Policy commits the agency to protecting environmental resources of the Tennessee Valley. TVA's Environmental Principles include assessing the effects of TVA operations to ensure environmental compliance. TVA has monitored aquatic communities within Wheeler Reservoir since 1985 to assure that plant operation does not adversely impact Wheeler Reservoir. In accordance with the NPDES permit and previous commitments (TVA 1999; TVA 2002), TVA will continue monitoring of reservoir conditions. Biological monitoring is performed in order to demonstrate there has not been significant impact on a balanced indigenous population of fish, shellfish, and wildlife, in and on Wheeler Reservoir caused by the alternative thermal limit granted under the NPDES permit in accordance with section 316(a) of the CWA as administered by the ADEM. Biological monitoring results are reported to the State of Alabama in accordance with the NPDES permit.

Table 7.2-11: Aquatic Listed Species Known to Occur Within Tributaries to Wheeler Reservoir, in a 10-Mile Radius of BFN, and From Tennessee River Miles 274.9 to 310.7

Common Name	Federal Status	State Status
Snails		
Anthony's river snail	E	AP
Slender campeloma	E	AP
Armored snail	E	AP
Mussels		
Spectaclecase	E	AP
Pink mucket	E	AP
Rough pigtoe	E	AP
Fishes		
Spring pygmy sunfish	T	AP
Tuscumbia darter		AP
Paddlefish		AP
Southern cavefish		AP

Federal Status Codes: E – Endangered; T – Threatened

State Status Codes: First letter – state designation: A – Alabama. Second letter – status in that state: P – Protected (Alabama) – level of endangerment not specified.

7.2.8 References

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8.0 RADIOLOGICAL ENVIRONMENTAL IMPACTS

8.1 Radiological Waste Streams

The radioactive waste systems at BFN Units 1, 2, and 3 are designed to collect, process, and dispose of radioactive wastes in a controlled and safe manner. These systems are designed to limit discharges in accordance with 10 CFR Part 50, Appendix I. The actual performance and operation of installed equipment, as well as reporting of actual offsite releases and doses, are controlled by the requirements of the Offsite Dose Calculation Manual (ODCM) (TVA 2015). The ODCM is subject to NRC inspection and describes the methods and parameters used for calculating offsite doses resulting from radioactive gaseous and liquid effluents, and ensuring compliance with NRC regulations. Adherence to these limits and objectives would continue under the proposed EPU.

Operation at the proposed EPU conditions would not result in any physical changes to the solid waste, liquid waste, or gaseous waste systems. The safety and reliability of these systems would be unaffected by the proposed EPU. Also, the proposed action would not affect the environmental monitoring of any of these waste streams or the radiological monitoring requirements of the BFN Units 1, 2, and 3, Radiation Protection Program. Under normal operating conditions, the proposed action would not introduce any new or different radiological release pathways and would not increase the probability of an operator error or equipment malfunction that would result in an uncontrolled radioactive release from the radioactive waste streams.

BFN Power Uprate Safety Analysis Report (PUSAR) Section 2.5.5.1, Gaseous Waste Management System, PUSAR Section 2.5.5.2, Liquid Waste Management System, and PUSAR Section 2.5.5.3, Solid Waste Management System, provide an assessment of the effect of the proposed EPU on the gaseous, liquid and solid radioactive waste systems and the associated effluents. The assessment is based on a comparison of ANSI/ANS 18.1-1984 based 10 CFR Part 50 Appendix I type analyses for both pre-EPU and EPU conditions using the ANSI/ANS 18.1-1984 Reference BWR concentrations (Table 8.2-1) as the starting point.

The following subsections summarize the results of additional assessment of the effect of the proposed EPU on radwaste effluents and associated doses to the public. The impact of the EPU on the radwaste gaseous and liquid releases and doses to the public is assessed herein by applying EPU scaling factors (NRC 1979) to the radioactive effluent release and dose information reported in the annual Radioactive Effluent Reports for the years 2009 to 2013 for BFN Units 1, 2, and 3 (TVA 2009; TVA 2010; TVA 2011; TVA 2012; TVA 2013). The average effluent releases for the site for the years 2009 to 2013 are reported in Tables 8.1-2 and 8.1-3. It is noted that the sum of the values for activity and volume, reported in Tables 8.1-1 through 8.1-3, represent the combined operations of BFN Units 1, 2, and 3.

8.1.1 Solid Low Level Radioactive Waste

BFN low-level radioactive waste (LLRW) includes solids from reactor coolant systems, solids in contact with liquids or gases from reactor coolant systems, and solids used in support of reactor coolant systems operation. The majority of BFN solid radioactive waste, as documented in Table 8.1-1, is shipped offsite as dry active waste. This waste is from outages, special projects and normal operations for Units 1, 2, and 3. Normal operations is a major contributor for BFN LLRW shipments due to system cleanup activities. Resin is a major contributor for BFN LLRW shipments as the BFN radwaste system utilizes six waste phase separators and three reactor water cleanup phase separators. On average, BFN has 29 spent resin shipments per year.

BFN LLRW includes resins, filters and evaporator bottoms; dry active waste; irradiated components; other waste (combined packages). These four LLRW categories are documented below in Table 8.1-1 in cubic feet, cubic meters and curies. Table 8.1-1 also presents the total average annual LLRW shipped offsite (2009-2013) as well.

BFN future LLRW shipments for processing and disposal will continue to be similar to those in Table 8.1-1 for the 5 year average annual volumes.

BFN PUSAR Section 2.5.5.3, Solid Waste Management System, provides an evaluation of effects the proposed EPU may have on the solid waste management system for BFN. The results of the evaluation indicate that the proposed EPU will result in a 15 percent increase in the total volume of solid waste generated for shipment offsite.

Assessment performed for this supplemental ER indicates that the activity levels of the solid waste would increase proportionately to the increase in activity of long-lived radionuclides in the reactor coolant with an increase of 5-13 percent. This percentage increase reflects the EPU increase in power level and is based on BFN operation at the current licensed thermal power (CLTP) level of 3,458 MWt and EPU operation at the proposed Target Licensed Thermal Power (TLTP) level of 3,952 MWt. EPU does not generate a new type of waste or create a new waste stream. Therefore, the types of radioactive waste that requires shipment are unchanged. Because the solid waste volume increase is small, the current design and operation of the solid waste management system will accommodate the effects of BFN EPU with no changes. The existing equipment and procedures that control radwaste shipments and releases to the environment will continue to ensure that BFN remains within the applicable regulatory guidance. Therefore, there are no significant environmental effects due to EPU.

Table 8.1-1: BFN Average Annual Low-Level Radioactive Waste Shipped Off Site, 2009-2013

Category of Waste	Cubic Feet	Cubic Meters	Curies
Resins, Filters and Evaporator Bottoms	5.04E+03	1.43E+02	4.74E+02
Dry Active Waste	7.95E+04	2.25E+03	5.03E+00
Irradiated Components	3.44E+01	9.76E-01	1.98E+04
Other Waste (Combined Packages)	4.92E+03	1.39E+02	1.11E+01
Total Average Annual Low-Level Radioactive Waste Shipped Off Site (2009–2013)	8.95E+04	2.53E+03	2.03E+04

8.1.2 Liquid Waste

Liquid radioactive wastes include liquids from the reactor process systems and liquids that have become contaminated with process system liquids. Table 8.1-2 presents liquid releases from BFN Units 1, 2 and 3 for the 5 year period from 2009 through 2013. As noted in Table 8.1-2, approximately 289 million liters and 8.0 Ci fission and activation products were released in an average year. The 5 year average includes abnormal releases in 2009, 2010, and 2012. The abnormal releases included the activity from F-18 (T1/2 - 110 minutes). There is significant transit time between the effluent point of release and the nearest water purification facility intake. The abnormal releases are included in the basis for this assessment, but are not expected to occur. If the abnormal releases were excluded the yearly average would be 0.26 Ci.

As indicated in BFN PUSAR Section 2.5.5.2, Liquid Waste Management System, the volume of liquid waste effluents is expected to increase by approximately 3.44 percent due operation at EPU conditions. The increased flow in the condensate demineralizers requires more frequent backwashes due to increased loading of soluble and insoluble species. The total volume of liquid waste (a 3.44 increase of pre-EPU volume) does not significantly challenge the radwaste system's capacity. Therefore, EPU does not have an adverse effect on the processing of liquid and solid radwaste.

The assessment performed indicates that the proposed EPU would have the following impact on the equilibrium radioactivity in the reactor coolant, which would in turn impact the concentrations of radioactive nuclides in the waste management systems. Consistent with ANSI/ANS-18.1-1984, the expected equilibrium concentration of tritium in the reactor coolant and steam is not dependent upon the thermal power level. The inventory of radionuclides with long half-lives increase by approximately 13 percent (due to the power increase). The iodine concentration in reactor coolant would increase by approximately 5 percent.

The assessment performed herein addresses the expected increase due to the EPU based on the reported average annual releases during this five-year period. Consistent with NUREG-0016, the expected total annual release of tritium is a function of the power level. Therefore, the annual release of tritium is expected to increase by approximately 15 percent. The concentration of non-tritiated activity in the reactor coolant system would increase by approximately 13 percent which would result in an estimated annual release of non-tritiated activity of 9.04 Curies.

The assessment also concluded that the projected releases following EPU discussed herein remain bounded by values provided in the BFN PUSAR, which are based on 10 CFR Part 50 Appendix I type analysis that used the radioactive and volumetric source terms identified in ANSI/ANS-18.1-1984. The existing equipment and procedures that control releases to the environment will continue to ensure that BFN remains within applicable limits. There are no significant environmental effects due to EPU.

Section 8.2 addresses the offsite radiation dose consequences of the EPU liquid effluent releases.

Table 8.1-2: Liquid Effluent Releases From BFN, 2009–2013

Year	Volume of Waste Released (Liters)	Activity Released (Ci)	Tritium (Ci)
2009	7.09E+06	3.48E+01[(1)]	8.43E+01[(2)]
2010	1.57E+06	3.82E+00[(1)]	1.09E+01[(2)]
2011	1.98E+06	1.47E-02	5.21E+00
2012	1.39E+09[(3)]	7.81E-02[(1)]	9.58E+00[(2)]
2013	4.40E+07	1.26E+00	8.79E+01
Annual Average	2.89E+08	8.00E+00	3.96E+01

Notes:

1. The sum of the activity released would be 1.99E-02 Ci(2009), 4.13E-03 Ci(2010), and 9.43E-04 Ci(2012) if F-18 from abnormal releases were excluded. The 5-year annual average includes abnormal F-18 releases.
2. The sum of the activity released would be 1.15E+01 Ci(2009), 2.82E+00 Ci(2010), and 1.41E+00 Ci(2012) if H-3 from abnormal releases were excluded. Abnormal releases were included in the 5-year annual average for tritium.
3. The sum of the volume released would be 2.65E+05 Liters(2012) if the volume from abnormal releases were excluded.

8.1.3 Gaseous Waste

Gaseous radioactive wastes mainly include activation gases and fission product radioactive noble gases vented from process equipment and, under certain circumstances, building ventilation exhaust air. Table 8.1-3 presents gaseous releases from BFN Units 1, 2, and 3 from 2009 through 2013. The evaluation presented in BFN PUSAR section 2.5.5.1, Gaseous Waste Management System, indicates that implementation of the proposed EPU does not significantly increase the inventory of nonradioactive carrier gases, such as air, normally processed in the gaseous waste management system. This is because plant system functions are not changing and the volume inputs remain the same.

Calculations of steam activity consistent with NUREG-0016 show that the activity of fission gases is not increased; however, iodine increases by approximately 5 percent and particulates increase approximately 13 percent. Consistent with NUREG-0016, the expected total annual release of tritium is a function of the power level. Therefore, the annual release of tritium is expected to increase by approximately 15 percent. The dose for the different types of airborne releases have been consistently less than 2 percent (TVA 2009; TVA 2010; TVA 2011; TVA 2012; TVA 2013) of the allowable limits. Increasing all of the activity by 15 percent would result in doses which are still less than 2 percent of the allowable limits.

The gaseous effluents are well within limits at original power operation and will remain well within limits following implementation of EPU. There are no significant environmental effects due to EPU.

Table 8.1-3: Gaseous Effluent Releases From BFN, 2009–2013

Year	Fission and Activation Gases (Ci)	Particulates (T1/2> 8 Days) (Ci)	Iodines (Ci)	Tritium (Ci)	C-14 (Ci)
2009	None Detected	2.04E-04	1.35E-03	9.55E+01	None Reported
2010	None Detected	1.03E-03	7.51E-03	3.13E+02	3.52E+01
2011	1.09E-02	5.98E-03	8.36E-03	9.74E+01	3.45E+01
2012	6.93E+02	2.55E-03	8.42E-03	5.97E+02	3.61E+01
2013	None Detected	4.37E-02	5.01E-03	2.87E+02	3.71E+01
Annual Average	1.39E+02	1.07E-02	6.13E-03	2.78E+02	2.86E+01

8.1.4 Spent Fuel

The proposed EPU would increase the average batch size of fuel assemblies needed for a refueling. The impact of EPU on spent fuel storage is that the number of dry storage casks required would increase by approximately 19 percent with EPU implementation. Casks will be loaded to maintain adequate spent fuel pool capacity. Implementation of the independent spent fuel storage installation (ISFSI) was reviewed as part of the TVA FSEIS for license renewal of the three units and restart of BFN Unit 1 (TVA 2002). BFN's proposed plans for an ISFSI dry storage facility included sufficient expansion room to accommodate uncertainty in the DOE schedule for a national repository and additional storage required for license extension, three unit operation, and EPU implementation (TVA 2002). The additional spent fuel would be accommodated in the independent spent fuel storage installation pending shipment of the waste to a permanent disposal facility. Therefore, there are no significant effects on the environment due to EPU.

8.2 Radiation Levels and Offsite Doses

8.2.1 Occupational Radiation Dose (Onsite Dose)

During power operation, the radiation sources in the core are directly related to the fission rate. These sources include radiation from the fission process, accumulated fission products and neutron reactions as a secondary result of fission. Historically, these sources have been defined in terms of energy or activity released per unit of power. Therefore, for a constant pressure power uprate (CPPU), the percent increase in the operating source terms is no greater than the percent increase in power. Core radiation sources increase proportional to the increase in reactor power. Radiation sources in the reactor coolant include activation products, activation corrosion products, and fission products. Scaling factors for major dose contributors were calculated for normal and post-accident doses to address EPU conditions. Normal operation scaling factors were calculated for direct radiation from the core, off-gas, reactor liquid coolant (fission products, activation products, and N-16), the reactor steam, (N-16), Turbine Building (N-16), the reactor water cleanup system (RWCU), and the condensate demineralizers. The calculations are based upon the alternate source term analysis and AREVA ATRIUM-10XM fuel. The EPU scaling factors were applied to the BFN dose calculations to evaluate the impact of EPU implementation.

As indicated in BFN PUSAR Section 2.10.1.2, Occupational and Onsite Radiation Exposure, the normal operation radiation levels increase slightly under EPU conditions. Plant shielding is designed to provide for personnel access to the plant to perform maintenance and carry out operational duties with personnel exposures limited to the criteria established by 10 CFR Part 20. Evaluations at the uprated power level conclude that the pre-uprate values for activity still bound the uprated values. Thus, the increase in radiation levels does not affect radiation zoning or shielding in the various areas of the plant, because it is offset by conservatism in the original design, source terms used, and analytical techniques.

In-plant radiation levels and associated doses are controlled by the BFN Radiation Protection Program to ensure that internal and external radiation exposures to station personnel, and the general population will be as low as reasonably achievable (ALARA), as required by 10 CFR Part 20. The TVA policy is to maintain occupational doses to individuals and the sum of dose equivalents received by all exposed workers ALARA.

Individual worker exposures can be maintained within acceptable limits by controlling access to radiation areas using the site ALARA program. Procedural controls compensate for increased radiation levels. In addition, BFN has previously implemented zinc injection and noble metal chemical addition to limit the increase in normal radiation doses from the implementation of hydrogen water chemistry.

Post-uprate radiation levels in most areas of the plant are expected to increase by no more than the percentage increase in power level. In a few areas near the reactor water piping and liquid radwaste equipment, the increase could be slightly higher due to the increase in production of activated corrosion products. Access to these areas is strictly controlled by existing Radiation Protection procedures. Individual worker exposures are maintained within acceptable limits by controlling access to radiation areas using the site ALARA program. Procedural controls compensate for increased radiation levels. Therefore, no new dose reduction programs are planned and the ALARA program would continue in its current form. Therefore, there are no significant effects on occupational radiation dose due to EPU.

8.2.2 Radiological Impacts Normal Operation (Offsite Dose)

Using scaling techniques of NUREG-0016, this analysis conservatively projects maximum doses from normal operation under the proposed EPU conditions taking into consideration the following:

- The reported gaseous and liquid effluent and dose data during that period
- NUREG-0016 equations and assumptions
- Conservative methodology

Pre-EPU dose estimates are calculated by taking the average 5 year annual organ and whole body dose values for gaseous and liquid effluents during the period from 2009 through 2013 - (TVA 2009; TVA 2010; TVA 2011; TVA 2012; TVA 2013). To predict doses under the proposed EPU conditions, the analysis assumes that the maximum increase in radioactivity content of the liquid and gaseous releases is related to the maximum percentage change per chemical class (NRC 1979) in the reactor and steam coolants over that of the pre-EPU case. To conservatively estimate the offsite dose due to EPU the average value from the annual radioactive effluent release reports is increased by a factor of 1.2.

Following EPU, TVA predicts that the maximum annual total body and organ doses (all pathways) from liquid effluent releases would increase slightly. As demonstrated in Table 8.2-1, the estimated EPU doses due to liquid effluents are significantly below the ODCM and EPA limits. Following EPU, TVA predicts that the maximum annual total body and organ doses (all pathways) from gaseous effluent releases would increase slightly. As demonstrated in Table 8.2-2, the estimated EPU doses due to gaseous effluents are significantly below the ODCM and EPA limits.

The current ISFSI storage pad is projected to be filled on or before 2022, prior to being loaded with EPU fuel. An additional storage pad is anticipated to be required, even if no EPU is approved. ISFSI dose contributions will continue to be monitored using the ODCM process.

The offsite doses due to the ISFSI would be negligibly affected by storage of EPU fuel, as changes in neutron and gamma sources are primarily a function of fuel burn up and cooling time rather than power.

Under pre-EPU conditions, direct radiation measurements made at the site boundary measured by environmental dosimeters deployed around BFN as part of the offsite Radiological Environmental Monitoring Program (REMP) indicated no increase in ambient radiation levels from plant operation. This is expected to continue under EPU conditions.

For CPPU, normal operation gaseous activity levels increase slightly while the level of N-16 in the turbine increase proportional to the rated steam flow. The increased steam flow rate and velocity result in shorter travel time to the turbine and less radioactive decay in transit. This leads to higher radiation levels in and around turbines and offsite skyshine. The typical shielding design more than adequately bounds increases due to power uprate. Although implementation of EPU increases the skyshine component to the offsite doses up to 32 percent due to N-16 in the equipment above grade, the expected post-EPU increase in the in-plant radiation exposure in the turbine building complex has a negligible effect on the estimated doses to members of the public. The turbine building concrete shielding and distance between the turbine building and offsite boundary are such that the post-EPU direct dose contribution from the steam components in the turbine building is negligible. The post-EPU N-16 skyshine dose rate at the nearest boundary is expected to be near the background radiation level. Therefore, it does not significantly impact the total estimated doses to members of the public.

A review was performed to determine the highest dose to a member of the public within the site boundary. The dose to a member of the public consists of the sum of dose commitments from effluent releases as well as any direct radiation dose. The gaseous effluent dose commitment is negligible compared to the direct radiation dose. The direct radiation dose was determined from area environmental dosimeters located onsite. It consisted of gamma dose from the plume, ground contamination, and from equipment sources (i.e., tanks, turbine shine, radioactive material storage areas, etc.). The critical location was determined to be an environmental dosimeter near the Livewell Center (Training Center). The average annual direct radiation dose accounting for background and occupancy was 0.87 mrem during the period of 2009 through 2013. It can be concluded that the dose limit for a member of the public at the site boundary as specified in 10 CFR 20.1301 would not be exceeded even at the projected 32 percent increase due to skyshine from N-16 after EPU.

The 40 CFR Part 190 annual whole body dose limit of 25 mrem to any member of the public includes the following:

- Contributions from direct radiation (including skyshine) from contained radioactive sources within the facility
- Whole body dose from liquid release pathways
- Whole body dose to an individual via airborne pathways

Taking into consideration the magnitude of the estimated annual EPU doses due to gaseous and liquid effluent releases and the negligible direct shine dose contribution from components within the facilities, ISFSI and skyshine, it is concluded that the 40 CFR Part 190 whole body dose limit of 25 mrem/yr will not be exceeded by operation at EPU conditions. Therefore, there are no significant effects on the environment due to EPU.

Table 8.2-1: Average Offsite Dose Commitments From Liquid Effluents

Type of Dose	ODCM Limit (mrem/year)	EPA Limit (mrem/year)	2009–2013 Average Annual Dose (mrem)	Projected Annual Dose (mrem)	Percentage of ODCM Limit Current / Projected (%)	Percentage of EPA Limit Current / Projected (%)
Total Body	3	25	0.014	0.0168	0.47 / 0.56	0.056 / 0.067
Any Organ	10	25	0.0204	0.0245	0.20 / 0.25	0.082 / 0.098

Table 8.2-2: Average Offsite Dose Commitments From Gaseous Effluents

Type of Dose	ODCM Limit (mrem/year)	EPA Limit (mrem/year)	2009–2013 Average Annual Dose(mrem)	Projected Annual Dose (mrem)	Percentage of ODCM Limit Current / Projected (%)	Percentage of EPA Limit Current / Projected (%)
Gamma Dose in Air (mrad)	10	25	2.28E-6	2.74E-6	0.000023 / 0.000027	0.000009 / 0.000011
Beta Dose in Air (mrad)	20	25	1.54E-6	1.85E-6	0.000008 / 0.000009	0.000006 / 0.000008
Any Organ (mrem)	15	25	9.83E-2	1.18E-1	0.66 / 0.79	0.39 / 0.47

8.3 Radiological Consequences of Accidents

8.3.1 Radiological Impacts—Accident Related

The radiological consequences resulting from the postulated designed basis accidents (DBAs) of loss of coolant accident, main steam line break accident, fuel-handling accident, and the control rod drop accident have been evaluated using NRC accepted methods. The results indicate existing regulatory requirements would continue to be met. Table 8.3-1 presents a summary of the radiological consequences of these postulated DBAs.

On July 31, 2002, in accordance with the provisions of 10 CFR 50.4 and 10 CFR 50.90, TVA submitted a request for a license amendment that supports a full scope application of an Alternative Source Term (AST) methodology for BFN Units 1, 2, and 3. This request was approved on September 27, 2004 (ML042730028). Full scope AST analyses were performed following the guidance in Regulatory Guide 1.183, Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors and Standard Review Plan Section 15.0.1, "Radiological Consequences Analyses using Alternative Source Terms." AST analyses were performed for the four Updated Final Safety Analysis Report (UFSAR) Chapter 14 BFN DBAs that could potentially result in offsite doses, those previously mentioned above. The core inventory assumed for these analyses consisted of choosing the bounding value of each isotope between GE14 fuel and AREVA's ATRIUM-10 fuel at EPU conditions. Subsequent evaluations have shown that the ATRIUM-10XM core inventory is bounded by the combined GE14/ATRIUM-10 source term. Bounding results appear in Table 8.3-1.

The analyses demonstrated that using AST methodologies, post-accident offsite doses remain within regulatory limits.

Table 8.3-1: Summary of Radiological Consequences of Postulated Accidents

	Offsite Dose at Exclusion Area Boundary (Rem TEDE)		Offsite Dose at Low Population Zone (Rem TEDE)	
Design Basis Accident	**Value**	**Limit**	**Value**	**Limit**
Loss of Coolant (LOCA)	1.71	25	2.38	25
Main Steam Line Break				
3.2 µCi/g DE I-131	0.13	2.5	0.07	2.5
32 µCi/g DE I-131	1.30	25	0.65	25
Fuel Handling	0.86	6.3	0.43	6.3
Control Rod Drop	1.17	6.3	0.70	6.3

Notes:
Rem = Roentgen Equivalent Man
TEDE =Total Effective Dose Equivalent
µCi/g = micro Curies per gram
DE = Dose Equivalent
I-131 = Iodine 131

8.4 References

ANSI/ANS 18.1 - 1984. American National Standard Radioactive Source Term for Normal Operation of Light Water Reactors.

NRC (U.S. Nuclear Regulatory Commission). 1979. *Calculation of Releases of Radioactive Materials I Gaseous and Liquid Effluents from Boiling Water Reactors*. (BWR-GALE CODE). NUREG-0016, January 1979. Accession No. ML091910213.

NRC 2000. Regulatory Guide 1.183. *Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors*.

TVA (Tennessee Valley Authority). 2002. *Final Supplemental Environmental Impact Statement for Operating License Renewal of the Browns Ferry Nuclear Plant in Athens, Alabama*. March 2002.

TVA. 2009. Browns Ferry Nuclear Plant Units 1, 2, and 3 2009 Radiological Impact Assessment Report, January 1, 2009 through December 31, 2009. Accession No. ML101260470

TVA. 2010. Browns Ferry Nuclear Plant Units 1, 2, and 3 2010 Radiological Impact Assessment Report, January 1, 2010 through December 31, 2010. Accession No. ML111250450.

TVA. 2011. Browns Ferry Nuclear Plant Units 1, 2, and 3 2011 Radiological Impact Assessment Report, January 1, 2011 through December 31, 2011. Accession No. ML12123A017.

TVA. 2012. Browns Ferry Nuclear Plant Units 1, 2, and 3 2012 Effluent and Waste Disposal Report, January 1, 2012 through December 31, 2012. Accession No. ML13126A100.

TVA. 2013. Browns Ferry Nuclear Plant Units 1, 2, and 3 2013 Annual Radioactive Effluent Release Report, January 1, 2013 through December 31, 2013. Accession No. ML14122A344.

TVA. 2015. Tennessee Valley Authority Browns Ferry Nuclear Plant Offsite Dose Calculation Manual, 0-ODCM-001, Revision 22. Browns Ferry Nuclear Plant. February 17, 2015.

9.0 ENVIRONMENTAL EFFECTS OF URANIUM FUEL CYCLE ACTIVITIES AND FUEL AND RADIOACTIVE WASTE TRANSPORT

Table S-3 of 10 CFR 51.51 provides the basis for evaluating the contribution of the environmental effects of the uranium fuel cycle to the environmental impacts of licensing nuclear power plants. Summary Table S-4 of 10 CFR 51.52 lists the environmental impacts of transporting nuclear fuel and waste to and from one light-water-cooled nuclear power plant under both normal conditions and accidents. However, since the 1970s when these tables were developed, most nuclear plants have increased both uranium-235 enrichment and fuel burnup limits, which are fundamental parameters that affect environmental impacts of the uranium fuel cycle, including transport.

In 1988, the NRC generically evaluated the impacts of increased enrichment and extended burnup fuel on the uranium fuel cycle, including transportation of nuclear fuel and wastes, to determine whether higher burnup and enrichment could result in environmental impacts greater than those described in Tables S-3 and S-4. The EA and FONSI (53 FR 6040) concluded that uranium enrichments up to 5 percent uranium-235 and burnup limits of up to 60,000 MWd/MTU would have no significant adverse environmental effects on the uranium fuel cycle or the transport of nuclear fuel and wastes, and would not change the impacts presented in Tables S-3 and S-4.

In 1999, in connection with the generic EIS (GEIS) for license renewal of nuclear power plants, the NRC examined the transport of spent fuel having higher initial enrichment (up to 5 percent) and higher discharge burnup (up to 62,000 MWd/MTU) to a geologic repository (NRC 1999). The conclusion of that evaluation was that the environmental impacts would be consistent with the values presented in Table S-4 and that the impacts in Table S-4 are bounding.

Increasing the electrical output of a BWR power plant is accomplished primarily by generating higher steam flow in the reactor and supplying it to the turbine generator. The higher steam flow is achieved by increasing the reactor power level and the feedwater flowing to the reactor. The additional reactor energy requirements for EPU are met primarily by increasing the reload fuel batch size and changing the fuel loading pattern and planned deployment of fuel enrichment and burnable poison, supplemented by adjustments to core management control rod pattern and/or core flow. The increase in core thermal power is achieved with a more uniform (flattened) power distribution such that EPU does not require any changes to fuel design limits.

Design studies project that, compared with the current re-load batch size at the current power level, EPU will require more assemblies per re-load, resulting in a slight increase in cycle dose associated with the production, handling, and storage of more fresh and spent fuel. However, because the burn-up limit is unchanged (the upper exposure limit is bounded by maintaining the fuel within the NRC-approved vendor-specific exposure limits) for EPU, and the U-235 enrichment limit of 5 percent also remains the same, the BFN fuel cycles will remain bounded by the impacts listed in Tables S-3 and S-4 of 10 CFR Part 51. For the purpose of bounding the impacts, TVA used a range of fuel vendor specifications for this analysis. TVA concludes, therefore, that impacts to the uranium fuel cycle and transport of nuclear fuel from the proposed action would be insignificant and not require mitigation.

While the analysis discussed above was based on a range of fuel vendor specifications, the analysis discussed below is based on a single vendor, TVA’s current fuel vendor for Units 1, 2, and 3, AREVA NP.

On February 14, 2001, TVA published a notice of adoption in the *Federal Register* for the FEIS, "Disposition of Surplus Highly Enriched Uranium," prepared by the U.S. Department of Energy (DOE), Office of Fissile Materials. TVA's actions related to the preferred alternative include entering into an interagency agreement with DOE to obtain approximately 33 metric tons of highly enriched uranium (HEU) for blend down and subsequently to use the low enriched uranium (LEU) in the form of nuclear reactor fuel at BFN. TVA actions related to the preferred alternative also include entering into contracts with a consortium composed of AREVA NP of Lynchburg, Virginia and Richland, Washington, and Nuclear Fuel Services of Erwin, Tennessee, to process and blend the uranium and to fabricate the fuel. After analysis of the adequacy and applicability and subsequent adoption of the DOE's FEIS, and following recirculation of the DOE's FEIS and consideration of public comments received on its adoption by TVA, TVA decided to implement the actions (as described above) related to the preferred alternative identified in DOE's FEIS. The decision was based on the substantial savings to TVA ratepayers in nuclear fuel costs in the years 2005–2015 without significantly impacting the environment, and that the environmental impacts associated with producing and transporting an equivalent amount of LEU from 14 million pounds of natural uranium (as U_3O_8) that, in turn, would require mining of 140,000 tons of ore would be avoided. The ROD for this action was published in the *Federal Register* on November 19, 2001 (66 FR 57997). The first fuel resulting from these processing, blending, and fabrication contracts was loaded into Unit 2 during the spring 2005, and the last full reload is expected to occur in the fall 2016 in Unit 1. (There may be partial core reloads later, depending on material availability, which may or may not occur during EPU operations.)

For blended low enriched uranium (BLEU) fuel, there is a higher percentage of the uranium-236 (U-236) isotope than for virgin uranium. U-236 is a neutron poison, requiring the enrichment to be increased as a compensation for reactivity loss. For fresh fuel with BLEU, the number of assemblies to be shipped increases, and the associated handling doses are increased due to the presence of the U-236 (surface contact source term increases from 4 to 8 mR/hr with commercial grade uranium to 10 to 15 mR/hr with BLEU). However, because the maximum enrichment and discharge burnup remain within the 5 percent and 62,000 MWd/MTU limits, respectively, the BFN fuel cycles with BLEU will still remain bounded by the impacts of Tables S-3 and S-4 of 10 CFR Part 51.

9.1 References

53 FR 6040. Extended Burnup Fuel Use in Commercial LWRs; Environmental Assessment and Finding of No Significant Impact. *Federal Register* 53:6040 (.

66 FR 57997. Blending of Surplus Highly Enriched Uranium From the Department of Energy, to Low Enriched Uranium for Subsequent Use as Reactor Fuel at the Tennessee Valley Authority's Browns Ferry Nuclear Plant. *Federal Register* 66:57997 (November 19, 2001).

NRC (U.S. Nuclear Regulatory Commission). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Vol. 1, Addendum 1, Main Report Section 6.3—Transportation, Table 9.1 Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants. August 1999.

10.0 EFFECTS OF DECOMMISSIONING

In 2002, NRC published NUREG-0586, Supplement 1, *Final GEIS on Decommissioning of Nuclear Facilities*, that discusses decommissioning of nuclear power reactors. The conclusion of NUREG-0586, Supplement 1, is that the environmental impacts of decommissioning are generally small and that only two environmental issues would require site specific evaluation: threatened and endangered species and environmental justice. (NRC 2002)

Prior to the projected end of operations, TVA would submit a preliminary decommissioning plan describing decommissioning activities, any environmental impacts of those activities, a schedule, and estimated costs. Implementation of EPU does not affect the ability of TVA to maintain sufficient financial reserves for decommissioning.

The slight potential for increase in environmental impacts due to decommissioning attributable to EPU is due to increases in the feedwater flow rate and increased neutron fluence. These increases in flow rate and neutron fluence could increase the amount of activated reactor vessel and corrosion products, respectively, and consequently, increase post-shutdown radiation levels. However, increases in radiation levels are expected to be insignificant, and would be addressed in the post-shutdown decommissioning activities report.

10.1 References

NRC (U.S. Nuclear Regulatory Commission). 2002. Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors. NUREG-0586, Supplement 1. Volume 1: Main Report, Appendices A through M.

ENCLOSURE 7

Supplement to BFN EPU LAR, Attachment 44, Probabilistic Risk Assessment

CONTENTS

1.0 EXECUTIVE SUMMARY

Tennessee Valley Authority (TVA) has proposed to uprate Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3 from the current licensed thermal power (CLTP) to approximately 120 percent of the original licensed thermal power (OLTP). The material modification will uprate each BFN unit electrical output by approximately 155 megawatts (MW). TVA performed an Interconnection System Impact Study (SIS) for the extended power uprate (EPU) of all three BFN units. The Interconnection SIS documents the transmission system and BFN main generator excitation system upgrades required to support the BFN EPU. Modification to the BFN main generator excitation system potentially affects the initiating event frequency used in the probabilistic risk assessment (PRA) previously performed for the BFN EPU project. This addendum serves to document evaluation of the effect on the PRA conclusion for the proposed main generator excitation system upgrades.

2.0 INTRODUCTION

The existing BFN main generator excitation system uses an alternating current (AC) generator to supply power to a rectifier assembly which produces a direct current (DC) output. The resultant DC voltage is supplied to the generator field via brushes and collector rings. The automatic voltage regulator (AVR) controls the output of exciter. The existing excitation system (AVR, AC generator, and rectifier) are to be replaced with an AVR/static exciter and dry transformer. The new excitation system will provide the field current directly to the brushes and collector rings eliminating the need for the rotating exciter.

BFN License Amendment Request (LAR) Attachment 44, Section 4.1.1, Initiating Events, describes the transient initiators and initiator frequencies. BFN LAR Attachment 44, Section 5.7, Sensitivity Analysis and Uncertainties, describes the effect of varying the frequency of the turbine trip transient initiator on the PRA results and conclusions. Replacing the main generator excitation system potentially affects the turbine trip transient initiator frequency.

In the TVA response to NRC request for additional information (RAI) APLA-RAI 08 (Reference 1), a combined sensitivity case was calculated to assess the sensitivity of the base core damage and large early release risk and change in core damage and large early release risk to a simultaneous increase in the annual frequency of several initiating events. In particular, the annual frequency of turbine trip (0.436/yr) was increased by 15% to account for possibility of more turbine trips resulting from operating at EPU conditions. Calculations supporting response to APLA-RAI 08 from Reference 1 showed that the combined sensitivity is within RG 1.174 risk acceptance guidelines. This combined sensitivity case did not include changing the rotating brush exciter to a static exciter.

3.0 ANALYSIS

The proposed static excitation system has a projected mean time between failure (MTBF) of 72 years (yr). Converted to a frequency, the failure frequency of the static excitation system is 1.4E-2/yr. The failure frequency for the existing excitation system (AVR and rotating exciter assembly) is not available, however the failure frequency for a like-kind, more reliable AVR is available. The MTBF of this more reliable version is used as a surrogate MTBF for the existing excitation system. The MTBF for the surrogate AVR is 61 years. Converted to a frequency, this reported failure frequency of the surrogate AVR is 1.6E-2/yr which, for the purpose of this analysis, is used as the failure frequency of the entire existing excitation system.

The failure frequency of the proposed static excitation system is lower than the failure frequency applied to the existing excitation system and therefore would be more reliable than the existing system. As a result, the turbine trip frequency in calculations supporting BFN EPU LAR Attachment 44 is conservative and is not increased by the proposed static excitation system modification.

4.0 CONCLUSION

Replacing the existing rotating brush exciter with a static excitation system does not result in a baseline risk increase nor a change in risk from CLTP to EPU power. The static excitation system is more reliable than the current excitation system. The effect of changing the turbine trip frequency due to replacing the excitation system is bounded by the sensitivity case presented to the NRC in response to APLA-RAI 08 (Reference 1).

5.0 REFERENCES

1. Letter from TVA to NRC, CNL-16-077, "Proposed Technical Specifications (TS) Change TS-505 - Request for License Amendments - Extended Power Uprate (EPU) - Supplement 14, Responses to Requests for Additional Information," dated April 27, 2016 (ML16118A298)

~~Withhold from Public Disclosure Under 10 CFR 2.390~~

ENCLOSURE 8

**Supplement to BFN EPU LAR, Attachment 6, NEDC-33860P,
Safety Analysis Report for Browns Ferry Nuclear Plant Units 1, 2, and 3
Extended Power Uprate, Section 2.5.1.2.2**

(Proprietary version)

ENCLOSURE 9

Supplement to BFN EPU LAR, Attachment 6, NEDO-33860P,
Safety Analysis Report for Browns Ferry Nuclear Plant Units 1, 2, and 3
Extended Power Uprate, Section 2.5.1.2.2

(Non-proprietary version)

GE HITACHI GE Hitachi Nuclear Energy

NEDO-33860
Revision 0
September 2015

Non-Proprietary Information – Class I (Public)

SAFETY ANALYSIS REPORT
FOR
BROWNS FERRY NUCLEAR PLANT
UNITS 1, 2, AND 3
EXTENDED POWER UPRATE

The spent fuel pool system is located in the reinforced concrete Reactor Building. There is no large normally operating rotating equipment adjacent to the spent fuel pool. Dynamic effects and missiles that might result from plant equipment failures in the vicinity of the spent fuel pool have not changed with respect the plant's current design.

The review criterion specified in Matrix 5 of RS-001 is applicable to EPUs that result in substantially higher system pressures or changes in existing system configuration. Pressure does increase in the condensate and feedwater systems. However, the areas of increased pressure are not in the vicinity of SSCs important to safety as defined by RG 1.115 Appendix A. The Browns Ferry EPU does not create any condition resulting in an increase in probability of the generation of internal missiles. In addition, the Browns Ferry EPU does not entail any changes in equipment configurations that could change the effect of internally generated missiles on important-to-safety equipment. Therefore, internally generated missiles meet all CLTR dispositions.

Conclusion

TVA has evaluated changes in system pressures, configurations, and equipment rotational speeds necessary to support the proposed EPU. The evaluation indicates that SSCs important to safety will continue to be protected from the effects of internally generated missiles in accordance with draft GDC-40. Therefore, the proposed EPU is acceptable with respect to the protection of SSCs important to safety from internally generated missiles.

2.5.1.2.2 Turbine Generator

Regulatory Evaluation

The turbine control system, steam inlet stop and control valves, low pressure turbine steam intercept and inlet control valves control the speed of the turbine under normal and abnormal conditions, and are thus related to the overall safe operation of the plant.

The NRC's acceptance criteria for the turbine generator are based on GDC-4, and relates to protection of SSCs important to safety from the effects of turbine missiles by providing a turbine overspeed protection system (with suitable redundancy) to minimize the probability of generating turbine missiles.

Specific NRC review criteria are contained in SRP Section 10.2.

Browns Ferry Current Licensing Basis

The General Design Criteria (GDC) listed in RS-001 are those currently specified in 10 CFR 50, Appendix A. The applicable Browns Ferry Nuclear Plant (Browns Ferry) principal design criteria predate these criteria. The Browns Ferry principal design criteria are listed in UFSAR Section 1.5, "Principal Design Criteria." In 1967, the AEC published for public comment a revised set of proposed General Design Criteria (Federal Register 32FR10213, July 11, 1967). Although not explicitly licensed to the AEC proposed General Design Criteria published in 1967, the Tennessee Valley Authority (TVA) performed a comparative evaluation of the design basis of Browns Ferry with the AEC proposed General Design Criteria of 1967. The Browns Ferry UFSAR, Appendix A, "Conformance to AEC Proposed General Design Criteria," contains this comparative evaluation. This evaluation discusses each of the groups of criteria set out in the July 1967 AEC release. For each group of criteria, there is a statement of TVA's understanding of the intent of the criteria in that group and a discussion of the plant design conformance with the intent of the group of criteria. Following a restatement of each of the proposed criteria is a table of references to locations in the Browns Ferry UFSAR where there is subject matter relating to the intent of that particular criteria.

While Browns Ferry is not generally licensed to the final GDC or the 1967 AEC proposed General Design Criteria, a comparison of the final GDC to the applicable AEC proposed General Design Criteria can usually be made. For the final GDC listed in the Regulatory Evaluation above, the Browns Ferry comparative evaluation of the comparable 1967 AEC proposed General Design Criteria (referred to here as "draft GDC") is contained in Browns Ferry UFSAR Appendix A: draft GDC-40.

The turbine generator is described in Browns Ferry UFSAR Sections 11.2, "Turbine-Generator," and 7.11, "Pressure Regulator and Turbine-Generator Control."

Systems and system component materials of construction, operating history, and programs used to manage aging effects were evaluated for plant license renewal and documented in the Browns Ferry License Renewal Safety Evaluation Report (SER), NUREG-1843, dated April 2006 (Reference 11). The license renewal evaluation associated with the turbine generator is documented in NUREG-1843, Section 2.3.4. Management of aging effects on the turbine generator is documented in NUREG-1843, Section 3.4.

Technical Evaluation

NEDC-33004P-A, Revision 4, "Constant Pressure Power Uprate," Class III, July 2003 (also referred to as CLTR) was approved by the NRC as an acceptable method for evaluating the effects of EPUs. Section 7.1 of the CLTR addresses the effect of EPU on the turbine-generator. The results of this evaluation are described below.

The topics addressed in this evaluation are:

Topic	CLTR Disposition	Browns Ferry Result
Turbine-Generator Performance	Plant Specific	Meets CLTR Disposition

The turbine-generator converts the thermal energy in the steam into electrical energy. The increase in thermal energy and steam flow from the reactor is translated to an increased electrical output from the station by the turbine-generator. The increase in steam flow can also change the previous missile avoidance and protection analysis (See Section 2.5.1.2.1).

The turbine-generator is required for normal plant operation and is not safety-related. Experience with previous power uprate applications indicates that turbine and generator modifications (e.g., turbine rotating element modification) are required to support power uprate. These modifications are required to support normal operation and are non-safety related. The turbine-generator overspeed protection systems were evaluated to ensure that adequate protection is provided for EPU conditions.

The turbine and generator were originally designed with a maximum flow-passing capability and generator output in excess of rated conditions to ensure that the original rated steam-passing capability and generator output were achieved. This excess design capacity ensured that the turbine and generator meet rated conditions for continuous operating capability with allowances for variations in flow coefficients from expected values, manufacturing tolerances, and other variables that may adversely affect the flow-passing capability of the units. The difference in the steam-passing capability between the design condition and the rated condition is called the flow margin.

At CLTP and at a reactor dome pressure of 1,050 psia, the main turbines operate with a current rated throttle steam flow of 14.153 Mlbm/hr at a throttle pressure of 1,000 psia. The generators are rated at 1,280 MVA at a power factor of 0.9.

At EPU RTP and at a reactor dome pressure of 1,050 psia, the main turbines will operate with a rated throttle steam flow of 16.44 Mlbm/hr at a throttle pressure of 983 psia. The original Browns Ferry main generators were rewound in anticipation of uprating the power. The reactive capability curves are shown in Figures 2.5-2a (Unit 1) and 2.5-2b (Units 2 and 3). The current main generators are rated as follows for EPU:

- Unit 1: 1,330 MVA at a 0.95 power factor
- Units 2 and 3: 1,332 MVA at a 0.93 power factor

The existing HP turbine for each Browns Ferry unit is not capable of passing the required EPU steam flow rate and will be replaced prior to EPU. The new HP turbine section has been designed with an effective throttle flow margin of 5 percent above the required EPU throttle flow. The design point of the new HP turbine included the flow margin in order to ensure that the HP turbine will pass the rated throttle flow, as well as to allow for reactor pressure control. Therefore, the Valves Wide Open (VWO) condition refers to the turbine supply steam flow with additional margin over rated condition when adjusted for the lower inlet pressure associated with higher flow. For operation at EPU, the high pressure turbine has been re-designed with replacement diaphragms, buckets, and a new rotor, for at least the minimum target throttle flow margin, to increase the flow passing capability.

The expected environmental changes, such as diurnal heating and cooling effects changing cycle efficiency, periodically require management of reactor power to remain within the generator rating. The required variations in reactor power do not approach the magnitude of changes periodically required for surveillance testing and rod pattern alignments and other occasional events requiring de-rating, such as equipment out-of-service for maintenance.

As part of the EPU on Unit 1, the original shrunk-on Low Pressure (LP) rotors were replaced with rotors of monoblock (integral) design. The HP rotors will also be replaced with rotors of monoblock design. Per CLTR Section 7.1, “The only safety related evaluation is the plant specific turbine-generator missile avoidance and protection analysis. The entrapped energy following a turbine trip or load rejection increases slightly for CPPU. Relative to the turbine generator missile protection analysis, many power plants have replaced high pressure and low pressure shrunk-on rotors with an integral rotor without shrunk-on wheels. These integral rotors are not considered a source for potential missile generation for CPPU for the slight increase in entrapped energy; therefore, a plant specific analysis is not required.”

As part of the EPU on Units 2 and 3, modifications and inspections have been performed to the shrunk-on wheels for the LP turbine rotors to reduce the probability of LP turbine rotor blade failure and ejection. The HP turbine rotors will also be replaced with rotors of monoblock design. A specific missile generation study was performed. See Section 2.5.1.2.1 for the turbine missile evaluation.

The turbine overspeed calculation compares the entrapped steam energy contained within the turbine and the associated piping, after the stop valves trip, and the sensitivity of the rotor train for the potential overspeed capability. The entrapped energy increases slightly for EPU conditions. Appendix A of the CLTR states that although the power uprate slightly increases the energy trapped in the turbine following a load rejection, the turbine overspeed would remain within design limits.

The turbine overspeed scenario considered is the emergency case where the EHC controls and the control and intercept valves fail to respond to the initial overspeed due to a load rejection event. For this scenario, the unit rapidly accelerates to the overspeed trip setpoint, thereby trip-closing the main and intermediate stop valves. The operating condition analyzed was the maximum power, valves wide open case, with low backpressure. This approach accounts for the two basic contributors to peak overspeed due to a load rejection event: 1) the energy due to entrapped (or entrained) steam within the steam path and inlet piping downstream of the main and intermediate steam valves; and 2) what is termed "valve lag overspeed," which takes into account the energy contributed by new steam entering the machine during the response time of the control and trip systems, and during the actual closing time of these valves. The overspeed trip setpoint is established such that the resulting peak speed will not exceed the 120% emergency overspeed limit due to overshoot. This ensures that the turbine is protected in an overspeed event. The turbine and turbine control system design changes for EPU have not yet been installed and the specific control setpoints have not been established. The setpoints will be adjusted to ensure that the turbine will not exceed 120% of rated speed due to overshoot. Equipment important to safety associated with the plant is protected from main turbine missiles by physical barriers and favorable alignment. Additionally, the independent spent fuel storage installation has been evaluated and determined acceptable with regard to plant generated main turbine missiles using the EPU turbine failure probability analyses as input. The effect of EPU is

Insert 1

offset by ensuring that the turbine speed will not exceed 120% of rated during an overspeed event.

Conclusion

TVA has evaluated the effects of the proposed EPU on the turbine generator. The evaluation indicates that the turbine generator will continue to provide adequate turbine overspeed protection to minimize the probability of generating turbine missiles and will continue to meet the requirements of draft GDC-40 following implementation of the proposed EPU. Therefore, the proposed EPU is acceptable with respect to the turbine generator.

2.5.1.3 Pipe Failures

Regulatory Evaluation

A review of the plant design was conducted regarding protection from piping failures outside containment to ensure that (1) such failures would not cause the loss of needed functions of safety-related systems and (2) the plant could be safely shut down in the event of such failures.

The NRC's acceptance criteria for pipe failures are based on GDC-4, which requires, in part, that SSCs important to safety be designed to accommodate the dynamic effects of postulated pipe ruptures, including the effects of pipe whipping and discharging fluids.

Specific NRC review criteria are contained in SRP Section 3.6.1.

Browns Ferry Current Licensing Basis

The General Design Criteria (GDC) listed in RS-001 are those currently specified in 10 CFR 50, Appendix A. The applicable Browns Ferry Nuclear Plant (Browns Ferry) principal design criteria predate these criteria. The Browns Ferry principal design criteria are listed in UFSAR Section 1.5, "Principal Design Criteria." In 1967, the AEC published for public comment a revised set of proposed General Design Criteria (Federal Register 32FR10213, July 11, 1967). Although not explicitly licensed to the AEC proposed General Design Criteria published in 1967, the Tennessee Valley Authority (TVA) performed a comparative evaluation of the design basis of Browns Ferry with the AEC proposed General Design Criteria of 1967. The Browns Ferry UFSAR, Appendix A, "Conformance to AEC Proposed General Design Criteria," contains this comparative evaluation. This evaluation discusses each of the groups of criteria set out in the July 1967 AEC release. For each group of criteria, there is a statement of TVA's understanding of the intent of the criteria in that group and a discussion of the plant design conformance with the intent of the group of criteria. Following a restatement of each of the proposed criteria is a table of references to locations in the Browns Ferry UFSAR where there is subject matter relating to the intent of that particular criteria.

While Browns Ferry is not generally licensed to the final GDC or the 1967 AEC proposed General Design Criteria, a comparison of the final GDC to the applicable AEC proposed General Design Criteria can usually be made. For the final GDC listed in the Regulatory Evaluation above, the Browns Ferry comparative evaluation of the comparable 1967 AEC proposed General

Insert 1

The main generator excitation systems, that existed on all three units, were GE Alterrex Excitation systems. The energy for excitation of the generator field is derived from the turbine using a self-excited shaft driven alternator. The output of the alternator is rectified by a set of water cooled stationary diode bridges mounted in the doghouse of the generator. The resultant DC voltage is supplied to the generator field via brushes and collector rings. In 2011 and 2012, TVA replaced the voltage regulators in the Alterrex Excitation systems with new ABB Unitrol 5000 voltage regulators. The Interconnection System Impact Study (SIS), performed for BFN at EPU conditions, determined that main generator stability issues exist for a 3-phase fault on one of several BFN transmission lines coincident certain transmission lines already out of service (N-1-1 event.). The present excitation system cannot raise the field voltage fast enough and high enough to prevent the main generator from becoming unstable. To address the transient stability issue, BFN will install a new shunt-fed, static excitation system on each of the three units. The new excitation system will provide the field current directly to the brushes and collector rings eliminating the need for the rotating Alterrex exciter and the stationary diodes. Additional computer simulations of the N-1-1 event for the SIS, with this new excitation system modeled, have shown that the generators remain stable. As the new excitation system requires a higher DC field voltage, the insulating material in the rotors will need to be evaluated as acceptable or replaced. When conditions exist, that make generator instabilities possible during and N-1-1 event, administrative controls will be implemented to limit unit output whenever certain transmission lines are out of service. Once the excitation systems are replaced on all three units, the administrative controls will no longer be necessary. Use of administrative controls to prevent transient instabilities, prior to the excitation systems being installed, is allowed by North American Reliability Council (NERC) standards.

ENCLOSURE 10

BFN EPU LAR, Attachment 47, List and Status of Plant Modifications, Revision 1.

Browns Ferry Units 1, 2 and 3 EPU Modifications, Revision 1

The modifications required to support Extended Power Uprate (EPU) for Browns Ferry Nuclear Power Station (BFN) Units 1, 2 and 3 have been compiled and are shown in Table 1. The modifications reported as 'Complete' in Table 1 are fully implemented, for all other modifications a schedule for full implementation is provided. All EPU modifications, either completed or being prepared, are in accordance with the TVA Plant Modifications and Engineering Change Control process.

Further evaluations may identify the need for additional modifications or obviate the need for some modifications. As such, Table 1 listings are not a formal commitment to implement the modifications exactly as described or per the proposed schedule. Additionally, various minor modifications and adjustments to plant equipment, which may be necessary, are not listed.

Table 1: BFN EPU Planned Modifications and Current Schedule

Modification	Description	Scheduled Completion (Note 1)
Replacement Steam Dryer	New steam dryers will be installed with increased structural design margin to accommodate EPU operation. • Replacement steam dryers are curved hood six-bank dryers analyzed for fatigue resulting from flow induced vibration and hydrodynamic loads. • Main steam line strain gages were previously installed to obtain measurements at CLTP conditions which were used to design the replacement steam dryers. • New main steam line strain gages will be installed to replace the existing strain gages which have reached end of life to obtain measurements during power ascension testing of the replacement steam dryers.	Unit 1 – Fall 2018 Unit 2 – Spring 2019 Unit 3 – Spring 2018
Main Turbine	Replace the High Pressure Turbine rotor. Incorporate GE's Advanced Design Steam Path which is designed for the increased flow associated with EPU. • Replace High Pressure Turbine diaphragms and rotor buckets.	Unit 1 – Fall 2018 Unit 2 – Spring 2019 Unit 3 – Spring 2018
	• Modify the cross around relief valves (CARVs) to permit increased set pressure.	Unit 1 – Complete Unit 2 – Complete Unit 3 – Complete
	• Replace and/or recalibrate Main Steam system flow and pressure instruments.	Unit 1 – Complete Unit 2 – Complete Unit 3 – Complete
Turbine Sealing Steam	Increase the size of the Steam Packing Unloader Valves (SPUVs) and associated piping to enable the turbine sealing system to accommodate EPU flow requirements. • Increase SPUVs and piping from 8-inch to 10-inch components. • Replace and rescale steam flow and steam pressure transmitters.	Unit 1 – Complete Unit 2 – Complete Unit 3 – Complete

Modification	Description	Scheduled Completion (Note 1)
Condensate Pumps	Upgrade Condensate pumps with new impellers and motors to accommodate the increased flows that will be required for EPU operation. • Replace impellers in each pump (3 pumps per Unit). • Replace 900 HP motors with 1250 HP motors. • Add orifice plate to the Condensate Recirculation line to reduce pressure drop across the flow control valve to minimize cavitation and vibration. • Replace existing pump discharge check valves with different style check valves having lower pressure drop and better transient response. • Replace pump suction strainers with stronger mesh screen to prevent screen deformation with the increased EPU flow conditions. • Change motor protection relay settings. • Recalibrate/replace pump and motor instrumentation.	Unit 1 – Complete Unit 2 – Complete Unit 3 – Complete
Condensate Booster Pumps	Replace the Condensate Booster (CB) pumps and motors to increase pump capacity to accommodate the increased flows that will be required for EPU operation. • Replace CB pumps with higher capacity pumps. • Replace air-cooled 1750 HP motors with water-cooled 3000 HP motors. • Replace existing pump discharge check valves with different style check valves having lower pressure drop and better transient response. • Change motor protection relay settings. • Recalibrate/replace pump and motor instrumentation.	Unit 1 – Complete Unit 2 – Complete Unit 3 – Complete
Condensate Pump and Condensate Booster Pump Area Ventilation	Provide additional cooling/ventilation in vicinity of the Condensate and Condensate Booster pumps to accommodate the increased heat load resulting from larger air-cooled Condensate Pump motors and supplement cooling requirements for the hydrogen water chemistry (HWC) main control panel. • Replace 3-position switches for operation of the Air Handling Units (AHUs) with 4-position switches that will allow parallel operation of the AHUs. • Addition of a balancing damper to the Condensate Pump motors to provide better balancing of air flow. • Addition of a branch duct and balancing damper to the HWC main control panel.	Unit 1 – Complete Unit 2 – Complete Unit 3 – Complete

Modification	Description	Scheduled Completion (Note 1)
Feedwater Pumps and Turbines	Upgrade the Feedwater system to provide increased Feedwater flow for EPU operation. • Replace pumps with higher capacity pumps. • Replace turbine rotor, diaphragms and buckets. • Replace turbine/pump coupling. • Upgrade seal water injection subsystem.	Unit 1 - Complete Unit 2 - Complete Unit 3 – Complete
	• Update Feedwater control system software for EPU conditions.	Unit 1 – Fall 2018 Unit 2 – Spring 2019 Unit 3 – Spring 2018
Moisture Separators	Modify the internals of the moisture separators to increase moisture removal and accommodate increased flows at EPU conditions. • Change vanes and added perforated plate on moisture separators. • Modify internal drains as needed.	Unit 1 - Complete Unit 2 - Complete Unit 3 - Complete
Feedwater Heaters	Upgrade Feedwater Heaters to support EPU operating conditions. • Re-rate the number 1, 2 and 3 Feedwater Heater shells to meet higher pressures, temperatures and flows under EPU conditions by modification of selected nozzles and replacement of shell relief valves to meet ASME code requirements. • Replace level control instrumentation on the number 1, 2 and 3 Feedwater Heaters to reduce susceptibility to flow induced turbulence (pressure transients).	Unit 1 – Complete Unit 2 – Complete Unit 3 – Spring 2018
	• Provide additional welds and bracing to the pass partition plates for Nos. 1, 2, 3, and 5 Feedwater Heaters. (Number 4 Feedwater Heaters' pass partition plates will be addressed with replacement of the tube bundle and channel head.)	Unit 1 – Complete Unit 2 – Complete Unit 3 – Complete
	• Due to the increase in tube-side design pressure with the increase head capacity of the Condensate Booster pumps, replace channel head relief valves for No. 3 Feedwater Heaters with valves having higher setpoints, and install a reinforcement ring on the manways for the number 3 and number 5 Feedwater Heaters.	Unit 1 – Complete Unit 2 – Complete Unit 3 – Spring 2018
	• On each of the number 3 Feedwater Heaters, replace the upper shell and install an extraction steam inlet duct to minimize heater shell erosion and preclude tube damage from steam jet impingement.	Unit 1 – Complete Unit 2 – Spring 2017 Unit 3 – Complete
	• Replace tube bundle and channel head in the number 4 Feedwater Heaters with a design less susceptible to damage from flow induced vibration.	Unit 1 – Fall 2018 Unit 2 – Spring 2019 Unit 3 – Spring 2018
Main Condenser Extraction Steam Bellows	Replace Main Condenser Extraction Steam bellows #2, #3, #4 and #5 with bellows accommodating higher design temperatures and pressures for EPU.	Unit 1 – Complete Unit 2 – Complete Unit 3 – Complete

Modification	Description	Scheduled Completion (Note 1)
Condensate Demineralizers	Install a 10th condensate demineralizer (and associated valves and controls) on each unit to accommodate the increased condensate flow associated with EPU operation.	Unit 1 - Complete Unit 2 - Complete Unit 3 - Complete
Steam Packing Exhauster Bypass	Increase the capacity of the steam packing exhauster bypass line to accommodate increased flow under EPU conditions. • Install larger piping and flow control valve.	Unit 1 - Complete Unit 2 - Complete Unit 3 - Complete
Torus Attached Piping	Modification to reinforce an existing pad at an ECCS ring header branch connection to address higher pipe stresses associated with EPU conditions. Required only on Units 2 and 3 as sufficient stress margin exists on Unit 1.	Unit 1 – N/A Unit 2 – Complete Unit 3 – Complete
Main Steam Supports	Modify one Unit 2 Main Steam pipe support due to increased loads resulting from turbine stop valve closure at EPU steam flow rates. All other existing Unit 2 Main Steam pipe supports, and all Main Steam pipe supports on Units 1 and 3, were determined to have sufficient design margin to accommodate the increased turbine stop valve closure loads.	Unit 1 – NA Unit 2 – Complete Unit 3 – NA
Reactor Recirculation Pumps & Motors	Upgrade the reactor recirculation system for EPU core flow operating conditions. • Perform analyses/evaluations to increase the design ratings for the recirculation pumps and motors. • Upgrade the Variable Frequency Drive (VFD) control system. • Perform pump and motor instrumentation upgrades - jet pump head, RCW flow, motor winding temperatures, VFD protective relay settings.	Unit 1 - Complete Unit 2 - Complete Unit 3 - Complete
	• Revise Upper Power Runback setting for EPU conditions.	Unit 1 – Fall 2018 Unit 2 – Spring 2019 Unit 3 – Spring 2018
Jet Pump Sensing Line Clamps	Install jet pump sensing line clamps to reduce pipe vibration under EPU conditions.	Unit 1 - Complete Unit 2 - Complete Unit 3 - Complete
Main Generator System	Uprate main generator to 1330 MVA (Unit 1) / 1332 MVA (Units 2 & 3). • Install rewound stator to support higher generator output capacity. • Replace/modify stator water cooling (SWC) instruments and change SWC flow, pressure, DP and temperature settings to support increased stator water cooling requirements.	Unit 1 - Complete Unit 2 - Spring 2019 Unit 3 - Complete
Main Generator Hydrogen Pressure	Increase generator hydrogen pressure from 65 psig to 75 psig to support EPU operation. • Change pressure regulating valve settings and pressure alarm setting. • Replace pressure switches as needed for new operating range. • Change generator field over-excitation relay settings. • Eliminate hydrogen flow integrator to mitigate hydrogen leakage.	Unit 1 – Fall 2018 Unit 2 – Spring 2019 Unit 3 – Spring 2018

Modification	Description	Scheduled Completion (Note 1)
Isophase Bus Duct Cooling	Modify isophase bus duct cooling system to remove increased bus duct heat under EPU conditions. • Replace cooling fans and motors. • Replace cooling coils.	Unit 1 - Complete Unit 2 - Complete Unit 3 - Complete
Main Bank Transformers	Upgrade main bank transformers to account for the higher power output from the main generators at EPU conditions. • Replace three 500 MVA transformers per unit. • Replace one Units 1 and 2 500 MVA spare transformer. • Install new dedicated Unit 3 500 MVA spare transformer.	Unit 1 - Complete Unit 2 - Complete Unit 3 - Installation complete, post-modification testing of the Unit 3 Spare Transformer pending
Vibration Monitoring	Install mounting brackets/supports and temporary instrumentation for vibration monitoring during EPU power ascension in accordance with Attachment 45 (Flow Induced Vibration Analysis and Monitoring Program).	Unit 1 – Fall 2018 Unit 2 – Spring 2019 Unit 3 – Spring 2018
Main Steam Isolation Valves (MSIV)	Modify MSIVs to support steam flow increase at EPU conditions. • Install longer stroke actuators to move the poppet further out of the flow stream. This modification reduced valve pressure drop to accommodate EPU conditions. • Perform additional modifications to improve performance of the MSIVs including new bonnets, nose guided poppets (trimmed profile), and larger diameter valve stems.	Unit 1 – Complete Unit 2 – Complete Unit 3 – Complete
Electro-Hydraulic Control (EHC) Software	Revise EHC software to address changes in plant parameters required to support EPU. • Electrical Overspeed set point, Intermediate Pressure, Power Load Unbalance, Turbine First Stage Pressure, and Megawatt (MW) Control	Unit 1 – Complete Unit 2 – Complete Unit 3 – Complete
Technical Specification Instrument Respan	Technical Specification Instrument respan and setpoint changes for EPU • Turbine 1st stage pressure scram bypass permissive setpoint change • Main steam line high flow isolation channel respan • APRM flow biased and setdown instrument respan and setpoint change	Unit 1 - Fall 2018 Unit 2 - Spring 2019 Unit 3 - Spring 2018
Balance of Plant Instrument Respan	Respan balance of plant (BOP) instruments for EPU. • Update hydrogen water chemistry programmable logic controller (PLC) software for control of hydrogen and oxygen injection at EPU. • Replace and respan hydrogen water chemistry flow instruments. • Replace and respan extraction steam pressure instruments. • Replace and respan feedwater heater pressure and level instruments. • Recalibrate setpoints for reactor feedwater low suction and steam jet air ejector stage I/II/III low pressure switches. • Respan high pressure turbine exhaust intermediate pressure. • Replace and respan offgas condenser cooling water temperature instruments.	Unit 1 - Complete Unit 2 - Complete Unit 3 - Complete

Modification	Description	Scheduled Completion (Note 1)
Condenser Instrumentation	Upgrade condenser instrumentation for improved reliability and performance monitoring under EPU conditions. • Replace/relocate condenser A/B/C hotwell pressure transmitters to improve inputs to the integrated computer system (ICS). • Add condenser circulating water (CCW) inlet/outlet temperature inputs to the integrated computer system (ICS). • Respan condenser A/B/C CCW outlet flow channels and add to ICS. • Revise reactor feed pump turbine (RFPT) trip to two out of three logic. • Modify Steam jet air ejector (SJAE) to remove the trip on low condenser vacuum and eliminate auto-start of standby SJAE.	Unit 1 - Complete Unit 2 - Complete Unit 3 - Complete
	• Install nine new condenser vacuum pressure transmitters per unit (3 on each condenser) and provide signals to electro-hydraulic control (EHC) system. • Move condenser A/B/C low vacuum alarm, low vacuum turbine trip and low vacuum bypass trip functions to EHC logic (previously performed by pressure switches). • Perform hardware and software changes to EHC system to support new alarm and trip functions.	Unit 1 - Fall 2018 Unit 2 - Spring 2019 Unit 3 - Spring 2018
Steam Jet Air Ejector (SJAE) Pressure switches	Revise setpoints for SJAE condensate pressure switches to prevent inadvertent SJAE isolation.	Unit 1 - Complete Unit 2 - Complete Unit 3 - Complete
Main Steam Acoustic Vibration Suppressors	Install Acoustic Vibration Suppressors (AVS) inside the Main Steam 6" diameter blind flanged branch lines to reduce acoustic loading on the steam dryer.	Unit 1 - Complete Unit 2 - Complete Unit 3 - Complete
Standby Liquid Control (SLC) System	The shutdown capability of the SLC system is being increased to support the Containment Accident Pressure Credit Elimination during an ATWS event as discussed in PUSAR Section 2.8.4.5.3 (Attachment 6) by increasing the Boron-10 enrichment.	Unit 1 – Fall 2018 Unit 2 – Spring 2019 Unit 3 – Spring 2018
Emergency High Pressure Makeup Pump	As part of the transition to National Fire Protection Association Standard (NFPA) 805, BFN is installing a non-safety related emergency high pressure pump in each unit to provide makeup from the Condensate Storage Tank to the Reactor Pressure Vessel. This modification is not required for EPU operation but is addressed in PUSAR Section 2.6.5.2 (Attachment 6), Containment Accident Pressure (CAP) Elimination. Although not needed for CAP Credit Elimination, use of the makeup pump will provide additional NPSH margin during the Fire Event.	Unit 1 – Fall 2016 Unit 2 – Spring 2017 Unit 3 – Spring 2018

Modification	Description	Scheduled Completion (Note 1)
Hardened Wetwell Vent	In response to EA-13-109, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," the Hardened Wetwell Vent (HWWV) will be modified to provide individual vent lines for each BFN unit. As discussed in PUSAR Section 2.6.1.4 (Attachment 6), the existing HWWV capacity would be reduced to 0.88% of rated thermal power under EPU conditions. However, with the implementation of this modification in response to EA-13-109, the capacity of the HWWV will be restored to 1% of EPU thermal power.	Unit 1 – Fall 2016 Unit 2 – Spring 2017 Unit 3 – Spring 2018
Static Excitation System	As a result of the increased electrical generation at EPU, the Excitation System on ~~u~~Units 1, 2, and 3 will be upgraded by installing a Static Excitation System. The system will include a dual channel digital automatic voltage regulator (AVR) for complete redundancy, with each channel consisting of an auto and manual back-up mode. (See also Note 2 below.)	Unit 1 - Fall 2020 Unit 2 - Spring 2023 Unit 3 - Spring 2024

Notes:

1) The expected completion timeframes reported in Table 1 correspond to the following refuel outages: For BFN Unit 1, Fall of 2016 is RFO-U1R11, Fall of 2018 is RFO-U1R12 and Fall 2020 is RFO-U1R13. For BFN Unit 2, Spring of 2017 is RFO-U2R19, Spring of 2019 is RFO-U2R20 and Spring 2023 is RFO-U2R22. For BFN Unit 3, Spring of 2018 is RFO-U3R18 and Spring 2024 is RFO-U3R21.

2) The Static Excitation System is not required to be installed prior to EPU operation. During the interim period of EPU operation preceding installation of the Static Excitation System, transmission system grid stability will be maintained through use of a detailed temporary operating guide.

ENCLOSURE 11

GE Hitachi Nuclear Energy Affidavit for NEDC-33860P, Revision 0

GE-Hitachi Nuclear Energy Americas LLC
AFFIDAVIT

I, James F. Harrison, state as follows:

(1) I am Vice President, Fuel Licensing, Regulatory Affairs, GE-Hitachi Nuclear Energy Americas LLC ("GEH"), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in GEH proprietary report, NEDC-33860P, *Safety Analysis Report for Browns Ferry Nuclear Plant Units 1, 2, and 3 Extended Power Uprate*, Revision 0, dated September 2015. GEH proprietary information within text is identified by a dotted underline within double square brackets. [[This sentence is an example.{3}]] Figures and large objects containing GEH proprietary information are identified with double square brackets before and after the object. In all cases, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F2.d 871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F2.d 1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. above.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GEH.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains detailed results and conclusions regarding supporting evaluations of the safety-significant changes necessary to demonstrate the regulatory acceptability of the analysis for a GEH Boiling Water Reactor (BWR). The analysis utilized analytical models and methods, including computer codes, which GEH has developed, obtained NRC approval of, and applied to perform evaluations of Power Uprates for a GEH BWR. The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GEH asset.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical

methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 17th day of September 2015.

James F. Harrison
Vice President, Fuel Licensing
Regulatory Affairs
GE-Hitachi Nuclear Energy Americas LLC
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