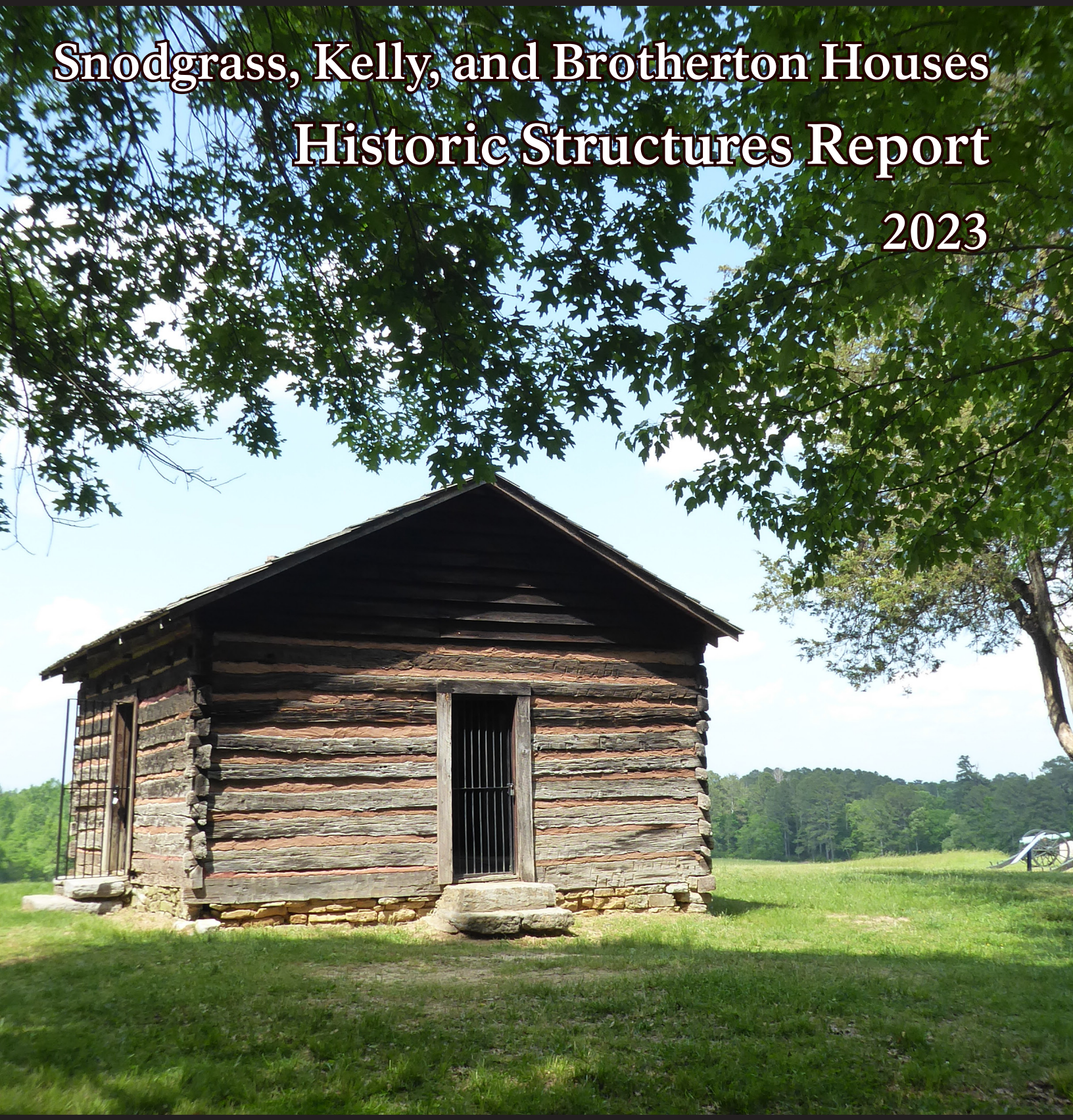
National Park Service
U.S. Department of the Interior

Chickamauga and Chattanooga National Military Park
Fort Oglethorpe, GA

# Snodgrass, Kelly, and Brotherton Houses Historic Structures Report

2023



Cultural Resources Partnerships and Science Division

Interior Region 2

# Snodgrass, Kelly, and Brotherton

Chickamauga and Chattanooga National Military Park

# Historic Structures Report

2023

for

**Chickamauga and Chattanooga National Military Park**
**Interior Region 2: South Atlantic-Gulf, National Park Service**

by

**JKOA**

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The historic structures report presented here exists in two formats. A traditional, printed version is available for study at the park, at the Interior Region 2: South Atlantic-Gulf office of the National Park Service (NPS), and at a variety of other repositories. For more widespread access, the historic structure report also exists in digital format through the IRMA Portal, Integrated Resource Management Applications, including the NPS Data Store, accessed at <https://irma.nps.gov/App/Reference/Welcome>, a website of the National Park Service.

July 2023
Historic Structures Report
Snodgrass, Kelly, and Brotherton Houses
Chickamauga and Chattanooga National Military Park
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**Snodgrass, Kelly, and Brotherton Houses**
**Chickamauga and Chattanooga National Military Park**
Historic Structures Report
2023

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# Foreword

We are pleased to provide this Historic Structures Report (HSR) for the Snodgrass, Kelly, and Brotherton Houses at Chickamauga and Chattanooga National Military Park (CHCH). JKOA would like to thank the National Park Service and CHCH park staff for their assistance and valuable input during the preparation of this document. We hope that this report can serve as a valuable planning document for the park as they address the current and future needs of these buildings.

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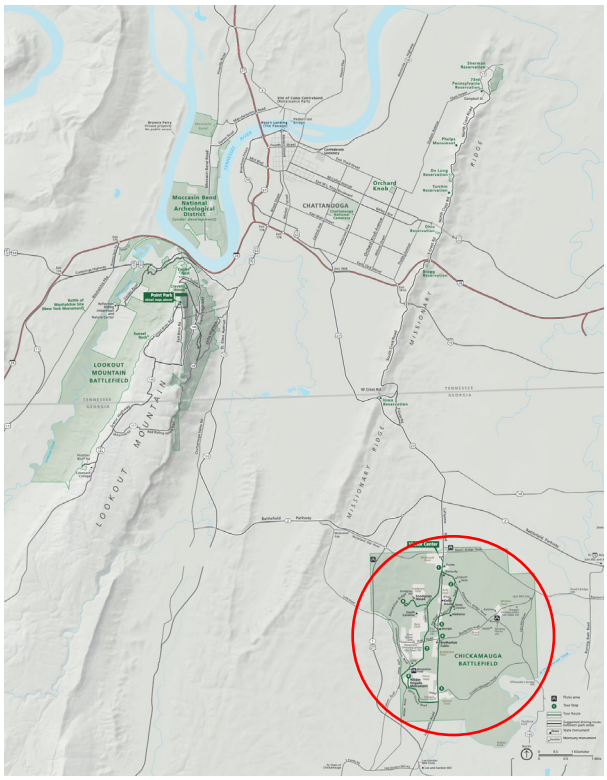



**Figure M1.** Map showing the four units of Chickamauga and Chattanooga National Military Park (CHCH). The park is in both Georgia and Tennessee, indicated by the horizontal line on the map. The Snodgrass, Kelly, and Brotherton Houses are in Tennessee in the Chickamauga Battlefield unit. (https://www.nps.gov/carto/hfc/carto/media/CHCHmap1.jpg)

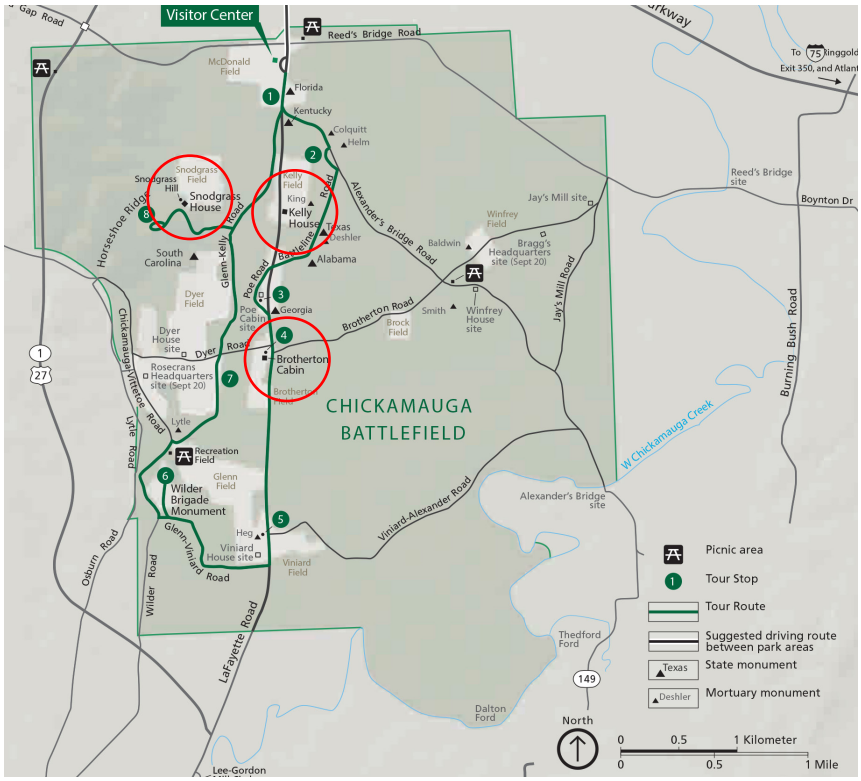



**Figure M2.** Map showing the Chickamauga Battlefield Unit of the Chattanooga National Military Park (CHCH). Circles indicate the locations of the Snodgrass, Kelly, and Brotherton Houses. (https://www.nps.gov/carto/hfc/carto/media/CHCHmap1.jpg)

# Management Summary

At the request of the National Park Service (NPS), Joseph K. Oppermann–Architect, P.A. (JKOA) has developed this Historic Structure Report (HSR) for the Snodgrass, Kelly, and Brotherton Houses at Chickamauga Battlefield. The houses are part of the Chickamauga and Chattanooga National Military Park. On the facing page is a regional map showing the location of the Chickamauga and Chattanooga National Military Park (CHCH) and a map of CHCH shows their location (*Figs. M1-M2*).

This HSR documents the development, use, and current condition of the Snodgrass, Kelly, and Brotherton Houses. The buildings played a significant role in the Civil War Battle of Chickamauga and are thought to have been largely rebuilt in the immediate period after the war.

Following NPS protocol, this HSR is divided into two major segments, Part *I: Developmental History,* and Part *II: Treatment and Use*. *Part I* is a scholarly report of several chapters documenting the context and evolution of the building; presenting a detailed physical description of the exterior and interior on a room-by-room basis and assessing current conditions; and describing the significance and integrity of the house. It is based on the combined analysis of documentary research and physical examination.

*Part II: Treatment and Use* contains chapters that review the requirements for treatment and use; present the NPS administratively determined ultimate treatment and use with an evaluation of alternative treatments; address resilience to natural disasters, and offer recommendations to achieve the ultimate treatment and use, coupled with recommendations for further enhancement. Recommendations reflect objectives identified by park management and an emphasis on preserving extant historic material and applying the new information gained.

A bibliography follows Part II. The appendices contain: (A) scaled documentation drawings of the current foundation, floor, and roof plans; and interior and exterior elevations, (B) Historic Photo Comparison Elevations, (C) Structural Investigation Report by 1200AE, (D) Wood Assessment Report by Anthony & Associates, and (E) a List of Implementation Projects.

## Historical Overview

The Snodgrass, Kelly, and Brotherton houses are located within Chickamauga National Battlefield, a park unit of the Chickamauga-Chattanooga National Military Park, headquartered in Fort Oglethorpe, Georgia. Thought to have been largely rebuilt ca. 1867, these log houses are representative of the principle residences of historic farmsteads present during the 1863 Civil War Battle of Chickamauga.[1]

White settlement of the Tennessee River Valley began soon after the War of 1812, spurred on by the discovery of gold in the region in 1828.[2] Walker County, Georgia, was established in 1833, assembled from historically Cherokee land. After the Cherokee were forcibly removed under the 1830 Indian Removal Act, their ancestral land was divided among white settlers during the sixth Georgia Land Lottery held in 1832.[3]

Early settlement patterns coincided with available natural resources. The land of the Tennessee River Valley and its associated smaller tributaries, including the West Chickamauga Creek, proved fertile. Settlers found a living in subsistence farming of mainly cotton, grain crops, and livestock.[4]

1. John Milner Associates, et. al., *Chickamauga Battlefield Cultural Landscape Report* (National Park Service, Southeast Regional Office, September 2004), appendix A, p.15.
2. Milner Associates, *CLR*, appendix A, p.15.
3. Milner Associates, appendix A, p. 2.
4. *Chickamauga and Chattanooga National Military Park Cultural Landscape Inventory* (National Park Service, Southeast Regional Office),1995, p. 41; "The Trail of Tears and the Forced Relocation of the Cherokee Nation," National Park Service, nps.gov/articles/the-trail-of-tears-and-the-forced-relocation-of-the-cherokee-nation-teaching-with-historic-places.htm.

While scattered thinly, landownership was clustered along established roadways and former Native American trails, such as Lafayette Road, along which several farmsteads and other community infrastructure developed. These early farmsteads consisted of simple log-constructed dwellings, usually covered in clapboard siding, and an array of utilitarian outbuildings such as barns, smokehouses, and privies.[5]

By 1863, a total of 24 farmsteads are recorded in the area that would become the battlefield at Chickamauga.[6] Among them are the farmsteads of the Snodgrass, Kelly, and Brotherton families.

The Civil War Battle of Chickamauga was fought between Union General William S. Rosecrans's Army of the Cumberland and Confederate General Braxton Bragg's Army of Tennessee over September 18-20, 1863. The battle took place over an area of roughly 20 square miles centered on Lafayette road in the area just south of modern-day Fort Oglethorpe and north of the historic Lee and Gordon's Mills.[7]

As the sounds of battle drew near, local families purportedly left their homes and sought shelter in a nearby ravine northwest of the Snodgrass house, where they remained for several days.[8]

The farmsteads located along Lafayette Road were some of the only distinctive landmarks in the area, and served as wayfinding devices for troop movements. Official battle reports from both armies are scattered with references to these farmsteads.[9]

Several of the farmsteads served as headquarters for commanders during the battle. The Brotherton house became the headquarters of Confederate General, Simon Bolivar Buckner, while the Snodgrass house served as headquarters for Union General George H. Thomas.[10]

The Brotherton, Kelly, and Snodgrass houses are also thought to have served as field hospitals during and after the Battle of Chickamauga, but as explained by Civil War medical treatment expert, Dr. Anthony Hodges, the houses would have served more of a triage function allowing for the stabilization of the wounded prior to their transport to the established field hospitals. Medial actions undertaken at these triage stations would have included the placing of splints and the packing of wounds to slow bleeding. For ease of access, it is likely the doors would have been taken off their hinges and the family's dining table would have been used as an examination table.[11]

After the war, many families returned to their land to rebuild, though some not immediately. The physical scars on the land caused by the battle were repaired and fields were re-sown. The area population grew with this return to agriculture, and by 1890, 24 new farmsteads had been established.[12]

The Brotherton house was one of few structures thought to have survived intact, albeit damaged. It is thought that the Snodgrass, Kelly, and Brotherton houses were "rebuilt and re-occupied" ca. 1867, "on or near" their known locations at the time of the battle.[13]

On August 19, 1890, Chickamauga and Chattanooga battlefields were enshrined as the nation's first National Military Park. The enabling legislation was also the first to authorize the preservation of an American battlefield.[14] The U.S. War Department was given administrative purvey.[15]

While the park supported adaptive reuse of the existing structures, the primary goal and ongoing concern was their preservation. In 1910, the park's commissioner gave the direction that the structures should be kept "in repair, with like dimension and materials."[16]

Administration of the park was transferred from the War Department to the National Park Service on August 10, 1933, as part of larger government

5. *CHCH CLI*, p. 9.
6. *CHCH CLI*, p. 41; Milner Associates, *CLR,* p. 8.
7. Milner Associates, *CLR*, appendix A, p.2.
8. James Alfred Sartian, *History of Walker County Georgia, Volume 1* (Dalton, GA, The A.J. Showalter Company, 1932), p. 100. Reprint of an article by Chattanooga judge Charles W. Lusk, published in *The Chattanooga News* 22 September 1923. The article relies heavily on interviews with members of Chickamauga Battlefield families some sixty years after the battle, and provides no other source material.
9. Milner Associates, *CLR*, appendix A, p.9.
10. Milner Associates, appendix A, p.9.
11. Jill K. Hanson and Robert W. Blythe, *Chickamauga and Chattanooga National Military Park Historic Resource Study* (National Park Service, Southeastern Regional Office, January 1999), pp. 49-50; Garry Adelman interview of James Ogden and Dr. Anthony Hodges.
12. *CHCH CLI*, p. 46
13. Milner Associates, *CLR*, appendix 1, p 15.
14. John C. Paige and Jerome A. Greene, *Administrative History of Chickamauga and Chattanooga National Military Park* (Denver: National Park Service, Denver Service Center, 1983), pp. 18-19.
15. Paige and Green, *Admin. History*, p. 1.
16. Paige and Green, p. 63.

reorganization to consolidate administration of historically significant properties under the NPS.[17] With the establishment of the National Register of Historic Places in 1966, the park as a whole would have been administratively listed; however, it was not formally listed under a historic district nomination until July 15, 1986.[18]

The three houses were actively used as part of the park's interpretive program as early as 1948.[19] In 1972, "living history" programs were developed for the park. The Snodgrass, Kelly, and Brotherton houses were outfitted with pre-Civil War period furnishings and opened to the public with living history demonstrations conducted by park volunteers in period costume. Additionally, a nineteenth-century farming exhibit was established at the Brotherton homestead.[20]

The living history programs continued through the 1970s, but waned into the next decade.[21] Following this, visitor access to the interiors of the houses was restricted by metal bars over the windows and doorways, which maintain views inside the structures. Modern interpretive signage and guided audio tours are provided.

## Period of Significance

The documentation for the Historic District lists the district-wide period of significance as 1863-1942, breaking down the significant dates within that range as 1863 (the date of the battle), 1890-1933 (commemorative-development period), and 1933-1942 (initial Park Service period). The houses are noted to be contributing to the commemorative/development period (1890-1933).

## Ultimate Treatment and Use

For all three houses, the NPS administratively determined Management Category is "Must Be Preserved and Maintained," and the Ultimate Treatment is *Preservation*. Further explanation can be found in the *Ultimate Treatment and Use* chapter, which begins on page 63.

17. Paige and Green, p. 89.
18. Edward E. Tinney and Lenard E. Brown, National Register of Historic Places Nomination Form, accepted June 6, 1986.
19. Paige and Green, p. 162.
20. Paige and Green, p. 167.
21. Paige and Green, p. 167.

## Project Scope and Methodology

**Purpose**

The purpose of this HSR is to document the historical evolution, significance, and present condition of the Snodgrass, Kelly, and Brotherton Houses and to provide clear information for use in the planning, repair, maintenance, and preservation of the building. The National Park Service will use this report to inform and guide its stewardship.

NPS Director's Order 28 (DO-28) recognizes an HSR as an optimal first phase of the preservation effort for an historic building, preceding design and implementation of its preservation, rehabilitation, restoration, or reconstruction. It is the primary guide to treatment and use of an historic structure, and considerable loss of information can result if an HSR is not completed. The information gleaned helps the preservation effort and provides information for interpretation. According to DO-28, "In no case should restoration, reconstruction, or extensive rehabilitation of any structure be undertaken without an approved HSR, Parts 1 and 2."[22]

DO-28 provides guidelines for recording and analyzing the history of a property from its construction through subsequent modifications to the present; to document the performance and condition of its materials, features, and stability; and to recommend an appropriate course of treatment based on those findings. NPS prepares a "Part III" completion report after the work is undertaken, which documents the repairs and changes made and becomes part of the HSR.

This HSR, which complies with those guidelines, offers a comprehensive, scholarly assessment of the history, fabric, and current condition of the Snodgrass, Kelly, and Brotherton Houses, and makes recommendations for future actions. The JKOA project team included Joseph K. Oppermann, FAIA, historical architect and principal-in-charge; Christopher M. Woollard, Associate AIA; Jeffrey P. Anderson, Associate AIA; and Langdon E. Oppermann, architectural historian/planner. This team researched, investigated, documented, and assessed this building and wrote this HSR. The interdisciplinary

22. *NPS Director's Order 28: Cultural Resources Management Guideline*, chapter 8.

approach broadens the understanding of building and aids the development of appropriate treatment recommendations.

**Document Research**

Our findings and recommendations for preservation of the house rely on research of primary and secondary sources, early photographs, maps, drawings, and oral histories, correlated with our physical investigation of extant building fabric. The Scope of Work for research prescribed by NPS for the Snodgrass, Kelly, and Brotherton Houses HSR project was "limited," explained as "research in readily available published sources, usually of a secondary character; research in documentary sources that are easily accessible and known to be of high yield; brief interviews of readily available persons to answer specific questions… It is anticipated that most research will be within the park's archives." In accordance with the scope, we relied for the most part on primary and secondary documents in Park archives and other easily accessible sources, and on brief interviews, though in order to gather information adequate for the report, we expanded our research to include additional records, both primary and secondary, in local and online collections. This research was performed to gather information about the original construction and past modifications and repairs.

**Recording and Physical Investigation**

Proceeding concurrently with the documentary research were the measured recording and investigation of the building. Detailed field drawings were made as the basis for digitized AutoCAD drawings of elevations as well as foundation, floor, and roof plans of the building, and selected historic interior features.

Physical investigation of the house to determine its evolutionary history, known as building archeology, was a large component of the work of identifying the scope and time frame of various changes. These investigations were integrated with the documentary research in a correlative approach to determine how the building was used and adapted over its history, and to understand the people involved.

**Condition Assessment**

Specialized assessment methodology was used to survey the condition of each exterior feature and each interior room, itemizing features and elements and photographing them in detail. Observations were documented with digital photographs, measured baseline field drawings, and field notes.

**Development of History, Chronology of Construction, and Evaluation of Significance**

The combined information from documentary research and physical investigations was analyzed, and a narrative context history and building-specific chronology of construction and alterations were written. The narrative physical description was prepared containing a systematic accounting of exterior and interior spaces, features, materials, and condition assessment. All narratives are supplemented by numerous photographs and drawings.

An evaluation of significance was prepared in accordance with the guidelines in *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*.[23] The seven aspects of historic integrity were assessed using the same guidelines. These evaluations of history, condition, significance, and integrity provided the basis for the development of recommended treatment alternatives.

## List of Key Treatment Topics

These items summarize several key treatment topics addressed in *Part II: Treatment and Use,* beginning on p. 59. This list is not an exhaustive list of proposed treatments. Topics listed here address the houses as a group. Part II provides a dedicated section for each log house.

### Crawlspace/Foundation Issues

- The limited crawl space is problematic and puts the floor joists in or near ground contact where they can absorb moisture either from moisture migrating through the soil or high relative humidity in the confined space. If the depth of the crawl space is increased, the repaired/replaced floor joists will be less likely to decay.
- Consider installing borate rods in logs where prolonged contact with moisture is a possibility. This would be in areas at door thresholds or where the lower course logs

23. *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation (Washington, D.C.: National Park Service, National Register of Historic Places, 1990, revised 1997).*

are within 8 inches of grade. The borate rods can extend the service life and offer some level of protection against wood decay.

- Wherever there are loose or missing stones, the foundations should be rebuilt.

## Replacement/Repair of Deteriorated Logs

- If log repairs are determined to be desirable either for restoring lost structural integrity due to decay or insect damage, dutchman repairs can be used by removing and replacing the area of deteriorated wood. Minor surface deterioration on an exterior log can be repaired using a log veneer attached to the existing log once the deteriorated surface material is removed.
- The wall logs are a mix of white oak and southern pine species groups. The wood species used for any repairs or replacement of the logs should be white oak. To provide long-term durability. Southern pine could be considered as an alternative if initial cost is a higher priority than longevity. In addition to wood species, replacement logs should be of the same dimensions with similar growth characteristics (e.g., knots), moisture content (to avoid differential shrinkage and open joints), and tool marks (to match historic appearance, if determined to be accurate).

## Floor Joist Issues

- Consider removing floor boards so that all joists can be examined for full length. Significant deterioration was noted, especially where joists are in contact with the ground / have high moisture contents, as expected.
- Generally, the crawl spaces are not ventilated. The only house that had vents is Brotherton, but even those are not sufficient to provide good air circulation. Understanding that this would alter the exterior appearance of the houses, adding more vents to improve circulation and reduce the moisture should be considered.
- Floor joist to sill log / foundation wall attachment as an issue at multiple locations. This lack of attachment leaves the wall base without lateral bracing. Several instances were noted where joists are periodically propped up by rubble or bearing directly on the ground. This was especially true at Brotherton.

## Roof Issues

- Rafters at Snodgrass that were pulling out of the top log and need to be reattached to prevent wind uplift. Improvement of roof structure connections to the top logs should be considered at each house.

## Chimney Issues

- The Chimney at Brotherton has major cracks and open joints. Minimally, the chimney will need to be locally rebuilt and repointed.
- At Kelly, the wood log portion of the chimney has severely deteriorated portions and east side is totally collapsing (particularly bad right at shoulder). The base logs just sit on the ground and have no foundation. Consider adding a stone foundation below base logs. Rebuild collapsed portion. Stone chimney base also has some voids which should be repaired / locally rebuilt.

# Administrative Data

## Locational Data

*Building Names:* Snodgrass House, Kelly House, Brotherton House
*Location:* Chickamauga and Chattanooga National Military Park (CHCH)

*County:* Catoosa County

*State:* Georgia

## Real Property Information

*Construction Dates:* The Snodgrass, Kelly, and Brotherton Houses are thought to have been rebuilt in part or in whole around 1867

## Numbering Information

*CRIS:* 000183 Snodgrass House; 000182 Kelly House; 000181 Brotherton House

## Size Information

*Floor Area:* Snodgrass: 360 sqft; Kelly House 387 sqft. Brotherton House: 614 sqft.
*Number of Stories:* 1 (Snodgrass, Kelly); 2 (Brotherton)
*Number of Rooms:* 1 (Snodgrass, Kelly); 2 (Brotherton)
*Number of Bathrooms:* 0

## Cultural Resource Data

*National Register Status:* Administratively listed 1966;
National Register historic district documentation for the Chickamauga and Chattanooga National Military Park accepted 1986, with the Snodgrass, Kelly, and Brotherton houses listed as contributing resources;
Additional Documentation for Chickamauga and Chattanooga National Military Park accepted 1998.

*Period of Significance of Historic District:* 1890-1933

## Proposed Treatment

***• The NPS administratively determined management category for the Snodgrass, Kelly, and Brotherton Houses is "Must Be Preserved and Maintained," and the Ultimate Treatment is Preservation. The treatment recommendations in this report continue the established Ultimate Treatment of Preservation. Specific measures that follow The Secretary of the Interior's Standards for Preservation are discussed in this report.***

***• The recommended ultimate use of the buildings has been defined in the 2015 amendment to the park's 1988 General Management Plan, calls for the houses to be interpreted.***

# Part I: Developmental History

## Historical Background and Context

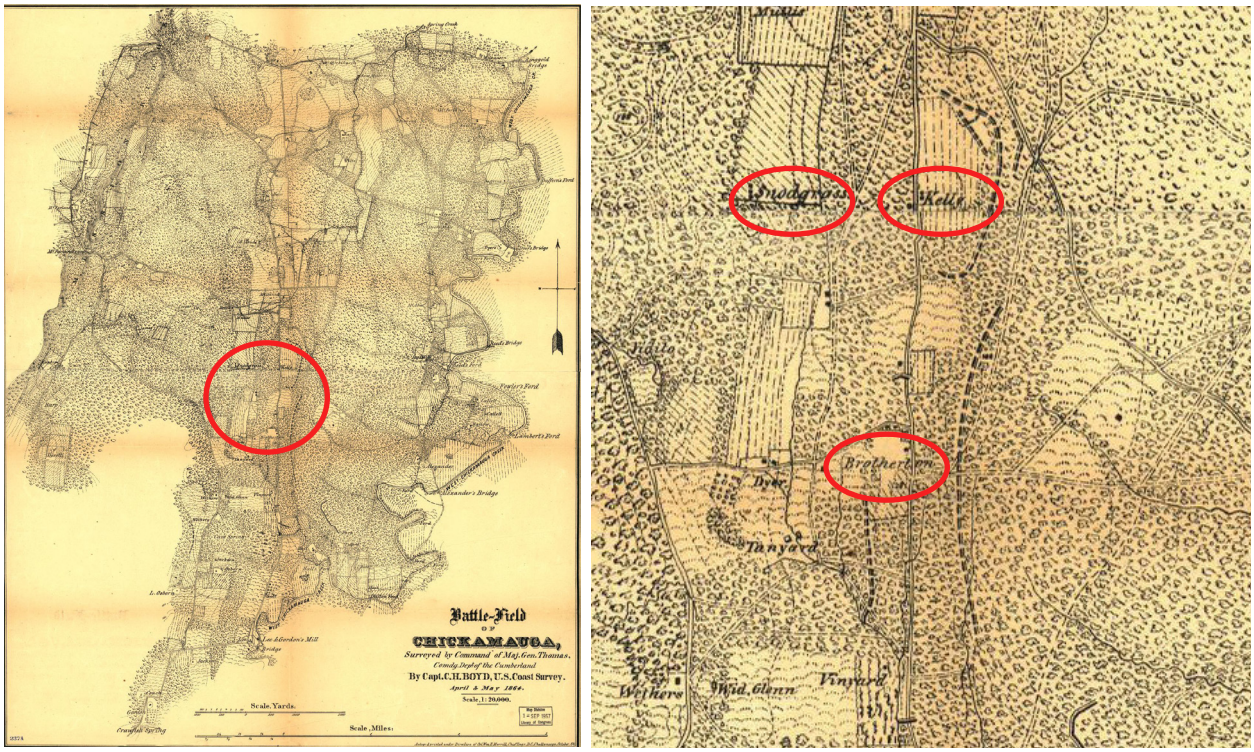



**Figure A1.** "Battle-field of Chickamauga, Surveyed by Command of Maj. Gen. Thomas, Comdg. Dept. of the Cumberland, by Capt. C.H. Boyd, U.S. Coast Survey. April & May, 1864." Survey and enlarged detail, house locations circled in red. (Library of Congress, Geography and Maps Division, lccn.loc.gov/99447307)

*This chapter provides the background and context of the Snodgrass, Kelly, and Brotherton Houses within their immediate setting and associations. The next chapter discusses construction of the buildings themselves and their later changes.*

### Introduction and Location

The Snodgrass, Kelly, and Brotherton houses are located within Chickamauga National Battlefield, a park unit of the Chickamauga-Chattanooga National Military Park, headquartered in Fort Oglethorpe, Georgia. While the park as a whole, spans the Georgia-Tennessee border, the Chickamauga Battlefield is in northern Georgia. Thought to have been largely rebuilt ca. 1867, these log houses are representative of the principle residences of historic farmsteads present during the 1863 Civil War Battle of Chickamauga.[24]

Straddling the Georgia counties of Walker and Catoosa, the approximately 5,280-acre Chickamauga Battlefield is bordered to the north by the city of Fort Oglethorpe, to the east and south by modern residential development, and to the west by the West Chickamauga Creek, a highway corridor, and a right-of-way owned by the Chattooga & Chickamauga Railroad.[25] While the land around the battlefield has largely been developed, the battlefield itself retains the character of a rural county.

The houses are located on a 0.75-mile stretch of historic Lafayette Road, which bisects the park north-south. The Kelly and Brotherton houses are situated immediately on the road, and the Snodgrass house is approximately half a mile to the west (*Fig A1*).[26]

24. John Milner Associates, et. al., *Chickamauga Battlefield Cultural Landscape Report* (National Park Service, Southeast Regional Office, September 2004), appendix A, p.15.

25. Milner Associates, *CLR*, ch. 1, pp. 3-4.

26. Distances measured on Google Earth.

## Antebellum Settlement (1830s-1861)

For the purposes of this report, the historic context begins in the 1830s. Information on the settlement of this area prior to this time is widely available in other park documents, notably the 2004 *Cultural Landscape Report* by John Milner Associates. It is briefly summarized here.

The Tennessee River Valley was first inhabited by the Mississippian peoples and their descendants, the Muscogee. Driven inland from East Coast by European settlement, the Cherokee began competing for this land in the 1600s. It was the Cherokee who principally inhabited the area when white settlers first arrived.[27]

White settlement of the Tennessee River Valley began soon after the War of 1812, spurred on by the discovery of gold in the region in 1828.[28] Walker County, Georgia, was established in 1833, assembled from historically Cherokee land. After the Cherokee were forcibly removed under the 1830 Indian Removal Act, their ancestral land was divided among white settlers during the sixth Georgia Land Lottery held in 1832.[29]

Early settlement patterns coincided with available natural resources. The land of the Tennessee River Valley and its associated smaller tributaries, including the West Chickamauga Creek, proved fertile. Settlers found a living in subsistence farming of mainly cotton, grain crops, and livestock.[30]

While scattered thinly, landownership was clustered along established roadways and former Native American trails, such as Lafayette Road, along which several farmsteads and other community infrastructure developed. These early farmsteads consisted of simple log-constructed dwellings, usually covered in clapboard siding, and an array of utilitarian outbuildings such as barns, smokehouses, and privies.[31]

By the early 1860s, a total of 24 farmsteads are recorded in the area that would become the battlefield at Chickamauga.[32] Among them are the farmsteads of the Snodgrass, Kelly, and Brotherton families.

While Georgia had a large enslaved population, the counties of northern Georgia were less reliant on enslaved labor. An 1861 map of Georgia listing the enslaved population as a percentage of each county places Walker County at 13% and Catoosa County at 14%. An entry can be found in the 1860 Slave Schedule for Walker County listing a "P.L. Kelley" as the owner of 16 enslaved persons ranging in age from 1 month to 35 years old. It is unclear if there is any relation to the Kelly family in this report. There are no entries for Snodgrass or Brotherton in the Schedule for Walker or Catoosa Counties.[33]

## 1863 Civil War Battle Associations

The political climate of the area was tense both during and after the Civil War. While both Tennessee and Georgia succeeded from the Union (United States Army), a large number of Union loyalists populated eastern Tennessee and northwestern Georgia. This often led to conflicts among local residents. Young men from the Snodgrass, Brotherton, and Kelly families are known to have fought for the Confederacy.[34]

The Civil War Battle of Chickamauga was fought between Union General William S. Rosecrans's Army of the Cumberland and Confederate General Braxton Bragg's Army of Tennessee over September 18-20, 1863. The battle took place over an area of roughly 20 square miles centered on Lafayette road in the area just south of modern-day Fort Oglethorpe and north of the historic Lee and Gordon's Mills.[35]

As the sounds of battle drew near, local families purportedly left their homes and sought shelter in a nearby ravine northwest of the Snodgrass house, where they remained for several days.[36]

27. *Milner Associates*, ch. 2, pp. 2-3.
28. *Milner Associates*, ch. 2, pp. 2-3.
29. *Milner Associates*, appendix A, p. 2; "The Trail of Tears and the Forced Relocation of the Cherokee Nation," NPS.
30. *Chickamauga and Chattanooga National Military Park Cultural Landscape Inventory* (National Park Service, Southeast Regional Office),1995, p. 41.
31. *CHCH CLI*, p. 9.
32. *CHCH CLI*, p. 41; Milner Associates, *CLR,* p. 8.
33. "1860 United States Slave Schedules, Georgia," Valdosta State University Archives and Special Collections, Collection number: 6405C63E-43A2-75BF-4F9A-AF72D44B8828, archivesspace.valdosta.edu/repositories/2/digital_objects/1880.
34. Milner Associates, *CLR*, ch. 2, p. 17; Sartian, *History of Walker County Georgia,* pp. 100, 102, 105.
35. Milner Associates, *CLR*, appendix A, p.2.
36. Sartian, *History of Walker County Georgia,* p. 100. Refer to footnote #8 for additional information regarding this source.

The farmsteads located along Lafayette Road were some of the only distinctive landmarks in the area, and served as wayfinding devices for troop movements. Official battle reports from both armies are scattered with references to these farmsteads.[37]

The Snodgrass, Kelly, and Brotherton farmsteads each played a prominent role in the battle. As summarized by the park's 1999 *Historic Resource Study*, "The Kelly house was a landmark for Union forces moving to extend Gen. Rosecrans's left on September 18 and 19. The Union left dug in around the Kelly Farm at the north end of the Chickamauga battlefield and repulsed repeated Confederate assaults."[38]

The deciding action of the battle took place near the Brotherton house on the afternoon of September 19 through the morning of September 20, when General James Longstreet's troops manage to break through the Union line, forcing Union troops to retreat.[39]

The Snodgrass farmstead, located on a rise in the land named Snodgrass Hill, served as a rallying point for union troops on the afternoon of the 20th. The defensive position afforded by the hill allowed Union troops to effectively fight off advancing forces while at the same time strategically retreating.[40]

While the Confederates won the battle, they ultimately failed in their goal of blocking the Union Army from retreating back to Chattanooga, where the Union would later claim a decisive victory.[41]

Several of the farmsteads served as headquarters for commanders during the battle. The Brotherton house became the headquarters of Confederate General, Simon Bolivar Buckner, while the Snodgrass house served as headquarters for Union General George H. Thomas.[42]

The Brotherton, Kelly, and Snodgrass houses are also thought to have served as field hospitals during and after the Battle of Chickamauga, but as explained by Civil War medical treatment expert, Dr. Anthony Hodges, the houses would have served more of a triage function allowing for the stabilization of the wounded prior to their transport to the established field hospitals.

Medical actions undertaken at these triage stations would have included the placing of splints and the packing of wounds to slow bleeding. For ease of access, it is likely the doors would have been taken off their hinges and the family's dining table would have been used as an examination table.[43]

## Post-bellum Context

After the war, many families returned to their land to rebuild, though some not immediately. The physical scars on the land caused by the battle were repaired and fields were re-sown. The area population grew with this return to agriculture, and by 1890, 24 new farmsteads had been established.[44]

The Brotherton house was one of few structures thought to have survived intact, albeit damaged. It is thought that the Snodgrass, Kelly, and Brotherton houses were "rebuilt and re-occupied" ca. 1867, "on or near" their known locations at the time of the battle.[45]

## Establishment of a National Battlefield

On August 19, 1890, Chickamauga and Chattanooga battlefields were enshrined as the

37. Milner Associates, *CLR*, appendix A, p.9.
38. Jill K. Hanson and Robert W. Blythe, *Chickamauga and Chattanooga National Military Park Historic Resource Study* (National Park Service, Southeastern Regional Office, January 1999), pp. 49-50.
39. Garry Adelman interview of CHCH Park Historian, James Ogden, "Tour Stop 9: Chickamauga: Confederate Breakthrough at the Brotherton Farm," American Battlefield Trust video, 12:40, April 7, 2022, youtube.com/watch?v=l8mA6iwiI6I.
40. Garry Adelman interview of CHCH Park Historian, James Ogden, and Tennessee Civil War Preservation Association Civil War medical practices expert, Dr. Anthony Hodges, "Tour Stop 10: The Rock of Chickamauga: Snodgrass Hill & Horseshoe Ridge," American Battlefield Trust video, 28:40, April 7, 2022, youtube.com/watch?v=0whwfuJTees.
41. "The Campaign for Chattanooga: Death Knell of the Confederacy?," National Park Service, informational pamphlet, npshistory.com/brochures/chch/2013.pdf.
42. Milner Associates, *CLR*, appendix A, p.9.
43. Hanson and Blythe, *CLI*, pp. 49-50; Garry Adelman interview of James Ogden and Dr. Anthony Hodges.
44. Hanson and Blythe, *CLI*, p. 46. Source information is unclear how many of these 24 farmsteads were the same as those present in the early 1860s.
45. Hanson and Blythe, appendix 1, p 15.



**Figure A2.** Period furniture inside Brotherton House as part of the Park's living history program, 1972. (CHCH Archives, box 0063, folder 0109)



**Figure A3.** Interpretive volunteer in period dress outside Snodgrass House as part of the Park's living history program, 1975. (CHCH Archives, box 0063, folder 0090)

nation's first National Military Park. The enabling legislation was also the first to authorize the preservation of an American battlefield.[46] The U.S. War Department was given administrative purvey.[47]

Property for the park was acquired from various landholders over the next few years. The Kelly and Brotherton parcels were both acquired by 1892; however, the records for the Snodgrass parcel are either not present in deed records research to date, or the property changed hands at some unknown point before it was acquired for the park.[48]

While the park supported adaptive reuse of the existing structures, the primary goal and ongoing concern was their preservation. In 1910, the park's commissioner gave the direction that the structures should be kept "in repair, with like dimension and materials."[49]

## National Park Service

Administration of the park was transferred from the War Department to the National Park Service on August 10, 1933, as part of larger government reorganization to consolidate administration of historically significant properties under the NPS.[50] With the establishment of the National Register of Historic Places in 1966, the park as a whole would have been administratively listed; however, it was not formally listed under a historic district nomination until July 15, 1986.[51]

The three houses were actively used as part of the park's interpretive program as early as 1948, when a trailside exhibit was installed at Brotherton house.[52] Guidance from a 1962 interpretive plan implemented the same year, identified the Brotherton house as a "visitor concentration point," and instructed park interpretive personnel to increase public contact at this location.[53]

In 1972, "living history" programs were developed for the park. The Snodgrass, Kelly, and Brotherton houses were outfitted with pre-Civil War period furnishings and opened to the public with living history demonstrations conducted by park volunteers in period costume. Additionally, a nineteenth-century farming exhibit was established at the Brotherton homestead.[54]

David Guiton, Park Superintendent at the time, remarked that "this was not a park at the time of the battle, this was pioneer farmland where 24 families lived, moved and had their being. Along with preserving the battlefield, we should also be preserving some remnants of how these people lived, the lifestyles that were a part of it." [55]

The living history programs continued through the 1970s, but waned into the next decade.[56] Following

46. John C. Paige and Jerome A. Greene, *Administrative History of Chickamauga and Chattanooga National Military Park* (Denver: National Park Service, Denver Service Center, 1983), pp. 18-19.
47. Paige and Greene, *Admin. History*, p. 1.
48. Paige and Greene, pp. 235-238.
49. Paige and Greene, p. 63.
50. Paige and Greene, p. 89.
51. Edward E. Tinney and Lenard E. Brown, National Register of Historic Places Nomination Form, accepted June 6, 1986.
52. Paige and Greene, *Admin. History*, p. 162.
53. Paige and Greene, p. 164.
54. Paige and Greene, p. 167.
55. Paige and Greene, p. 167.
56. Paige and Greene, p. 167.

this, visitor access to the interiors of the house was restricted by metal bars over the windows and doorways, which maintain views inside the structures. Modern interpretive signage and guided audio tours are provided.

# Chronology of Development and Use

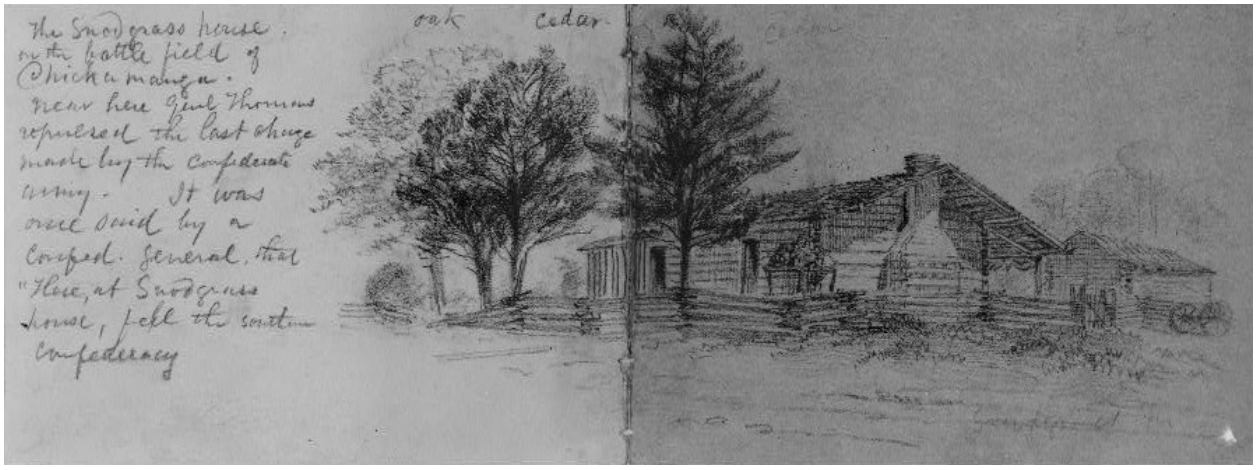



**Figure B1.** Sketch of Snodgrass House by Civil War artist correspondent, Alfred Rudolph Waud, ca. 1890. Written text reads, "The Snodgrass House on the battlefield of Chickamauga. Near here Genl. Thomas repulsed the last charge made by the Confederate Army. It was once said by a Confed. General that 'There, at Snodgrass house, fell the southern confederacy.'" (Library of Congress, Morgan Collection of Civil War Drawings, lccn.loc.gov/2004660147. The LOC gives the date of this image as 1863; however, information regarding the probable date of this image provided by CHCH Park Historian, James Ogden)

*The majority of information on physical changes to the Snodgrass, Kelly, and Brotherton Houses comes from the photographic record of the building, such that it exists.*

## Snodgrass House

### Pre-1867

The date of construction of the original Snodgrass homestead, home to George Washington Snodgrass and his large family, is unknown, but likely shortly after he purchased the land in 1855 assuming there was no pre-existing house on the land.[57] The 1860 United States Census lists George, age 50, as a farmer, and the value of his land at $1,000. His family members are listed as, Elizabeth, age 28; Mary, age 16; Eunice, age 9; Georgia, age 6; William, age 4; Julia, age 3; Martha, age 1; and James, age less than 1 year.[58] Twice widowed, Elizabeth was George's third wife. George also had two adult sons – Charles, who served in the Confederate Army, and John, who lived at home due to special needs.[59]

The early house is thought to have been a dogtrot design, with two enclosed spaces connected by a covered breezeway. The farmstead also had a smokehouse.[60]

Daughter Julia, who would have been around 6 years old at the time of the Battle of Chickamauga, recalls leaving the house with her family in the afternoon of September 19, 1863, to take shelter in a nearby ravine where members of the Kelly and Brotherton families also supposedly hid.[61]

57. Harry Smeltzer, "The Snodgrass Family at Chickamauga," *Civil War Times*, August 2010, historynet.com/snodgrass-family-chickamauga/. This article appeared with little to no source information in what would best be described as an enthusiast magazine. Further research into this information is needed for confirmation of its validity.

58. 1860 US Census, Walker County, GA, 9th District, p. 9, familysearch.org/ark:/61903/3:1:33SQ-GYBT-N52?i=8. Other sources have Eunice named Virginia.

59. Sartian, *History of Walker County Georgia,* p. 101. Refer to footnote #8 for additional information regarding this source.

60. Sartian, p. 101.

61. Sartian, p. 101.

Julia recalled the experience nearly 60 years later. She remembers hearing the "roar of battle" on Friday, September 18. Despite this, her father refused to retreat from the house immediately.[62]

"About three o' clock on Saturday afternoon, the 19th, bullets began falling around their house, and going through the roof, and their father gave the word to retreat. They went northwest from their house up a ravine, and camped in the woods." There they "remained for eight days and nights" with other local families, during which time "... they were utterly without shelter, and practically without food."[63]

"They suffered much from lack of water. The weather had been dry for weeks, the marching armies had ground the roads into dust which hung over the valley like a pall, and many of the springs and wells were dry. The weather grew colder while they were at this camp and they had not sufficient coverings even for the little children, and on some mornings the children's heads would be white with frost."[64]

Despite the relative brevity of the battle, the families' long stay in the makeshift camp "is explained by the fact that all houses and buildings were filled to overflowing with the wounded and they thus were prevented from returning home."[65]

Upon returning to the house, the Snodgrass family found "nothing remained but broken and blood stained furniture and other fearful evidences of the agony of the wounded." They relocated to temporary housing in nearby Ringgold until after the war.[66]

The Snodgrass family "suffered the destitution common to the people of the south. One small source of income was from the picking up of bullets and other relics on the battlefield and selling them in Chattanooga."[67]

## ca. 1867

Snodgrass house is thought to have been rebuilt in whole or in part around 1867.[68]

62. Sartian, p. 101.
63. Sartian, p. 101.
64. Sartian, p. 101.
65. Sartian, p. 101.
66. Sartian, pp. 101-102.
67. Sartian, p. 102.
68. Hanson and Blythe, *HRS,* p.21, citing information appearing in the 1985 National Register Nomination without citation. This information is also repeated in the 1998 National Register Nomination Additional Information filing, also by Hanson and Blythe.



**Figure B2.** Snodgrass House, northeast oblique, ca. 1895 (Boynton, H.V., compiler. *Dedication of the Chickamauga and Chattanooga National Military Park, September 18-20, 1895.* "Report of the Joint Committee to Represent the Congress at the Dedication of the Chickamauga and Chattanooga National Military Park." Washington, D.C.: Government Printing Office, 1896, p. 41)



**Figure B3.** Snodgrass House, northeast oblique, ca. 1895 (Boynton, Henry V., The National Military Park: Chickamauga – Chattanooga; An Historical Guide (Cincinnati, Ohio: The Robert Clarke Company, 1895), xx, 307 pp., maps, illus., index)

## 1895

The earliest images of the house are a ca. 1890 sketch drawn by Civil War artist correspondent, Alfred Rudolph Waud (*Fig. B1*), a photograph included in an 1895 publication commemorating the dedication of the Chickamauga and Chattanooga National Military Park, presumably taken for the publication (*Fig. B2*), and a second photo taken ca. 1895 and published in a guidebook for the park (*Fig. B3*). The three images are entirely consistent with each other.

All three images show a larger structure than what exists today. Three components of the main structure are visible, a south-facing single-room house visually consistent with the present-day house, a gable-end extension to the west that appears to have vertical weatherboard siding and a separate entrance facing south, and an extension to the north that follows the same roof line as the main house. Also visible is an outbuilding just to the north of the house.



**Figure B4.** Snodgrass House, northeast oblique, ca. 1902. Photograph by William Henry Jackson. (Library of Congress, Detroit Publishing Company Photograph Collection, lccn.loc.gov/2016799089)



**Figure B5.** Snodgrass House, southwest oblique, ca. 1913. (CHCH Archives)



**Figure B6.** Snodgrass House, east elevation, 1927. Captioned, "Mrs. Julia Snodgrass standing in front of her old home." (Tennessee State Library and Archives, Tennessee Historic Sites Picture Collection, ID# 13414)

### ca. 1902

A photograph taken by William Henry Jackson ca. 1902 (*Fig. B4*) is again entirely consistent with the earlier images. Visible eccentricities in the log immediately above the front door of the main house are identical in the 1895 and ca. 1902 photographs.

### ca. 1913

The gable-end extension west of the main house and the shed extension south of the house appear to have been removed by 1913 (*Fig. B5*). The lighter areas where there is no grass show the remaining footprint of these additions. The stone at the bottom right of the photograph may be from the foundations.

### 1927

A 1927 photograph is noted as showing "Mrs. Julia Snodgrass standing in front of her old home" (*Fig. B6*). Julia was the child of George Washington Snodgrass, and whose recollections of the battle can be found at the beginning of this section.

### 1958

The Snodgrass barn was demolished in 1958.[69]

### 1961

A series of 1961 photographs document extensive work at the Kelly house including replacement of selected trim and chinking, all roof framing members, and roofing. Based on physical investigations conducted for this report, replacement material of the same age at the Snodgrass house indicates this same work was undertaken at or around the same time.

### 1964

An NPS Individual Building Data Form 10-768 dated June 30, 1964 notes that the structure of the Snodgrass house is in fair condition, and that the house's general state of repair is also fair. A rudimentary floor plan shows the house in its present configuration, meaning that by this time the extension to the north had been removed. A photograph of the house associated with this form, though dated 1969, shows the wood shingle roof in poor condition and a noticeable slump in the logs on the south elevation centered on the doorway (*Fig. B7*).[70]

69. Hanson and Blythe, *HRS*, ch 2, p 41.
70. Individual Building Data Form 10-768, June 30, 1964, CHCH Archives, Box 0030, File 0007.



**Figure B7.** Snodgrass House, east elevation, ca. 1969. (CHCH Archives, box 0030, file 0007)



**Figure B9.** Snodgrass House, west elevation, July 1977. (CHCH Archives, box 0030, file 0027)



**Figure B8.** Snodgrass House, south elevation October 1976 (CHCH Archives, box 0039, file 0058)



**Figure B10.** Snodgrass House, north elevation, July 1977. (CHCH Archives, box 0030, file 0027)

## 1976-77

Photos taken in September of 1976 and July of 1977 show the house much as it appears today (*Figs. B8-B10*). Any work after this date have likely only consisted of routine maintenance. More recent park administrative documents such that they include contemporary photographs, provide no additional information.

## Kelly House

### Pre-1867

The date of construction of the original Kelly homestead is unknown. Park administrative documents interchangeably use the spellings Kelly and Kelley, and give the occupant names as both Elisha/Elijah, and as George W.

Other sources clarify that the house and land were owned by Elijah Kelly and rented to his brother Elisha. Elisha was father to five or six children including sons, William, Newton, and George W. Being of age at the time of the battle, George served in the Confederate Army.[71]

Little else is known about the Kelly family, although it is thought that they joined the other local families in the temporary camp in the woods during the course of the battle.[72]

### ca. 1867

The Kelly house is thought to have been rebuilt in part or in whole around 1867.[73] According to the 1999 Historic Resource Study, "Based on newspapers used as insulation in the walls, the Kelly house seems to have been constructed shortly after the war on or very near the site of a house at the south end of the 750-acre Kelly Farm that was depicted in a painting done after the battle. This single-pen log structure is very similar to the house or 'block house' described by battle participants."[74]

### 1895

A photograph included in an 1895 publication commemorating the dedication of the Chickamauga and Chattanooga National Military Park, presumably taken for the publication, is the first available depiction of the house (*Fig. B11*). It appears much as it does today with the additions of a centered open porch with a shed roof on the west (front) elevation and a hatch for what is presumably a root cellar opening to the south.

71. Sartian, *History of Walker County Georgia,* p. 105.
72. Sartian, p. 101.
73. Hanson and Blythe, *HRS,* p.21, citing information appearing in the 1985 National Register Nomination without citation. This information is also repeated in the 1998 National Register Nomination Additional Information filing, also by Hanson and Blythe.
74. Hanson and Blythe, p. 51.

### 1900-1917

Appearing in photos from the early 20th century (*Figs. B12-B13*) are a small extension to the east under the same roof line and a chimney (albeit collapsed) that appears to be entirely of stone masonry construction. It is unclear if these last two features were present in 1895, as they cannot be seen in the angle of the earlier photograph. Visible on the opposite side of Lafayette Road is the Kelly barn.



**Figure B11.** Kelly House, southwest oblique, ca. 1895 (Boynton, H.V., compiler. *Dedication of the Chickamauga and Chattanooga National Military Park, September 18-20, 1895.* "Report of the Joint Committee to Represent the Congress at the Dedication of the Chickamauga and Chattanooga National Military Park." Washington, D.C.: Government Printing Office, 1896, p. 361)



**Figure B12.** Kelly house on left, Kelly Barn on right, looking north on Lafayette Road, 1900-1915. (Library of Congress, Detroit Publishing Company Photograph Collection, lccn.loc.gov/2016811084)



**Figure B13.** Kelly house, northwest oblique, ca.1917. (CHCH Archives, box 0061, file 0050)



**Figure B14.** Kelly house, northwest oblique, December 1958. (CHCH Archives, box 0061, file 0040)

## 1942

A metal shingle roof was present on the Kelly house by the onset of WWII as the metal shingles were collected as part of a 1942 scrap metal drive at the park. The metal roof was replaced with asphalt shingles.[75]

## 1958

A 1958 photo labeled "Kelly house before repairs," shows that by this time the shed-roof front porch and rear extensions had been removed, and that the chimney had been reconstructed in a manner similar to what is present today (*Fig. B14*). The roof appears to be of wood shingles, rather than the asphalt shingles said to have been installed in 1942. The reason for such extensive repair to the roof framing alluded to in the photograph's description is unclear from the photograph. The Kelly barn was also demolished in 1958.[76]

75. Milner Associates, *CLR*, ch 2, p 40.
76. Milner Associates, ch 2, p 41.



**Figure B15.** Kelly house, southwest oblique, May 1961. Replacement roof framing and gable end wall framing. (CHCH Archives)



**Figure B16.** Kelly house, south gable end wall, May 1961. Applying new board siding. (CHCH Archives)

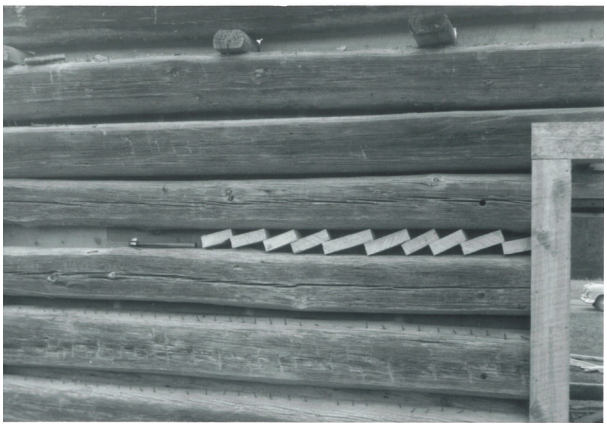


**Figure B17.** Kelly house, detail of west elevation near door, May 1961. Replacement chinking. (CHCH Archives)

## 1961

A series of 1961 photographs (*Figs. B15-B17*) document extensive work at the Kelly house including replacement of trim and chinking, all roof framing members, and roofing. Based on physical investigations conducted for this report, the roof framing members installed in 1961 are still present today.

## 1964

An NPS Individual Building Data Form 10-768 dated June 30, 1964 notes that the structure of the Kelly house is in fair condition, and that the house's general state of repair is also fair. A rudimentary floor plan shows the house in its present configuration. The form also notes that the walls of the house were rechinked in 1961, which is consistent with photographic evidence, but it relates none of the other work documented by the 1961 photographs.[77]

77. Individual Building Data Form 10-768, June 30, 1964, CHCH Archives, Box 0030, File 0007.

## 1972-77

Photos taken in March of 1972 and July of 1977 (*Figs. B18-B20*) show the house much as it appears today. Any work after this date have likely only consisted of routine maintenance. More recent park administrative documents such that they include contemporary photographs, provide no additional information. At some point within the last 20 years, the chimney partially-collapsed and remains in a partially collapsed state today. Based on physical investigations, this was not a recent occurrence.



**Figure B18.** Kelly house, northwest oblique, March 15, 1972. (CHCH Archives, box 0061, file 0049)



**Figure B19.** Kelly house, southwest oblique, March 15, 1972. (CHCH Archives, box 0061, file 0048)



**Figure B20.** Kelly house, east elevation July 1977. (CHCH Archives, box 0030, file 0027)

## Brotherton House

### Pre-1867

The date of construction of the original Brotherton homestead, home to George and Martha Brotherton and their many children, is unknown.

George and Martha had eight children, Thomas, James L., William, George W., Susan, Sarah, Janie B., and Adaline. Thomas and James L. both fought for the Confederacy at the time of the battle. Daughter Sarah was married to Larkin H. Poe, and lived nearby. Larkin was also a Confederate soldier.[78]

Adaline, reputed to have been born on August 11, 1840, making her 23 years old at the time of battle, was interviewed at age 84. According to her recollections, her family, despite hearing the approaching sounds of battle, did not depart their house until the evening of Saturday, September 19. They joined the other local families in the temporary camp in the woods.[79]

The Brotherton's cows survived the battle, and Adaline "went once each day, after the battle, to their home and milked these cows, and turned the milk over to the nurses to be fed to the wounded soldiers who filled their yard and home." [80]

Upon their return to the house, the family found several dead Federal soldiers in their yard, which they purportedly buried on the property.[81]

### ca. 1867

Like the others, the Brotherton house is thought to have been rebuilt in whole or in part around 1867.[82]

### 1895

Two photographs included in an 1895 publication commemorating the dedication of the Chickamauga and Chattanooga National Military Park, presumably taken for the publication, are the first available depictions of the house (*Figs. B21-B22*). It appears much as it does today with the addition of a small extension to the west (rear) under the same roof line. Also visible to the west of the house is an outbuilding.

### 1900-1930s

An early twentieth-century photograph shows the rear shed extension more clearly, although the northwest corner of the extension had collapsed by this point (*Fig. B23*). The outbuilding present in the 1895 photograph is no longer present. A photograph taken in 1928 (*Fig. B24*) and one likely from the 1930s (*Fig. B25*) show two additional views of the houses in the early twentieth century.

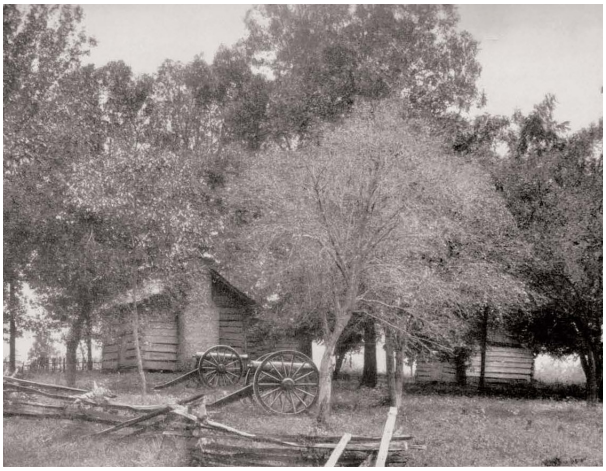


**Figure B21.** Brotherton House, northeast oblique, ca. 1895. (Boynton, H.V., compiler. *Dedication of the Chickamauga and Chattanooga National Military Park, September 18-20, 1895.* "Report of the Joint Committee to Represent the Congress at the Dedication of the Chickamauga and Chattanooga National Military Park." Washington, D.C.: Government Printing Office, 1896, p. 41)

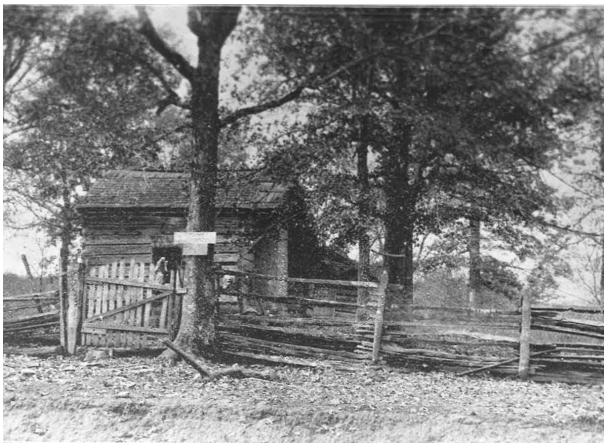


**Figure B22.** Brotherton House, viewed from the north, ca. 1895. (Boynton, H.V., compiler. *Dedication of the Chickamauga and Chattanooga National Military Park, September 18-20, 1895.* "Report of the Joint Committee to Represent the Congress at the Dedication of the Chickamauga and Chattanooga National Military Park." Washington, D.C.: Government Printing Office, 1896, p. 49)

78. Sartian, *History of Walker County Georgia,* p. 102.
79. Sartian, p. 102.
80. Sartian, p. 102.
81. Sartian, p. 102.
82. Hanson and Blythe, *HRS,* p.21, citing information appearing in the 1985 National Register Nomination without citation. This information is also repeated in the 1998 National Register Nomination Additional Information filing, also by Hanson and Blythe.

## 1939

A photograph dated October 4, 1939 appears to show the house after recently completed repairs (*Fig. B26*). The sill log on the west (front) elevation appears to be newly installed, as does the wood shingle roof. The rear shed extension is no longer present. It is possible that this work was done by one of the Civilian Conservation Corps (CCC) Camps active at Chickamauga during this period.[83]

## 1960

A photograph taken on April 22, 1960 at the same angle as the 1939 photograph shows no change, save for aging of materials and the removal of the chinking (*Fig. B27*). Historically, chinking was often removed during the warm months to promote air circulation; however, this was likely done ahead of work on the building.

83. Paige and Greene, *Admin. History*, p. 87.



**Figure B23.** Brotherton House, northwest oblique, 1900-1915. (Library of Congress, Detroit Publishing Company Photograph Collection, lccn.loc.gov/2016815314)



**Figure B24.** Brotherton House, viewed from the east, June 4, 1928. (CHCH Archives)



**Figure B25.** Brotherton House, northeast oblique, 1930s. (CHCH Archives)

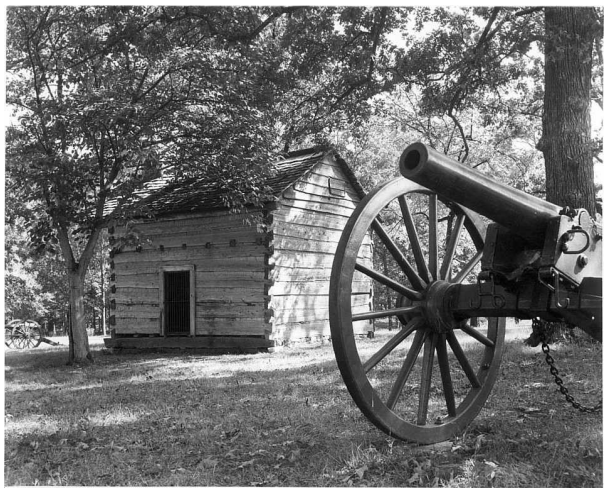


**Figure B26.** Brotherton House, southwest oblique, October 4, 1939. (Tennessee State Library and Archives, Department of Conservation Photographs Collection, ID# 18922)

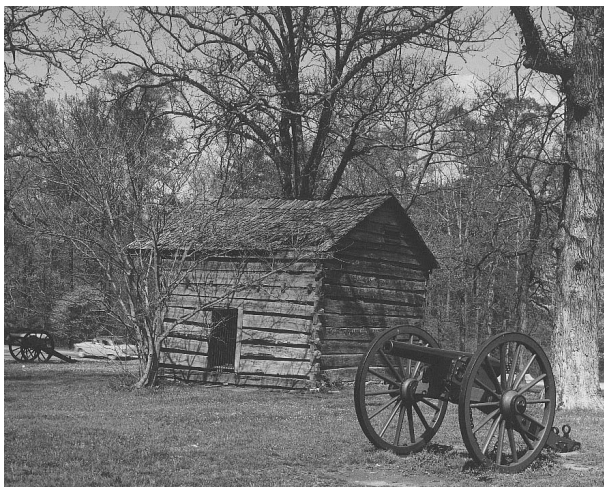


**Figure B27.** Brotherton House, southwest oblique, April 22, 1960. (Tennessee State Library and Archives, Department of Conservation Photographs Collection, ID# 19322)

## 1961

A series of 1961 photographs document extensive work at the Kelly house including replacement of selected trim and chinking, all roof framing members, and roofing. Based on physical investigations conducted for this report, replacement material of the same age at the Brotherton house indicates this same work was undertaken at or around the same time.

## 1964

An NPS Individual Building Data Form 10-768 dated June 30, 1964 notes that the structure of the Brotherton house is in good condition, and that the house's general state of repair is also good. A rudimentary floor plan shows the house in its present configuration. The form also notes that the roof was replaced in 1961, which is consistent with photographic evidence.[84]

## 1977

Photograph taken in July of 1977 (*Figs. B28-B29*) show the house much as it appears today. Any work after this date have likely only consisted of routine maintenance. More recent park administrative documents such that they include contemporary photographs, provide no additional information.



**Figure B28.** Brotherton House, southwest oblique, June 30, 1964. (CHCH Archives, box 0030, file 0027)



**Figure B29.** Brotherton House, northeast oblique, July, 1977. (CHCH Archives, box 0030, file 0027)

84. Individual Building Data Form 10-768, June 30, 1964, CHCH Archives, Box 0030, File 0007.

# Physical Description and Condition Assessment



**Figure C1.** The Snodgrass house as viewed from the southwest. Unless otherwise noted, all photos in this section were taken by JKOA and its consultants in September 2021 and May 2022.

## Snodgrass House

***The front of the Snodgrass House faces south-southwest. For the purposes of this report, the house is said to face south.***

### Architectural Overview

The Snodgrass House is a single-story, single-pen log structure with a side-gabled roof (*Fig. C1*). The roof projects beyond the exterior wall at the north elevation, covering the lower portion of the exterior shouldered log chimney. The interior consists of one space accessed by a total of three exterior doorways, one on each of the east, west, and south elevations. One window opening is positioned at the east end of the north elevation. The structure is thought to have been reconstructed using logs originally used in a larger structure.

### Façade Organization

The south elevation has a single doorway at its center that is accessed by stone steps. The east and west elevations are mirror images of each other, each with a centered doorway and projecting roof rake at their north ends. The north elevation has a centered log chimney protected by the projecting roof. A window opening with vertical bars is east of the chimney (*Figs. C2-C5*).

### Construction Characteristics

***Please also see the Structural Investigation Report by 1200AE located in Appendix C.***

#### Floor Framing

Floor framing was observed by removing plank floorboards in two locations, one near the west doorway and the other near the hearth at the north



**Figure C2.** Snodgrass House - South Elevation.



**Figure C3.** Snodgrass House - East Elevation.



**Figure C4.** Snodgrass House - West Elevation.



**Figure C5.** Snodgrass House - North Elevation.

end of the interior. The joists range in size from 7" to 8" in diameter and have a flattened top surface to accommodate the flooring above (*Fig. C6*). The joists are typically spaced at about 22" on center, while those at the north end near the fireplace hearth are spaced at about 30" on center. The base of some logs sits at grade while others sit just above grade. The joists have 5" deep notches at the ends that bear on the inside projection of the foundation wall (*Figs. C7-C8*).

### Gable End Framing

The gable ends are framed with sawn studs measuring about 3¼" wide by 4" deep that are spaced at about 3'-8" on center (*Fig. C9*). The exterior weatherboard is applied directly to the studs. The framing and weatherboard are modern.

### Roof Framing

Sawn rafters measure 3¼" wide by 4" deep and are spaced at approximately 35" on center. The rafters meet a sawn ridge plate at the peak of the roof and are tied with 1" thick collar ties that vary between 4" and 6¾" deep (*Figs. C10-C11*). Rafters are nailed to the top round at their bases.



**Figure C6.** Snodgrass House - Log floor joists visible through probe opening.



**Figure C7.** Snodgrass House- Log floor joist in contact with grade.



**Figure C8.** Snodgrass House - Notched end of log floor joist at west bearing (at floor probe). Note floorboard above and gap between joist and stone foundation wall below.

Seven tie beams span to tie the long east and west walls together. The beams vary between 3¼" to 4" in width and 4¼" to 6" in depth (*Fig. C10*). The beams are notched about 3½" deep at the ends to bear on the logs below. The notched ends are exposed on the exterior. The roof framing is modern.

The cantilevered north end of the roof is supported by two projecting top rounds at the



**Figure C9.** Snodgrass House - Gable end framing.

eaves (*Fig. C12*). The top rounds each measure about 6 ½" wide by 8" deep. The east end has been sistered by a 1¾"-wide by 5¾"-deep member.

Modern continuous roof decking is exposed at the interior and at the underside of the north cantilever and eaves and measures about 5¼" wide by likely 1" or 1¼" thick (*Fig. C11*).



**Figure C10.** Snodgrass House - Roof framing and tie beams.



**Figure C11.** Snodgrass House - Overview of roof framing.



**Figure C12.** Snodgrass House - Cantilevered top round at north eave. Note deterioration of member and added sister.



**Figure C13.** Snodgrass House - Exposed rafter tails and ends of tie beams visible on exterior.

### Utility Systems

The house has no utility services or mechanical, electrical, or plumbing components.

## Exterior Features

### Foundation

The house is supported by a mortared stone perimeter foundation that varies in height from



**Figure C14.** Snodgrass House - Perimeter stone foundation wall. Note displaced stones.



**Figure C15.** Snodgrass House - Perimeter stone foundation wall. Note missing and displaced stones.

about 5” at the lowest point to 1’-2” at the highest point above grade. The stones vary in size, but generally range between 4” to 6” tall and 8” to 12” long (*Figs. C14-C15*). A few larger stones measure about 2’-0” long. The majority of the stone is greyish in color, though some stones have a tan or brownish coloration. The foundation wall is continuous beneath the lowest course of logs. The continuous foundation wall is a later addition. The ca. 1913 photographs of the house show perimeter stone piers at the exterior walls. See photos in the *Chronology of Development and Use* chapter and *Appendix B*.

### Exterior Walls

With the exception of the gable ends, the entirety of the exterior walls are comprised of log construction with cementitious chinking. The logs are roughly squared and generally range in dimension from 7” to 10” deep by 4” wide. Half-dovetail joinery connects the logs at the four exterior corners, as well as at the corners of the log chimney. The logs typically extend beyond the corner joints by about 1½” to 2½” at most locations (*Figs. C16-C17*). Based on comparison with an 1895 and several ca. 1913 photos, much of the log construction present then remains today See *Appendix B* for comparisons.



**Figure C17.** Snodgrass House - Weatherboard siding of gable ends.

The Gable ends are clad with rough-sawn weatherboard applied to a wood frame (*Fig. C17*). The framing and weatherboard are modern. The weatherboard measures about 1” thick and has a 7” exposure. The framing elements are described in the *Construction Characteristics* section.

### Doorways

The building has three doorways, one on each of the south, east, and west elevations. Each of the doorways hold a modern metal gate and the east and west doorways each hold a modern reproduction board-and-batten door. The



**Figure C16.** Snodgrass House - Exterior log walls and half-dovetail corner joinery.



**Figure C18.** Snodgrass House - South doorway and exterior steps.



**Figure C19.** Snodgrass House - Typical modern gate hinge.

board-and-batten doors are held in an open position, while the gates are locked to prevent visitor access.

The south doorway has no board-and-batten door, but has a modern metal gate measuring 2'-1½" wide by 5'-8" tall by 1 ½" thick. The gate is hung with two modern 5"-tall butt hinges and is secured with a stationary padlock hasp on the latch side of the opening. The modern lintel-cut plank board casing measures 5½" wide by 1" thick (*Figs. C19-C20*).



**Figure C20.** Snodgrass House - East doorway and exterior steps. Note that west doorway is similar.

The east doorway holds a modern metal gate of similar design to that found at the south doorway. The gate measures 2'-9½" wide by 5'-8" tall by 1½" thick (*Fig. C20*). The hinges and lock are the same as those found at the south doorway. The inner board-and-batten door is a modern reproduction that measures 2'-10" wide by 5'-8" tall by 1" thick (*Fig. C21*). The boards range in width from 7¾" wide to as narrow as 1¾" wide and measure 1" thick. Three battens measure 5⅞" wide by 1⅛" thick and X-bracing between the battens is made up of members measuring 2⅞" wide by ⅞" thick. The door is hung with two 6" strap hinges and has remaining modern hardware for a securing bar (*Figs. C23-C24*). The modern lintel-cut plank board exterior casing measures 5⅛" wide by 1" thick.

The west doorway is similar to the east and holds a gate measuring 2'-10½" wide by 5'-10" tall by 1½" thick. The gate shares the same hardware as the other doorways. The modern reproduction board-and-batten door at the interior measures 2'-11¼" wide by 5'-9" tall by 1" thick (*Fig. C22*). The boards range in width from 5½" to 5⅞" wide and measure 1" thick. The battens measure 6" wide by 1" thick and are oriented in a Z pattern. The door is



**Figure C21.** Snodgrass House - Board-and-batten door in east doorway.



**Figure C22.** Snodgrass House - Board-and-batten door in west doorway.



**Figure C23.** Snodgrass House - Typical strap hinge.

hung with two 6” strap hinges and has remaining modern hardware for a securing bar. The modern lintel-cut plank board exterior casing measures 4⅝” wide by 1” thick.

### Windows

The house has a single window opening on the north elevation that measures 2’-2 ¼” wide by 1’-10¼” tall (*Fig. C25*). Modern metal bars measuring ⅞” in diameter run vertically within the opening and are spaced at about 3” on center. The bars fit into holes drilled in the head and sill of the opening. The exterior casing is a modern lintel cut plank board measuring 5½” wide by 1” thick.

### Exterior Steps

Two stone steps access each of the three exterior doorways (*Figs. C18, C20*). The stones are grey in color and appear to be limestone. The steps are not early material and based on historic photographs, were installed sometime between 1969 and 1976. See photos in the *Chronology of Development and Use* chapter and *Appendix B*. At the south doorway, the bottom step measures 3’-5½” wide by 10½” tall and has an 11”-deep tread. The upper step measures 3’-0¾” wide by 9” tall with a 1’-10” deep tread. The upper tread lies about 2” below the level of the interior floor.

At the east doorway, the bottom step measures 4’-1” wide by 3’-1” deep by 9” tall. The lower tread measures 1’-8” deep. The top step measures 3’-6” wide by 1’-11” deep by 7” tall. The top tread lies about 8” below the level of the interior floor.

The bottom step at the west doorway measures 4’-0” wide by 1’-1” deep overall by 6” tall. The top step measures 4’-0” wide by 1’-10” deep by 7” tall.



**Figure C24.** Snodgrass House - Security bar hardware at east doorway.



**Figure C25.** Snodgrass House - Window opening on north elevation.



**Figure C26.** Snodgrass House - Overview of chimney



**Figure C27.** Snodgrass House - Detail of chimney shoulder.

The top tread lies about 8" below the level of the interior floor.

### Chimney

A log exterior chimney engages the center of the north elevation (*Figs. C26-C27*). A clear view of the chimney is not visible in the ca. 1913 photos; however, the portion of the chimney below the roof appears nearly identical to the way it did by 1977. See photos in the *Chronology of Development and Use* chapter and *Appendix B*. Larger logs are used below the shoulders of the chimney and are similar in size to those used on the main house. At the shoulder, the logs transition to round sections with saddle joints at the corners. The shoulder logs range from about 4" to 5" in diameter and corbel inward to form the base of the chimney stack. The logs are connected to the north wall using tenons. The stack measures about 1'-5" north-south by 1'-10" east-west and is made up of round logs measuring about 3" to 4" in diameter. The chimney stack extends about 1'-0" beyond the surface of the roof. The height of the stack in 1977 photographs suggests that about three courses of logs at the top of the chimney have been lost.

### Roofing and Rainwater Dispersal

The house has a gable roof clad with cedar shingles (*Fig. C28*). The northern roof rake extends about 4'-4" beyond the north exterior wall, providing cover for the exterior chimney. The wood shingles vary in width, but generally range from 4" to 6" wide and have an 8" exposure. There are no gutters or downspouts installed, nor is there evidence to suggest that any have been installed previously. Rafter tails are exposed at the eave line and rafters, outriggers, and decking boards are exposed at



**Figure C28.** Snodgrass House - Wood-shingle roof.



**Figure C29.** Snodgrass House - Example of hole drilled in log on north elevation.

the extending north rake. There are no gutters or downspouts.

### Finishes

The entirety of the exterior envelope is unpainted, with the exception of the modern gates, which have a black powder coated finish.

### Other Features

At the west elevation and north elevations, near the center of the overall height of the wall, are holes drilled into the logs that may relate to being salvaged material, or may represent past locations for hanging items such as tools or cooking utensils (*Fig. C29*). While the date of these features is unknown, most if not all of them are visible in the ca. 1913 photos of the house.

## Interior Description

The interior of the Snodgrass House consists of a single room accessed from the center of each of the south, east, and west elevations (*Figs. C30-C31*). A fireplace is centered on the north wall and a window opening is just east of the fireplace. The room measures 18'-11" north-south by 17'-3" east-west with a floor-to-ceiling height of 12'-6" tall. Floor plan drawings can be found in A*ppendices A and B.*

### Flooring

Random-width plank board flooring is typical throughout the interior. Widths vary between 5¼" 7", 7¾" and 8" wide and the boards are 1" thick. The flooring is not thought to be early material.

### Walls and Ceiling

The log construction of the exterior walls is exposed throughout the room. At the ceiling, the roof framing and wall framing of the gable ends is similarly exposed. Boards of varying widths and thicknesses are applied at the interior face of the chinking in the majority of locations (*Fig. C32*). The



**Figure C30.** Snodgrass House - View of interior looking southeast.



**Figure C31.** Snodgrass House - View of interior looking north.



**Figure C32.** Snodgrass House - Typical interior wall finish.

structural system elements are described in detail in the *Construction Characteristics* section.

### Doorways

The room has three exterior doorways that are described in the *Exterior Features* section. Each doorway holds a modern reproduction board-and-



**Figure C33.** Snodgrass House - Overview of fireplace.

batten door and a modern metal gate. The interior faces of the doorways have no casings.

### Windows

One window opening at the east end of the north wall contains no sash but does hold vertical bars. The window is described in detail in the *Exterior Features* section. The inside face of the opening has no casing. As late as 1977, the opening had a hinged board-and-batten shutter. See photographs in the *Chronology of Development and Use* chapter and *Appendix B*.

### Fireplace

A stone fireplace is centered on the north wall and is comprised of stones that vary in size, ranging from 4" to 6" to 9" tall by 4" to 9" to 28" wide (*Fig. C33*). The firebox measures about 3'-7" wide by 2'-2" deep by 3'-10" tall. There is no mantel. The fieldstone hearth measures about 5'-5" wide by 2'-0" deep.

### Finishes

All elements of the interior are unpainted no evidence of applied finishes.

## Character-Defining Features - Snodgrass House

- The overall massing of the single-pen, gable-roofed log house;
- The location and organization of window and door openings;
- The exterior log chimney;
- The wood shingled roof;
- The projecting roof rake on the north elevation;
- The log exterior wall construction;
- The exposed roof framing;
- The floor framing and wood flooring;
- The board-and-batten door designs at the exterior doorways;
- The stone fireplace hearth and firebox;
- The stone exterior steps.

# Kelly House

***For the purposes of this report, the front of the Kelly House is said to face west.***

## Architectural Overview

The Kelly House is a single-story, single-pen log structure with a side-gabled roof (*Fig. C34*). The roof projects beyond the exterior wall at the north elevation, covering the lower portion of the exterior log chimney. The interior consists of one space accessed by two exterior doorways, one



**Figure C34.** View of the Kelly House from the northwest.



**Figure C35.** Kelly House - West elevation.



**Figure C36.** Kelly House - East elevation.



**Figure C37.** Kelly House - North elevation.



**Figure C38.** Kelly House - South elevation.

centered on each of the east and west elevations. The structure has no window openings.

## Façade Organization

The front, or west elevation has a centered doorway accessed by a stone step and has a projecting roof rake at its north end. The east elevation is a near mirror image but lacks the stone step at the doorway. The north elevation has a centered log chimney protected by the projecting roof. The south elevation has no openings (*Figs. C36-C38*).

## Construction Characteristics

***Please also see the Structural Investigation Report by 1200AE located in Appendix C.***

### Floor Framing

Floor framing was observed by removing a plank floorboard in the northwest corner of the interior. The joists range in size from 5" to 6" in diameter and have a flattened top surface to accommodate the flooring above (*Fig. C39*). The bottom face of the joists appears to be similarly hewn flat. The joists vary in spacing from about 36" to 43" on center. Grade level lies about 11" to 1-0½" below the tops of the joists, leaving an air gap between the floor structure and grade. The joists have 5" deep notches at the ends that bear on the inside projection of the foundation wall. The ends of the joists are visible from the exterior (*Fig. C40*).



**Figure C39.** Kelly House - Floor log joist at west bearing end. Note sisters and notched end connection.



**Figure C40.** Kelly House - Notched end of floor log joists at east exterior wall.



**Figure C41.** Kelly House - Gable end wall framing.



**Figure C42.** Kelly House - Overview of roof framing.

### Gable End Framing

The gable ends are framed with sawn studs measuring about 1¾" wide by 3½" deep that are spaced at about 24" on center (*Fig. C41*). The exterior weatherboard is applied directly to the



**Figure C43.** Kelly House - Bearing end of tie beam.

studs. The gable end framing and weatherboards appear modern.

### Roof Framing

Sawn rafters measure 2" wide by 4” deep and are spaced at approximately 24” on center (*Fig. C42*). The rafters meet a sawn ridge plate measuring 1” wide by 3½” deep at the peak of the roof and are tied with 1”-thick by 3½”-deep collar ties. Four diagonal braces, matching the dimension of the collar ties, are laid flat against the underside of the rafters at the corners of the roof structure and extend to near the centerline of building. Rafters are nailed to the top round at their bases, with 2” wide by 4” deep rafter tails nailed to the ends of every other rafter. The rafter tails extend to the exterior. The roof structure is modern, dating from the 1961 work campaign.

Six round log tie beams span to tie the long east and west walls together (*Fig. C43*). The beams vary between 6” to 7” in diameter and are spaced at 3-0” to 4’-9” on center. The top face it notched to a 4” depth at the bearing ends. The notched ends bear on the log walls and the ends are visible on the exterior. The beams are notched about 3 ½” deep at the ends to bear on the logs below. The notched ends are exposed on the exterior.

The cantilevered north end of the roof is supported by two projecting top rounds at the eaves (*Fig. C44*).

Continuous modern roof decking is exposed at the interior and at the underside of the north cantilever and eaves and measures about 5¼” wide by likely 1” or 1¼” thick (*Fig. C42*).

### Utility Systems

The house has no utility services or mechanical, electrical, or plumbing components.

## Exterior Features

### Foundation

The log structure sits close to grade, with a one-to-two course stone foundation wall visible on the north, south, and west elevations (*Fig. C46*). The infill foundation wall does not appear in the May 1961 construction photographs. The top of the foundation wall measures about 4” above grade at the lowest point and about 8½” above grade at the highest point. The lowest log on the east elevation



**Figure C44.** Kelly House - Cantilevered top rounds supporting north roof projection.



**Figure C45.** Kelly House - Log exterior walls and typical corner joinery.



**Figure C46.** Kelly House - South elevation showing weatherboard gable end.

is in contact with grade (*Fig. C45*). The stones vary in size, but generally range between 3" to 7" tall and 8" to 12" long. The majority of the stone is greyish in color, though some stones have a tan or brownish coloration.

### Exterior Walls

With the exception of the gable ends, the entirety of the exterior walls are comprised of log construction with chinking (*Fig. C45*). The logs vary between squared and round logs. The existing structure appears consistent with its appearance in 1961. See photos in the *Chronology of Development and Use* chapter and *Appendix B*. Corner joinery varies between square notches, dovetails, and saddle connections. The logs vary in size but generally range from 5½" to 8½" wide by 6½" to 9" deep. Replacement logs are about 8" wide by 8" to 10" deep. The log extensions at the corners measure about 1½" in length. Extensive work on the Kelly House took place in 1961. See photos in the *Chronology of Development and Use* chapter and *Appendix B*.

The gable ends are clad with rough-sawn weatherboard applied to a wood frame. The weatherboard measures about 1" thick and has an 8" to 8¾" exposure (*Fig. C46*). The framing and weatherboard likely date to the 1961 work. The framing elements are described in the *Construction Characteristics* section.

### Doorways

The building has two doorways, one on each of the east and west elevations. Each of the doorways hold a modern metal gate and a modern reproduction board-and-batten door. The board-and-batten doors are held in an open position, while the gates are locked to prevent visitor access.

The east doorway holds a modern metal gate with vertical bars (*Fig. C47*). The gate measures 2'-9½" wide by 5'-0¾" tall by 1½" thick. The gate is hung



**Figure C47.** Kelly House - East doorway.



**Figure C48.** Kelly House - West doorway.



**Figure C49.** Kelly House - Interior face of typical board-and-batten door.



**Figure C50.** Kelly House - Strap hinges of east doorway.



**Figure C51.** Kelly House - Typical padlock hasp.



**Figure C52.** Kelly House - Hinge at west doorway.

with two modern 5”-tall butt hinges and is secured with a stationary padlock hasp on the latch side of the opening. The lintel-cut plank board casing measures 5½” wide by 1” thick and consists of two pieces layered on top of each other.

The inner board-and-batten door at the east doorway is a modern reproduction that measures 2’-11¼” wide by 5’-2½” tall by 1⅛” thick (*Fig. C49*). The boards range in width from 9½” wide to 3 ½” wide and measure 1⅛” thick. Two battens each measure 5⅞” wide by 1⅛” thick and X-bracing between the battens is made up of members of the same dimension. The door is hung with two 6” iron strap hinges and has an iron padlock hasp (*Figs. C50-C51*).

The west doorway is similar to the east and holds a modern metal gate measuring 2’-10½” wide by 5’-10” tall by 1½” thick (*Fig. C48*). The gate shares the same hardware as the east doorway. The modern reproduction board-and-batten door at the interior measures 2’-10½” wide by 5’-9” tall by 1” thick. The boards range in width from 4¾” to 6½” wide and measure 1⅛” thick. The battens measure 4” wide by 1” thick and are oriented in an X pattern. The door is hung with two iron T-strap hinges with 10” straps and 7” tall butts (*Fig. C52*). The door is secured with an iron padlock hasp. The lintel-cut plank board exterior casing measures 5¾” wide by 1¾” thick.

### Windows

The structure has no window openings.

### Exterior Steps

A mortared stone step accesses the west doorway from grade (*Fig. C48*). The step measures 3’-1” wide by 1’-2” deep by 5 ½” tall. The top surface of the step lies about 6” below the interior floor level. The step does not appear in the 1961 photographs.



**Figure C53.** Kelly House - Side view of chimney. Note collapse of shoulder base.

### Chimney

A log exterior chimney engages the center of the north elevation (*Fig. C53*). The logs at the base of the chimney have straight sides and measure 3" to 4" wide and 5" to 6" deep. The logs do not appear to be connected to the north exterior wall of the building. A 6" wide by 4½" deep supports the base of the chimney shoulder and smaller round logs measuring 3½" to 5" in diameter form the shoulder and chimney stack. The logs are connected with saddle joints. The chimney stack measures about 2'-10" east-west by 2'-1" north-south and extends about 1'-0" beyond the surface of the roof. The log portion of the chimney was entirely reconstructed as part of the 1961 work.

### Roofing and Rainwater Dispersal

The house has a gable roof clad with cedar shingles (*Fig. C54*). The northern roof rake extends about 4'-0" beyond the north exterior wall, providing cover for the exterior chimney. The wood shingles vary in width, but generally range from 4" to 6" wide and have an 8" exposure. There are no gutters or downspouts installed, nor is there evidence to suggest that any have been installed previously. Rafter tails are exposed at the eave line and rafters, outriggers, and decking boards are exposed at the extending north rake.



**Figure C54.** Kelly House - Wood shingle roof.

### Finishes

The entirety of the exterior envelope is unpainted, with the exception of the modern gates, which have a black powder coated finish.

## Interior Description

The interior of the Kelly House consists of a single room accessed from the center of each of the east and west elevations (*Figs. C55-C56*). A fireplace is centered on the north wall. The room measures 20'-7" north-south by 16'-10" east-west with a floor-to-ceiling height of 14'-4" tall. Floor plan drawings can be found in A*ppendices A and B*.

### Flooring

Modern wood flooring is consistent throughout the interior and consists of plank boards ranging in width from 8" to 12" by 1" thick.

### Walls and Ceiling

The log construction of the exterior walls is exposed throughout the room. At the ceiling, the roof framing and wall framing of the gable ends is similarly exposed. Boards of varying widths and thicknesses are applied at the interior face of the chinking in the majority of locations. The structural system elements are described in detail in the *Construction Characteristics* section.

### Doorways

The room has two exterior doorways that are described in the *Exterior Features* section. Each doorway holds a modern reproduction board-and-batten door and a modern gate. The interior faces of the doorways each have modern plank board casings. The east doorway casing measures 1" thick by 2½" wide, while the west doorway has a casing measuring 4" wide by 1⅞" thick.

### Fireplace

A stone fireplace is centered on the north wall and is comprised of stones that vary in size, ranging from 5" to 7" tall by 6" to 10" to as much as 27" wide (*Fig. C57*). The firebox measures about 3'-4"



**Figure C55.** Kelly House - View of interior looking southeast.



**Figure C56.** Kelly House - View of interior looking northwest.



**Figure C57.** Kelly House - Overview of fireplace.

wide by 2'-6" deep by 4'-4" tall. A simple mantel around the firebox is made up of plank boards measuring 1" thick by 7⅞" wide. The fieldstone hearth measures about 6'-0" wide by 2'-3" deep. The masonry firebox is supported by two 4"-wide by ½"-thick iron members that appear to be salvaged machine parts. The stone portion of the fireplace extends to a height of about 5'-0" before transitioning to log construction for the shoulders and stack of the chimney. The stone portion of the chimney is present in the 1961 construction photos, though it may have been reconstructed at this time.

### Finishes

All elements of the interior are unpainted no evidence of applied finishes.

## Character-Defining Features

- The overall massing of the single-pen, gable-roofed log house;
- The location of the exterior door openings;
- The exterior log chimney;
- The wood shingled roof;
- The projecting roof rake on the north elevation;
- The log exterior wall construction;
- The exposed roof framing;
- The floor framing and wood flooring;
- The board-and-batten door designs at the exterior doorways;
- The stone fireplace hearth and firebox;
- The stone exterior steps.

# Brotherton House

***For the purposes of this report, the front of the Brotherton House is said to face east.***



**Figure C58.** Brotherton House - East elevation.



**Figure C59.** Brotherton House - West elevation.



**Figure C60.** Brotherton House - North elevation.



**Figure C61.** Brotherton House - South elevation.

## Architectural Overview

The Brotherton house is a single-story, single-pen log structure with a side-gabled roof (*Fig. C58*). The roof projects beyond the exterior wall at the north elevation, covering the lower portion of the exterior stone chimney. The interior consists of one space at the lower level accessed by two exterior doorways, one centered on each of the east and west elevations. A second level is accessed by an interior stair in the southeast corner. The structure has no window openings.

## Façade Organization

The front, or east elevation has a centered doorway accessed by stone steps and has a projecting roof rake at its north end. The west elevation is a mirror image of the east. The north elevation has a centered stone chimney protected by the projecting roof. The south elevation has no openings (*Fig. C58-C61*).

## Construction Characteristics

***Please also see the Structural Investigation Report by 1200AE located in Appendix C.***

### Floor Framing

Floor framing was observed by removing a plank floorboard along the east wall of the interior at



**Figure C62.** Brotherton House - Exposed floor framing at removed floorboard.



**Figure C63.** Brotherton House - Floor framing at east bearing end, note that joist stops short of wall and bears on grade.



**Figure C64.** Brotherton House - Underside of second-floor framing.

the doorway (*Fig. C62*). The joists at this location measure 9” in diameter with a flattened top surface to accommodate the flooring above. The joists are spaced vary in spacing from 24” to 34” on center. Some of the logs are in direct contact with grade, while others have a small air gap (*Fig. C63*). Bricks and stones have been added to prop up the log joists at some locations.

The second floor is supported by seven hewn beams measuring 2¾” to 3¾” wide by 5” to 6” deep that also serve as tie beams for the east and west walls (*Fig. C64*). The beams are spaced at 2’-6” to 2’-9” on center. The beams bear on the walls below and are visible from the exterior.

### Gable End Framing

The gable ends are framed with sawn studs measuring about 2” wide by 4” deep that are spaced at about 3’-0” on center (*Fig. C65*). The exterior weatherboard is applied directly to the studs. The gable end framing and weatherboards appear modern.

### Roof Framing



**Figure C65.** Brotherton House - Gable end wall framing and overview of roof framing.



**Figure C66.** Brotherton House - Top round supporting north roof projection.

The roof structure is modern and has sawn rafters measure 2 wide by 4” deep and are spaced at approximately 24” on center. The rafters meet a sawn ridge plate measuring 1” wide by 3¾” deep at the peak of the roof and are tied with 1”-thick by 3¾”-deep collar ties (*Fig. C65*). Four diagonal braces measuring 1” by 4” are laid flat against the underside of the rafters at the corners of the roof structure and extend to near the centerline of building. Rafters are nailed to the top round at their bases, with 2” wide by 4” deep rafter tails nailed to the ends of every other rafter. The rafter tails extend to the exterior.

The cantilevered north end of the roof is supported by two projecting top rounds at the eaves (*Fig. C66*).

Continuous modern roof decking is exposed at the interior and at the underside of the north cantilever and eaves and measures about 5¼” wide by likely 1” or 1¼” thick (*Fig. C65*).

### Utility Systems

The house has no utility services or mechanical, electrical, or plumbing components.

## Exterior Features

### Foundation

The log structure sits close to grade, with the perimeter stone foundation supporting the bottom course of logs. The top of the foundation wall measures about 4” above grade at the lowest point and about 12” above grade at the highest point (*Fig. C67*). The stones vary in size, but generally range between 3” to 5” tall and 8” to 12” long. The majority of the stone is greyish in color, though some stones have a tan or brownish coloration. A ca. 1930s photo taken from the northeast shows a loosely stacked stone foundation with many voids.



**Figure C67.** Brotherton House - Stone perimeter foundation.

### Exterior Walls

With the exception of the gable ends, the entirety of the exterior walls are comprised of log construction with chinking (*Fig. C68*). The logs are generally hewn with flat sides and have half-dovetail joinery at the corners. The logs vary in size but generally range from 4" to 5" wide by 11" deep. The sill logs measure about 8" by 8", and the top rounds measure about 10" wide by 8" deep. The log extensions at the corners measure about 1½" to 3½" in length. A number of the logs appear to date to at least the 1930s. See photos in the *Chronology of Development and Use* chapter and *Appendix B*.

The Gable ends are clad with rough-sawn weatherboard applied to a wood frame. The weatherboard measures about 1" thick and has an 8" to 8¾" exposure. The framing elements are described in the *Construction Characteristics* section.

### Doorways

The building has two doorways, one on each of the east and west elevations. Each of the doorways hold a modern gate and the west doorway also holds a reproduction board-and-batten door. The board-and-batten door is held in an open position, while the gates are locked to prevent visitor access.

The east doorway holds a modern metal gate with vertical bars (*Fig. C69*). The gate measures 3'-0½" wide by 5'-6¾" tall by 1½" thick. The gate is hung with two modern 4½"-tall butt hinges and is secured with a stationary padlock hasp on the latch



**Figure C68.** Brotherton House - Log exterior walls and corner joinery.



**Figure C69.** Brotherton House - East exterior doorway.



**Figure C70.** Brotherton House - West exterior doorway.

side of the opening. The lintel-cut plank board casing measures 5⅜" wide by ⅞" thick.

The west doorway holds a metal gate measuring 3'-1¼" wide by 5'-10" tall by 1½" thick (*Fig. C70*). The gate shares the same hardware as the east doorway. The lintel-cut plank board casing measures 5⅜" wide by ⅞" thick.

The inner board-and-batten door at the west doorway is a modern reproduction that measures 3'-2" wide by 5'-11½" tall by 1⅛" thick. The boards measure 5 ¾" wide by 1" thick, while the two battens each measure 5⅞" wide by 1" thick and have a diagonal brace forming a Z pattern. The door is hung with two 6" iron strap hinges and has an iron padlock hasp. Metal brackets for a securing bar remain on the interior (*Fig. C71*).

### Windows

The structure has no window openings.

### Exterior Steps

Modern stone steps access the east and west doorways from grade (*Figs. C69-C70*). The east steps measure 3'-9" wide and consist of two treads and two risers, with the bottom stone tread



**Figure C71.** Brotherton House - Strap hinge and security bar bracket at west doorway.



**Figure C72.** Brotherton House - Overview of stone chimney on north elevation.



**Figure C73.** Brotherton House - Wood shingle roof.

measuring 1-2” deep and the upper tread measures 26” deep. Each of the two risers measure 9” tall. The interior floor level lies about 3½” above the level of the upper tread. A ca. 1930s photograph shows no steps at the east doorway and a shed addition on the west elevation.

The west step consists of a single tread measuring 2’-7” wide by 2’-1” deep by 5 ½” tall. The interior floor level lies about 8” above the level of the step. The step was in place by ca. 1972.

### Chimney

An early stone exterior chimney engages the center of the north elevation and is made up of stones varying in size from about 4” to 8” tall and 10” to 14” to 20” long (*Fig. C72*). The base of the chimney measures about 3’-0” north-south by 5’-10” east-west and has corbeled shoulders at a height of about 10’-10” above grade. The chimney stack measures about 2’-5” north-south by 3’-3” east-west and extends 1’-3” above the roof ridge.

### Roofing and Rainwater Dispersal

The house has a gable roof clad with cedar shingles. The northern roof rake extends about 4’-1” beyond the north exterior wall, providing cover for the exterior chimney (*Fig. C73*). The wood shingles vary in width, but generally range from 4” to 6” wide and have an 8” exposure. A ridge comb shingle extends from the eastern roof slope. There are no gutters or downspouts installed, nor is there evidence to suggest that any have been installed previously. Rafter tails are exposed at the eave line and rafters, outriggers, and decking boards are exposed at the extending north rake.

### Finishes

The entirety of the exterior envelope is unpainted, with the exception of the modern gates, which have a black powder coated finish.

## Interior Description

The interior of the Brotherton House consists of a single room at the lower level accessed from the center of each of the east and west elevations (*Figs.*



**Figure C74.** Brotherton House - View of interior at lower level looking southeast.



**Figure C75.** Brotherton House - View of interior at lower level looking north.



**Figure C76.** Brotherton House - View of interior at upper level looking north.

*C74, C76*). A fireplace is centered on the north wall. The room measures about 16'-11" north-south by 16'-10" east-west with a floor to ceiling height of 7'-6" tall. An upper level is accessed by an interior stair in the southeast corner (*Fig. C75*). A floor plan is found in *Appendices A and B*.

### Flooring

Modern wood flooring is consistent throughout both levels and consists of plank boards ranging in width from 5½" to 9½" by 1" thick.

### Walls and Ceiling

The log construction of the exterior walls is exposed throughout the room. At the ceiling, the roof framing and wall framing of the gable ends is similarly exposed. Boards of varying widths and thicknesses are applied at the interior face of the chinking in the majority of locations. The structural system elements are described in detail in the *Construction Characteristics* section.

### Doorways

The room has two exterior doorways that are described in the *Exterior Features* section. Each doorway holds a modern gate, while the west doorway also holds a reproduction board-and-batten door. The interior faces of the doorways lack casings.

### Fireplace

A stone fireplace is centered on the north wall and is comprised of stones that vary in size, ranging from 4" to 7" tall by 6" to 10" to 24" wide (*Fig. C77*). The firebox measures about 4'-9" wide by 2'-4" deep by 3'-7" tall. A simple modern mantel around the firebox is made up of plank boards measuring ¾" thick by 9⅝" wide. A shelf spans the width of the fireplace. The fieldstone hearth measures about 5'-2" wide by 1'-9" deep.

### Staircase

The upper level is accessed by a modern interior stair that ascends along the east wall, beginning just south of the exterior doorway and measuring 2'-0" wide (*Fig. C78*). The stair has ten treads measuring 7⅞" deep by 1⅛" thick and eleven risers ranging between 7½" and 9" tall. Stringers at each side of the stair carriage measure 1⅛" thick. The railing along the west side of the stair measures 2'-8" tall and has a 2" by 4" handrail.

### Finishes

All elements of the interior are unpainted no evidence of applied finishes.

## Character-Defining Features

- The overall massing of the single-pen, gable-roofed log house;
- The location of the exterior door openings;
- The exterior stone chimney;
- The wood shingled roof;
- The projecting roof rake on the north elevation;



**Figure C77.** Brotherton House - Overview of fireplace.



**Figure C78.** Brotherton House - Staircase in southeast corner.

- The log exterior wall construction;
- The exposed roof framing;
- The floor framing and wood flooring;
- The board-and-batten door designs at the exterior doorways;
- The stone fireplace hearth and firebox;
- The interior staircase;
- The stone exterior steps.

## Condition Assessment

The following section is a summary of the assessments performed by the JKOA and its consultants, including 1200AE, structural engineers, and Ron Anthony, wood scientist. The assessment is divided by structure, then by system and feature. Full reports by 1200AE and Anthony & Associates can be found in Appendix C and D, respectively. The individual assessment reports should be reviewed for complete understanding of found conditions.



**Figure C79.** Snodgrass House - Perimeter stone foundation wall. Note missing and displaced stones.



**Figure C80.** Snodgrass House - Missing foundation stones west of fireplace.

## Snodgrass House

### Foundation

Several loose stones were observed around the perimeter of the house, in particular at the corners. A cornerstone was displaced at the southwest corner (*Fig. C79*). On the west side of the chimney, some stones were missing and have provided access for wildlife to enter into the crawlspace below the floor joists (*Fig. C80*).

### Log Condition

The logs in Snodgrass are generally in good condition. Figures 9-22 of *Appendix D* show various conditions that either should be considered for repair or may be historically significant.

The results of the visual observations, probing, moisture content readings, and resistance drilling of the logs and framing members gleaned through the wood assessment that may require treatment are summarized as follows:

- Top plates – south top plated is decayed on the west end to approximately 48", the west top plate is decayed at the south end with no void at approximately 20" from the south end. This deterioration is due to a prior roof leak.
- Rafters – rafters vary in dimension, rafter number 1 parallel to the south top plate is decayed, rafter number 2 from the south on the west top plate is decayed, and is sistered with a 1"x 2" board, all rafters on the west side have shifted outboard and the nails securing the rafter to the top plate are exposed.
- Sill logs – the east sill log had a 1.5" channel south of the stone step, the west sill log showed significant deterioration at the door threshold and was shown to be thin (3.5' to 4") when drilled along its length.
- Log crowns – generally in fair condition with some minor deterioration in the end grain that does not extend into the notch.
- Floor joists – overall condition is unknown but where exposed, the joist was decayed and had termite damage, other joists no longer had fastener-holding capacity (the nails could be pulled out).

### Exterior Wall Structure

The log extensions are experiencing varying levels of deterioration. The end-grain of exterior



**Figure C81.** Snodgrass House - Deteriorated sill log at west façade near door threshold.

log extensions can take on moisture seasonally, shrinking or swelling more than the rest of the log. The combination of increased moisture and dimensional changes make the log ends more susceptible to deterioration over the long term. Despite localized deterioration, the corner connections appear to remain relatively intact.

The wall logs were, in general, in fair condition. One exception was the sill log at the west façade, which is severely deteriorated (*Fig. C81*). The deterioration was particularly noticeable at the door threshold, where the sill was notched from 10" down to 4" and the increased exposure at the top face of the member has likely contributed to its deterioration over time. However, deterioration was noted along the sill log's length. Similar but less severe deterioration was noted at the east sill log near the door threshold. The east sill log is not notched at the threshold.

### Floor Framing

Some of the log joists were observed to be in contact with the ground below (*Fig. C82*), whereas



**Figure C83.** Snodgrass House - Notched end of floor log joist at west bearing (at floor probe). Note floorboard above and gap between joist and stone foundation wall below.

others had a small air gap between the two. Logs in contact with the ground were found by the wood specialist to have significantly higher moisture content, as would be expected, and generally exhibited higher levels of deterioration. In several locations, small bricks or stones were observed to be propping up the log joists at random locations along their span.

At the west wall, the joists were notched down to a 5" depth. This notched portion bears on the inside projection of the stone foundation wall. Several of the joists at the threshold were observed to be severely deteriorated at their ends. One joist end had been cut and sistered with a sawn lumber



**Figure C82.** Snodgrass House - Floor joist in contact with grade.



**Figure C84.** Snodgrass House - Deteriorated top rounds and roof rafter at southwest corner of building. Note sister on rafter.



**Figure C85.** Snodgrass House - Rafter end pulling out from top round.

member. Another joist had a shallower notched end, closer to 3½" deep, and did not fully bear on the foundation wall (*Fig. C83*).

### Roof Framing

At the interior southwest corner of the building, there is evidence of moisture intrusion through the roof and resulting deterioration of wood elements (*Fig. C84*). Both top rounds and the southernmost roof rafter are deteriorated. The rafter was sistered and one wall stud was replaced at some point in time. It does not appear that the moisture intrusion is on-going.

The rafters are nailed at their bases to the top round and appear to be pulling out in some locations, in particular at the west side of the house (*Fig. C85*).

The eastern cantilevered top round on the north elevation is deteriorated and sistered with a sawn member (*Fig. C86*).

### Chimney and Fireplace

The log chimney appears to be in overall good condition. Several hearth stones are loose.



**Figure C86.** Snodgrass House - Cantilevered top round deteriorated and sistered at end, north façade at roof overhang.

### Exterior Doors

The exterior doors are in fair condition. The inner board-and-batten door at the south doorway is missing.

The bases of both wood doors are deteriorated, likely due to water splashing up from the threshold (*Fig. C87*).

### Windows

The window opening is in good condition.



**Figure C87.** Snodgrass House - Typical deterioration of board-and-batten doors.



**Figure C88.** Snodgrass House - Mortar joints at exterior steps. Note that mortar has typically separated from the stones.



**Figure C89.** Snodgrass House - Deterioration of threshold and adjacent flooring. Note that floorboard was removed for the purposes of investigation.

### Exterior Steps

The steps are in overall good condition. Mortar joints between the stones have generally failed (*Fig. C88*).

### Roofing and Rainwater Dispersal

The current roof was installed in 2012 and remains in overall good condition. No obvious signs of active leaks were observed.

### Flooring

The floorboards throughout the interior are in overall good condition, though weathering is typical at the doorways, as the interior doors are generally kept open (*Fig. C89*).

## Kelly House

### Foundation

Due to the alternating coursing of the logs, the sill logs at the east and west sides, the long sides of the house, are lower than the sill logs on gable ends and the stone foundation sits entirely below grade. A test pit was dug at the southeast corner of the building in the presence of the park archaeologist and other NPS personnel (*Fig. C90*). The lower 3" of the sill log was found to be embedded below grade and the stone foundation below was determined to extend only an additional 3" into the ground.

At several locations around the chimney, an awl was inserted into the ground directly below the sill log to determine whether the chimney might be built on a stone foundation as well. The awl entered fully into the ground without encountering any foundations; therefore, it appears that the chimney sill base logs are set directly on grade (*Fig. C91*).

### Log Condition

The logs in Kelly are generally in good condition. Figures 23 – 32 of *Appendix D* show various conditions that either should be considered for repair or may be historically significant.

The results of the visual observations, probing, moisture content readings, and resistance drilling of the logs and framing members gleaned through the wood assessment that may require treatment are summarized as follows:

- Sill logs – the east sill log has small (1" to 1.5" voids) along the length of the log, the west sill has a 3" to 3.5" decay channel both north and south of the door.
- Wall logs – the 5th log on the east wall, south of the door has surface deterioration, the 6th log on the west wall has deterioration on the south end.
- Log crowns – generally in fair condition, some minor voids in the end grain.



**Figure C90.** Kelly House - Test pit at southeast corner showing shallow stone foundation under sill log.



**Figure C91.** Kelly House - Awl inserted into ground at northeast corner of chimney.

### Exterior Walls

Many of the wall logs appear to have been replaced, most likely during the major 1961 work campaign.

The sill logs (east and west façade base logs) are partially buried in the ground, as noted in the foundation section.

The log extensions and corner connections are experiencing varying levels of deterioration. The end-grain of exterior log extensions can take on moisture seasonally, shrinking or swelling more than the rest of the log. The combination of increased moisture and dimensional changes make the log ends more susceptible to deterioration over the long term. Several of the corner connections are severely deteriorated and have lost structural capacity (*Fig. C92*).

The condition of the wall logs varies significantly depending on location and age. The partially buried sill logs showed evidence of deterioration.



**Figure C92.** Kelly House - Deteriorated corner connections and log extensions, southwest corner.



**Figure C93.** Kelly House - Floor log joist at west bearing end. Note sisters and notched end connection.



**Figure C94.** Kelly House - Hewn log chimney at shoulder transition. Note masonry chimney mass inside of hewn log chimney exterior.

### Floor Framing

An air gap is maintained beneath the floor joists, allowing them to dry.

At the west wall, the joists were notched down to a 3” depth. This notched portion bears on the top surface of the sill log, notched to receive the joists. One joist end had been sistered with two pieces of sawn lumber 1” by 4” in size (*Fig. C93*).

### Roof Framing

The roof framing appears to be in good condition.



**Figure C95.** Kelly House - Typical deterioration of board-and-batten doors.

### Chimney and Fireplace

The chimney logs are connected with saddle notches at the north corners and do not appear to be connected to the main building walls. The east side of the chimney at the shoulder transition has collapsed and deteriorated wood is visible at this location (*Fig. C94*).

The hearth and fire box are constructed of stone. Several hearth stones were very loose. The plank board mantel is modern.

### Exterior Doors

The exterior doors are in fair condition; however, the bases of both wood doors are deteriorated, likely due to water splashing up from the threshold (*Fig. C95*).

### Exterior Steps

The steps are in overall good condition.

### Roofing and Rainwater Dispersal

The current roof was installed in 2012 and remains in overall good condition. No obvious signs of active leaks were observed.

### Flooring

The floorboards throughout the interior are in overall good condition, though weathering is typical at the doorways, as the interior doors are generally kept open.

## Brotherton House

### Foundation

The house is supported on a continuous, shallow stone foundation. At the southwest corner, the top of the stone foundation is flush with grade, so the sill log is in contact with the ground.



**Figure C97.** Brotherton House - Stone foundation at east façade, north end. Note opening with metal grate.

The stones around the perimeter of the house were observed to be fairly loose with gaps and voids present (*Fig. C96*). At the north end of the east wall foundation, an opening in the stone foundation with a metal grate was observed (*Fig. C97*). This grate was presumably placed there to encourage air flow in the crawl space. One additional opening of a similar size was observed at the north wall (Figure 35); however, no metal grate was present.

### Log Condition

The logs in Brotherton are generally in good condition. Figures 33 – 44 of *Appendix D* show various conditions that either should be considered for repair or may be historically significant.

The results of the visual observations, probing, moisture content readings, and resistance drilling of the logs and framing members gleaned through the wood assessment that may require treatment are summarized as follows:

- Sill logs – the east sill log has significant decay at all locations drilled, the west sill log



**Figure C96.** Brotherton House - Loose stones at south wall foundation.



**Figure C98.** Brotherton House - Stone foundation at north façade, east side. Note opening in stone foundation.



**Figure C99.** Brotherton House - Deteriorated sill log, east side.

shows slight surface deterioration.

- Wall logs – the 6th wall log on the south elevation showed minor surface deterioration.
- Log crowns – generally in fair condition

### Exterior Walls

Several of the wall logs have been replaced. The sill logs (east and west façade base logs) are fully above grade, although the southern end of the west sill log meets grade and is showing slight signs of deterioration. The east sill log shows some signs of deterioration along its southern portion (*Fig. C99*). With the exception of the sill logs, the wall logs appeared to be in fair condition.

### First Floor Framing

One floorboard was removed on the east of the interior near the east door and adjacent to the stair base (*Fig. C100*). The floor framing below and its connection to the east wall were exposed. The joist at the stair base, had its base embedded in the ground below and was deteriorated, likely due to



**Figure C100.** Brotherton House - Floor probe at east door and stair.



**Figure C101.** Floor log joist at east bearing end. Note joist is notched and stops short of wall. Note also contact with ground and related deterioration.

continued exposure to moisture from the ground (*Fig. C101*). Two of the joists observed still had bark attached and remnants of removed branches. The presence of bark invites insect damage and has likely hastened the deterioration of the joists (*Fig. C102*).

Some of the logs were observed to be in contact with the ground below whereas others had a small air gap between the two. Logs in contact with the ground typically have higher moisture content, as would be expected, and generally exhibit higher levels of deterioration. In several locations, small bricks or stones were observed to be propping up the log joists at random locations along their span.

### Second Floor Framing

The ends of the second-floor joists project several inches beyond the exterior face of wall. This makes the joists susceptible to retaining moisture through the end grain. Some signs of moisture were visible at the interior of the bearing ends. In addition, some longitudinal cracking was visible, which may indicate overstress.



**Figure C102.** Brotherton House - Floor log joist at floor probe, looking west. Note deterioration and remnants of bark and branches.

### Interior Stair

At the south (upper) end of the stringers, there is some separation between the stringer ends and the wall (Figure 45). A vertical plank has been nailed to the inside stringer to provide additional support (*Fig. C103*).

The framing around the stair opening is not very substantial; the header supporting the joists at the opening is only 1-3/4" wide by 5-5/8" deep. It is end nailed with two nails into the supporting trimmer, which is a typical joist.

### Roof Framing

The roof framing appears to be in good condition.

### Chimney and Fireplace

Significant cracks and open joints are visible on all faces of the chimney. At the north face of the chimney, cracks were observed to extend the full height of the chimney (*Fig. C104*). Open joints at the base were measured to be up to 2½" wide. Some previously repointed joints have reopened and the new cracks were measured to be up to ½" wide (*Fig. C105*). At the east face of the chimney, large open joints of similar magnitude were noted at the base (*Fig. C106*). The northeast corner of the chimney appears to be pushing outward. On



**Figure C103.** Brotherton House - Interior staircase. Note vertical member at right.



**Figure C104.** Brotherton House - Cracking at north face of chimney.



**Figure C105.** Brotherton House - Cracking at north side of stone chimney.



**Figure C106.** Brotherton House - Cracking at east side of stone chimney.

the west face of the chimney, open joints were also observed but there was less evidence of movement.

The masonry above the fireplace opening at the interior is supported with 10" thick segmental stone arch. The arch is very shallow, with a 52" clear width and only a 3" rise (*Fig. C107*). A ferrous, helical tie was installed approximately 16" above the first-floor level, presumably to tie the chimney walls together. There is a large void adjacent the east end of the tie and therefore the tie does not appear to be functioning.

A test pit was dug at the east face of the northeast corner of the chimney. The stone chimney wall was found to extend only about 6" below grade (Figure 53).

The plank board mantel appears to be modern.

### Exterior Doors

The exterior door is in fair condition; however, the base of the interior wood door is deteriorated, likely due to water splashing up from the threshold.

### Exterior Steps

The steps are in overall good condition; however, mortar joints have typically failed.



**Figure C107.** Brotherton House - View of fireplace and hearth. Note stone arch above fireplace opening.



**Figure C108.** Brotherton House - Deterioration of board-and-batten door.

### Roofing and Rainwater Dispersal

The current roof was installed in 2012 and remains in overall good condition. No obvious signs of active leaks were observed.

### Flooring

The floorboards throughout the interior are in overall good condition, though weathering is typical at the doorways, as the interior doors are generally kept open.

# Significance and Integrity

## National Register of Historic Places

The National Register of Historic Places is the official list of the nation's historic places worthy of preservation. Authorized by the National Historic Preservation Act of 1966 and overseen by the National Park Service, it is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources.[86]

The significance evaluation identifies the important historical associations of a property and comments on its architectural, archaeological, and social value as they relate to the National Register. A property's significance is tied to a discrete period of time in which its important contributions were made, and to relevant national, state, and local historic contexts.

### Significance Criteria

In order for a property to be eligible for inclusion in the National Register, it must possess significance under at least one of four criteria. The Criteria for Evaluation for listing state:

> The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:
>
> A. That are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. That are associated with the lives of persons significant in our past; or
>
> C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> D. That has yielded, or may be likely to yield, information important in prehistory or history.
>
> *Criteria Considerations*
> Ordinarily cemeteries, birthplaces, graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the National Register. However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the following categories:
>
> a. A religious property deriving primary significance from architectural or artistic distinction or historical importance; or
>
> b. A building or structure removed from its original location but which is primarily significant for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or
>
> c. A birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building associated with his or her productive life; or
>
> d. A cemetery that derives its primary importance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or
>
> e. A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or
>
> f. A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or
>
> g. A property achieving significance within the past 50 years if it is of exceptional importance.[87]

86. National Park Service, "National Register of Historic Places." https://www.nps.gov/subjects/nationalregister/index.htm.

87. Code of Federal Regulations, Title 36, Part 60, "The National Register Criteria for Evaluation" (36 CFR Part 60).

## National Register Status of Snodgrass, Kelly, and Brotherton Houses

All three houses were listed as contributing structures within the Chickamauga Battlefield unit in the National Register historic district documentation for the Chickamauga and Chattanooga National Military Park, approved and accepted on July 15, 1986.[88]

The 1986 National Register documentation lists three areas of significance for CHCH: conservation, military, and sculpture.[89]

An Additional Documentation filing was entered into the Register on November 24, 1998.

According to the 1999 *Historic Resource Study*, all three houses "contribute to the national significance of the district under criterion A because they are long-standing elements of the park's interpretive program and help to create a scene similar to what prevailed in fall 1863."[90]

### Period of Significance

The documentation for the Historic District lists the district-wide period of significance as 1863-1942, breaking down the significant dates within that range as 1863 (the date of the battle), 1890-1933 (commemorative-development period), and 1933-1942 (initial Park Service period). The houses are noted to be contributing to the commemorative/development period (1890-1933).[91]

Because of the specific way the houses are recognized in the National Register documentation, it is perhaps more useful to think of them as something more akin to the many monuments that dot the park's landscape. In this sense they can be understood more as indicators of significance, rather than being intrinsically significant. This mitigates some, but not all, of the limitations explored in the next section.

## Assessment of Integrity

An assessment of integrity is to be based on an evaluation of the existence and condition of the physical features that date to a property's period of significance, taking into consideration the degree to which the qualities of integrity are present. The *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation* defines integrity as "the ability of a property to convey its significance."[92]

The property must retain the essential physical features that enable it to convey its historical significance, those features that define both why a property is significant (National Register criteria) and when it was significant (period of significance).[93]

The seven aspects of integrity as defined in the National Register Criteria for Evaluation are location, design, setting, materials, workmanship, feeling, and association. These are explained in *Bulletin 15:*

> Location is the place where the historic property was constructed or the place where the historic event occurred. . . . Design is the combination of elements that create the form, plan, space, structure, and style of a property. . . . Setting is the physical environment of a historic property. . . . Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property. . . . Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory. . . . Feeling is a property's expression of the aesthetic or historic sense of a particular period of time. . . . Association is the direct link between an important historic event or person and a historic property.[94]

JKOA investigations and evaluations for this HSR include an assessment of the historic integrity of Snodgrass, Kelly, and Brotherton houses.

#### *Integrity of Location*

All three houses are thought to have been significantly rebuilt after the Civil War in the immediate vicinity of where they were originally located. They all therefore retain integrity of location.

88. NRHP Nomination Form, section 7, p. 3.
89. NRHP Nomination Form, section 8.
90. *Historic Resource Study*, p. 49.
91. NRHP Nomination Form, section 8 and section 7, p. 3.
92. *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*, (Washington, D.C.: National Park Service, National Register of Historic Places, 1990, revised 1997), pp. 44– 45.
93. *National Register Bulletin 15*, pp. 44– 45.
94. *National Register Bulletin 15*, pp. 44– 45.

*Integrity of Design*
Knowing all three houses were largely rebuilt in the post-Civil War period, the determination of integrity of design needs to be made with regard to 1890-1933 commemorative/development period of the park.

Based on photographic evidence, all three of the houses were larger than their present configurations when they were documented in 1895.

For Snodgrass house, the photographic record supports that by the end of the significance date range in 1933, the house consisted of the same basic configuration it retains today. Therefore, it can be argued that Snodgrass house retains integrity of design to its period of significance.

The photographic record indicates that significant modifications to the configuration of both Kelly and Brotherton houses occurred after 1933. Therefore, Kelly and Brotherton houses cannot be said to retain integrity of design.

*Integrity of Setting*
All three houses continue to be part of the interpreted battlefield to which they maintain their historic association. Historic viewsheds are largely preserved. Therefore, all three houses retain integrity of setting.

*Integrity of Materials and Workmanship*
Again, knowing all three houses were largely rebuilt in the post-Civil War period, the determination of integrity of materials and workmanship needs to be made with regard to 1890-1933 commemorative/ development period of the park.

Based on historic documents, the photographic record, and physical investigations, from the top plates down, plus the roofing material, the houses retain integrity of materials and workmanship. Their basic composition and specific material components remain largely true to their original design intent.

While the existing logs display a variety of installation methods and notch types, a comparison of available historic photographs indicates that the vast majority were in place by the end of the period of significance for the houses (1933). Thus, regardless of the varying quality of workmanship and method of installation, the log walls of the houses do retain integrity with regard to the period of significance (1890-1933).

Everything above the top plates, save for the roofing material, does not retain integrity of material and craftsmanship. The roof structure and gable-end cladding were replaced in 1961 using the same design for all three houses without regard for their original and distinctive designs. These alterations visibly changed the character of all three houses both inside and outside.

*Integrity of Feeling*
Integrity of feeling was bolstered through the park's living history program established in the 1970s during which the interiors of the houses were furnished, the farmstead setting was staged, and living history interpretation was conducted with park volunteers in period costume. This allowed the park to portray the antebellum pioneer story line associated with the houses. Without this active interpretation, the passive interpretation on site explains the association, but does not fully convey the feeling.

*Integrity of Association*
All three houses retain integrity of association to the Civil War Battle of Chickamauga. This integrity is maintained through preservation and interpretation.

# Part II: Treatment and Use

## Requirements for Treatment and Use

The treatment and use of all historic properties maintained by the NPS are guided by federal laws and regulations as well as NPS policies, directives, and functional requirements. In addition to protecting cultural resources, they address safety, fire protection, energy conservation, universal accessibility, and abatement of hazardous materials. If rigidly interpreted, some of these requirements may be contradictory or at cross purposes. Any treatment must be carefully considered to ensure that the historic fabric including character, form, construction techniques, and overall authenticity of the structure is preserved.

### The National Historic Preservation Act

The 1966 National Historic Preservation Act (NHPA), as amended, establishes programs for the preservation of historic and cultural properties, including buildings, landscapes, and archaeological sites. Its implementation has established laws and authorities that are binding on the NPS.

### Section 106

Section 106 of the NHPA requires a consultative process prior to any federal agency undertaking, or federal involvement in an undertaking, that might affect historic properties listed or eligible for listing in the National Register of Historic Places. The regulations are codified at 36 CFR Part 800, "Protection of Historic Properties." The agency must initiate consultation; identify and evaluate historic properties; assess effects to historic properties; take steps to avoid, minimize, or mitigate adverse effects; and give the Advisory Council on Historic Preservation "a reasonable opportunity to comment with regard to such undertaking."



**Figure II-1.** The Brotherton House as viewed from the southeast.

Section 106 strives to ensure that all interested parties have a voice in the preservation of our nation's cultural heritage. The published regulations require, among other things, consultation with State Historic Preservation Officers (SHPOs) and other appropriate parties, which may include local governments, government or nongovernment applicants, Tribal Historic Preservation Officers (THPOs) and tribal leaders, other parties, the general public, and the Advisory Council.

The regulations establish criteria under which the Advisory Council may comment, but the vast majority of federal undertakings do not involve Advisory Council review.

A programmatic agreement among the Advisory Council for Historic Preservation, the National Conference of State Historic Preservation Officers, and the NPS expedites the Section 106 review process. With certain conditions, routine repairs and maintenance that do not alter the appearance of the historic structure or involve widespread or total replacement of historic features or materials are not subject to review outside the NPS.

## Director's Order 28

Director's Order 28 is the NPS Cultural Resources Management Guideline, which requires planning for the protection of cultural resources on park property.

## The Secretary of the Interior's Standards

The Secretary of the Interior's Standards for the Treatment of Historic Properties articulate best practices for protecting a wide range of historic properties. They provide a philosophical rationale for historic preservation that is almost universally accepted in the United States and applies to a wide variety of resource types, including buildings, sites, structures, objects, and districts. Revised in 2017, the Standards are codified at 36 CFR Part 68.

The Standards describe four broad approaches to the treatment of historic properties: Preservation, Rehabilitation, Restoration, and Reconstruction. Definitions of each of these treatments are found in the *Alternatives for Treatment and Use* subsection of this report (p. 61).

## Americans with Disabilities Act of 1990 and Architectural Barriers Act of 1968

The 1990 Americans with Disabilities Act (ADA) establishes comprehensive civil rights protection for disabled Americans, both in employment and in their right to free, unaided access to public buildings.

The 1968 Architectural Barriers Act (ABA) applies to facilities designed, built, altered, or leased with certain federal funds. The law is intended to provide unaided access to federal buildings. While people with restricted mobility have most benefited, the protections of ADA and ABA extend to those with impaired vision, hearing, or other disabilities.

Requirements for full compliance with ADA and ABA regulations are extensive and easiest to apply to new construction. Full compliance for historic buildings is more difficult. When a project would require significant alterations to their historic character, the regulations authorize a process for arriving at alternatives that can preserve historic character while maximizing disabled visitors' access.

## Director's Order 42

Director's Order 42 concerns the NPS goal to ensure that all people have the highest reasonable level of accessibility to NPS programs, facilities, and services in conformance with relevant regulations and standards. The level of accessibility to be provided will be consistent with the obligation to conserve park resources and preserve the quality of the park's experience. A fundamental principal of the order is to "seek to provide the highest level of accessibility that is reasonable, and not simply provide the minimum level that is required by law. Consequently, managers are encouraged to exceed the requirements for visitor accessibility through innovative techniques and partnerships whenever possible and reasonable."

The five objectives of the Director's Order are:

- Incorporate the long-range goal of providing the highest level of accessibility that is reasonable for people of all abilities in all facilities, programs, and services, instead of providing "separate" or "special" programs;

- Implement this goal within the daily operation of the NPS, its policies, organizational relationships, and implementation strategies;
- Provide further guidance and direction regarding the NPS interpretation of laws and policies;
- Establish a framework for the effective implementation of actions necessary to achieve the highest level of accessibility that is reasonable; and,
- Ensure the implementation of "universal design" principles within the national park system.

## Building Code Requirements

Treatment of the Snodgrass, Kelly, and Brotherton Houses may be guided by the following codes:

- International Building Code (IBC), 2018
- International Existing Building Code (IEBC), 2018
- International Energy Conservation Code (IECC), 2018
- International Plumbing Code (IPC)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA) Code 914
- NPS Guiding Principles of Sustainable Design

The NPS is not legally bound to local or state building codes. The 2018 IBC and its appendices, as well as the 2018 IEBC with appendices and Resource A, are currently referenced by the NPS Denver Service Center for design and construction.

The National Fire Protection Association (NFPA) has promulgated codes for historic buildings, most notably NFPA 909, “Code for the Protection of Cultural Resources Properties - Museums, Libraries, and Places of Worship,” and NFPA 914, “Code for Fire Protection of Historic Structures.” As a matter of policy, NPS provides a reasonable level of fire protection for all historic buildings and structures.[95]

95. NPS Structural Fire Reference Manual 58, 2015, https://www.nps.gov/subjects/fire/upload/reference-manual-58.pdf.

Threats to public health and safety must be eliminated, but alternative ways to prevent them are always sought when full code compliance would needlessly compromise the integrity of a historic building.

Consulting with the NPS Branch Chief of Structural Fire located at the National Interagency Fire Center (NIFC) in Boise, Idaho regarding the requirements of fire protection for this historic structure is recommended. NPS Regional Structural Fire Managers (RSFMs) are also responsible for NPS structural fire program management within their regions and should also be consulted.

### Abatement of Hazardous Materials

The houses were renovated in an era when hazardous materials such as lead-based paint, asbestos, and toxic wood preservatives were commonly used. Painted surfaces were not observed but could be concealed. Asbestos, considered a miracle product for decades, was used as an additive to provide fireproof qualities and additional strength to a wide variety of building materials through the late 1970s. Examples of building materials relevant to the house that commonly containing asbestos or hazardous materials include, but are not limited to:

- Plaster and Stucco, including cementitious chinking/daubing
- Mortar
- Preservatives applied to logs and other members

If left undisturbed, lead-based paint and asbestos-containing materials pose no threat to building occupants. However, appropriate abatement measures should precede any future work on building elements suspected to contain hazardous materials.

## NPS Management Policies

NPS General Management Policies (2006), especially chapter 5, “Cultural Resource Management,” guide its oversight of historic properties. Based on the authority of some nineteen Acts of Congress and many more Executive Orders and regulations, these policies require planning to ensure that decision-making

and priority-setting processes integrate information about cultural resources and consultation and collaboration with outside entities. They also support good stewardship to ensure that cultural resources are preserved and protected, receive appropriate treatments (including maintenance), and are made available for public understanding and enjoyment.

**Section 5.3.5, Treatment of Cultural Resources**
This section of NPS General Management Policies provides specific directives, including a stipulation that "the preservation of cultural resources in their existing states will always receive first consideration."

It also states:

> ... treatments entailing greater intervention will not proceed without the consideration of interpretive alternatives.... Pending treatment decisions reached through the planning process, all resources will be protected and preserved in their existing states. Except for emergencies that threaten irreparable loss without immediate action, no treatment project will be undertaken unless supported by an approved planning document appropriate to the proposed action. (p. 50)

The park's *Long Range Interpretive Plan* (LRIP) is an example of an approved planning document. HSRs and CLRs are intended to inform the planning process.

# Ultimate Treatment and Use



**Figure II-2.** The Kelly House as viewed from the northwest.

*This chapter presents the Ultimate Treatment and Use, introduced by the NPS Alternatives considered.*

## Alternatives for Treatment and Use

The United States Department of the Interior is responsible for establishing professional standards and providing advice on the preservation and protection of all cultural resources listed in or eligible for listing in the National Register of Historic Places. Accordingly, the National Park Service developed The Secretary of the Interior's Standards for the Treatment of Historic Properties ("Secretary's Standards," or "Standards"), which are intended to be applied to a wide variety of resource types, including buildings, sites, structures, objects, and districts.[96]

The Standards address four treatments: preservation, rehabilitation, restoration, and reconstruction. These are neither technical nor prescriptive, but are intended to promote responsible preservation practices.[97] The NPS defines the four major treatments as follows:

> ***Preservation*** is defined as the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New exterior additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical,

96. The Standards were developed in 1978, updated in 1983 and again in 1995 before the most recent 2017 revisions. They are codified at 36 CFR Part 68.

97. Anne E. Grimmer, *The Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings* (Washington, DC: National Park Service, Technical Preservation Services, rev. 2017).

electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project.[98]

***Rehabilitation*** is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.[99]

***Restoration*** is defined as the act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a restoration project.[100]

***Reconstruction*** is defined as the act or process of depicting by means of new construction, the form, features, and detailing of a non-surviving site, landscape, building, structure, or object for the purpose of replicating its appearance at a specific period of time and in its historic location.[101]

## Ultimate Treatment and Use

For each of the Snodgrass, Kelly, and Brotherton Houses, the NPS administratively determined Management Category is "Must Be Preserved and Maintained," and the Ultimate Treatment is ***Preservation***. This Management Category is defined by the NPS Cultural Resources Inventory System (CRIS). This treatment allows for the efforts necessary to preserve, maintain, and repair historic materials and features, and permits minor modifications as needed to address new information regarding historic integrity and to meet the needs of contemporary interpretation. The ***Preservation*** treatment retains historic features and permits removal of non-historic features.

***Rehabilitation*** focuses on work towards a compatible use for a property. The current interpretive use of the houses is the most suitable use for these simple one-room structures and is expected to continue.

***Restoration*** would return the building to its appearance during the period of significance. Each of the houses has been modified from its appearance during the period of significance, meaning that restoration could be an option.

***Reconstruction*** does not apply as the buildings remain in place.

JKOA recommendations determined during the investigations and assessments for this HSR for achieving the NPS administratively determined treatment of ***Preservation*** are found in the *Recommendations for Achieving Ultimate Treatment and Use* chapter that follows.

A summary of the recommended ultimate treatments and uses is as follows:

***• The NPS administratively determined management category for the Snodgrass, Kelly, and Brotherton Houses is "Must Be Preserved and Maintained," and the Ultimate Treatment is Preservation. This Management Category is defined by the NPS Cultural Resources Inventory System (CRIS). The treatment recommendations in this report continue the established Ultimate Treatment of Preservation. Specific measures that follow The Secretary of the Interior's Standards for Preservation are discussed in this report.***

***• The recommended ultimate use of the building has been defined in the 2015 amendment to the park's 1988 General Management Plan, calls for the cabins to be interpreted.***

### Standards for Preservation Treatment

The Secretary of the Interior's Standards include individual standards addressing each of the four treatments. The *Standards for Preservation* are to be applied taking into consideration the economic and technical feasibility of each project. They are as follows:

1. A property will be used as it was historically, or be given a new use that maximizes the retention of distinctive materials, features, spaces and spatial relationships. Where a treatment and use have not been identified, a property will

98. **Preservation** Treatment Standards, www.nps.gov/tps/standards/four-treatments/treatment-preservation.htm.
99. **Rehabilitation** Treatment Standards, www.nps.gov/tps/standards/four-treatments/treatment-rehabilitation.htm.
100. **Restoration** Treatment Standards, www.nps.gov/tps/standards/four-treatments/treatment-restoration.htm.
101. **Reconstruction** Treatment Standards, www.nps.gov/tps/standards/four-treatments/treatment-reconstruction.htm.

be protected and, if necessary, stabilized until additional work may be undertaken.

2. The historic character of a property will be retained and preserved. The replacement of intact or repairable historic materials or alteration of features, spaces and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place and use. Work needed to stabilize, consolidate and conserve existing historic materials and features will be physically and visually compatible, identifiable upon close inspection and properly documented for future research.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. The existing condition of historic features will be evaluated to determine the appropriate level of intervention needed. Where the severity of deterioration requires repair or limited replacement of a distinctive feature, the new material will match the old in composition, design, color and texture.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
8. Archaeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.[102]

102. Preservation Treatment Standards, https://www.nps.gov/tps/standards/four-treatments/treatment-preservation.htm.

# Recommendations for Achieving Ultimate Treatment and Use

*The Recommended Ultimate Treatment for the Snodgrass, Kelly, and Brotherton Houses is Preservation, as administratively determined by the National Park Service. Recommendations for Snodgrass House begin on p.68, followed by Kelly House on p. 82, and finally Brotherton House on p. 93. Note that there is some duplication between the recommendations for the sake of providing a dedicated standalone section for each house.*

## Guidelines for Treatment

Recommendations have been formulated based on the guidelines provided by The Secretary of the Interior's Standards for Preservation and reflect the administratively determined ultimate treatment. The full list of Preservation standards is provided in the *Ultimate Treatment and Use* chapter. Other guiding documents are outlined in the *Requirements for Treatment and Use* chapter.

Recommendations that further enhance the ultimate treatment of preserving the buildings are based on the findings of this HSR and are included in the *Recommendations for Further Research* subsection at the end of each house section. That discussion includes recommendations for performing additional studies.

Implementation of the recommendations provided by this report should adhere to the following guidelines:

- Undertake all work in compliance with The Secretary of the Interior's Standards for Preservation.
- Retain the historic character of the building and its surroundings by protecting the building and significant site features.
- Ensure that any proposed new elements or construction are compatible with the historic character of the building and site.
- Protect adjacent natural resources during construction projects.
- Document through photography, written narratives, and detailed as-built drawings, all changes and treatments to the building and its immediate site. Maintain records of treatments and preserve documentation according to professional archival standards. Maintain a copy of these records in NPS archives.
- Retain features and materials of both the exterior and interior of the building that survive from the period of significance to the greatest extent possible. See listing of Character-defining features on pages 28 (Snodgrass), 37 (Kelly), and 45 (Brotherton).
- Incorporate sustainable design principles in future projects that respect preservation principles.

# Snodgrass House Recommendations

*The actions recommended below are organized by feature and are intended to provide a conceptual framework for achieving the recommended ultimate treatment and use. They do not and are not intended to provide the detailed guidance of architectural/ engineering plans and specifications.*

## Site and Site Drainage

### Observations

The immediate Snodgrass House site is relatively flat, but drops off gently to the southeast and northwest.

Site drainage at the majority of the building perimeter is adequate to carry water away from the foundation, with the exception of the inside corners to the east and west of the fireplace. Low spots in each corner allow water to pool and likely enter the crawlspace (*Fig. II-3*).

### Recommendations

- Adjust the grading around the chimney to either allow the two low areas to effectively drain water away from the foundation wall. Ensure that an archaeologist oversees these efforts.
- Monitor site following major rainfall events in order to identify site drainage issues and plan interventions accordingly. The introduction of drainage swales may be a good solution for directing site drainage with little if any visual impact when sensitively designed. Any site work of this nature should be overseen by an archaeologist.
- Implement regular monitoring of site drainage at intervals indicated in the *Monitoring Checklist* found on p. 109.



**Figure II-3.** Snodgrass House - Hole in foundation wall at west side of chimney. Note standing water. Photograph taken September 2022 during a rainstorm.

### Relevant NPS Preservation Briefs

- Preservation Brief 36: *Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes*

## Structural System

***See the Structural Investigation Report prepared by 1200AE located in Appendix C for more information regarding the structural system.***

### Foundations and Crawlspace

*Observations*

The stone foundation at the perimeter of the house had areas of missing and/or loose stone, creating discontinuities in the support for the log walls and allowing animals to enter the crawlspace. Wherever there are loose or missing stones, the foundations should be rebuilt with mortar to match the existing in kind.

Frost depth in this region of Georgia is ten inches. It is unclear whether the existing stone foundations extend to frost depth as no test pits were performed at Snodgrass House. There are no signs of distress or uneven settlement of the building due to foundation issues, so larger-scale modifications to the foundations beyond minor repairs are likely not warranted. Recommendations for masonry repair can be found in the *Masonry Recommendations* section on p.71.

There is little or no ventilation within the crawl space, creating a very humid environment. In addition, several of the log floor joists were



**Figure II-4.** Snodgrass House - Floor joist in contact with grade.

observed to be in contact with the ground (*Fig. II-4*). This creates conditions that favor deterioration of the wood floor framing, which were noted to have a high moisture content in several areas where tested on site.

*Recommendations*

- Perform masonry repairs outlined in the *Masonry Recommendations* section on p.71.
- Remove soil beneath floor joists to prevent the underside of the joists from making contact with grade. This can be done locally, creating valleys below the joists themselves, or can be done over the entire area of the crawlspace, provided that the stone foundations are not undermined. Any soil removal should be performed in concert with Archaeology. While removing soil over the entire area would be preferable in terms of improving the airflow, localized soil removal can be considered if reducing the amount of excavation and archaeology is preferable to the NPS.
- Improve ventilation of the crawlspace by creating new openings in the foundation wall. Increased air circulation would improve the condition and longevity of the floor framing. Omit select stones to provide greater airflow while maintaining the existing stone coursing. Consider two openings on each of the east and west elevations and a single opening on each of the north and south elevations. Alternatively, multiple smaller openings may be visually preferable to fewer large ones. A large opening may be about 1'-0" wide by 6" tall, representing the size of one of the larger foundation stones. Install hardware cloth on the inside of the crawlspace openings during the proposed floor framing repair work to deter vermin. Install the mesh to the mortar joints of the inside face of the foundation wall using stainless steel fasteners and washers.

### First Floor Framing

*Observations*

The existing log joists at Snodgrass House were found to have sufficient structural capacity for residential use or limited visitation with small groups. For logs in good condition, no reinforcement is considered to be required unless a different use for the structure with higher loading requirements is considered.

The floor joists were found to exhibit severe deterioration where observed at the floor probes. Areas where the joists were in contact with the ground were most heavily deteriorated, as were several of the end bearing conditions (*Fig. II-5*). Soft spots were noted while walking across the floor.

Where logs are deteriorated at their bearing ends, this connection should be reestablished. The end connection is critical both for bearing of the joists themselves and for bracing the base of the exterior walls. Joist ends should be observed fully once floorboards are removed to identify and document each connection type.

**Recommendations**

- Remove flooring so that all joists can be examined across the entirety of their length. Number and retain the floorboards for reinstallation.
- If a use with a higher load requirement is desired, joists can be sistered or an intermediate support below the joists can be provided to increase its load capacity.
- Where logs are severely deteriorated, depending on the area of deterioration, repairs can be made by scarfing in portions of joists to match the existing in wood species, grade and size. Joists vary between



**Figure II-5.** Snodgrass House - Notched end of floor log joist at west bearing (at floor probe). Note floorboard above and gap between joist and stone foundation wall below.

white oak and southern yellow pine (see *Wood Assessment Report* in *Appendix D*). Alternatively, joists can be sistered with new members.

- Joist ends should be extended as necessary to bear on the stone foundation projection or pocket into the exterior log and create a positive connection. This can be done by sistering or scarfing on joist extensions.
- If the deterioration of a particular log is so severe that it cannot be salvaged, it should be replaced in kind with a member of the same wood species, grade and diameter and with similar end/bearing detailing as the existing.

### Exterior Logs

*Observations*

Exterior logs were generally found to be in fair condition, with a few exceptions:

The sill log at the west end was severely deteriorated, especially in the vicinity of the door sill (*Figs. II-6, II-7*). The east sill log was also deteriorated at the door sill but less so.



**Figure II-6.** Snodgrass House - Deteriorated sill log at west façade near door threshold.



**Figure II-7.** Snodgrass House - Minor deterioration of sill log at east doorway.

At the southwest corner, the top logs exhibit some deterioration due to water infiltration through the roof (*Fig. II-8*). The water intrusion appears to have been mitigated.

*Recommendations*

- The areas of deteriorated sill logs should be repaired with scarfed in log members to restore their structural integrity. White oak logs should be used to match the existing.
- At the southwest corner, dutchman repairs to the top logs may be warranted and the existing wood should be matched. The west top plate was noted to be southern pine and the south top plate was noted to be white oak. See the *Log Walls Recommendations Section* for considerations regarding dutchman repairs.
- Where surface deterioration exists on other logs, this is not considered a structural concern and veneer repairs can be performed. See the *Log Walls Recommendations* section in *Exterior Features* on p. 72 for considerations regarding veneer repairs.

### Roof Framing

*Observations*

The roof framing and tie beams were typically found to be in good condition and do not require reinforcement.

The rafters were observed to be pulling out from the top log. Nailed connections have failed in withdrawal due to wind uplift forces (*Fig. II-9*).



**Figure II-8.** Snodgrass House - Deteriorated top rounds and roof rafter at southwest corner of building. Note sister on rafter.



**Figure II-9.** Snodgrass House - Nails pulling out at rafter end due to wind forces.

*Recommendations*

- It is recommended that, if there is an opportunity to remove the roofing material, the existing nailed connections be removed and a screw be installed from the top down through the rafter end and into the top log. If no roofing repairs are to be performed, a hold-down can also be installed at the interior face of the rafter to the top log, although this connection may be more visible and would alter the appearance of the house from the interior.
- See the *Animals, Vermin, and Pests Recommendations* section on p.80 for guidance regarding potential bat activity.

## Exterior Features

### Masonry

#### Observations

The Snodgrass House has a mortared stone perimeter foundation. The foundation wall was made continuous sometime after ca. 1913 and was previously supported by stone piers.

Stones are dislodged at the southeast and southwest corners, as well as west of the chimney (*Figs. II-3, II-10, II-11*).

#### Recommendations

- Regularly monitor stone for new and worsening cracks.
- Reset loose and dislodged stones and mortar back into place.
- Improve ventilation in the crawlspace by creating new vent openings as described in the *Structural Systems Recommendations* section. Install recessed grates or wire mesh to prevent vermin access at all vent openings.
- Perform mortar analysis on a sample of original mortar to determine formula for repairs. See the *Recommendations for Further Research* section on p.80 for more information. The repointing mortar should have the same performance characteristics and coloration as the original mortar in order to prevent damage to the stone or an inconsistent appearance. Care should be taken to ensure that mortar joints maintain the original appearance of the masonry. Repointing that covers too much of the projecting stones will diminish the three-dimensionality of the stonework and will call unwanted attention to the mortar joints.
- Ensure that electric saws and grinders are not used to remove mortar from historic masonry. These tools are imprecise and pose a high risk of damage to historic material. Repointing should be performed



**Figure II-10.** Snodgrass House - Displaced stone at southwest corner.



**Figure II-11.** Snodgrass House - Loose and displaced stones at southeast corner.

by skilled masons with experience working with historic buildings. Appropriate methods of mortar removal include the use of hand tools or a combination of hand tools and small pneumatic chisels.

- Clean biologic growth from surfaces, testing a wide range of cleaning methods and materials before use of a chosen cleaning system.
- Always test cleaning methods in a small, inconspicuous area to gauge effectiveness.
- Test cleaning methods by progressing from the gentlest solution, such as presoaking with warm water, to mild non-ionic detergents, and finally to more aggressive commercial cleaners as necessary to remove soiling or staining. All methods should be agitated with a soft, natural bristle brush to prevent damaging the surface of the material being cleaned.
- Clean masonry elements using the lowest level of abrasion and mildest cleaning solution possible while achieving the desired results.
- Ensure that pressure washing with water is performed at a low psi (garden hose level up to about 300-400psi) with a fan-tip nozzle and a minimum distance of 30 inches from nozzle tip to masonry surface.
- Prohibit use of high-pressure washing (in excess of 400 psi) to clean historic masonry. The pressure exerted on the surface by a pressure washer can result in damage or loss of material, and also exposes historic materials to large volumes of water.
- Blasting with hard material (sand, nutshells, glass beads, etc.) should never be considered as an option for cleaning or removing coatings from masonry.

**Relevant NPS Preservation Briefs:**

- Preservation Brief 1: *Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings*
- Preservation Brief 2: *Repointing Mortar Joints in Historic Masonry Buildings*
- Preservation Brief 6: *Dangers of Abrasive Cleaning*

## Log Walls

***See the Wood Assessment Report prepared by Anthony and Associates located in Appendix D for more information regarding the logs.***

### Observations

The logs of the Snodgrass House are generally in good condition. See the *Wood Assessment Report* in *Appendix D*, Figures 9-22 for conditions that either should be considered for repair or may be historically significant. Wood species, structural grade, moisture contents, and resistance drilling results are also described in the *Wood Assessment Report*.

Results of the visual observations, probing, moisture content readings, and resistance drilling of the logs and framing members gleaned through the wood assessment that may require treatment are summarized as follows:

- Top plates – south top plated is decayed on the west end to approximately 48", the west top plate is decayed at the south end with no void at approximately 20" from the south end. This deterioration is due to a prior roof leak (*Fig. II-8*)
- Sill logs – the east sill log had a 1.5" channel south of the stone step, the west sill log showed significant deterioration at the door threshold and was shown to be thin (3.5' to 4") when drilled along its length (*Fig. II-6*).
- Log crowns – generally in fair condition with some minor deterioration in the end grain that does not extend into the notch.

Non-historic cementitious chinking is in fair to good condition with isolated areas of failure.

### Recommendations

- Ensure that log repairs are performed by a skilled craftsperson with extensive experience in working with historic log structures. Low-quality repairs will be visually obvious and will be more prone to failure.
- If log repairs are determined to be desirable either for restoring lost structural integrity due to decay or insect damage, dutchman repairs can be used by removing and replacing the area of deteriorated wood. Minor surface deterioration on an exterior log can be repaired using a log veneer attached to the existing log once the

deteriorated surface material is removed.

- The wall logs are a mix of white oak and southern pine species groups. The wood species used for any repairs or replacement of the logs should be white oak if a goal is to provide long-term durability. Southern pine could be considered as an alternative if initial cost is a higher priority than longevity. In addition to wood species, replacement logs should be of the same dimensions with similar growth characteristics (e.g., knot frequency, size, and spacing), moisture content (to avoid differential shrinkage and open joints), growth ring count (e.g. avoid using southern pine logs with less than six growth rings per inch when observing the end grain), and tool marks (to match historic appearance, if determined to be accurate). Dutchman repairs are preferable to full log replacement. When sourcing materials for repairs, consider specifying reclaimed material since it will be easier to match the characteristics of the existing material. Any replacement material should be less than 20% moisture content at the time of the repair to minimize differential shrinkage between replacement and existing material (to provide a tight joint) and reduce the likelihood of wood decay due to the high moisture content.
- Maintain vegetation around the house to improve the ability for the lower course of logs to remain dry.
- Do not fill log checks. A common concern is that checks should be filled to prevent moisture from entering the interior of the log, resulting in internal decay. Filling the checks with mortar, daubing, or a sealant will seldom keep moisture out in the long term and once moisture is in the wood, it is generally trapped. The checks should not be filled; they should be left open to allow for drying when the wood gets wet. Removing leaves and debris periodically (initially, annually) is sufficient maintenance for reducing the development of decay via the checks in the logs.
- Do not use wood fillers or consolidents to repair surface damage. Similar, to filling checks, these consolidents will hold moisture inside the log and ultimately result in the deterioration of the log around the repair. Instead, either use a veneer repair, as outlined previously, or tool the deteriorated area to effectively shed water. If performed by a skilled craftsman, the tooled area should be almost imperceptible.
- For extending the service life of the logs, borate rods can be inserted into the logs susceptible to moisture absorption to mitigate additional deterioration by wood decay fungi. Borate rods can be inserted into holes drilled into the log where deterioration has been identified. Borates are low-level toxicity preservatives that are used to improve the durability of both new and in-service wood products. Borates require moisture to migrate through the wood but can be leached from the wood with too much exposure to moisture; therefore, they will need to be inserted in the area of active deterioration, unless the deteriorated wood is replaced and the source of moisture is eliminated. Borates also effectively control termites, carpenter ants, a variety of beetles,



**Figure II-12.** Snodgrass House - Deterioration of west threshold and adjacent flooring. Note that floorboard was removed for the purposes of investigation.



**Figure II-13.** Snodgrass House - Condition at east threshold. Note lack of slope to drain water.



**Figure II-14.** Snodgrass House - Condition at south threshold. Note exposed end grain of flooring.

and other wood boring insects. Topical borate treatments (liquids) applied to the surface offer no protection to the more vulnerable interior of large timbers and are not recommended.

- To install borate rods, holes are drilled into the areas where moisture is a concern (i.e., ground contact), the rods are inserted, and the holes are filled with either a pressure-treated wood plug or a plastic threaded plug. Borate rods are typically effective for three to ten years depending on environmental conditions, but they should be inspected on a 5-year cycle given the current and anticipated moisture exposure of most of the elements. The borates should be incorporated into a cyclic, long-term maintenance program.
- Replace any portions of failing or missing chinking in kind based on findings of recommended material analysis. See *Recommendations for Further Research* section on p.80 for more information.

**Relevant NPS Preservation Briefs:**

- Preservation Brief 29: *The Preservation and Repair of Historic Log Buildings*.



**Figure II-15.** Snodgrass House - Typical deterioration of board-and-batten doors.

## Exterior Doors

### Observations

The Snodgrass House has three exterior doorways, one on each of the south, east, and west elevations. Each doorway holds a modern metal gate that controls access. The east and west openings also have a modern inward-swinging board-and-batten door, while the south doorway does not.

The board-and-batten inner doors are currently kept in an open position at all times, allowing park visitors to view the interior of the house through the metal gates. The open doors expose the wood thresholds, flooring, and by extension the floor framing and sill logs to increased moisture infiltration from rainfall. The door thresholds have little if any slope to drain water away from the end grain of the doors or to protect the sill log beneath (*Figs. II-12, II-13*). At the south doorway, the end grain of the floorboards is exposed at the face of the doorway (*Fig. II-14*).

The bases of the board-and-batten doors show signs of moisture damage due to water splashing from the threshold below (*Fig. II-15*). Several boards have portions missing at their base. Some of this damage likely dates from when the doors were still regularly closed as part of day-to-day operations; however, the hinge side bottom corner of the doors show signs of being saturated on a regular basis in the open position.

All hardware associated with the board-and-batten doors is modern. The metal gates are also modern and have a powder coated finish. The gates are in good operating condition.



**Figure II-16.** Snodgrass House - Window opening as viewed from the exterior.

### Recommendations

- Repair broken or extensively deteriorated boards at exterior doorways in kind. Perform Dutchman repairs where deterioration affects only a small portion of the overall board. The faces of the doors appear to be made up of southern yellow pine. When the doors eventually require replacement, use of a more durable but still historically appropriate wood such as white oak should be considered.
- Replace the existing thresholds, which are not historic material, with versions that introduce adequate slope to shed water away from the doors. The threshold should extend far enough to the exterior to prevent shed water from dripping on to the sill log.
- Fabricate and install a new board-and-batten door for the south doorway based on existing examples. For longevity, white oak may be considered as a durable and historically appropriate species.
- Adjust park operation procedures to include closure of the board-and-batten doors after park hours and before and after major rain events. The existing metal gates would remain in place for security. See *Recommendations for Ultimate Use* section for discussion of potential interior use.
- When repairs to exterior casings become necessary, replace existing plank-board casings in kind.
- Regularly maintain hardware at board-and-batten doors and gates, applying lubricants, replenishing paint finishes as appropriate, and making repairs to extend the life of the hardware.
- Implement regular monitoring of doorways and lubrication of hardware at intervals indicated in the *Monitoring Checklist* found on p.109.



**Figure II-17.** Snodgrass House - Mortar joints at exterior steps. Note that mortar has typically separated from the stones.

## Windows

### Observations

The Snodgrass house has a single window opening on the north elevation, east of the chimney (*Fig. II-16*). The opening once held a board-and-batten shutter, but currently holds only modern metal bars (See Fig. B.10 in the Chronology of Development and Use Chapter).

The window sill has little slope to effectively shed water. Although the opening is somewhat protected by the projecting roof, wind-driven rain could lead to deterioration of the sill and logs beneath the window over time, especially as weather events intensify and increase in frequency.

### Recommendations

- Consider fabricating and reinstalling a board-and-batten shutter for the window opening to protect the sill and interior from wind-driven rain. Model the shutter and hardware after what is already being used at the exterior doorways.
- Retain existing window bars to provide security if the house remains closed to the public. The shutter, as with the exterior doors, should be closed ahead of severe weather events.

## Exterior Steps

### Observations

The mortared stone steps accessing the house's three doorways are each modern, installed sometime in the latter half of the twentieth century.



**Figure II-18.** Snodgrass House - Damaged chimney cap. Note displaced chinking at left and missing top log courses.

The steps are in overall good condition; however, mortar joints have typically failed (*Fig. II-17*).

### Recommendations

- Repoint the steps in accordance with the recommendations outlined in the preceding *Masonry Recommendations* section.
- Regularly monitor stone for new and worsening cracks.
- If necessary, adjust the pitch of the stone treads when repointing to ensure that water sheds away from the building.

## Roofing and Roof Drainage

### Observations

The current cedar shingle roof is thought to have been installed in 2012 and appears to be in good condition.

The chimney stack has lost two to three courses of logs at its cap. A portion of the chinking from the missing portion is resting on the roof (*Fig. II-18*).

### Recommendations

- Monitor roofing for missing or displaced shingles and leaks.
- See the *Chimney Recommendations* section for information regarding chimney repairs. Assume some minor roof repair will be required adjacent to the chimney stack at the time that chimney work is completed.
- Implement regular inspection roofing at intervals indicated in the *Monitoring Checklist* found on p.109.

### Relevant NPS Preservation Briefs

- Preservation Brief 4: *Roofing for Historic Buildings*
- Preservation Brief 39: *Controlling Unwanted Moisture in Historic Buildings*

## Chimney

### Observations

An exterior log chimney is centered on the north elevation and has a stone firebox that extends to the shoulders of the chimney on the interior before transitioning to fully log construction.

There is a hole in the masonry foundation wall at the west side of the chimney at grade (*Fig. II-3*).

The upper two to three courses of logs at the chimney cap have been lost (*Fig. II-18*). Photos of the house from the late 1970s show the cap being notably taller than the current condition, which barely peeks above the comb of the roof shingles.

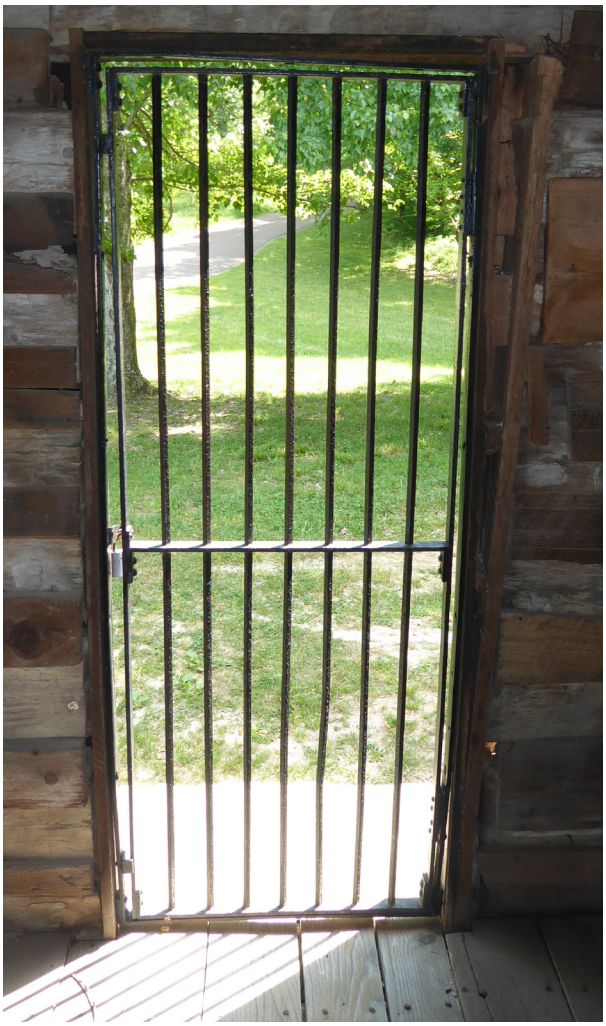


**Figure II-19.** Snodgrass House - South doorway as viewed from the interior.

See the *Chronology of Development and Use* chapter for historic photos.

#### Recommendations

- Repair the foundation wall at the west side of the chimney in accordance with the *Masonry Recommendation*s section.
- Reconstruct the missing log courses at the top of the chimney in accordance with log replacement recommendations outlined in the *Log Walls Recommendations* section. Ensure that the replacement logs match the rest of the chimney stack in size and characteristics. Perform any repairs to the roof at the base of the chimney at the same time.
- See the *Animals, Vermin, and Pests Recommendations* section on p.80 for guidance regarding potential bat activity.

## Interior Features

### Flooring

#### Observations

The wood flooring throughout the interior is thought to be modern. Overall, the flooring is in good condition, with some localized minor deterioration and weathering at each of the three exterior doorways.

The exterior doors being open at all times allows water to sit at these locations and has ultimately led to deterioration. The south doorway currently has no door installed and is secured only with a metal gate (*Fig. II-19*).

#### Recommendations

- Retain existing flooring; replacing deteriorated boards in kind. See the *Structural Recommendations* section regarding potential need to remove the flooring to perform floor framing and crawlspace repairs.
- See the *Exterior Doors* and *Recommendations for Ultimate Use Recommendations* Sections for ways of minimizing damage to flooring at the exterior doorways.

### Interior Trim

#### Observations

The house has no interior trim elements. The inner face of the exterior door and window jambs are exposed to the interior. Boards applied at the interior of the log walls are addressed in the *Walls and Ceiling Recommendations* section.

### Walls and Ceilings

#### Observations

The log exterior wall construction is exposed throughout the interior. The roof framing is exposed at the ceiling.

Boards of varying widths are installed at the gaps between the log courses.

#### Recommendations

- Retain applied boards at the interior walls. If log repairs necessitate removal of the boards, complete the work in sections and label the boards for reinstallation in the same locations.
- Implement regular monitoring of walls and ceilings for water infiltration at intervals indicated in the *Monitoring Checklist* found on p.109.

### Fireplace

#### Observations

A stone firebox and hearth are on the north wall. The stone appears to be in good condition. The fireplace has no mantel. Some stones of the hearth are loose.

#### Recommendations

- Monitor masonry for new or worsening cracks and plan for repairs accordingly. Repair loose stones at hearth. See the *Masonry Recommendations* section on p71.

### Fire Protection and Security

#### Observations

The house does not have any form of fire protection or security systems. The interior is not regularly occupied and the doorways are secured with locked metal gates.

The house does not have power or water service to support an alarm or fire suppression system and there are no plans to add these systems.

### Recommendations

- If the house is opened to the public on a more regular basis, consider including a fire extinguisher on the interior.
- Maintain locking gates on the exterior doors after park hours and anytime the building is not open to the public.



**Figure II-20.** Snodgrass House - Overview of west doorway.

### Building and Site as Artifacts

#### Observations

It is important to think of the building and its surroundings as having archaeological value. Evidence of the creation and evolution of this place is embodied in the building and site features, and sometimes hidden below the ground's surface.

#### Recommendations

- Strive to protect evidence of the evolution of the building as part of future work campaigns.
- As part of any project requiring ground disturbances, have an archaeologist on call to review any potential findings.

### Operations and Maintenance Program

The park currently does not have formal procedures established for conserving the historic building materials.

#### Recommendations

- Initiate an Operations and Maintenance (O&M) program focused on this building, specifically to:
  - Develop a protocol of best practices for maintenance, including lists of proven products, materials, and methods.
  - Also develop a list of products, materials, and methods that should NOT be used.
  - Avoid the use of new construction products and materials until the specific application has been sufficiently tested and approved by the appropriate NPS management unit.

### Monitoring Checklist

Use of a Condition Monitoring Checklist outlining inspection topics and the date of inspection helps both to formalize the monitoring process and to create a record for future reference.

A checklist tailored specifically to the needs of the Snodgrass, Kelly, and Brotherton Houses, each of which faces similar maintenance challenges, was prepared for this HSR and can be found on p.109.

#### Recommendations

- Adopt the recommended inspection schedule included in the Checklist or substitute a more suitable one.
- Adjust the list of inspections as appropriate. Integrate the monitoring schedule into park activities.
- Retain the Checklists for tracking needs and scheduling remedial actions.

## Accessibility and Universal Design

#### Observations

All three entrances to the building are accessed by two stone steps, which limit accessibility. Currently, the house is not open to the public. Park visitors can instead view the interior through the metal gates at grade.

The lowest threshold at the Snodgrass House is on the west elevation, which lies about 1'-0" above grade level (*Fig. II-20*). A ramp designed in accordance with ABA/ADA standards would require a run of approximately 12'-0" to reach this level. A ramp of this size would become a major feature of the landscape and building and would greatly detract from the historic character of the site.

**Recommendations**

- If the interior of the house remains closed to the public, the park may choose to take no action. If the interior is opened to the public, the park may consider Options 1 or 2.
- Option 1: Consider improving the ability for someone in a wheelchair to view the interior of the house. The non-historic west stone steps could be removed to allow a wheelchair to approach the doorway more closely. In this scenario, the metal gate at the west opening would likely need to remain secured to prevent visitors from using the doorway to enter and exit.
    - Because the house is a single room, the vast majority of the interior can be seen from a single vantage point. In Option 1, care should be taken to ensure that interior interpretation design is cognizant of what is and isn't visible from the accessible doorway.
    - As the steps currently prevent wheelchairs from closely approaching any doorway, Option 1 may be considered regardless of whether the interior is opened to the public.
- Option 2: Consider adjusting the grade in front of the west doorway to reduce the distance between grade and the threshold. This could reduce the distance from grade by several inches, resulting in a reduced ramp length. Care should be taken to ensure that soil is not placed against the masonry foundation wall, as it is not designed to retain.
    - Consider the archaeological implications of Option 2 and weigh them against the value of providing universal access to the interior. Even a reduced ramp length will have a major visual impact on the site and will impact the proportions of the building.

## Resilience to Natural Hazards

### Climate

**Observations**

Average temperatures and precipitation at CHCH are increasing and are projected to continue to increase. Storm frequency and intensity is also projected to increase. These changes will have major impacts on frequency of maintenance required for buildings. Storm preparation and adequate drainage to handle increased rainfall will also be critical.

A number of studies have been prepared by NPS on a park-by-park basis that address changing climatic conditions and interpret historic climate data. Studies include "Recent Climate Change Exposure of Chickamauga and Chattanooga National Military Park" (Monahan & Fisichelli, 2014) and "Chickamauga and Chattanooga National Military Park: How Might Future Warming Alter Visitation?" (Fisichelli & Ziesler, 2015). Both documents are available on NPS.gov.

**Recommendations**

- Consider the potential effects of climate change issues on the building and its immediate site, such as increased storm threats, changes in average temperature and rainfall totals, and associated loss or degradation of resources.
- Monitor weather-related deterioration and evaluate needed responses to protect the building and its immediate site in coordination with overall assessment of climate change effects on the park overall.
- Complete site drainage recommendations advocated by this HSR.
- Complete roof framing modifications advocated by this HSR to protect against wind uplift.
- Use studies regarding adaptation to natural hazards to inform management decisions. Current studies that address the park include those cited above.
- Assume increased visitation will take place in the coming years and adjust maintenance schedules appropriately.
- Consult regularly with the NPS Interior Region 2 Climate Change, Socioeconomics, and Adaptation Coordinator to inform management policies. Coordinate with planning and documentation projects being implemented by the NPS Region.
- Evaluate building maintenance schedules as necessary to account for the possibility of more frequent exterior painting/finishing campaigns, roof repairs, and roof and site

drainage repairs in response to increased and more intense projected precipitation. The Condition Monitoring Checklist found on page 109 of this report helps guide cyclical maintenance and frequent monitoring of conditions, and creates a record.

- Update emergency and disaster planning to address resiliency to natural hazards and mitigation of the effects of hazardous events.

### Animals, Vermin, and Pests

#### Observations

No obvious evidence of active vermin or pest activity were noted during the assessments for this report; however, ongoing monitoring for activity is important to the wellbeing of the building and park visitors.

The house is known to commonly host roosting bats.

#### Recommendations

- Regularly inspect the house for termite activity, including the presence of mud tunnels. Installation and regular replenishment of termite bait stations should be considered.
- Remove any insect nests that may appear on the building exterior. Monitor the building regularly for insect activity.
- Be vigilant to prevent habitation of vermin such as mice, rats, or snakes on the interior of the building.
- A bat survey should be performed by a wildlife biologist or other qualified personnel prior to start of work if work occurs in the spring or summer months (March 31- October 15). Bat activity during the fall and winter months is reduced and may be considered when scheduling repairs. Ideally, bat roosting inside the house should be discouraged and operations recommendations including the regular closure of doors may reduce this activity.

## Recommendations for Ultimate Use

The Snodgrass House is currently interpreted by wayside signage near the building. The interior is not open to the public and is not interpreted. The current floor framing conditions make public access problematic, and park operations currently do not include controlling access to the house.

Following the implementation of floor framing repairs, it is the recommendation of this report that the house be opened to the public on a daily or semi-regular basis. A more comprehensive story of the house and its site could be told using interpretive panels on the interior. Basic furnishings to further enhance interpretation could be considered depending on when the building is open and to what extent visitor monitoring is feasible. For instance, the house may be fully open for a few hours each day, after which the gates would be secured. The inner board-and-batten doors would be opened and closed ideally nightly, but at minimum before and after major rainfall or weather events.

## Recommendations for Further Research

### Material Analyses

Complete mortar analysis prior to any repointing campaign to determine color and composition of existing mortar. Matching the original mortar coloration is critical to avoiding a "patchwork" appearance when spot repointing.

Perform material analysis on cementitious chinking to determine a compatible formula for repairs.

Hazardous materials testing should be performed on mortar prior to repointing. See the *Hazardous Materials Testing Recommendations* for more information.

### Hazardous Materials Testing

#### Observations

Work was performed at the house in a time period when asbestos, and toxic wood preservatives were commonly used. Asbestos, considered a miracle product for decades, was used as an additive to provide fireproof qualities and additional strength to a wide variety of building materials through the late 1970s. Examples of building materials relevant to the house that commonly containing asbestos or hazardous materials include, but are not limited to:

- Plaster and Stucco, including cementitious chinking/daubing

- Mortar
- Preservatives applied to logs and other members

No known examples of painted surfaces that may contain lead were observed. If painted surfaces are encountered, test them before disturbing coatings.

If left undisturbed, lead-based paint and asbestos-containing materials pose no threat to building occupants. However, appropriate abatement measures should precede any future work on building elements suspected to contain hazardous materials.

**Recommendations**

- Perform appropriate abatement measures for hazardous materials prior to future work that could disturb suspected hazardous materials.

# Kelly House Recommendations

*The actions recommended below are organized by feature and are intended to provide a conceptual framework for achieving the recommended ultimate treatment and use. They do not and are not intended to provide the detailed guidance of architectural/ engineering plans and specifications.*

## Site and Site Drainage

### Observations

The Kelly House site is essentially flat, with the log structure sitting very close to grade and at some locations in direct contact with grade (*Figs. II-21, II-22*).

Despite the flatness of the site, there did not appear to be indication that water collects at the base of the structure. The sill log along the east elevation sits at or below grade for much of its length.

### Recommendations

- Make adjustments along the east sill log to reduce grade and get the log out of contact with soil. This adjustment may require introduction of a drainage swale east of the building to ensure that water continues to drain away from the building. Drainage swales have little if any visual impact when sensitively designed. Any site work of this nature should be overseen by an archaeologist.
- Monitor site following major rainfall events in order to identify site drainage issues and plan interventions accordingly.
- Implement regular monitoring of site drainage at intervals indicated in the *Monitoring Checklist* found on p.109.



**Figure II-21.** Kelly House - Overview of site from northwest.

### Relevant NPS Preservation Briefs

- Preservation Brief 36: *Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes*

## Structural System

***See the Structural Investigation Report prepared by 1200AE located in Appendix C for more information regarding the structural system.***

### Foundations and Crawlspace

*Observations*

The stone foundation at the perimeter of the house had limited areas of missing and/or loose stone, creating discontinuities in the support for the log walls and allowing animals to enter the crawl space. Wherever there are loose or missing stones, the foundations should be rebuilt with mortar to match the existing in kind.

A test pit dug at the southeast corner of the building revealed that the lower 3" of the sill log was found to be embedded below grade and the stone foundation below was determined to extend only an additional 3" into the ground (*Fig. II-23*). Frost depth in this region of Georgia is 10 inches.



**Figure II-22.** Kelly House - View of east sill in contact with grade.



**Figure II-23.** Kelly House - Test pit at southeast corner showing shallow stone foundation.

While the foundations ideally would extend to or below the frost depth, there are no signs of distress or uneven settlement of the building due to foundation issues, so lowering of the foundations is likely not warranted. However, the embedment of the timber sill log should be addressed. See the *Exterior Log Walls Recommendations* section.

There is little or no ventilation within the crawl space, creating a potentially humid environment.

Based on limited access at the floor probe, the observed log floor joists were not in contact with the ground and had approximately 5" to 6" of clear space between the bottom of the joists and the ground (*Fig. II-24*). When joists are in contact with the ground, this creates conditions that favor deterioration of the wood floor framing. It should be confirmed by additional observation whether the remainder of the floor joists are also raised above the ground, which is the desirable condition.

*Recommendations*

- Perform masonry repairs outlined in the *Masonry Recommendations* section on p.85.
- If found to be necessary after further investigation (see *Floor Framing Recommendations* section) remove soil beneath floor joists to prevent the underside of the joists from making contact with grade. This can be done locally, creating valleys below the joists themselves, or can be done over the entire area of the crawlspace, provided that the stone foundations are not undermined. Any soil removal should be performed in concert with Archaeology. While removing soil over the entire area would be preferable in terms of improving the airflow, localized soil removal can be considered if reducing the amount of excavation and archaeology is preferable to the NPS.
- Improve ventilation of the crawlspace by creating new openings in the foundation wall. Increased air circulation would improve the condition and longevity of the floor framing. Omit select stones to provide greater airflow while maintaining the existing stone coursing. Consider two openings on each of the east and west elevations and a single opening on each of the north and south elevations. Alternatively, multiple smaller openings may be visually preferable to fewer large ones. A large opening may be about 1'-0" wide by 6" tall, representing the size of one of the larger foundation stones. Install hardware cloth on the inside of the crawlspace openings during the proposed floor framing repair work to deter vermin. Install the mesh to the mortar joints of the inside face of the foundation wall using stainless steel fasteners and washers.



**Figure II-24.** Kelly House - Floor log joist at west bearing end. Note sisters and notched end connection.

**First Floor Framing**

**Observations**

The existing log joists at Kelly House were found to have insufficient structural capacity for most uses, assuming no intermediate supports for the joists are present. Only two of the joists could be measured fully and it could not be confirmed whether any intermediate joist supports exist due to limited access through a single probe (*Fig. II-24*).

The condition of the floor joists could not be determined fully due to limited access. One observed joist had already been sistered, presumably due to an existing deteriorated condition at its bearing end. Areas where joists may be in contact with the ground and end bearing conditions are typically the most vulnerable to deterioration.

If logs are found to be deteriorated after further examination, depending on the extent and severity of deterioration, repairs can be made scarfing in portions of joists to match the existing in wood species, grade and size. Alternatively, joists can be sistered with new members. If the deterioration of a particular log is so severe that it cannot be salvaged, it should be replaced in kind with a member of the same wood species, grade and

diameter and with similar end / bearing detailing as the existing.

If logs are found to be deteriorated at their bearing ends, this connection should be reestablished. The end connection is critical both for bearing of the joists themselves and for bracing the base of the exterior walls.

**Recommendations**

- Remove flooring so that all joists can be examined across the entirety of their length. Number and retain the floorboards for reinstallation.
- If a use with a higher load requirement is desired, joists can be sistered or an intermediate support below the joists can be provided to increase its load capacity.
- Where logs are found to be severely deteriorated after further examination, depending on the area of deterioration, repairs can be made by scarfing in portions of joists to match the existing in wood species, grade and size. Joists vary between white oak and southern yellow pine (see *Wood Assessment Report* in *Appendix D*). Alternatively, joists can be sistered with new members.
- Joist ends should be extended where necessary to pocket into the exterior log and create a positive connection. This can be done by sistering or scarfing on joist extensions.
- If the deterioration of a particular log is so severe that it cannot be salvaged, it should be replaced in kind with a member of the same wood species, grade and diameter and with similar end/bearing detailing as the existing.

### Roof Framing

*Observations*

The roof framing and tie beams were typically found to be in good condition and do not require reinforcement (*Fig. II-25*).

When the roofing is next replaced, the park may consider improving the connections between the rafter ends and the top logs. Alternatively, tie-downs could be installed at the interior. These measures will help the roof structure to resist uplift.

**Recommendations**

- If there is an opportunity to remove the roofing material, the existing nailed connections be removed and a screw be installed from the top down through the rafter end and into the top log. If no roofing repairs are to be performed, a hold-down can also be installed at the interior face of the rafter to the top log, although this connection may be more visible and would alter the appearance of the house from the interior.
- See the *Animals, Vermin, and Pests Recommendations* section on. p.93 for guidance regarding potential bat activity.

### Exterior Log Walls

Exterior logs were generally found to be in fair condition, with a few exceptions:

A test pit dug at the southeast corner of the building revealed that the lower 3" of the sill log was found to be embedded below grade and is showing signs of deterioration from extended exposure to moisture (*Fig. II-23*). The embedment of the timber sill log could result in long-term deterioration of the log due to continued exposure to moisture.

The log extensions and corner connections are experiencing varying levels of deterioration. The end-grain of exterior log extensions can take on moisture seasonally, shrinking or swelling more than the rest of the log. The combination of increased moisture and dimensional changes make the log ends more susceptible to deterioration over the long term. Several of the corner connections are severely deteriorated and have lost structural capacity (*Fig. II-26*). It is likely that there is enough redundancy in the remainder of the corner



**Figure II-25.** Kelly House - Overview of roof framing.



**Figure II-26.** Kelly House - Deteriorated corner connections and log extensions, southwest corner.

connections to provide adequate structural capacity. Options for treatment are described in the Recommendations section.

**Recommendations**

- Locally lower the exterior grade and slope the grade away from the west sill if this is acceptable from an archaeological perspective. Due to the existing flatness of the grade surrounding the building, introducing swales a distance away from the building might be required to achieve the necessary slopes. Alternatively, gravel could be installed along the sides of the sill to promote drainage away from the sill. However, regrading is the preferred option from the perspective of longevity.
- Depending on the severity of the deterioration, scarf a new log end onto the existing, matching the existing in geometry and wood species. Alternatively, in order to maintain the historic materials for the extent of time possible, the corners can be observed periodically to determine whether worsening conditions may require localized replacement at a future date.
- Where surface deterioration exists on other logs, this is not considered a structural concern and veneer repairs can be performed. See the *Log Walls Recommendations* section in *Exterior Features* for considerations regarding veneer repairs.

## Exterior Features

### Masonry

#### Observations

- The Kelly House has a shallow mortared stone foundation. The foundation at the north, south, and east elevations is about one to two courses tall, while the east elevation has no visible foundation stone (*Fig. II-27*).

#### Recommendations

- Regularly monitor stone for new and worsening cracks.
- Reset any loose and dislodged stones and mortar back into place.
- Improve ventilation in the crawlspace by creating new vent openings as described in the *Structural Systems Recommendations* section. Install recessed grates or wire mesh to prevent vermin access at all vent openings.
- Perform mortar analysis on a sample of original mortar to determine formula for repairs. See the *Recommendations for Further Research* section on p. 94 for more information. The repointing mortar should have the same performance characteristics and coloration as the original mortar in order to prevent damage to the stone or an inconsistent appearance. Care should be taken to ensure that mortar joints maintain the original appearance of the masonry. Repointing that covers too much of the projecting stones will diminish the three-dimensionality of the stonework and will call unwanted attention to the mortar joints.
- Ensure that electric saws and grinders are not used to remove mortar from historic masonry. These tools are imprecise and pose a high risk of damage to historic material. Repointing should be performed by skilled masons with experience working with historic buildings. Appropriate methods of mortar removal include the use of hand tools or a combination of hand tools and small pneumatic chisels.



**Figure II-27.** Kelly House - Sill at east elevation, note proximity to grade.

- Clean biologic growth from surfaces, testing a wide range of cleaning methods and materials before use of a chosen cleaning system.
- Always test cleaning methods in a small, inconspicuous area to gauge effectiveness.
- Test cleaning methods by progressing from the gentlest solution, such as presoaking with warm water, to mild non-ionic detergents, and finally to more aggressive commercial cleaners as necessary to remove soiling or staining. All methods should be agitated with a soft, natural bristle brush to prevent damaging the surface of the material being cleaned.
- Clean masonry elements using the lowest level of abrasion and mildest cleaning solution possible while achieving the desired results.
- Ensure that pressure washing with water is performed at a low psi (garden hose level up to about 300-400psi) with a fan-tip nozzle and a minimum distance of 30 inches from nozzle tip to masonry surface.
- Prohibit use of high-pressure washing (in excess of 400 psi) to clean historic masonry. The pressure exerted on the surface by a pressure washer can result in damage or loss of material, and also exposes historic materials to large volumes of water.
- Blasting with hard material (sand, nutshells, glass beads, etc.) should never be considered as an option for cleaning or removing coatings from masonry.

**Relevant NPS Preservation Briefs:**

- Preservation Brief 1: *Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings*
- Preservation Brief 2: *Repointing Mortar Joints in Historic Masonry Buildings*
- Preservation Brief 6: *Dangers of Abrasive Cleaning*

## Log Walls

### Observations

The logs of the Kelly House are generally in good condition. See the *Wood Assessment Report* in *Appendix D*, Figures 23-32 for conditions that either should be considered for repair or may be historically significant. Wood species, structural grade, moisture contents, and resistance drilling results are also described in the *Wood Assessment Report*.

Results of the visual observations, probing, moisture content readings, and resistance drilling of the logs and framing members gleaned through the wood assessment that may require treatment are summarized as follows:

- Sill logs – the east sill log has small (1" to 1.5" voids) along the length of the log, the west sill has a 3" to 3.5" decay channel both north and south of the door (*Figs. II-28, II-29*).
- Wall logs – the 5$^{th}$ log from the bottom on the east wall, south of the door has surface deterioration, the 6$^{th}$ log from the bottom on the west wall has deterioration on the south end (*Fig. II-30*).
- Log crowns – generally in fair condition, some minor voids in the end grain.

Non-historic cementitious chinking is in fair to good condition with isolated areas of failure.



**Figure II-28.** Kelly House - Deterioration south of east doorway at sill.



**Figure II-29.** Kelly House - Deterioration north of east doorway at sill.



**Figure II-30.** Kelly House - Deterioration at 6th log from bottom on the west elevation.

### Recommendations

- Ensure that log repairs are performed by a skilled craftsperson with extensive experience in working with historic log structures. Low-quality repairs will be visually obvious and will be more prone to failure.
- If log repairs are determined to be desirable either for restoring lost structural integrity due to decay or insect damage, dutchman repairs can be used by removing and replacing the area of deteriorated wood. Minor surface deterioration on an exterior log can be repaired using a log veneer attached to the existing log once the deteriorated surface material is removed.
- The wall logs are a mix of white oak and southern pine species groups. The wood species used for any repairs or replacement of the logs should be white oak if a goal is to provide long-term durability. Southern pine could be considered as an alternative if initial cost is a higher priority than longevity. In addition to wood species, replacement logs should be of the same dimensions with similar growth characteristics (e.g., knot frequency, size, and spacing), moisture content (to avoid differential shrinkage and open joints), growth ring count (e.g. avoid using southern pine logs with less than six growth rings per inch when observing the end grain), and tool marks (to match historic appearance, if determined to be accurate). Dutchman repairs are preferable to full log replacement. When sourcing materials for repairs, consider specifying reclaimed material since it will be easier to match the characteristics of the existing material. Any replacement material should be less than 20% moisture content at the time of the repair to minimize differential shrinkage between replacement and existing material (to provide a tight joint) and reduce the likelihood of wood decay due to the high moisture content.
- Maintain vegetation around the house to improve the ability for the lower course of logs to remain dry.
- Do not fill log checks. A common concern is that checks should be filled to prevent moisture from entering the interior of the log, resulting in internal decay. Filling the checks with mortar, daubing, or a sealant will seldom keep moisture out in the long term and once moisture is in the wood, it is generally trapped. The checks should not be filled; they should be left open to allow for drying when the wood gets wet. Removing leaves and debris periodically (initially, annually) is sufficient maintenance for reducing the development of decay via the checks in the logs.
- Do not use wood fillers or consolidents to repair surface damage. Similar, to filling checks, these consolidents will hold moisture inside the log and ultimately result in the deterioration of the log around the repair. Instead, either use a veneer repair, as outlined previously, or tool the deteriorated area to effectively shed water. If performed by a skilled craftsman, the tooled area should be almost imperceptible.
- For extending the service life of the logs, borate rods can be inserted into the logs susceptible to moisture absorption to mitigate additional deterioration by wood decay fungi. Borate rods can be inserted into holes drilled into the log where deterioration has been identified. Borates are low-level toxicity preservatives that are used to improve the durability of both new and in-service wood products. Borates require moisture to migrate through the wood but can be leached from the wood with too much exposure to moisture; therefore, they will need to be inserted in the area of active deterioration, unless the deteriorated wood is replaced and the source of moisture is

eliminated. Borates also effectively control termites, carpenter ants, a variety of beetles, and other wood boring insects. Topical borate treatments (liquids) applied to the surface offer no protection to the more vulnerable interior of large timbers and are not recommended.

  - To install borate rods, holes are drilled into the areas where moisture is a concern (i.e., ground contact), the rods are inserted, and the holes are filled with either a pressure-treated wood plug or a plastic threaded plug. Borate rods are typically effective for three to ten years depending on environmental conditions, but they should be inspected on a 5-year cycle given the current and anticipated moisture exposure of most of the elements. The borates should be incorporated into a cyclic, long-term maintenance program.

- Replace any portions of failing or missing chinking in kind based on findings of recommended material analysis. See *Recommendations for Further Research* section on p.94 for more information.

**Relevant NPS Preservation Briefs:**

- Preservation Brief 29: *The Preservation and Repair of Historic Log Buildings*.

## Exterior Doors

### Observations

The Kelly House has two exterior doorways, one on each of the east and west elevations. Each doorway holds a modern metal gate that controls access and a modern board-and-batten door.

The board-and-batten inner doors are currently kept in an open position at all times, allowing park visitors to view the interior of the house through the metal gates. The open doors expose the wood thresholds, flooring, and by extension the floor framing and sill logs to increased moisture infiltration from rainfall (*Figs. II-31, II-32*). The door thresholds have little if any slope to drain water away from the end grain of the doors or to protect the sill log beneath.

The bases of the board-and-batten doors show signs of moisture damage due to water splashing from the threshold below (*Fig. II-31*). Some of this damage likely dates from when the doors were still regularly closed as part of day-to-day operations; however, the hinge side bottom corner of the doors show signs of being saturated on a regular basis in the open position.

All hardware associated with the board-and-batten doors is modern. The metal gates are also modern and have a powder coated finish. The gates are in good operating condition.

### Recommendations

- Repair broken or extensively deteriorated boards at exterior doorways in kind. Perform Dutchman repairs where deterioration affects only a small portion of the overall board. The faces of the doors appear to be made up of southern yellow pine. When the doors eventually require replacement, use of a more durable but still historically appropriate wood such as white oak should be considered.
- Replace the existing thresholds, which are not historic material, with versions that introduce adequate slope to shed water away from the doors. The threshold should extend far enough to the exterior to prevent shed water from dripping on to the sill log.
- Adjust park operation procedures to include closure of the board-and-batten



**Figure II-31.** Kelly House - Typical deterioration of board-and-batten doors.

doors after park hours and before and after major rain events. The existing metal gates would remain in place for security. See *Recommendations for Ultimate Use* section for discussion of potential interior use.

- When repairs to exterior casings become necessary, replace existing plank-board casings in kind.
- Regularly maintain hardware at board-and-batten doors and gates, applying lubricants, replenishing paint finishes as appropriate, and making repairs to extend the life of the hardware.
- Implement regular monitoring of doorways and lubrication of hardware at intervals indicated in the *Monitoring Checklist* found on p.109.

## Exterior Steps

### Observations

The mortared stone steps accessing the house's west doorway are modern, likely installed sometime in the latter half of the twentieth century.

The steps are in overall good condition; however, mortar joints have typically failed.

### Recommendations

- Repoint the steps in accordance with the recommendations outlined in the preceding *Masonry Recommendations* section on p.85.
- Regularly monitor stone for new and worsening cracks.
- If necessary, adjust the pitch of the stone treads when repointing to ensure that water sheds away from the building.



**Figure II-32.** Kelly House - West steps and threshold.

## Roofing and Roof Drainage

### Observations

The current cedar shingle roof is thought to have been installed in 2012 and appears to be in good condition.

### Recommendations

- Monitor roofing for missing or displaced shingles and leaks.
- Implement regular inspection roofing at intervals indicated in the *Monitoring Checklist* found on p.109.

### Relevant NPS Preservation Briefs

- Preservation Brief 4: *Roofing for Historic Buildings*
- Preservation Brief 39: *Controlling Unwanted Moisture in Historic Buildings*

## Chimney

### Observations

The exterior, wood log portion of the chimney is exhibiting severe deterioration. The east side of the chimney is collapsing, most severely at the shoulder (*Fig. II-33*).

The base logs of the exterior portion of the chimney bear directly on the ground without a stone foundation below (*Fig. II-34*).

The stone chimney at the interior has some voids visible in the lower portion. The hearth has some loose stones.

### Recommendations

- Support the chimney stack and disassemble the shoulder portion of the chimney.



**Figure II-33.** Kelly House - Hewn log chimney at shoulder transition. Note masonry chimney mass inside of hewn log chimney exterior.



**Figure II-34.** Kelly House - Overview of chimney showing deterioration and base logs directly on grade.

Reconstruct the collapsed chimney shoulder in accordance with log replacement recommendations outlined in the *Log Walls Recommendations* section. Ensure that the replacement logs match the existing in size and characteristics. Replace deteriorated logs with white oak logs of similar visual characteristics as the logs they are replacing. Replicate the corner joinery used at the current chimney shoulder. New material should be integrated into the existing structure in such a way that the existing material is not compromised. This may require additional tooling at the existing fabric to ensure sound connections.

- Ensure that all log repair is performed by an experienced craftsman familiar with working on historic log structures.
- If the lower log portion is to be rebuilt, we recommend considering adding a stone foundation below the base logs.
- When the exterior log portion is dismantled, any voids or open joints in the stone portion of the chimney should be repointed. Follow the considerations outlined in the Exterior Masonry Section. Similarly, reset any loose hearth stones on the interior.
- See the *Animals, Vermin, and Pests Recommendations* section on p.93 for guidance regarding potential bat activity.

## Interior Features

### Flooring

#### Observations

The wood flooring throughout the interior is thought to be modern. Overall, the flooring is in good condition, with some localized minor deterioration and weathering at the exterior doorways.

The exterior doors being open at all times allows water to sit at these locations and has ultimately led to deterioration.

#### Recommendations

- Retain existing flooring; replacing deteriorated boards in kind. See the *Structural Recommendations* section regarding potential need to remove the flooring to perform floor framing and crawlspace repairs.
- See the *Exterior Doors* and *Recommendations for Ultimate Use Recommendations* Sections for ways of minimizing damage to flooring at the exterior doorways.

### Interior Trim

#### Observations

The house has few interior trim elements. The inner face of the west exterior door jamb is exposed to the interior. The east doorway has a simple modern plank board casing. Boards applied at the interior of the log walls are addressed in the *Walls and Ceiling Recommendations* section.

#### Recommendations

- Retain existing interior trim elements. If elements become damaged or deteriorated, replace in kind.

### Walls and Ceilings

#### Observations

The log exterior wall construction is exposed throughout the interior. The roof framing is exposed at the ceiling.

Boards of varying widths are installed at the gaps between the log courses.

#### Recommendations

- Retain applied boards at the interior walls. If log repairs necessitate removal of the boards, complete the work in sections and label the boards for reinstallation in the same locations.
- Implement regular monitoring of walls and ceilings for water infiltration at intervals indicated in the *Monitoring Checklist* found on p.109.

### Fireplace

#### Observations

- A stone firebox and hearth are on the north wall. The stone appears to be in good condition, but has a few voids and loose stones at the hearth (*Fig. II-35*). The fireplace has no mantel.

#### Recommendations

- Monitor masonry for new or worsening cracks and plan for repairs accordingly. Reset loose stones and repoint. See the *Masonry Recommendations* section.

### Fire Protection and Security

#### Observations

The house does not have any form of fire protection or security systems. The interior is not regularly occupied and the doorways are secured with locked metal gates.

The house does not have power or water service to support an alarm or fire suppression system and there are no plans to add these systems.



**Figure II-35.** Kelly House - Loose stones at hearth.

#### Recommendations

- If the house is opened to the public on a more regular basis, consider including a fire extinguisher on the interior.
- Maintain locking gates on the exterior doors after park hours and anytime the building is not open to the public.

### Building and Site as Artifacts

#### Observations

It is important to think of the building and its surroundings as having archaeological value. Evidence of the creation and evolution of this place is embodied in the building and site features, and sometimes hidden below the ground's surface.

#### Recommendations

- Strive to protect evidence of the evolution of the building as part of future work campaigns.
- As part of any project requiring ground disturbances, have an archaeologist on call to review any potential findings.

## Operations and Maintenance Program

The park currently does not have formal procedures established for conserving the historic building materials.

#### Recommendations

- Initiate an Operations and Maintenance (O&M) program focused on this building, specifically to:
  - Develop a protocol of best practices for maintenance, including lists of proven products, materials, and methods.
  - Also develop a list of products, materials, and methods that should NOT be used.
  - Avoid the use of new construction products and materials until the specific application has been sufficiently tested and approved by the appropriate NPS management unit.

## Monitoring Checklist

Use of a Condition Monitoring Checklist outlining inspection topics and the date of inspection helps both to formalize the monitoring process and to create a record for future reference.

A checklist tailored specifically to the needs of the Snodgrass, Kelly, and Brotherton Houses, each of which faces similar maintenance challenges, was prepared for this HSR and can be found on p.109.

### Recommendations

- Adopt the recommended inspection schedule included in the Checklist or substitute a more suitable one.
- Adjust the list of inspections as appropriate. Integrate the monitoring schedule into park activities.
- Retain the Checklists for tracking needs and scheduling remedial actions.

## Accessibility and Universal Design

### Observations

The west doorway is accessed by stone steps, while the east doorway is accessed from grade (*Fig. II-36*). Currently, the house is not open to the public. Park visitors can instead view the interior through the metal gates at grade.

The lowest threshold at the Kelly House is on the east elevation, which lies about 11" above grade level. A ramp designed in accordance with ABA/ADA standards would require a run of approximately 11'-0" to reach this level. A ramp of this size would become a major feature of the landscape and building and would greatly detract from the historic character of the site.



**Figure II-36.** Kelly House - Overview of east doorway.

### Recommendations

- If the interior of the house remains closed to the public, the park may choose to take no action. If the interior is opened to the public, the park may consider Options 1 or 2.
- Option 1: Consider improving the ability for someone in a wheelchair to view the interior of the house from an exterior vantage point. The east doorway has no stair, which allows someone in a wheelchair to directly approach the doorway for views inside.
    - Because the house is a single room, the vast majority of the interior can be seen from a single vantage point. Ensure that interior interpretation design is cognizant of what is and isn't visible from the accessible doorway.
- Option 2: Consider construction of a ramp approaching the east doorway.
    - Consider the archaeological implications of Option 2 and weigh them against the value of providing universal access to the interior. The ramp will have a major visual impact on the site and will impact the proportions of the building.

## Resilience to Natural Hazards

### Climate

#### Observations

Average temperatures and precipitation at CHCH are increasing and are projected to continue to increase. Storm frequency and intensity is also projected to increase. These changes will have major impacts on frequency of maintenance required for buildings. Storm preparation and adequate drainage to handle increased rainfall will also be critical.

A number of studies have been prepared by NPS on a park-by-park basis that address changing climatic conditions and interpret historic climate data. Studies include "Recent Climate Change Exposure of Chickamauga and Chattanooga National Military Park" (Monahan & Fisichelli, 2014) and "Chickamauga and Chattanooga

National Military Park: How Might Future Warming Alter Visitation?" (Fisichelli & Ziesler, 2015). Both documents are available on NPS.gov.

#### Recommendations

- Consider the potential effects of climate change issues on the building and its immediate site, such as increased storm threats, changes in average temperature and rainfall totals, and associated loss or degradation of resources.
- Monitor weather-related deterioration and evaluate needed responses to protect the building and its immediate site in coordination with overall assessment of climate change effects on the park overall.
- Complete site drainage recommendations advocated by this HSR.
- Complete roof framing modifications advocated by this HSR to protect against wind uplift.
- Use studies regarding adaptation to natural hazards to inform management decisions. Current studies that address the park include those cited above.
- Assume increased visitation will take place in the coming years and adjust maintenance schedules appropriately.
- Consult regularly with the NPS Interior Region 2 Climate Change, Socioeconomics, and Adaptation Coordinator to inform management policies. Coordinate with planning and documentation projects being implemented by the NPS Region.
- Evaluate building maintenance schedules as necessary to account for the possibility of more frequent exterior painting/ finishing campaigns, roof repairs, and roof and site drainage repairs in response to increased and more intense projected precipitation. The Condition Monitoring Checklist found on page 109 of this report helps guide cyclical maintenance and frequent monitoring of conditions, and creates a record.
- Update emergency and disaster planning to address resiliency to natural hazards and mitigation of the effects of hazardous events.

## Animals, Vermin, and Pests

#### Observations

No obvious evidence of active vermin or pest activity were noted during the assessments for this report; however, ongoing monitoring for activity is important to the wellbeing of the building and park visitors.

The house is known to commonly host roosting bats.

#### Recommendations

- Regularly inspect the house for termite activity, including the presence of mud tunnels. Installation and regular replenishment of termite bait stations should be considered.
- Remove any insect nests that may appear on the building exterior. Monitor the building regularly for insect activity.
- Be vigilant to prevent habitation of vermin such as mice, rats, or snakes on the interior of the building.
- A bat survey should be performed by a wildlife biologist or other qualified personnel prior to start of work if work occurs in the spring or summer months (March 31- October 15). Bat activity during the fall and winter months is reduced and may be considered when scheduling repairs. Ideally, bat roosting inside the house should be discouraged and operations recommendations including the regular closure of doors may reduce this activity.

# Recommendations for Ultimate Use

The Kelly House is currently interpreted by wayside signage near the building. The interior is not open to the public and is not interpreted. The current floor framing conditions make public access problematic, and park operations currently do not include controlling access to the house.

Following the implementation of floor framing repairs, it is the recommendation of this report that the house be opened to the public on a daily or semi-regular basis. A more comprehensive story of the house and its site could be told using interpretive panels on the interior. Basic

furnishings to further enhance interpretation could be considered depending on when the building is open and to what extent visitor monitoring is feasible. For instance, the house may be fully open for a few hours each day, after which the gates would be secured. The inner board-and-batten doors would be opened and closed ideally nightly, but at minimum before and after major rainfall or weather events.

# Recommendations for Further Research

## Material Analyses

Complete mortar analysis prior to any repointing campaign to determine color and composition of existing mortar. Matching the original mortar coloration is critical to avoiding a "patchwork" appearance when spot repointing.

Perform material analysis on cementitious chinking to determine a compatible formula for repairs.

Hazardous materials testing should be performed on mortar prior to repointing. See the *Hazardous Materials Testing Recommendations* for more information.

## Hazardous Materials Testing

### Observations

Work was performed at the house in a time period when asbestos and toxic wood preservatives were commonly used. Asbestos, considered a miracle product for decades, was used as an additive to provide fireproof qualities and additional strength to a wide variety of building materials through the late 1970s. Examples of building materials relevant to the house that commonly containing asbestos or hazardous materials include, but are not limited to:

- Plaster and Stucco, including cementitious chinking/daubing
- Mortar
- Preservatives applied to logs and other members

No known examples of painted surfaces that may contain lead were observed. If painted surfaces are encountered, test them before disturbing coatings.

If left undisturbed, lead-based paint and asbestos-containing materials pose no threat to building occupants. However, appropriate abatement measures should precede any future work on building elements suspected to contain hazardous materials.

### Recommendations

- Perform appropriate abatement measures for hazardous materials prior to future work that could disturb suspected hazardous materials.

# Brotherton House Recommendations

*The actions recommended below are organized by feature and are intended to provide a conceptual framework for achieving the recommended ultimate treatment and use. They do not and are not intended to provide the detailed guidance of architectural/engineering plans and specifications.*

## Site and Site Drainage

### Observations

The immediate Brotherton House site is essentially flat, but gradually drops off to the northeast (*Fig. II-37*).

Despite the flatness of the site, there did not appear to be indication that water collects at the base of the structure.

### Recommendations

- Monitor site following major rainfall events in order to identify site drainage issues and plan interventions accordingly. The introduction of drainage swales may be a good solution for directing site drainage with little if any visual impact when sensitively designed. Any site work of this nature should be overseen by an archaeologist.
- Implement regular monitoring of site drainage at intervals indicated in the *Monitoring Checklist* found on p.109.

### Relevant NPS Preservation Briefs

- Preservation Brief 36: *Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes*



**Figure II-37.** Brotherton House - Overview of site from southeast.

## Structural System

***See the Structural Investigation Report prepared by 1200AE located in Appendix C for more information regarding the structural system.***

### Foundations and Crawlspace

#### *Observations*

The stone foundation at the perimeter of the house had limited areas of missing and/or loose stone, creating discontinuities in the support for the log walls and allowing animals to enter the crawl space (*Figs. II-38, II-39*).

At the north end of the east wall foundation, an opening in the stone foundation with a metal grate was observed (*Fig. II-40*). This grate was presumably placed there to encourage air flow in the crawl space. One additional opening of a similar size was observed at the north wall; however, no metal grate was present (*Fig. II-39*). The foundation walls likely require additional vents to provide increased air movement and decrease the humidity in the crawl space. While adding



**Figure II-38.** Brotherton House - Loose stones at south wall foundation.



**Figure II-39.** Brotherton House - Stone foundation at north façade, east side. Note opening in stone foundation.

vents would change the exterior appearance of the house, it would improve the condition and longevity of the floor framing. The existence of the two observed grates serves as precedent.

No test pits were dug at the foundations of the main portion of the house; therefore, it is unknown how far the foundations extend below grade. Frost depth in this region of Georgia is 10 inches. It is unclear whether the existing stone foundations extend to frost depth as no test pits were performed at Brotherton House. There are no signs of distress or uneven settlement of the building due to foundation issues, so modifications to the foundations are likely not warranted.

At the southwest corner, the top of the stone foundation is flush with grade, so the sill log is in contact with the ground. See the *Exterior Log Walls Recommendations* section.

Based on limited access at the floor probe, the observed log floor joists were partially in contact with the ground. This creates conditions that favor deterioration of the wood floor framing, which were noted to have a high moisture content in several areas where tested on site.

*Recommendations*

- Perform masonry repairs outlined in the *Masonry Recommendations* section on p.99.
- If found to be necessary after further investigation (see *Floor Framing Recommendations* section) remove soil beneath floor joists to prevent the underside of the joists from making contact with grade. This can be done locally, creating valleys below the joists themselves, or can be done over the entire area of the crawlspace, provided that the stone foundations are not undermined. Any soil removal should be performed in concert with Archaeology. While removing soil over the entire area would be preferable in terms of improving the airflow, localized soil removal can be considered if reducing the amount of excavation and archaeology is preferable to the NPS.
- Improve ventilation of the crawlspace by creating new openings in the foundation wall. Increased air circulation would improve the condition and longevity of the floor framing. Omit select stones to provide greater airflow while maintaining the existing stone coursing. Maintain the existing openings while adding an opening to the east elevation, two openings on the west elevation, and one opening on the south elevation. Alternatively, multiple smaller openings may be visually preferable to fewer large ones. A large opening may be about 1'-0" wide by 6" tall, representing the size of one of the larger foundation stones. Install hardware cloth on the inside of the crawlspace openings during the proposed floor framing repair work to deter vermin. Install the mesh to the mortar joints of the inside face of the foundation wall using stainless steel fasteners and washers.

### First Floor Framing

*Observations*

The existing first floor log joists at Brotherton House, where they could be measured, were found



**Figure II-40.** Brotherton House - Stone foundation at east façade, north end. Note opening with metal grate.



**Figure II-41.** Floor log joist at east bearing end. Note joist is notched and stops short of wall. Note also contact with ground and related deterioration.

to have sufficient structural capacity for residential use or limited visitation with small groups. For logs in good condition, no reinforcement is considered to be required unless a different use for the structure with higher loading requirements is considered. The existing joists were noted to have stones or bricks propping up the joists at intermediate locations. This could be done in a more consistent manner to increase load capacity.

The condition of the floor joists could not be determined fully due to limited access. One joist observed at the probe location was severely deteriorated due to contact with the ground. The bearing ends of the joists at the probe were no longer supported at the wall (*Fig. II-41*). They had been cut, presumably due to deterioration. Areas where joists may be in contact with the ground and end bearing conditions are typically the most vulnerable to deterioration.

Two of the joists observed still had bark attached and remnants of removed branches. The presence of bark invites insect damage and has likely hastened the deterioration of the joists (*Fig. II-42*).

*Recommendations*

- Remove flooring so that all joists can be examined across the entirety of their length. Number and retain the floorboards for reinstallation.
- If a use with a higher load requirement is desired, joists can be sistered or an intermediate support below the joists can be provided to increase its load capacity.
- Where logs are found to be severely deteriorated after further examination, depending on the area of deterioration, repairs can be made by scarfing in portions of joists to match the existing in wood species, grade and size. Joists vary between white oak and southern yellow pine (see *Wood Assessment Report* in *Appendix D*). Alternatively, joists can be sistered with new members.
- Reestablish connections where logs are deteriorated at their bearing ends, or where the ends of the joists do not reach the perimeter walls. The end connection is critical both for bearing of the joists themselves and for bracing the base of the exterior walls. Joist ends should be observed fully once floorboards are removed to identify and document each connection type.
- Joist ends should be extended to bear on the stone foundation projection or pocket into the exterior log and create a positive connection. This can be done by sistering or scarfing on joist extensions.
- If the deterioration of a particular log is so severe that it cannot be salvaged, it should be replaced in kind with a member of the same wood species, grade and diameter and with



**Figure II-42.** Brotherton House - Floor log joist at floor probe, looking west. Note deterioration and remnants of bark and branches.



**Figure II-43.** Brotherton House - Interior staircase. Note vertical member at right.

similar end/bearing detailing as the existing.

- Remove bark and branch remnants from joists.

### Second Floor Framing and Stair

*Observations*

The south (upper) end of the stair stringers was not connected well to the edge joist and is currently propped up with a vertically oriented plank, which bears on the first-floor floorboards (*Fig. II-43*).

Structural analysis of the typical second-floor joists indicates that they have a low live load capacity, on the order of 15 to 20 pounds per square foot (psf). However, the framing members around the stair opening are even less substantial and have a lower live load capacity; the header and trimmers are inadequate both in their size and in the connection of the header to the trimmers. Some longitudinal cracking in the second-floor joists was visible, which may be a physical manifestation of overstress.

*Recommendations*

- Reinforce the end connection of the stair, providing a positive connection between the stair stringer and the end joist.
- Reinforce the framing around the stair opening and the connection of the header to the trimmers. This can be done by sistering the existing members. Access to the upper level should be limited to maintenance unless additional reinforcement of the second-floor joists is performed.

### Roof Framing

*Observations*

The roof framing and tie beams were typically found to be in good condition and do not require reinforcement or repair (*Fig. II-44*)



**Figure II-44.** Brotherton House - Overview of roof framing.

*Recommendations*

- When the roofing is next replaced, the park may consider improving the connections between the rafter ends and the top logs. Alternatively, tie-downs could be installed at the interior. These measures will help the roof structure to resist uplift.
- See the *Animals, Vermin, and Pests Recommendations* section on p.107 for guidance regarding potential bat activity.

### Exterior Log Walls

*Observations*

The exterior log walls were found to be in fair condition, with the following exceptions:

The sill logs (east and west façade base logs) are fully above grade, although the southern end of the west sill log meets grade and is showing slight signs of deterioration from extended exposure to moisture (*Fig. II-45*). The east sill log shows some signs of deterioration (*Figs. II-46, II-47*). The contact of the timber sill log with the ground could



**Figure II-45.** Brotherton House - South end of west sill.



**Figure II-46.** Brotherton House - South end of east sill.

result in long-term deterioration of the log due to continued exposure to moisture.

*Recommendations*

- Locally lower the exterior grade and slope the grade away from the sill if this is acceptable from an archaeological perspective. Alternatively, gravel could be installed along the sides of the sill to promote drainage away from the sill. However, regrading is the preferred option from the perspective of longevity. The deteriorated logs themselves do not appear to warrant replacement or repair at this point in time; however, they should be observed periodically for signs of increased deterioration. Future repairs, if warranted, may consist of localized dutchmen using wood to match the existing in species and grade. See the *Log Walls Recommendations* section in *Exterior Features* for considerations regarding dutchman and veneer repairs.

## Exterior Features

### Masonry

#### Observations

- The Brotherton House has a shallow mortared stone foundation. With the exception of the north elevation, the foundation only extends one to two courses above grade.

#### Recommendations

- Regularly monitor stone for new and worsening cracks.
- Reset any loose and dislodged stones and mortar back into place.



**Figure II-47.** Brotherton House - North end of east sill.

- Improve ventilation in the crawlspace by creating new vent openings as described in the *Structural System Recommendations* section. Install recessed grates or wire mesh to prevent vermin access at all vent openings.
- Perform mortar analysis on a sample of original mortar to determine formula for repairs. See the *Recommendations for Further Research* section on p.103 for more information. The repointing mortar should have the same performance characteristics and coloration as the original mortar in order to prevent damage to the stone or an inconsistent appearance. Care should be taken to ensure that mortar joints maintain the original appearance of the masonry. Repointing that covers too much of the projecting stones will diminish the three-dimensionality of the stonework and will call unwanted attention to the mortar joints.
- Ensure that electric saws and grinders are not used to remove mortar from historic masonry. These tools are imprecise and pose a high risk of damage to historic material. Repointing should be performed by skilled masons with experience working with historic buildings. Appropriate methods of mortar removal include the use of hand tools or a combination of hand tools and small pneumatic chisels.
- Clean biologic growth from surfaces, testing a wide range of cleaning methods and materials before use of a chosen cleaning system.
- Always test cleaning methods in a small, inconspicuous area to gauge effectiveness.
- Test cleaning methods by progressing from the gentlest solution, such as presoaking with warm water, to mild non-ionic detergents, and finally to more aggressive commercial cleaners as necessary to remove soiling or staining. All methods should be agitated with a soft, natural bristle brush to prevent damaging the surface of the material being cleaned.
- Clean masonry elements using the lowest level of abrasion and mildest cleaning solution possible while achieving the desired results.
- Ensure that pressure washing with water is performed at a low psi (garden hose level up

to about 300-400psi) with a fan-tip nozzle and a minimum distance of 30 inches from nozzle tip to masonry surface.

- Prohibit use of high-pressure washing (in excess of 400 psi) to clean historic masonry. The pressure exerted on the surface by a pressure washer can result in damage or loss of material, and also exposes historic materials to large volumes of water.
- Blasting with hard material (sand, nutshells, glass beads, etc.) should never be considered as an option for cleaning or removing coatings from masonry.

**Relevant NPS Preservation Briefs:**

- Preservation Brief 1: *Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings*
- Preservation Brief 2: *Repointing Mortar Joints in Historic Masonry Buildings*
- Preservation Brief 6: *Dangers of Abrasive Cleaning*

## Log Walls

### Observations

The logs of the Brotherton House are generally in good condition. See the *Wood Assessment Report* in *Appendix D*, Figures 33-44 for conditions that either should be considered for repair or may be historically significant. Wood species, structural grade, moisture contents, and resistance drilling results are also described in the *Wood Assessment Report*.

Results of the visual observations, probing, moisture content readings, and resistance drilling of the logs and framing members gleaned through the wood assessment that may require treatment are summarized as follows:

- Sill logs – the east wall log has significant decay at all locations drilled (*Figs. II-46, II-47)*.
- The west sill log shows slight surface deterioration (*II-45*).
- Wall logs – the 6$^{th}$ wall log on the south elevation showed minor surface deterioration (*Fig. II-48*).
- Log crowns – generally in fair condition.

Non-historic cementitious chinking is in fair to good condition with isolated areas of failure.



**Figure II-48.** Brotherton House - Surface deterioration on south elevation.

### Recommendations

- Ensure that log repairs are performed by a skilled craftsperson with extensive experience in working with historic log structures. Low-quality repairs will be visually obvious and will be more prone to failure.
- If log repairs are determined to be desirable either for restoring lost structural integrity due to decay or insect damage, dutchman repairs can be used by removing and replacing the area of deteriorated wood. Minor surface deterioration on an exterior log can be repaired using a log veneer attached to the existing log once the deteriorated surface material is removed.
- The wall logs are a mix of white oak and southern pine species groups. The wood species used for any repairs or replacement of the logs should be white oak if a goal is to provide long-term durability. Southern pine could be considered as an alternative if initial cost is a higher priority than longevity. In addition to wood species, replacement logs should be of the same dimensions with similar growth characteristics (e.g., knot frequency, size, and spacing), moisture content (to avoid differential shrinkage and open joints), growth ring count (e.g. avoid using southern pine logs with less than six growth rings per inch when observing the end grain), and tool marks (to match historic appearance, if determined to be accurate). Dutchman repairs are preferable to full log replacement. When sourcing materials for repairs, consider specifying reclaimed

material since it will be easier to match the characteristics of the existing material. Any replacement material should be less than 20% moisture content at the time of the repair to minimize differential shrinkage between replacement and existing material (to provide a tight joint) and reduce the likelihood of wood decay due to the high moisture content.

- Maintain vegetation around the house to improve the ability for the lower course of logs to remain dry.
- Do not fill log checks. A common concern is that checks should be filled to prevent moisture from entering the interior of the log, resulting in internal decay. Filling the checks with mortar, daubing, or a sealant will seldom keep moisture out in the long term and once moisture is in the wood, it is generally trapped. The checks should not be filled; they should be left open to allow for drying when the wood gets wet. Removing leaves and debris periodically (initially, annually) is sufficient maintenance for reducing the development of decay via the checks in the logs.
- Do not use wood fillers or consolidents to repair surface damage. Similar, to filling checks, these consolidents will hold moisture inside the log and ultimately result in the deterioration of the log around the repair. Instead, either use a veneer repair, as outlined previously, or tool the deteriorated area to effectively shed water. If performed by a skilled craftsman, the tooled area should be almost imperceptible.
- For extending the service life of the logs, borate rods can be inserted into the logs susceptible to moisture absorption to mitigate additional deterioration by wood decay fungi. Borate rods can be inserted into holes drilled into the log where deterioration has been identified. Borates are low-level toxicity preservatives that are used to improve the durability of both new and in-service wood products. Borates require moisture to migrate through the wood but can be leached from the wood with too much exposure to moisture; therefore, they will need to be inserted in the area of active deterioration, unless the deteriorated wood is replaced and the source of moisture is eliminated. Borates also effectively control termites, carpenter ants, a variety of beetles, and other wood boring insects. Topical borate treatments (liquids) applied to the surface offer no protection to the more vulnerable interior of large timbers and are not recommended.
    - To install borate rods, holes are drilled into the areas where moisture is a concern (i.e., ground contact), the rods are inserted, and the holes are filled with either a pressure-treated wood plug or a plastic threaded plug. Borate rods are typically effective for three to ten years depending on environmental conditions, but they should be inspected on a 5-year cycle given the current and anticipated moisture exposure of most of the elements. The borates should be incorporated into a cyclic, long-term maintenance program.
- Replace any portions of failing or missing chinking in kind based on findings of recommended material analysis. See *Recommendations for Further Research* section on p. 108 for more information.

**Relevant NPS Preservation Briefs:**

- Preservation Brief 29: *The Preservation and Repair of Historic Log Buildings*.



**Figure II-49.** Brotherton House - Typical deterioration of board-and-batten doors.

## Exterior Doors

### Observations

The Brotherton House has two exterior doorways, one on each of the east and west elevations. Each doorway holds a modern metal gate that controls access and a modern board-and-batten door.

The board-and-batten inner doors are currently kept in an open position at all times, allowing park visitors to view the interior of the house through the metal gates. The open doors expose the wood thresholds, flooring, and by extension the floor framing and sill logs to increased moisture infiltration from rainfall. The door thresholds have little if any slope to drain water away from the end grain of the doors or to protect the sill log beneath (*Fig. II-50*).



**Figure II-50.** Brotherton House - Threshold at east doorway and east exterior steps.

The bases of the board-and-batten doors show signs of moisture damage due to water splashing from the threshold below (*Fig. II-49*). Some of this damage likely dates from when the doors were still regularly closed as part of day-to-day operations; however, the hinge side bottom corner of the doors show signs of being saturated on a regular basis in the open position.

All hardware associated with the board-and-batten doors is modern. The metal gates are also modern and have a powder coated finish. The gates are in good operating condition.

### Recommendations

- Repair broken or extensively deteriorated boards at exterior doorways in kind. Perform Dutchman repairs where deterioration affects only a small portion of the overall board. The faces of the doors appear to be made up of southern yellow pine. When the doors eventually require replacement, use of a more durable but still historically appropriate wood such as white oak should be considered.
- Replace the existing thresholds, which are not historic material, with versions that introduce adequate slope to shed water away from the doors. The threshold should extend far enough to the exterior to prevent shed water from dripping on to the sill log.
- Adjust park operation procedures to include closure of the board-and-batten doors after park hours and before and after major rain events. The existing metal gates would remain in place for security. See *Recommendations for Ultimate Use* section for discussion of potential interior use.
- When repairs to exterior casings become necessary, replace existing plank-board casings in kind.
- Regularly maintain hardware at board-and-batten doors and gates, applying lubricants, replenishing paint finishes as appropriate, and making repairs to extend the life of the hardware.
- Implement regular monitoring of doorways and lubrication of hardware at intervals indicated in the *Monitoring Checklist* found on p.109.

## Exterior Steps

### Observations

The mortared stone steps accessing the house's two doorways are each modern, installed sometime in the latter half of the twentieth century.

The steps are in overall good condition; however, mortar joints have typically failed at the east steps (*Fig. II-50*). The west step is a single stone.

### Recommendations

- Repoint the east steps in accordance with the recommendations outlined in the preceding *Masonry Recommendations* section on p.99.
- Regularly monitor stone for new and worsening cracks.
- If necessary, adjust the pitch of the stone treads when repointing to ensure that water sheds away from the building.

## Roofing and Roof Drainage

### Observations

The current cedar shingle roof is thought to have been installed in 2012 and appears to be in good condition.

### Recommendations

- Monitor roofing for missing or displaced shingles and leaks.
- Implement regular inspection roofing at intervals indicated in the *Monitoring Checklist* found on p.109.

### Relevant NPS Preservation Briefs

- Preservation Brief 4: *Roofing for Historic Buildings*
- Preservation Brief 39: *Controlling Unwanted Moisture in Historic Buildings*

## Chimney

### Observations

The Brotherton House has a stone masonry chimney centered on the north elevation. The chimney has large cracks and open joints along the full height of the chimney and outward displacement at the corner (*Figs. II-51, II-52, II-53)*. This is likely due to a combination of factors:

The shallow stone arch at the fireplace opening creates a large horizontal thrust that cannot be resisted by the small jambs at either side of the opening (*Fig. II-54*). This has caused the chimney to "unzip" along the center all the way up the chimney. It is likely that the helical tie that was installed was intended to resist some of this thrust, but considering that the end of the tie is sitting in an open joint, it is clearly no longer functioning.

Long-term exposure to the elements has cause the mortar to deteriorate. This has contributed to the chimney's inability to resist the forces on the chimney. As cracks form, more water is able to get in and the mortar deteriorates further.

The test pit at the corner showed that the stone only extended about 6" below grade. Frost depth for this part of the state is between 10" but closer to 10". Inadequate foundation depth is not likely the primary cause of the problems but can certainly contribute.

Fort Oglethorpe is in a seismically active area. Similar to the frost depth, it appears unlikely that this is the primary reason for the masonry distress, but a masonry element with open joints and cracks



**Figure II-51.** Brotherton House - Cracking at north face of chimney.



**Figure II-52.** Brotherton House - Cracking at north side of stone chimney.



**Figure II-53.** Brotherton House - Cracking at east side of stone chimney.

is less able to resist lateral (wind or seismic) loads and cracks could open up further in a seismic or high wind event.

Due to the low slope of the grade around the chimney, it is possible that water may collect adjacent to the chimney foundation during a rain storm. This could reduce the capacity of the soils below the foundation.

**Recommendations**
Two options are identified for chimney repairs:

- Option 1: Repair / reinforce the chimney in place.
  - Underpin chimney to lower foundations to or below frost depth.
  - Reinforce the stone arch to minimize the effects of the horizontal thrust by installing a curved, stainless or galvanized steel angle lintel set back so that it is not visible from the interior.
  - Install stainless steel joint reinforcement in a u-shape (3 exterior sides) for the full height of chimney.
  - Deeply repoint all masonry from the exterior and fill all voids with masonry or mortar.
- Option 1 is the preferred option from a historic preservation perspective, and the National Park Service has indicated its preference for this option based on the historic preservation considerations. However, it should be noted that it is the less preferred option from a structural engineering perspective. This option would not allow the interior face of the chimney masonry or the portion of the chimney that is against the building to be repaired or repointed, so it will potentially not address all cracks and voids.
- Option 2: Rebuild chimney in kind.
  - Fully document existing chimney construction and then deconstruct chimney.
  - Pour a concrete mat foundation down to frost.
  - Rebuild chimney using salvaged stone to match existing.
  - Rebuilt chimney should include reinforcement of the stone arch to minimize the effects of the horizontal thrust. This could consist of installing a curved, stainless or galvanized steel angle lintel set back so that it is not visible from the interior. Alternatively, stainless steel joint reinforcement in the form of tension ties could be installed in the masonry joints above the arch to resist the thrust.
  - Install stainless steel joint reinforcement in a u-shape (3 exterior sides) at the portions of the chimney below the arch /lintel.
- While Option 2 is the more aggressive of the two options, it would provide the most structurally sound solution and the best long-term durability.
- Depending on the timeframe for chimney repairs, it may be prudent to monitor the cracks to confirm and measure any continued movement. While it does appear that previously repointed cracks have



**Figure II-54.** Brotherton House - View of fireplace and hearth. Note stone arch above fireplace opening.

continued to widen, it is not known when these cracks were repointed and whether the movement is still on-going. This movement can be measured by installing crack-gauges and documenting the measurements at regular intervals through digital photography. Monthly monitoring of the gauges would be appropriate.

- In addition, the area surrounding the chimney should be monitored following major rainfall events in order to identify any site drainage issues and plan interventions accordingly. If this is found to be an issue, the site should be regraded locally to slope away from the building. This should be done in concert with archaeology.
- See the *Animals, Vermin, and Pests Recommendations* section on p.107 for guidance regarding potential bat activity.

## Interior Features

### Flooring

#### Observations

The wood flooring throughout the interior is thought to be modern. Overall, the flooring is in good condition, with some localized minor deterioration and weathering at the exterior doorways.

The exterior doors being open at all times allows water to sit at these locations and has ultimately led to deterioration.

#### Recommendations

- Retain existing flooring; replacing deteriorated boards in kind. See the *Structural Recommendations* section regarding potential need to remove the flooring to perform floor framing and crawlspace repairs.
- See the *Exterior Doors* and *Recommendations for Ultimate Use Recommendations* Sections for ways of minimizing damage to flooring at the exterior doorways.

### Interior Trim

#### Observations

The house does not have any interior trim elements. Boards applied at the interior of the log walls are addressed in the *Walls and Ceiling Recommendations* section.

### Walls and Ceilings

#### Observations

The log exterior wall construction is exposed throughout the interior. The roof framing is exposed at the ceiling.

Boards of varying widths are installed at the gaps between the log courses.

#### Recommendations

- Retain applied boards at the interior walls. If log repairs necessitate removal of the boards, complete the work in sections and label the boards for reinstallation in the same locations.
- Implement regular monitoring of walls and ceilings for water infiltration at intervals indicated in the *Monitoring Checklist* found on p.109.

### Fireplace

#### Observations

- A stone firebox and hearth are on the north wall (*Fig. II-54*). The stone appears to be in good condition. The fireplace has simple modern plank board mantel with shelf.
- The firebox has a very shallow arch that is not well supported and is contributing to cracking issues on the main body of the chimney. See the *Chimney Recommendations* section for more information.

#### Recommendations

- Complete structural repairs to the chimney as outlined in the Chimney Recommendations section. See the Masonry Recommendations section for more information on approach to masonry repairs.
- Retain existing modern mantel.

### Fire Protection and Security

#### Observations

The house does not have any form of fire protection or security systems. The interior is not regularly occupied and the doorways are secured with locked metal gates.

The house does not have power or water service to support an alarm or fire suppression system and there are no plans to add these systems.

### Recommendations

- If the house is opened to the public on a more regular basis, consider including a fire extinguisher on the interior.
- Maintain locking gates on the exterior doors after park hours and anytime the building is not open to the public.

### Building and Site as Artifacts

#### Observations

It is important to think of the building and its surroundings as having archaeological value. Evidence of the creation and evolution of this place is embodied in the building and site features, and sometimes hidden below the ground's surface.

#### Recommendations

- Strive to protect evidence of the evolution of the building as part of future work campaigns.
- As part of any project requiring ground disturbances, have an archaeologist on call to review any potential findings.

## Operations and Maintenance Program

The park currently does not have formal procedures established for conserving the historic building materials.

#### Recommendations

- Initiate an Operations and Maintenance (O&M) program focused on this building, specifically to:
    - Develop a protocol of best practices for maintenance, including lists of proven products, materials, and methods.
    - Also develop a list of products, materials, and methods that should NOT be used.
    - Avoid the use of new construction products and materials until the specific application has been sufficiently tested and approved by the appropriate NPS management unit.

## Monitoring Checklist

Use of a Condition Monitoring Checklist outlining inspection topics and the date of inspection helps both to formalize the monitoring process and to create a record for future reference. A checklist tailored specifically to the needs of the Snodgrass, Kelly, and Brotherton Houses, each of which faces similar maintenance challenges, was prepared for this HSR and can be found on p.109.

#### Recommendations

- Adopt the recommended inspection schedule included in the Checklist or substitute a more suitable one.
- Adjust the list of inspections as appropriate. Integrate the monitoring schedule into park activities.
- Retain the Checklists for tracking needs and scheduling remedial actions.

## Accessibility and Universal Design

#### Observations

The east and west doorways are accessed by modern stone steps. Two treads are found at the east doorway and a single treat is at the west doorway. Currently, the house is not open to the public. Park visitors can instead view the interior through the metal gates at grade.

The lowest threshold at the Snodgrass House is on the west elevation, which lies about 1'-2" above grade level. A ramp designed in accordance with ABA/ADA standards would require a run of approximately 14'-0" to reach this level. A ramp of this size would become a major feature of the landscape and building and would greatly detract from the historic character of the site.

#### Recommendations

- If the interior of the house remains closed to the public, the park may choose to take no action. If the interior is opened to the public, the park may consider Options 1 or 2.
- Option 1: Consider improving the ability for someone in a wheelchair to view the interior of the house. The non-historic west stone step could be removed to allow a wheelchair to approach the doorway more closely. In this scenario, the metal gate at the west opening would likely need to remain secured to prevent visitors from using the doorway to enter and exit.
    - Because the house is a single room, the vast majority of the interior can be seen from a single vantage point. In Option

1, care should be taken to ensure that interior interpretation design is cognizant of what is and isn't visible from the accessible doorway.

  - As the step currently prevents wheelchairs from closely approaching any doorway, Option 1 may be considered regardless of whether the interior is opened to the public.

- Option 2: Consider adjusting the grade in front of the west doorway to reduce the distance between grade and the threshold. This could reduce the distance from grade by several inches, resulting in a reduced ramp length. Care should be taken to ensure that soil is not placed against the masonry foundation wall, as it is not designed to retain.

  - Consider the archaeological implications of Option 2 and weigh them against the value of providing universal access to the interior. Even a reduced ramp length will have a major visual impact on the site and will impact the proportions of the building.

## Resilience to Natural Hazards

### Climate

#### Observations

Average temperatures and precipitation at CHCH are increasing and are projected to continue to increase. Storm frequency and intensity is also projected to increase. These changes will have major impacts on frequency of maintenance required for buildings. Storm preparation and adequate drainage to handle increased rainfall will also be critical.

A number of studies have been prepared by NPS on a park-by-park basis that address changing climatic conditions and interpret historic climate data. Studies include "Recent Climate Change Exposure of Chickamauga and Chattanooga National Military Park" (Monahan & Fisichelli, 2014) and "Chickamauga and Chattanooga National Military Park: How Might Future Warming Alter Visitation?" (Fisichelli & Ziesler, 2015). Both documents are available on NPS.gov.

#### Recommendations

- Consider the potential effects of climate change issues on the building and its immediate site, such as increased storm threats, changes in average temperature and rainfall totals, and associated loss or degradation of resources.
- Monitor weather-related deterioration and evaluate needed responses to protect the building and its immediate site in coordination with overall assessment of climate change effects on the park overall.
- Complete site drainage recommendations advocated by this HSR.
- Complete roof framing modifications advocated by this HSR to protect against wind uplift.
- Use studies regarding adaptation to natural hazards to inform management decisions. Current studies that address the park include those cited above.
- Assume increased visitation will take place in the coming years and adjust maintenance schedules appropriately.
- Consult regularly with the NPS Interior Region 2 Climate Change, Socioeconomics, and Adaptation Coordinator to inform management policies. Coordinate with planning and documentation projects being implemented by the NPS Region.
- Evaluate building maintenance schedules as necessary to account for the possibility of more frequent exterior painting/finishing campaigns, roof repairs, and roof and site drainage repairs in response to increased and more intense projected precipitation. The Condition Monitoring Checklist found on page 109 of this report helps guide cyclical maintenance and frequent monitoring of conditions, and creates a record.
- Update emergency and disaster planning to address resiliency to natural hazards and mitigation of the effects of hazardous events.

### Animals, Vermin, and Pests

#### Observations

No obvious evidence of active vermin or pest activity were noted during the assessments for this report; however, ongoing monitoring for activity is important to the wellbeing of the building and park visitors.

The house is known to commonly host roosting bats.

#### Recommendations

- Regularly inspect the house for termite activity, including the presence of mud tunnels. Installation and regular replenishment of termite bait stations should be considered.
- Remove any insect nests that may appear on the building exterior. Monitor the building regularly for insect activity.
- Be vigilant to prevent habitation of vermin such as mice, rats, or snakes on the interior of the building.
- A bat survey should be performed by a wildlife biologist or other qualified personnel prior to start of work if work occurs in the spring or summer months (March 31- October 15). Bat activity during the fall and winter months is reduced and may be considered when scheduling repairs. Ideally, bat roosting inside the house should be discouraged and operations recommendations including the regular closure of doors may reduce this activity.

## Recommendations for Ultimate Use

The Brotherton House is currently interpreted by wayside signage near the building. The interior is not open to the public and is not interpreted. The current floor framing conditions make public access problematic, and park operations currently do not include controlling access to the house.

Following the implementation of floor framing repairs, it is the recommendation of this report that the house be opened to the public on a daily or semi-regular basis. A more comprehensive story of the house and its site could be told using interpretive panels on the interior. Basic furnishings to further enhance interpretation could be considered depending on when the building is open and to what extent visitor monitoring is feasible. For instance, the house may be fully open for a few hours each day, after which the gates would be secured. The inner board-and-batten doors would be opened and closed ideally nightly, but at minimum before and after major rainfall or weather events.

## Recommendations for Further Research

### Material Analyses

Complete mortar analysis prior to any repointing campaign to determine color and composition of existing mortar. Matching the original mortar coloration is critical to avoiding a "patchwork" appearance when spot repointing.

Perform material analysis on cementitious chinking to determine a compatible formula for repairs.

Hazardous materials testing should be performed on mortar prior to repointing. See the *Hazardous Materials Testing Recommendations* for more information.

### Hazardous Materials Testing

#### Observations

Work was performed at the house in a time period when asbestos, and toxic wood preservatives were commonly used. Asbestos, considered a miracle product for decades, was used as an additive to provide fireproof qualities and additional strength to a wide variety of building materials through the late 1970s. Examples of building materials relevant to the house that commonly containing asbestos or hazardous materials include, but are not limited to:

- Plaster and Stucco, including cementitious chinking/daubing
- Mortar
- Preservatives applied to logs and other members

No known examples of painted surfaces that may contain lead were observed. If painted surfaces are encountered, test them before disturbing coatings.

If left undisturbed, lead-based paint and asbestos-containing materials pose no threat to building occupants. However, appropriate abatement measures should precede any future work on building elements suspected to contain hazardous materials.

#### Recommendations

- Perform appropriate abatement measures for hazardous materials prior to future work that could disturb suspected hazardous materials.

# CONDITION MONITORING CHECKLIST
# SNODGRASS, KELLY, AND BROTHERTON HOUSES

| Feature | Action | Frequency | Date |
|---|---|---|---|
| **Rainwater Collection & Dispersal:** | | | |
| • ***Wood Shingle Roofing*** | ○ Inspect for loosing and missing shingles. | Post-Storms | |
| | ○ Inspect interior for leaks at roofing. | Post-Storms | |
| • ***Site Drainage*** | ○ Monitor site drainage to ensure that water is being carried away from the structure. | Seasonally | |
| **Masonry** | ○ Monitor for new or worsening cracks. | Twice yearly | |
| **Exterior Walls** | ○ Inspect for advancing deterioration of logs.<br>○ Inspect installed borate rods at exposed log members.<br>○ Inspect borate rods at concealed members (joists). | Twice yearly<br>Annually<br>~Every 5 years | |
| **Doors & Doorways** | ○ Probe with awl for rot if soft wood<br>○ Lubricate hardware<br>○ Inspect thresholds for deterioration. | Twice yearly | |
| **Perimeter Vegetation** | ○ Trim surrounding vegetation to promote airflow around the buildings. | Seasonally | |
| **Structural Systems** | ○ Visually inspect the roof framing and floor diaphragm for stresses and deterioration. | Twice yearly | |
| **Interior Finishes & Material Substrate** | ○ Inspect for evidence of water infiltration at ceilings and perimeter exterior walls, doors and windows due to failure in exterior envelope. | Post-Storms | |

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# Appendix A:
# Documentation Drawings Showing Sample and Drilling Locations

***1. Snodgrass House***

Sheet 1:  Floor Plan

Sheet 2:  Reflected Ceiling Plan

Sheet 3:  Roof Plan

Sheet 4:  South Elevation

Sheet 5: East Elevation

Sheet 6: North Elevation

Sheet 7: West Elevation

Sheet 8: Interior - North Wall

Sheet 9: Interior - West Wall

Sheet 10: Interior - South Wall

Sheet 11: Interior - East Wall

***2. Kelly House***

Sheet 12:  Floor Plan

Sheet 13:  Reflected Ceiling Plan

Sheet 14:  Roof Plan

Sheet 15:  South Elevation

Sheet 16: East Elevation

Sheet 17: North Elevation

Sheet 18: West Elevation

Sheet 19: Interior - North Wall

Sheet 20: Interior - West Wall

Sheet 21: Interior - South Wall

Sheet 22: Interior - East Wall

***3. Brotherton House***

Sheet 23:  Floor Plan

Sheet 24:  Reflected Ceiling Plan

Sheet 25:  Roof Plan

Sheet 26:  South Elevation

Sheet 27: East Elevation

Sheet 28: North Elevation

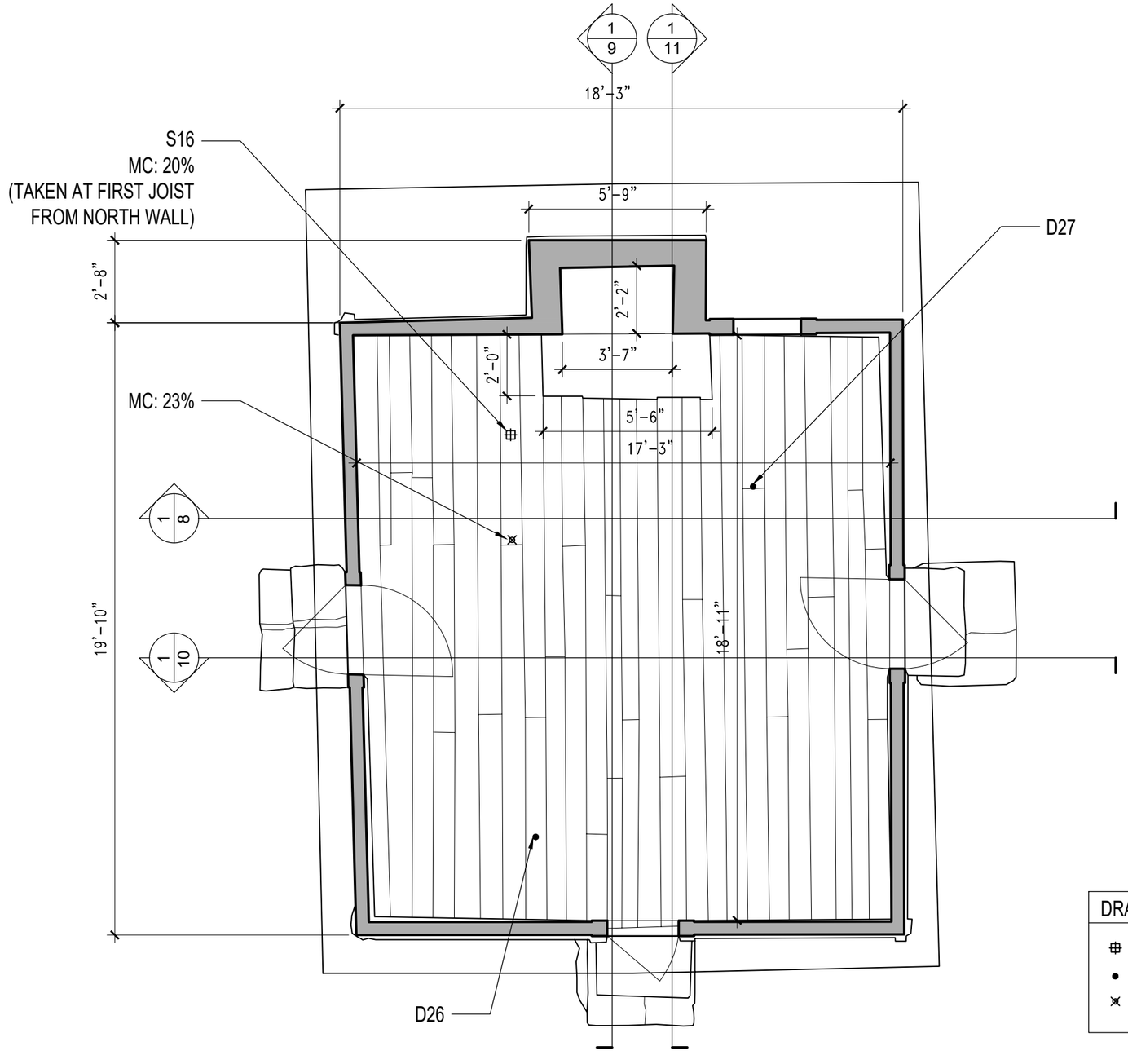
Sheet 29: West Elevation

Sheet 30: Interior - North Wall

Sheet 31: Interior - West Wall

Sheet 32: Interior - South Wall

Sheet 33: Interior - East Wall




| DRAWING KEY | |
|---|---|
| ⌖ | SAMPLE LOCATION |
| • | RESISTANCE DRILLING LOCATION |
| ⌘ | MOISTURE CONTENT READING |

1 SNODGRASS HOUSE - FLOOR PLAN

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

PLAN NORTH

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WINSTON-SALEM, NORTH CAROLINA

# SNODGRASS HOUSE

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CHICKAMAUGA & CHATTANOOGA NATIONAL MILITARY PARK
FORT OGLETHORPE, GA

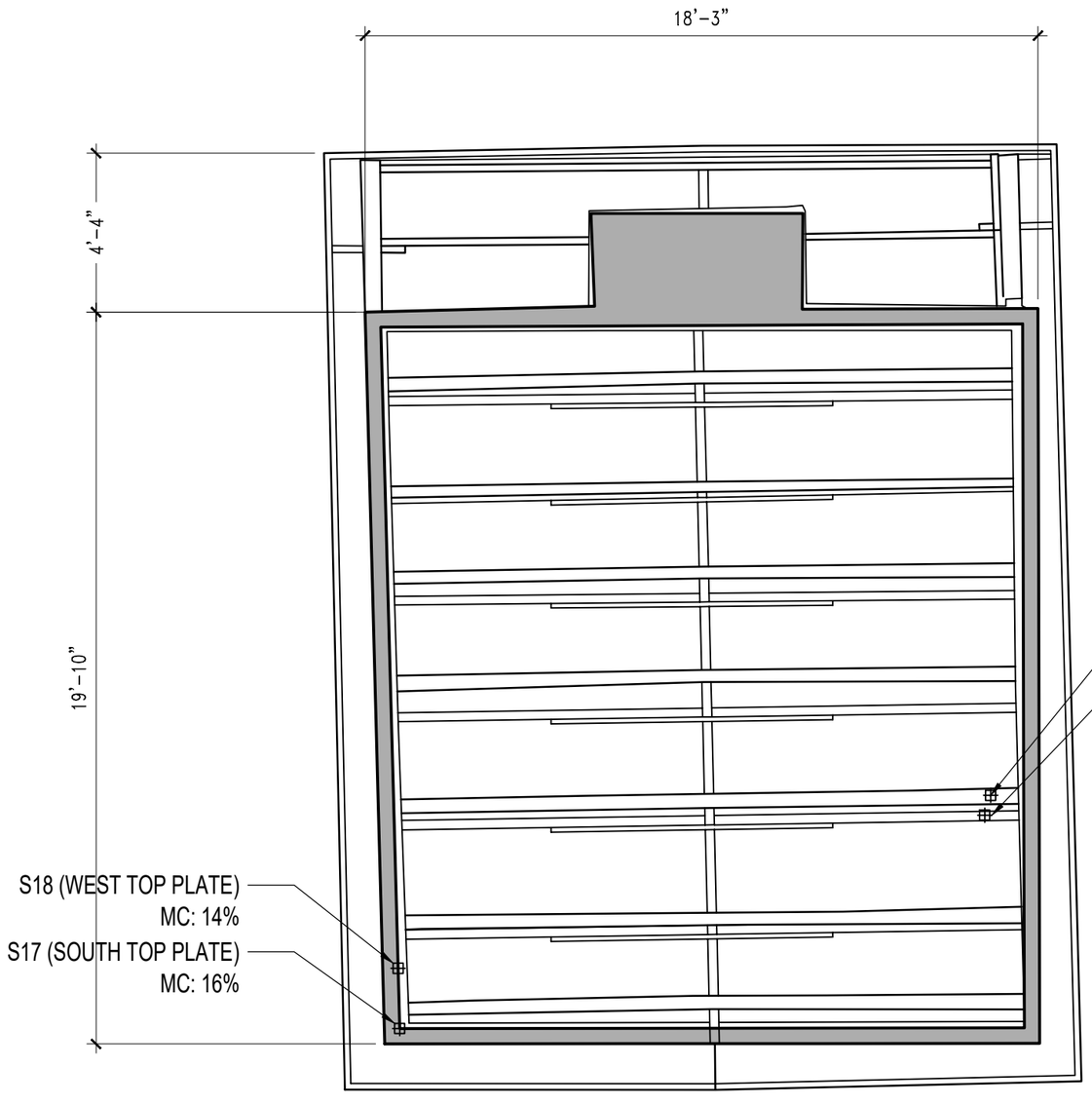
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HSR APPENDIX A: SHEET

1




| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌖ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

PLAN NORTH

1 REFLECTED CEILING PLAN

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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SNODGRASS HOUSE

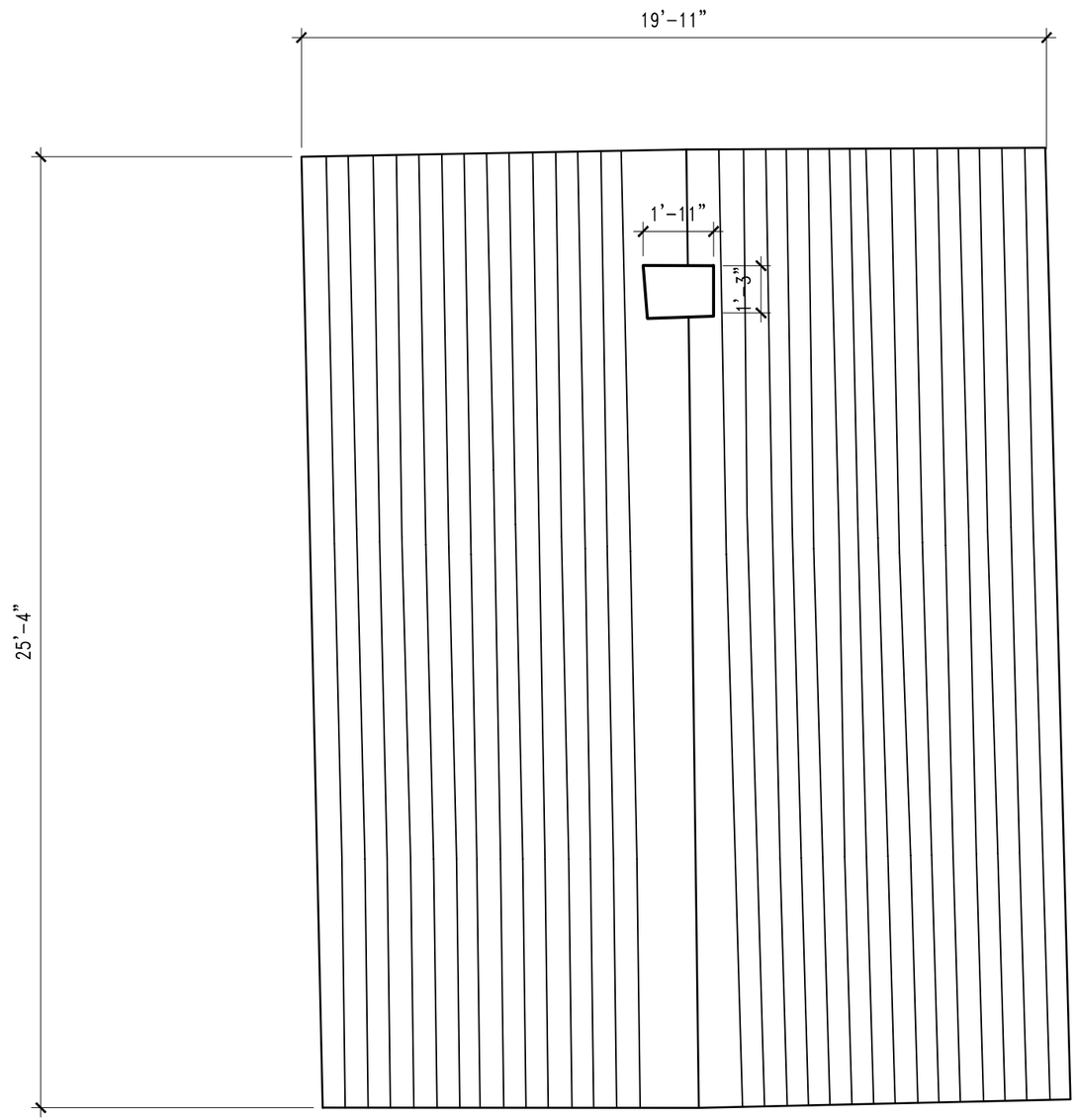
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HSR APPENDIX A: SHEET
2




1 ROOF PLAN

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌖ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

PLAN NORTH

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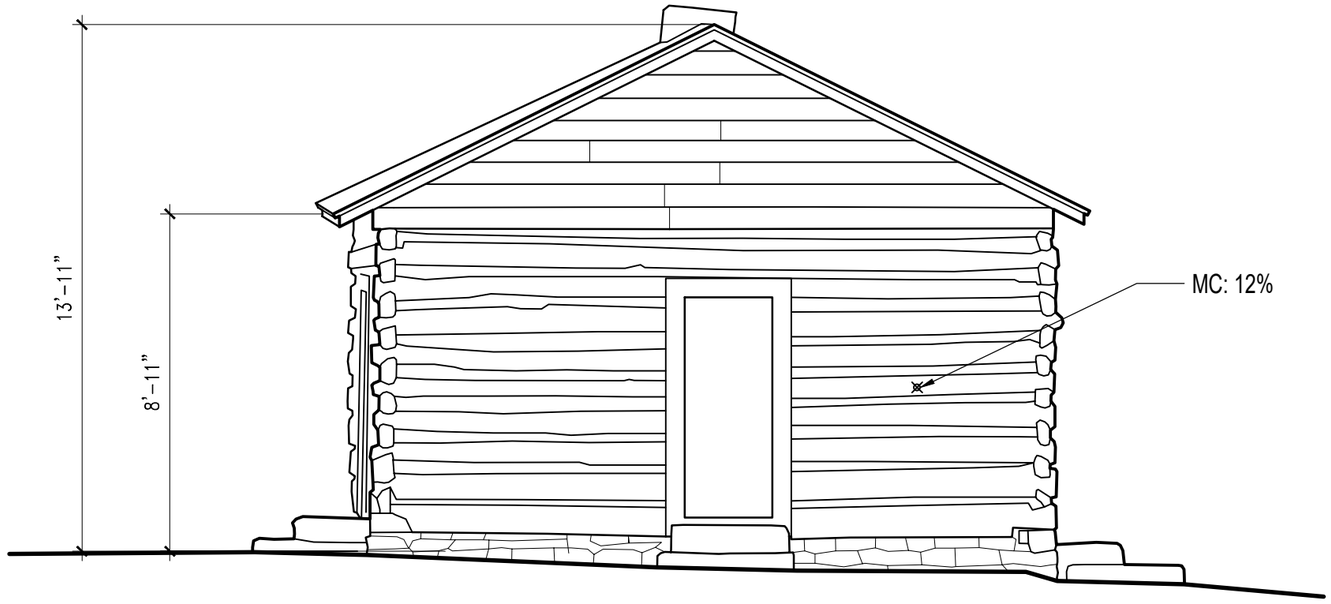
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HSR APPENDIX A: SHEET

3




NOTE: HEIGHTS VARY DUE TO DIFFERENCES IN GRADE

1 SOUTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌘ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

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# SNODGRASS HOUSE

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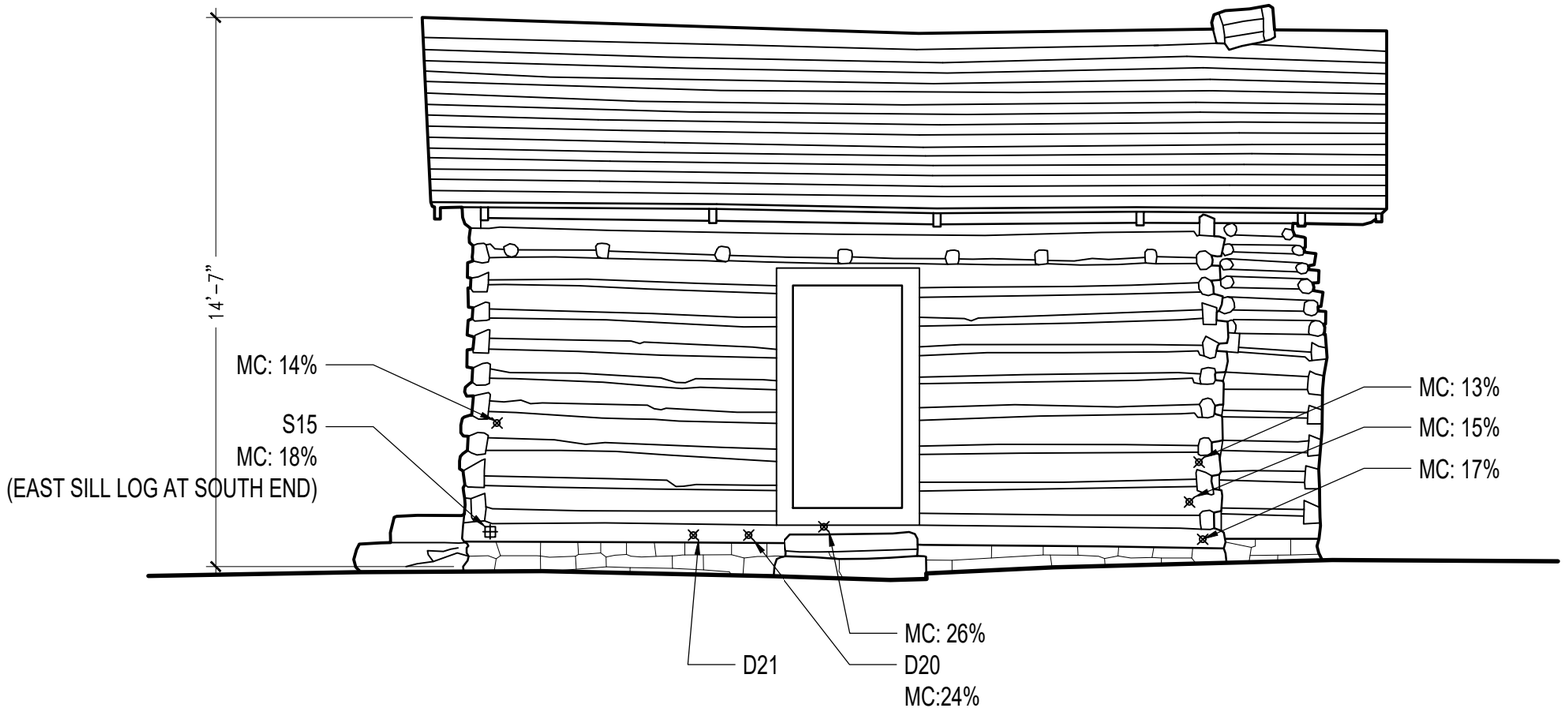
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HSR APPENDIX A: SHEET

4




1 EAST ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

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# SNODGRASS HOUSE

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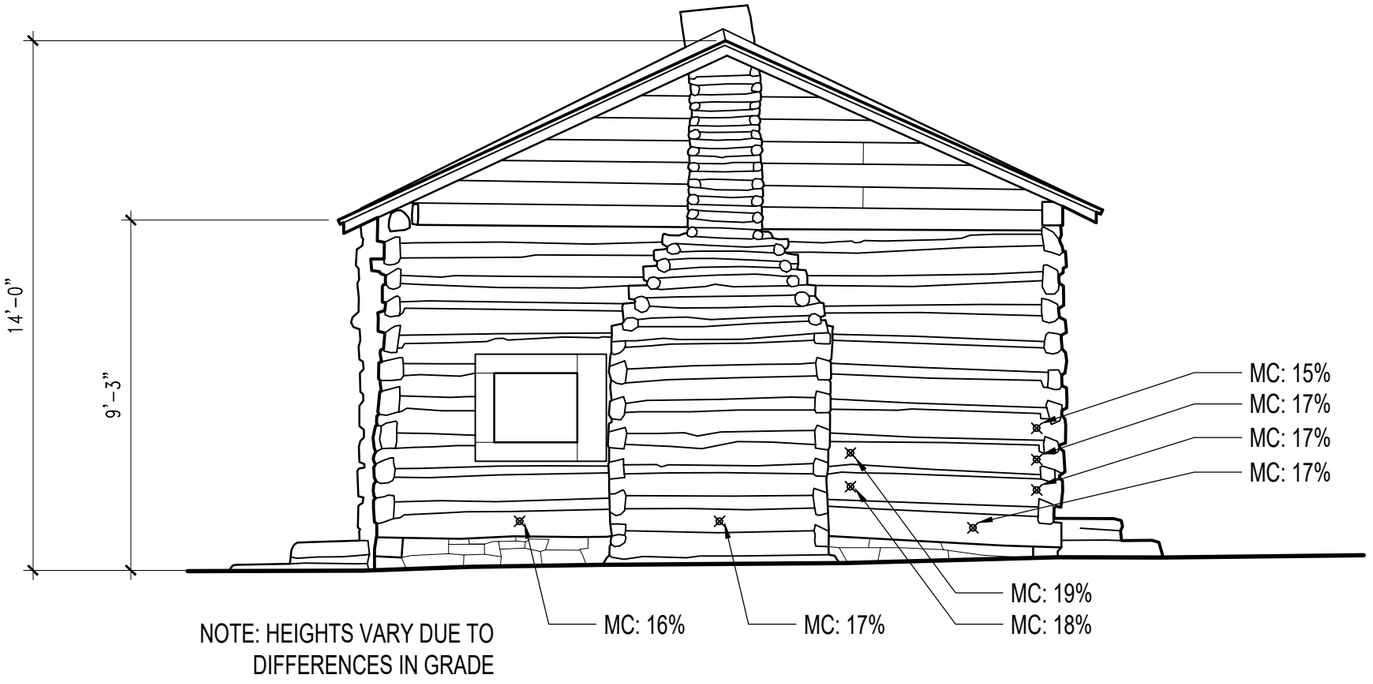
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HSR APPENDIX A: SHEET

5




NOTE: HEIGHTS VARY DUE TO DIFFERENCES IN GRADE

1 NORTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

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# SNODGRASS HOUSE

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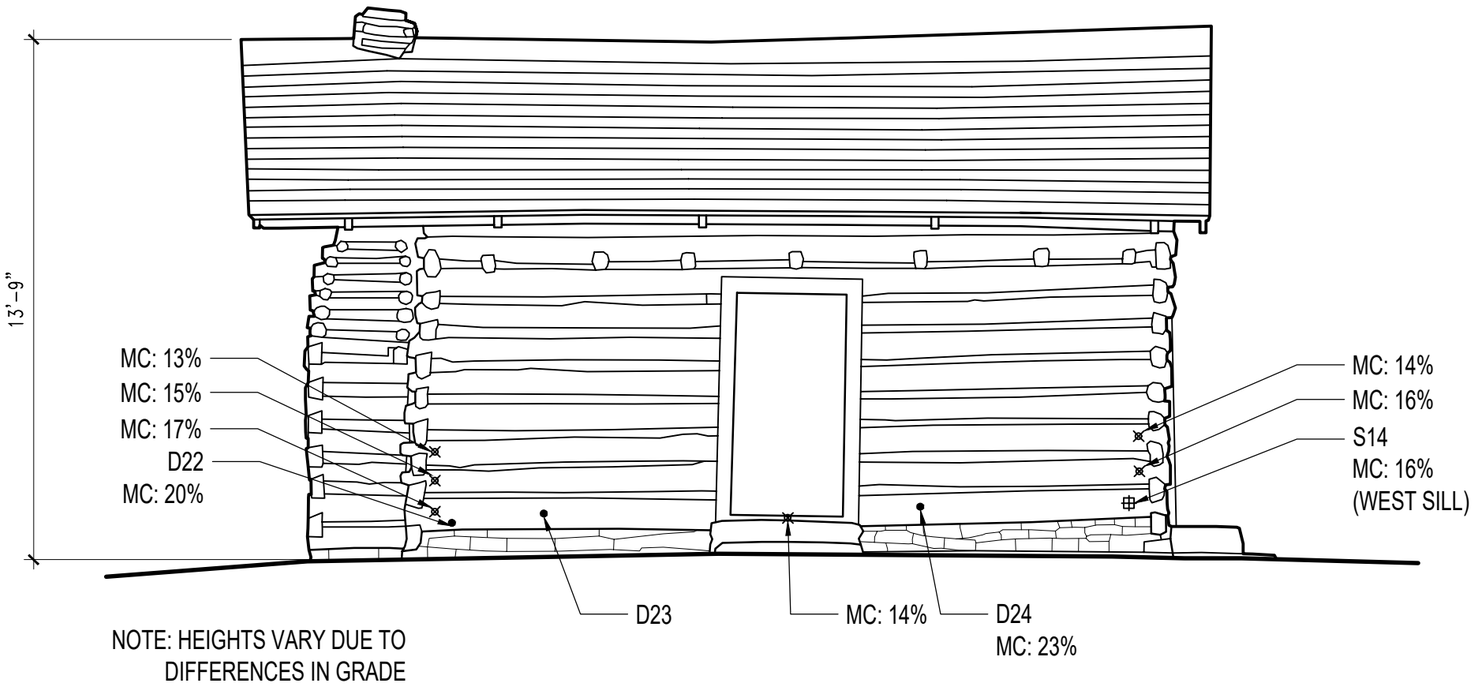
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NOTE: HEIGHTS VARY DUE TO DIFFERENCES IN GRADE

| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌘ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

1 WEST ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

SNODGRASS HOUSE

U.S. DEPT. OF THE INTERIOR: NATIONAL PARK SERVICE (NPS)
CHICKAMAUGA & CHATTANOOGA NATIONAL MILITARY PARK
FORT OGLETHORPE, GA

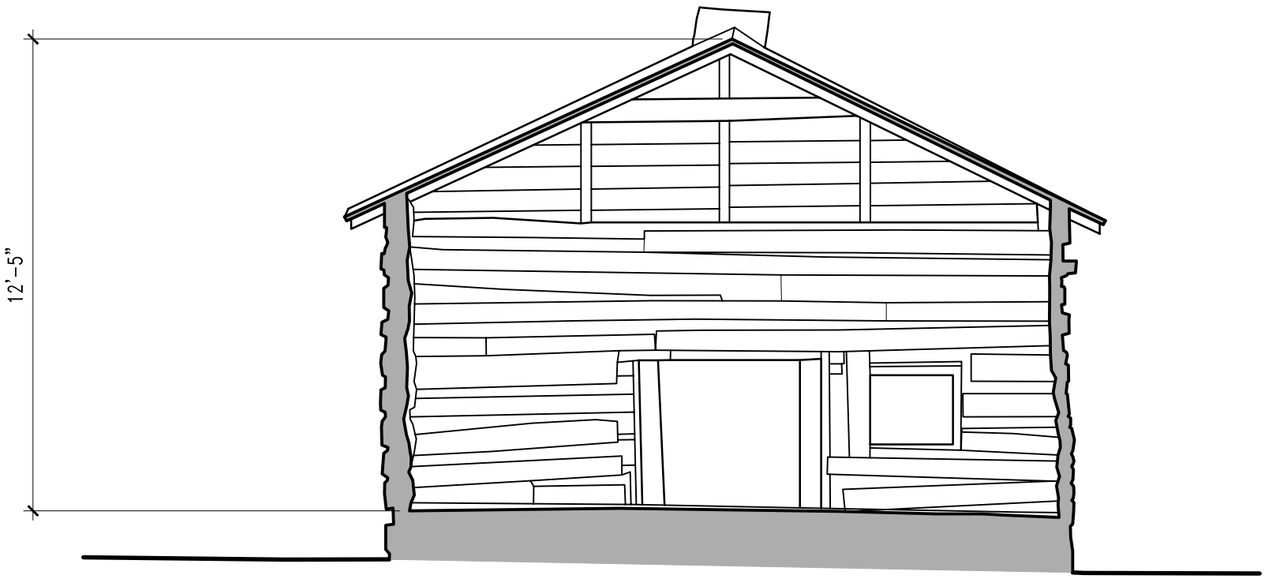
RECORDATION DATE:
05.05.2022

RECORDED BY:
PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET

7




1 INTERIOR ELEV. - NORTH WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌘ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

# SNODGRASS HOUSE

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FORT OGLETHORPE, GA

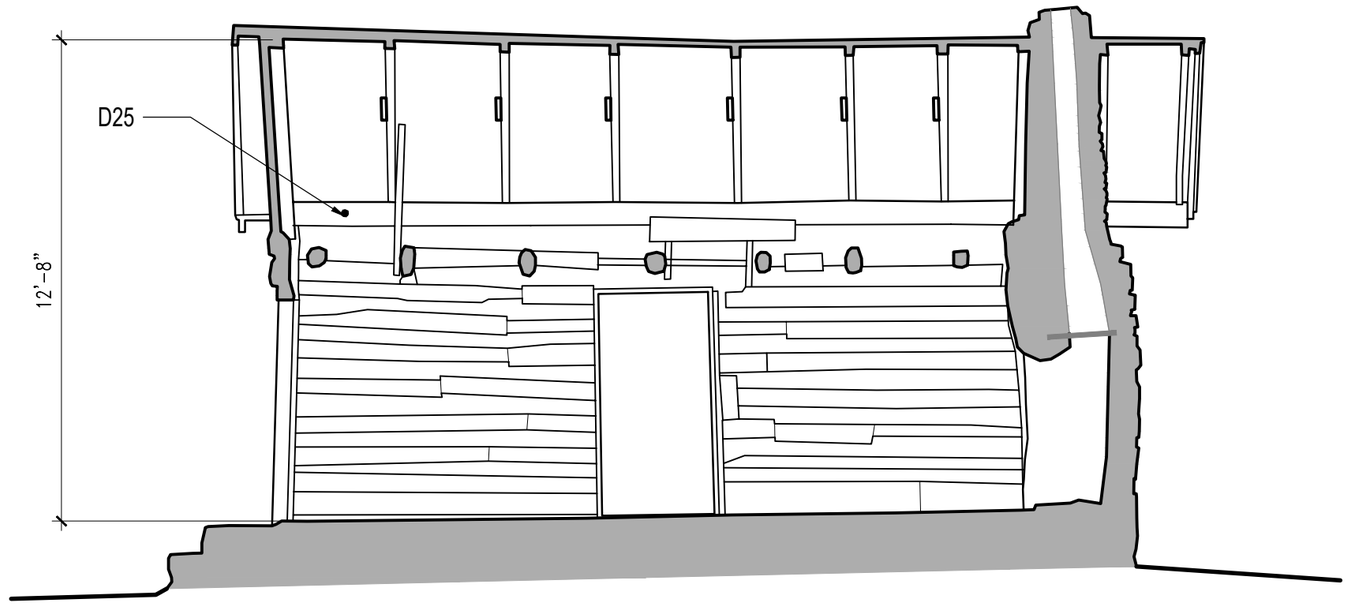
RECORDATION DATE:
05.05.2022

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SCALE:
1/4" = 1'-0"

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8




1 INTERIOR ELEV. - WEST WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

# SNODGRASS HOUSE

U.S. DEPT. OF THE INTERIOR: NATIONAL PARK SERVICE (NPS)
CHICKAMAUGA & CHATTANOOGA NATIONAL MILITARY PARK
FORT OGLETHORPE, GA

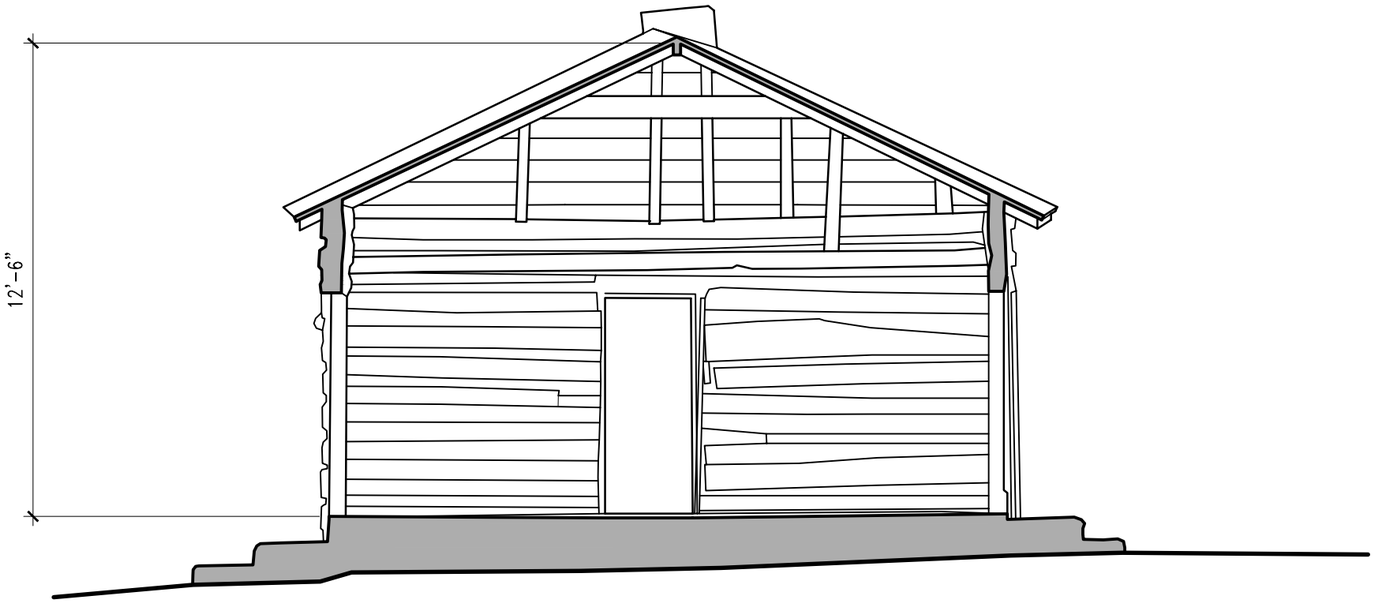
RECORDATION DATE:
05.05.2022

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PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET

9




1 INTERIOR ELEV. - SOUTH WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

SNODGRASS HOUSE

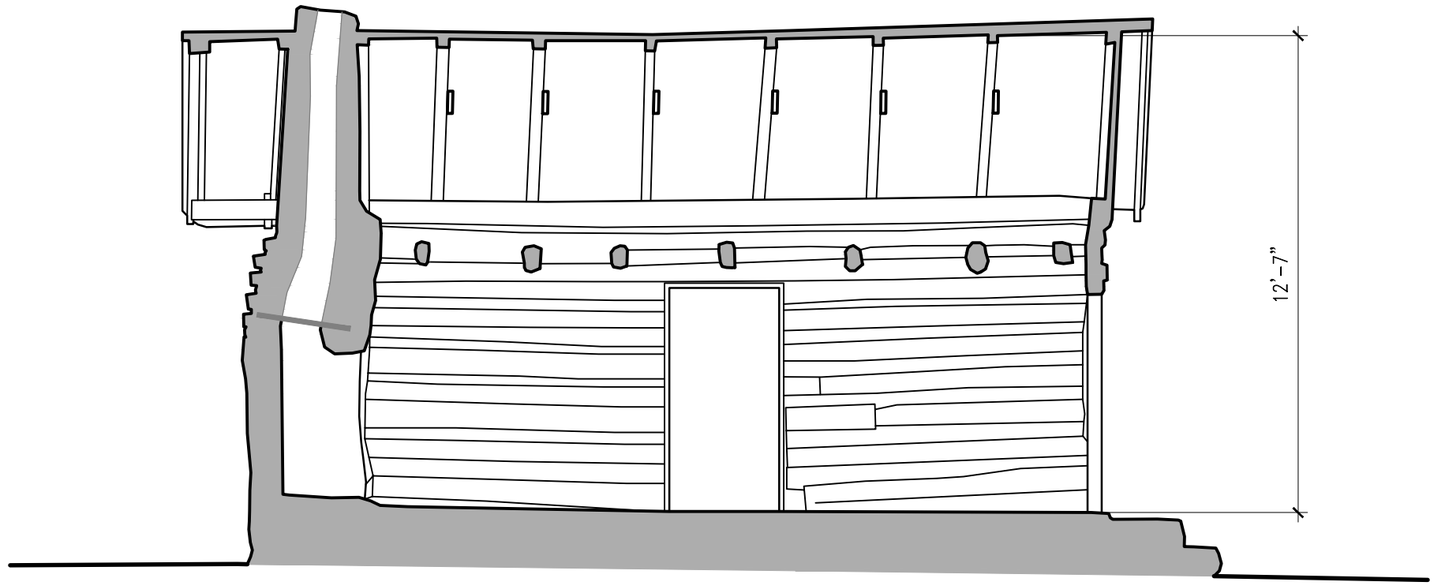
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FORT OGLETHORPE, GA

RECORDATION DATE:
05.05.2022

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SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET
10




1 INTERIOR ELEV. - EAST WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

# SNODGRASS HOUSE

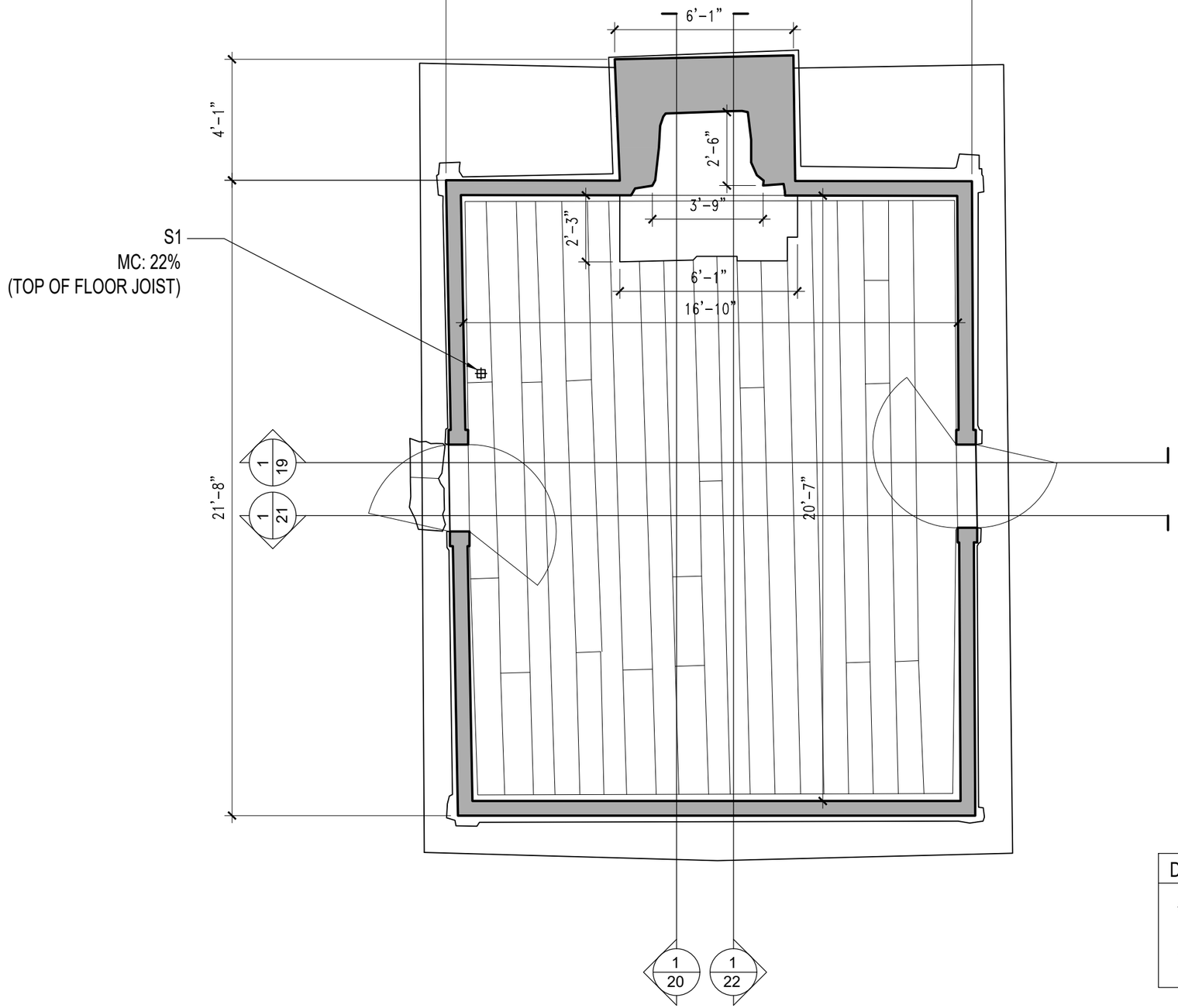
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FORT OGLETHORPE, GA

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05.05.2022

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SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET
11




| DRAWING KEY |
| --- |
| ⌗ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌘ MOISTURE CONTENT READING |

1 FLOOR PLAN

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

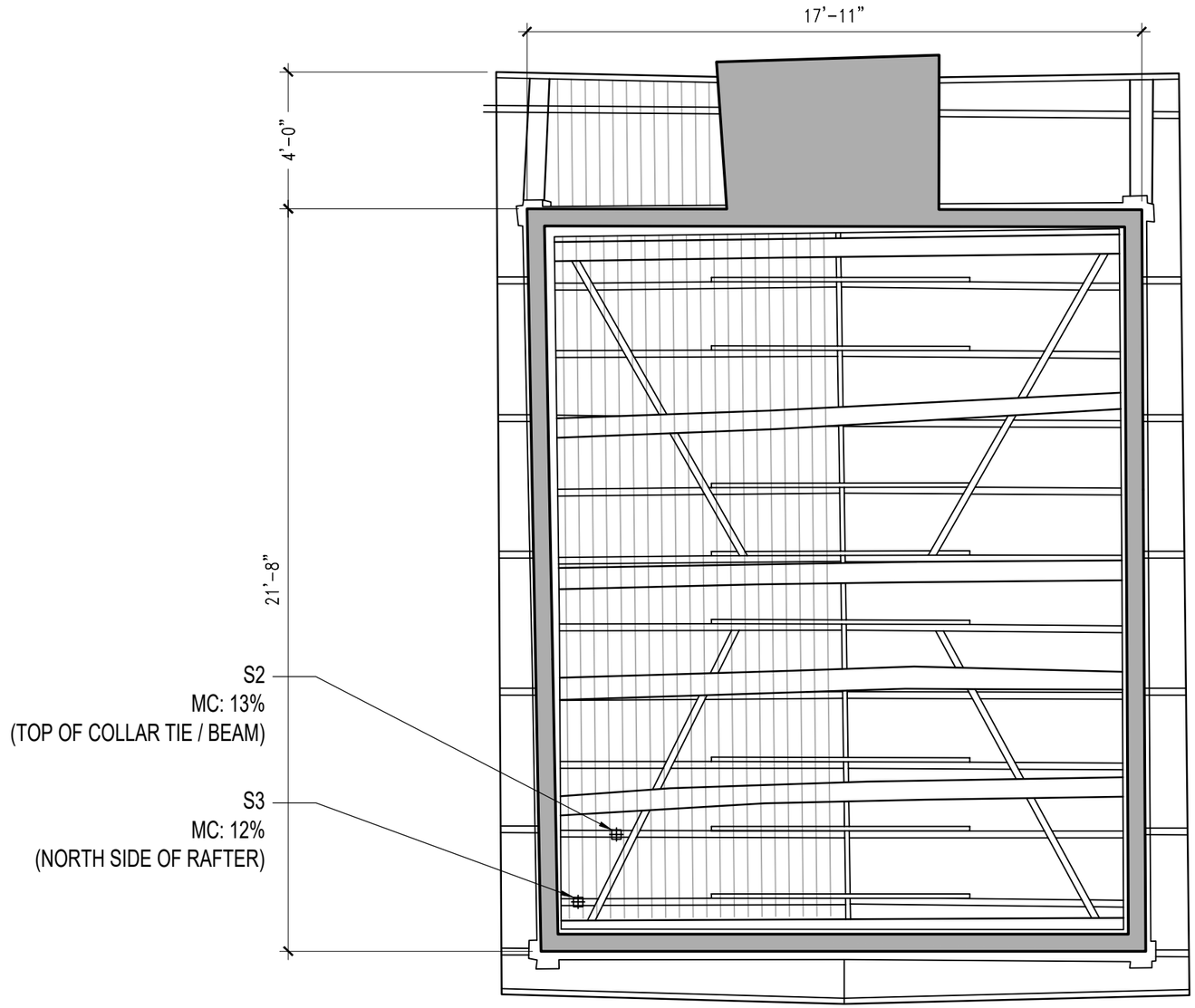
KELLY HOUSE
U.S. DEPT. OF THE INTERIOR: NATIONAL PARK SERVICE (NPS)
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FORT OGLETHORPE, GA

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05.05.2022

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SCALE:
1/4" = 1'-0"

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12




1 REFLECTED CEILING PLAN

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

| DRAWING KEY |
| --- |
| ⌗ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌘ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

KELLY HOUSE

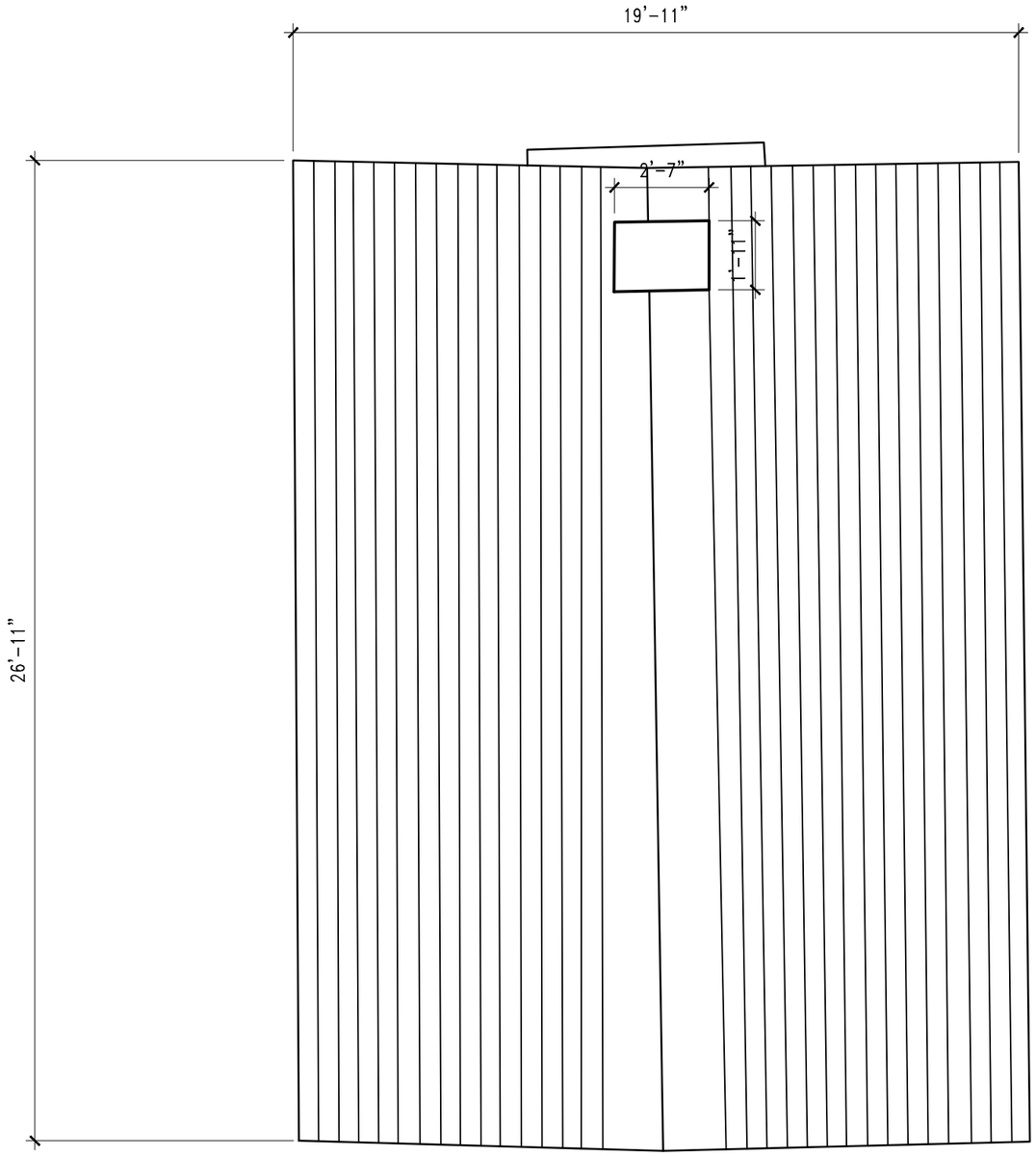
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05.05.2022

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SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET
13




1 ROOF PLAN

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

| DRAWING KEY |
| --- |
| ⌗ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌖ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

# KELLY HOUSE

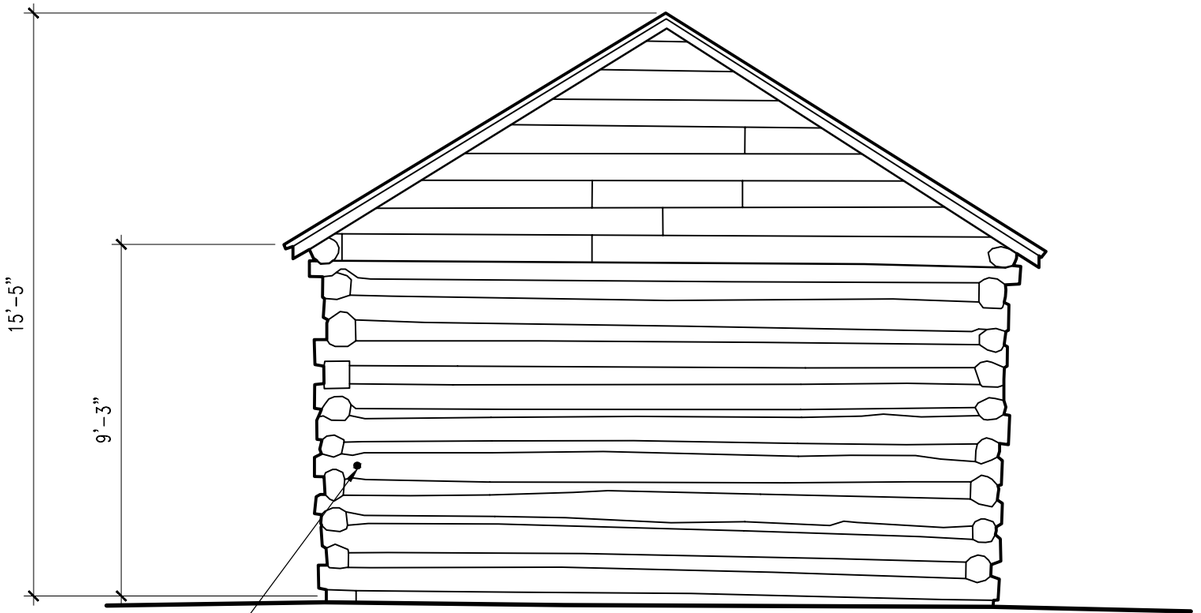
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RECORDATION DATE:
05.05.2022

RECORDED BY:
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SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET
14




NOTE: HEIGHTS VARY DUE TO DIFFERENCES IN GRADE

1 SOUTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌘ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

KELLY HOUSE

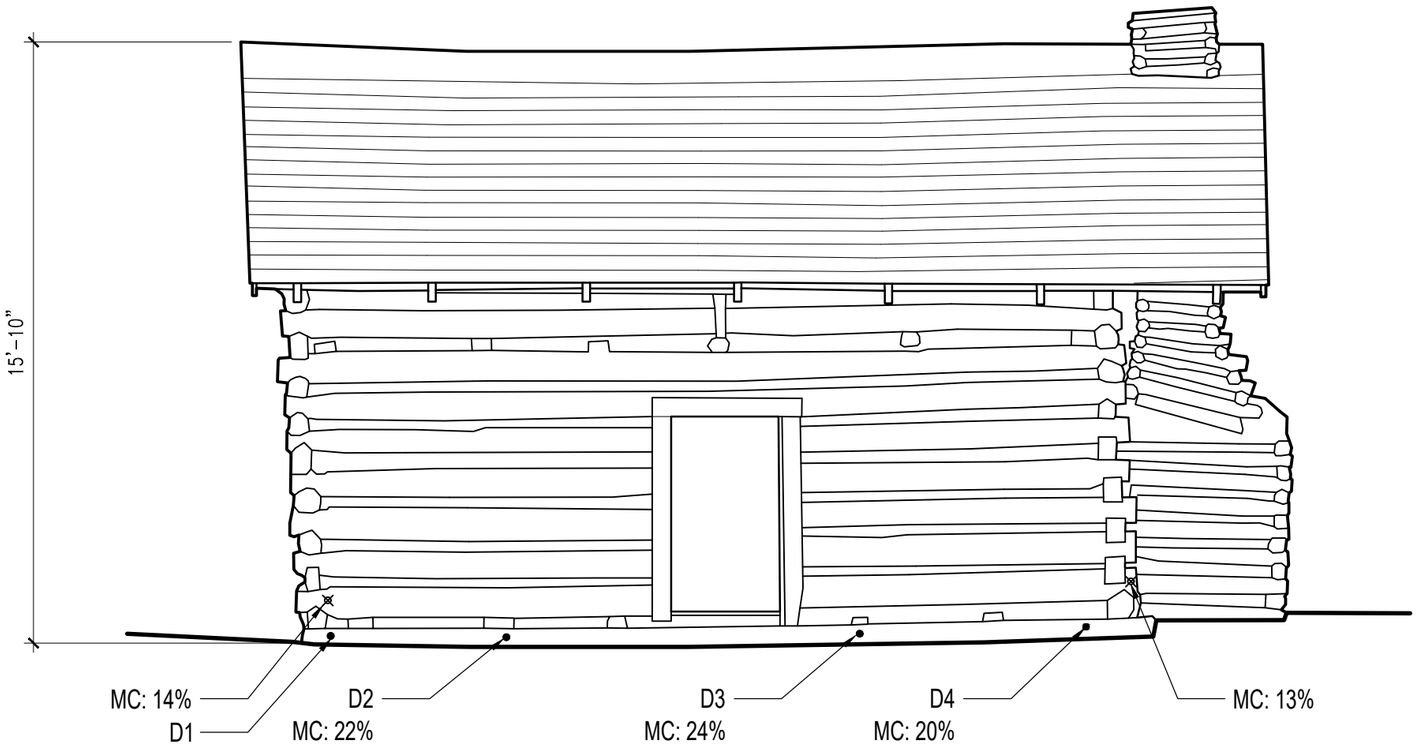
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FORT OGLETHORPE, GA

RECORDATION DATE:
05.05.2022

RECORDED BY:
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SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET
15




| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌘ MOISTURE CONTENT READING |

1 EAST ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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WINSTON-SALEM, NORTH CAROLINA

KELLY HOUSE

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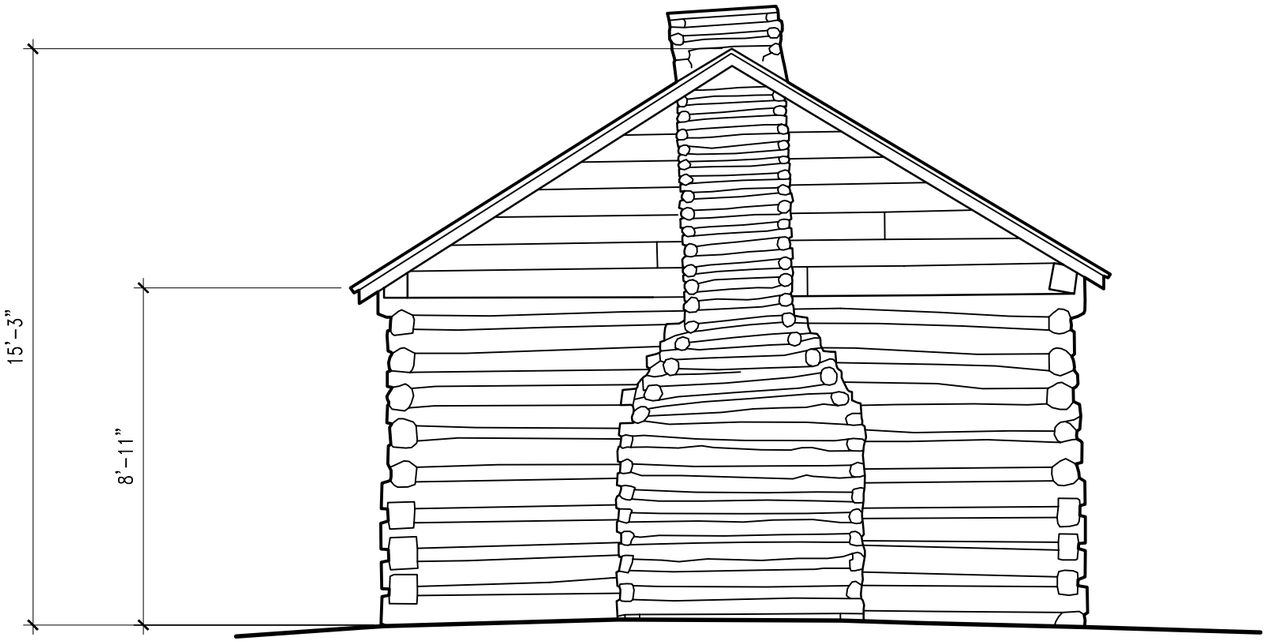
RECORDATION DATE:
05.05.2022

RECORDED BY:
PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET

16




NOTE: HEIGHTS VARY DUE TO
DIFFERENCES IN GRADE

1 NORTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

# KELLY HOUSE

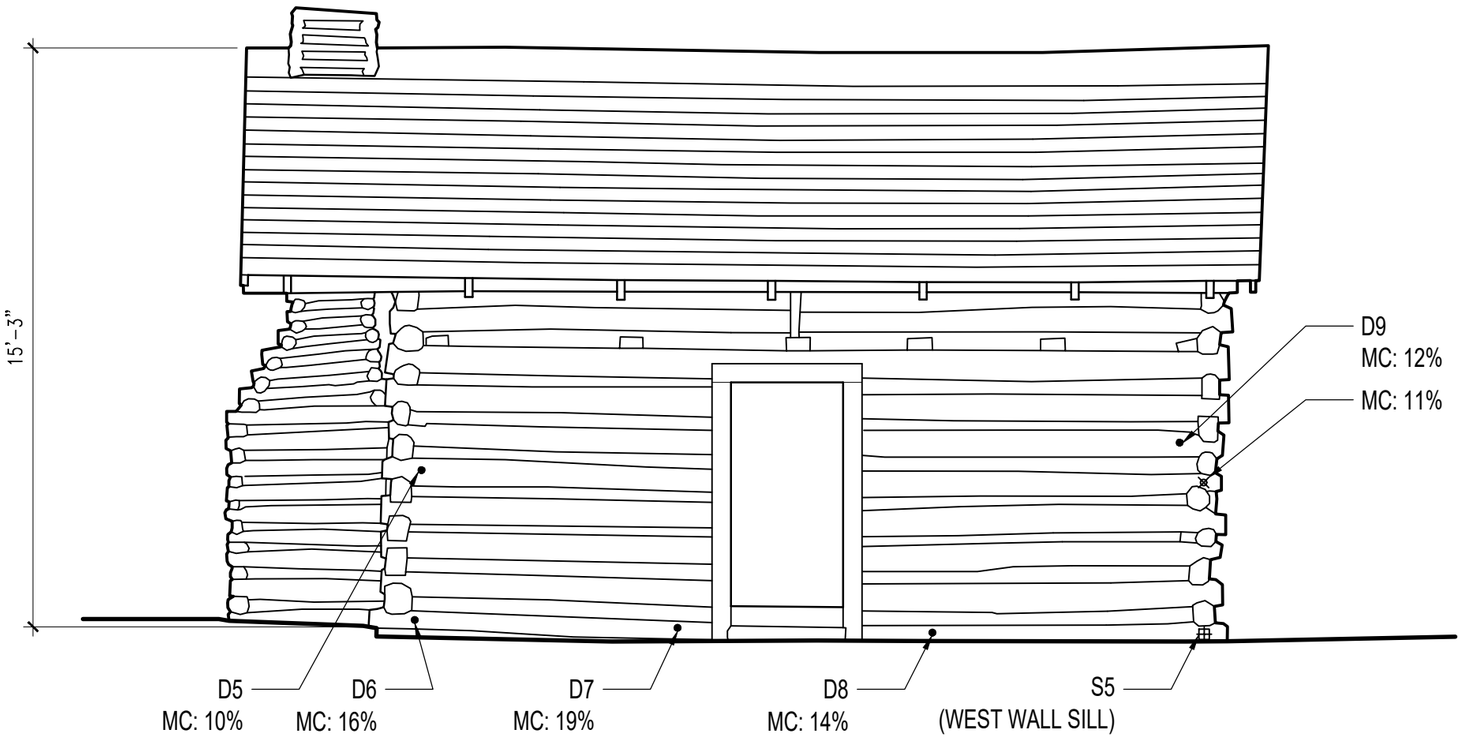
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CHICKAMAUGA & CHATTANOOGA NATIONAL MILITARY PARK
FORT OGLETHORPE, GA

RECORDATION DATE:
05.05.2022

RECORDED BY:
PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET
17




DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

1 WEST ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

KELLY HOUSE

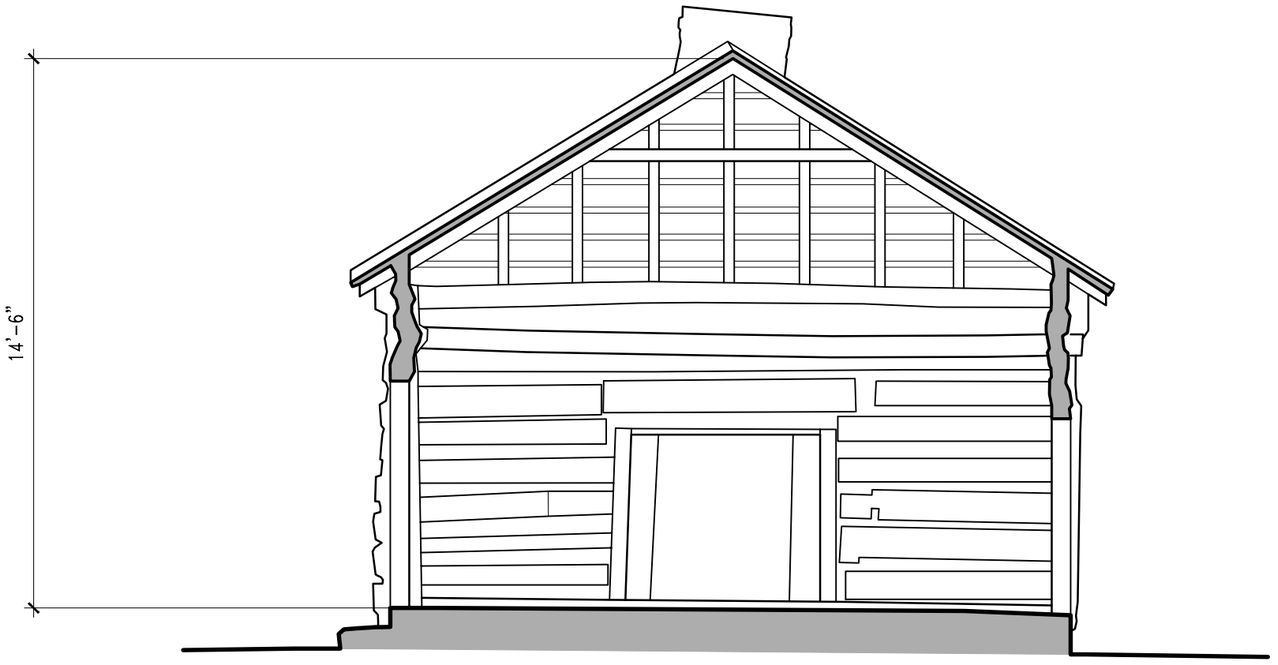
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FORT OGLETHORPE, GA

RECORDATION DATE:
05.05.2022

RECORDED BY:
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SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET
18




1 INTERIOR ELEV. - NORTH WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

KELLY HOUSE

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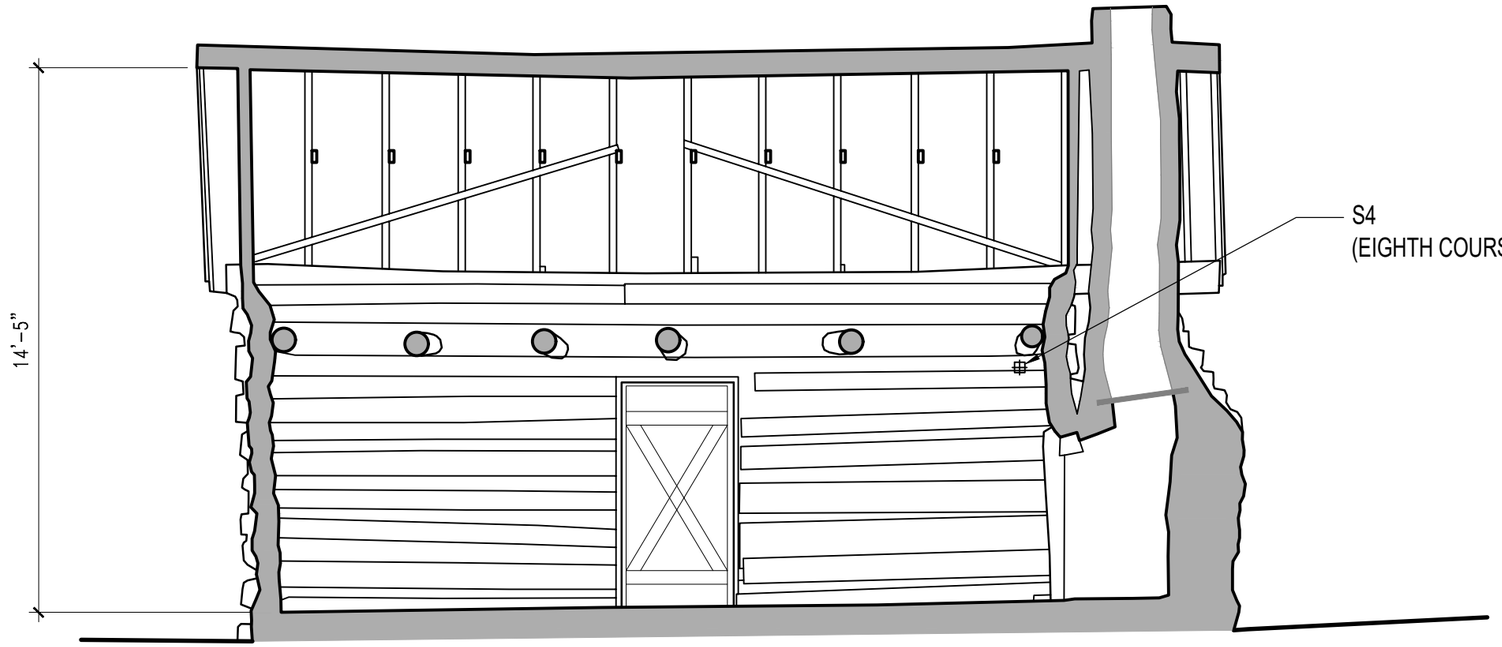
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05.05.2022

RECORDED BY:
PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET

19




1 INTERIOR - WEST WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

DRAWING KEY

- ⌖ SAMPLE LOCATION
- • RESISTANCE DRILLING LOCATION
- ⌘ MOISTURE CONTENT READING

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

KELLY HOUSE

U.S. DEPT. OF THE INTERIOR: NATIONAL PARK SERVICE (NPS)
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FORT OGLETHORPE, GA

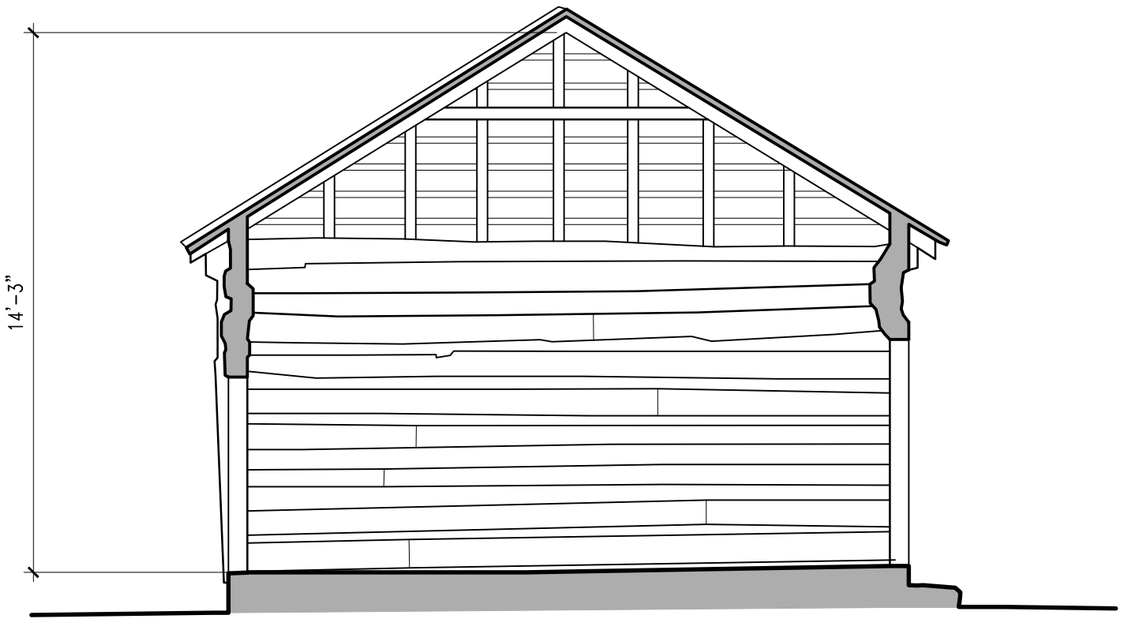
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05.05.2022

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PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET

20




1 INTERIOR ELEV. - SOUTH WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

KELLY HOUSE

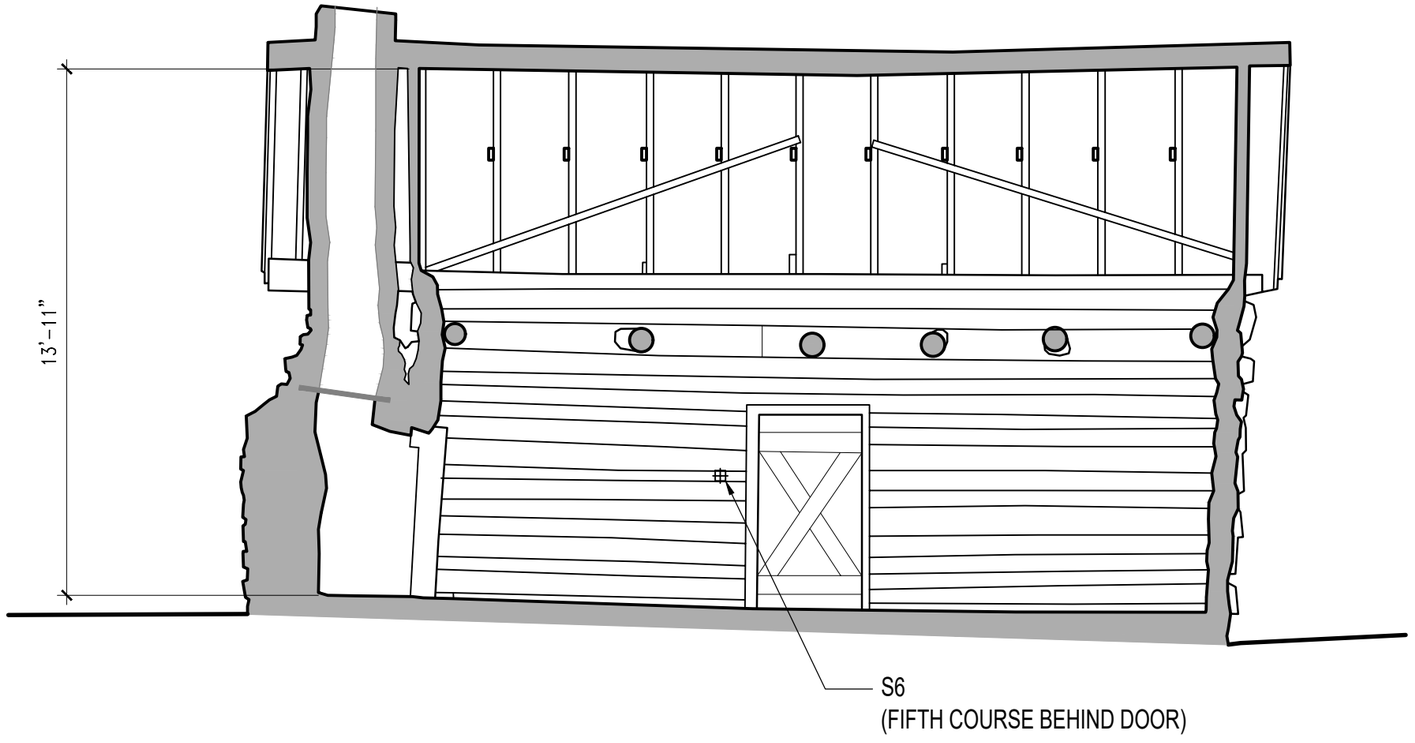
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FORT OGLETHORPE, GA

RECORDATION DATE:
05.05.2022

RECORDED BY:
PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET
21




1 INTERIOR ELEV. - EAST WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌖ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

# KELLY HOUSE

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CHICKAMAUGA & CHATTANOOGA NATIONAL MILITARY PARK
FORT OGLETHORPE, GA

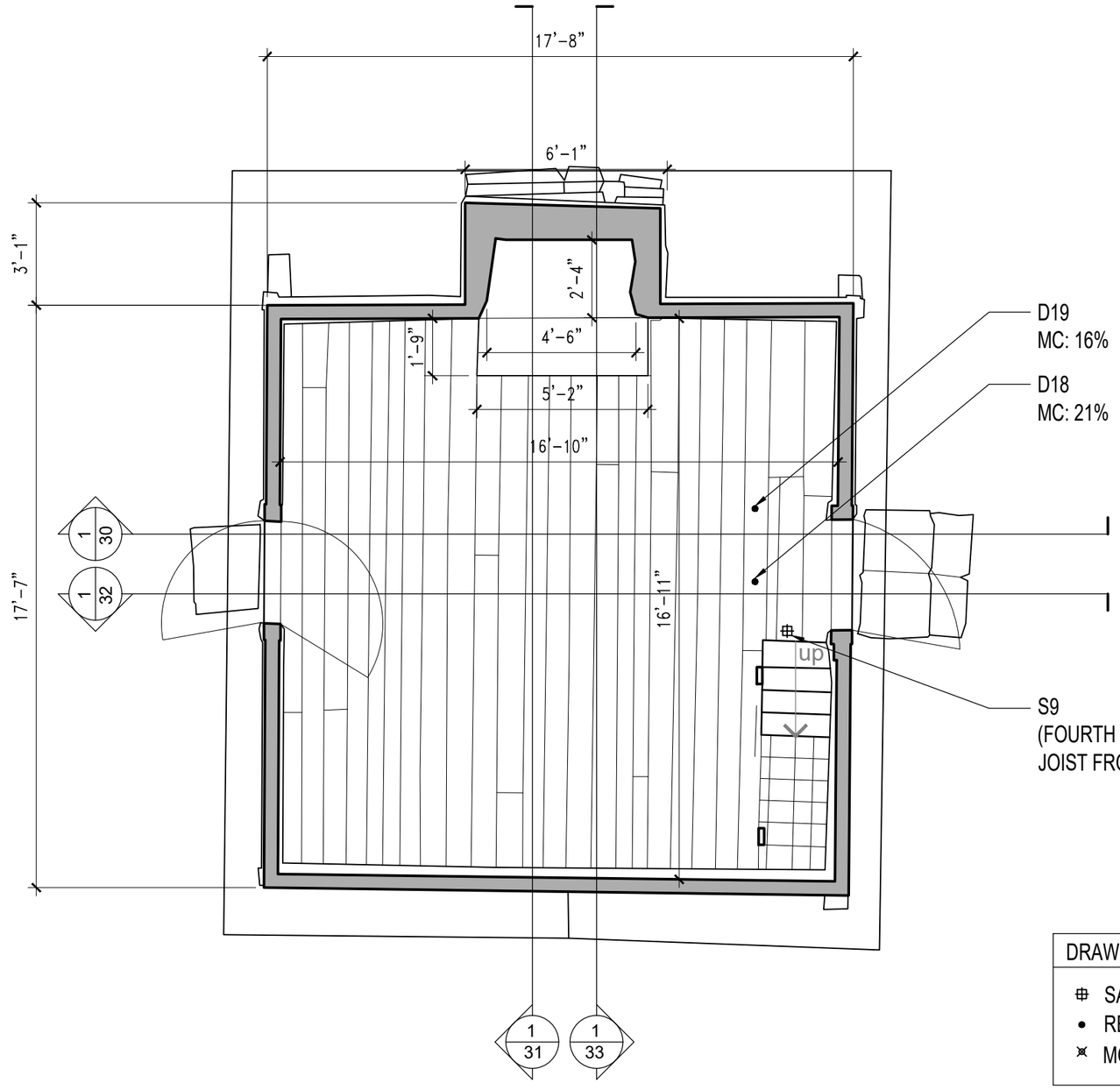
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RECORDED BY:
PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET

22




DRAWING KEY

- ⌖ SAMPLE LOCATION
- • RESISTANCE DRILLING LOCATION
- ⌘ MOISTURE CONTENT READING

1 FLOOR PLAN

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

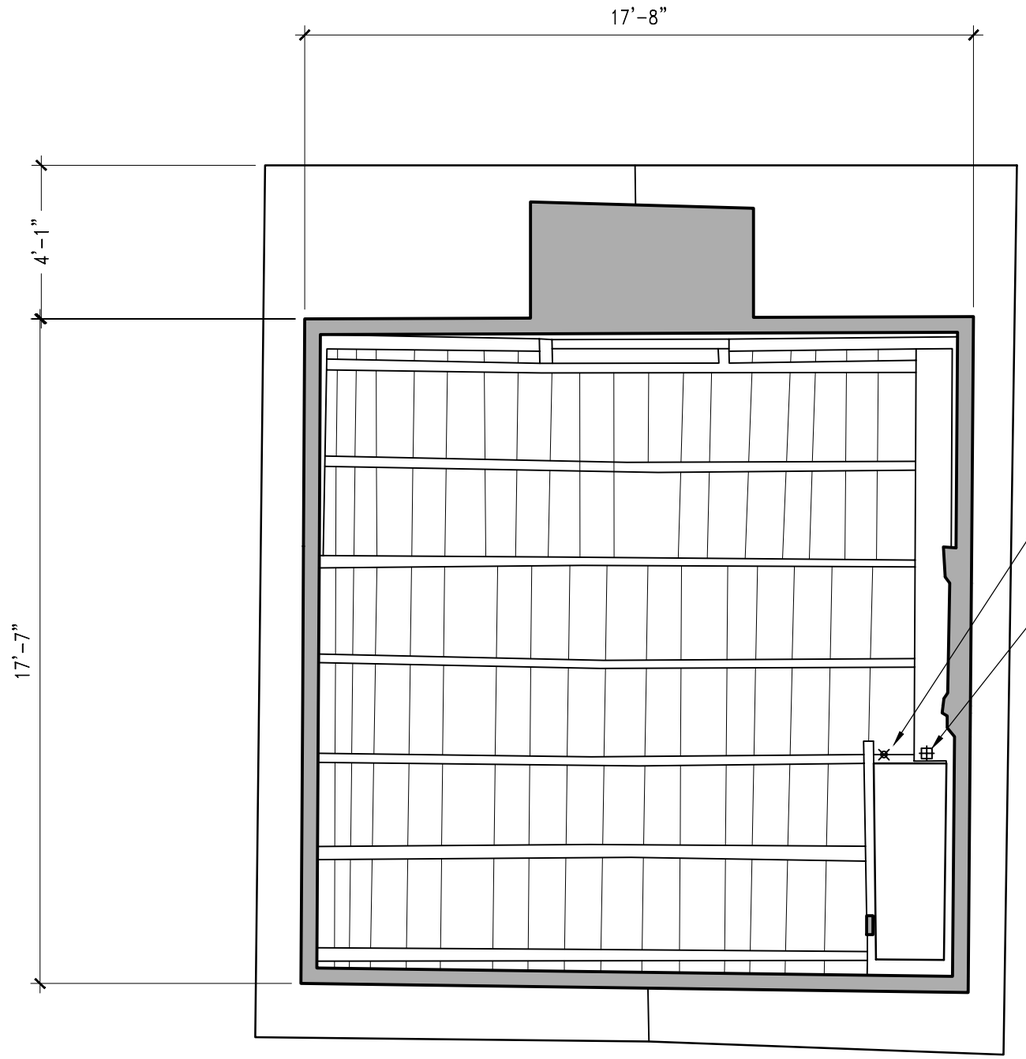
BROTHERTON HOUSE
U.S. DEPT. OF THE INTERIOR: NATIONAL PARK SERVICE (NPS)
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FORT OGLETHORPE, GA

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05.05.2022

RECORDED BY:
PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET
23




| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ✕ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

1 REFLECTED CEILING PLAN

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

BROTHERTON HOUSE

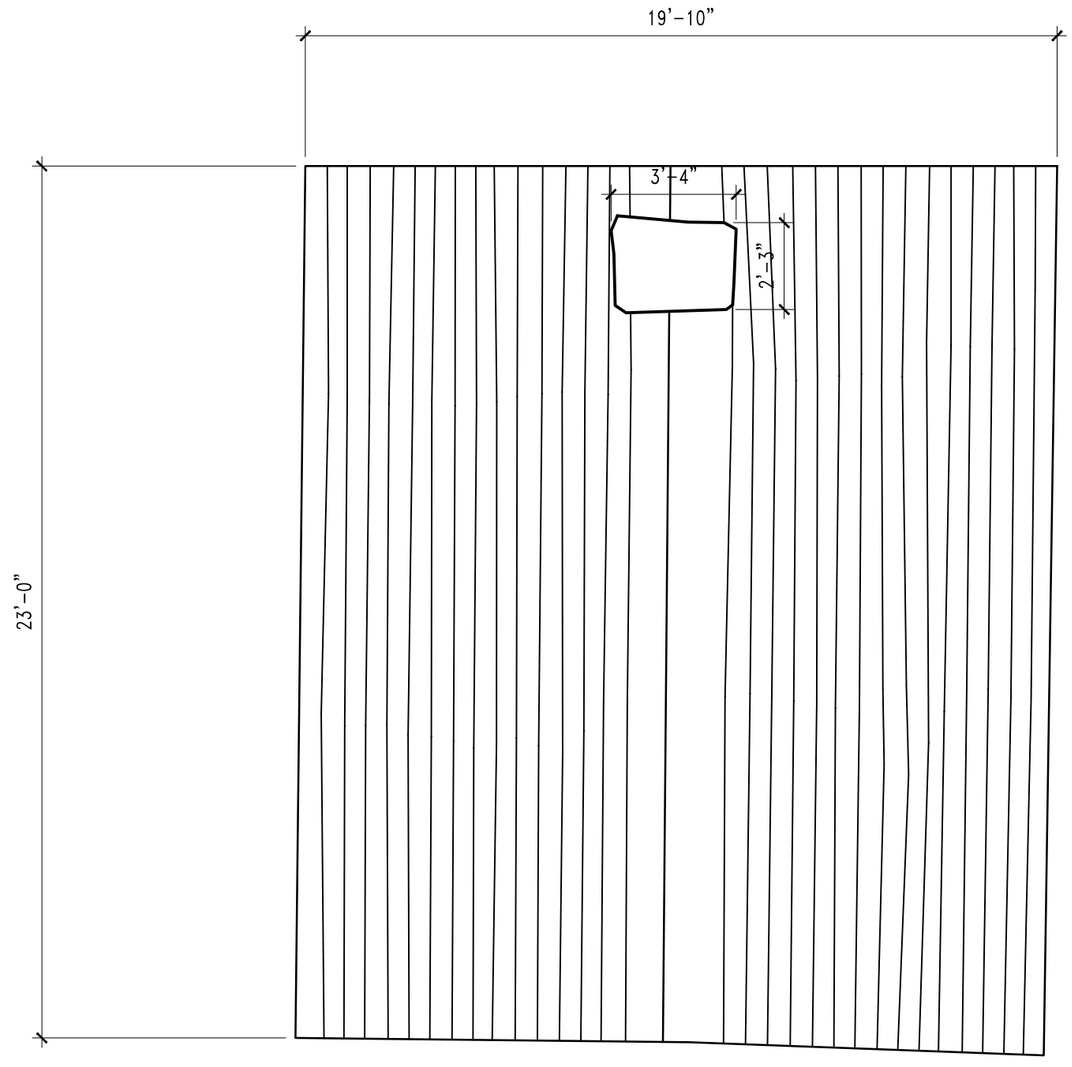
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FORT OGLETHORPE, GA

RECORDATION DATE: 05.05.2022

RECORDED BY: PA +CMW

SCALE: 1/4" = 1'-0"

HSR APPENDIX A: SHEET




DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

1 ROOF PLAN

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

BROTHERTON HOUSE

U.S. DEPT. OF THE INTERIOR: NATIONAL PARK SERVICE (NPS)
CHICKAMAUGA & CHATTANOOGA NATIONAL MILITARY PARK
FORT OGLETHORPE, GA

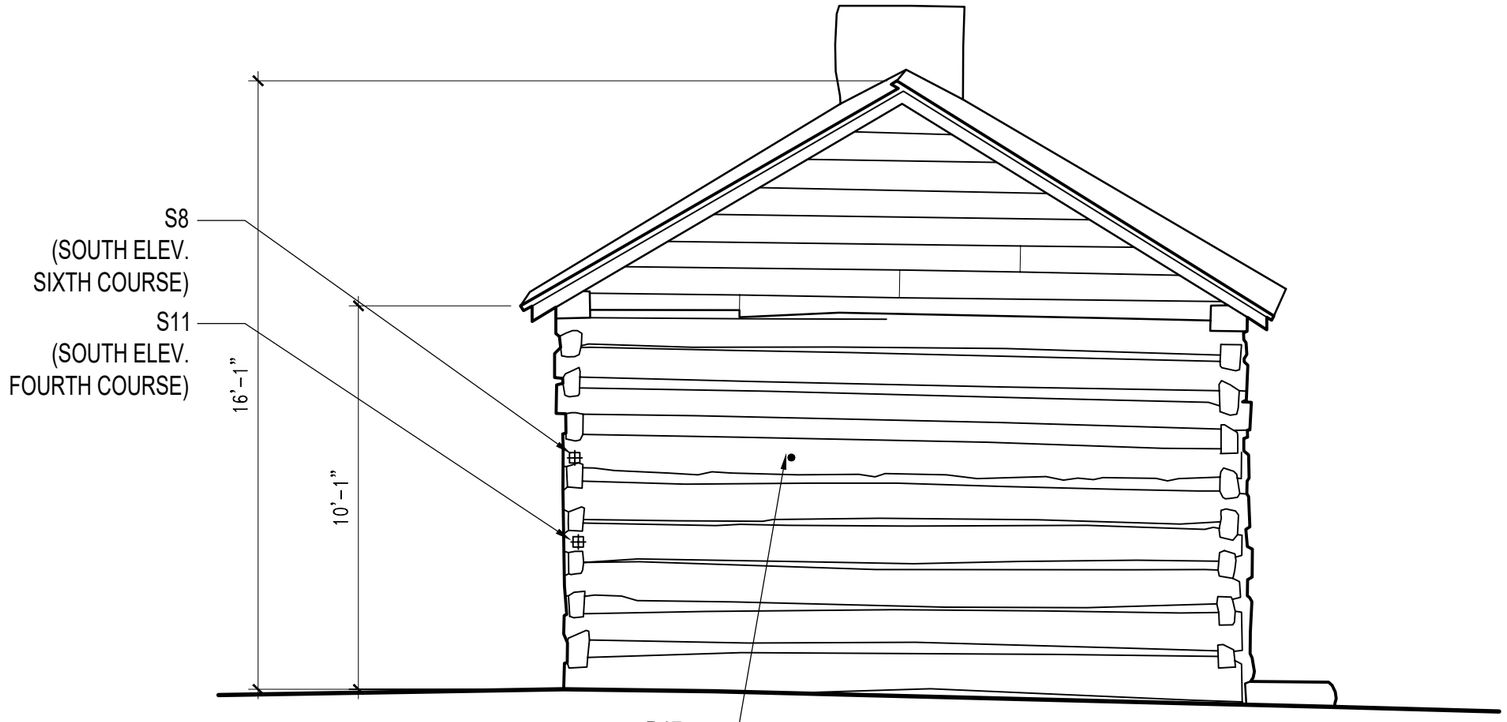
RECORDATION DATE:
05.05.2022

RECORDED BY:
PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET

25




NOTE: HEIGHTS VARY DUE TO DIFFERENCES IN GRADE

1 SOUTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

| DRAWING KEY |
| --- |
| ⌗ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⨯ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

BROTHERTON HOUSE

U.S. DEPT. OF THE INTERIOR: NATIONAL PARK SERVICE (NPS)
CHICKAMAUGA & CHATTANOOGA NATIONAL MILITARY PARK
FORT OGLETHORPE, GA

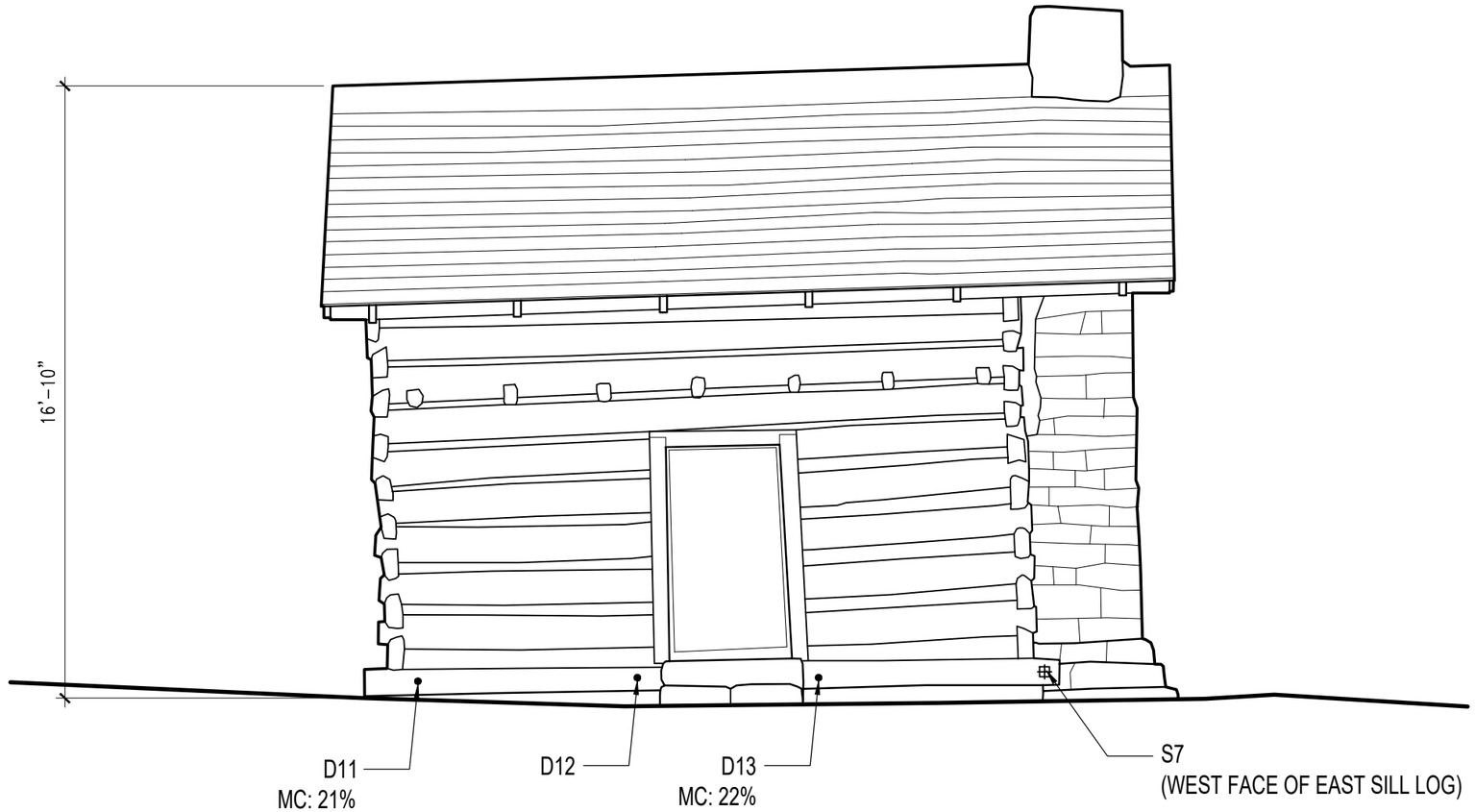
RECORDATION DATE: 05.05.2022

RECORDED BY: PA +CMW

SCALE: 1/4" = 1'-0"

HSR APPENDIX A: SHEET

26




NOTE: HEIGHTS VARY DUE TO DIFFERENCES IN GRADE

1 EAST ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌘ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

BROTHERTON HOUSE

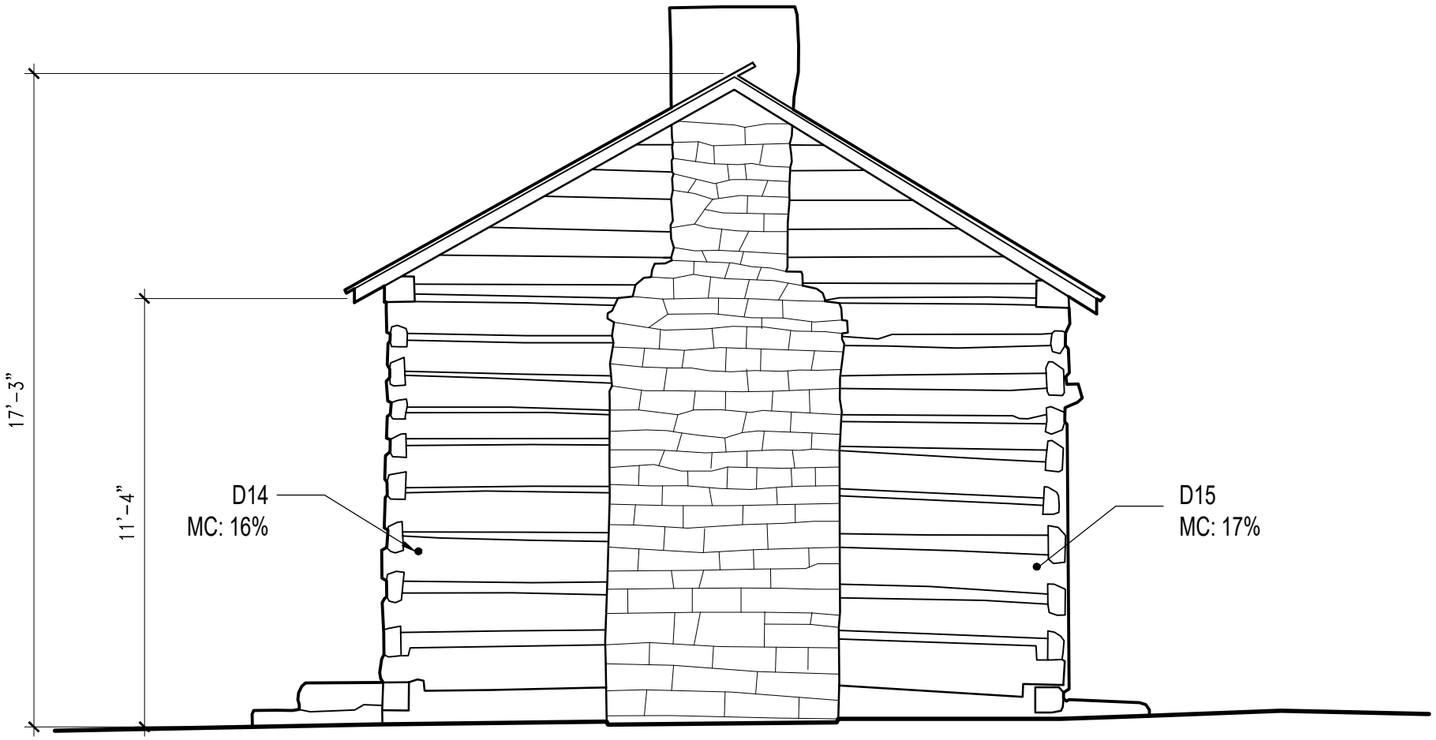
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FORT OGLETHORPE, GA

RECORDATION DATE:
05.05.2022

RECORDED BY:
PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET
27




NOTE: HEIGHTS VARY DUE TO DIFFERENCES IN GRADE

1 NORTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌖ MOISTURE CONTENT READING |

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

# BROTHERTON HOUSE

U.S. DEPT. OF THE INTERIOR: NATIONAL PARK SERVICE (NPS)
CHICKAMAUGA & CHATTANOOGA NATIONAL MILITARY PARK
FORT OGLETHORPE, GA

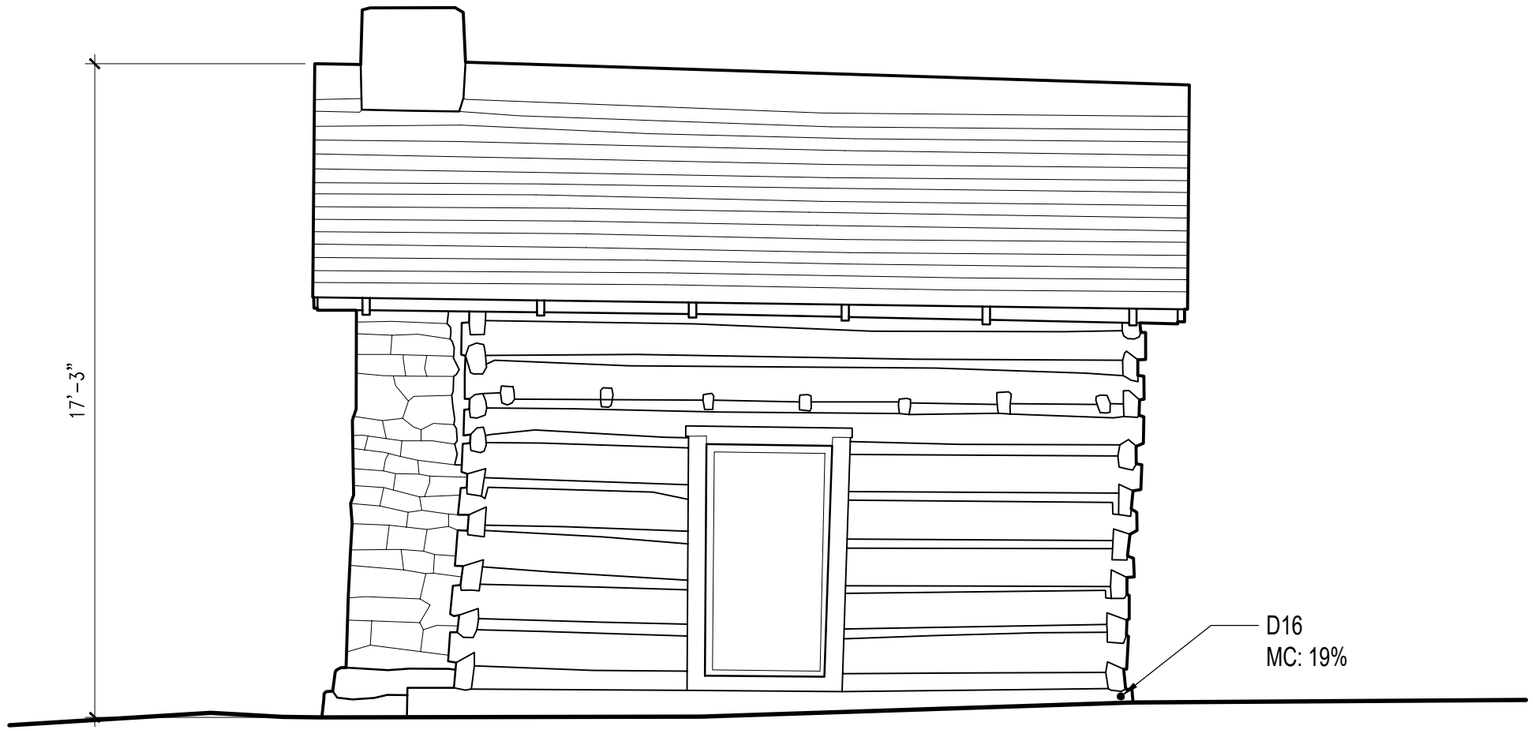
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PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET

28




NOTE: HEIGHTS VARY DUE TO DIFFERENCES IN GRADE

1 WEST ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
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BROTHERTON HOUSE

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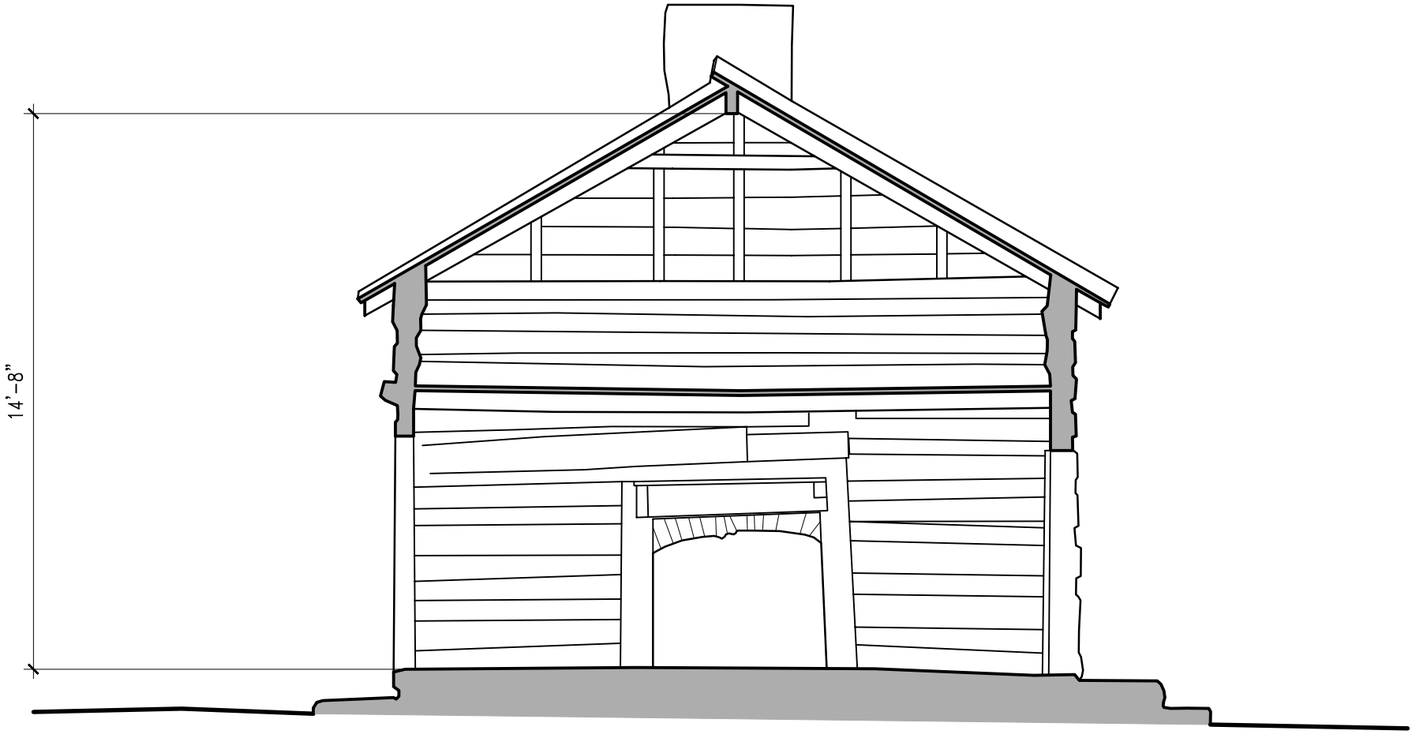
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SCALE:
1/4" = 1'-0"

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29




1 INTERIOR ELEV. - NORTH WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

NOTE: SEE APPENDIX D DRAWINGS FOR

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WINSTON-SALEM, NORTH CAROLINA

BROTHERTON HOUSE

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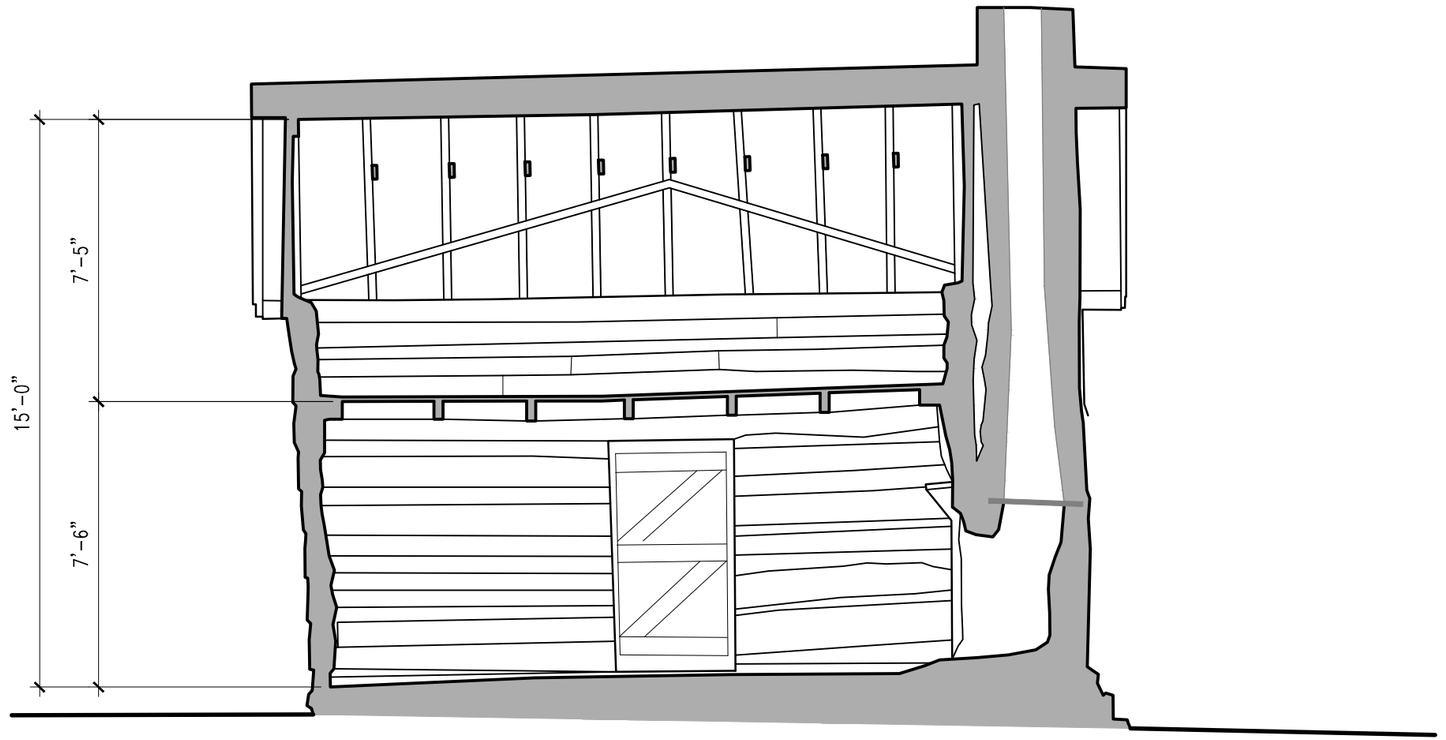
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SCALE:
1/4" = 1'-0"

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30




DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

1 INTERIOR - WEST WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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BROTHERTON HOUSE

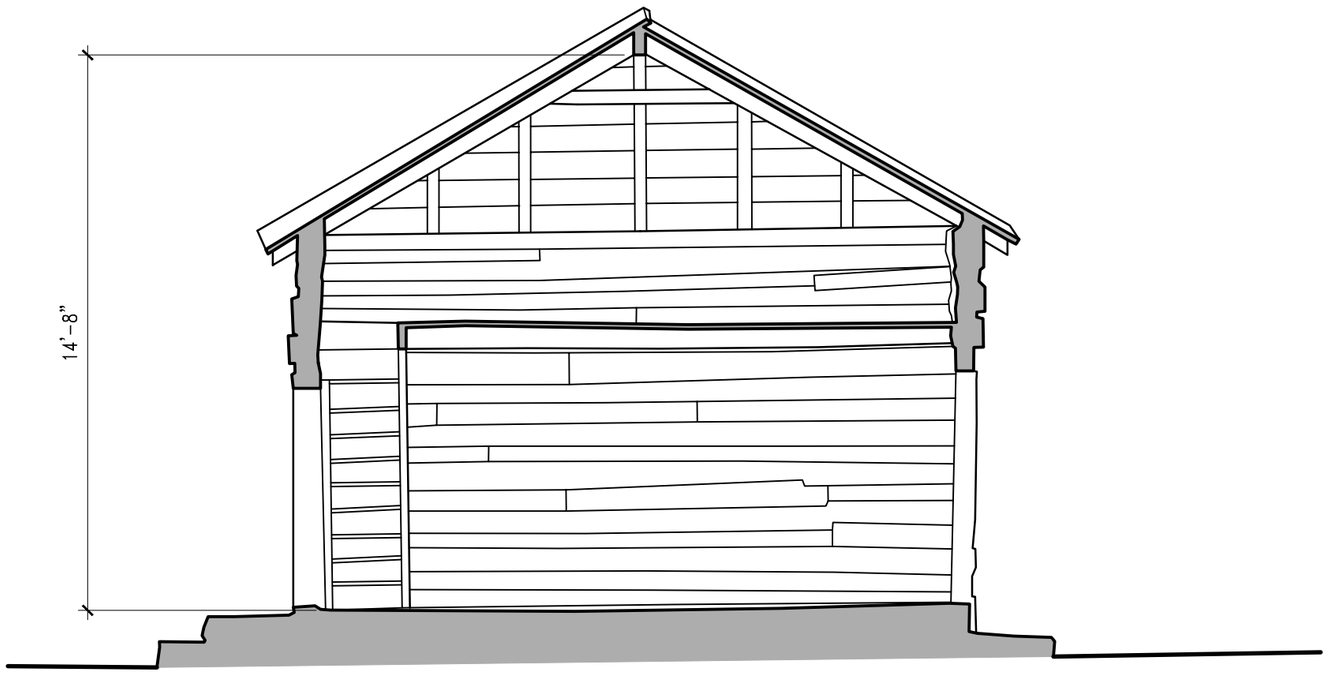
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SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET
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1 INTERIOR ELEV. - SOUTH WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

DRAWING KEY

- SAMPLE LOCATION
- RESISTANCE DRILLING LOCATION
- MOISTURE CONTENT READING

NOTE: SEE APPENDIX D DRAWINGS FOR ADDITIONAL STRUCTURAL INFORMATION

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
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# BROTHERTON HOUSE

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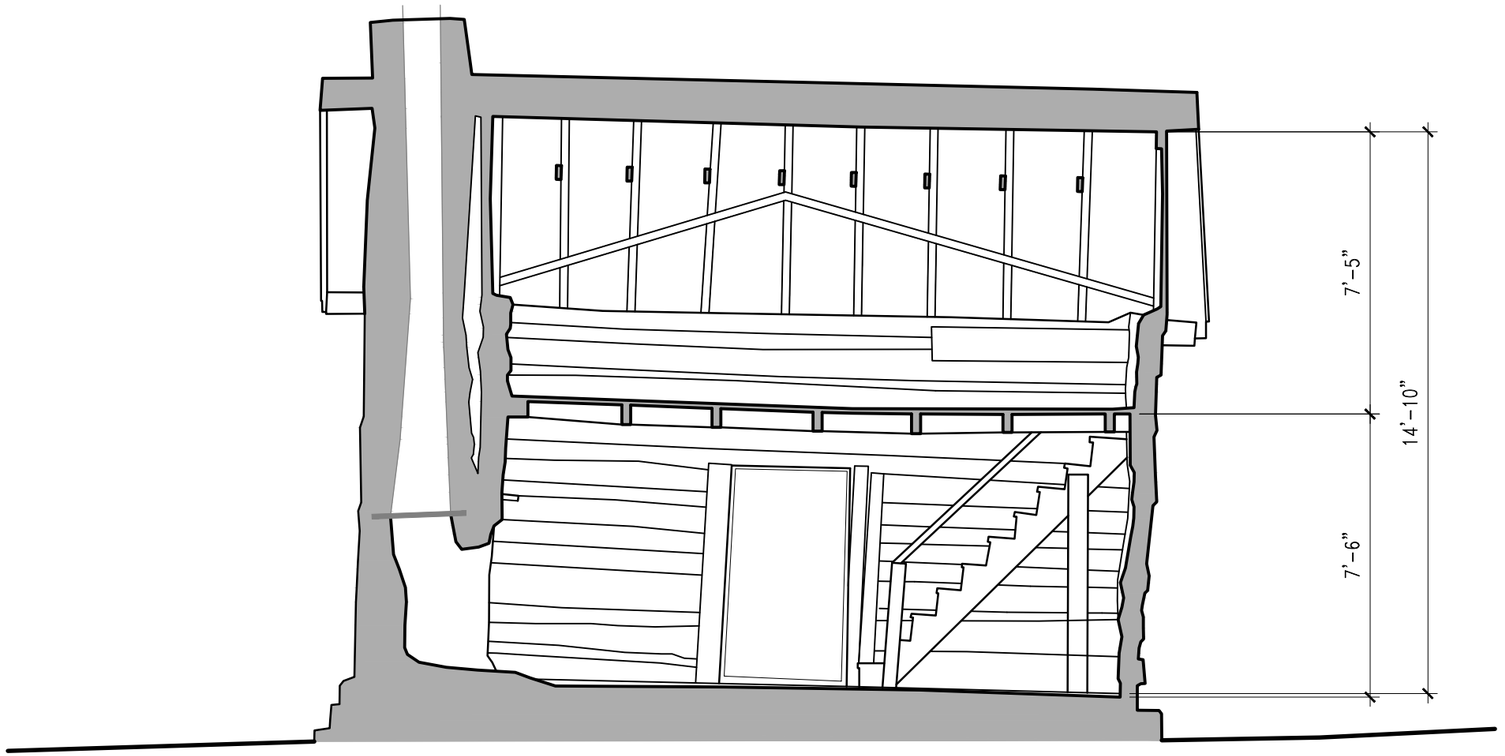
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RECORDED BY:
PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX A: SHEET

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| DRAWING KEY |
| --- |
| ⌖ SAMPLE LOCATION |
| • RESISTANCE DRILLING LOCATION |
| ⌘ MOISTURE CONTENT READING |

1 INTERIOR - EAST WALL

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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BROTHERTON HOUSE

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SCALE:
1/4" = 1'-0"

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# Appendix B:
# Historic Photo Comparison Elevations

***1. Snodgrass House***

Sheet 1:  South Elevation

Sheet 2: East Elevation

Sheet 3: North Elevation

Sheet 4: West Elevation

***2. Kelly House***

Sheet 5:  South Elevation

Sheet 6: East Elevation

Sheet 7: North Elevation

Sheet 8: West Elevation

***3. Brotherton House***

Sheet 9:  South Elevation

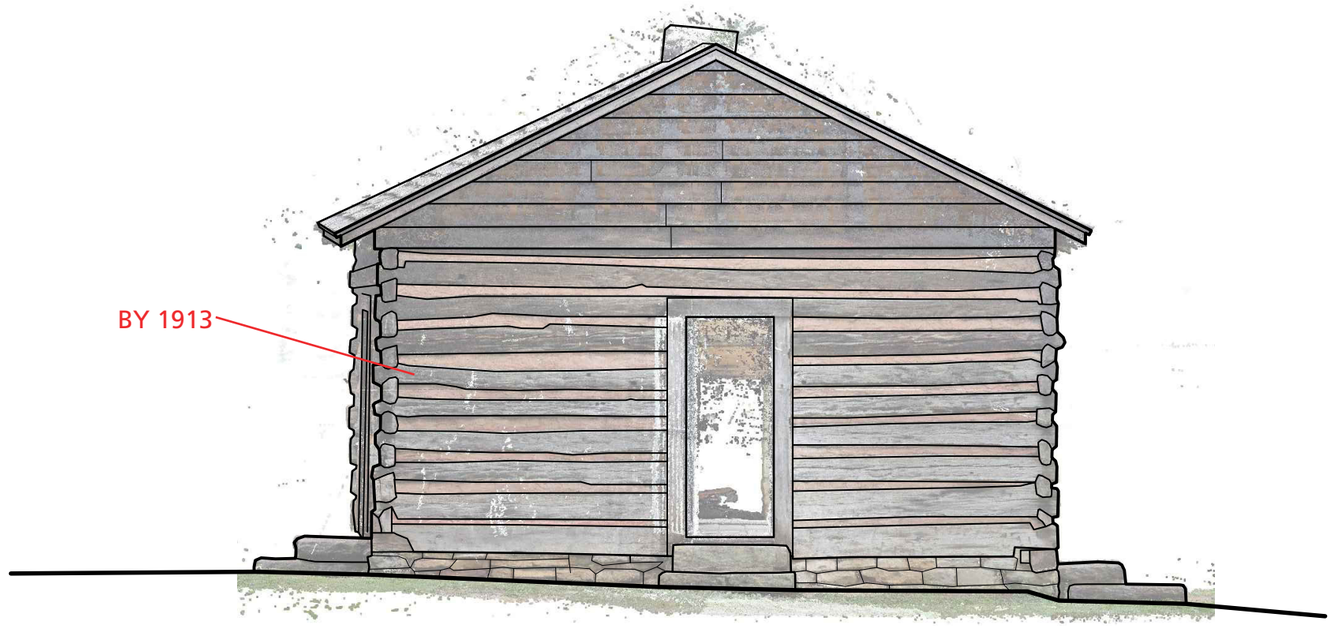
Sheet 10: East Elevation

Sheet 11: North Elevation

Sheet 12: West Elevation



Snodgrass House: South and West Elevations ca. 1913. Photo included for comparison - resolution not high enough to identify many individual log characteristics. One unique log identified.




NOTE: SNODGRASS EAST ELEVATION SHOWS LARGE AMOUNTS OF MATERIAL REMAINING FROM 1895. IT IS REASONABLE TO ASSUME THAT MUCH OF THE WALL MATERIAL OF THE MAIN CABIN DATES FROM THIS TIME, HOWEVER, PHOTOS HAVE NOT BEEN LOCATED.

NOTE: LOGS COMPARED VISUALLY BASED ON AVAILABLE DATED PHOTOGRAPHS. DATES HAVE BEEN PROVIDED BASED ON LIMITED EVIDENCE AND SHOULD BE WEIGHED ACCORDINGLY. PHOTOS WERE NOT AVAILABLE FOR EACH ELEVATION DURING A GIVEN PERIOD. SOME PHOTOS ARE NOT OF HIGH ENOUGH RESOLUTION TO MAKE A DETERMINATION. ROOF STRUCTURE KNOWN TO HAVE BEEN REPLACED IN 1961.

1 SOUTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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SNODGRASS HOUSE

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SCALE: 1/4" = 1'-0"

HSR APPENDIX B: SHEET 1



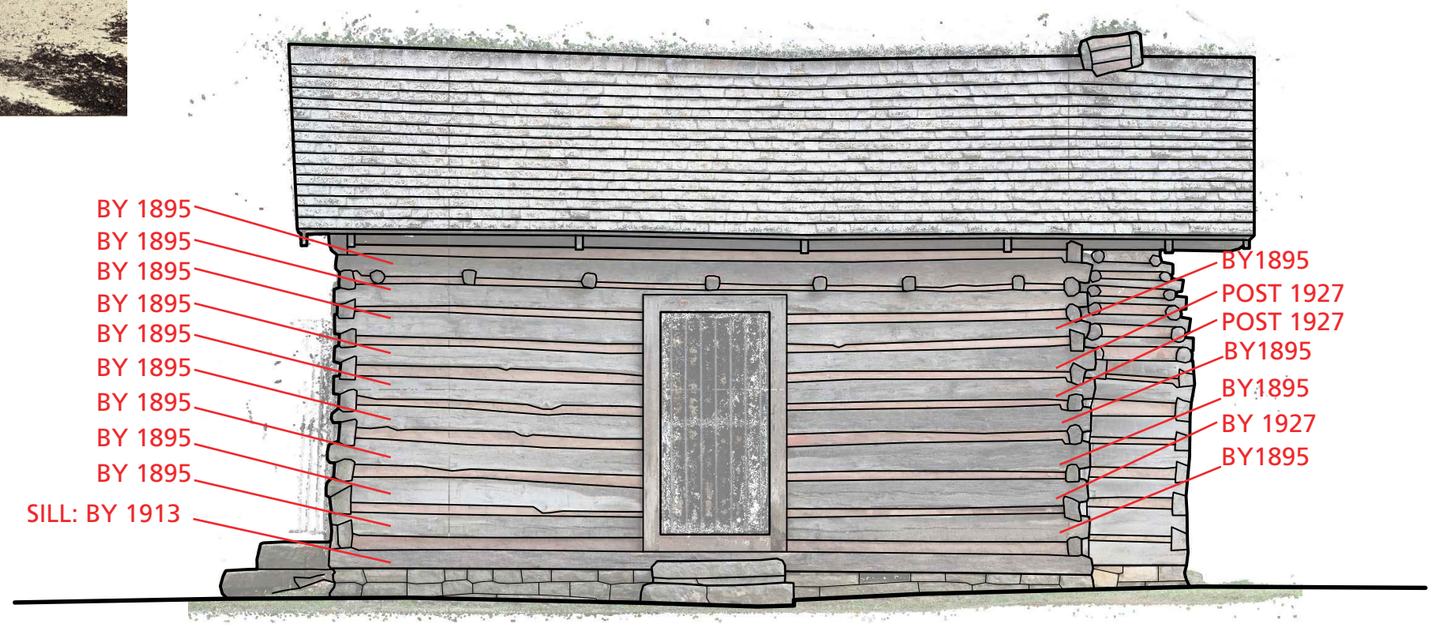
Snodgrass House: East Elevation 1895



Snodgrass House: East Elevation ca. 1913.



Snodgrass House: East Elevation 1927.




NOTE: LOGS COMPARED VISUALLY BASED ON AVAILABLE DATED PHOTOGRAPHS. DATES HAVE BEEN PROVIDED BASED ON LIMITED EVIDENCE AND SHOULD BE WEIGHED ACCORDINGLY. PHOTOS WERE NOT AVAILABLE FOR EACH ELEVATION DURING A GIVEN PERIOD. SOME PHOTOS ARE NOT OF HIGH ENOUGH RESOLUTION TO MAKE A DETERMINATION. ROOF STRUCTURE KNOWN TO HAVE BEEN REPLACED IN 1961.

1 EAST ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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SNODGRASS HOUSE

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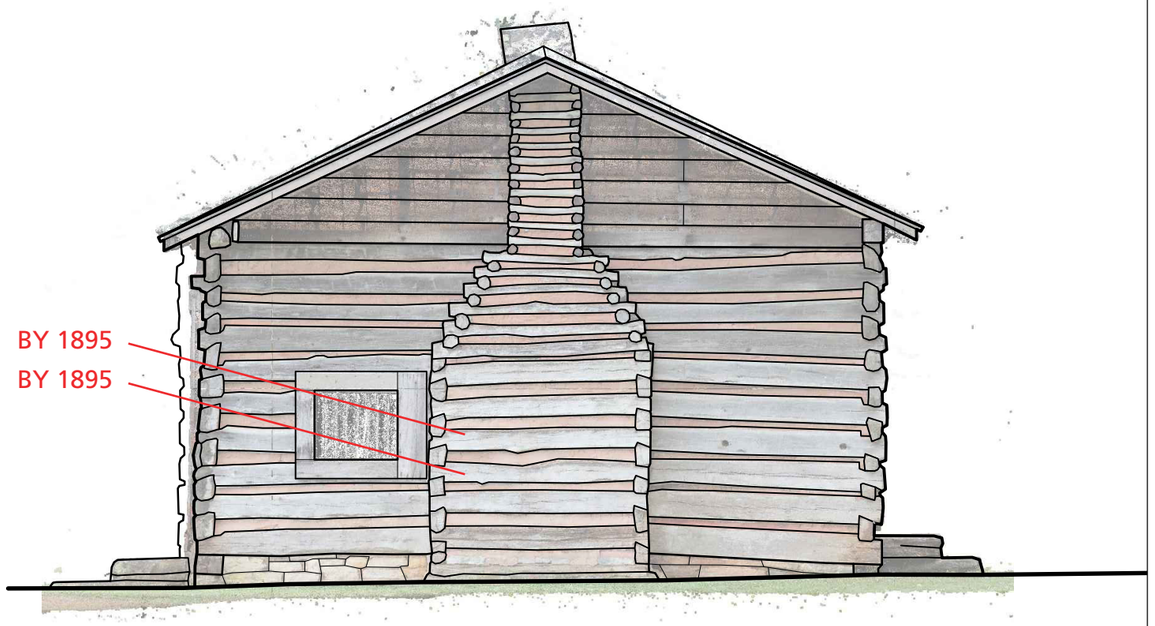
RECORDED BY:
PA +CMW

SCALE:
1/4" = 1'-0"

HSR APPENDIX B: SHEET
2



Snodgrass House: Partial North Elevation 1895




NOTE: SNODGRASS EAST ELEVATION SHOWS LARGE AMOUNTS OF MATERIAL REMAINING FROM 1895. IT IS REASONABLE TO ASSUME THAT MUCH OF THE WALL MATERIAL OF THE MAIN CABIN DATES FROM THIS TIME, HOWEVER, PHOTOS HAVE NOT BEEN LOCATED.

NOTE: LOGS COMPARED VISUALLY BASED ON AVAILABLE DATED PHOTOGRAPHS. DATES HAVE BEEN PROVIDED BASED ON LIMITED EVIDENCE AND SHOULD BE WEIGHED ACCORDINGLY. PHOTOS WERE NOT AVAILABLE FOR EACH ELEVATION DURING A GIVEN PERIOD. SOME PHOTOS ARE NOT OF HIGH ENOUGH RESOLUTION TO MAKE A DETERMINATION. ROOF STRUCTURE KNOWN TO HAVE BEEN REPLACED IN 1961.

1 NORTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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SNODGRASS HOUSE

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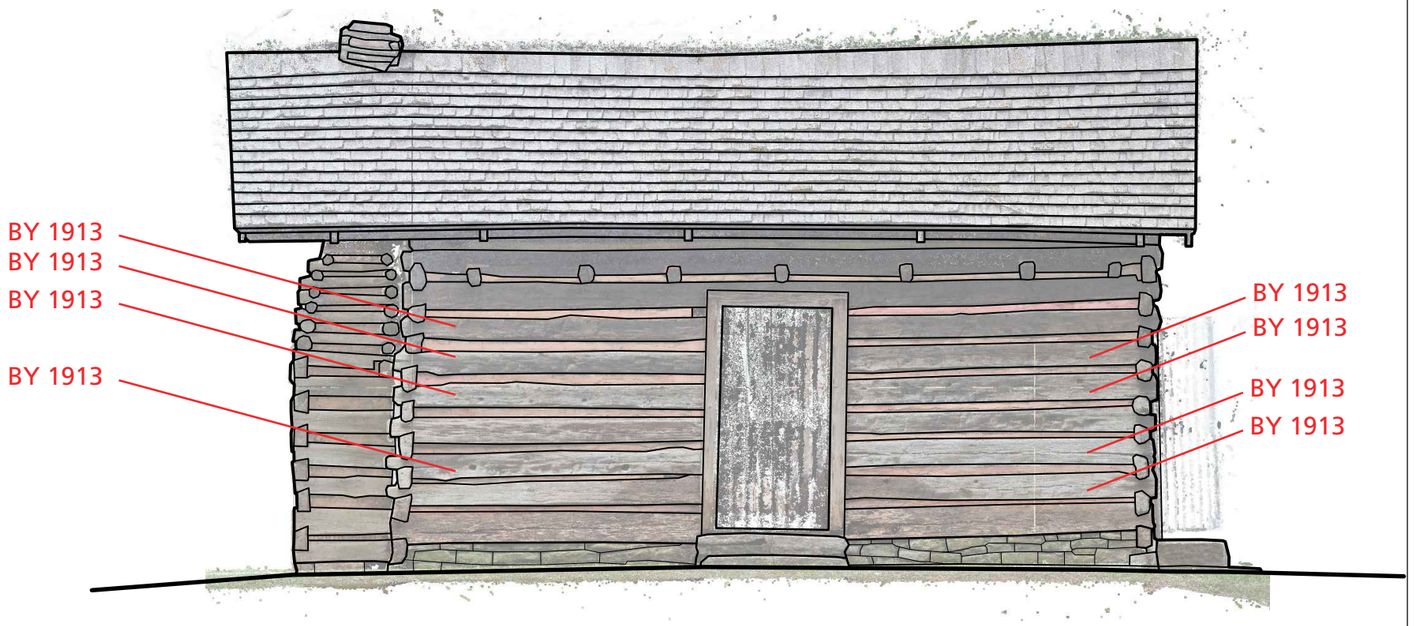
SCALE:
1/4" = 1'-0"

HSR APPENDIX B: SHEET

3



Snodgrass House: West Elevation ca.1913.




NOTE: SNODGRASS EAST ELEVATION SHOWS LARGE AMOUNTS OF MATERIAL REMAINING FROM 1895. IT IS REASONABLE TO ASSUME THAT MUCH OF THE WALL MATERIAL OF THE MAIN CABIN DATES FROM THIS TIME, HOWEVER, PHOTOS HAVE NOT BEEN LOCATED.

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1 WEST ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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SNODGRASS HOUSE

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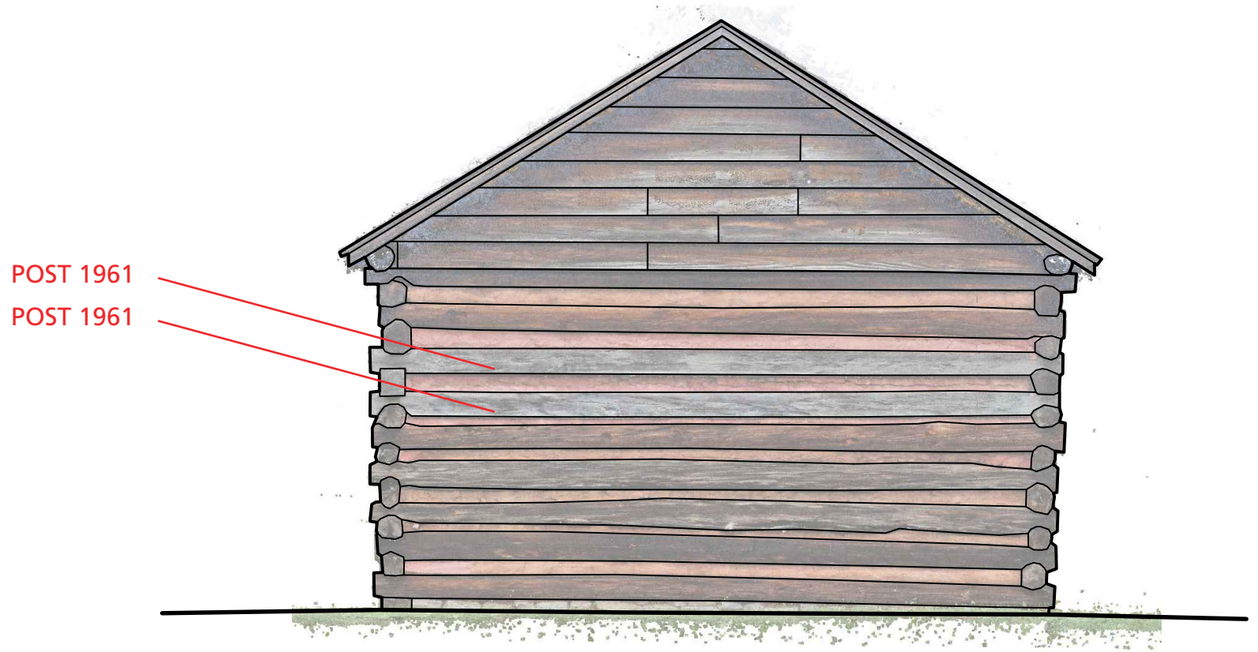
SCALE: 1/4" = 1'-0"

HSR APPENDIX B: SHEET

4



Kelly House: South Elevation, May 1961




NOTE: HIGH RESOLUTION PHOTOS OF KELLY SOUTH ELEVATION PRIOR TO 1961 HAVE NOT BEEN LOCATED.

NOTE: LOGS COMPARED VISUALLY BASED ON AVAILABLE DATED PHOTOGRAPHS. DATES HAVE BEEN PROVIDED BASED ON LIMITED EVIDENCE AND SHOULD BE WEIGHED ACCORDINGLY. PHOTOS WERE NOT AVAILABLE FOR EACH ELEVATION DURING A GIVEN PERIOD. SOME PHOTOS ARE NOT OF HIGH ENOUGH RESOLUTION TO MAKE A DETERMINATION. ROOF STRUCTURE KNOWN TO HAVE BEEN REPLACED IN 1961.

1 SOUTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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KELLY HOUSE

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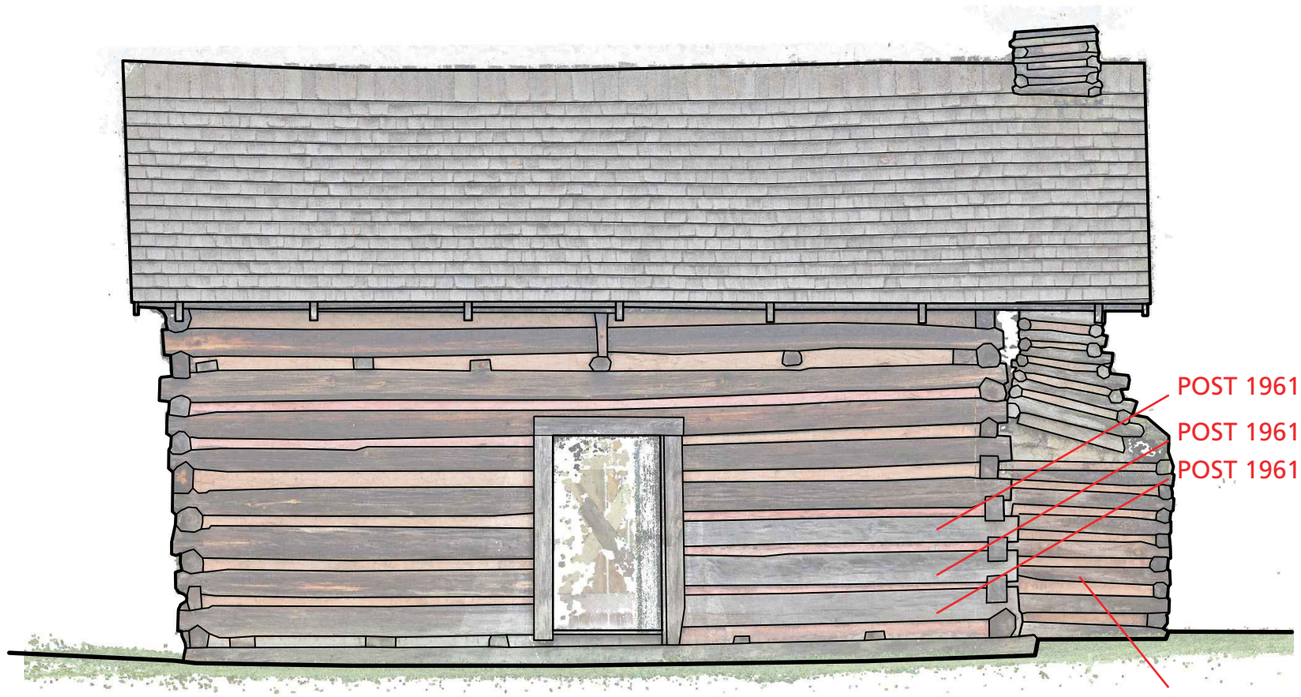
SCALE:
1/4" = 1'-0"

HSR APPENDIX B: SHEET

5



Kelly House: Partial East Elevation, May 1961




NOTE: HIGH RESOLUTION PHOTOS OF KELLY EAST ELEVATION PRIOR TO 1961 HAVE NOT BEEN LOCATED.

NOTE: LOGS COMPARED VISUALLY BASED ON AVAILABLE DATED PHOTOGRAPHS. DATES HAVE BEEN PROVIDED BASED ON LIMITED EVIDENCE AND SHOULD BE WEIGHED ACCORDINGLY. PHOTOS WERE NOT AVAILABLE FOR EACH ELEVATION DURING A GIVEN PERIOD. SOME PHOTOS ARE NOT OF HIGH ENOUGH RESOLUTION TO MAKE A DETERMINATION. ROOF STRUCTURE KNOWN TO HAVE BEEN REPLACED IN 1961.

1 EAST ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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KELLY HOUSE

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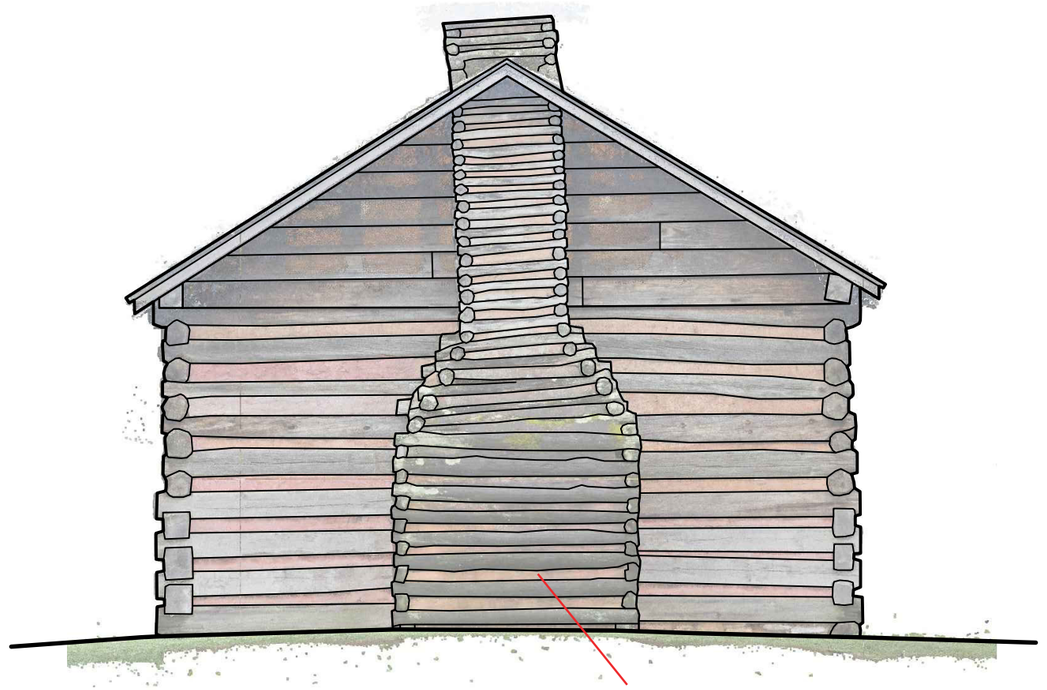
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SCALE:
1/4" = 1'-0"

HSR APPENDIX B: SHEET
6



Kelly House: Northwest oblique, ca. 1917.



CHIMNEY
RECONSTRUCTED
IN 1961.

PHOTO NOT OF HIGH ENOUGH RESOLUTION
TO MAKE CONCLUSIONS.

1 NORTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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KELLY HOUSE

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SCALE:
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APPENDIX B:
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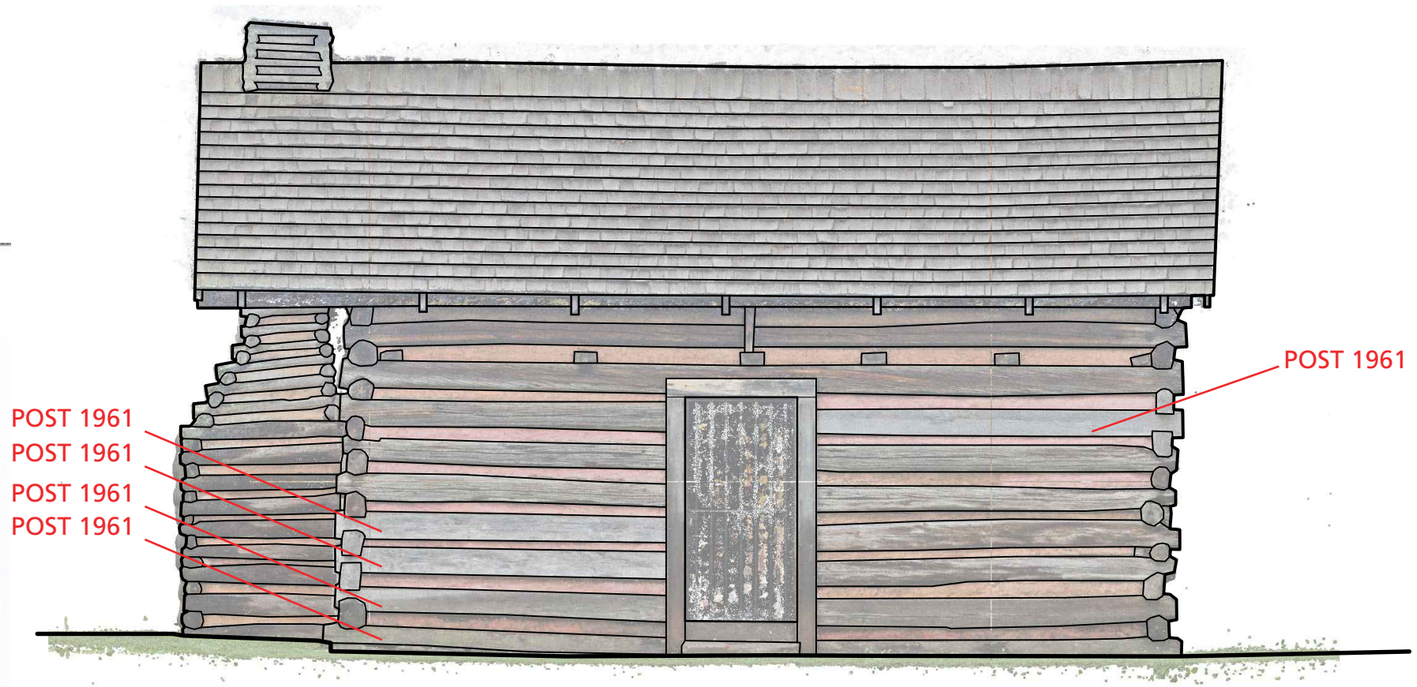
7



Kelly House: Northwest oblique, ca. 1917.




Kelly House: West Elevation, May 1961.




NOTE: LOGS COMPARED VISUALLY BASED ON AVAILABLE DATED PHOTOGRAPHS. DATES HAVE BEEN PROVIDED BASED ON LIMITED EVIDENCE AND SHOULD BE WEIGHED ACCORDINGLY. PHOTOS WERE NOT AVAILABLE FOR EACH ELEVATION DURING A GIVEN PERIOD. SOME PHOTOS ARE NOT OF HIGH ENOUGH RESOLUTION TO MAKE A DETERMINATION. ROOF STRUCTURE KNOWN TO HAVE BEEN REPLACED IN 1961.

1 WEST ELEVATION
SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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KELLY HOUSE
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SCALE:
1/4" = 1'-0"

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8



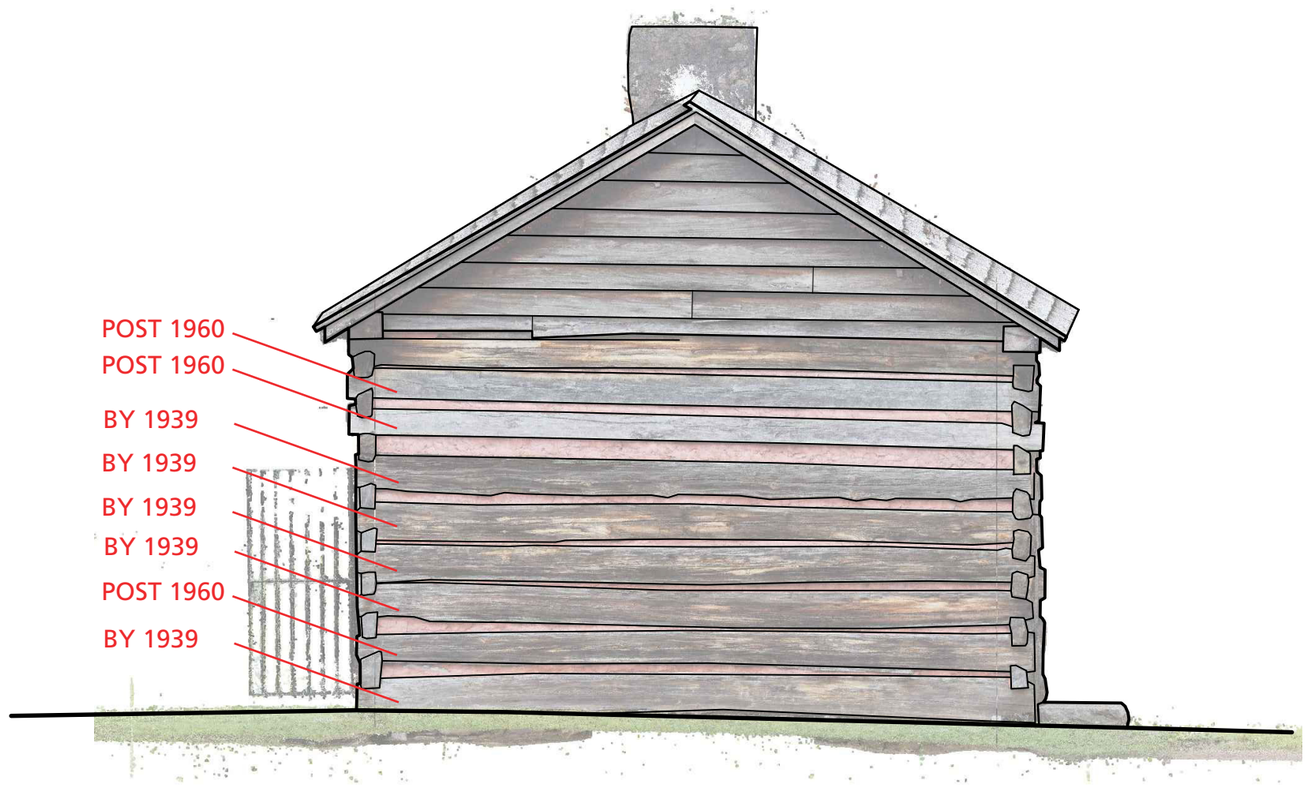
Brotherton House: Southwest Oblique, 1939.



Brotherton House: Southwest Oblique, 1955.



Brotherton House: Southwest Oblique, 1960.




NOTE: LOGS COMPARED VISUALLY BASED ON AVAILABLE DATED PHOTOGRAPHS. DATES HAVE BEEN PROVIDED BASED ON LIMITED EVIDENCE AND SHOULD BE WEIGHED ACCORDINGLY. PHOTOS WERE NOT AVAILABLE FOR EACH ELEVATION DURING A GIVEN PERIOD. SOME PHOTOS ARE NOT OF HIGH ENOUGH RESOLUTION TO MAKE A DETERMINATION. ROOF STRUCTURE KNOWN TO HAVE BEEN REPLACED IN 1961.

1 SOUTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
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BROTHERTON HOUSE

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SCALE: 1/4" = 1'-0"

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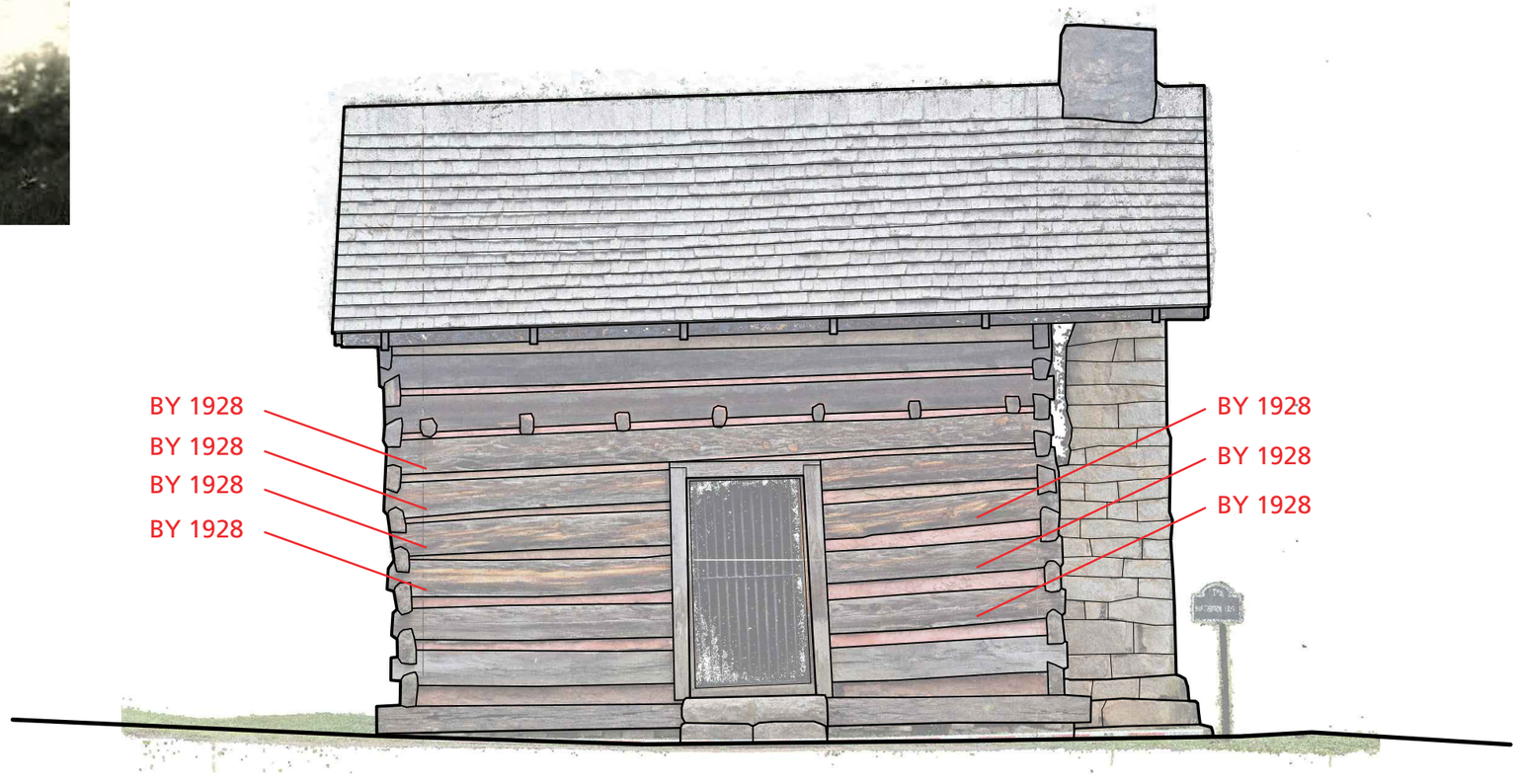
9



Brotherton House: East Elevation, June 1928




Brotherton House: Northeast Oblique, Undated, suggested ca. 1930s




NOTE: LOGS COMPARED VISUALLY BASED ON AVAILABLE DATED PHOTOGRAPHS. DATES HAVE BEEN PROVIDED BASED ON LIMITED EVIDENCE AND SHOULD BE WEIGHED ACCORDINGLY. PHOTOS WERE NOT AVAILABLE FOR EACH ELEVATION DURING A GIVEN PERIOD. SOME PHOTOS ARE NOT OF HIGH ENOUGH RESOLUTION TO MAKE A DETERMINATION. ROOF STRUCTURE KNOWN TO HAVE BEEN REPLACED IN 1961.

1 EAST ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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BROTHERTON HOUSE

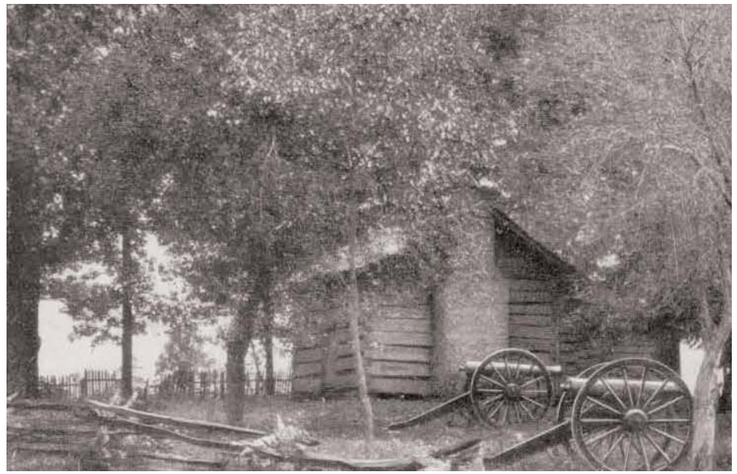
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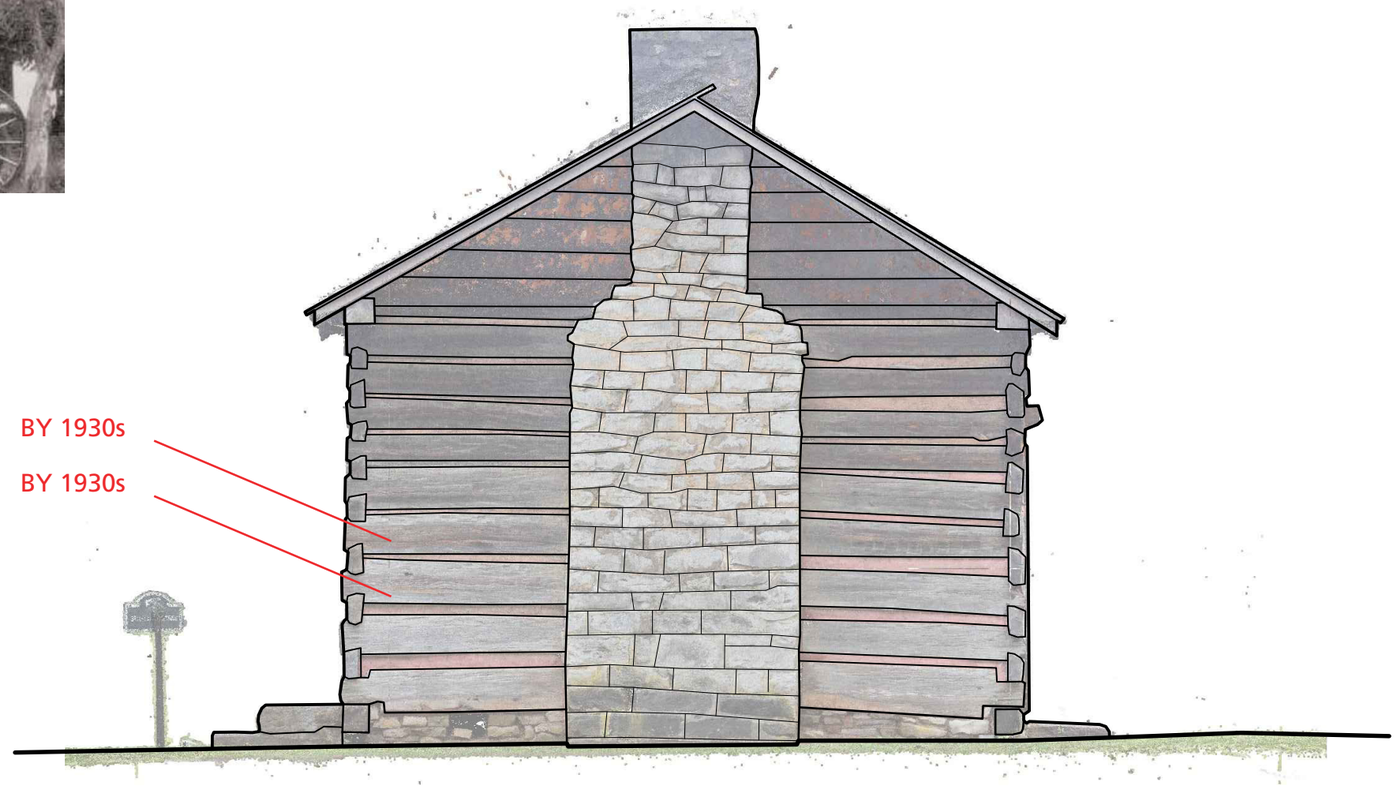
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Brotherton House: Northeast Oblique, ca. 1895.




Brotherton House: Northeast Oblique, ca. 1930s




NOTE: LOGS COMPARED VISUALLY BASED ON AVAILABLE DATED PHOTOGRAPHS. DATES HAVE BEEN PROVIDED BASED ON LIMITED EVIDENCE AND SHOULD BE WEIGHED ACCORDINGLY. PHOTOS WERE NOT AVAILABLE FOR EACH ELEVATION DURING A GIVEN PERIOD. SOME PHOTOS ARE NOT OF HIGH ENOUGH RESOLUTION TO MAKE A DETERMINATION. ROOF STRUCTURE KNOWN TO HAVE BEEN REPLACED IN 1961.

1 NORTH ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
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BROTHERTON HOUSE

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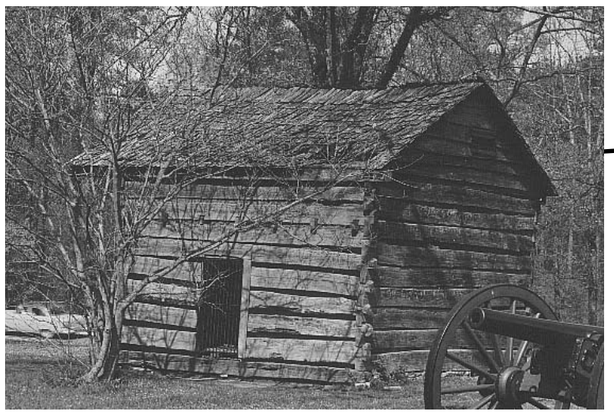
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11



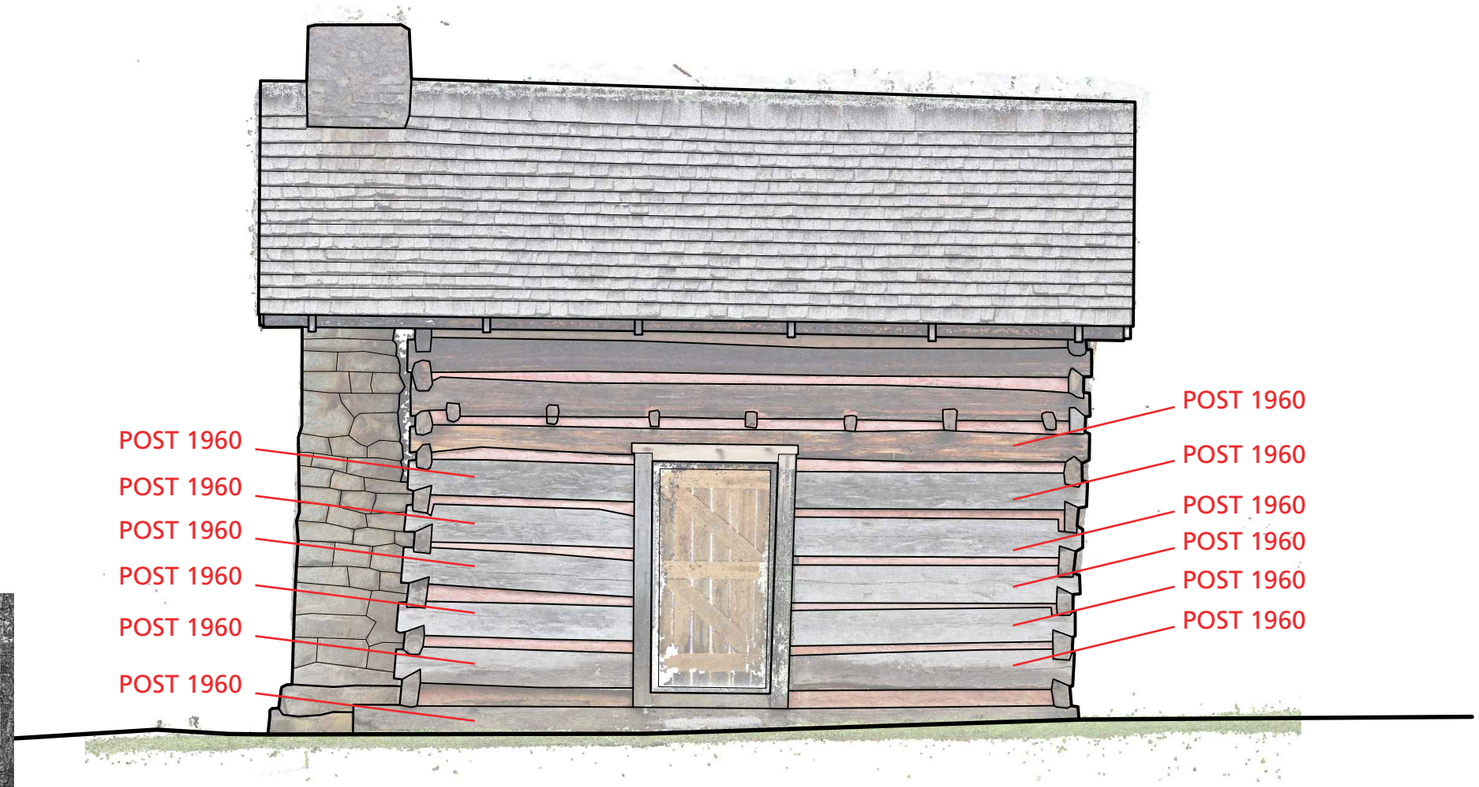
Brotherton House: Southwest Oblique, 1939.



Brotherton House: Southwest Oblique, 1955.



Brotherton House: Southwest Oblique, 1960.




NOTE: LOGS COMPARED VISUALLY BASED ON AVAILABLE DATED PHOTOGRAPHS. DATES HAVE BEEN PROVIDED BASED ON LIMITED EVIDENCE AND SHOULD BE WEIGHED ACCORDINGLY. PHOTOS WERE NOT AVAILABLE FOR EACH ELEVATION DURING A GIVEN PERIOD. SOME PHOTOS ARE NOT OF HIGH ENOUGH RESOLUTION TO MAKE A DETERMINATION. ROOF STRUCTURE KNOWN TO HAVE BEEN REPLACED IN 1961.

1 WEST ELEVATION

SCALE: 1/4" = 1'-0"

0 2' 4' 8' 12'

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BROTHERTON HOUSE

U.S. DEPT. OF THE INTERIOR: NATIONAL PARK SERVICE (NPS)
CHICKAMAUGA & CHATTANOOGA NATIONAL MILITARY PARK
FORT OGLETHORPE, GA

RECORDATION DATE: 05.05.2022

RECORDED BY: PA +CMW

SCALE: 1/4" = 1'-0"

HSR APPENDIX B: SHEET

12

# Appendix C:
# Structural Investigation by 1200AE

MCC 1200
ARCHITECTURAL ENGINEERS PLLC

# CHCH Snodgrass, Kelly, and Brotherton Houses

## Historic Structure Report



1200AE PROJECT NO. 21-129

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# Introduction

The historic houses on the battlefield of Chickamauga include the Brotherton, Kelly, and Snodgrass houses, three one-room log cabins. They are the only survivors of the twenty-four farm complexes that dotted the landscape in 1863 and are considered to be contributing to the national significance of the Chickamauga Battlefield. Brotherton and Kelly Houses were rebuilt after the battle by their owners and Snodgrass House is thought to contain a portion of the 1863 structure.

1200 Architectural Engineers (1200AE) is preparing the structural portion of a Historic Structure Report (HSR) for the three historic buildings for the National Park Service (NPS). The park would like to restore, repair, and rehabilitate these houses and explore various ways in which to utilize them. This document will provide the management of the Chickamauga and Chattanooga National Military Park with a conditions assessment of the structural elements of the historic houses and will develop specific structural treatment and monitoring recommendations to ensure their preservation. The structures' vulnerability to potential future natural hazards, based on NPS Park Climate Projections, will also inform these recommendations.

# Investigation - General

1200AE visited the sites on May 2 and 3, 2022 to document the existing structures and their conditions. This site visit was performed in coordination with representatives from Joseph K. Oppermann - Architect, P. A. and from Anthony & Associates, Inc., the wood scientist. Structural elements were measured and recorded in field notes and photographs.

Observations are summarized below by house, accompanied by photographs as appropriate. Framing plans with member sizes and conditions are included in Appendices C1, C2 and C3.

# Criteria for Structural Analysis

### *Applicable Codes and Standards*

The following codes and standards are specified by the local Building Department:

1. The International Building Code (IBC), 2018 edition, with Georgia amendments (2020 and 2022)

2. The International Existing Building Code (IEBC), 2018 edition, with Georgia amendments (2020 and 2022)

3. ASCE 7-16, Minimum Design Loads for Buildings and Other Structures

The following structural design codes will be followed as specified by the governing codes and standards:

4. NDS 2018, National Design Specification for Wood Construction
5. TMS 402-16, Building Code Requirements for Masonry Structures
6. TMS 602-16, Specification for Masonry Structures

### *Structural Loading*

1. Risk Category

   The Risk Category of buildings and other structures is determined based on the building's use or occupancy. Factors influencing this determination include the total number of persons who would be at risk were failure to occur, the mobility of the occupants and their ability to cope with dangerous situations, the potential for release of toxic chemicals, and the loss of services vital to the welfare of the community. Risk Category I represents the lowest and Risk Category IV represents the highest risk based on these criteria.

   Given that the future use of the building has not yet been determined, two Risk Categories appear possible:

   Risk Category I structures generally encompass buildings that normally are unoccupied and that would result in negligible risk to the public should they fail. These have included barns, storage shelters, and similar small structures.

   Risk Category II includes the vast majority of structures, including most residential, commercial and industrial buildings.

2. Uniformly Distributed Live Loading

   The following values are specified by the applicable codes and standards and have been selected as potential future uses of the space(s).

| Occupancy or Use | Live Loadings | |
|---|---|---|
| | Uniform | Concentrated |
| Classrooms | 40 psf | 1000 lbs |
| Meeting Rooms / Offices | 50 psf | 2000 lbs |
| Typical Residential Spaces, U.N.O. | 40 psf | 300 lbs |
| Residential Stairs | 40 psf | 300 lbs on 4 $in^2$ |
| Habitable Attics and Sleeping Areas | 30 psf | 300 lbs |
| Uninhabitable Attics with Storage* | 20 psf | 300 lbs |
| Uninhabitable Attics without Storage | 10 psf | 300 lbs |
| Roof (unreduced) | 20 psf | 300 lbs |

* Applied only to areas where clear height between the floor and the underside of the rafters is 42" or greater

Roof live load reduction is permitted by code and depends on the tributary area of a framing member as well as the roof slope. Based on the roof slope of the cabins, the roof live load can be reduced from 20 psf to 18 psf.

3. Exposure Category

The exposure category is based on a combination of the wind direction and the surface roughness of the site surrounding the structure.

| | |
|---|---|
| Mean Roof Height | 13 feet +/- ( < 30 feet) |
| Surface Roughness | B (wooded areas), C (flat open terrain) |
| Exposure | B for Surface Roughness B<br>C for Surface Roughness C |

In the case of the cabins, Kelly House is fully exposed and falls into Category C. Snodgrass and Brotherton Houses are adjacent to trees or wooded areas on one side of the cabins and likely fall between Category B and C, depending on the wind direction. Category C will be used for calculations of snow and wind loads for all cabins.

4. Snow Loading

Sloped roof snow loads and unbalanced snow loads will be accounted for in accordance with ASCE 7.

| | |
|---|---|
| Ground Snow Load (pg) | 10 psf |
| Exposure of Roof | Fully exposed |
| Exposure Factor (Ce) | 0.9 |
| Thermal Factor (Ct) | 1.2 (Unheated and open air structures) |
| Cold Roof Slope Factor (Cs) | 1.0 |

| | Risk Category I | Risk Category II |
|---|---|---|
| Importance Factor (Is) | 0.8 | 1.00 |
| Sloped Roof Snow Load (ps) | 6.1 psf | 7.6 psf |

5. Wind Loading

The ASCE 7 Section on wind loads is used to calculate the design forces. The design base shear is found using the static force procedure with the following factors:

| | |
|---|---|
| Wind Exposure | C (see above) |

| | Risk Category I | Risk Category II |
|---|---|---|
| Basic Wind Speed (V) | 97 mph | 105 mph |
| Importance Factor (Iw) | 1.0 | 1.0 |

Tornadoes have not been considered in the ASCE7 wind load provisions because of their low probability of occurrence. However, some building owners may choose to consider them to provide occupants a greater level of protection or to minimize building damage.

| | |
|---|---|
| Tornado Wind Speed | 250 mph |
| EF Number | EF-5 (Enhanced Fujita Scale) |

6. Seismic Loading

   The ASCE 7 Section on earthquake loads is used to calculate the design forces. The design base shear is found using the equivalent lateral force procedure, simplified design procedure, with the following factors:

| | |
|---|---|
| Site Class (soil factor) | D (assumed, to be verified) |
| Short Period Map Value ($S_s$) | 49.4% g |
| 1-Sec Period Map Value ($S_1$) | 12.3% g |
| 5% Spectral Response Acceleration ($S_{DS}$) | 46.3% g |
| 5% Spectral Response Acceleration ($S_{D1}$) | 19.3% g |
| Seismic Design Category | C |
| Importance Factor (Ie) | 1.0 (For both Risk Categories I and II) |
| | |
| Basic Structural System | Wood log bearing walls |
| Seismic Resisting System | Wood log shear walls |
| Response Modification Factor (R) | 4.0 (see below) |

   In ASCE 7, shear panel walls with wood structural panels rated for shear resistance have an R value of 6.5, other non-rated shear panel walls have a R value of 2, and shear walls with flat strapped bracing have an R value of 4. Log walls are not specifically mentioned. Lower R values represent brittle/stiff systems and result in higher seismic design loads, whereas higher R values represent ductile/flexible systems and result in lower seismic design loads. Based on review of various publications regarding this topic, an R value of 4 has been selected for the log walls, as this value has been used for many years with great success in high seismic areas.

## Serviceability Considerations

1. Floor and Roof Deflections
   a) The floor live load deflection of wood beams not supporting ceiling finishes shall not exceed 1/360 of span lengths. Total deflection (dead + live) shall not exceed 1/240 of span lengths.
   b) The roof deflection under live, snow or wind load of wood beams not supporting ceiling finishes shall not exceed 1/240 of span lengths. Total deflection (dead + live) shall not exceed 1/180 of span lengths.

## Structural Behavior of a Log House

Log buildings resist gravity (dead, live and snow) loads through the compressive strength of the log walls themselves. The roof framing (and second floor framing, where present), bears on the log walls below, which transfer the load from the top log down to the sill log and then down to the foundation in bearing. Where gravity loads imposed on the roof framing cause the rafter

bases to thrust outward, collar ties attached to the rafters and/or tie beams high in the log walls can help resist the outward thrust.

Log buildings resist lateral (wind and seismic) loads through the interlocking joinery at the building corners, friction between courses of logs and the foundation, and any additional mechanical interlocking mechanisms introduced into the structure.

The specific structural behavior of each of the houses is discussed in more detail below.

# Snodgrass House

## General Description

Snodgrass House is located on Snodgrass Hill Road in the Chickamauga Battlefield. It is a single-pen, side-gabled log cabin approximately 26 feet by 20 feet in plan. There are doors on three sides of the cabin and a hewn-log, shouldered chimney on the fourth, the north side. The extant structure is thought to have been rebuilt using original logs of a larger structure.



**Figure 1**: General view of Snodgrass House

## Review of Available Documents

No existing drawings or written documents are currently available for Snodgrass House. Several historic photographs were provided by the Park; however, the dates are largely unknown.

## Existing Structure and Conditions

The existing structural elements and their conditions are described in detail below and are also documented in the accompanying sketches in Appendix C1. All photographs are by 1200AE unless noted otherwise.

## Foundation

The house is supported on a continuous stone foundation. It was measured to extend from 5" to 14-1/2" above grade, depending on the elevation and plan location. Due to the alternating coursing of the logs, the base logs, and therefore the top of stone foundation, at the gable ends are lower than the sill logs on the sides of the house (Figure 2). It is unknown how deep the walls extend below grade as no test pits were dug at this location.

A floorboard was removed at the interior of the west door threshold, exposing the interior face of the stone foundation wall. This was observed to extend approximately 3" beyond the inside face of the log wall (Figure 3).

Several loose stones were observed around the perimeter of the house, most prevalent at the corners. A cornerstone was displaced at the southwest corner (Figure 2). On the west side of the chimney, some stones were missing and have provided access for wildlife to enter the crawlspace below the floor joists (Figure 4).



**Figure 2:** Displaced stone at foundation, SW corner. Note base log is lower at south façade than at west façade due to log coursing.



**Figure 3:** Stone foundation wall interior projection at west wall



**Figure 4:** Missing stones at foundation west of chimney.

## Walls

The walls are constructed of chinked, hewn logs with straight sides, The east sill log was measured to be 7-3/4" wide by 6" deep and the east top plate was measured to be 6-1/2" wide by 8" deep. Typical wall logs are approximately 4" wide by 9" deep. The logs are connected with half-dovetail notches at the corners (Figure 5). The log extensions beyond the corner connections vary and are on the order of 1-1/2" to 2-1/2".

The log extensions are experiencing varying levels of deterioration. The end-grain of exterior log extensions can take on moisture seasonally, shrinking or swelling more than the rest of the log. The combination of increased moisture and dimensional changes makes the log ends more susceptible to deterioration over the long term. Despite localized deterioration, the corner connections appear to remain relatively intact.

The wall logs were, in general, in fair condition. One exception was the sill log at the west façade, which is severely deteriorated (Figure 6). The deterioration was particularly noticeable at the door threshold, where the sill was notched from 10" down to 4" and the increased exposure at the top face of the member has likely contributed to its deterioration over time. However, deterioration was noted along the sill log's length. Similar but less severe deterioration was noted at the east sill log near the door threshold. Note that the east sill log is not notched at the threshold.

Gable ends are framed with sawn lumber studs of varying sizes and are clad in horizontal boards above the top plate (Figure 7).



**Figure 5:** Half dovetail log construction at corner



**Figure 6:** Deteriorated sill log at west façade near door threshold



**Figure 7:** Gable end wall construction

## Floor Framing

Existing 1"-thick wood floorboards were removed in two locations to expose the floor framing below. One of the probes was located directly adjacent to the door threshold at the west entrance and the other near the fireplace hearth. The observed joists ranged from 7" to 8" diameter log joists with the top surface hewn flat to provide solid bearing for nailing of the floorboards. Joists are typically spaced at approximately 22" on center, with the logs at the fireplace hearth spaced more widely at 30" on center, based on observations at the probes as well as the nail patterns in the floorboards.

Some of the logs were observed to be in contact with the ground below (Figure 8), whereas others had a small air gap between the two. Logs in contact with the ground were found by the wood specialist to have significantly higher moisture content, as would be expected, and generally exhibited higher levels of deterioration. Based on movement of the floorboards in other areas of the house, it is assumed that other joists are also deteriorated. In several locations, small bricks or stones were observed to be propping up the log joists at random locations along their span.

At the west wall, the joists were notched down to a 5" depth. This notched portion bears on the inside projection of the stone foundation wall. Several of the joists at the threshold were observed to be severely deteriorated at their ends. One joist end had been cut and sistered with a sawn lumber member approximately 5-3/4" x 3-3/4" in size. Another joist had a shallower notched end, closer to 3-1/2" deep, and did not fully bear on the foundation wall (Figure 9).



**Figure 8:** Floor log joist in contact with ground



**Figure 9:** Notched end of floor log joist at west bearing (at floor probe). Note floorboard above and gap between joist and stone foundation wall below.

## Roof Framing

The roof consists of wood shingles on wood roof boards supported on 3-1/4" wide by 4" deep rafters spaced at approximately 35" on center. The rafters are nailed to a sawn ridge plate at the peak and tied together with collar ties made of 1" thick boards of depths ranging from 4" to 6-3/4" (Figure 10).

The rafters are nailed at their bases to the top plate and appear to be pulling out in some locations, most visibly at the west side of the house (Figure 11). Rafter tails approximately 2" wide by 4" deep are nailed into the sides of every other rafter near its bearing on the top plate.

Seven tie beams span parallel to the roof framing and tie the long walls of the structure together, helping to resist the outward thrust on the walls from the roof load above. The beams are sawn and vary in size and spacing. Beams were measured to be 3-1/4" to 4" in width by 4-1/4" to 6" in depth and were notched at their bearing ends to a 3-1/2" depth to bear on the wall log below. The notched end is visible at the exterior of the building.

The roof extends out to shelter the chimney and is supported on the two cantilevered top plates, the uppermost logs on the long sides of the building. These were measured to be approximately 6-1/2" wide by 8" deep. The eastern cantilevered end is deteriorated and was sistered with a 1-3/4" wide x 5-3/4" member (Figure 12).



**Figure 10:** General view of roof framing and tie beams



**Figure 11:** Rafter end pulling out from top plate (photograph by JKOA)



**Figure 12:** Cantilevered top plate deteriorated and sistered at end, north façade at roof overhang

At the interior southwest corner of the building, there is evidence of moisture intrusion through the roof and resulting deterioration of wood elements (Figure 13). Both top plates and the southernmost roof rafter are deteriorated. The rafter was sistered and one wall stud was replaced at some point in time. It does not appear that the moisture intrusion is on-going.



**Figure 13:** Deteriorated top plates and roof rafter at southwest corner of building. Note sister on rafter.

## Chimney and Fireplace

The chimney is located at the north side of the house and is covered by the roof projection. It is a chinked, hewn-log, shouldered chimney. The lower portion of the walls is constructed of hewn logs with straight sides, approximately 4" wide by 7" deep. The logs are connected with half-dovetail notches at the north corners and are connected to the main building walls with tenons, i.e. square notches. At the shoulder, the logs transition to smaller round logs ranging in 3-1/2" to 5" diameter (Figure 14).

The hearth and fire box are constructed of the same stone as the foundation walls (Figure 15). Several hearth stones were loose.



**Figure 14:** Hewn log chimney at shoulder transition



**Figure 15:** View of fireplace and hearth

## Structural Analysis

The following wood species identification and grading, where possible, was provided by Anthony & Associates for use in this analysis:

- Floor Joist: White Oak, no grade possible
- Tie Beams: Southern Yellow Pine, Select Structural
- Roof Rafters: Southern Yellow Pine, Select Structural
- Sill Logs: White Oak, no grade possible
- Top Plate: One White Oak, One Southern Yellow Pine; no grade possible

### Floor Framing

The floor log joists were analyzed using White Oak Select Structural wood, given the age of the building and the quality of the visible framing. A log diameter of 7" and 8" was used for each joist to capture the range of sizes observed and the measured tributary area for each joist was used to determine the loading. Assuming good condition, the floor framing was determined to have a floor live load capacity ranging from 35 pounds per square foot (psf) to 75 psf, depending on log diameter and spacing. This is adequate for residential occupancy and could also accommodate limited visitation in small groups. In order to achieve the above-noted load capacities, any deficiencies in the floor framing would need to be remedied.

### Roof Framing

The roof framing was analyzed for code-specified combinations of dead, live, snow and wind loads. The analysis was performed enveloping the roof behavior based on two assumptions:

1. The tie beam is fully engaged and prevents the roof from thrusting outward.
2. The tie beam is ignored and the roof rafters are allowed to kick out at the eaves.

In the first scenario, the rafters and the tie beam were found to be within the allowable stress limits; however, the collar tie was greatly overstressed for all cases except the wind uplift case, since the collar tie was forced into compression. This is not the intent of the collar tie and assumed to be a conservative assumption.

In the second scenario, the rafters were found to be at approximately twice the allowable stress level for the highest load case, the dead plus live load case. The rafters were adequate for all other load combinations, including snow and wind loads.

In reality, the roof system likely functions somewhere between these two cases, where the tie beams act more as spring, providing partial lateral restraint at the roof eaves. This amount of restraint is limited to the friction between the pocketed tie beam ends and the log walls and any other mechanical fasteners that might connect them. With

this intermediate scenario, and given that the roof framing shows no signs of distress in the members themselves, it can reasonably be assumed that the framing is adequate for the imposed loads.

The uplift at the rafter ends was calculated to be just under 200 pounds per rafter. The existing nailed connection has pulled out. Nails do not have large capacities in withdrawal (pull-out), considerably less than 200 pounds depending on the nail diameter and embedment length, and this nailed connection is not able to resist the wind uplift forces during high wind events.

## Conclusions and Recommendations

### Foundation and Crawlspace

- The stone foundation at the perimeter of the house had areas of missing and/or loose stone, creating discontinuities in the support for the log walls and allowing animals to enter the crawl space. Wherever there are loose or missing stones, the foundations should be rebuilt locally with mortar to match the existing in kind.
- Frost depth in this region of Georgia is 10 inches. It is unclear whether the existing stone foundations extend to frost depth as no test pits were performed at Snodgrass House. There are no signs of distress or uneven settlement of the building due to foundation issues, so lowering of the foundations is likely not warranted.
- There is little or no ventilation within the crawl space, creating a very humid environment. In addition, several of the log floor joists were observed to be in contact with the ground (see below). This creates conditions that favor deterioration of the wood floor framing, which were noted to have a high moisture content in several areas where tested on site. We recommend installing vents in the foundation wall to promote air circulation in that space. While this would change the exterior appearance of the house, it would improve the condition and longevity of the floor framing. In addition, the soil in contact with the log joists should be removed. This can be done locally, creating valleys below the joists themselves, or can be done over the entire area of the crawlspace, provided that the stone foundations are not undermined. Any soil removal should be performed in concert with Archaeology. While removing soil over the entire area would be preferable in terms of improving the airflow, localized soil removal can be considered if reducing the amount of excavation and archaeology is preferable to the NPS.

**First Floor Framing**

- The existing log joists at Snodgrass House, where they could be measured, were found to have sufficient structural capacity for residential use or limited visitation with small groups. For logs in good condition, no reinforcement is considered to be required unless a different use for the structure with higher loading requirements is considered. If a use with a higher load requirement is desired, joists can be sistered or an intermediate support below the joists can be provided to increase its load capacity.
- The floor joists were found to exhibit severe deterioration where observed at the probes. Areas where the joists were in contact with the ground were most heavily deteriorated, as were several of the end bearing conditions. Given that other soft spots were noted while walking across the floor, we recommend removing all floorboards so that all joists can be examined along their full lengths.
- Where logs are severely deteriorated, depending on the area of deterioration, repairs can be made by scarfing in portions of joists to match the existing in wood species, grade and size. Alternatively, joists can be sistered with new members. If the deterioration of a particular log is so severe that it cannot be salvaged, it should be replaced in kind with a member of the same wood species, grade and diameter and with similar end / bearing detailing as the existing.
- Where logs are deteriorated at their bearing ends, this connection should be reestablished. The end connection is critical both for bearing of the joists themselves and for bracing the base of the exterior walls. Joist ends should be observed fully once floorboards are removed to identify and document each connection type. Joist ends should be extended to bear on the stone foundation projection or pocket into the exterior log and create a positive connection. This can be done by sistering or scarfing on joist extensions.

**Walls**

- Exterior logs were generally found to be in fair condition, with a few exceptions:
    - The sill log at the west end was severely deteriorated, especially in the vicinity of the door sill. The east sill log was also deteriorated at the door sill but less so. These areas of deteriorated logs should be repaired with scarfed in log members to restore their structural integrity. White Oak logs should be used to match the existing.
    - At the southwest corner, the top logs exhibit some deterioration due to water infiltration through the roof. The water intrusion appears to have been mitigated. At this location, dutchman repairs to the top logs may be warranted and the existing wood should be matched. The west top plate

was noted to be Southern Pine and the south top plate was noted to be White Oak.
    - Where surface deterioration exists on other logs, this is not considered a structural concern and veneer repairs can be performed.

**Roof Framing**

- The roof framing and tie beams were typically found to be in good condition and do not require reinforcement.
- The rafters were observed to be pulling out from the top log. Nailed connections have failed in withdrawal due to wind uplift forces. It is recommended that, if there is an opportunity to remove the roofing material, the existing nailed connections be removed and a screw be installed from the top down through the rafter end and into the top log. If no roofing repairs are to be performed, a hold-down can also be installed at the interior face of the rafter to the top log, although this connection may be more visible and would alter the appearance of the house from the interior.

**Chimney and Fireplace**

- The chimney at Snodgrass House was found to be in good condition from the exterior.
- Some of the stones at the hearth were observed to be loose and should be reset.

# Kelly House

## General Description

Kelly House is located on LaFayette Road in the Chickamauga Battlefield. It is a single-pen, side-gabled log cabin approximately 24 feet by 20 feet in plan. There are doors on both long sides of the cabin and a hewn-log chimney at one gable end flanked by a window.



**Figure 16**: General view of Kelly House

## Review of Available Documents

Photographs of the 1960's reconstructions were observed while on site and have been provided by the Park for reference. These photographs show that the roof was entirely reconstructed, as was the chimney. In addition, an earlier drawing of the cabin viewed on site showed a shed roof extension on the east side of the building. This extension is no longer present.

## Existing Structure and Conditions

The existing structural elements and their conditions are described in detail below and are also documented in the accompanying sketches in Appendix C2. All photographs are by 1200AE unless noted otherwise.

## Foundation

The house is supported on a continuous, shallow stone foundation. On the north and south sides, the gable ends of the house, the stone was measured to extend from 4" to 8-1/2" above grade, depending on the elevation and plan location (Figure 17).

Due to the alternating coursing of the logs, the sill logs at the east and west sides, the long sides of the house, are lower than the sill logs on the gable ends and the stone foundation sits entirely below grade. A test pit was dug at the southeast corner of the building in the presence of the Park archaeologist and other NPS personnel (Figure 18). The lower 3" of the sill log was found to be embedded below grade and the stone foundation below was determined to extend only an additional 3" into the ground.

At several locations around the chimney, an awl was inserted into the ground directly below the sill log to determine whether the chimney might be built on a stone foundation as well. The awl entered fully into the ground without encountering any foundations; therefore, it appears that the chimney sill base logs are set directly on grade (Figure 19).



**Figure 17:** Stone foundation wall visible at south gable end wall



**Figure 18:** Test pit at southeast corner showing shallow stone foundation under sill log



**Figure 19:** Awl inserted into ground at northeast corner of chimney

## Walls

The walls are constructed of chinked, hewn logs with straight sides. Many of the wall logs have been replaced, either with reclaimed telephone poles or other replacement members.

The sill logs (east and west façade base logs) are partially buried in the ground, as noted in the foundation section above. The east sill log was measured to be approximately 10" wide by 10" deep. Typical earlier wall logs are approximately 5-1/2" to 8-1/2" wide by approximately 9" deep and are connected with v- notches at the corners (Figure 20). Replacement logs are approximately 8" wide by 8" to 10" deep and are connected with squared off saddle notches at the corners. The log extensions beyond the corner connections vary and are on the order of 1-1/2".

The log extensions and corner connections are experiencing varying levels of deterioration. The end-grain of exterior log extensions can take on moisture seasonally, shrinking or swelling more than the rest of the log. The combination of increased moisture and dimensional changes make the log ends more susceptible to deterioration over the long term. Several of the corner connections are severely deteriorated and have lost structural capacity (Figure 21).

The condition of the wall logs varies significantly depending on location and age. The partially buried sill logs showed evidence of deterioration.

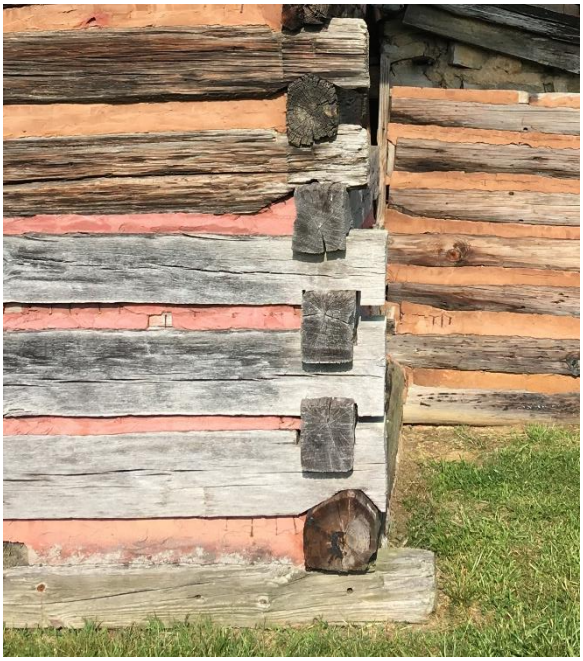


**Figure 20:** Corner log construction showing V-notches at earlier logs and squared off saddle joints at replacement logs



**Figure 21:** Deteriorated corner connections and log extensions, southwest corner

At the interior, chinking could be observed at the northwest corner of the building. It consisted of pieces of wood boards set diagonally in the space between adjacent logs (Figure 22).

Gable ends are framed with 1-3/4" by 3-1/2" sawn lumber studs spaced at 24" on center and are clad in horizontal boards above the top plate (Figure 23).



**Figure 22:** Diagonal board chinking



**Figure 23:** Gable end wall construction

## Floor Framing

One existing 7/8"-thick wood floorboard was removed in the northwest corner of the interior to expose the floor framing below and its connection to the west wall. The observed joists ranged from 5" to 6" diameter log joists with the top surface hewn flat to provide solid bearing for nailing of the floorboards. The bottom surface also appeared to be hewn flat, resulting in 5" to 5-3/4" total joist depths. The ground was measured to be approximately 11" to 12-1/2" from the top of the floorboards, leaving an air gap below the joists (Figure 24). Joists are spaced at 36" to 43" on center based on observations at the probe as well as the nail patterns in the floorboards.

At the west wall, the joists were notched down to a 3" depth. This notched portion bears on the top surface of the sill log, notched to receive the joists. One joist end had been sistered with two pieces of sawn lumber 1" x 4" in size (Figures 24 and 25).

At the east wall, where there had previously been a shed addition, the notched ends of the log joists were visible at the exterior of the building (Figure 26). The notched ends were measured to be from 5-1/2" to 9-1/2" wide by 2-1/2" deep.



**Figure 24:** Floor log joist at west bearing end. Note sisters and notched end connection.



**Figure 25:** Sistered **f**loor log joist at floor probe. Note air gap below joists in crawl space.



**Figure 26:** Notched end of floor log joists at east exterior wall.

## Roof Framing

The roof consists of wood shingles on wood roof boards supported on 2" wide by 4" deep rafters spaced at approximately 24" on center. The rafters are nailed to a 1" by 3-1/2" sawn ridge plate at the peak and tied together with collar ties made of 1" by 3-1/2" boards. Four diagonal braces, also 1" by 3-1/2", are laid flat and connect to a series of rafters from the building corners to four points near the centerline of the building just above the collar ties (Figure 27). These provide some racking resistance in the roof structure.

The rafters are toenailed at their bases to the top plate (Figure 28). Rafter tails approximately 2" wide by 4" deep are nailed into the sides of every other rafter near its bearing on the top plate and project towards the outside through a notch in the top plate.

Six tie beams span parallel to the roof framing and tie the long walls of the structure together, helping to resist the outward thrust on the walls from the roof load above. The beams are round logs and vary in size and spacing. Beams were measured to be 6" to 7" in diameter and their top face is notched at their bearing ends to a 4" depth (Figure 29). The notched ends bear on the wall log below and are visible at the exterior of the building. Tie beam spacing was measured to range from 3'-0" to 4'-9" on center. The northernmost tie beam is notched 3" at its bottom face for a length of 22" at the center of the beam.

The roof extends out to shelter the chimney and is supported on the two cantilevered top plates, the uppermost logs on the long sides of the building.



**Figure 27:** General view of roof framing and tie beams



**Figure 28:** Rafter ends nailed into top plate. Note rafter tail adjacent to left rafter.



**Figure 29:** Log tie beam pocketing into exterior wall with top of beam notched.

## Chimney and Fireplace

The chimney is located at the north side of the house and is covered by the roof projection. It is a chinked, hewn-log, shouldered chimney. The lower portion of the walls is constructed of hewn logs with straight sides, approximately 3" to 4" wide by 5" to 6" deep. The logs are connected with saddle notches at the north corners and do not appear to be connected to the main building walls. At the base of the shoulder, a 6" wide by 4-1/2" deep member creates the transition and smaller round logs ranging in 3-1/2" to 5" diameter continue towards the top. The east side of the chimney at the shoulder transition has collapsed and deteriorated wood is visible at this location (Figure 30).

The hearth and fire box are constructed of stone (Figure 31). Several hearth stones were very loose. The chimney masonry mass is approximately 12" thick and extends just over 5' in height, after which point the chimney transitions to only chinked logs. The masonry above the fireplace opening at the interior is supported with two 4"-wide by ½"-thick iron members that appear to be salvaged machine parts (Figure 32). From the collapsed area at the exterior, a 6" to 8" gap was measured between the exterior face of masonry and the interior face of the log wall.



**Figure 30:** Hewn log chimney at shoulder transition. Note masonry chimney mass inside of hewn log chimney exterior.



**Figure 31:** View of fireplace and hearth



**Figure 32:** Lintel at hearth opening made from repurposed iron machine parts

## Structural Analysis

The following wood species identification and grading, where possible, was provided by Anthony & Associates for use in this analysis:

- Floor Joist: Southern Yellow Pine, no grade possible
- Tie Beams: Southern Yellow Pine, (4) Select Structural, (2) No. 2
- Roof Rafters: Southern Yellow Pine, Select Structural
- Sill Logs: White Oak, no grade possible
- Wall Logs: Southern Yellow Pine; no grade possible

### Floor Framing

The floor log joists were analyzed using Southern Yellow Pine Select Structural wood, given the age of the building and the quality of the visible framing. Given that only the two northernmost joists could be measured fully, a log diameter of 5-1/2" was used to calculate the load capacities for those two joists. For the remainder of the joists, some assumptions could be made for the width of the joists based on the sizes of the notches observed at the east exterior wall; however, this was not sufficient to calculate the joist capacities with certainty since their depth is not currently known. For those joists, a maximum depth of 6-1/2" was assumed. The measured tributary area for each joist was used to determine the loading. Assuming good condition and no intermediate joist supports, the floor framing was determined to have a floor live load capacity ranging from 15 pounds per square foot (psf) to 30 psf, depending on log diameter and spacing. The upper range of this load capacity is adequate for residential occupancy and could also accommodate limited visitation in small groups; however this framing likely requires reinforcing or the addition of intermediate supports, pending further observation and analysis. In order to achieve the above-noted load capacities, any deficiencies in the floor framing would need to be remedied.

### Roof Framing

The roof framing was analyzed for code-specified combinations of dead, live, snow and wind loads. The analysis was performed enveloping the roof behavior based on two assumptions:

1. The tie beam is fully engaged and prevents the roof from thrusting outward.
2. The tie beam is ignored and the roof rafters are allowed to kick out at the eaves.

In the first scenario, the rafters and the tie beam were found to be within the allowable stress limits; however, the collar tie was greatly overstressed for all cases except the wind uplift case, since the collar tie was forced into compression. This is not the intent of the collar tie and assumed to be a conservative assumption.

In the second scenario, the rafters were found to be at approximately twice the allowable stress level for the highest load case, the dead plus live load case. The rafters were adequate for all other load combinations, including snow and wind loads.

In reality, the roof system likely functions somewhere between these two cases, where the tie beams act more as spring, providing partial lateral restraint at the roof eaves. This amount of restraint is limited to the friction between the pocketed tie beam ends and the log walls and any other mechanical fasteners that might connect them. With this intermediate scenario, and given that the roof framing shows no signs of distress in the members themselves, it can reasonably be assumed that the framing is adequate for the imposed loads.

The uplift at the rafter ends was calculated to be approximately 135 pounds per rafter. The existing toe-nailed connection appears to be functioning properly to resist the wind uplift forces during high wind events, as no signs of pull-out or connection failure are evident.

## Conclusions and Recommendations

**Foundation and Crawlspace**

- The stone foundation at the perimeter of the house had limited areas of missing and/or loose stone, creating discontinuities in the support for the log walls and allowing animals to enter the crawl space. Wherever there are loose or missing stones, the foundations should be rebuilt locally with mortar to match the existing in kind.
- A test pit dug at the southeast corner of the building revealed that the lower 3" of the sill log were found to be embedded below grade and the stone foundation below was determined to extend only an additional 3" into the ground. Frost depth in this region of Georgia is 10 inches. While the foundations ideally would extend to or below the frost depth, there are no signs of distress or uneven settlement of the building due to foundation issues, so lowering of the foundations is likely not warranted. However, the embedment of the timber sill log should be addressed (see below).
- There is little or no ventilation within the crawl space, creating a potentially humid environment. We recommend installing vents in the foundation wall to promote air circulation in that space. While this would change the exterior appearance of the house, it would improve the condition and longevity of the floor framing.
- Based on limited access at the floor probe, the observed log floor joists were not in contact with the ground and had approximately 5" to 6" of clear space

between the bottom of the joists and the ground. When joists are in contact with the ground, this creates conditions that favor deterioration of the wood floor framing. It should be confirmed by additional observation whether the remainder of the floor joists are also raised above the ground, which is the desirable condition. If there is contact between the soil and the log joists, the soil should be removed. This can be done locally, creating valleys below the joists themselves, or can be done over the entire area of the crawlspace, provided that the stone foundations are not undermined. Any soil removal should be performed in concert with Archaeology. While removing soil over the entire area would be preferable in terms of improving the airflow, localized soil removal can be considered if reducing the amount of excavation and archaeology is preferable to the NPS.

**First Floor Framing**

- The existing log joists at Kelly House were found to have insufficient structural capacity for most uses, assuming no intermediate supports for the joists are present. Only two of the joists could be measured fully and it could not be confirmed whether any intermediate joist supports exist due to limited access through a single probe. We recommend removing all floorboards to allow measurement of all joists and observation of their conditions. Pending further evaluation, if a use with a higher load requirement than the calculated joist capacity is desired, joists can be sistered or an intermediate support below the joists can be provided to increase the floor load capacity.
- The condition of the floor joists could not be determined fully due to limited access. One observed joist had already been sistered, presumably due to an existing deteriorated condition at its bearing end. Areas where joists may be in contact with the ground and end bearing conditions are typically the most vulnerable to deterioration. We recommend removing all floorboards so that all joists can be examined along their full lengths.
- If logs are found to be deteriorated after further examination, depending on the extent and severity of deterioration, repairs can be made by scarfing in portions of joists to match the existing in wood species, grade and size. Alternatively, joists can be sistered with new members. If the deterioration of a particular log is so severe that it cannot be salvaged, it should be replaced in kind with a member of the same wood species, grade and diameter and with similar end / bearing detailing as the existing.
- If logs are found to be deteriorated at their bearing ends, this connection should be reestablished. The end connection is critical both for bearing of the joists themselves and for bracing the base of the exterior walls. Joist ends should be

extended to pocket into the exterior log and create a positive connection. This can be done by scarfing on joist extensions.

**Roof Framing**

- The roof framing and tie beams were typically found to be in good condition and do not require reinforcement.
- The toe-nails holding down the ends of the rafters at the top logs in the wall appear to be functioning properly and are not pulling out. However, given that it is anticipated that the intensity of storms and therefore the related wind loads will be increasing with the changing climate, it may be prudent to reinforce these end connections. If there is an opportunity to remove the roofing material, the existing nailed connections can be reinforced with a screw installed from the top down through the rafter end and into the top log. If no roofing repairs are to be performed, a hold-down can also be installed at the interior face of the rafter to the top log, although this connection may be more visible and would alter the appearance of the house from the interior.

**Walls**

- Exterior logs were generally found to be in fair condition, with a few exceptions:
    - A test pit dug at the southeast corner of the building revealed that the lower 3" of the sill log were found to be embedded below grade and are showing signs of deterioration from extended exposure to moisture. The embedment of the timber sill log could result in long-term, continued deterioration of the log. We recommend locally lowering the exterior grade and sloping the grade away from the sill, provided this is acceptable from an archaeological perspective. Due to the existing flatness of the grade surrounding the building, introducing swales a distance away from the building might be required to achieve the necessary slopes. Alternatively, gravel could be installed along the sides of the sill to promote drainage away from the sill. However, regrading is the preferred option from the perspective of longevity.
    - The log extensions and corner connections are experiencing varying levels of deterioration. The end-grain of exterior log extensions can take on moisture seasonally, shrinking or swelling more than the rest of the log. The combination of increased moisture and dimensional changes make the log ends more susceptible to deterioration over the long term. Several of the corner connections are severely deteriorated and have lost structural capacity. It is likely that there is enough redundancy in the remainder of the corner connections to provide adequate structural capacity. However, depending on the severity of the deterioration, a new log end matching the existing in geometry and wood species can be

scarfed onto the existing. Alternatively, in order to maintain the historic materials for the extent of time possible, the corners can be observed periodically to determine whether worsening conditions may require localized replacement at a future date.

- Where surface deterioration exists on other logs, this is not considered a structural concern and veneer repairs can be performed.

**Chimney and Fireplace**

- The exterior, wood log portion of the chimney is exhibiting severe deterioration. The east side of the chimney is collapsing, most severely at the shoulder. We recommend rebuilding the collapsed portion of the chimney in kind.
- The base logs of the exterior portion of the chimney bear directly on the ground without a stone foundation below. If the log portion is to be rebuilt, we recommend considering adding a stone foundation below the base logs.
- The stone chimney at the interior has some voids visible in the lower portion. When the exterior log portion is dismantled, any voids or open joints in the stone portion of the chimney should be repointed.
- The hearth has some loose stones. These should be reset.

# Brotherton House

## General Description

Brotherton House is located on LaFayette Road in the Chickamauga Battlefield. It is a single-pen, side-gabled log cabin approximately 21 feet by 20 feet in plan. There are doors on both long sides of the cabin and a stone masonry chimney on one gable-end side. A sleeping and storage loft / second floor is present at the interior of the building. While on site, Park staff informed the team that the cabin was partially reconstructed in the 1960's. It appears likely the roof was rebuilt and the chimney reinforced at that time.



**Figure 33**: General view of Brotherton House

## Review of Available Documents

No existing drawings or written documents are currently available for Brotherton House. Several historic photographs were provided by the Park; however, the dates are largely unknown.

## Existing Structure and Conditions

The existing structural elements and their conditions are described in detail below and are also documented in the accompanying sketches in Appendix C3. All photographs are by 1200AE unless noted otherwise.

## Foundation

The house is supported on a continuous, shallow stone foundation. On the north and south sides, the gable ends of the house, the stone was measured to extend from 4-1/2" to 12" above grade, depending on the elevation and plan location. Due to the alternating coursing of the logs, the sill logs at the east and west sides, the long sides of the house, are lower than the sill logs on gable ends. At the southwest corner, the top of the stone foundation is flush with grade, so the sill log is in contact with the ground.

The stones around the perimeter of the house were observed to be fairly loose with gaps and voids present (Figure 34). At the north end of the east wall foundation, an opening in the stone foundation with a metal grille was observed (Figure 35). This grille was presumably placed there to encourage air flow in the crawl space. One additional opening of a similar size was observed at the north wall (Figure 36); however, no metal grille was present.

No test pits were dug at the foundations of the main portion of the house; therefore, it is unknown how far the foundations extend below grade.



**Figure 34:** Loose stones at south wall foundation.



**Figure 35:** Stone foundation at east façade, north end. Note opening with metal grille.



**Figure 36:** Stone foundation at north façade, east side. Note opening in stone foundation.

## Walls

The walls are constructed of chinked, hewn logs with straight sides. Several of the wall logs have been replaced.

The sill logs (east and west façade base logs) are fully above grade, although the southern end of the west sill log meets grade and is showing slight signs of deterioration. The sill logs were measured to be approximately 8" wide by 8" deep. The east sill log shows some signs of deterioration along its southern portion (Figure 37).

Typical wall logs are approximately 4" to 5" wide by approximately 11" deep and are connected with half-dovetail notches at the corners (Figure 38). The log extensions beyond the corner connections vary and are on the order of 1-1/2" to 3-1/2". The top plate was measured to be 10" wide by 8" deep. With the exception of the sill logs, the wall logs appeared to be in fair condition.

Gable ends are framed with 2" by 4" sawn lumber studs spaced at approximately 3'-0" on center and are clad in horizontal boards. Studs bear on the top plate and are oriented flat wise against the horizontal boards (Figure 39).



**Figure 37:** Deteriorated sill log, east side



**Figure 38:** Corner log construction showing half dovetail notches. Note projecting 2nd floor joists.



**Figure 39:** Gable end wall construction

## First Floor Framing

One existing 7/8"-thick wood floorboard was removed on the east of the interior near the east door and adjacent to the stair base (Figure 40). The floor framing below and its connection to the east wall were exposed. The joist aligned with the centerline of the door was measured to be a 9" diameter log with the top surface hewn flat to provide solid bearing for nailing of the floorboards. The joist directly to the south, at the stair base, had its base embedded in the ground below and was deteriorated, likely due to continued exposure to moisture from the ground (Figure 41). Two of the joists observed still had bark attached and remnants of removed branches. The presence of bark invites insect damage and has likely hastened the deterioration of the joists (Figure 42).

Some of the logs were observed to be in contact with the ground below whereas others had a small air gap between the two. Logs in contact with the ground typically have higher moisture content, as would be expected, and generally exhibit higher levels of deterioration. In several locations, small bricks or stones were observed to be propping up the log joists at random locations along their span.

Joists were measured to be spaced at 24" to 34" on center based on observations at the probe as well as the nail patterns in the floorboards.



**Figure 40:** Floor probe at east door and stair.



**Figure 41:** Floor log joist at east bearing end. Note joist is notched and stops short of wall. Note also contact with ground and related deterioration.



**Figure 42:** Floor log joist at floor probe, looking west. Note deterioration and remnants of bark and branches.

## Second Floor Framing and Stair

Seven beams span east to west and support the second floor above. These beams run parallel to the roof framing above and also act as tie beams to tie the east and west walls of the structure together, helping to resist the outward thrust on the walls from the roof load above (Figure 43). Second floor floorboards were measured to be 1" thick.

The beams are hewn, rectangular sections and vary in size and spacing. Beams were measured to be 2-3/4" to 3-3/4" wide by 5" to 6" deep and were spaced at 2'-6" to 2'-9" on center. Their full section bears on the wall log below (Figure 44) and their ends are visible at the exterior of the building (Figure 45). The ends project several inches beyond the exterior face of wall. This makes the joists susceptible to retaining moisture through the end grain. Some signs of moisture were visible at the interior of the bearing ends. In addition, some longitudinal cracking was visible, which may indicate overstress.

The stair leads from the first to the second floor and is framed with two 1-1/8" thick by 5-1/4" (min.) stringers (Figure 43). Treads and risers are constructed of 1" floorboards. At the south (upper) end of the stringers, there is some separation between the stringer ends and the wall (Figure 46). A 6-1/4"-wide vertical plank has been nailed to the inside stringer to provide additional support. This plank bears on the first-floor floorboards.

The framing around the stair opening is not very substantial; the header supporting the joists at the opening is only 1-3/4" wide by 5-5/8" deep. It is end nailed with two nails into the supporting trimmer, which is a typical joist.



**Figure 43:** Looking east at stair & 2nd floor framing



**Figure 44:** 2nd floor joists pocketing into wall



**Figure 45:** 2nd floor joist projections visible at exterior



**Figure 46:** Stair stringer separation from wall

## Roof Framing

The roof consists of wood shingles on wood roof boards supported on 2" wide by 4" deep rafters spaced at approximately 24" on center. The rafters are nailed to a 1" by 3-3/4" sawn ridge plate at the peak and tied together with collar ties made of 1" by 3-3/4" boards. Four diagonal braces, 1" by 4", are laid flat and connect to a series of rafters from the building corners to two points near the centerline of the building directly below the collar ties (Figure 47). These provide some racking resistance in the roof structure.

The rafters bear on and are toenailed to the top plate. One rafter was observed to be shimmed (Figure 48). Rafter tails approximately 2" wide by 4" deep are nailed into the sides of every other rafter near its bearing on the top plate and project towards the outside through a notch in the top plate.



**Figure 47:** General view of roof framing



**Figure 48:** Rafter ends with shim, bearing on top plate.

The roof extends out to shelter the chimney and is supported on the two cantilevered top plates, the uppermost logs on the long sides of the building (Figure 49). These logs were hewn and were measured to be 10" wide by 8" deep.



**Figure 49:** Top plate cantilever to support roof overhang at chimney (north end).

## Chimney and Fireplace

The chimney is located at the north side of the house and is covered by the roof projection. It is a shouldered chimney constructed of stone masonry for its full height. (Figure 50).

Significant cracks and open joints are visible on all faces of the chimney. At the north face of the chimney, cracks were observed to extend the full height of the chimney (Figure 50). Open joints were measured to be up to 2-1/2" wide near the base of the chimney. Some previously repointed joints have reopened and the new cracks were measured to be up to ½" wide (Figure 51). At the east face of the chimney, large open joints of similar magnitude were noted at the base (Figure 52). The northeast corner of the chimney appears to the pushing outward. On the west face of the chimney, open joints were also observed but there was less evidence of movement.



**Figure 50:** Stone chimney elevation, looking south.



**Figure 51:** Cracking at north side of stone chimney.



**Figure 52:** Cracking at east side of stone chimney.

The hearth and fire box are constructed of the same stone as the remainder of the chimney (Figure 53). Based on approximate measurements, the chimney walls at the base are on the order of 10" to 12" thick. The masonry above the fireplace opening at the interior is supported with 10" thick segmental stone arch. The arch is very shallow, with a 52" clear width and only a 3" rise. A ferrous, helical tie was installed approximately 16" above the first-floor level, presumably to tie the chimney walls together. There is a large void adjacent the east end of the tie and therefore the tie is not engaged and is not functioning as intended.



**Figure 53:** View of fireplace and hearth. Note stone arch above fireplace opening.

A test pit was dug at the east face of the northeast corner of the chimney. The stone chimney wall was found to extend only about 6" below grade (Figure 54).



**Figure 54:** Test pit at northeast corner of chimney

## Structural Analysis

The following wood species identification and grading, where possible, was provided by Anthony & Associates for use in this analysis:

- Floor Joist: Eastern Red Cedar, no grade possible
- Tie Beams: Southern Yellow Pine, Select Structural
- Roof Rafters: Southern Yellow Pine, Select Structural
- Sill Logs: White Oak, no grade possible
- Wall Logs" Southern Yellow Pine, no grade possible

### First Floor Framing

The floor log joists were analyzed using Redwood No. 1 wood, as no values are provided in the NDS for Eastern Red Cedar. These values were considered to be a reasonable approximation. A log diameter of 7" and 8" was used for each joist to capture the range of sizes observed and the measured tributary area for each joist was used to determine the loading. Assuming good condition, the floor framing was determined to have a floor live load capacity ranging from 30 pounds per square foot (psf) to 50 psf, depending on log diameter and spacing. This is adequate for residential occupancy and could also accommodate limited visitation in small groups. In order to achieve the above-noted load capacities, any deficiencies in the floor framing would need to be remedied.

### Second Floor Framing

The second-floor joists were analyzed using Southern Yellow Pine Select Structural wood base on the results of the wood testing and grading. These joists act as both support for the second floor and as tie beams for the exterior log walls to resist the lateral thrust from the roof framing. The typical joists were found to be able to support live loads in the range of 16 to 31 pounds per square foot (psf), depending on the specific member size and joist spacing, which varied. This is sufficient for access but not for storage or to accommodate groups of visitors.

The trimmers and header at the stair opening were not analyzed but further reduce the live load capacity from the values noted above.

### Roof Framing

The roof framing was analyzed for code-specified combinations of dead, live, snow and wind loads. The analysis was performed enveloping the roof behavior based on two assumptions:

1. The tie beams (second floor joists) are fully engaged and prevents the roof from thrusting outward.

2. The tie beams (second floor joists) are ignored and the roof rafters are allowed to kick out at the eaves.

In the first scenario, the rafters and the tie beam were found to be within the allowable stress limits; however, the collar tie was greatly overstressed for all cases except the wind uplift case, since the collar tie was forced into compression. This is not the intent of the collar tie and assumed to be a conservative assumption.

In the second scenario, the rafters were found to be at approximately twice the allowable stress level for the highest load case, the dead plus live load case. The rafters were adequate for all other load combinations, including snow and wind loads.

In reality, the roof system likely functions somewhere between these two cases, where the tie beams act more as spring, providing partial lateral restraint at the roof eaves. This amount of restraint is limited to the friction between the pocketed tie beam ends and the log walls and any other mechanical fasteners that might connect them. With this intermediate scenario, and given that the roof framing shows no signs of distress in the members themselves, it can reasonably be assumed that the framing is adequate for the imposed loads.

The uplift at the rafter ends was calculated to be approximately 135 pounds per rafter. The existing toe-nailed connection appears to be functioning properly to resist the wind uplift forces during high wind events, as no signs of pull-out or connection failure are evident.

## Conclusions and Recommendations

**Foundation and Crawlspace**

- The stone foundation at the perimeter of the house had limited areas of missing and/or loose stone, creating discontinuities in the support for the log walls and allowing animals to enter the crawl space. Wherever there are loose or missing stones, the foundations should be rebuilt locally with mortar to match the existing in kind.
- At the north end of the east wall foundation, an opening in the stone foundation with a metal grate grille observed. This grate presumably was placed there to encourage air flow in the crawl space. One additional opening of a similar size was observed at the north wall; however, no metal grille was present. The foundation walls likely require additional vents to provide increased air movement and decrease the humidity in the crawl space. In addition, the existing vent opening in the foundation wall that is missing its metal grille should have a new grille installed. While adding vents would change the exterior

appearance of the house, it would improve the condition and longevity of the floor framing. The existence of the two observed grilles serves as precedent.

- No test pits were dug at the foundations of the main portion of the house; therefore, it is unknown how far the foundations extend below grade. Frost depth in this region of Georgia is 10 inches. It is unclear whether the existing stone foundations extend to frost depth as no test pits were performed at Brotherton House. There are no signs of distress or uneven settlement of the building due to foundation issues, so lowering of the foundations is likely not warranted.
- At the southwest corner, the top of the stone foundation is flush with grade, so the sill log is in contact with the ground. See recommendations for sill logs below.
- Based on limited access at the floor probe, the observed log floor joists were partially in contact with the ground (see below). This creates conditions that favor deterioration of the wood floor framing, which were noted to have a high moisture content in several areas where tested on site. We recommend removing the soil in contact with the log joists. This can be done locally, creating valleys below the joists themselves, or can be done over the entire area of the crawlspace, provided that the stone foundations are not undermined. Any soil removal should be performed in concert with Archaeology. While removing soil over the entire area would be preferable in terms of improving the airflow, localized soil removal can be considered if reducing the amount of excavation and archaeology is preferable to the NPS.

**First Floor Framing**

- The existing first-floor log joists at Brotherton House, where they could be measured, were found to have sufficient structural capacity for residential use or limited visitation with small groups. For logs in good condition, no reinforcement is considered to be required unless a different use for the structure with higher loading requirements is considered. If a use with a higher load requirement is desired, joists can be sistered or an intermediate support below the joists can be provided to increase its load capacity. In some locations, the existing joists were noted to have stones or bricks propping up the joists at intermediate locations. This could be done in a more consistent manner to increase load capacity.
- The condition of the floor joists could not be determined fully due to limited access. One joist observed at the probe location was severely deteriorated due to contact with the ground. The bearing ends of the joists at the probe were no longer supported at the wall. They had been cut, presumably due to deterioration. Areas where joists may be in contact with the ground and end bearing conditions are typically the most vulnerable to deterioration. We recommend removing all floorboards so that all joists can be examined for full length.

- Two of the joists observed still had bark attached and remnants of removed branches. The presence of bark invites insect damage and has likely hastened the deterioration of the joists. If the floorboards are removed fully for observation of the joists, we recommend removing the remainder of the bark from the log joists to slow down their deterioration.
- Where logs are severely deteriorated, depending on the area of deterioration, repairs can be made by scarfing in portions of joists to match the existing in wood species, grade and size. Alternatively, joists can be sistered with new members. If the deterioration of a particular log is so severe that it cannot be salvaged, it should be replaced in kind with a member of the same wood species, grade and diameter and with similar end / bearing detailing as the existing.
- Where logs are deteriorated at their bearing ends, or where the ends of the joists do not reach the perimeter walls, this connection should be reestablished. The end connection is critical both for bearing of the joists themselves and for bracing the base of the exterior walls. Joist ends should be observed fully once floorboards are removed to identify and document each connection type. Joist ends should be extended to bear on the stone foundation projection or pocket into the exterior log and create a positive connection. This can be done by sistering or scarfing on joist extensions.

**Second Floor Framing and Stair**

- The south (upper) end of the stair stringers was not connected well to the edge joist and is currently propped up with a vertically oriented plank, which bears on the first-floor floorboards. The end connection of the stair should be reinforced, providing a positive connection between the stair stringer and the end joist.
- Structural analysis of the typical second floor joists indicates that they have a low live load capacity, on the order of 15 to 20 pounds per square foot (psf). However, the framing members around the stair opening are even less substantial and have a lower live load capacity; the header and trimmers are inadequate both in their size and in the connection of the header to the trimmers. Some longitudinal cracking in the second-floor joists was visible, which may be a physical manifestation of overstress. We recommend that the framing around the stair opening and the connection of the header to the trimmers be reinforced. This can be done by sistering the existing members. Access to the upper level should be limited to maintenance, unless additional reinforcement of the second-floor joists is performed.

**Roof Framing**

- The roof framing and tie beams were typically found to be in good condition and do not require reinforcement or repair.

- The toe-nails holding down the ends of the rafters at the top logs in the wall appear to be functioning properly and are not pulling out. However, given that it is anticipated that the intensity of storms and therefore the related wind loads will be increasing with the changing climate, it may be prudent to reinforce these end connections. If there is an opportunity to remove the roofing material, the existing nailed connections can be reinforced with a screw installed from the top down through the rafter end and into the top log. If no roofing repairs are to be performed, a hold-down can also be installed at the interior face of the rafter to the top log, although this connection may be more visible and would alter the appearance of the house from the interior.

**Walls**

- The exterior log walls were found to be in fair condition, with the following exception:
    - The sill logs (east and west façade base logs) are fully above grade, although the southern end of the west sill log meets grade and is showing slight signs of deterioration from extended exposure to moisture. The east sill log shows some signs of deterioration along its southern portion. The contact of the timber sill log with the ground could result in long-term deterioration of the log due to continued exposure to moisture. We recommend locally lowering the exterior grade and sloping the grade away from the sill, provided this is acceptable from an archaeological perspective. Alternatively, gravel could be installed along the sides of the sill to promote drainage away from the sill. However, regrading is the preferred option from the perspective of longevity. The deteriorated logs themselves do not appear to warrant replacement or repair at this point in time; however, they should be observed periodically for signs of increased deterioration. Future repairs, if warranted, may consist of localized dutchmen using wood to match the existing in species and grade.

**Chimney**

The stone masonry chimney has large cracks and open joints along the full height of the chimney and outward displacement at the corner. This is likely due to a combination of factors:

- The shallow stone arch at the fireplace opening creates a large horizontal thrust that cannot be resisted by the small jambs at either side of the opening. This has caused the chimney to "unzip" along the center all the way up the chimney. It is likely that the helical tie that was installed was intended to resist some of this

thrust, but considering that the end of the tie is sitting in an open joint, it is clearly no longer functioning.

- Long-term exposure to the elements has cause the mortar to deteriorate. This has contributed to the chimney's inability to resist the forces on the chimney. As cracks form, more water is able to get in and the mortar deteriorates further.
- The test pit at the corner showed that the stone only extended about 6" below grade. Frost depth for this part of the state is between 10" but closer to 10". Inadequate foundation depth is not likely the primary cause of the problems but can certainly contribute.
- Fort Oglethorpe is in a seismically active area. Similar to the frost depth, it appears unlikely that this is the primary reason for the masonry distress, but a masonry element with open joints and cracks is less able to resist lateral (wind or seismic) loads and cracks could open up further in a seismic or high wind event.
- Due to the low slope of the grade around the chimney, it is possible that water may collect adjacent to the chimney foundation during a rain storm. This could reduce the capacity of the soils below the foundation.

Our treatment recommendations are as follows:

<u>Option 1: Repair / reinforce the chimney in place.</u>

1. Underpin chimney to lower foundations to or below frost depth.
2. Reinforce the stone arch to minimize the effects of the horizontal thrust by installing a curved, stainless or galvanized steel angle lintel set back so that it is not visible from the interior.
3. Install stainless steel joint reinforcement in a u-shape (3 exterior sides) for the full height of chimney.
4. Deeply repoint all masonry from the exterior and fill all voids with masonry or mortar.

Option 1 is the preferred option from a historic preservation perspective, and the National Park Service has indicated its preference for this option based on the historic preservation considerations. However, it should be noted that it is the less preferred option from a structural engineering perspective. This option would not allow the interior face of the chimney masonry or the portion of the chimney that is against the building to be repaired or repointed, so it will potentially not address all cracks and voids.

<u>Option 2: Rebuild chimney.</u>

1. Fully document existing chimney construction and then deconstruct chimney.
2. Pour a concrete mat foundation down to frost.

3. Rebuild chimney using salvaged stone to match existing.
4. Rebuilt chimney should include reinforcement of the stone arch to minimize the effects of the horizontal thrust. This could consist of installing a curved, stainless or galvanized steel angle lintel set back so that it is not visible from the interior. Alternatively, stainless steel joint reinforcement in the form of tension ties could be installed in the masonry joints above the arch to resist the thrust.
5. Install stainless steel joint reinforcement in a u-shape (3 exterior sides) at the portions of the chimney below the arch / lintel.

While Option 2 is the more aggressive of the two options, it would provide the most structurally sound solution and the best long-term durability.

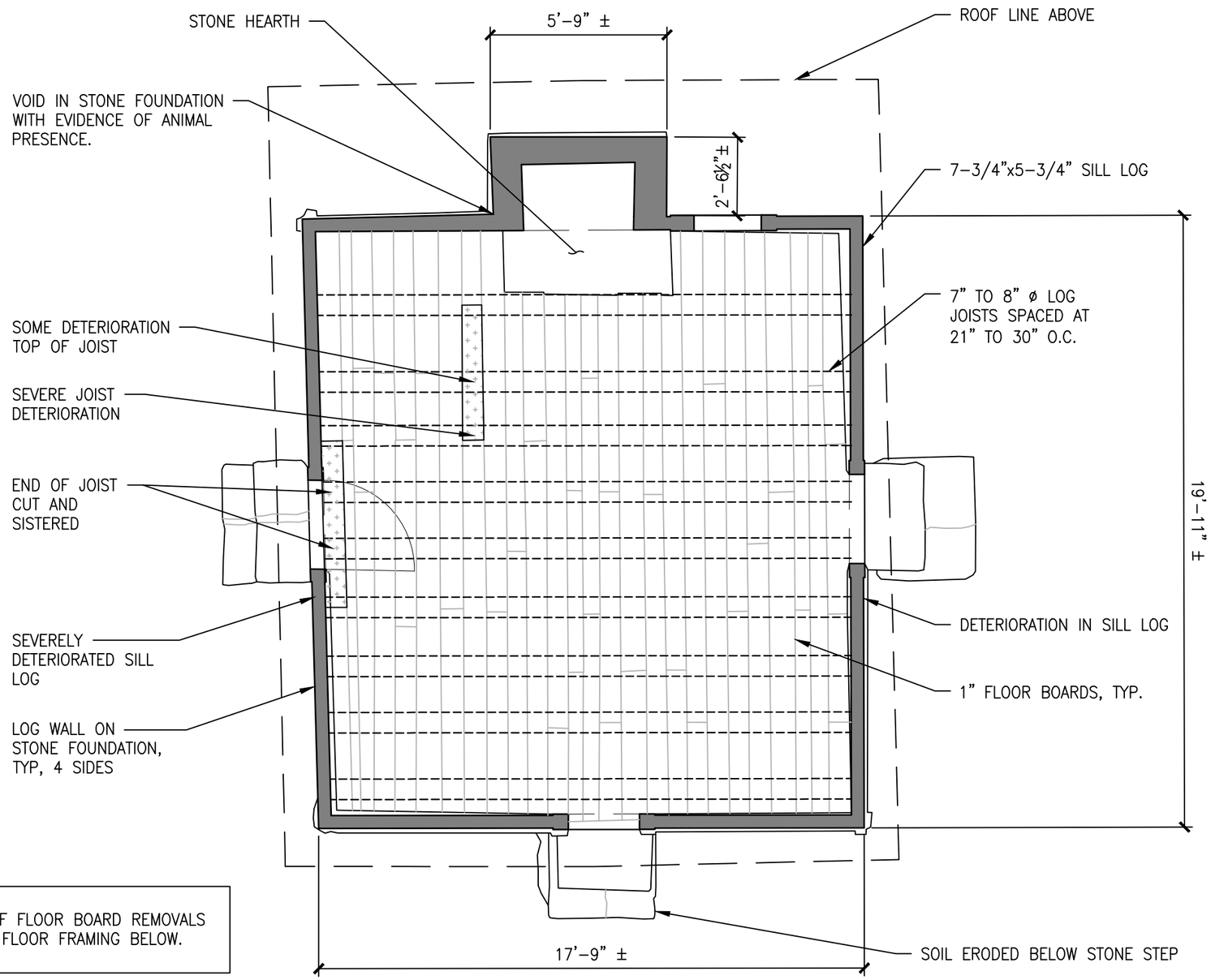
Depending on the timeframe for chimney repairs, it may be prudent to monitor the cracks to confirm and measure any continued movement. While it does appear that previously repointed cracks have continued to widen, it is not known when these cracks were repointed and whether the movement is still on-going. This movement can be measured by installing crack-gauges and documenting the measurements at regular intervals through digital photography. Monthly monitoring of the gauges would be appropriate.

In addition, the area surrounding the chimney should be monitored following major rainfall events in order to identify any site drainage issues and plan interventions accordingly. If this is found to be an issue, the site should be regraded locally to slope away from the building. This should be done in concert with Archaeology.

# Appendix C1: Snodgrass House Structural Sketches

S1.1: Floor Framing / Foundation Plan

S1.2: Roof Framing Plan




1 / S1.1

# FLOOR FRAMING / FOUNDATION PLAN

SCALE: 1/4" = 1'-0"

NORTH

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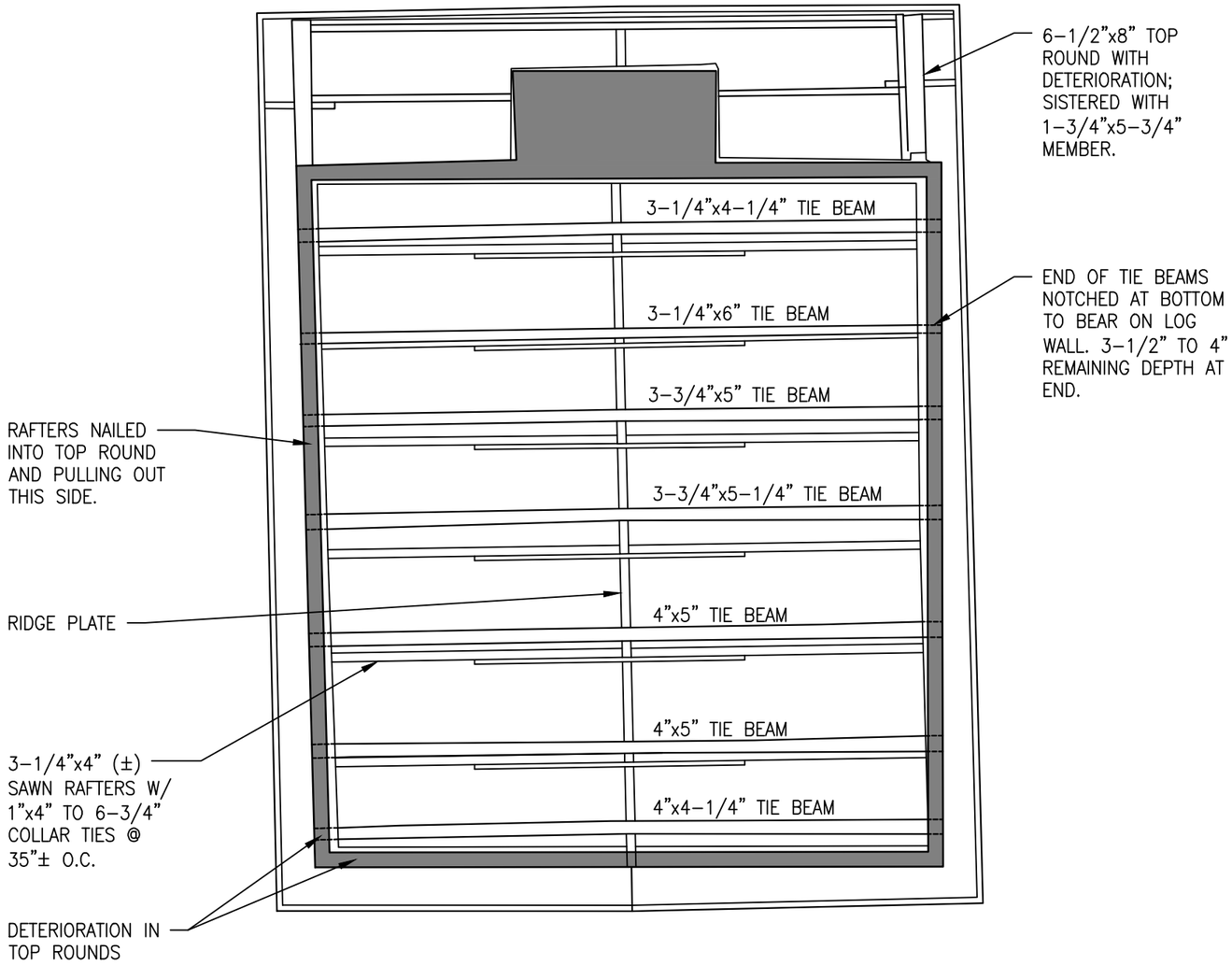
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FORT OGLETHORPE, GA

Date: 04/17/23 | Submission: Historic Structure Report | Project Number: 21-129

Project Title: SNODGRASS HOUSE

HSR Appendix C

S1.1




1 / S1.2

## ROOF FRAMING PLAN

SCALE: 1/4" = 1'–0"

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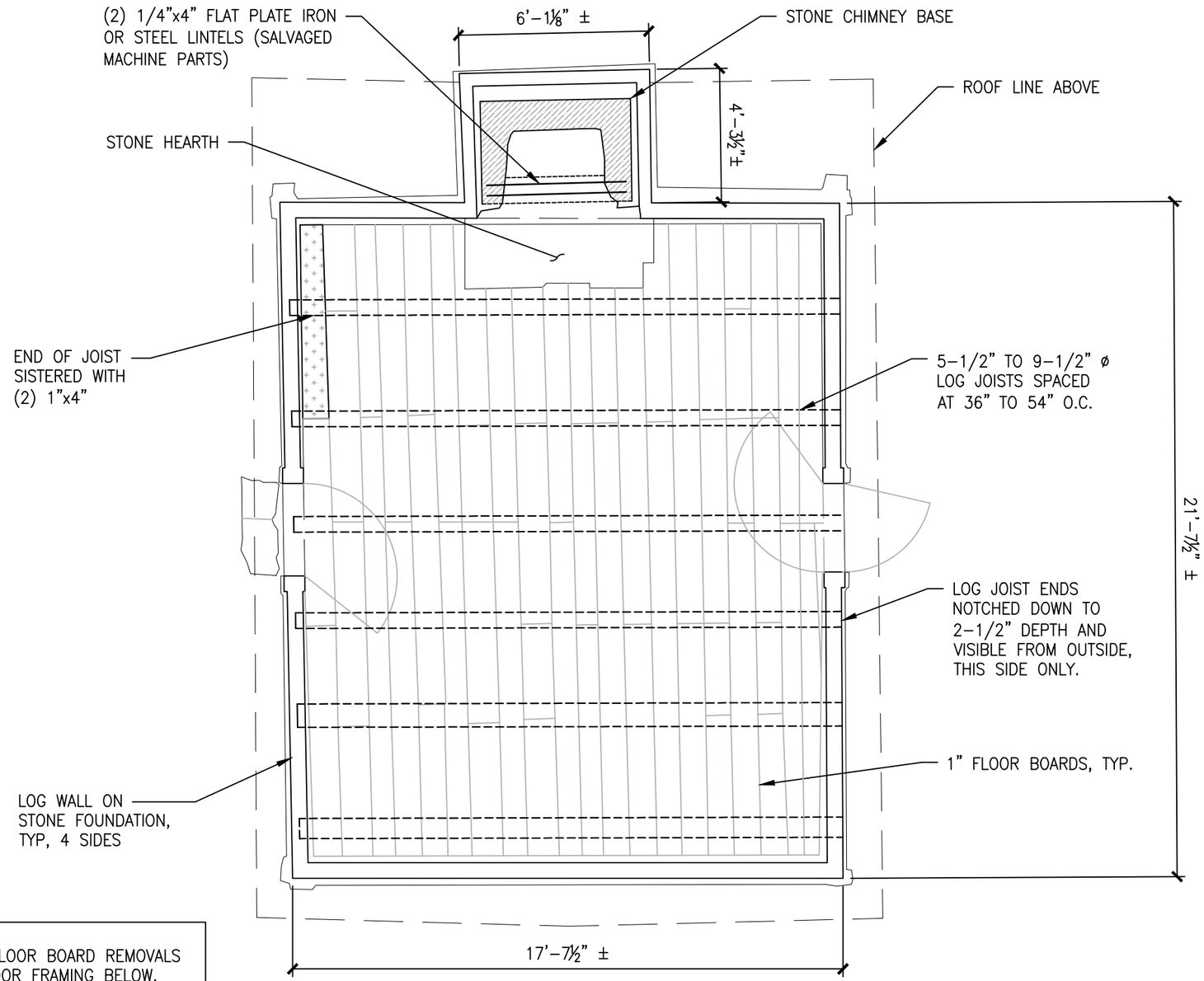
HSR Appendix C

S1.2

# Appendix C2: Kelly House Structural Sketches

S2.1: Floor Framing / Foundation Plan

S2.2: Roof Framing Plan




INDICATES LOCATION OF FLOOR BOARD REMOVALS ON SITE TO OBSERVE FLOOR FRAMING BELOW.

1 / S2.1 FLOOR FRAMING / FOUNDATION PLAN

SCALE: 1/4" = 1'-0"

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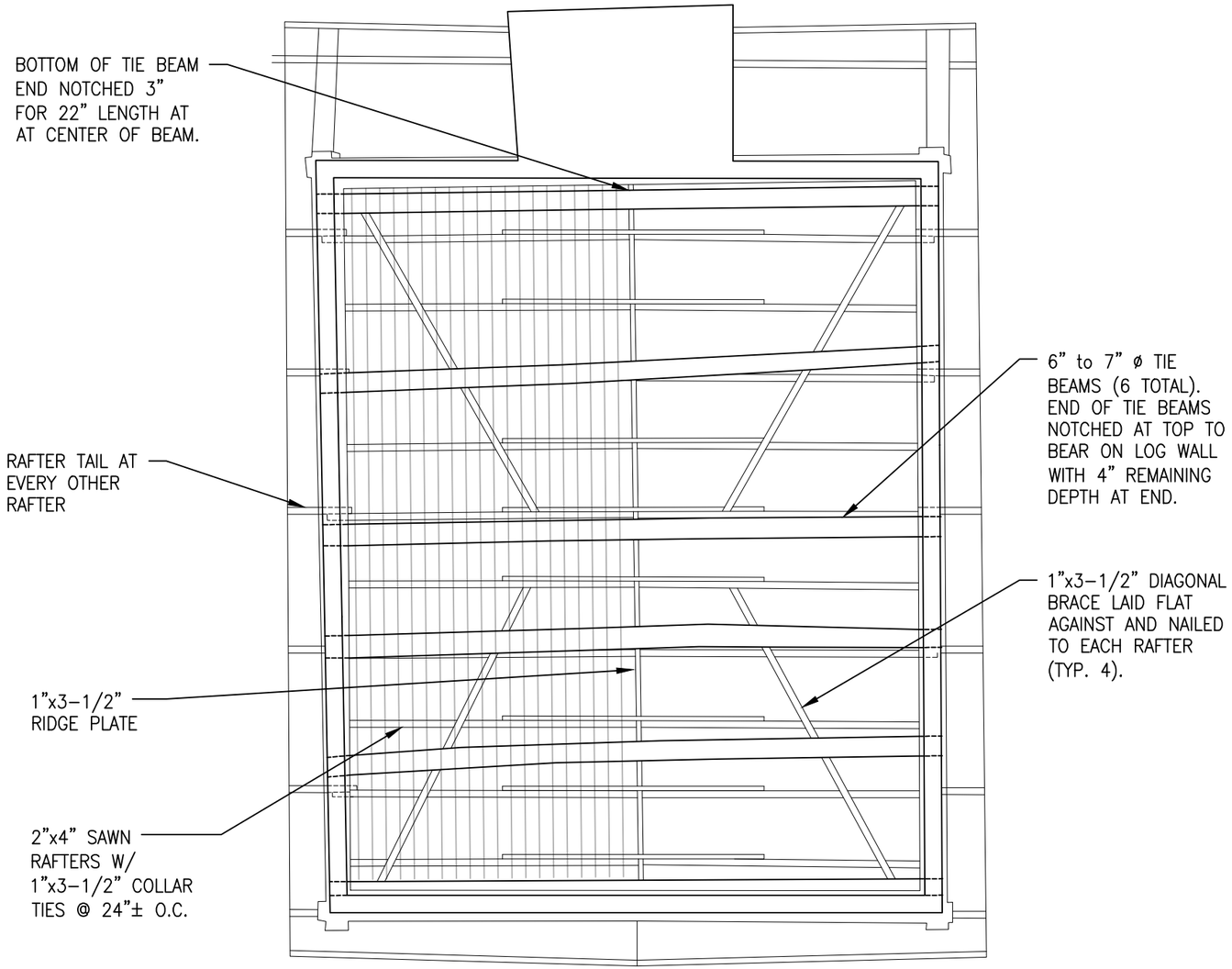
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Project Title: KELLY HOUSE

HSR Appendix C

S2.1




1 / S2.2 ROOF FRAMING PLAN

SCALE: 1/4" = 1'-0"

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Project Title: KELLY HOUSE

HSR Appendix C

S2.2

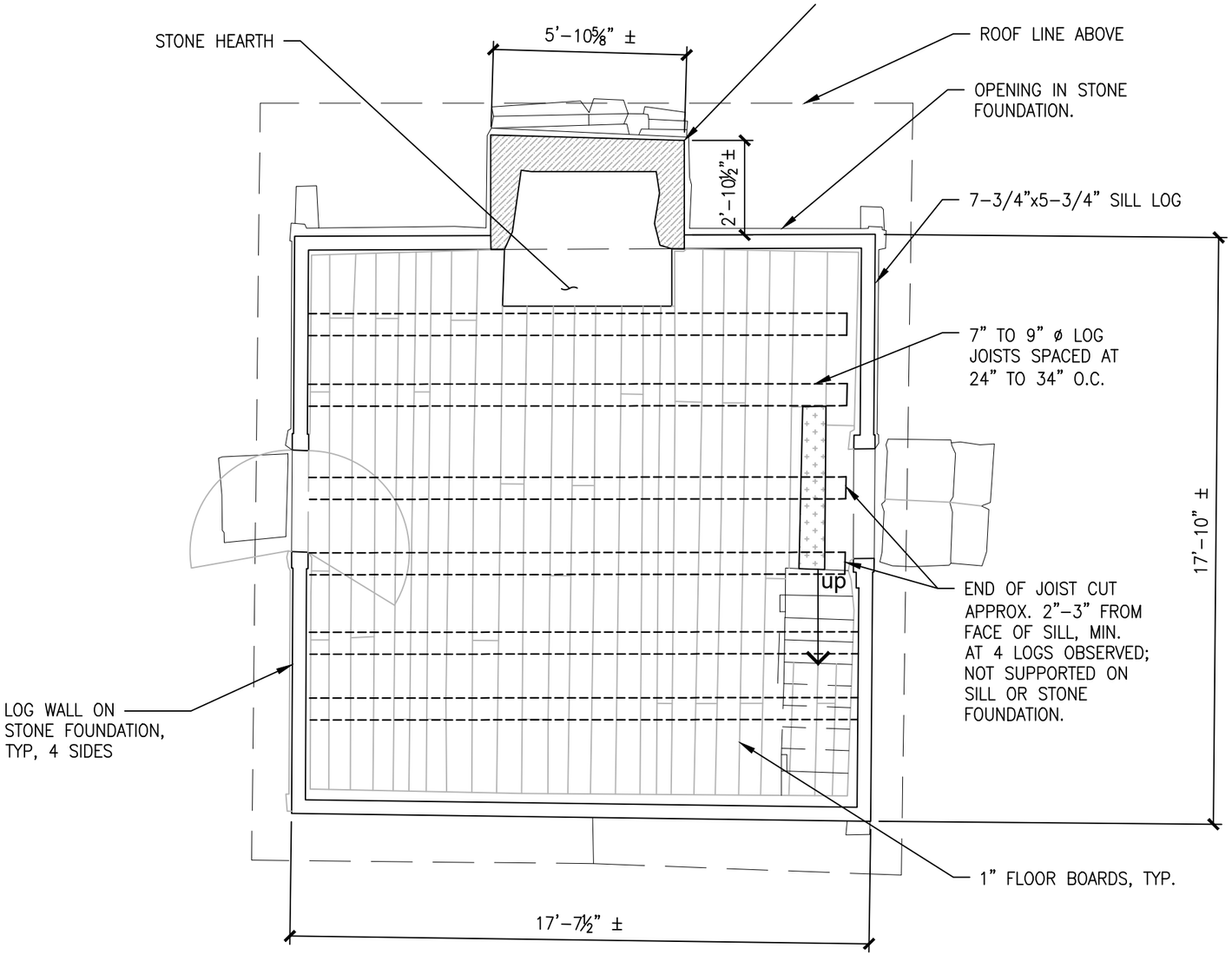
# Appendix C3: Brotherton House Structural Sketches

S3.1: Floor Framing / Foundation Plan

S3.2: Second Floor (Tie Beam) Framing Plan

S3.3: Building Section – Looking East

S3.4: Chimney Elevations




INDICATES LOCATION OF FLOOR BOARD REMOVALS ON SITE TO OBSERVE FLOOR FRAMING BELOW.

1 / S3.1 FLOOR FRAMING / FOUNDATION PLAN

SCALE: 1/4" = 1'-0"

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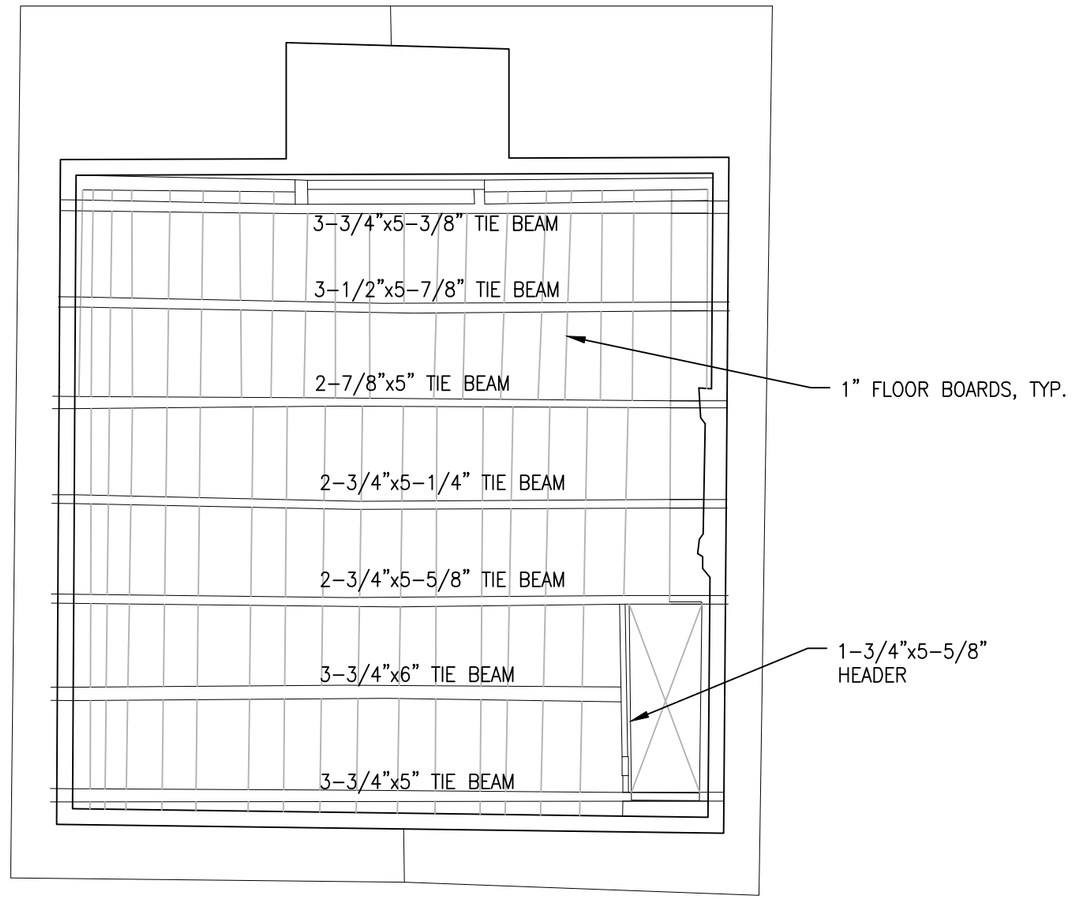
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Project Title: BROTHERTON HOUSE

HSR Appendix C

S3.1




1 / S3.2 SECOND FLOOR (TIE BEAM) FRAMING PLAN

SCALE: 1/4" = 1'–0"

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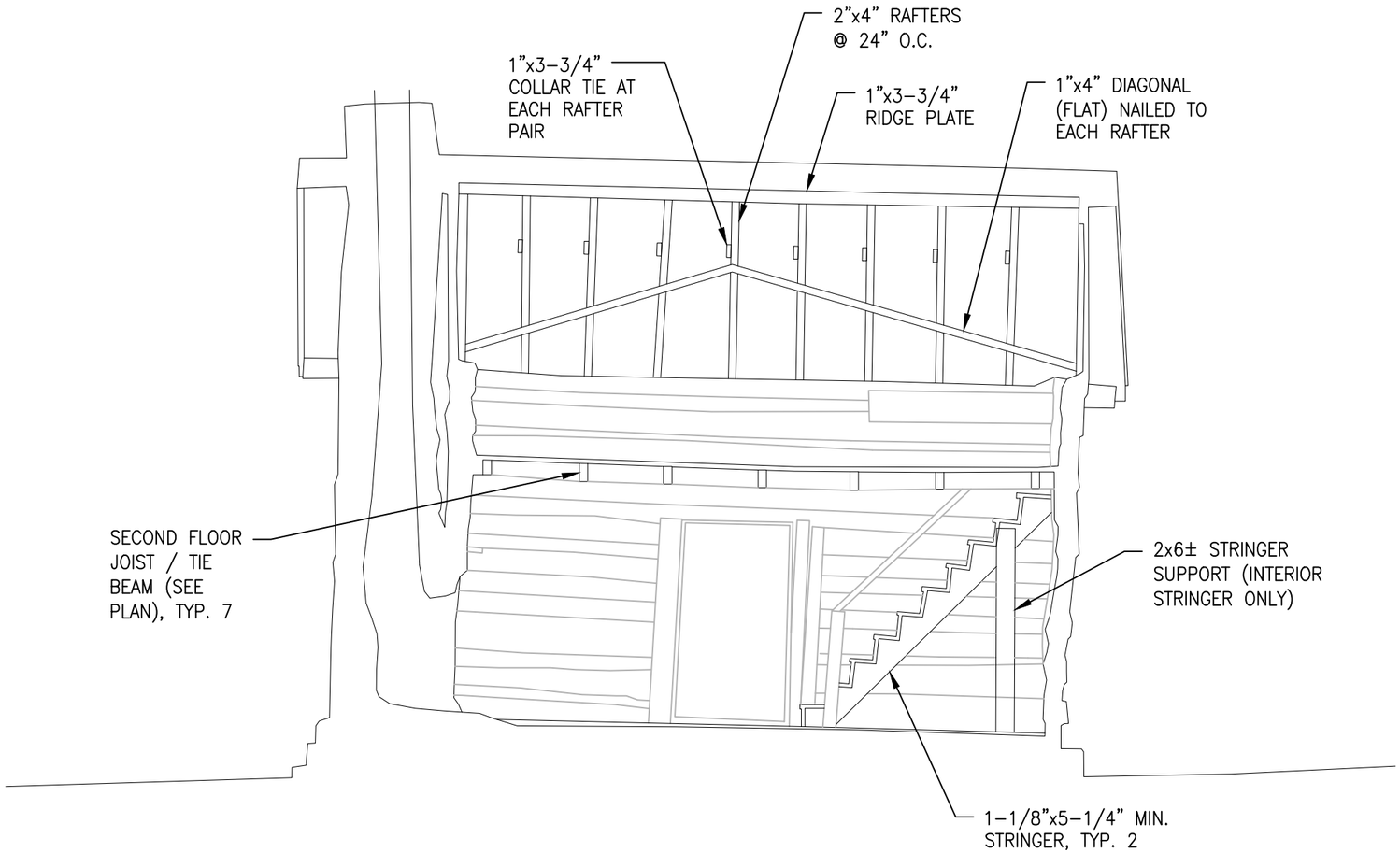
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HSR Appendix C

S3.2




1 / S3.3 BUILDING SECTION – LOOKING EAST

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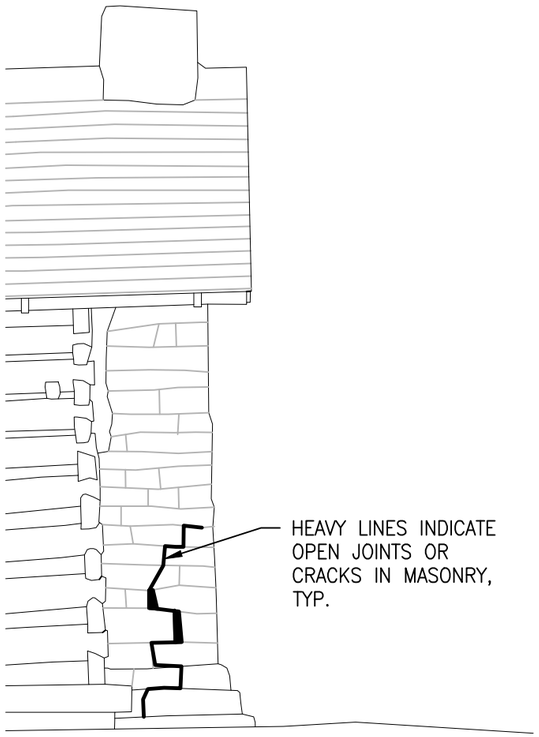
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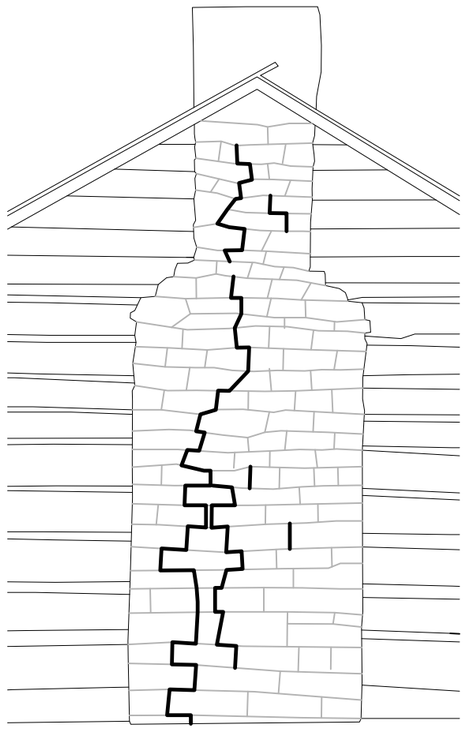
Project Title: BROTHERTON HOUSE

HSR Appendix C

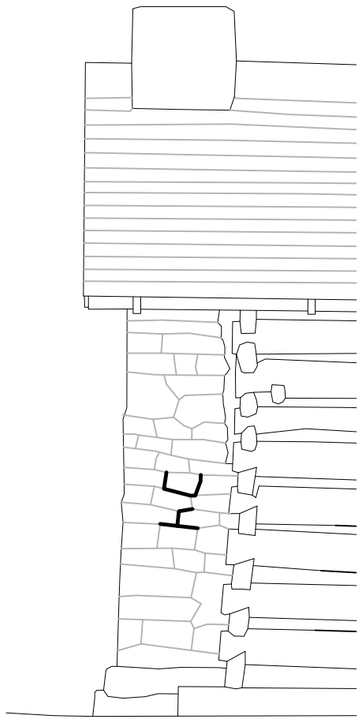
S3.3



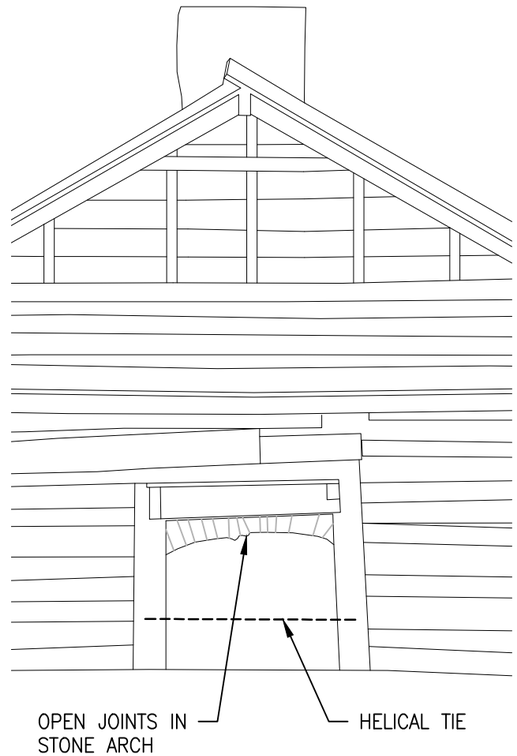

EAST ELEVATION



NORTH ELEVATION



WEST ELEVATION




SOUTH ELEVATION
(INTERIOR)

1
S3.4

## CHIMNEY ELEVATIONS

SCALE: 1/4" = 1'-0"

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Date: 04/17/23 | Submission: Historic Structure Report | Project Number: 21-129

Project Title: BROTHERTON HOUSE

HSR Appendix C

S3.4

# Appendix D:
# Wood Assessment Report by Anthony & Associates

*Report:*

# Wood Assessment of Log Buildings at Chickamauga & Chattanooga NMP



*Submitted to:*

Joseph K. Oppermann - Architect, P. A.
539 N. Trade St.
Winston-Salem, NC 27101

*Submitted by:*

Anthony & Associates, Inc.
P.O. Box 271400
Fort Collins, CO 80527-1400

*November 13, 2022*

# Wood Assessment of Log Buildings at Chickamauga & Chattanooga NMP

## BACKGROUND

This work was based on project needs provided by Mr. Jeff Anderson of Joseph K. Oppermann - Architect, P. A. (JKOA). The overall goal of the project is to document the Snodgrass, Kelly, and Brotherton Houses (the Houses) located in Chickamauga & Chattanooga National Military Park, make recommendations for treatment options, and explore various ways to utilize them. The purpose of this wood assessment is to provide information on the logs and related wood framing to be included in the Historic Structures Report that will be prepared by JKOA. Based on the wood assessment, the project team should have a better understanding of the log structures and the necessary information to make informed decisions about potential repairs to the structures based on various use options.

## SCOPE OF WORK

The work is intended to provide information to the project team to identify the species of the logs, location and extent of deterioration, as well as areas with elevated moisture content that can support insect or decay activity. This information will aid in determining use options and needed repairs for the Houses.

The scope of work will be a written report that includes:

- A narrative of findings/conclusions of the wood assessment
- Treatment recommendations for preserving the existing logs and a conceptual approach to making repairs
- Wood species identification for the earliest/original construction.
- Recommendations for wood species/grade to be used for repairs.

An on-site meeting was conducted with the preservation architect and structural engineer at the beginning of the field investigation to verify the objectives based on preservation goals. The field methods used during the wood assessment are described below.

### *Species Identification*

Identifying wood species, along with determining the structural grade and condition, makes it possible to determine design properties for conducting a structural analysis and to identify compatible material for repairs. Wood species were identified by removing small samples from members in each of the Houses, from which the species or species group were identified under microscopic examination (Figure 1). Eighteen total samples were removed to identify species.



**Figure 1.** Sample removal for species identification using a portable drill and a plug cutter on a sill log, Kelly House.



**Figure 2.** Sample removed from the sill log, Kelly House.

### *Visual Inspection and Probing*

Visual examination of the wood allows for identifying components that are missing, broken, or in an advanced state of deterioration. Missing components are those which have been removed or have fallen away because of deterioration, failure, or vandalism. If missing components were intended to provide

protection from the elements (i.e., to prevent moisture intrusion), their replacement may be essential to prevent long-term damage to the element or structure. Visual inspection also allows for the detection of past or current moisture problems, as evidenced by moisture stains on the exposed surface of the wood. Further, visual inspection enables detection of external wood decay fungi or insect activity as determined by the presence of decay fruiting bodies, fungal growth, insect bore holes or wood substance removed by wood-destroying insects (Figure 3).



**Figure 3**. Visual inspection showing decay of the sill log and door trim, Snodgrass House.

Internal decay and insect damage are often difficult to detect due to the lack of evidence on the exposed surface of the wood. Probing the wood with an awl enables rapid detection of voids in the wood that may not be visible on the surface if a thin shell of wood is all that is left. It can also indicate the approximate depth of any deterioration that is visible on the surface (Figure 4). Visual inspection and probing provide a rapid means of identifying areas that may need further investigation using resistance drilling.



**Figure 4.** Probing with an awl to determine the depth of surface deterioration of a sill log due to failure of the daubing, Kelly House.

### *Moisture Content Determination*

Prolonged exposure to moisture can produce undesirable conditions and long-term maintenance issues for wood in a structure. Limited moisture diagnostics were conducted on the Houses to identify areas of moisture absorption or intrusion and to determine whether further investigation of potential areas of decay was warranted (Figure 5).



**Figure 5.** Measuring the moisture content of a log, Kelly House.

Moisture content measurements identify wood with favorable moisture levels for the growth of wood-decay fungi. Generally, if the moisture content is less than 20 percent wood-decay fungi are unable to grow. While fungi may be present at lower moisture contents, they are unable to continue to deteriorate the wood without sufficient moisture. Moisture contents from 20 to 30 percent indicate areas of concern where sufficient moisture is present for fungi to grow but not sufficient to indicate advanced decay. Moisture contents above 30 percent are

often an indication of advanced decay with internal voids and / or surface deterioration.

Moisture content measurements of the extant logs also identify an appropriate target moisture content for repair and replacement material. Shrinkage and checking in replacement material due to seasonal humidity changes can be minimized by determining the equilibrium moisture content of the existing wood (the moisture content the wood seeks to attain throughout the seasons) and specifying the moisture content of replacement material to match.

### *Structural Grading*

Logs and structural lumber used in new construction are intended to comply with the relevant building code for that jurisdiction. For wood construction, structural engineers rely on design values referenced in the building code to determine an acceptable species, size, and grade for a particular load condition. The design values given in the building code for solid wood products are established by the American Forest & Paper Association and published as the *National Design Specification for Wood Construction*.[1] The published design values are based on test data and procedures published by the American Society for Testing and Materials (ASTM) that demonstrate the engineering performance of the material.[2] Wood products are graded in accordance with procedures promulgated by one of several forest products industry associations, such as the Northeastern Lumber Manufacturers Association (NELMA).[3]

For existing structures, the engineer often relies on available species and current standards to determine the adequacy of the wood members to remain in service. Since many older structures were built before building codes or design values for wood products were established (and, thus, before grade stamps were used), engineers are often in a quandary when determining what design values are appropriate. Frequently an assumed species and grade are assigned, only to show that the wood members are structurally deficient. The result is often an overly conservative estimate of design values and unnecessary replacement and repair decisions with the associated unnecessary project costs.

Through in-situ visual grading of logs of interest to the structural engineer, grade information was determined to provide the wood properties necessary for an

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[1] American Forest & Paper Association and American Wood Council, 2018, *National Design Specification for Wood Construction*, Washington, D.C.

[2]American Society for Testing and Materials, 2016, *Annual Book of Standards*, Vol. 04.10: D245, Standard Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber; D2555, Standard Test Methods for Establishing Clear Wood Strength Values. ASTM, West Conshohocken, Pennsylvania.

[3] Northeastern Lumber Manufacturers Association (2013). *Standard Grading Rules for Northeastern Lumber*. Cumberland, Maine.

engineer to conduct structural analysis. For visual grading, the size of knots and the slope of grain (deviation of the wood fibers from parallel) are the two factors that typically determine the grade that can be assigned (Figures 6 and 7). A structural analysis based on grade information can predict the structural members' ability to support anticipated load requirements and provide information critical for determining the extent of any necessary repairs.



**Figure 6**. Knot in a tie beam that was used to determine structural grade.



**Figure 7**. Significant slope of grain in a tie beam that was used to determine the structural grade.

### *Assessing Deterioration using Resistance Drilling*

Resistance drilling is a quasi-nondestructive technique for determining the relative density of wood (Figure 8). It is well suited for determining internal problems in logs and other wood components which do not show obvious signs of deterioration, such as surface decay. Any internal voids due to decay or insect damage at the location drilled can be detected by determining the relative

density of the wood. The relative density is recorded as a small diameter needle penetrates the wood.



**Figure 8.** Resistance drilling of a wall log to determine the presence of internal deterioration, Kelly House.

## FINDINGS

Although it is often useful to list all information on a structure under the subheading for that structure, the commonality between wood species, structural grade, and moisture content between the Houses suggests that the discussion of the findings maybe more useful when discussed together. The Houses used similar wood species, the structural grades were similar, and moisture content readings exhibited similar conditions. That being the case, these data are provided in the tables below for all three houses and, in separate sections, photographs showing various conditions unique to each house are shown.

Describing the construction of the Houses was not part of the scope of the wood assessment but it is worth noting that some logs in a given house were hewn, others were not, and even the wall logs on a particular elevation might differ. Similarly, the log crowns and notches varied on a given house. The crowns were typically round but some were pitched, the result of a V-notch. The notches included half dovetail, V-notches, square notches, and full-dovetail notches at a minimum. It is unclear what this mix of construction typology says about the original structures or subsequent construction/repair campaigns.

### *Species Identification*

Reportedly, it is unlikely that any of the wood in the three houses is original fabric. It is unknown if attempts were made to make repairs using the same wood species or structural grade. Nonetheless, as is shown in Table 1, two wood

species groups dominate the species used in all three houses: the southern pine group (*Pinus spp*.) and the white oak group (*Quercus spp*.). One floor joist in Brotherton was identified as eastern redcedar, a species not typically used as structural material. Figures in Appendix A of the main report show the locations where samples were removed for species identification from each House.

Subspecies of both the southern pine group and white oak group are native to northern Georgia and may have been used in the original construction of the houses. Shortleaf pine (*Pinus echinata*), eastern white pine (*Pinus strobus*), loblolly pine (*Pinus taeda*), and Virginia pine (*Pinus virginiana*) are known to grow in northern Georgia. Of those, all are in the southern pine group except eastern white pine. Southern pines in this species group are not resistant to decay fungi or insect attack unless pressure treated with a wood preservative. The white oak group in northern Georgia numbers perhaps a dozen or more species but true white oak (*Quercus alba*) dominates the group by number of trees. White oaks are considered moderately resistance to decay fungi and some insect attack.

**Table 1.** Species Identification Table, Chickamauga Log Houses

| Sample No | House | Member | Location | Species | Moisture Content (percent) |
|---|---|---|---|---|---|
| S12 | Snodgrass | tie beam | 3rd from south end | southern yellow pine (*Pinus spp.*) | |
| S13 | Snodgrass | rafter | 3rd from south end | southern yellow pine | |
| S14 | Snodgrass | sill log | west wall | white oak (*Quercus spp*.) | 16 |
| S15 | Snodgrass | sill log | east wall, south end | white oak | 18 |
| S16 | Snodgrass | floor joist | 1st from north end | white oak | 20 |
| S17 | Snodgrass | top plate | south wall, west end | white oak | 16 |
| S18 | Snodgrass | top plate | west wall, south end | southern yellow pine | 14 |
| S01 | Kelly | floor joist | top of joist, second from north end wall | southern yellow pine | 22 |
| S02 | Kelly | tie beam | fifth from north end wall | southern yellow pine | 13 |
| S03 | Kelly | roof rafter | north face | southern yellow pine | 12 |
| S04 | Kelly | wall log | west wall, 8th course, north end | southern yellow pine | |
| S05 | Kelly | sill log | west wall, south end | white oak | |

| Sample No | House | Member | Location | Species | Moisture Content (percent) |
|---|---|---|---|---|---|
| S06 | Kelly | wall log | east wall, 5th course, behind door | southern yellow pine | |
| S07 | Brotherton | sill log | east wall, west face of north end | white oak | |
| S08 | Brotherton | wall log | south wall, 6th course, west side | southern yellow pine | |
| S09 | Brotherton | floor joist | east side, 4th from north end | eastern redcedar (*Juniperus virginiana)* | |
| S10 | Brotherton | ceiling joist | 3rd from south end | southern yellow pine | 14 |
| S11 | Brotherton | wall log | south wall, 4th course, west end | southern yellow pine | |

***Structural Grade***

Large knots were not observed on the rafters, tie beams, and ceiling joists in the Houses. Similarly, the slope of grain, as determined by the presence of seasoning checks, was slight, i.e., the grain was not observed to twist around the log on these structural members. Severe slope of grain was observed on some wall logs but the effect was minimal because of the type of loading on those logs.

Table 2 provides the structural grades for the various member types of interest to the structural engineer. Many of these members were logs but some were dimension lumber. All of the structural members visually graded were southern pine, regardless of whether they were logs or dimension lumber. For dimension lumber, the grade of Select Structural has different design values than Select Structural logs. Note that the floor joists were not assigned a structural grade because of very limited access below the floor boards.

The rafters, tie beams, and ceiling joists (in Brotherton only) could be assigned the grade of Select Structural based on observed knot size and slope of grade. Of the six tie beams in the Kelly House, two had knots or slope of grain that reduced the grade to No. 2 for the group, although the other four tie beams could be assigned the grade of Select Structural. If structural analysis shows that the No. 2 grade is insufficient to support the required loads, it would be possible to reinforce or replace the two weaker No. 2 members only and retain the other four members.

**Table 2. Structural Grade based on Observed Visual Characteristics**

| House | Member Type | Structural Grade | Comments |
|---|---|---|---|
| Snodgrass | Rafters | Select Structural | |
| Snodgrass | Tie beams | Select Structural | |
| Snodgrass | Floor joists | insufficient data | |
| Kelly | Rafters | Select Structural | |
| Kelly | Tie beams | No. 2 | Two of 6 are No. 2, others are Select Structural, as marked on the drawings |
| Kelly | Floor joists | insufficient data | |
| Brotherton | Rafters | Select Structural | |
| Brotherton | Ceiling joists | Select Structural | |
| Brotherton | Floor joists | insufficient data | |

### *Moisture Content Readings*

The moisture content measurements given in Table 3 lists only the readings not taken at either a species identification sampling location (which are shown in Table 1) or a resistance drilling location (which are shown in the table in the Appendix of this report). Figures in Appendix A of the main report show the locations where moisture content measurements were taken in each House. The moisture content readings were generally below 20 percent. The only readings greater than or equal to 20 percent were either sill logs in ground contact, floor joists, or sills below doors, i.e., logs that were able to absorb moisture due to direct contact with or close proximity to the ground. These members often exhibited wood decay and, at the time of this assessment, provide a favorable environment for active wood decay; i.e., the damage is on-going.

**Table 3.** Additional Moisture Content Measurements for the Log Buildings at Chickamauga & Chattanooga NMP

| House | Elevation | Log Number | Location | Moisture Content (percent) |
|---|---|---|---|---|
| Snodgrass | | floorboard | 7th row from west wall, 6' from fireplace | 23 |
| Snodgrass | South | 5 | east end | 12 |
| Snodgrass | East | 4 | south end | 14 |
| Snodgrass | East | 1 | below door | 26 |
| Snodgrass | East | 1 | north end | 17 |
| Snodgrass | East | 2 | north end | 15 |
| Snodgrass | East | 3 | north end | 13 |
| Snodgrass | North | 1 | under window | 16 |
| Snodgrass | North | 2 | center of fireplace | 17 |
| Snodgrass | North | 2 | just west of fireplace | 18 |

| House | Elevation | Log Number | Location | Moisture Content (percent) |
|---|---|---|---|---|
| Snodgrass | North | 3 | just west of fireplace | 19 |
| Snodgrass | North | 1 | near west end | 17 |
| Snodgrass | North | 2 | west end | 17 |
| Snodgrass | North | 3 | west end | 17 |
| Snodgrass | North | 4 | west end | 15 |
| Snodgrass | West | 2 | north end | 17 |
| Snodgrass | West | 3 | north end | 15 |
| Snodgrass | West | 4 | north end | 13 |
| Snodgrass | West | 1 | under door | 14 |
| Snodgrass | West | 2 | south end | 16 |
| Snodgrass | West | 3 | south end | 14 |
| Kelly | East | 2 | south end | 14 |
| Kelly | East | 2 | north end | 13 |
| Kelly | West | 5 | south end | 11 |
| Brotherton | | rafter | 3rd from south end, east side | 12 |

***General Comments on Condition Assessment***

Condition was determined from visual inspection combined with probing, moisture content measurements, and resistance drilling. Figures in Appendix A of the main report show the locations where resistance drilling was conducted in each House.

The terms, "good," "fair," and "poor" can be used to describe the condition of the logs and associated framing members. "Good" is used to describe members that have no evidence to minor evidence of deterioration due to decay or insect attack. Minor deterioration means that the damage is not visibly obvious and that it is incidental to the member's ability to perform its current function. These members may have small, localized areas of intermittent deteriorated wood that can be easily penetrated with an awl on the surface or may be shown to have a limited number of small internal voids. These determinations may be based on visual inspection, probing, and/or resistance drilling. Logs may be determined to be in "fair" condition if there are obvious visible but localized voids or intermittent damage. A member classified as in "poor" condition is one that has significant deterioration, most likely due to wood decay fungi or insect activity. Members in poor condition are, generally, no longer able to perform their intended function and may contribute to the failure of the member or supporting structure. The three houses exhibit the full range of conditions.

Logs and structural timber will typically have seasoning checks on one or two faces, which are due to differential shrinkage of the timber and are part of the

natural process as the wood dries. A check is a separation of wood fibers in a log or dimension lumber, typically along the length of the member, that results from the drying of the wood after processing or installation in the structure. Narrow seasoning checks can be seen in the second course log seen in Figure 3. Checks are not defects and do not reduce the performance of the piece structurally, unless two checks on opposite faces join to form a through split. Checks are often used to determine the slope of grain in a member when conducting visual grading.

Weathering of wood results from cyclic wetting and drying of the wood, exposure to ultraviolet light, and erosion by wind-blown debris, a process similar to sandblasting. It does not get categorized as deterioration, such as decay, since it does not generally impact the performance or the member, only the appearance. Unlike decay or insect attack, weathering is typically not a significant factor in the failure of wood members and the collapse of a structure. Weathering will change the appearance of wood, but the process is so slow that failure of components due to decay or insect attack generally occurs long before weathering becomes a major factor in the failure. Weathering seldom damages the wood enough to require replacement, with the exception of shingles and cladding. Weathered wood is often considered aesthetically pleasing with the silver-gray or dark brown patina and may be a character-defining feature of the structure for the period of significance.

When weathering occurs, the degree of color change or texture on the log surface is a function of the wood species, chemical constituents in the wood, specific gravity of the wood, growth-ring count, and elevation of the log on the building, among other factors. The age of a log relative to another log in the Houses cannot be determined from their appearance. A new log with fresh cut surfaces obviously has a different appearance than a log that has been in service for decades but none of the logs in the houses are freshly cut. Photos provided by NPS (many of which were not dated) do not offer a means of making conclusive statements about the age of the logs on a given elevation or house.

Additionally, NPS staff have suggested that telephone poles have been used as replacement logs. This may be due to the different appearance of the logs. No physical evidence that supports the theory that telephone poles were used in a previous repair campaign was discovered during the wood assessment. No documentation was reviewed that supported the use of telephone poles. If there is a primary source, such as a receipt for purchase of poles from a telephone company, someone would need to investigate the species, source and date of manufacture of the poles based on that information. Further, use of the terminology "telephone poles" appears to be anecdotal. Telephone pole is not a technical term that has a basis in the wood pole realm. While people often refer

to any wood pole as a telephone pole or, perhaps a power pole, they are, technically, wood poles. Wood poles are used by both the electric utility and telecommunication industries.

If any of the logs were recycled wood poles, they would almost certainly be southern pine, the most common species used in northern Georgia for distribution poles (the smaller poles for low voltage overhead lines) and telecommunication poles. Hypothetically, assuming the poles were replaced at least 20-25 years ago and had been in service as wood poles for the typical period for a pressure treated southern pine pole, the poles would have been manufactured sometime before 1960.

Most poles manufactured prior to the 60s were treated under pressure using either creosote or pentachlorophenol. The poles would have been treated to what was referred to as "refusal"; in other words, as much chemical as possible was forced into the wood to provide the maximum service life. Industry standards were changed once it was realized that treating to refusal used a considerable volume of creosote or pentachlorophenol (using diesel fuel as the carrier). It was expensive, wasted chemicals, and reduced the manufacturers' profit. As a result, the American Wood Preservers Association (now the American Wood Protection Association) established standards that put limits on the depth of penetration and the weight per cubic foot of the preservative for specific application, such as wood poles.

What does this mean for the logs in the houses? If some of the logs were from older poles that had been removed from service, (1) they would have not been recycled if they were deteriorated and (2) they would have been treated to refusal with either creosote or pentachlorophenol. The chemicals from the pressure treatment would volatilize for decades and would continue to do so today. The logs would have a strong odor of either creosote or diesel fuel, even today. No such odor was detected. The logs had the faint odor and appearance associated with weathered wood, not wood that had been treated to the level of a wood pole.

Should there be an interest in whether chemicals had been introduced into the logs under pressure (but not whether they had been used as wood poles), chemical tests can be conducted to determine the presence of either creosote or pentachlorophenol. Such tests may be able to determine whether chemical treatment was used or not but the tests would not indicate whether any of the logs came from recycled wood poles. Historical documentation would be needed to confirm that hypothesis.

As mention above (although not part of a condition assessment and noted in other sections of the project report), various corner notch configurations were observed. There was no consistency or pattern to the use of a specific notch type in the Houses that can aid in determining the age of a particular log relative to other logs. Different notching on a structure can be found even from the same period of construction, often due to reuse of logs from other structures. In the Houses, it was more likely that different craftspeople used whatever notch was within their skill set.

The type of notch will not provide insight into the date (age) of the log or period of construction. Dendrochronology may be able to provide some insight into the possible age range of a given log. Dendrochronology may be able to aid in putting a range on when a tree was harvested but reuse of logs was very typical in these types of structures, making it difficult to determine the period of construction even if the harvest date is known. As such, dating the logs for the Houses would be of little value and is not recommended as the information gained could not be used with a reasonable degree of certainty. It should be noted that using different notch types for connecting the logs does not impact the structural integrity of the House. However, *workmanship* does impact the integrity of the notch, as poor detailing and loose notches will allow for water intrusion that can lead to decay.

There are a few examples of log conditions worth illustrating. These are shown in the sections below for each house.

***Snodgrass House***

The logs in Snodgrass are generally in good condition. Figures 9-22 show various conditions that either should be considered for repair or may be historically significant. In addition to the wood species, structural grade, and moisture contents given in Tables 1-3 above, the results of the resistance drilling for Snodgrass are given in the Appendix to this report.

As part of the overall project, JKOA documented the conditions of the various materials in the Houses and 1200 AE documented the conditions of structural members. Although some duplication of reporting may exist, results of the visual observations, probing, moisture content readings, and resistance drilling of the logs and framing members gleaned through the wood assessment that may require treatment are summarized as follows:

- Top plates – south top plated is decayed on the west end to approximately 48”, the west top plate is decayed at the south end with no void at approximately 20” from the south end. This deterioration is due to a prior roof leak.

- Rafters – rafters vary in dimension, rafter no. 1 parallel to the south top plate is decayed, rafter no. 2 from the south on the west top plate is decayed, and is sistered with a 1″x 2″ board, all rafters on the west side have shifted outboard and the nails securing the rafter to the top plate are exposed.
- Sill logs – the east sill log had a 1.5″ channel south of the stone step, the west sill log showed significant deterioration at the door threshold and was shown to be thin (3.5′ to 4″) when drilled along its length.
- Log crowns – generally in fair condition with some minor deterioration in the end grain that does not extend into the notch.
- Floor joists – overall condition is unknown but where exposed, the joist was decayed and had termite damage, other joists no longer had fastener-holding capacity (the nails could be pulled out).



**Figure 9.** Stone foundation supporting logs above grade; note trimmed vegetation not in contact with the logs, east elevation, south end. Sill log is in fair to good condition with a minor decay channel; otherwise logs in good condition.



**Figure 10.** Leaning chimney wall showing non-uniform width of daubing between the logs.



**Figure 11.** Nails between log courses used to retain daubing, logs appear in good condition.



**Figure 12.** Holes with unknown purpose in the third course on the west elevation.



**Figure 13.** Deteriorated door boards in poor condition allowing moisture and rodents into the structure, west elevation.



**Figure 14.** Ceiling joists and roof framing in good condition. Note the dimension lumber tie beam near the roof peak as well as the lower tie beam (in the foreground) at the top of the walls.



**Figure 15.** False rafter tail visible on the interior of the house. Roof sheathing and framing in good condition.



**Figure 16.** Exposed rafter end adjacent to tie beam showing random nailing securing the rafter to the top plate, west elevation.



**Figure 17.** Butt-jointed wall logs in good condition, likely previous repairs.



**Figure18.** Deteriorated rafter in fair condition near the southwest corner.



**Figure 19.** Sistered rafter in poor condition, or rafter tail; nails indicate a recent repair, southwest corner. Note top wall log on the south elevation in poor condition showing extensive deterioration on the west end.



**Figure 20.** Top wall log on the south elevation in poor condition showing deterioration along the length of the log, west end of the log.



**Figure 21.** Floor board removed to expose floor joists. The joists were in poor condition.



**Figure 22.** Door sill on west elevation and floor joist, both in poor condition, viewed from above.

***Kelly***

The logs in Kelly are generally in good condition. Figures 23 – 32 show various conditions that either should be considered for repair or may be historically significant. In addition to the wood species, structural grade, and moisture contents given in Tables 1-3 above, the results of the resistance drilling for Snodgrass are given in the Appendix to this report.

Results of the visual observations, probing, moisture content readings, and resistance drilling of the logs and framing members gleaned through the wood assessment that may require treatment are summarized as follows:

- Sill logs – the east sill log has small (1" to 1.5" voids) along the length of the log, the west sill has a 3" to 3.5" decay channel both north and south of the door.
- Wall logs – the 5th log on the east wall, south of the door has surface deterioration, the 6th log on the west wall has deterioration on the south end.
- Log crowns – generally in fair condition, some minor voids in the end grain.



**Figure 23.** Floor board removed to expose joist in fair to good condition but with limited clearance and intermediate support along the span.



**Figure 24.** Exposed floor joist showing close proximity to soil and irregular support, appears to be in fair to good condition based on visual observations only.



**Figure 25.** Exposed floor joist showing contact and close proximity to soil and irregular support along the span. Note the surface of joist and underside of the floor boards does not show deterioration and appears to be in fair to good condition in spite of the soil contact. The joists could not be assessed for condition other than visually and limited probing with an awl.



**Figure 26.** Connection detail between the rafter and the top wall log. The top plate and rafter are in fair to good condition.



**Figure 27.** Termite damage and surface deterioration in poor to fair condition on the exterior face of the south end of the 6th wall log, west elevation.



**Figure 28.** Exposed end of a log crown in fair condition.



**Figure 29.** Exposed end of a log crown in fair condition (because of limited loss of cross section) with an internal void. The log notches do not mate well because of different notching or improper cuts.



**Figure 30.** Exposed foundation detail at the southeast corner after excavation indicating that the visible logs are the lowest courses.



**Figure 31.** Sill log in ground contact in fair to good condition, northeast corner.



**Figure 32.** Log crowns showing considerable variability in the notching methods used. Logs are generally in fair to good condition.

### *Brotherton*

The logs in Brotherton are generally in good condition. Figures 33 – 44 show various conditions that either should be considered for repair or may be historically significant. In addition to the wood species, structural grade, and moisture contents given in Tables 1-3 above, the results of the resistance drilling for Snodgrass are given in the Appendix to this report.

Results of the visual observations, probing, moisture content readings, and resistance drilling of the logs and framing members gleaned through the wood assessment that may require treatment are summarized as follows:

- Sill logs – the east will log has significant decay at all locations drilled, the west sill log shows slight surface deterioration.

- Wall logs – the 6th wall log on the south elevation showed minor surface deterioration.
- Log crowns – generally in fair condition



**Figure 33.** Course of support stones beneath the sill log; note the trimmed vegetation is not in contact with the logs.



**Figure 34.** Deteriorated sill log, east elevation.



**Figure 35.** Architectural door trim; note hewn marks on header log above door.



**Figure 36.** Floor framing and crawl space viewed through the foundation opening showing limited access.



**Figure 37.** Floor board removed near the east entry door to expose floor joists.



**Figure 38.** Roof rafter with shim, likely to accommodate an improper cut on the rafter, east elevation near the south wall.



**Figure 39.** Roof framing configuration, framing is in good condition.



**Figure 40.** Typical half dovetail notches at the corners. Note weathered appearance of logs.



**Figure 41.** Notch with shim, likely to fill improper cut of the log. Shims may have been used due to shrinkage of the logs or poor fabrication of the notches. Wall logs are generally in fair to good condition.



**Figure 42.** Notch with shim, likely to fill improper cut of the log. Shims may have been used due to shrinkage of the logs or poor fabrication of the notches. Note seasoning check in the wall log.



**Figure 43.** Lichens on a log crown in fair condition.



**Figure 44.** Ceiling joist of dimension lumber in good condition penetrating the log wall; note that the end grain is free of deterioration, east elevation.

## TREATMENT CONSIDERATIONS

### *Log Repairs and Replacement*

If log repairs are determined to be desirable either for restoring lost structural integrity due to decay or insect damage, dutchman repairs can be used by removing and replacing the area of deteriorated wood. Minor surface deterioration on an exterior log can be repaired using a log veneer attached to the existing log once the deteriorated surface material is removed.

The wall logs are a mix of white oak and southern pine species groups. The wood species used for any repairs or replacement of the logs should be white oak

if a goal is to provide long-term durability. Southern pine could be considered as an alternative if initial cost is a higher priority than longevity. In addition to wood species, replacement logs should be of the same dimensions with similar growth characteristics (e.g., knot frequency, size, and spacing), moisture content (to avoid differential shrinkage and open joints), growth ring count (e.g., avoid using southern pine logs with less than six growth rings per inch when observing the end grain) and tool marks (to match historic appearance, if determined to be accurate). Dutchman repairs are preferable to full-log replacement. When sourcing material for repairs, consider specifying reclaimed material since it will be easier to match the characteristics of the existing material. Any replacement material should be less than 20 percent moisture content at the time of the repair to minimize differential shrinkage between replacement and existing material (to provide for a tight joint) and reduce the likelihood of wood decay due to the high moisture content.

### *Vegetation and Grade*

At the time of this assessment, all of the vegetation had been trimmed around the perimeter of the Houses. This allows for drying of the lower course logs after wetting, which was somewhat reflected in the moisture content readings. Should the vegetation not be trimmed, the moisture content of the lower-course logs would be elevated, putting those logs at greater risk of decay.

The grade around the Houses (not to be confused with structural grade of the logs and dimension lumber) allows for some drainage towards the structures. Providing for positive drainage away from the Houses on all elevations would reduce the likelihood of moisture problems.

### *Seasoning Checks*

A common concern is that checks should be filled to prevent moisture from entering the interior of the log, resulting in internal decay. Filling the checks with mortar, daubing, or a sealant will seldom keep moisture out in the long term and once moisture is in the wood, it is generally trapped. The checks should not be filled; they should be left open to allow for drying when the wood gets wet. Removing leaves and debris periodically (initially, annually) is sufficient maintenance for reducing the development of decay via the checks in the logs.

### *Remedial Treatment to Retard Decay and Extend the Service Life of the Logs*

For extending the service life of the logs, borate rods can be inserted into the logs susceptible to moisture absorption to mitigate additional deterioration by wood decay fungi. Borate rods can be inserted into holes drilled into the log where deterioration has been identified. Borates are low-level toxicity preservatives

that are used to improve the durability of both new and in-service wood products. Borates require moisture to migrate through the wood but can be leached from the wood with too much exposure to moisture; therefore, they will need to be inserted in the area of active deterioration, unless the deteriorated wood is replaced and the source of moisture is eliminated. Borates also effectively control termites, carpenter ants, a variety of beetles, and other wood boring insects. Topical borate treatments (liquids) applied to the surface offer no protection to the more vulnerable interior of large timbers and are not recommended.

To install borate rods, holes are drilled into the areas where moisture is a concern (i.e., ground contact), the rods are inserted, and the holes are filled with either a pressure-treated wood plug or a plastic threaded plug. Borate rods are typically effective for three to ten years depending on environmental conditions, but they should be inspected on a 5-year cycle given the current and anticipated moisture exposure of most of the elements. The borates should be incorporated into a cyclic, long-term maintenance program.

## SUMMARY

The logs of the Houses are, generally, in fair to good condition, with a few lower logs in need of repair due to long-term contact with moisture, conditions that have been exacerbated by poor drainage and proximity to vegetation. Additionally, a few logs below roof leaks are deteriorated and should be repaired. The primary mechanism of deterioration is wood decay fungi facilitated by moisture that is absorbed and trapped into the logs. The floor joists are, generally, in poor condition (other than Kelly House) due to ground contact and a lack of ventilation in the limited crawl space below the flooring. The wood assessment findings can be summarized as follows:

- The wood species used in all three houses is a mix of species or species groups: southern pine group (*Pinus spp.)*, the white oak group (*Quercus spp.*) and eastern redcedar (*Juniperus virginiana*).
- The wood species used for any repairs or replacement of the logs should be white oak to provide long-term durability. Southern pine could be considered as an alternative if initial cost is a higher priority than longevity. If log repairs are determined to be desirable either for restoring lost structural integrity due to decay or insect damage, dutchman repairs can be used by removing and replacing the deteriorated wood.
- If logs need to be replaced, they should be replaced with logs of the same dimensions with similar growth characteristics, moisture content, and tool marks.

- Moisture content readings ranged from 14 to 26 percent for the sill logs, 10 to 19 percent for logs above the sill logs, and 16 to 23 percent for floorboards and floor joist. Most of the logs and framing members do not provide a favorable environment for wood decay, unless in ground contact (sill logs or floor joists) at the time of the assessment.
- The structural grade that can be assigned to the tie beams and framing members was Select Structural, with the exception of two tie beams in the Kelly House, which can be assigned the grade of No. 2. The species and dimensions would dictate the allowable design values published in the *National Design Specification for Wood Construction*.
- The condition of the logs is, generally fair to good, with a few exceptions.
- The condition of the floor joists is generally poor as observed when floor boards were removed, except in the Kelly House, which appeared in fair to good condition. There was limited access to assess the joists in all three houses.
- The mechanism of deterioration is wood decay fungi, termites, carpenter bees, and wood-boring beetles, with decay being the primary mechanism.
- Limited resistance drilling showed that few internal voids were present and decay damage was, generally, limited to what was visible.
- The current construction and maintenance of the Houses appears to prevent moisture wetting the wood sufficiently to support active wood decay in most locations.
- The limited crawl space is problematic and puts the floor joists in or near ground contact where they can absorb moisture either from moisture migrating through the soil or high relative humidity in the confined space. If the depth of the crawl space is increased, the repaired/replaced floor joists will be less likely to decay.
- Elevating the logs that are in ground contact by improving/installing a foundation to raise the logs would extend the service life of the lower courses of logs.
- Keep vegetation from in contact or near the lower course of logs that are not supported above grade on stone foundations. Although this was not seen as a problem during this assessment because the grass had recently been mowed, allowing vegetation growth would provide a more favorable environment for decay and insect damage.
- The National Park Service may want to consider installing borate rods in logs where prolonged contact with moisture is a possibility. This would be in areas at door thresholds or where the lower course logs are within 8

inches of grade. The borate rods can extend the service life and offer some level of protection against wood decay.

## APPENDIX

**Table A1.** Resistance drilling log for the Log Buildings at Chickamauga & Chattanooga NMP

| Drilling Number | House | Elevation | Log Number | Location | Moisture Content (percent) | Comment |
|---|---|---|---|---|---|---|
| D01 | Kelly | East | 1 | sill log, 10" from south end, 2" up | | 2" solid, 1" punky, then solid |
| D02 | Kelly | East | 1 | 60" from south end, 2" from bottom | 22 | no void |
| D03 | Kelly | East | 1 | 82" from north end, 2" from bottom | 24 | 1" solid, 1.5" void 3" solid 1" void |
| D04 | Kelly | East | 1 | 15" from north end, 2" from bottom | 20 | 6" solid, then possibly deteriorated |
| D05 | Kelly | West | 5 | 12" from north end, 3" from top | 10 | no void |
| D06 | Kelly | West | 1 | 14" from north end 2" from top | 16 | no void |
| D07 | Kelly | West | 1 | 7" north of door jamb, 2.5" from top | 19 | 1.5" solid, 3.5" channel, then solid |
| D08 | Kelly | West | 1 | 14.5" south of south (door) jamb, 2.5" from top | 14 | 2" solid, 3" channel, then solid |
| D09 | Kelly | West | 6 | 13" from south end, 3" from top | 12 | 2.5" deteriorated, then solid |
| D10 | Kelly | South | 4 | 12" from west end, mid-depth | 10 | 2" void |
| D11 | Brotherton | East | 1 | 23" from south end, 1" above bottom | 21 | 2.5" solid, 3" void, then solid |
| D12 | Brotherton | East | 1 | 8" south of step, 2.5" above bottom | | 1.5" solid, then void |
| D13 | Brotherton | East | 1 | 4" north of step, 2" above bottom | 22 | 2.5" solid, 5" void/channel |
| D14 | Brotherton | North | 3 | 10" from east end, 2.5" from top | 16 | no void |
| D15 | Brotherton | North | 3 | 8" from west end, 1.5" from top | 17 | no void |
| D16 | Brotherton | West | 1 | 15" from south end, 2" from bottom | 19 | no void |
| D17 | Brotherton | South | 6 | 6' 6" from west end, 3" from bottom | 11 | minor surface deterioration, no void |
| D18 | Brotherton | Interior | floor joist | 3rd from north end, 24" from door, mid-width, VT | 21 | no void |
| D19 | Brotherton | Interior | floor joist | 2nd from north end, 26" from wall, mid-width, VT | 16 | no void |

| Drilling Number | House | Elevation | Log Number | Location | Moisture Content (percent) | Comment |
|---|---|---|---|---|---|---|
| D20 | Snodgrass | East | 1 | 9" south of east step, 1" above bottom | 24 | no void, but below check |
| D21 | Snodgrass | East | 1 | 24" south of east step, 2" from top | | 1.5" channel |
| D22 | Snodgrass | West | 1 | 8" from north end, 5" from bottom | 20 | 3.5" log, no void |
| D23 | Snodgrass | West | 1 | 45" from north end, 3" from bottom | | 3.5" log, no void |
| D24 | Snodgrass | West | 1 | 66" from south end, 2.5" from bottom | 23 | 4" log, no void, but below check |
| D25 | Snodgrass | West | top plate | 20" from south end, 3" from top | | no void |
| D26 | Snodgrass | Interior | floor joist | 2nd from south end, west of door | | 3" void/channel |
| D27 | Snodgrass | Interior | floor joist | 2nd from north end, middle of window | | 1" floor decking solid, at least 3.5" of joist solid |

# Appendix E:
# List of Implementation Projects

## List of Implementation Projects

The following is a list of potential projects relating to the Snodgrass, Kelly, and Brotherton Houses. Justification for each project is provided for the purposes of submitting the Project Management Information System (PMIS). Note that many projects are interdependent and should not be completed as standalone projects.

1. Kelly House Chimney Repairs

- Reconstruct collapsed chimney shoulder at Kelly House. Provide chimney footing.
- Justification: The shoulder of the chimney has partially collapsed, causing the chimney stack to shift and channeling water into the base of the chimney.

2. Foundation and Joist Repairs at Snodgrass, Kelly, and Brotherton Houses

- Remove flooring at each cabin to fully assess floor joists and their bearing points. Excavate crawlspace beneath to ensure airspace beneath joists. Repair joists and stone foundation walls as outlined in Part II of this HSR, including ventilation improvements.
- Justification: Joist condition is obscured by the existing flooring. Joists at the Snodgrass and Brotherton Houses in particular require repairs. The joists are commonly in contact with grade, which is causing moisture damage, especially when combined with little ventilation of the crawlspaces.

3. Site Grading

- Adjust grade at the Snodgrass House to ensure that water does not pool around the chimney. Adjust grade at the east sill of the Kelly House and southwest corner of the Brotherton House to avoid the sill logs sitting at or below grade.
- Justification: Water is collecting around the chimney at the Snodgrass House. The water can migrate into the crawlspace and contribute to joist deterioration. The east sill at the Kelly House is experiencing accelerated moisture damage due to being in contact with grade. Similar impacts are seen at the southwest sill at Brotherton.

3. Improve Roof Structure Connections

- Reconnect pulled-out rafters at Snodgrass House. Optionally install structural ties. In preparation for increasing storm intensity, consider installing similar ties at Kelly and Brotherton Houses.
- Justification: Wind uplift at Snodgrass has resulted in the toe-nailed rafter connections pulling out of the top plate of the east and west walls. Although similar conditions were not observed at the other houses, it is reasonable to assume they will eventually exhibit the same behavior.

4. Brotherton House Chimney Repairs

- Repair the Brotherton House chimney using either Option 1 (repair in place) or Option 2 (repair by reconstruction) as outlined in Part II of this HSR.
- Justification: The chimney is exhibiting cracking and stone displacement.

5. Door and Threshold Repairs

- Selective repair of board-and-batten doors. Replacement of thresholds with alternate design that adequately sheds water to protect the log sills beneath.
- Justification: The doors exhibit deterioration. The thresholds are also commonly deteriorated and their lack of slope is contributing to the deterioration of the sill logs.

6. Log Repairs

- Perform dutchman and veneer repairs at identified locations across all three houses.
- Justification: All three houses exhibit isolated locations of deteriorated logs.

**National Park Service**
**U.S. Department of the Interior**

**Snodgrass, Kelly, and Brotherton Houses**
**Chickamauga and Chattanooga National Military Park**
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