

Buck House
Carl Sandburg Home National Historic Site
Historic Structure Report
Phase 1



December 2014

for

Cultural Resources Division
Southeast Region, National Park Service

by

JOSEPH K. OPPERMAN – ARCHITECT, P.A.

539 N. Trade Street Winston-Salem, NC 27101

www.jkoa.net 336/721-1711

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Carl Sandburg Home National Historic Site
Flat Rock, NC

The historic structure report presented here exists in two formats. A traditional, printed version is available for study at the park, the Southeastern Regional Office of the NPS (SERO), and at a variety of other repositories. For more widespread access, the historic structure report also exists in a web-based format through ParkNet, the website of the National Park Service. Please visit www.nps.gov for more information.

Cover: Buck House photographed in 2013. (JKOA)

Buck House
Carl Sandburg Home National Historic Site
Flat Rock, NC
Historic Structure Report
2014

Approved by:


Superintendent, Carl Sandburg Home National Historic Site

14 Jan 2015
Date

Recommended by:


Chief, Cultural Resources Division, Southeast Region

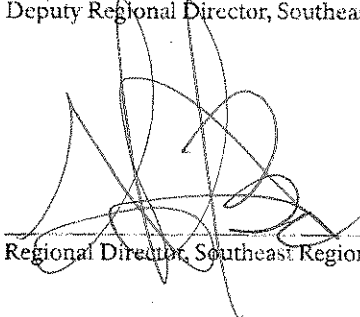
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Recommended by:


Deputy Regional Director, Southeast Region

1-27-15
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Approved by:


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Date

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Phase I

Introduction

Due to limited funds, the National Park Service (NPS) is dividing this Historic Structure Report into multiple phases.

This report represents the first phase which includes three types of investigation of building fabric: 1.) visual inspection to determine condition; 2.) dendrochronology to establish initial construction date, and; 3.) analysis of a sampling of historic paints and finishes to gauge the variety of coatings.

The goal of these investigations is to provide recommendations for repairs to stabilize and protect the building from further deterioration, while broadening the understanding of the architectural character of the building.

I. Description

This small house is located east of and downhill from the buildings of the Barn Complex. It faces east and sits snug against the hill behind it. A dirt road, an offshoot of the park's main service road, approaches from the south.



Figure 1. Buck House approach from the south.

The footprint of the house measures 30'-4" in width by 26'-6" in depth. An open shed roof 7'-8" deep spans the entire front or east elevation; the roof framing is supported by five wood posts set on a low stone wall running north-south. One story in height, the house is wood-framed and sheathed with weatherboard. The front or main body of the house is side gabled with a central chimney of brick at about midpoint on the roof ridge. A rear shed-roof addition is the width of the main body. Composition shingles cover the gable roof of the front section and the front shed roof. Unpainted 5-V galvanized roofing panels cover the rear shed section.

The front section has two rooms, north and south, separated by a shared chimney. Each room has a front and back doorway roughly opposite one another. Each has a board-and-batten door. Both rooms have a matching six-over-six light, double-hung, wood sash window on its end wall.

The long rear section is divided into three rooms by two board walls, each with doorway. The north room has a three-over-three light, double-hung, wood sash window on its north wall; a doorway on the west wall has a board-and-batten door. The middle room has no window or exterior doorway.



Figure 2. Southeast oblique.



Figure 3. Northwest oblique.

The south room has a doorway on its south wall with a board-and-batten door, and a three-over-three light, double-hung, wood sash window on its west wall; the window matches the one in the north room.



Figure 4. Buck House as seen from southwest on the hill where the Barn Complex is located.

II. Use

The Connemara goat barn and extensive breeding operation is described in the HSR for the Sandburg Barn Complex. Mrs. Sandburg needed a location to house bucks well away from the females. This existing house was the choice; thus its current name. The history of the house prior to the Sandburg era has not been researched in detail.

The Sandburgs altered the house for use by the bucks. It is currently used for National Park Service storage and is not open to the public.

III. Investigations

A. Visual Assessment

1. Age

The front section was the original house as indicated by the configuration of framing. The rear section is an addition.

A number of design characteristics suggest that the original building dates from the second quarter of the nineteenth century. These characteristics include:

- The two pedimented gable ends of the house, a typical feature of the Greek Revival style of architecture which was especially popular in the 1830s thru 1850s.



Figure 5. Classical trim of door and window casings as seen on front door of north room. Note door pintel.

- The classical trim of the interior casing of all four doorways and both windows is also common to the Greek Revival style. The doorways and windows are potentially rich sources of various types of information including hardware, wear patterns, and paint colors and types.



Figure 6. Fireplace mantel of north room.



Figure 7. Close-up view of north room mantel.

- The early fireplace mantels with classical details.



Figure 8. Mortise-and-tenon joinery of roof rafters.



Figure 9. South elevation window with driven pintel for single-leaf shutter. Hole marks the location of lower missing pintel.

- The sash sawn lumber and mortise-and-tenon joinery of the roof framing, common to early-nineteenth century construction. Wall and floor framing was not accessible for inspection.
- The hand-wrought iron driven pintles for strap door hinges and strap window shutters. The west jamb of the south window and the south jamb of the northern door on the east elevation retain their pintles. All four doors and both windows have scars from driven pintles.



Figure 10. North elevation window with two pintel holes in east casing. Shutter dog attached to weatherboard siding.

- The hand-wrought iron shutter dog on the north elevation.

Though small, the original building is a sophisticated design. It was also constructed by skilled craftsmen. The carpentry trim is handsome and restrained, not exuberant. The joinery is a skillful combination of mitered and square edges. The cuts are straight and true. This house was planned by someone well versed in architectural principles. The persons who built it were accomplished in their trades.

When the back shed section was added is not immediately clear from the exposed physical evidence. Both windows have double-hung three-light sash that date from the early-twentieth century; however, they may be elements from another early building, salvaged and reused at this house later in the century.

Mrs. Sandburg added features to adapt the building for the bucks. The two dividing board walls and their slat gates appear to be her work. Apparently, she also installed the slat gate in the doorway between the two rooms of the front section, the feed trough in the north room, and the gate that created an enclosed area between the trough and the south wall of the north room.

All six board-and-batten doors of the house, four on the exterior and two between the front and back sections, are modern, apparently installed by NPS. One early board-and-batten door is mounted on the west wall of the north room of the original house.



Figure 11. Slat gate installed by Sandburg. Note moisture-damaged plaster on chimney.



Figure 12. Modern board-and-batten door installed by Sandburg. Early door attached to wall above.



Figure 13. Doorway between north and south room as seen from south room. Note sheets of plywood on walls and ceiling.



Figure 14. Decorative bead at exterior door casings.

Most walls and ceilings in both the front and the back sections of the house are covered with plywood sheets, presumably installed by NPS. The undersides of the ceiling joists retain lime stains from the original plaster ceilings.

The faces of the exposed chimney stack in both front rooms retain remnants of lime plaster; some may be early.

The framing for the closet east of the chimney is original, as is the framing for the dividing wall on

the west side of the chimney. The board walls of the closet appear to be original as well.

Early wood and plaster elements throughout the front section retain multiple layers of paint. On the exterior, too, there are early wood features that appear to retain many of their paint layers.

2. Condition:

While the building appears to be generally stable, the following conditions are matters of concern:

- A roof leak is present along the southern end of the east front shed roof, directly damaging



Figure 15. Damaged shingles of front shed roof.



Figure 16. Rot in roof deck below damaged shingles of front shed roof.

roof framing and deck boards. Splash off the ground below is threatening the finishes of the building's lower elements.

- Animals are burrowing under the house. The chimney has settled, forming cracks in the chimney stack both at first-floor level and attic level.



Figure 17. Splash from roof leak is damaging the protective finishes on low level architectural features.



Figure 18. Animal entry burrows on front (east) elevation.



Figure 19. Animal burrows at north fireplace may be undermining chimney stack.



Figure 20. Chimney has settled. Patched joints have continued to open. Note lime stains on bottom of ceiling joists, indicating a previous plaster ceiling.



Figure 21. Water pools at building perimeter. Decaying organic material keeps the ground wet. Low wood elements are susceptible to rot.

- Negative slope of ground around the perimeter of the house causes water to drain towards the house and to pool, keeping the ground wet. The inevitable buildup of organic material in the Fall adds to the moisture retention.
- Both windows of the original house have rot in the wooden elements.
- The sill of the west doorway has rot.
- The damaged screen in the north gable vent allows entry by insects and small animals.
- The open chimney allows rain, insects, and small animals to enter.
- Carpenter bees are damaging exterior wood elements.
- The modern exterior wood siding has extensive knots, splitting, and checking.
- The exterior paint exhibits failure between paint layers, an indication of poor preparation before repainting.

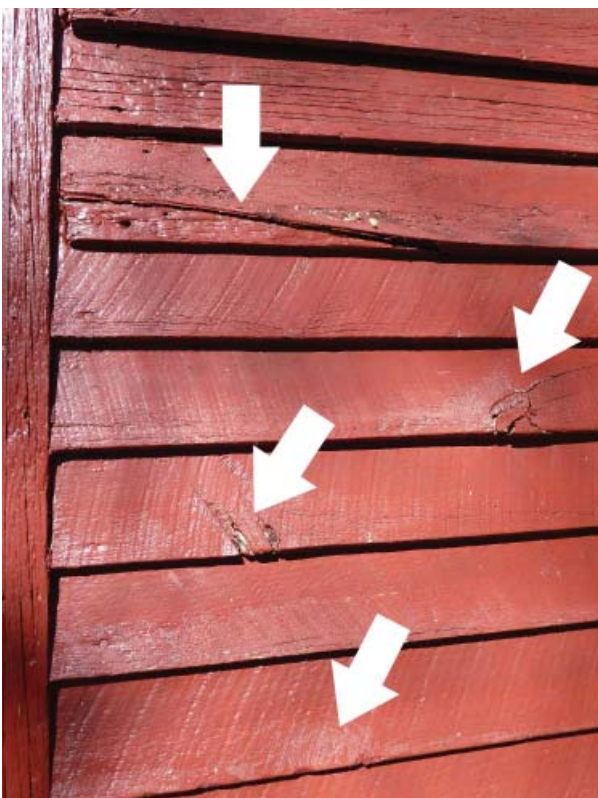


Figure 22. Recent siding has numerous knots and abundant checking, splitting, and cupping.



Figure 23. Failure between paint layers.

3. Recommended Actions:

The life, safety, and welfare of persons are of the highest priority. However, the public does not have access to this building, limiting the occasional occupant to trained staff members. Serious threat to persons was not identified.

The greatest single threat to a building is water. The wetting and drying of natural materials increases their rate of deterioration. And the

presence of water is necessary for many animals, plants, and insects that cause damage to buildings. Efforts should focus on shedding water from the building envelope, and carrying the water away from the building. It is important to keep the building envelope intact and capable of resisting the weather.

A number of architectural features are early. Special effort should be made to leave these elements undisturbed until they can be documented and further studied.

Recommendations are as follows:

Repair and Modification

- Repair roof leak.
- Close off access by burrowing animals.
- Repair deteriorated elements of the building envelope such as roofs, flashing, windows, doors, and siding.
- Replace inferior materials, such as defective siding, which are prone to fail.
- Cap the chimney.
- Install wire mesh in north elevation vent.
- Consider installing gutters and downspouts.
- Establish positive drainage around the exterior perimeter of the house to drain water away from the house.
- Seasonally remove plants, fallen leaves, and other organic materials to prevent build up on and around the building.

Other Actions

- Educate staff and others about the importance of the early architectural elements that remain in the building as discussed above in *Section III Investigation of Physical Evidence: Age*. Avoid disturbing those elements, including their finishes.
- Make regular inspections of the condition of elements of the building, especially during rain storms, to assess how the building and site perform.
- Install electrical service with outlets and utilitarian lighting sufficient to make regular interior inspections and periodic repairs. Initiate administrative policy that requires electrical power to be turned off at the electrical panel whenever the building is not occupied.



Figure 24. Early sheet metal keeper for a missing door's rim lock.



Figure 25. Driven pintel for a strap hinge remains; single-leaf shutter is missing.



Figure 26. Coring structural timbers for dendrochronology.

- Be vigilant: the early board-and-batten doors and window shutters of the front section are missing and may be reused or stored elsewhere. The two window shutters measure 2'-4" wide by 3'-10" tall. The two front doors measure 3'-0" wide by 6'-6" tall. The two rear doors measure 2'-2" wide by about 6'-4" tall.

B. Historic Paint & Finish Analysis

In an attempt to help understand the construction chronology of certain buildings, and also to provide information about appearance at the time of Sandburg's occupancy, Dorothy Krotzer, architectural conservator with Building Conservation Associates, took paint samples of the Buck House as well as several buildings of the Barn Complex. Given the tight budget, the testing could not be exhaustive. But the testing does answer some major questions.

For economy of preparation and ease of comparison, the results are compiled in a single document. The complete report is attached as Appendix A.

Analysis of samples taken from exterior surfaces of the Buck House determined that the building went unpainted for an extended period of time.

On exposed exterior elevations there are multiple coats of red paint on top of very weathered wood surfaces. Krotzer concludes the red paints date to the Sandburg period. Beneath the front porch where partially protected from the elements, there is the same number of top layers of red paint but below is a pale yellow. Krotzer concludes that the yellow is probably not the original color, given the disturbed subsurface to which it was applied. At this time, nothing can be said about early exterior paint colors.

On the interior, the analysis identified specific paint colors for the scattered remaining architectural elements, but the room paint schemes are not particularly clear. Of particular note is the sample taken from the mantelpiece of the south room of the original two-room house. It is a hardwood, maybe mahogany and was varnished. This is more evidence that suggests that this was a house of some importance.

remain at the park for testing at a later date when more of the chronology for this region has been established.

C. Dendrochronology

Construction characteristics and architectural style suggest the Buck House was constructed in the decades prior to the Civil War. To establish the initial date of construction and thus better understand their building chronology, Michael Worthington, dendrochronologist of the Oxford Tree-Ring Laboratory, took samples from this building and several of the Barn Complex for testing. The samples appeared to be adequate in size and quality. For economy and ease of comparison, the results were compiled as a single document. Unfortunately, comparative data from nearby regions were found to be insufficiently correlated to the samples and all the tests were inconclusive. The report is attached as Appendix B.

The dendrochronologists concluded that Connemara is in an area with a microclimate significantly different from areas on either side of the Blue Ridge Mountains where the tree chronology has been established. However, the test data has been recorded and will

Appendix A:

Finishes Analysis

Carl Sandburg Home National Historic Site Barn Complex

Finishes Analysis

Flat Rock, North Carolina



December 2014



BUILDING CONSERVATION ASSOCIATES INC

Carl Sandburg Home National Historic Site Barn Complex

Finishes Analysis

Flat Rock, North Carolina

Prepared For

Joseph K. Oppermann - Architect P.A.
Winston-Salem, North Carolina

Prepared By

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Appendix A: Key to Sample Locations

Appendix B: Sample Stratigraphies and Photomicrographs

1.0 INTRODUCTION AND BACKGROUND INFORMATION

At the request of Joe Oppermann, FAIA, of Joseph K. Oppermann - Architect, P.A. (JKOA), Building Conservation Associates, Inc. (BCA) prepared an analysis of paint finishes for the barn complex of the Carl Sandburg Home National Historic Site in Flat Rock, North Carolina. The goal of the finishes analysis is to provide information related to construction chronology and historic paint colors of the barn complex buildings. This information will be integrated into a Historic Structures Report being prepared by JKOA for the National Park Service, the current owner of the site.

The barn complex consists of ten buildings, of which five were examined as part of this study: Isolation Barn, Goat Barn, Horse Barn, Buck Kid Quarters and Corn Crib. A sixth building, the Buck House, was also examined. (*Images 1-6*) Although the latter, the Buck House, is technically not part of the barn complex (as it exists some distance from the barns) and the work on this building is being performed under a separate contract, it is being discussed with the barn buildings to consolidate all findings and streamline the report writing process. All buildings are located on a farm known as Connemara, which was the home of writer and political activist Carl Sandburg and his family from 1945 to 1968. The period of interpretation for the site is circa 1950, once the Sandburgs acquired the property and made substantial changes that are still in place today.

The barn buildings date from different periods and have experienced different degrees of alteration throughout history.¹ The earliest of the barn buildings are the Isolation Quarters and the Buck Kid Quarters, both believed to have been in the late 19th century by either the Memminger or Gregg family. The Buck Kid Quarters were altered by the Sandburgs in the 1940s-50s and substantially rehabilitated by the NPS in the 1970s. The largest of the structures, the Goat Barn, was built between 1900 and the 1920s by the Smyth family. The main block of the building (the current southern two-thirds of the barn) is believed to be the earliest portion of the building, with the rear (north) and side (west) additions having been added by the 1920s. The Sandburgs also made changes to the building in 1945, most notably the modification of some of the openings on the front of the building and remodeling of the back. Other structures include the adjacent Horse Barn, built by the Smyths between 1900-1915 and altered by the Sandburgs, and the Corn Crib, which may date to either the Smyth or Gregg period. The Buck House, located some distance from the barnyard, is believed to date to the first half of the 19th century and therefore may possibly be attributable to the Memminger family.

This report summarizes the findings of the finishes analyses. Following the introductory information regarding the study methodology, the report discusses the findings of the research and then makes recommendations for appropriate restoration paint colors. All mounted cross-sections have been

¹ All information related to construction dates and alteration chronology included in this paragraph are derived from Section 1B of the draft Historic Structure Report (HSR) prepared by Joseph K. Oppermann Architects.

labeled and permanently housed and will be archived at BCA's Philadelphia office unless otherwise requested by the client.

All work required for the execution of this study was performed by Dorothy S. Krotzer, BCA Regional Director. Paint samples were taken from the site in August 2014 and laboratory analysis was performed in August through October 2014.



Image 1. Goat Barn, August 2014.



Image 2. Horse Barn, August 2014.



Image 3. Buck Kid Quarters, August 2014.



Image 4. Corn Crib, August 2014.



Image 5. Isolation Barn, August 2014.



Image 6. Buck House, August 2014.

2.0 METHODOLOGY

Prior to the site visit and removal of samples, information related to the history the barn complex and Buck House was reviewed. Historic images provided by JKOA were studied in order to gain a general understanding of the history of the buildings and any information related to their exterior paint finishes.

Once the relevant historical documentation was reviewed, a site visit was made and the buildings were physically examined for areas from which representative samples of paint finishes could be removed. Once these intact areas were identified and JKOA consulted, samples were removed. Paint samples were removed using a scalpel or Exacto knife. A total of fifty-five finish samples were removed from the buildings and taken back to the laboratory for analysis. A list of all samples and the location from which they were removed is provided in *Appendix A*.

All finish samples were initially examined in reflected light using a Nikon high-resolution stereomicroscope SMZ-1500 with variable magnification (16x-160x) to identify which samples would be embedded and sectioned for analysis. The selected samples were then mounted in a commercial polyester/methacrylate resin polymerized with a methyl ethyl ketone peroxide catalyst (Bioplast®). Embedded samples were sectioned on a Leco® VC-50 micro-saw for microscopic examination. The sectioned samples were dry-polished using a series of fine Micromesh® polishing clothes ranging from 6,000 to 12,000 grit. Sectioned samples were observed under a Nikon 50i compound microscope in visible light filtered through a daylight correction filter. Photomicrographs of representative samples were taken using a 5 mega pixel Nikon DigiSight color digital camera system and are included in this report to illustrate specific observations.

All paint samples were viewed in cross-section and their paint layering sequences, or stratigraphies, recorded. These stratigraphies are included in *Appendix B*. Once the stratigraphies of every sample were deciphered, significant paint layers were identified and raw samples were manipulated in order to expose these layers for color matching purposes. The exposed layers were visually matched to two different color systems, the standardized Munsell color system and the commercial Benjamin Moore paint palette. All color matches are included in *Section 4.0* of this report.

3.0 SUMMARY OF FINDINGS

Goat Barn (Samples CSB.11 through CSB. 40)

Approximately thirty samples were removed from the Goat Barn in an attempt to help understand the building's construction chronology, and also to provide information about the barn's appearance during the Sandburgs period of occupancy. The latter task proved easier than the former and so its results will be discussed first.

The Sandburgs were known to have made certain changes to the Goat Barn, including altering the openings on the front of the barn and constructing the Milk House and walkway behind the barn. Examination of the paint samples removed from the known Sandburg era alterations revealed that the first paint color on both the siding and the trim was a dark red brown. The following samples removed from known Sandburg alterations contain red as the first layer: CSB.36 (removed from the weatherboards in the gable of the dormer above the west entrance on the front elevation), CSB.31 (removed from the interior side of the weatherboards installed along the existing rear elevation), and CSB.18 (removed from the underside of the roof sheathing on the hyphen leading to the Milk House). *(Image 7)* This physical evidence is consistent with the archival evidence. An invoice from the Rigby-Morrow Company building materials supplier includes "Estee Red" paint identified by Mrs. Sandburg as being for the barn. In addition, historic photographs of the Goat Barn show it being painted a dark color, both weatherboards and trim, in 1946, 1949 and 1954. *(Images 8-11)* By 1956, however, the trim was painted white. The next available photographs, which date to 1971, show the barn in a weathered state with dark red paint on both weatherboards and trim. It is unclear, from either physical or archival evidence, how long the trim was painted white from 1956 to 1968 when the NPS acquired the property. *(Image 12)*

Using the paint evidence to answer questions about the construction chronology of the Goat Barn was more challenging. However, some conclusions can be drawn about the construction based on paint evidence. For example, paint samples removed from protected areas of original exterior siding that are now preserved inside interior spaces (CSB.28 and CSB. 37), as well as existing exterior siding on the rear elevation of the west addition (CSB.23) and the east end wall of the rear shed (CSB.12) contain the same basic paint layering sequence, including the same original color. In these locations, the first paint layer is a pale yellow, which is followed by two layers of cream and then between one and three layers of dark red. The presence of the same first paint layer in these three locations suggests that these components of the barn all date to the same period and are original. It also indicates that the first floor level of the rear elevation of the main block of the barn was treated like the exterior during the early part of its history. The presence of the same early paint colors as were found on existing exterior surfaces indicates these surfaces were treated like the exterior, suggesting the rear shed was open until the Sandburg period of occupancy. *(Images 13-15)*

It should be noted, however, that the surface of the wood substrate in each of the samples discussed above is very weathered. So, it is also possible that these elements date to different periods of construction and were allowed to weather, unpainted, before being painted pale yellow at some early point in the barn's history and during the Smyth period of ownership.

It is also interesting to note that the uppermost paint layer of sample CSB. 37, which was removed from a weatherboard on the original rear elevation of the barn now enclosed by a second story hay loft, is red. This indicates that the exterior of the barn was red when the second story hayloft was added. If this hayloft was added by the Smyths, then this means the Goat Barn was painted red before the Sandburgs' arrival at Connemara. It seems more likely that the Sandburgs were responsible for adding the rear second story hayloft, but that they did not do so immediately upon acquiring the property.

The exterior window and door trim were also investigated. The trim around window openings on the original rear elevation of the Goat Barn (now enclosed) was painted white. Samples removed from the first and second floor level in this location (CSB.29 and CSB.38) both have two layers of white before being painted red. It is possible, however, that these windows were added by the Sandburgs because of the few number of paint layers they possess. (*Image 16*) For instance, a sample removed from the door trim on the west elevation of the main block of the Goat Barn (CSB.27) has seven layers of white finishes (a combination of lime wash and white paint) before being painted red six times. This sample most likely represents the full spectrum of trim colors from the original period of construction through current day, indicating the trim was painted white until some time during the Sandburg period. (*Image 17*)

Photographic evidence supports the presence of white as a trim color during both the Smyth and Sandburg periods of occupancy. *Image 18* shows the barn circa 1915 when the Smyths owned the property, and the trim color is white while the body of the barn is a medium color, presumably the early pale yellow or cream. *Image 8* shows the barn in 1946, once the Sandburgs owned the property, and the window trim appears to be the same color as the siding (dark red). Although the window and door trim appears to remain dark red during the majority of the Sandburg's occupancy, there was a point after 1954 when the trim was painted white, as evidenced by *Image 11*.

A sample removed from the window casing of the rear elevation (CSB.21) does not conform to this theory. In this location, the casing was painted the same color as the siding (pale yellow, creams, dark reds). However, there is an anomalous dark green between the most recent cream and the first red, which was not seen anywhere else on the Goat Barn. It is unclear if the green relates to the window trim or the siding, since the sample was taken where the casing meets the siding. It is also curious that this window would have early paint at all, since it is part of the existing rear elevation that was

known to have been enclosed by the Sandburgs. It is possible the window was removed from another location on the barn and installed here when the rear shed was enclosed.

It should also be mentioned that the Sandburgs often reused materials and building elements from other locations, including the main house. For instance, records show that they brought gates and doors with them from Michigan specifically for use in the Goat Barn.

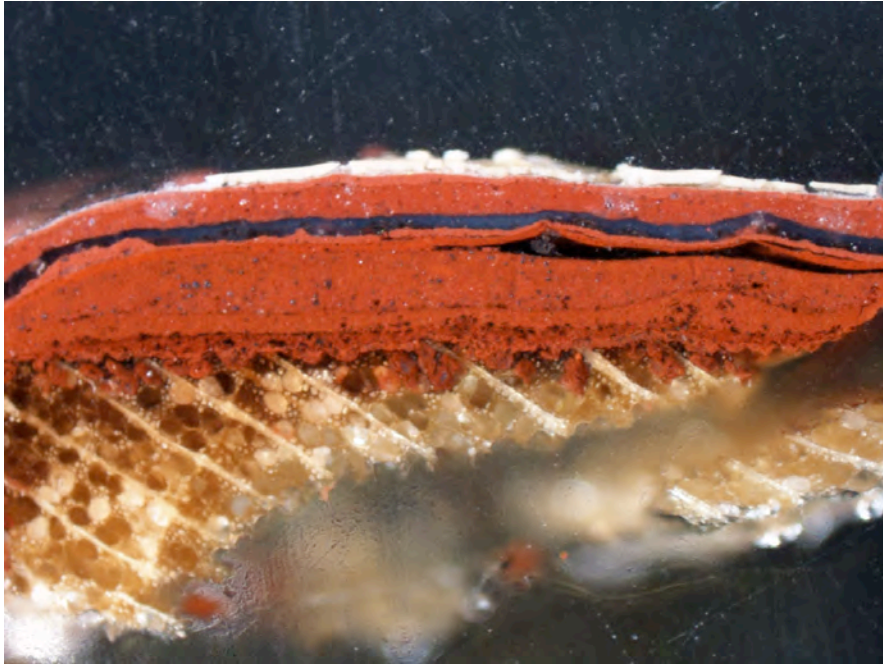


Image 7. Cross-section of sample CSB.36, removed from one of the weatherboards in the gable of the hayloft opening added by the Sandburgs to the front of the Goat Barn. Note the presence of only dark red paint. (40x, Visible Light)



Image 8. The Goat Barn, circa 1946, showing a dark paint color on the weatherboards and window casing. (CARL 3000-02-09P)



Image 9. The Goat Barn, circa 1949, showing a dark paint color still remains on the building. (CARL 3000-11-28P)



Image 10. The Goat Barn, circa 1954, with Mrs. Sandburg and her goats. Note the dark paint colors on barn. (CARL 3000-04-04P)



Image 11. The Goat Barn, circa 1956, showing a dark color on the body of the barn and white window casings. (CARL 3003-2.3-1)



Image 12. The Goat Barn, circa 1971, once the NPS acquired the property. Note the red color on the barn and its deteriorated condition. (CARL 4009-2-1-G-84)

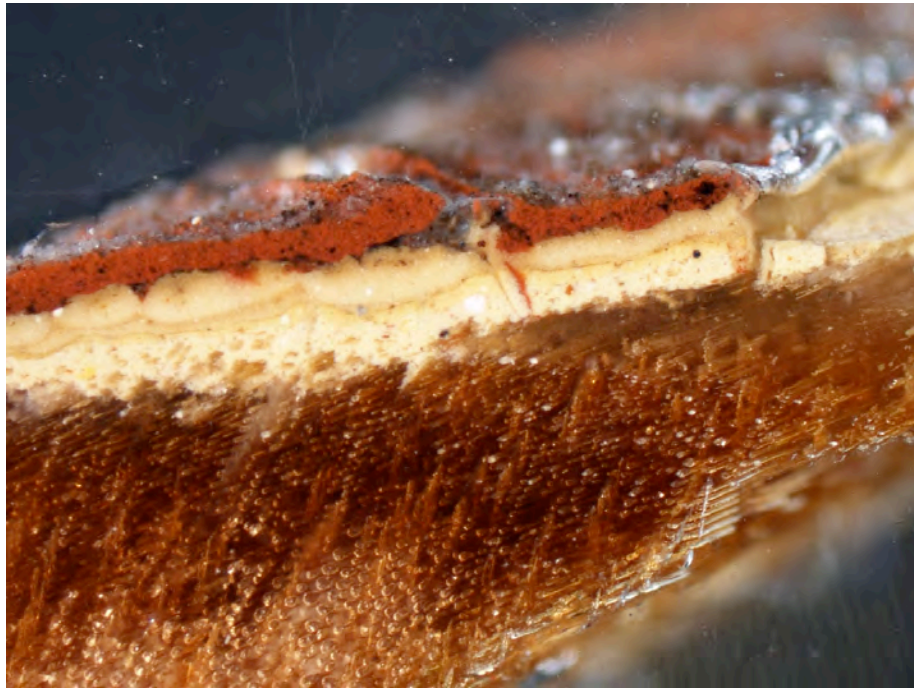


Image 13. Sample CSB.37, removed from the siding of the original rear elevation of the Goat barn, now enclosed by the second story hayloft. Note early pale yellow and cream layers below a single layer of red paint. (40x, Visible Light)



Image 14. Sample CSB. 23, removed from the east elevation of the rear shed. Note same early colors as in sample above. (100x, Visible Light)



Image 15. This sample (CSB.12) was removed from the siding of the rear elevation of the west shed addition. It too has the same early paint layers as in the above samples. (100x, Visible Light)

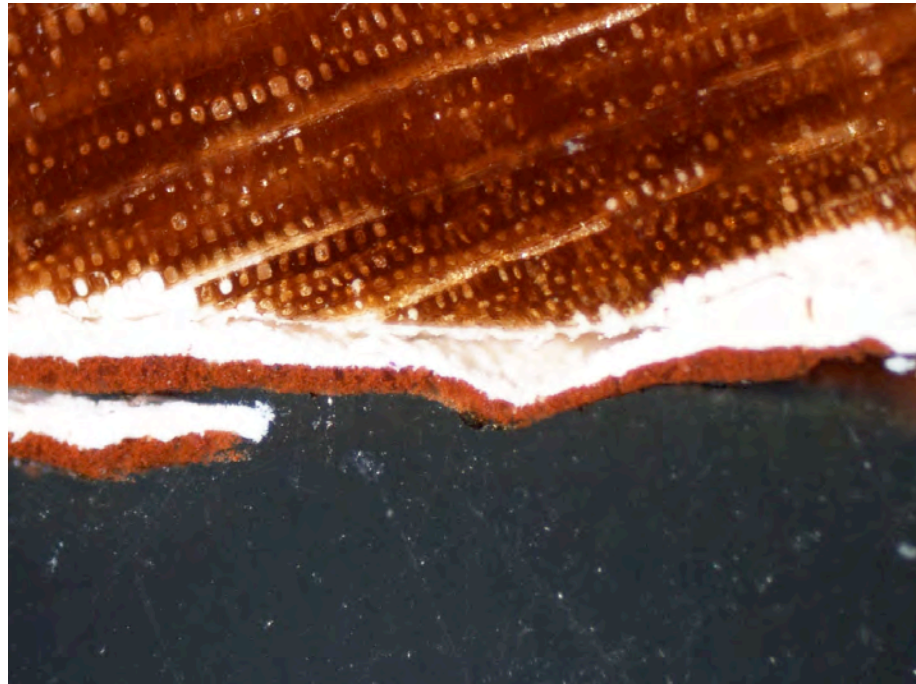


Image 16. Sample CSB.38 was removed from the same area as Sample CSB.37, the now enclosed second floor level rear elevation of the Goat Barn. This sample was removed from the window casing and shows only two layers of white and then a layer of red paint. (100x, Visible Light)



Image 17. Sample CSB.27 was removed from the door trim on the west elevation of the Goat Barn and contains several layers of white finishes before red paint began to be applied. (40x, Visible Light)



Image 18. The Goat Barn and Horse Barn, circa 1915, showing a medium to light colored paint on the body of the building and a very light color (white) on the windows and doors. (CARL 3001-04-01P)

Horse Barn (Samples CSB.7 through CSB.10)

The Horse Barn was built by the Smyths in the early 20th century and modified either by the Smyths or the Sandburgs. The alterations include enclosing of the front elevation with weatherboards and installing a smaller door on this elevation, altering the original gambrel shaped door opening. It is unclear when this change was made, but it was in place by 1946, when a photograph shows this configuration. (*Image 19*) When the NPS took over the property and began making repairs to the barn buildings in the 1970s, a substantial amount of the barn's siding was replaced, particularly to the west of the current front door opening. (*Images 20-21*)

Paint samples were removed from four locations on the exterior of the Horse barn, three from the front (south) elevation and one from the west elevation. All samples were removed from the weatherboards, except sample CSB.10, which was removed from the casing of the front door. The weatherboard samples, all of which were removed from weatherboards that were not replaced in the 1970s by the NPS and are believed to be original, share a very similar paint layering sequence. They all have evidence of an early pale green paint and an early cream paint. After this, the weatherboards were painted dark red between seven and eleven times. The cream paint looks very similar to the second or third cream paint layer on the Goat Barn and most likely relates to the same Smyth period paint campaign. The sample removed from the door casing does not contain either of the cream or pale green paint finishes. Instead, its first paint color is dark red followed by white and seven layers of dark red. None of the historic photographs show white trim on this building once the front door configuration was changed. However, the paint sample evidence suggests that it was painted white early in the barn's history. (*Image 22*)

It is very likely that the paint color on the horse barn as depicted in the circa 1915 photograph was either the pale green or cream. By contrast, the Sandburg photograph from 1946 shows the Horse Barn finished with a dark color, presumably the dark red paint. The trim color appears to be red as well; there is no photographic evidence of white paint on the door or window casing. It appears that the barn was painted red from the 1940s until the current day.



Image 19. The Horse Barn, circa 1946. (CARL 3000-02-09P)



Image 20. The Horse Barn, circa 1971. (CARL 4009-2-I-G-101)



Image 21. The Horse Barn, circa 1972. (CARL 4008-19-07P)



Image 22. Sample CSB.7 was removed from the upper area of siding on the front elevation of the Horse barn, the area that was not modified. The early pale blue-green and cream paint colors visible at the top of the photograph are believed to be original to the barn. (100x, Visible Light)

Buck Kid Quarters (Samples CSB.3 through CSB. 6)

Photographic evidence shows that the Sandburgs modified this building by adding wide plank weatherboards to the west elevation to replace earlier slatted siding by 1952. They also enclosed the south elevation of the building with vertical siding. In a circa 1915 photograph, taken well before the Sandburg modifications, the siding of the west elevation appears unpainted or possibly with a weathered finish. (*Image 23*) In a photograph taken after the Sandburg changes, which may date to either 1948 or 1954, the siding appears unpainted while the rake boards appear to be painted a dark color. (*Image 24*) In the 1952 photograph, the building (including the weatherboards) appears dark and may be unpainted or painted a dark color. (*Image 25*) An undated photograph from the University of Illinois at Urbana-Champaign Library also shows a building that may or may not be painted. Because the image is taken from a distance and is black-and-white, it is difficult to discern the paint finish. (*Image 27*) By 1972, the building had fallen into a state of disrepair and was substantially rehabilitated by the NPS. Photographs from this year show total removal of the roof structure, but the weatherboards of the west and south elevation appear intact. (*Image 26*)

Four samples were removed from the Buck Kid Quarters, three from the exterior and one from the interior. The three exterior samples, removed from weatherboards on the north, west and east elevations, contain between three and six layers of dark red paint. The sample removed from the west elevation has the greatest number of paint layers (six), as well as the most disturbed substrate condition. This evidence suggests that these weatherboards were unpainted for a time prior to being painted with the red paint. (*Image 28*)

The sample removed from the interior of the building (CSB.6) has a different paint layering sequence. This sample, removed from a diagonal framing brace that was most likely exposed prior to the Sandburgs enclosing this elevation, contains six layers of white lime wash and one layer of red paint. (*Image 29*)

Based on the photographic and physical evidence, it appears that the Buck Kid Quarters was most likely lime washed originally and then painted with a dark red color either by the Sandburgs or the NPS. The photograph from 1952, although only a black-and-white image, does seem to suggest a painted building (although this would then mean that the photograph in *Image 24* would have to date to 1948 because it clearly shows unpainted weatherboards).

The 1952 photograph also shows white paint on the door surround of the west elevation. However, this door opening has been modified since the 1952 photograph, since it appears as a five-panel door in this photograph and a vertical-board door with a seemingly different surround in the later photograph in *Image 27*. Evidence of the white paint color on the door surround of the west

elevation that is visible in the 1952 photograph, could not be found as part of the current study, suggesting the door and surround have indeed been replaced.



Image 23. The Buck Kid Quarters, circa 1915. (CARL 3001-05-01P)



Image 24. This photograph of the Buck Kid Quarters, may be from either 1948 or 1954 (both dates are on photograph in the archives). Note that the weatherboards appear unpainted, but the gable and fence appear to be painted a dark color. (CARL 3000-01-54P)



Image 25. The Buck Kid Quarters, circa 1952. The building appears painted and the door casing is a light color, presumably white. (CARL 3000-01-40P)



Image 26. The Buck Kid Quarters, 1972, when the NPS performed significant repairs on the building. (CARL 4008-16-13P)



Image 27. An undated photograph from the *Carl Sandburg Collection Photographs* of the University of Illinois at Urbana-Champaign Library, shows the Buck Kid Quarters in active use during the Sandburg period. It is still unclear whether the weatherboards and trim are painted, however note the different door than in *Image 25* above. (Rare Book and Manuscript Library, University of Illinois at Urbana-Champaign, *Carl Sandburg Collection Photographs*, Inventory Number 014-028-008. www.library.illinois.edu/contentdm/cdm4/item_viewer.php?CISOROOT=/sandburg&CISOPTR=544&CISOBOX=1&REC=9; accessed 10 June 2012)



Image 28. Sample CSB.4, removed from a plank between joist ends on the north elevation of the Buck Kid Quarters, has only four layers of red paint. The wood substrate is highly weathered. (40x, Visible Light)

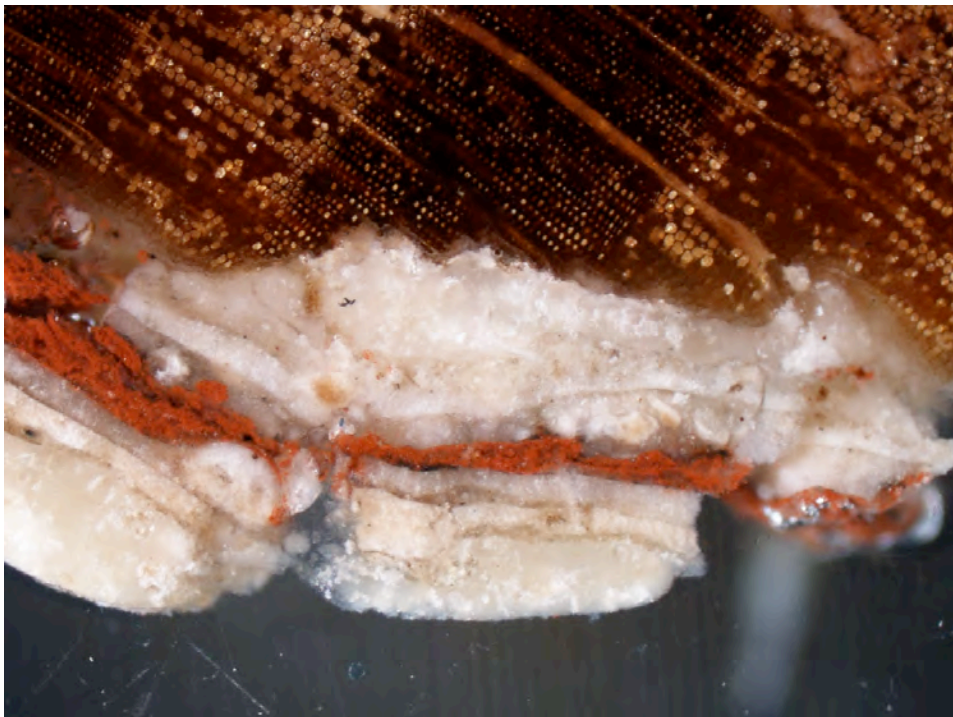


Image 29. Sample CSB.6, removed from a diagonal brace inside the Buck Kid Quarters, shows evidence of whitewash and a layer of later red paint. This element appears to be original to the building. (40x, Visible Light)

Isolation Barn (Sample CSB.44)

Two samples were removed from the exterior wide plank weatherboards of the Isolation Quarters, one from the north elevation and one from the west elevation. The latter sample was removed from a protected area and contained more layers of finishes, and was therefore examined in cross-section. In this location, a total of seven layers of finishes were documented, two layers of white lime wash, one layer of white paint and four layers of red paint. (*Image 30*)

Historic photographs of the Isolation Barn are limited to those from the 1970s, once the NPS gained ownership of the property. These photographs show a dark-colored barn, presumably painted red, with some replacement boards and a new door that had not yet been painted. According to JKOA, there is documentation that the Sandburgs painted the Isolation Quarters red by the end of their period of occupancy, and this may be the paint color visible in the 1971 NPS photograph in *Image 30*. However, it is not possible to know if this building was painted red in 1950, the site's period of interpretation. (*Image 31*)

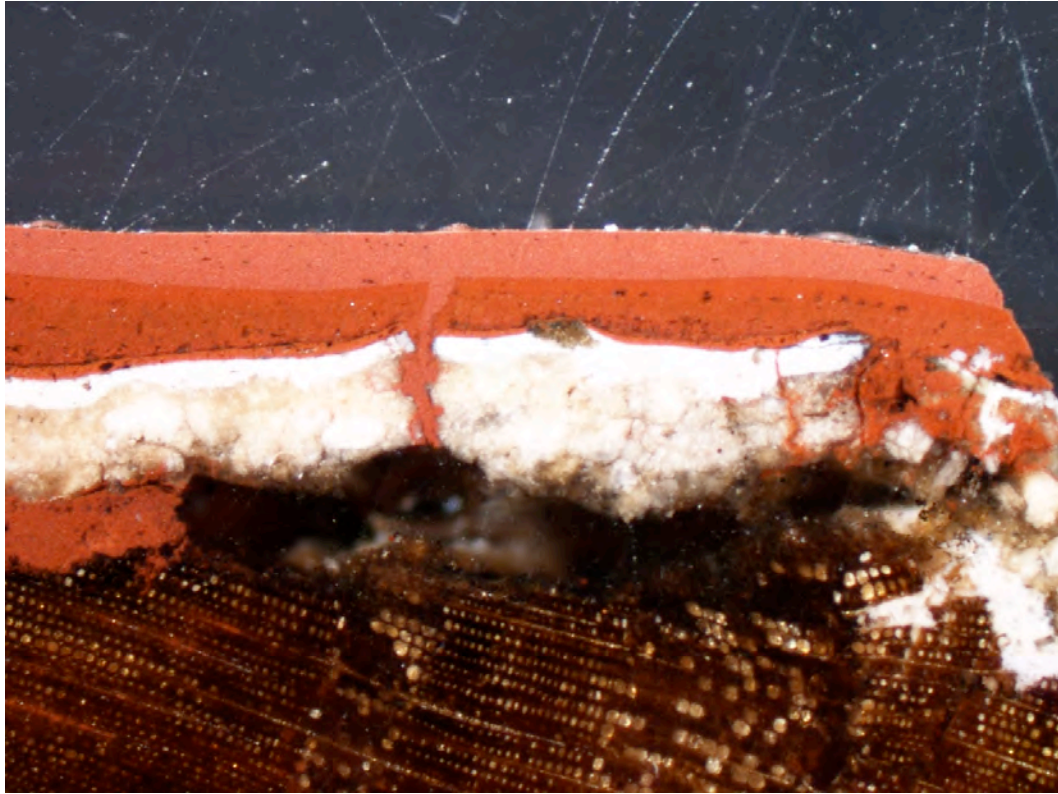


Image 30. Sample CSB.44 was removed from the west elevation of the Isolation Barn and contains early lime wash and white paint finishes, as well as more recent reds. (40x, Visible Light)



Image 31. The Isolation Barn, 1971. (CARL 4008-12-02P)

Corn Crib (Samples CSB.1 and CSB. 2)

Samples were removed from protected areas of the building, under the roof overhang. One sample was removed from the wood slat above the door and the other from the uppermost piece of lath under the roofline. The door was also investigated in situ. In all of the locations that were examined, only recent campaigns of red paint were observed. In the samples viewed in cross section, five layers of red paint are present on top of a weathered wood substrate. (*Image 32*)

Historic images of the corn crib suggest its exterior was either unpainted or treated with a light colored finish, most likely lime wash. Two undated historic photographs from the Smyth era show this light colored appearance. No physical evidence of a light colored finish, such as a lime wash, was found during the current study. The lack of a light-colored finish does not provide conclusive evidence either way regarding the corn crib's early finish history, since it is possible that there was a light colored finish that weathered off but it is also possible that the wood was originally unpainted. Neither the photographic or physical evidence provides conclusive information on the corn crib's early finishes.

Photographs from 1956 and 1971 show a dark-colored, presumably painted, corn crib. It is unfortunately not possible to know if the existing paint on the corn crib dates back to the 1950s. It is also not possible to know if the color on the corn crib in the 1956 photograph is red, but it is very possible based on the paint evidence found on the other barn buildings. (*Images 33-35*)



Image 32. Sample CSB.2 was removed from a slat above the door of the Corn Crib. Note highly weathered wood substrate. (40x, Visible Light)



Image 33. The Corn Crib during the Smyth era. (CARL 3001-I6-22P, Smyth Family Photograph Collection)



Image 34. The Corn Crib, 1956. (CARL 3003-2.3-1)



Image 35. The Corn Crib, 1971, under NPS stewardship. (CARL 4008-15-02P)

Buck House (Samples CSB.45 through CSB. 55)

Exterior

Paint samples were removed from five locations on the exterior of the Buck House, including four from the main building block and one from the enclosed rear shed. In all locations, the wood substrate appears rough and weathered, suggesting the earliest paint in these areas is most likely not original. Three of the five samples have the exact same paint layering sequence: four layers of dark red paint. The locations of these samples include the siding of the rear shed, the siding on the south elevation of the main portion of the building and the cornice on the south elevation of the main portion of the building. (*Image 36*)

A sample removed from the front (east) elevation that is protected by a porch contains the same four layers of dark red paint. However, underneath the red paint is a pale yellow paint that looks very similar to the pale yellow found on the Goat Barn. As stated previously, this pale yellow is probably not the Buck House's original paint color, given the disturbed surface of the wood substrate on which it was applied, but it is still likely early. Although it is not known when it was applied, if it the same as the pale yellow on the Goat Barn, then it most likely dates to the Smyth period. (*Image 37*)

A sample removed from the corner trim of the main portion of the house (where it meets the enclosed rear porch) also has traces of earlier paint finishes. This trim piece contains evidence of dark green and white paint, suggesting the trim was treated differently from the weatherboards on the body of the house. The green was most likely applied to the house when the siding was pale yellow and the white when the first layer of dark red was applied. (*Image 38*)

Interior

The samples removed from the interior do not provide a particularly coherent picture of the house's interior paint scheme, but some observations can still be made. First, the window and door trim in the south room of the main portion of the building (CSB.50 and CSB.51) have more paint layers than the trim in the north room (CSB.53 and CSB.54). The trim in the south room has a total of five paint layers, the first of which is green. The second paint layer is dark green, followed by a dark orange and then two layers of pale green. By contrast, the trim in the north room contains only the dark green and the dark orange. The fact that this interior trim contains only the middle paint layers in the sequence suggests that it was installed later than the trim in the south room and that it was also re-painted less frequently. The lack of more recent re-painting may relate to how the two rooms were used later in the house's history. (*Images 39-40*)

The mantelpiece (CSB.52) retains a good bit of paint evidence and appears to have been varnished originally. It is a hardwood, possibly mahogany, so a varnish treatment would not have been

surprising. After the varnish, the mantelpiece was painted dark gray twice, then dark green, dark orange and light green. The latter three colors directly relate to the window and door trim paint colors. (Image 41)

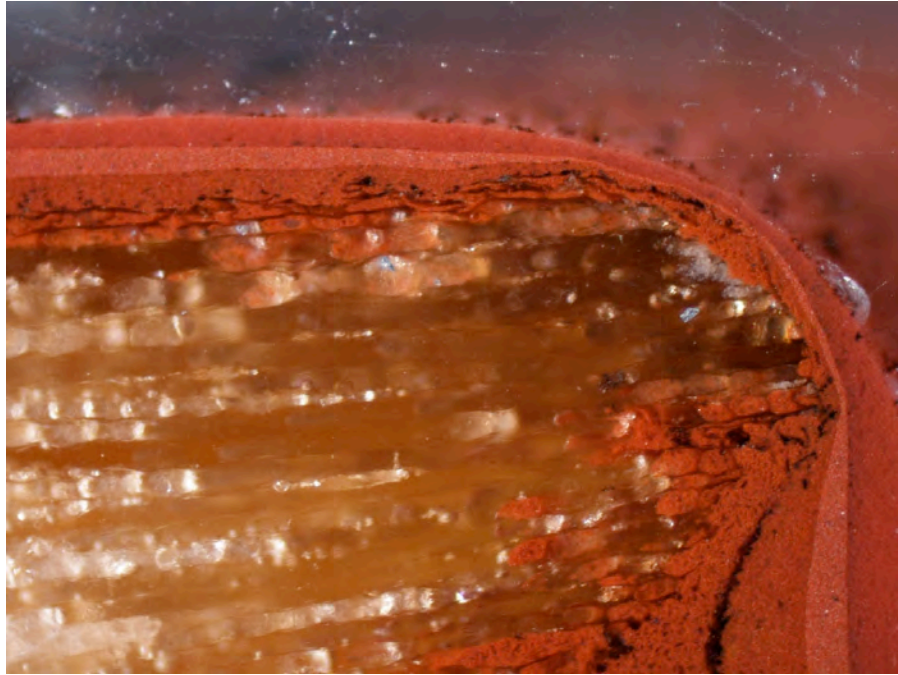


Image 36. Sample CSB.47 was removed from the siding of the enclosed rear porch of the Buck House. (40x, Visible Light)



Image 37. Sample CSB.49 was removed from a protected area of the exterior siding of the Buck House, under the front porch. It contains earlier paint layers, including a yellowish-cream similar to that seen on the Goat Barn. (100x, Visible Light)

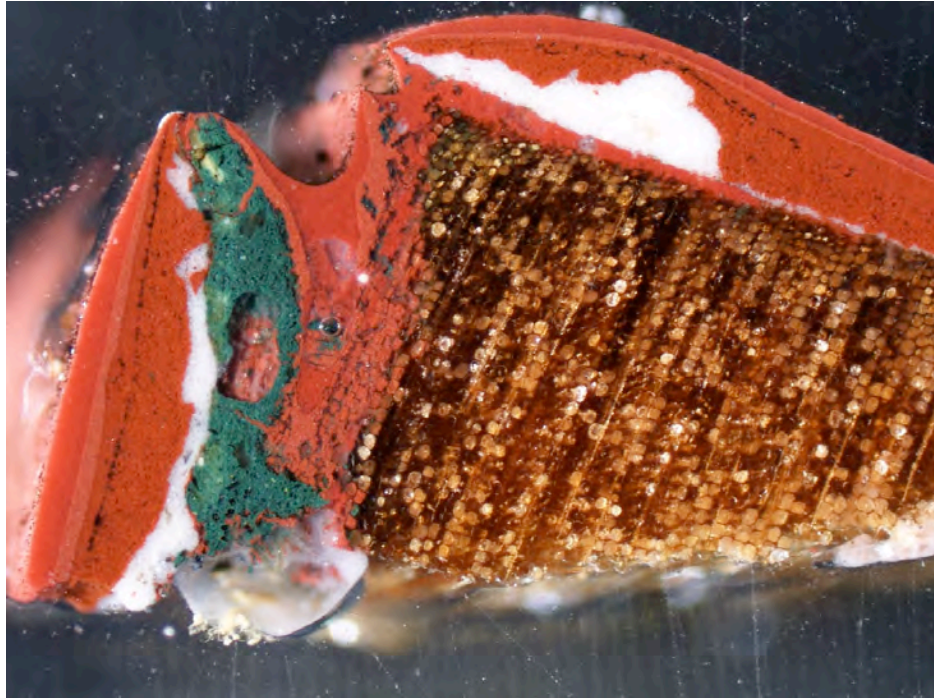


Image 38. Sample CSB.48 was removed from the vertical corner trim of the main portion of the Buck House. Note the early dark green and white paint colors. (40x, Visible Light)

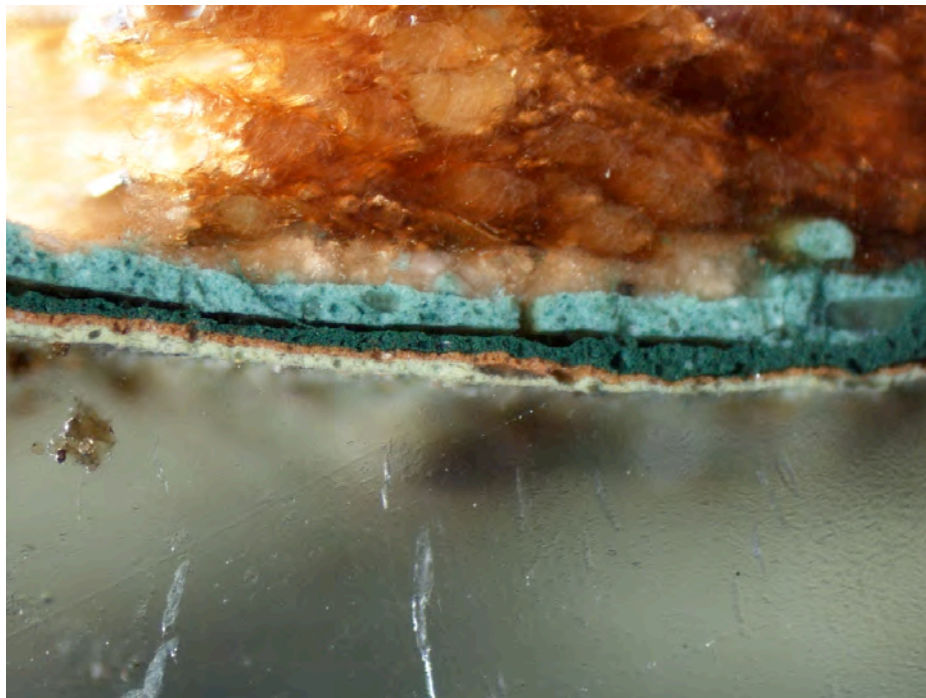


Image 39. Sample CSB.51, removed from a window casing in the south interior room of the Buck House, has four layers of paint, including an original pale blue-green. (100x, Visible Light)

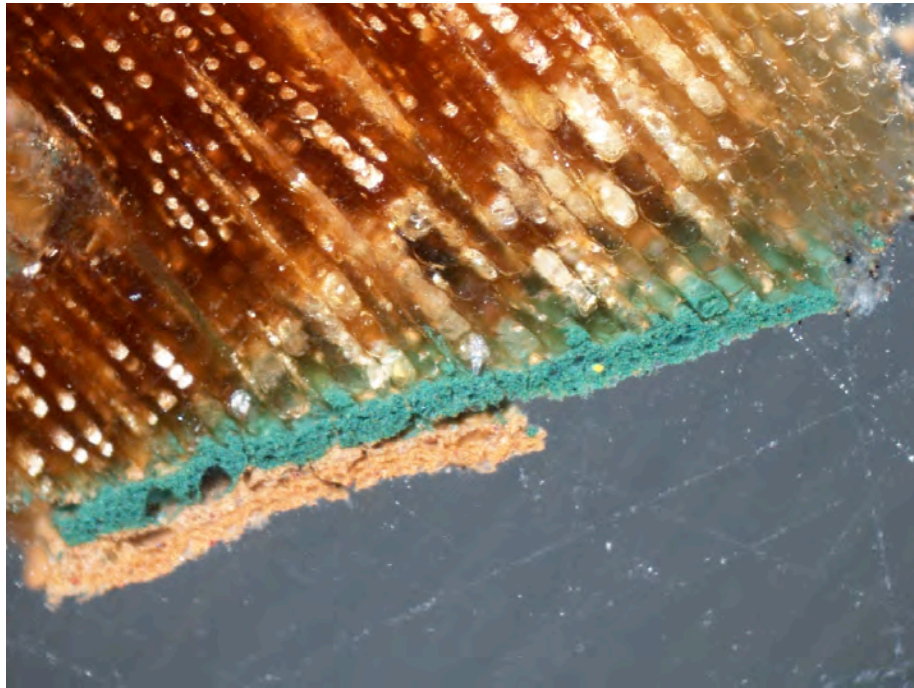


Image 40. Sample CSB.54, removed from a door casing in the north interior room of the Buck House, has only two layers of paint (which are the same as the later layers in Sample CSB.51 above). (100x, Visible Light)

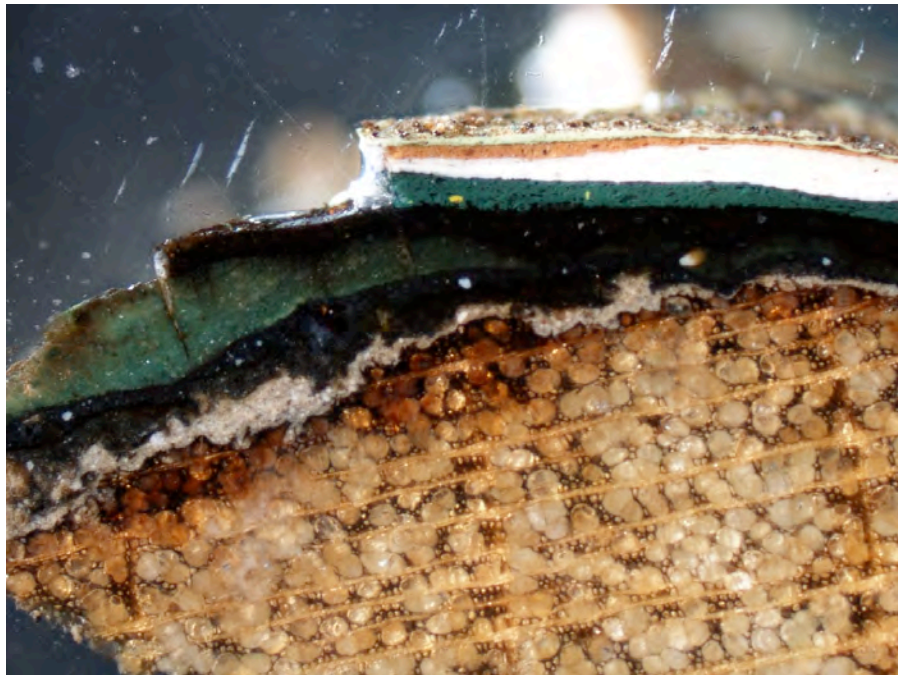


Image 41. Sample CSB.52, was removed from the mantelpiece of the Buck House. It contains an original varnish layer followed by dark grays and dark green, before being painted the same dark green and dark orange found on other trim inside the building. (40x, Visible Light)

4.0 CONCLUSIONS AND RECOMMENDATIONS

Making recommendations for an appropriate paint scheme for the five buildings of the barn complex and the Buck House is relatively straightforward if one assumes a period of interpretation of circa 1950. This period represents the time when the Sandburgs purchased the property and made major alterations to the barn buildings, particularly the Goat Barn. Most of those alterations are still in place and represent the current existing condition of the buildings. Although paint evidence has not always been well preserved on these auxiliary buildings, recommendations can still be made based on the fragmentary evidence that does still exist, as well as historic photographs.

For the Goat Barn and the Horse Barn, the paint scheme applied to these buildings during the initial Sandburg period of occupancy was dark red. The dark red was found on both the siding and the trim.

For the Buck Kid Quarters, based on the current evidence, it is not possible to know what year the building was first painted during the Sandburg period of occupancy, nor the colors employed when it was first painted. Photographic evidence suggests the building was painted by 1952; however, the photograph was taken some distance from the building and it is a black-and-white image, so this evidence is not conclusive. The undated University of Illinois photograph (*Image 27*), which dates to later in the Sandburg's period of ownership, may also show a painted building. The latter photograph also shows a different door than the one depicted in the 1952 photograph (*Image 25*) and the color of the door and trim is a dark color, most likely red. This color is different than the white that is visible on the door trim in the 1952 photograph. Additional research is necessary to determine exactly when the Buck Kid Quarters was painted by the Sandburgs and what colors they used. The 1952 photograph, as well as the University of Illinois photograph, should be further studied (at higher resolution, if possible) to determine if the building was painted at the time the photographs were taken, since both date to the Sandburg period (albeit beyond the 1950 period of interpretation). Additional paint samples could also be removed from protected locations of historic fabric to try to determine the early paint finishes on the building's trim.

For both the Isolation Barn and Corn Crib, there is neither solid photographic or physical evidence for their paint finish circa 1950. However, based on the findings for the other barn complex buildings, a paint scheme of dark red is recommended for these buildings as well.

For the exterior of the Buck House, the same dark red can be applied to the weatherboards and cornice. While there is no way to determine if the earliest red paint layer dates to the NPS era or the Sandburg era, the only other choice would be to paint the Buck House the early pale yellow found on the protected front elevation. This paint color, however, is associated with the Smyth period and to re-instate it on the Buck House seems out of synch with the paint treatment for the rest of the buildings in the barn complex. Unfortunately, not enough information was gained from the

exterior trim sample (removed from the vertical corner piece on the west elevation of the building) to allow a paint color recommendation to be made for the trim. It is possible that the white paint color was applied to the trim when the red paint was applied to the body of the building, but more samples would need to be removed from the building in order to establish this. Additional samples should be removed from exterior window and door casings, and compared to the paint evidence on the corner piece, to try to identify the color of the trim during the red paint campaign. If historic photographs of the buildings are found that date to the Sandburg period, this would also be helpful in determining if the trim was a light (white) or dark color.

Recommendations for Restoration Paint Colors

Please note that any attempt to reproduce this page, including printing from the electronic version of the report, will distort the color of the provided chip. Only the actual color chip or notation should be used for paint replication purposes.

Dark Red

Munsell Color Match: 7.5R 3/4

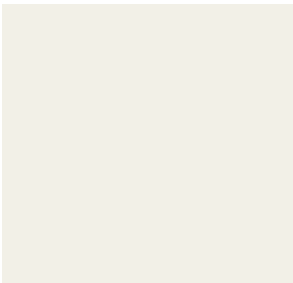
Benjamin Moore Color Match: Beaver Brown 2104-20



White

Munsell Color Match: N 9.5

Benjamin Moore Color Match: OC-45

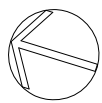
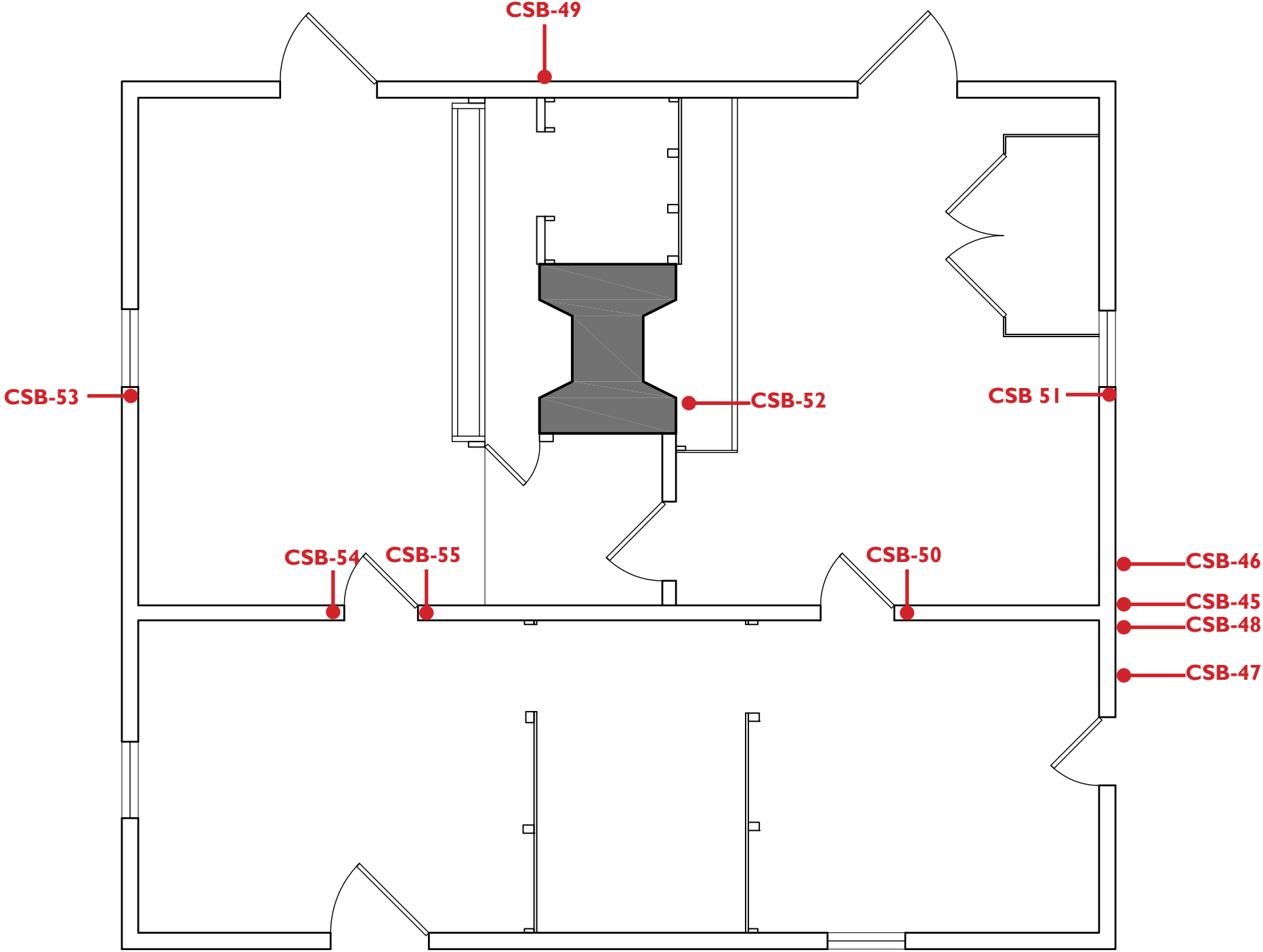


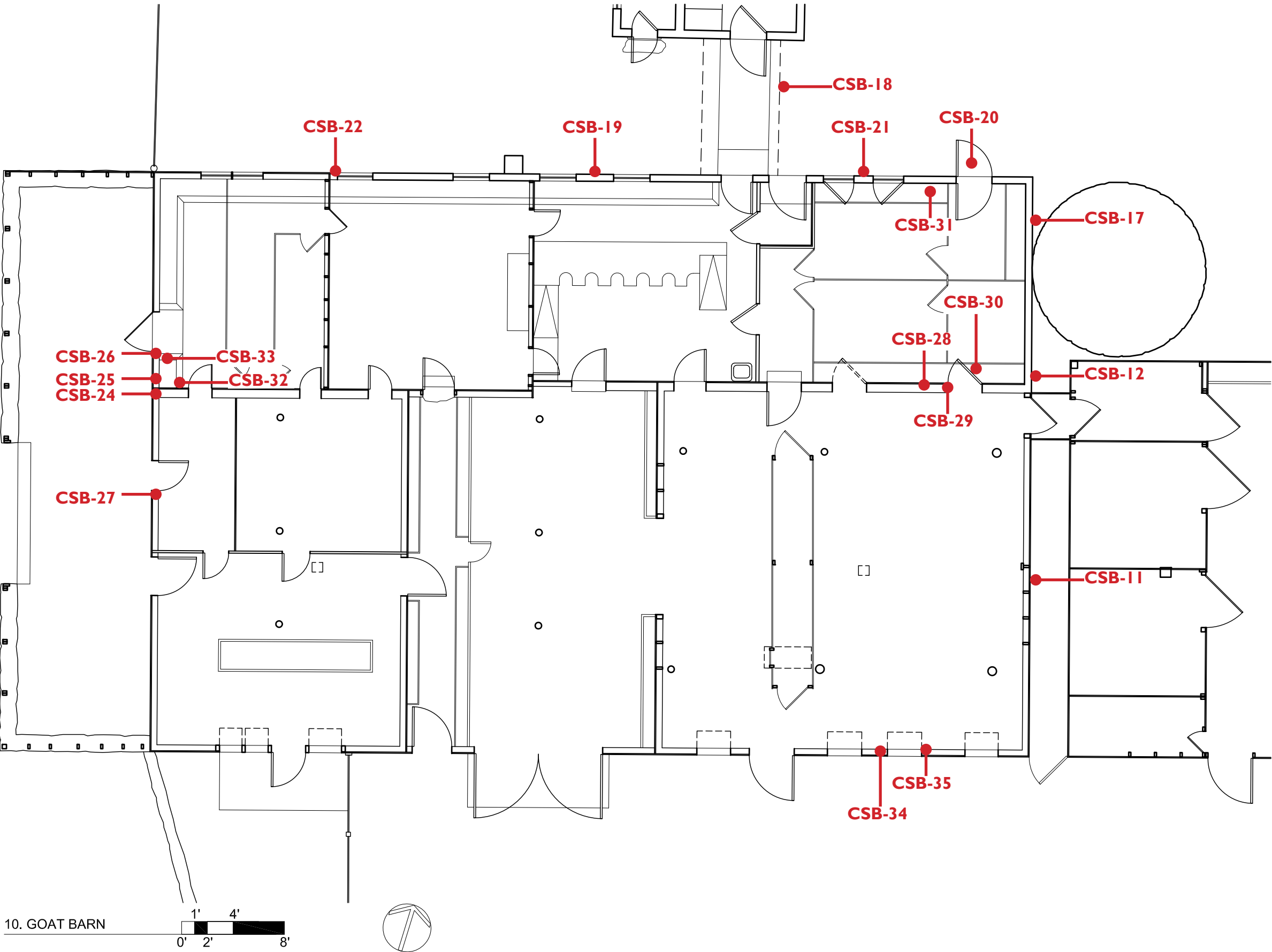
APPENDIX A.
KEY TO SAMPLE LOCATIONS

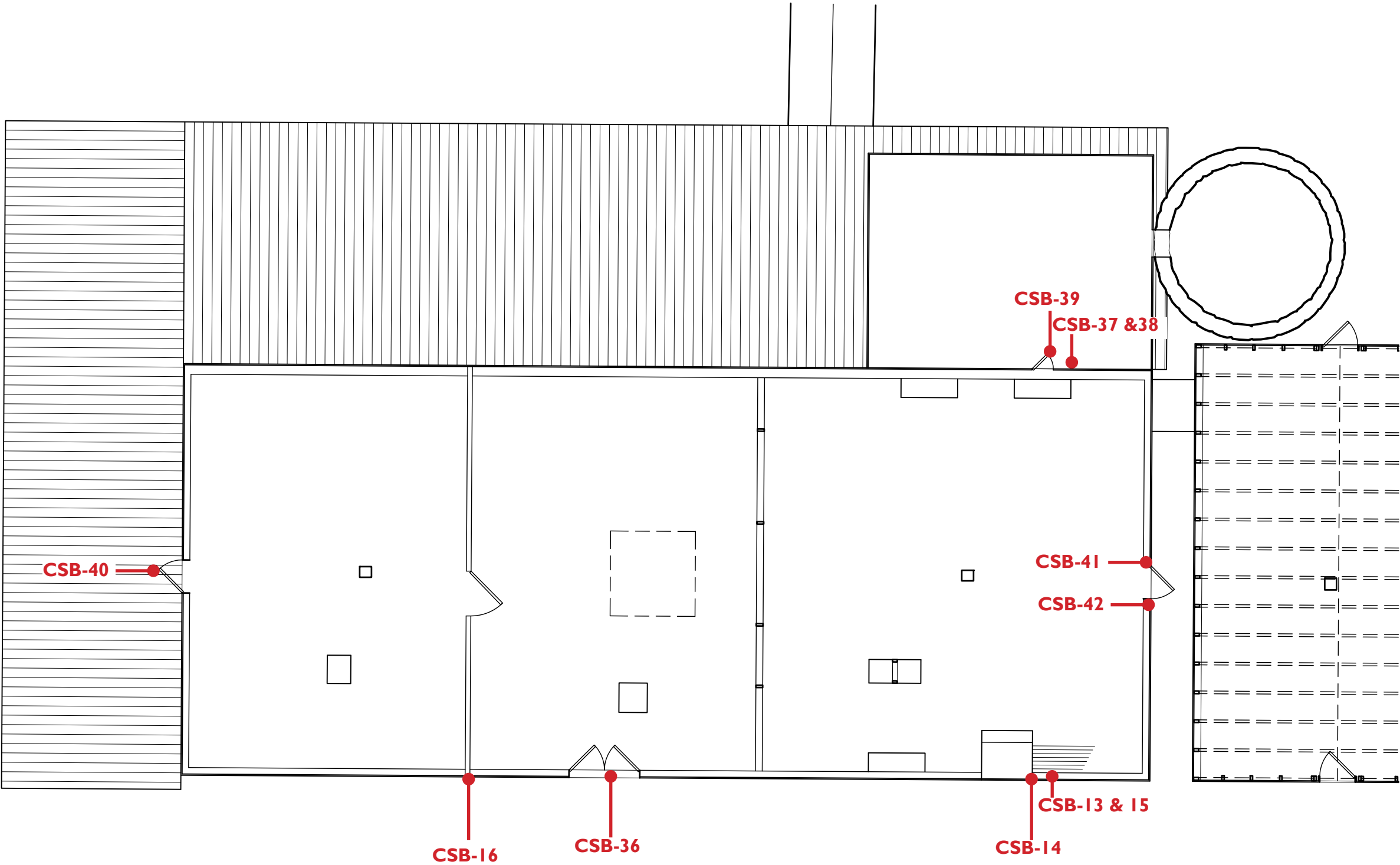
Sample	Location	Description
CSB 1	Corn Crib	At uppermost pice of lath.
CSB 2	Corn Crib	Weathered slat above door.
CSB 3	Buck Kid Quarters 1st Floor	Clapboard on gable under roof overhang. (Park Service reconstruction).
CSB 4	Buck Kid Quarters 1st Floor	Plank between joist ends. -Image 494
CSB 5	Buck Kid Quarters 1st Floor	First clapboard above board and batten.
CSB 6	Buck Kid Quarters 1st Floor	Diagonal Brace (probably exposed prior to clapboard installation).
CSB 7	Horse Barn 1st Floor	2nd Clapboard below roof sheathing.
CSB 8	Horse Barn 1st Floor	Clapboard under roof sheathing.
CSB 9	Horse Barn 1st Floor	Large split wood sample.
CSB 10	Horse Barn 1st Floor	Door frame.
CSB 11	Goat Barn 1st Floor	Clapboard 6' above ground. (Should be original part of barn.)
CSB 12	Goat Barn 1st Floor	Siding on addition.
CSB 13	Goat Barn 2nd Floor	2nd clapboard below roof sheathing.
CSB 14	Goat Barn 2nd Floor	Door jamb.
CSB 15	Goat Barn 2nd Floor	Rafter end (5th rafter westward of east elevation)
CSB 16	Goat Barn 2nd Floor	2nd clapboard below roof sheathing.
CSB 17	Goat Barn 1st Floor	Sample taken in hard-to-reach area next to silo that only has earlier paint.
CSB 18	Goat Barn 1st Floor	Underside of roof sheathing.
CSB 19	Goat Barn 1st Floor	Siding behind old phone connection box.
CSB 20	Goat Barn 1st Floor	3rd clapboard below roof sheathing (above door).
CSB 21	Goat Barn 1st Floor	Window casing at lintel.
CSB 22	Goat Barn 1st Floor	Window casing at jamb.
CSB 23	Goat Barn 1st Floor	Top clapboard below roof sheathing. Also, 3rd clapboard below sheathing.
CSB 24	Goat Barn 1st Floor	(South of seam) clapboard approx 6' above ground.

CSB 25	Goat Barn 1st Floor	(North of seam) claboard approx 6' above ground.
CSB 26	Goat Barn 1st Floor	Door trim at jamb, south side of opening.
CSB 27	Goat Barn 1st Floor	Door trim at jamb south side of opening.
CSB 28	Goat Barn 1st Floor	Clapboard west of window jamb.
CSB 29	Goat Barn 1st Floor	Window casing at jamb.
CSB 30	Goat Barn 1st Floor	On shutter. (Shutter red on north side, whitewash(?) on south side).
CSB 31	Goat Barn 1st Floor	Clapboard east of window.
CSB 32	Goat Barn 1st Floor	North wall of original building.
CSB 33	Goat Barn 1st Floor	West end wall of north shed addition.
CSB 34	Goat Barn 1st Floor	Window trim, west side of window, jamb trim.
CSB 35	Goat Barn 1st Floor	Window trim, east jamb.
CSB 36	Goat Barn 2nd Floor	Clapboards in gable of dormer, above door opening.
CSB 37	Goat Barn 2nd Floor	Clapboards.
CSB 38	Goat Barn 2nd Floor	East jamb of window opening, trim.
CSB 39	Goat Barn 2nd Floor	North face of shutter.
CSB 40	Goat Barn 2nd Floor	Edge of shutter
CSB 41	Goat Barn 2nd Floor	Exterior of shutter.
CSB 42	Goat Barn 2nd Floor	Edge of jamb, south side of opening.
CSB 43	Isolation Quarters	Clapboard, east of window.
CSB 44	Isolation Quarters	Clapboard below eaves.
CSB 45	Buck House	West return (miter) of canted crown molding under pent cornice of gable (main Building).
CSB 46	Buck House	Clapboard, 3rd down, below pent cornice (main building).
CSB 47	Buck House	Clapboard below shed roof (enclosed porch).
CSB 48	Buck House	Vertical corner trim of main building, approx 10" below pent cornice.
CSB 49	Buck House	Clapboard approx. 3.5' above ground.
CSB 50	Buck House	Trim on south side of opening.
CSB 51	Buck House	Trim on west side of opening.
CSB 52	Buck House	Mantle (wood).

CSB 53	Buck House	Trim at west jamb.
CSB 54	Buck House	Salvaged door hanging on wall above opening.
CSB 55	Buck House	Trim at jamb, south side of opening.

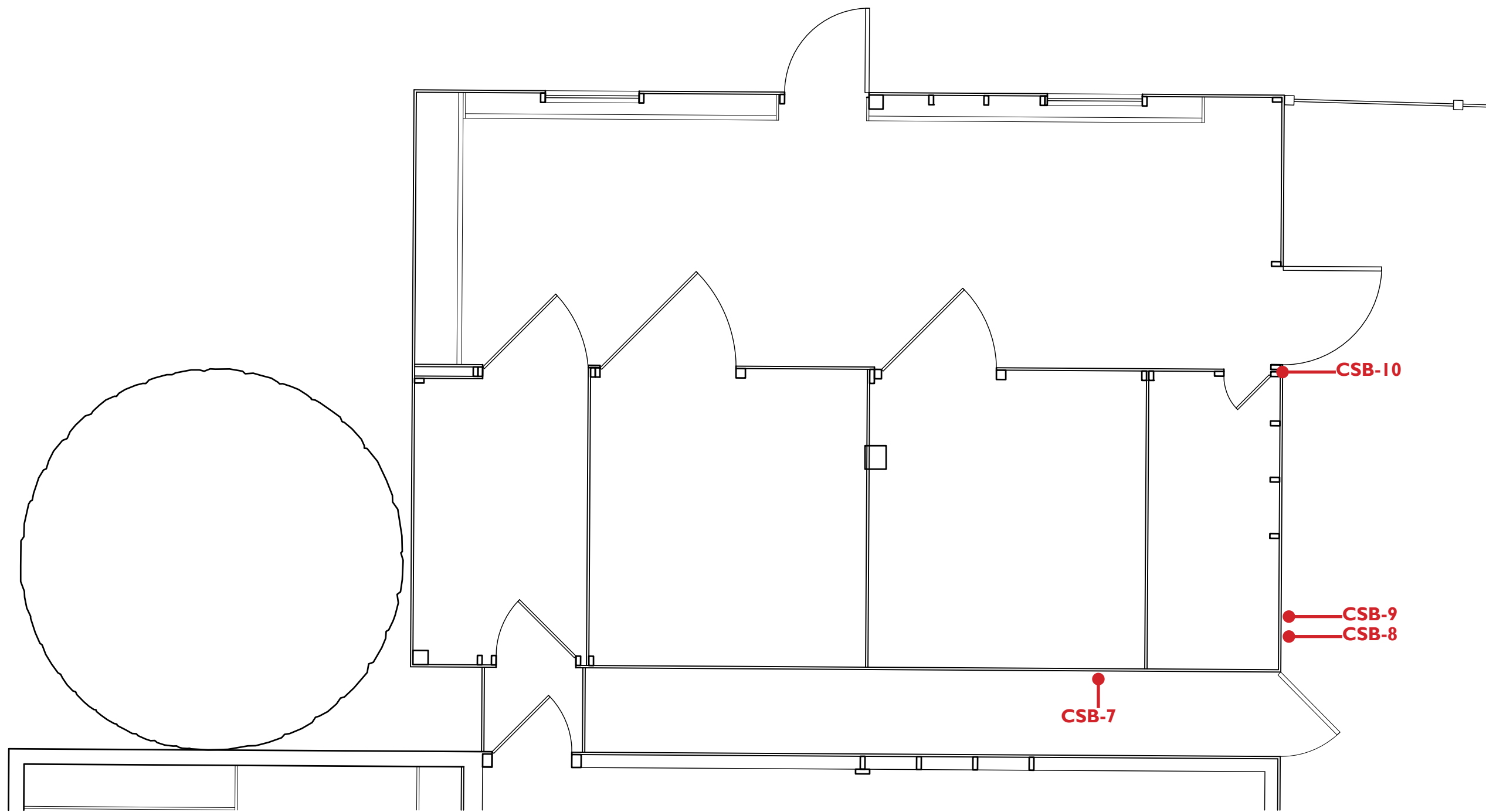






10. GOAT BARN SECOND FLOOR

0' 1' 2' 4' 8'

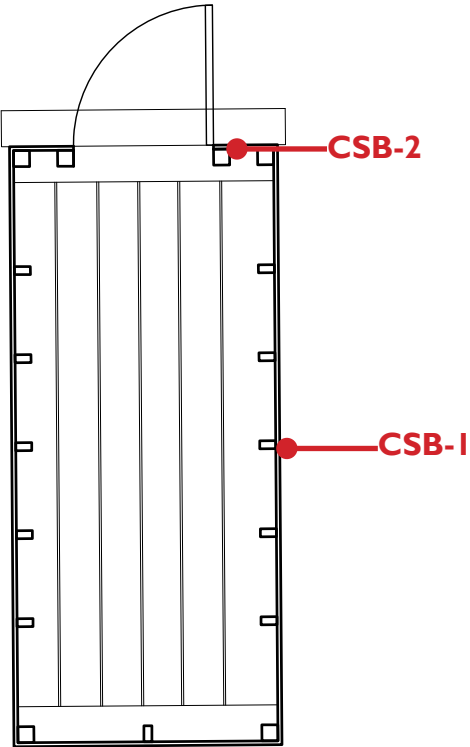
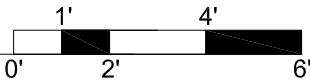


XX. SILO
0' 1' 2' 4' 6'

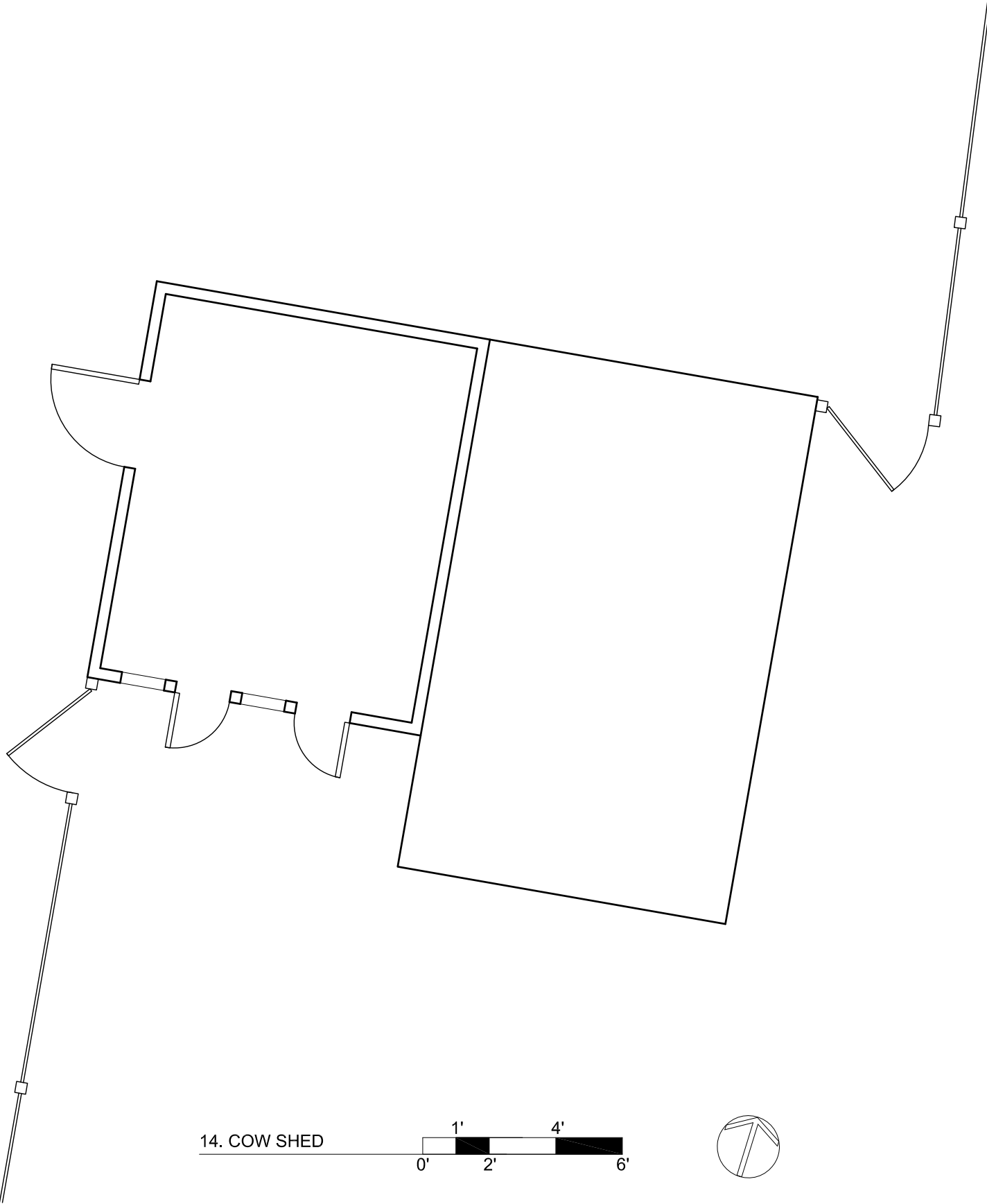
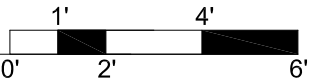


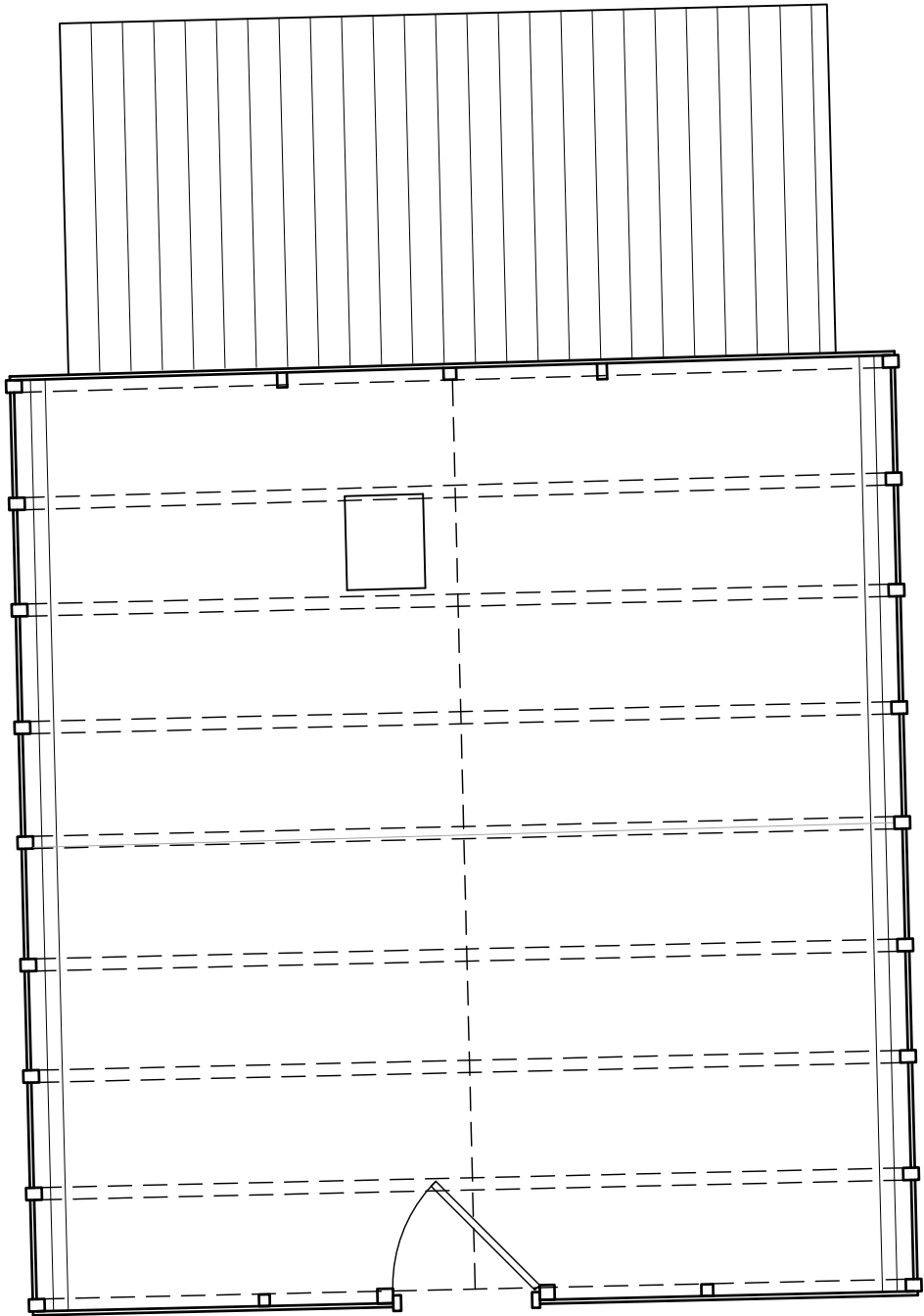
12. HORSE BARN
0' 1' 2' 4' 6'

09. CORN CRIB

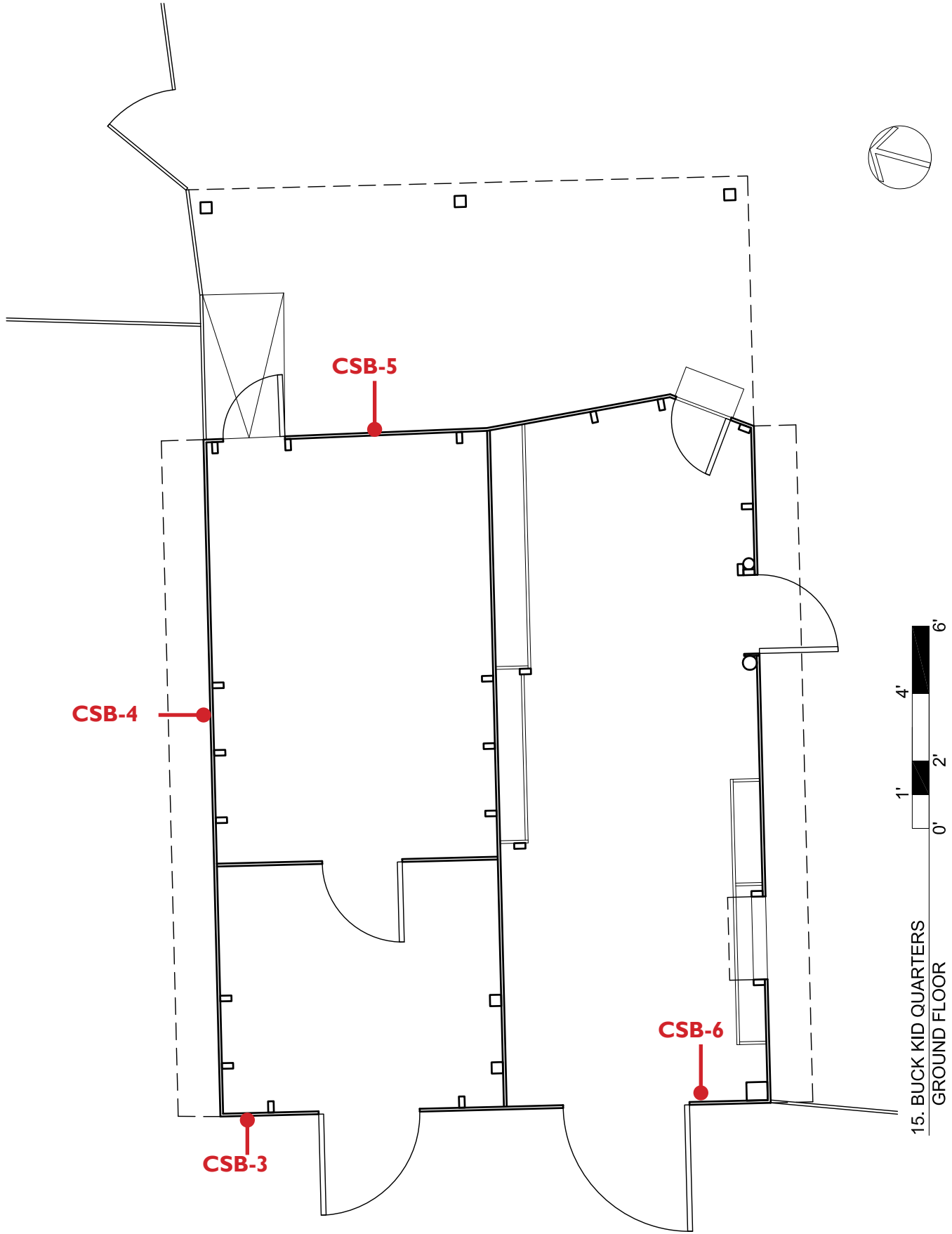
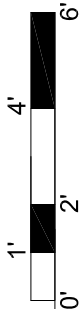


14. COW SHED

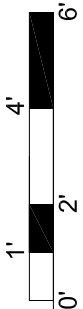


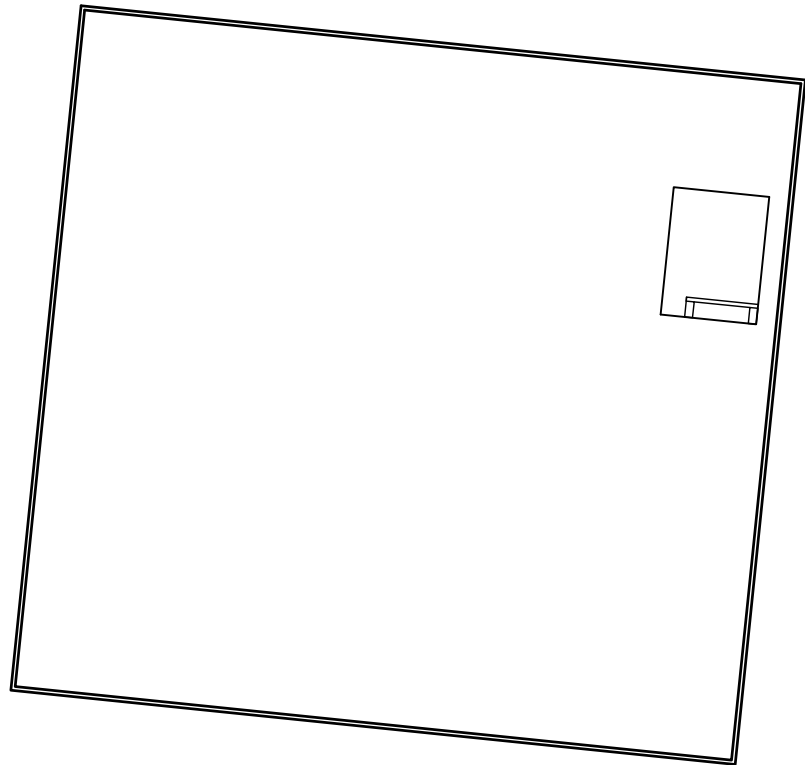


15. BUCK KID QUARTERS
SECOND FLOOR

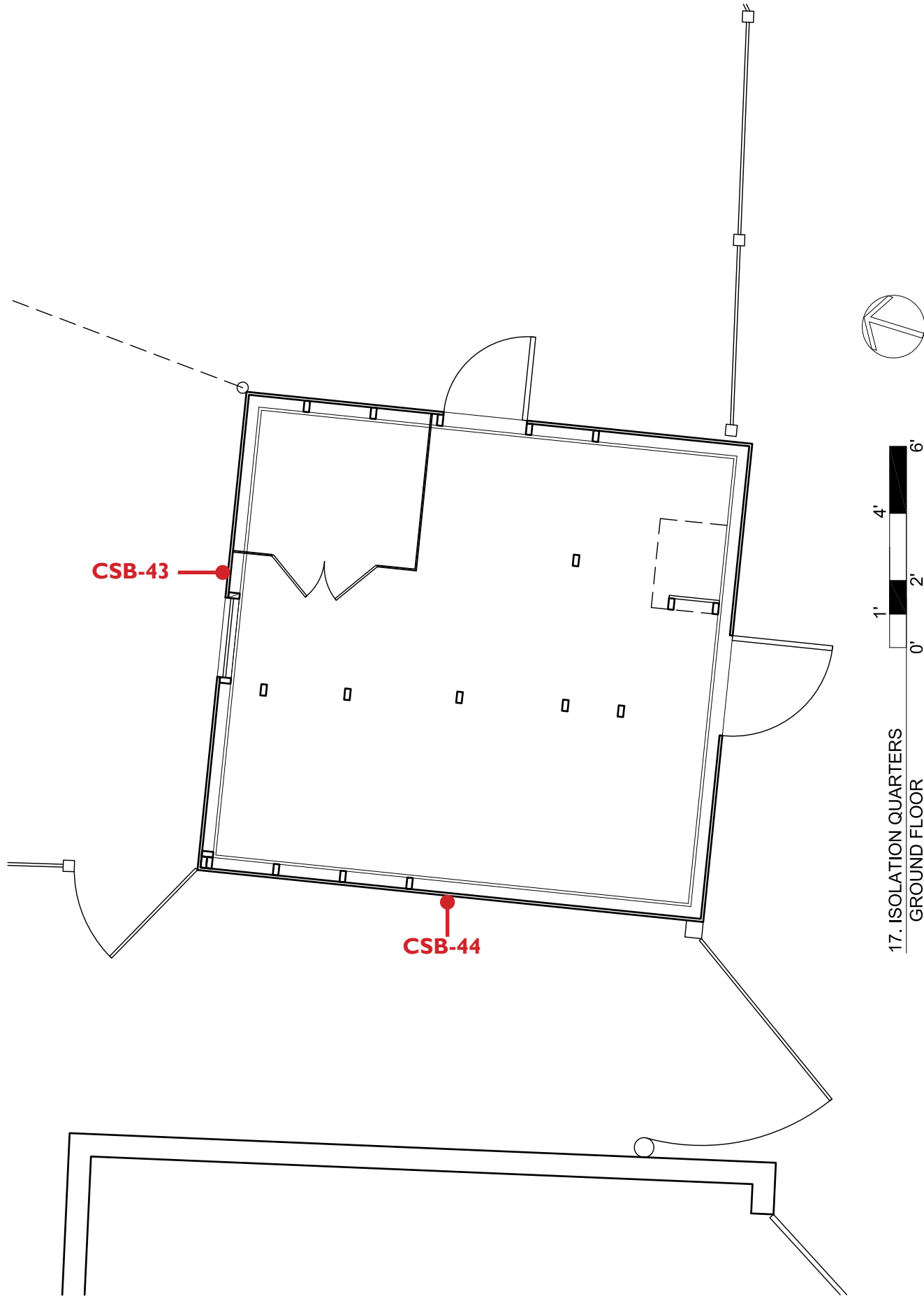


15. BUCK KID QUARTERS
GROUND FLOOR





17. ISOLATION QUARTERS
SECOND FLOOR

A scale bar for the second floor plan. It is a horizontal line with vertical tick marks at 0', 2', 4', and 6'. The text '0'', '2'', '4'', and '6'' is placed below the tick marks.

17. ISOLATION QUARTERS
GROUND FLOOR

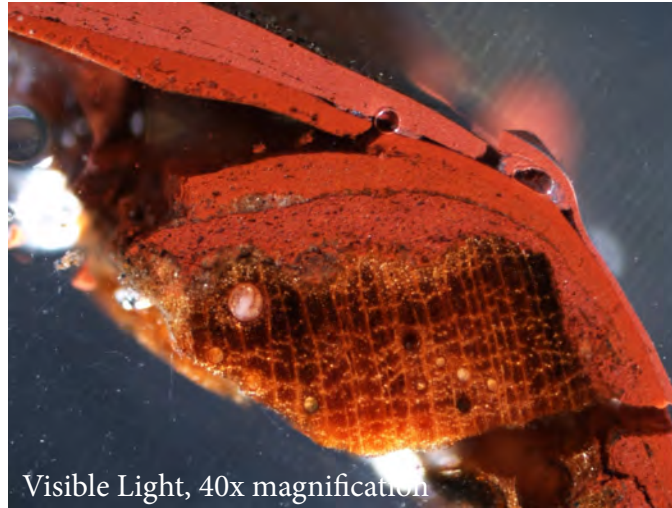
A scale bar for the ground floor plan. It is a horizontal line with vertical tick marks at 0', 2', 4', and 6'. The text '0'', '2'', '4'', and '6'' is placed below the tick marks.

APPENDIX B.

**SAMPLE STRATIGRAPHIES AND
PHOTOMICROGRAPHS**

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



SAMPLE: CSB I	LOCATION: Corn Crib
DESCRIPTION: At uppermost pice of lath.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		Uneven surface
1	Red	
2	Red	
3	Red	
4	Red	
5	Red	
6		
7		
8		
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies

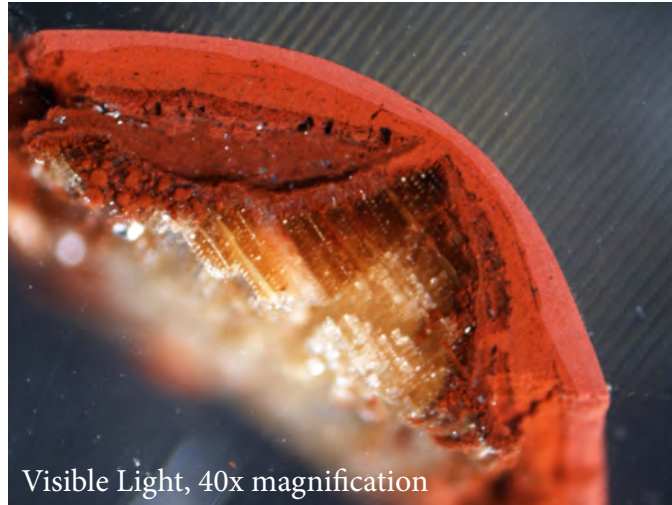


SAMPLE: CSB 2	LOCATION: Corn Crib
DESCRIPTION: Weathered slat above door.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		Uneven surface
1	Red	
2	Red	
3	Red	
4	Red	
5	Red	
6		
7		
8		
9		
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11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



SAMPLE: CSB 3	LOCATION: Buck Kid Quarters 1st Floor
DESCRIPTION: Clapboard on gable under roof overhang. (Park Service reconstruction)	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		Uneven Surface
1	Red	
2	Red	
3	Red	
4	Red	
5	Red	
6	Red	
7		
8		
9		
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



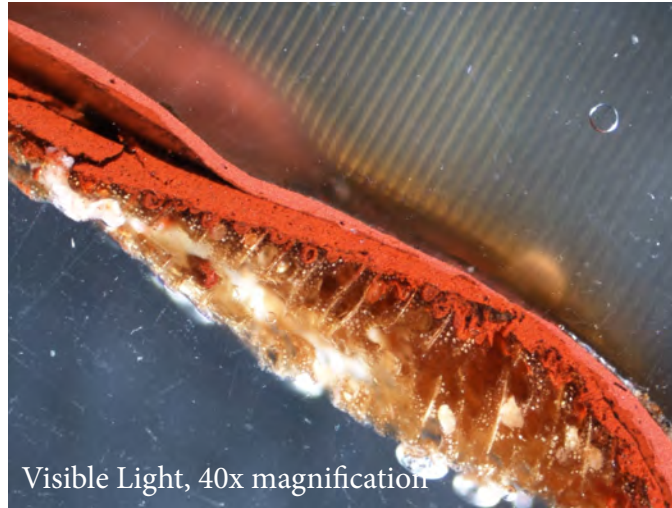
SAMPLE: CSB 4	LOCATION: Buck Kid Quarters 1st Floor
DESCRIPTION: Plank between joist ends.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		Uneven/ stripped
1	Red	
2	Red	
3	Red	
4	Red	
5	Red	
6		
7		
8		
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies



SAMPLE: CSB 5	LOCATION: Buck Kid Quarters 1st Floor
DESCRIPTION: First clapboard above board and batten.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		Uneven
1	Red	
2	Red	
3	Red	
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies

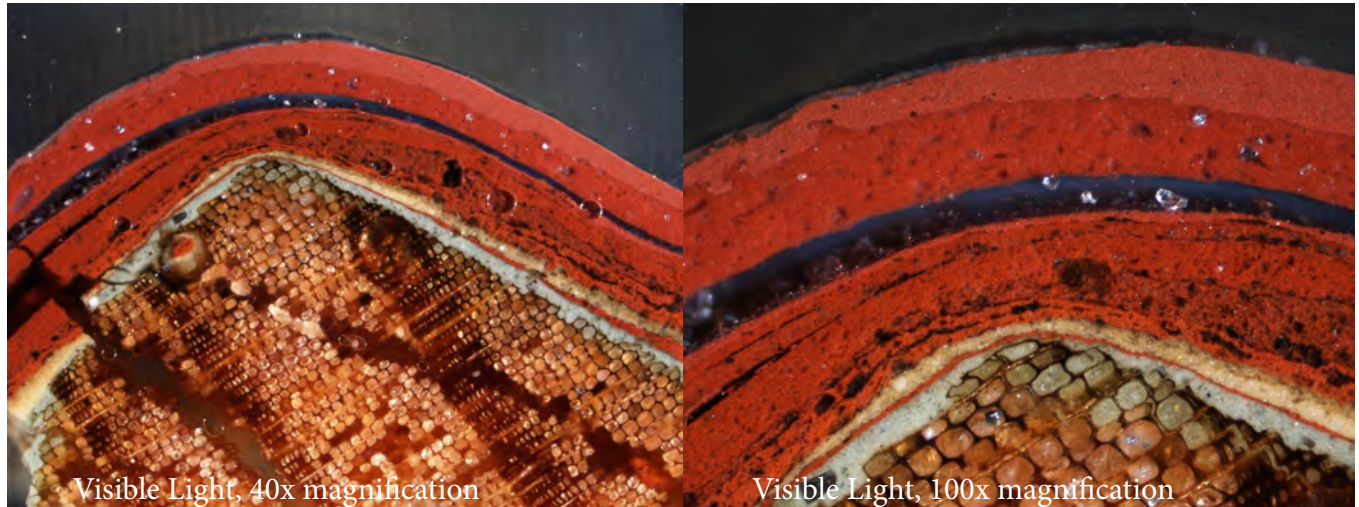


SAMPLE: CSB 6	LOCATION: Buck Kid Quarters 1st Floor
DESCRIPTION: Diagonal Brace (probably exposed prior to clapboard installation)	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	White (limewash)	
2	White (limewash)	
3	White (limewash)	
4	Red-Orange	
5	White (limewash)	
6	White (limewash)	
7	White (limewash)	
8		
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12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



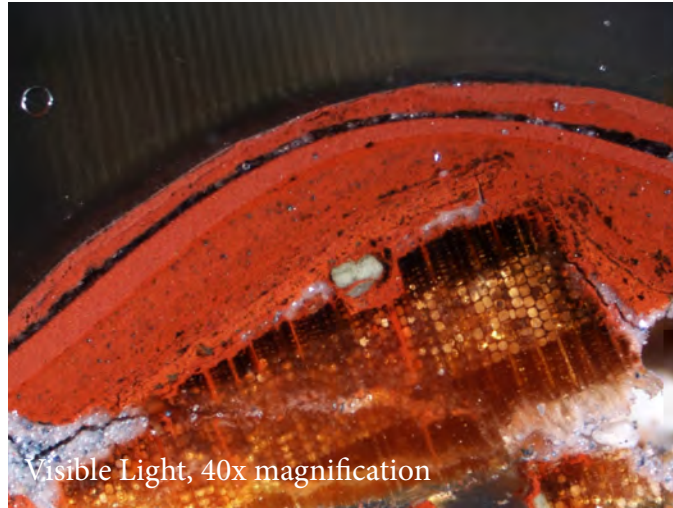
SAMPLE: CSB 7	LOCATION: Horse Barn 1st Floor
DESCRIPTION: 2nd Clapboard below roof sheathing.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Pale Blue- Green	
2	Pale Yellow	
3	Dark Brown	Discoloration?
4	Red	
5	Red	
6	Red	
7	Red	
8	Red	
9	Red	
10	Red	
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies



SAMPLE: CSB 8	LOCATION: Horse Barn 1st Floor
DESCRIPTION: Clapboard under roof sheathing.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Pale Green	Traces
2	Red	
3	Red	
4	Red	
5	Red	
6	Red	
7	Red	
8	Red	
9	Red	
10	Red	
11	Red	
12	Red	
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies

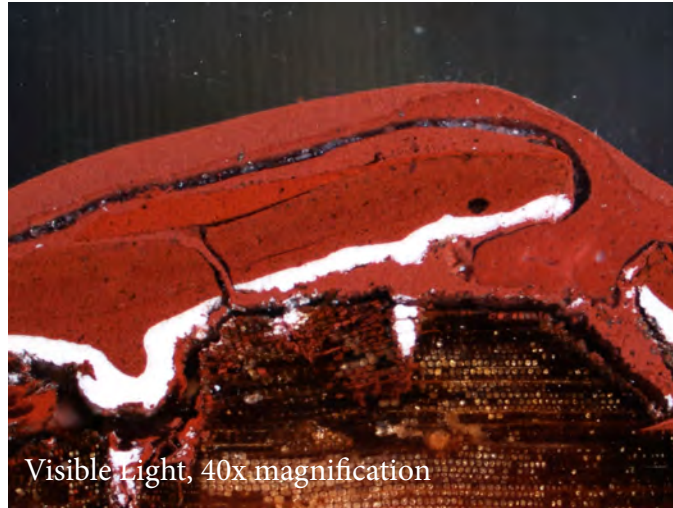


SAMPLE: CSB 9	LOCATION: Horse Barn 1st Floor
DESCRIPTION: Large split wood sample.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
I	Red	
2	Pale Green	Traces
3	Pale Yellow	Traces
4	Red	
5	Red	
6	Red	
7	Red	
8	Red	
9	Red	
10	Red	
11	Red	
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



SAMPLE: CSB 10	LOCATION: Horse Barn 1st Floor
DESCRIPTION: Door frame.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Red	
2	White	
3	Red	
4	Red	
5	Red	
6	Red	
7	Red	
8	Red	
9	Red	
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies

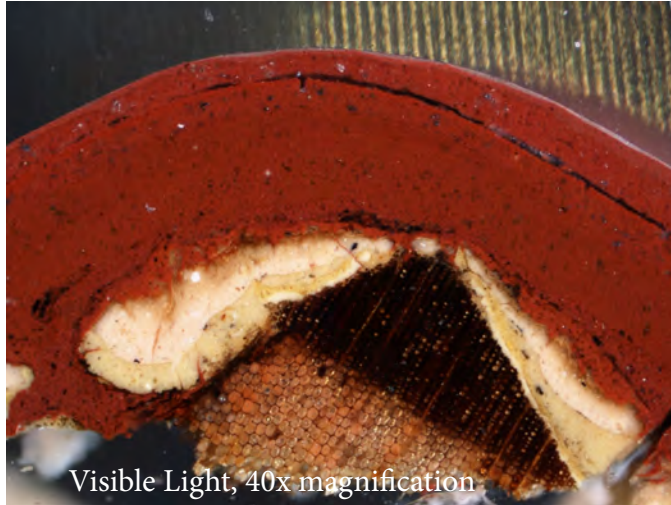


SAMPLE: CSB 11	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Clapboard 6' above ground. (Should be original part of barn.)	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Red	Leak Down
2	Pale Yellow / Cream	
3	Pale Yellow	
4	Red	
5	Red	
6	Red	
7	Red	
8		
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10		
11		
12		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



Visible Light, 40x magnification



Visible Light, 100x magnification

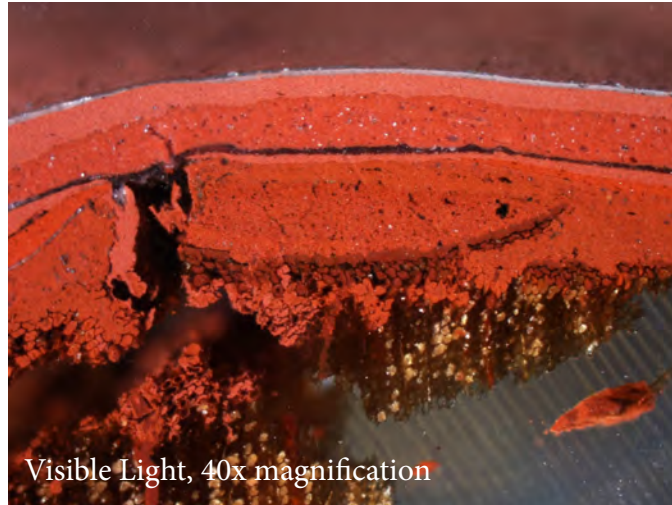
SAMPLE: CSB 13	LOCATION: Goat Barn 2nd Floor
DESCRIPTION: 2nd clapboard below roof sheathing	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Cream	
2	Pale Yellow-Brown	
3	Red	
4	Red	
5	Red	
6	Red	
7	Red	
8	Red	
9		
10		
11		
12		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies

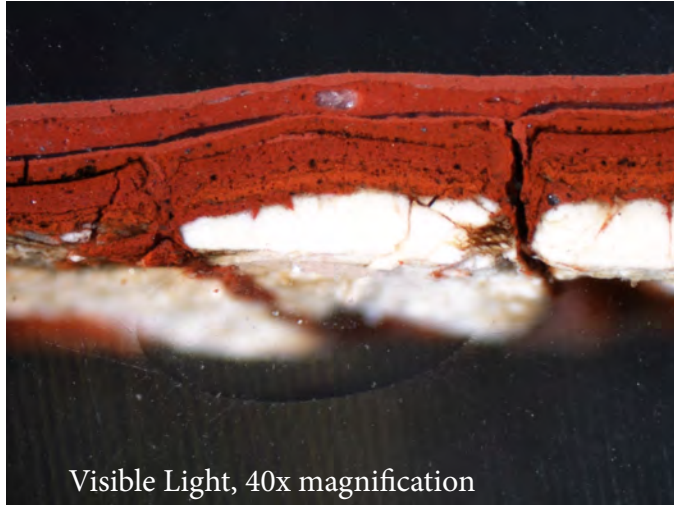


SAMPLE: CSB 14	LOCATION: Goat Barn 2nd Floor
DESCRIPTION: Door jamb.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		Weathered
1	Red (Dark)	
2	Red	
3	Red	
4	Red	
5	Red	
6	Red	
7	Red	
8	Red	
9		
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



Visible Light, 40x magnification



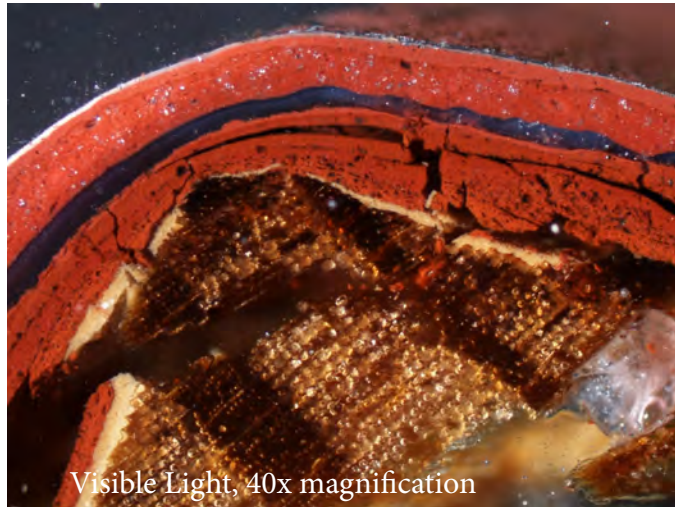
Visible Light, 100x magnification

SAMPLE: CSB I 5	LOCATION: Goat Barn 2nd Floor
DESCRIPTION: Rafter end (5th rafter westward of east elevation)	

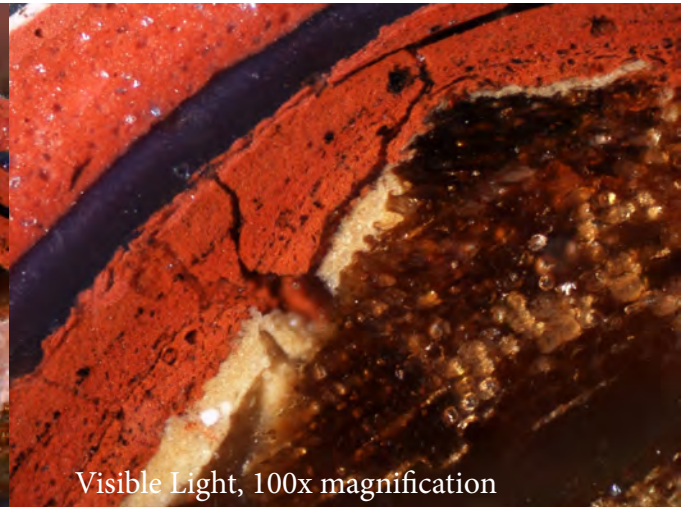
LAYER	REFLECTED LIGHT COLOR	NOTES
None		
1	White	
2	Red	
3	Red	
4	Red	
5	Red	
6	Red	
7	Red	
8	Red	
9		
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



Visible Light, 40x magnification



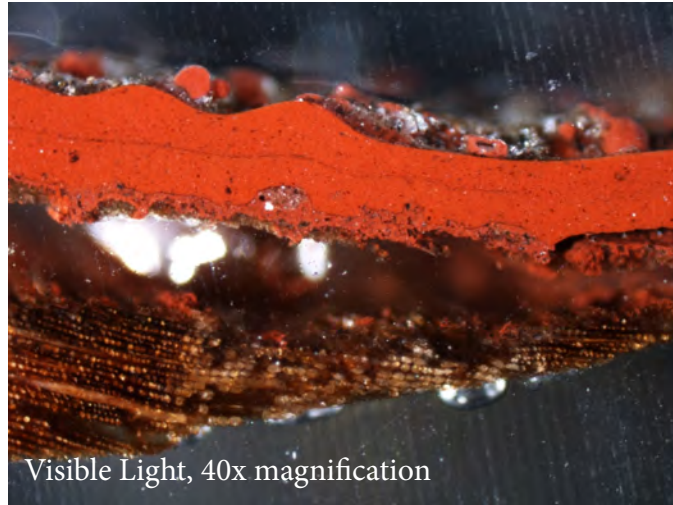
Visible Light, 100x magnification

SAMPLE: CSB 16	LOCATION: Goat Barn 2nd Floor
DESCRIPTION: Sample taken in hard-to-reach area next to silo that only has earlier paint	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Dark Cream/ Light Brown	
2	Red	
3	Red	
4	Red	
5	Red	
6	Red	
7		
8		
9		
10		
11		
12		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies

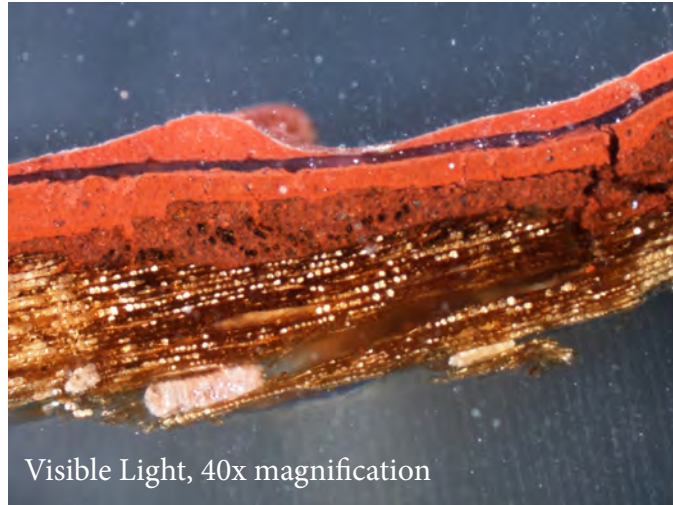


SAMPLE: CSB 17	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Sample taken in hard-to-reach area next to silo that only has earlier paint	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Red Brown (medium)	
2	Red	
3	Red	
4	Red	
5		
6		
7		
8		
9		
10		
11		
12		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



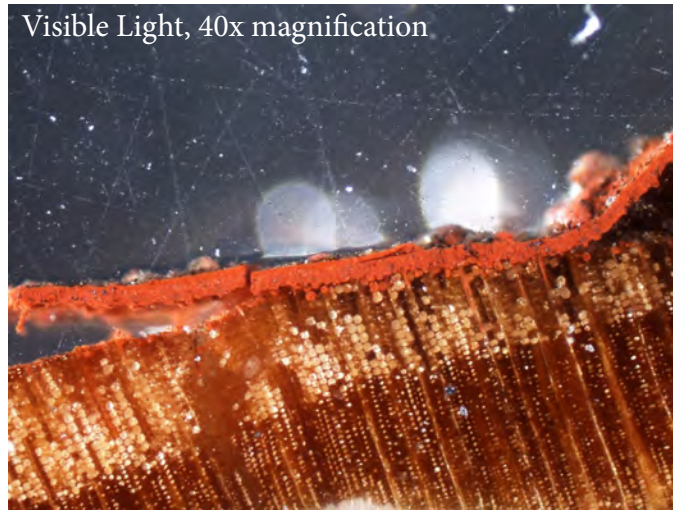
SAMPLE: CSB I 8	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Underside of roof sheathing.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Reddish Brown (medium)	
2	Red	
3	Red	
4		
5		
6		
7		
8		
9		
10		
11		
12		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies



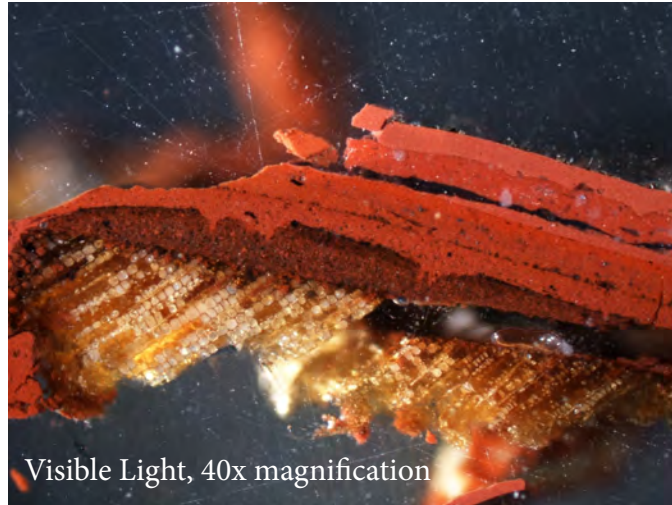
SAMPLE: CSB 19	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Siding behind old phone connection box.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Red	
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies

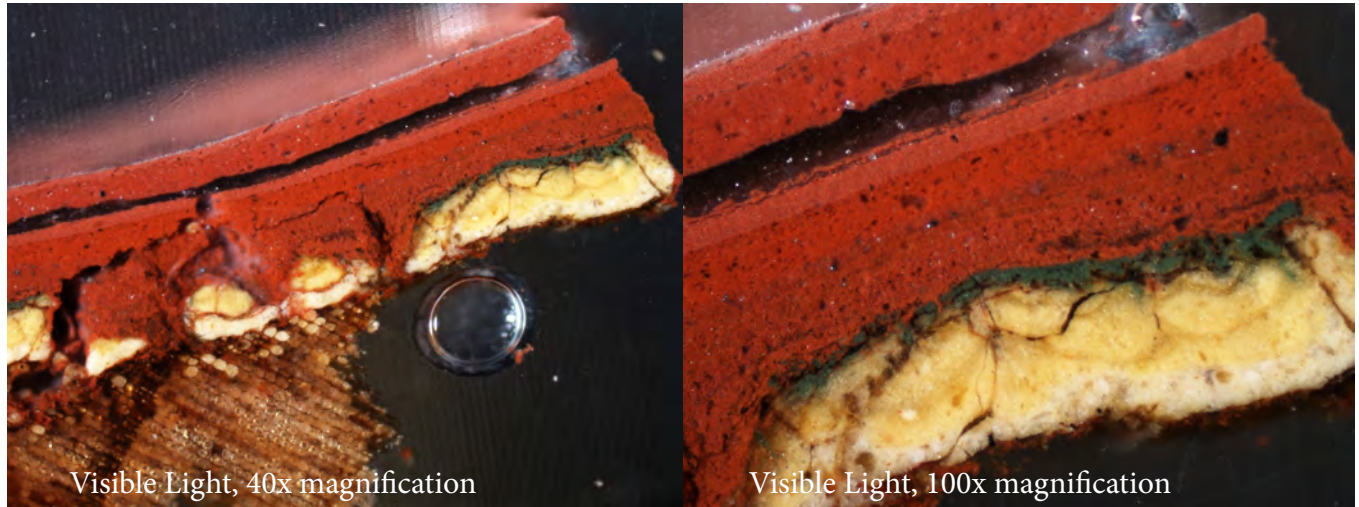


SAMPLE: CSB 20	LOCATION: Goat Barn 1st Floor
DESCRIPTION: 3rd clapboard below roof sheathing (above door).	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Red - Brown	
2	Dark Red - Brown	
3	Red	
4	Red	
5	Red	
6	Red	
7	Red	
8		
9		
10		
11		
12		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies

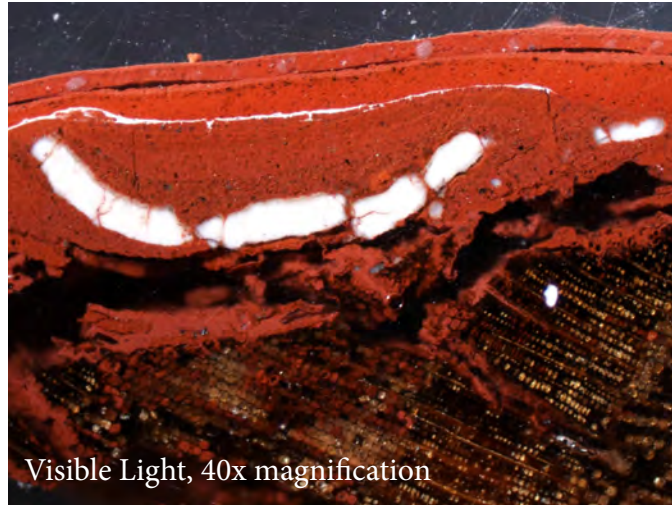


SAMPLE: CSB 2I	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Window casing at lintel.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Cream	
2	Pale Yellow	
3	Pale Yellow	
4	Green (Kelly)	
5	Red	
6	Red	
7	Red	
8	Red	
9	Red	
10	Red	
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies

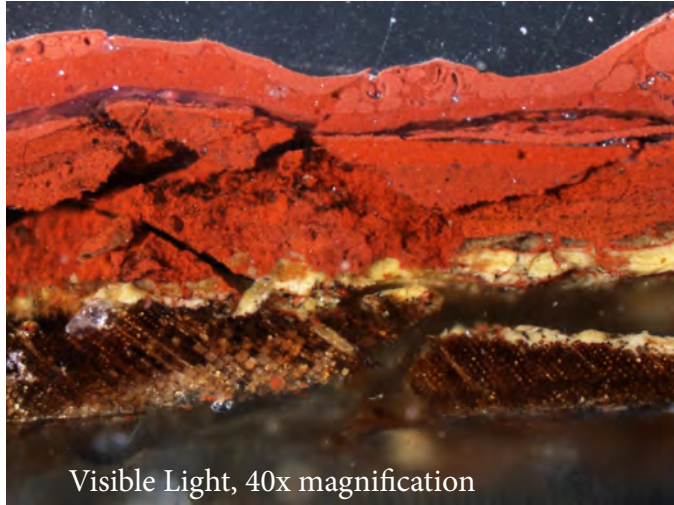


SAMPLE: CSB 22	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Window casing at jamb.	

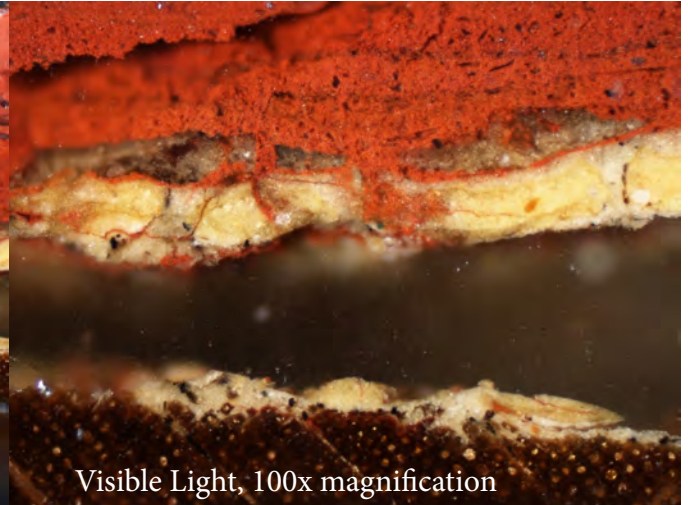
LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Red	Leak Down
2	Red	Leak Down
3	White	
4	Red	
5	Red	
6	Red	
7	Red	
8	Red	
9	White	
10	Red	
11	Red	
12	Red	
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



Visible Light, 40x magnification



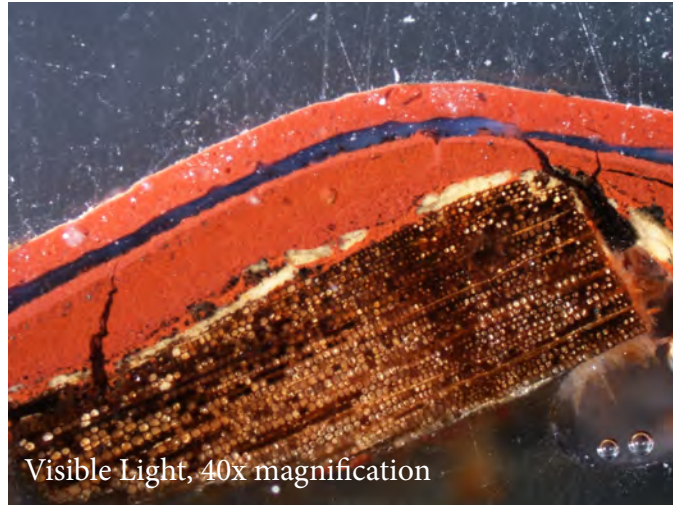
Visible Light, 100x magnification

SAMPLE: CSB 23	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Top clapboard below roof sheathing. Also, 3rd clapboard below sheathing.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Cream	
2	Pale Yellow	
3	Cream	
4	Dark Brown	
5	Red	
6	Red	
7	Red	
8	Red	
9	Red	
10	Red	
11	Red	
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies

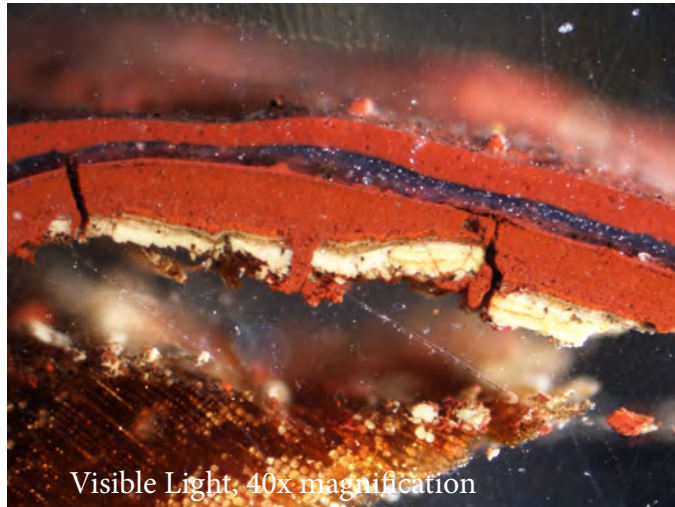


SAMPLE: CSB 24	LOCATION: Goat Barn 1st Floor
DESCRIPTION: (South of seam) clapboard approx 6' above ground.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Cream	Disrupted
2	Red	
3	Red	
4	Red	
5		
6		
7		
8		
9		
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



Visible Light, 40x magnification



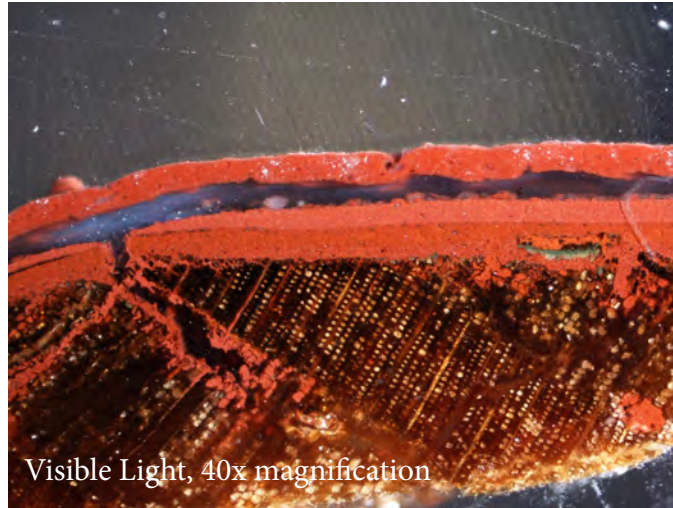
Visible Light, 100x magnification

SAMPLE: CSB 25	LOCATION: Goat Barn 1st Floor
DESCRIPTION: (North of seam) claboard approx 6' above ground.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies

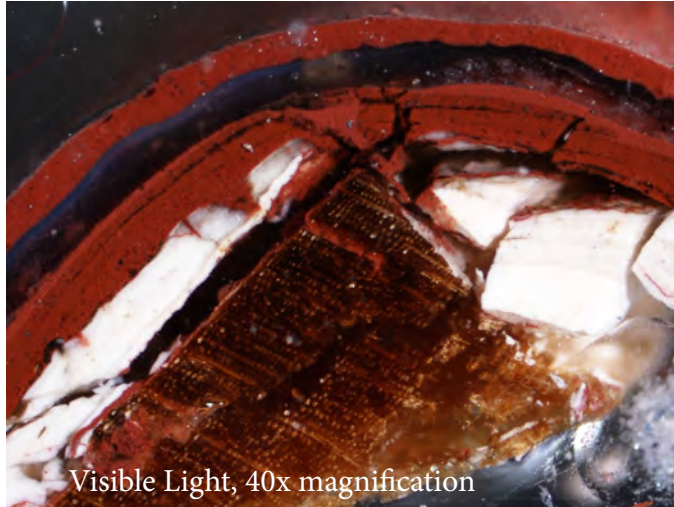


SAMPLE: CSB 26	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Door trim at jamb, south side of opening	

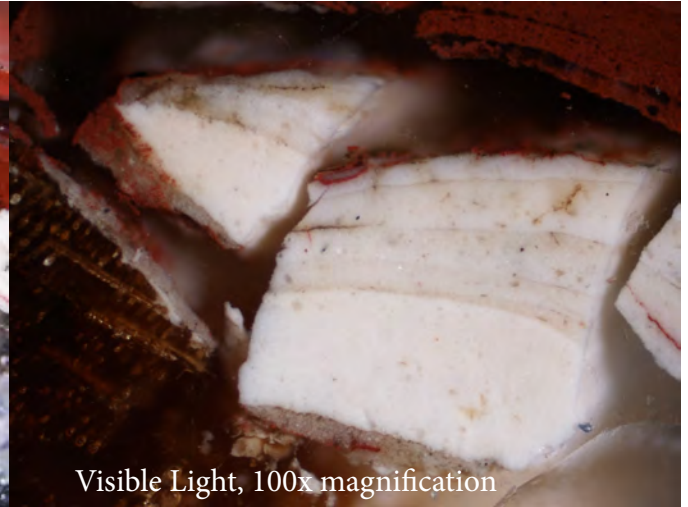
LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Cream	
2	Kelly Green	Fragments
3	Red	
4	Red	
5	Red	
6	Red	
7	Red	
8		
9		
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11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



Visible Light, 40x magnification



Visible Light, 100x magnification

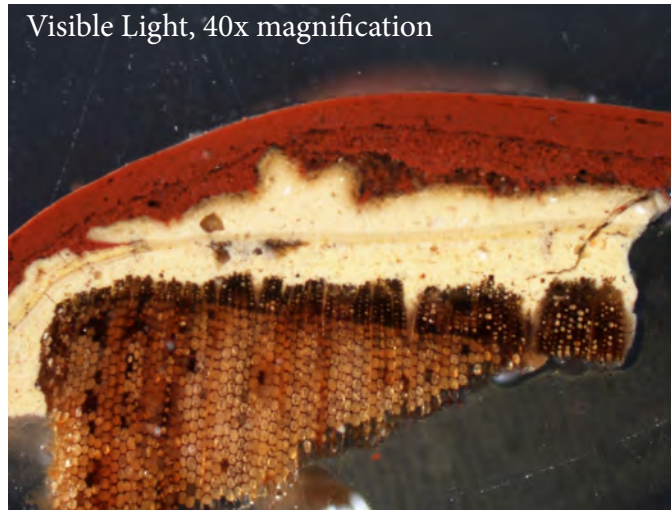
SAMPLE: CSB 27	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Door trim at jamb south side of opening.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Light Gray/ White	Limewash?
2	White	
3	White	
4	White	
5	White	
6	White	
7	White	
8	Red	
9	Red	
10	Red	
11	Red	
12	Red	

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies



SAMPLE: CSB 28	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Clapboard west of window jamb.	

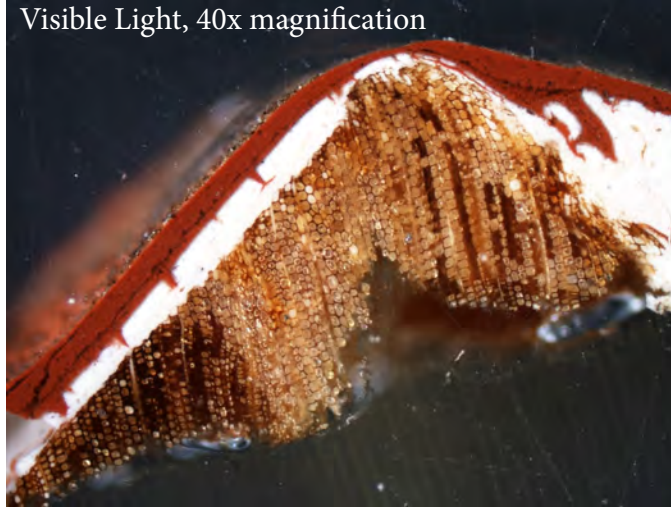
LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Cream	
2	Pale Yellow	
3	Cream	
4	Light Brown	Discoloration?
5	Red	
6	Red	
7	Red	
8	Red	
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies

Visible Light, 40x magnification



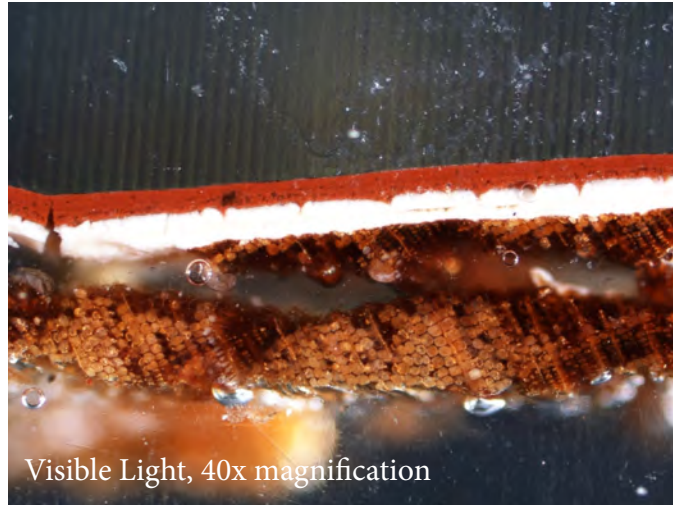
SAMPLE: CSB 29	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Window casing at jamb.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	White	
2	White	
3	Red	
4	Red	
5		
6		
7		
8		
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies



SAMPLE: CSB 30	LOCATION: Goat Barn 1st Floor
DESCRIPTION: On shutter. (Shutter red on north side, whitewash(?) on south side).	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	White	
2	White	
3	Red	
4	Red	
5	Red	
6		
7		
8		
9		
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



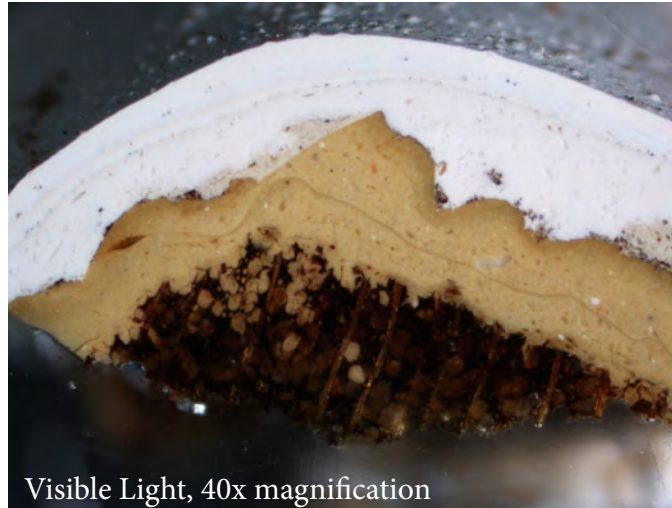
SAMPLE: CSB 3 I	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Clapboard east of window.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		Weathered
1	Red	
2	Red	
3	Red	
4		
5		
6		
7		
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9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies



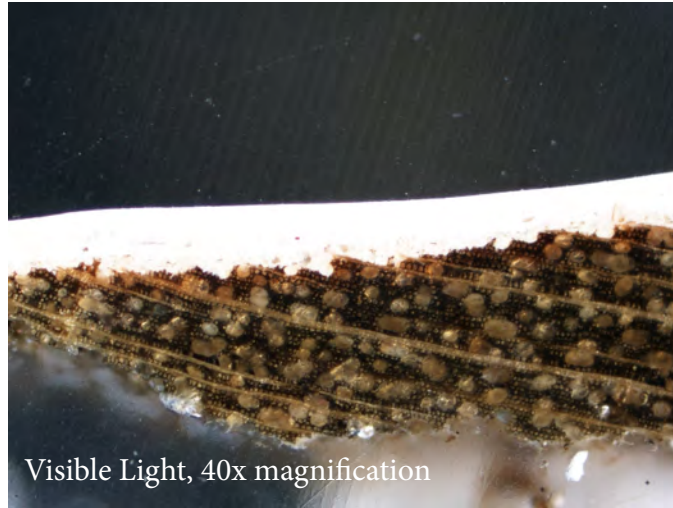
SAMPLE: CSB 32	LOCATION: Goat Barn 1st Floor
DESCRIPTION: North wall of original building.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Cream	
2	Cream	
3	White / Light Gray	
4	White	
5	White	
6	White	
7		
8		
9		
10		
11		
12		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies



SAMPLE: CSB 33	LOCATION: Goat Barn 1st Floor
DESCRIPTION: West end wall of north shed addition.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	White	
2	White	
3	White	
4		
5		
6		
7		
8		
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11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



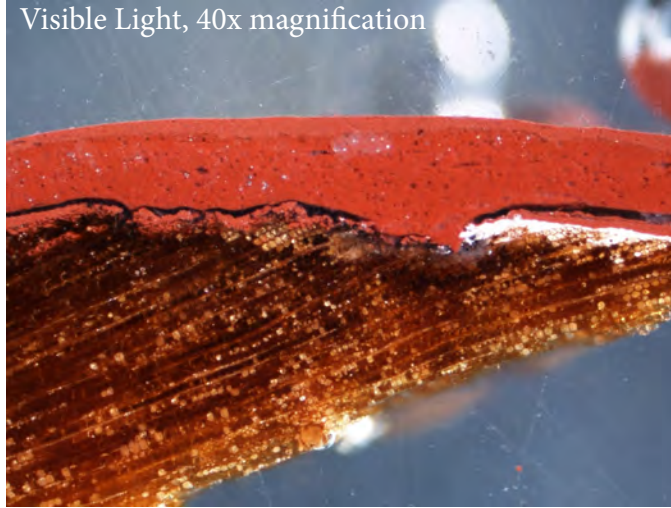
SAMPLE: CSB 34	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Window trim, west side of window, jamb trim.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		Weathering
1	Red	Leak down
2	White	
3	Red	
4	Red	
5	Red	
6		
7		
8		
9		
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies

Visible Light, 40x magnification



SAMPLE: CSB 35	LOCATION: Goat Barn 1st Floor
DESCRIPTION: Window trim, east jamb.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	White	
2	Red	
3	Red	
4	Red	
5		
6		
7		
8		
9		
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies

Visible Light, 40x magnification



SAMPLE: CSB 36	LOCATION: Goat Barn 2nd Floor
DESCRIPTION: Clapboards in gable of dormer, above door opening.	

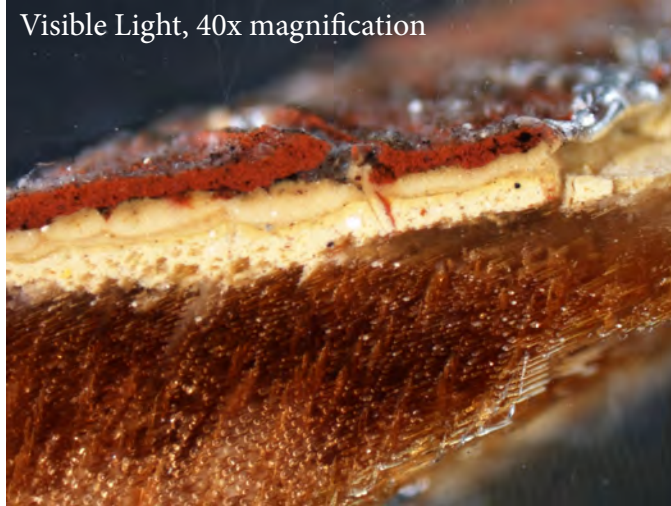
LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Dark Red (Browning)	
2	Red	
3	Red	
4	Red	
5	Red	
6	White	
7		
8		
9		
10		
11		
12		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies

Visible Light, 40x magnification

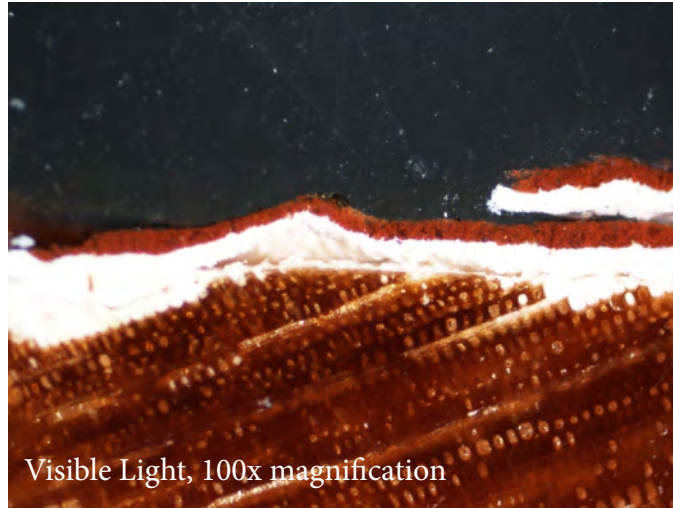


SAMPLE: CSB 37	LOCATION: Goat Barn 2nd Floor
DESCRIPTION: Clapboards.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Cream	
2	Pale Yellow	
3	Cream	
4	Cream	
5	Red	
6		
7		
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12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies

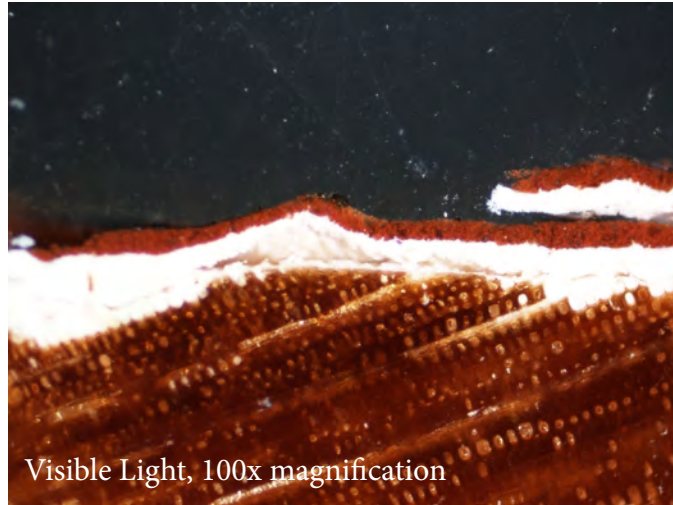


SAMPLE: CSB 38	LOCATION: Goat Barn 2nd Floor
DESCRIPTION: East jamb of window opening, trim.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	White	
2	White	
3	Red	
4		
5		
6		
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11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies

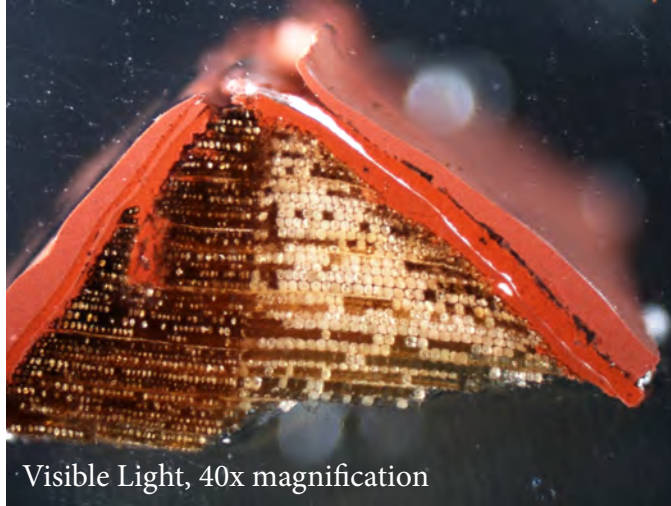


SAMPLE: CSB 39	LOCATION: Goat Barn 2nd Floor
DESCRIPTION: North face of shutter.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Red	
2	White	
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site
Barn Complex

Finishes Analysis: Stratigraphies

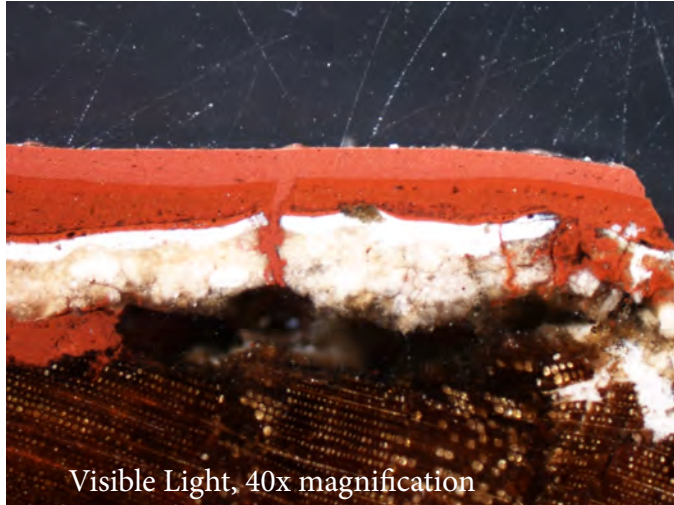


SAMPLE: CSB 40	LOCATION: Goat Barn 2nd Floor
DESCRIPTION: Edge of shutter	

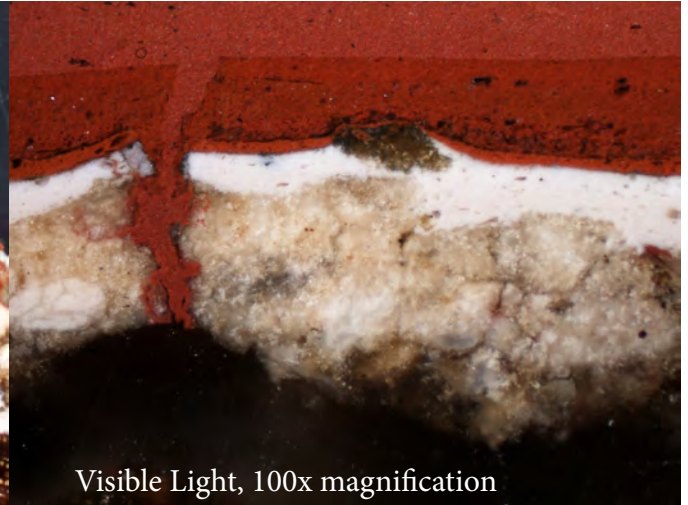
LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Red	
2	White	
3	Red	
4	Red	
5		
6		
7		
8		
9		
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



Visible Light, 40x magnification



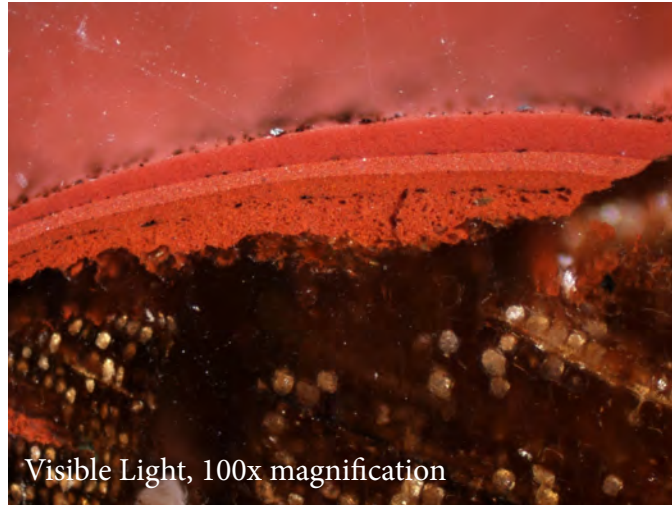
Visible Light, 100x magnification

SAMPLE: CSB 44	LOCATION: Isolation Quarters
DESCRIPTION: Clapboard below eaves.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	White - limewash	
2	White - limewash	
3	White	
4	Red	
5	Red	
6	Red	
7	Red	
8		
9		
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



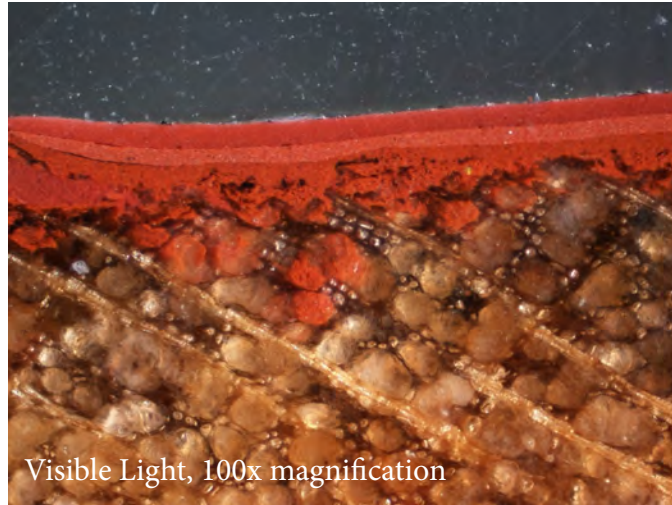
SAMPLE: CSB 45	LOCATION: Buck House
DESCRIPTION: West return (miter) of canted crown molding under pent cornice of gable (main Building).	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Red	
2	Red	
3	Red	
4	Red	
5		
6		
7		
8		
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies



SAMPLE: CSB 46	LOCATION: Buck House
DESCRIPTION: Clapboard, 3rd down, below pent cornice (main building).	

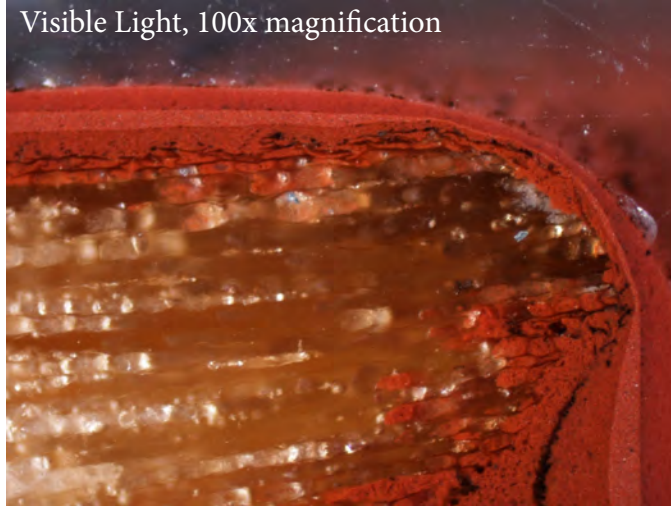
LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Red	
2	Red	
3	Red	
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies

Visible Light, 100x magnification



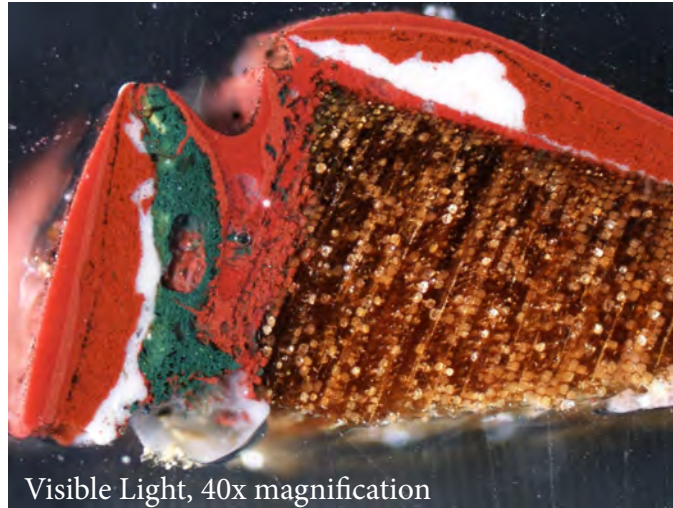
SAMPLE: CSB 47	LOCATION: Buck House
DESCRIPTION: Clapboard below shed roof (enclosed porch).	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Red	
2	Red	
3	Red	
4	Red	
5		
6		
7		
8		
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies

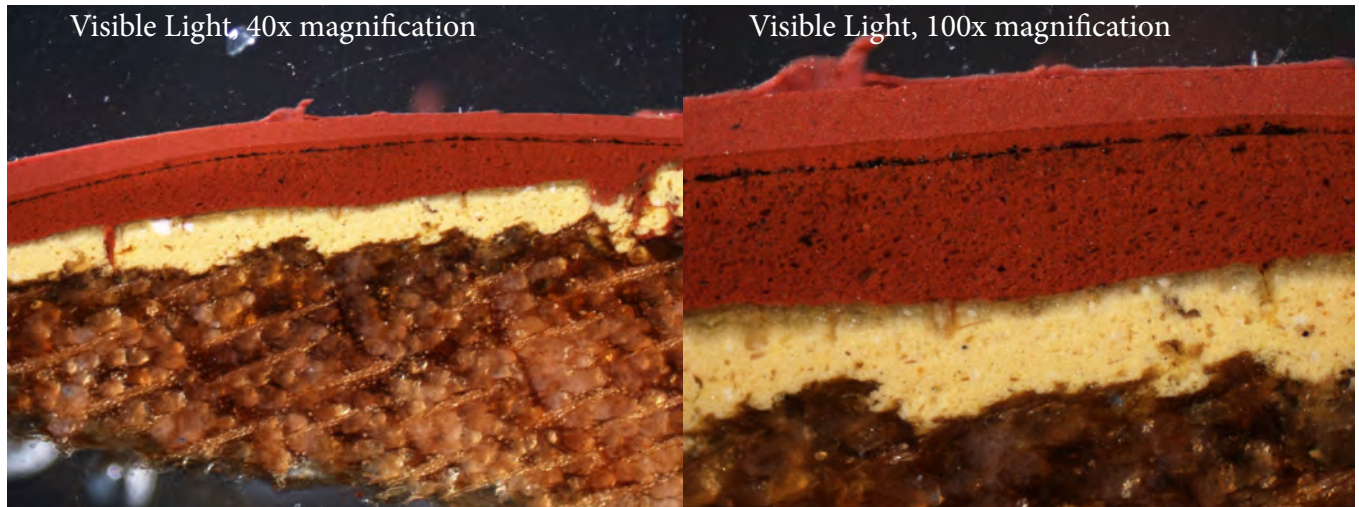


SAMPLE: CSB 48	LOCATION: Buck House
DESCRIPTION: Vertical corner trim of main building, approx 10" below pent cornice.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Dark Green (Kelly)	
2	White	
3	Red	
4	Red	
5	Red	
6	Red	
7		
8		
9		
10		
11		
12		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



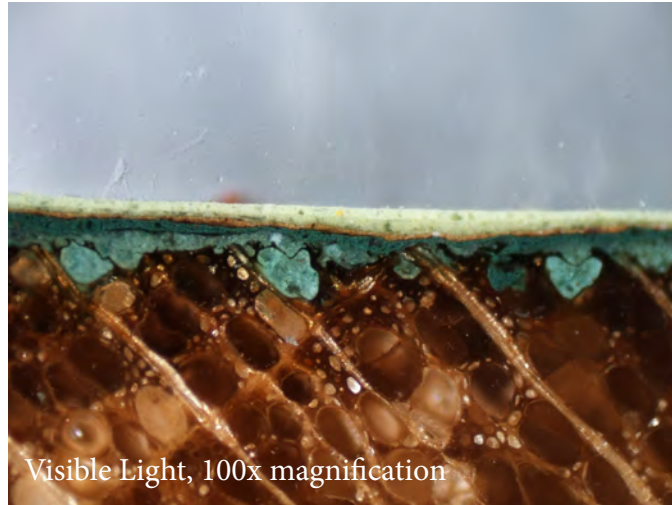
SAMPLE: CSB 49	LOCATION: Buck House
DESCRIPTION: Clapboard approx. 3.5' above ground.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Pale Yellow	
2	Light Brown	Discoloration?
3	Red	
4	Red	
5	Red	
6		
7		
8		
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies

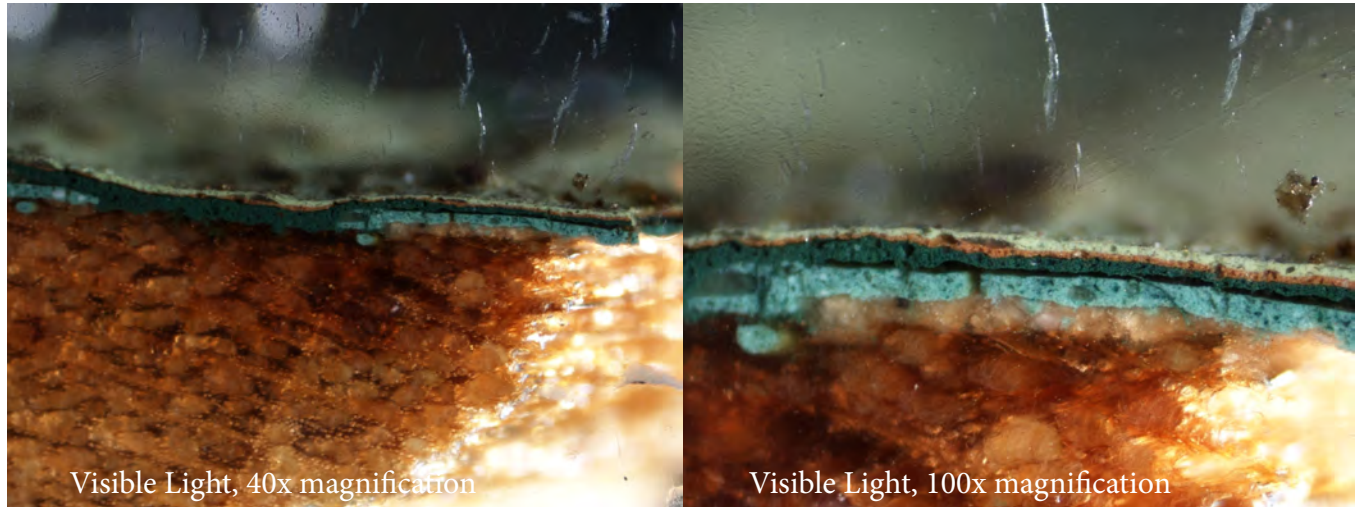


SAMPLE: CSB 50	LOCATION: Buck House
DESCRIPTION: Trim on south side of opening.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Blue- Green/ Turquoise	
2	Kelly Green (dark)	
3	Dark Orange	
4	Light Green	
5	Light Green	
6		
7		
8		
9		
10		
11		
12		
13		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies

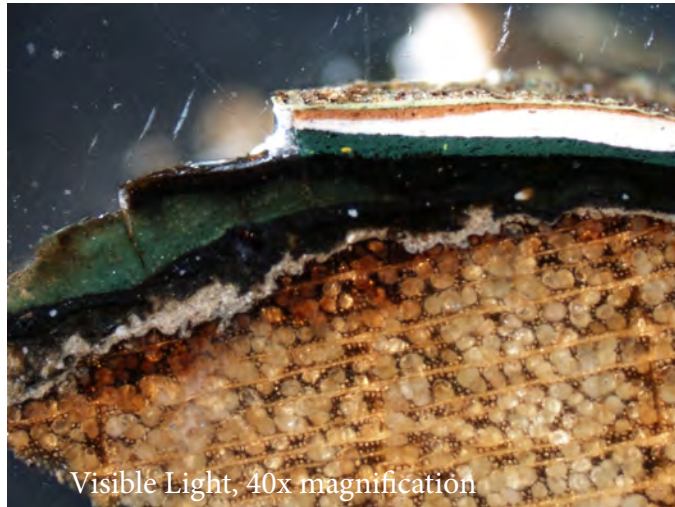


SAMPLE: CSB 51	LOCATION: Buck House
DESCRIPTION: Trim on west side of opening.	

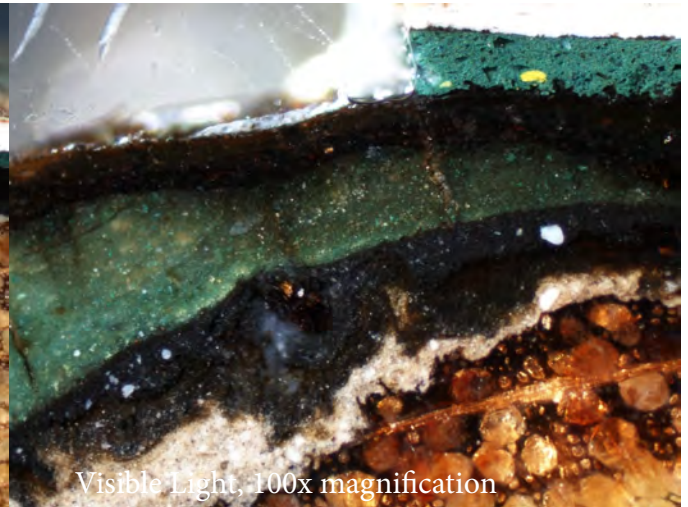
LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	White	Limewash?
2	Blue-Green/ Turquoise	
3	Dark Kelly Green	
4	Dark Orange	
5	Light Green	
6		
7		
8		
9		
10		
11		
12		

**Carl Sandburg Home National Historic Site
Barn Complex**

Finishes Analysis: Stratigraphies



Visible Light, 40x magnification



Visible Light, 100x magnification

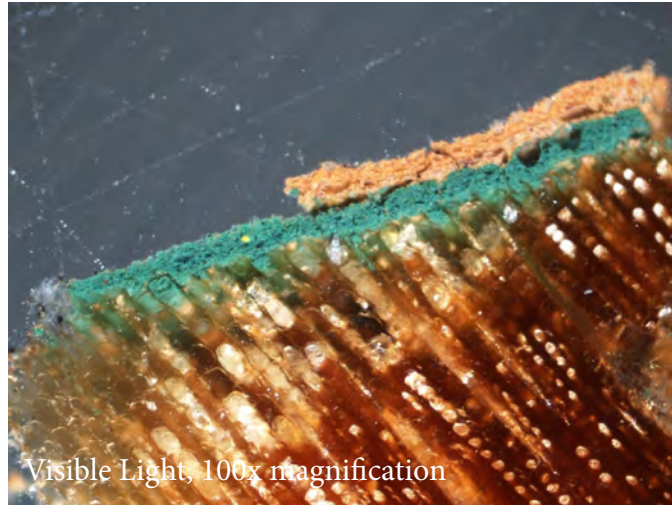
SAMPLE: CSB 52	LOCATION: Buck House
DESCRIPTION: Mantle (wood).	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Varnish	
2	Light Gray	
3	Dark Gray	
4	Dark Green	
5	Black	
6	Kelly Green	
7	White	
8	Dark Orange	
9	Light Green	
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies



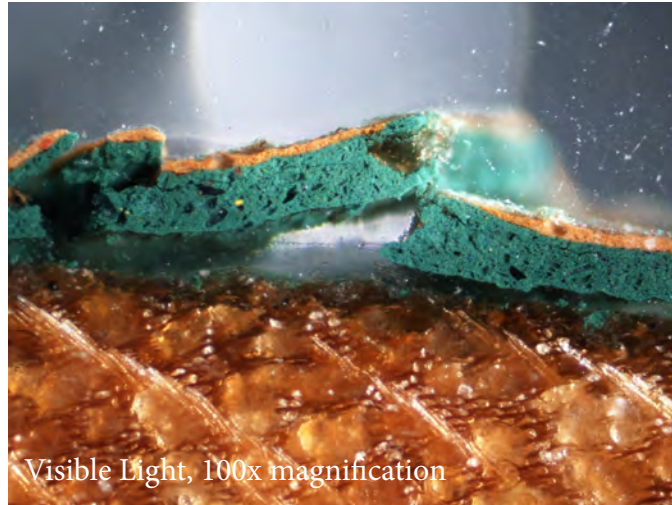
SAMPLE: CSB 54	LOCATION: Buck House
DESCRIPTION: Salvaged door hanging on wall above opening.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Kelly Green	
2	Dark Orange	
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Carl Sandburg Home National Historic Site

Barn Complex

Finishes Analysis: Stratigraphies



SAMPLE: CSB 55	LOCATION: Buck House
DESCRIPTION: Trim at jamb, south side of opening.	

LAYER	REFLECTED LIGHT COLOR	NOTES
Wood		
1	Dark Green	
2	Dark Orange	
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Appendix B:

Dendrochronology Report

**Oxford Tree-Ring Laboratory
Report 2014/17**

**The Tree-Ring Dating of the
Buck House and Selected Barns and Corn Crib of the Barns Complex at the
Carl Sandburg Home National Historic Site,
Flat Rock, North Carolina**

Michael J. Worthington and Jane I. Seiter

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www.dendrochronology.com
Telephone: 410-929-1520

December 2014

Overview of Dendrochronology at the Carl Sandburg Home National Historic Site, Flat Rock, North Carolina

The Carl Sandburg Home National Historic Site was the home of the Pulitzer Prize-winning poet for twenty-two years. After his death, it was opened as an historic site to preserve his legacy. In addition to the Sandburg Residence it also contains Connemara, an award-winning goat farm run by Lillian Sandburg, Carl Sandburg's wife.

Dendrochronological analysis was commissioned on six buildings within the Connemara complex: the Buck House, the Isolation Quarters, the Buck Kid Quarters, the Main Barn, the Horse Barn, and the Corn Crib. This research was undertaken in an attempt to resolve individual questions relating to the construction of each building and to create a well-replicated master chronology to help date other buildings in the area. Forty-seven timbers in total were sampled from the six buildings, but none were found to date.

Dates sampled: November 6, 7, and 8, 2013; May 25 and 26, 2014

Owner: National Park Service

Commissioner: Joseph K. Oppermann - Architect

Street address: Flat Rock, NC 28731

Summary published: www.dendrochronology.com

Building summaries:



Figure 1. Buck House.

Buck House, Carl Sandburg Home, Flat Rock, NC (35.272098, -82.449123)

Felling dates: **Undated**

Rafter (0/1); Studs (0/3); Joist (0/1).

The Buck House is a two-level, wood-framed building with a central chimney stack, a porch on one side, and a lean-to addition on the back. It is situated several hundred yards to the northeast of the main farmyard, outside of the main farm complex.



Figure 2. Isolation Quarters.

Isolation Quarters, Carl Sandburg Home, Flat Rock, NC (35.271093, -82.449044)

Felling dates: **Undated**

Joists (0/4); Rafters (0/3); Stud (0/1).

The Isolation Quarters is a small, wood-framed structure of two levels clad in red weatherboard. It is located a short distance away from the main farmyard to the east of the garage.



Figure 3. Buck Kid Quarters.

Buck Kid Quarters, Carl Sandburg Home, Flat Rock, NC (35.271240, -82.449256)

Felling date: **Undated**

Joists (0/3); Brace (0/1); Stud (0/4).

The Buck Kid Quarters is a small, wood-framed structure of two levels clad in red weatherboard. It is located to the southeast of the Horse Barn and faces west onto the main farmyard.



Figure 4. Main Barn.

Main (or Goat) Barn, Carl Sandburg Home, Flat Rock, NC (35.271386, -82.449484)

Felling dates: **Undated**

Joists (0/6); Stud (0/1).

The Main Barn is the largest structure in the Connemara farm complex. It is a two-story, wood-framed building clad in red weatherboard. It faces south onto the main farmyard and is located to the west of the Horse Barn.



Figure 5. Horse Barn.

Horse Barn, Carl Sandburg Home, Flat Rock, NC (35.271422, -82.449305)

Felling dates: **Undated**

Joists (0/5); Brace (0/1); Stud (0/5); Door post (0/1).

The Horse Barn is a wood-framed structure of two levels clad in red weatherboard. It is located to the east of the Main Barn, with its gable facing south onto the main farmyard.



Figure 6. Corn Crib.

Corn Crib, Carl Sandburg Home, Flat Rock, NC (35.271226, -82.449365)

Felling dates: **Undated**

Door posts (0/2); Corner posts (0/2); Stud (0/2); Wall plate (0/1).

The Corn Crib is a small, single-story structure located in the main farmyard of the Connemara complex, to the south of the Main Barn. It is clad with horizontal lattice boards topped with a pitched shingled roof and sits on top of four posts that raise it several feet above the ground.

How Dendrochronology Works

Dendrochronology has over the past few decades become one of the leading and most accurate scientific dating methods. While not always successful, when it does work, it is precise, often to the season of the year. Tree-ring dating to this degree of precision is well known for its use in dating historic buildings and archaeological timbers. However, more ancillary objects such as doors, furniture, panel paintings, and wooden boards in medieval book-bindings can sometimes be successfully dated.

The science of dendrochronology is based on a combination of biology and statistics. In temperate zones, a tree puts on a new layer of growth underneath the bark every year, with the effect being that the tree grows wider and taller as it ages. Each annual ring is composed of the growth which takes place during the spring and summer and continues until about November, when the leaves are shed and the tree becomes dormant for the winter period. For the two principal American oaks, the white and red (*Quercus alba* and *Q. rubra*), as well as for the black ash (*Fraxinus nigra*) and many other species, the annual ring is composed of two distinct parts: the spring growth or early wood, and the summer growth, or late wood. Early wood is composed of large vessels formed during the period of shoot growth which takes place between March and May, before the establishment of any significant leaf growth. This is produced by using most of the energy and raw materials laid down the previous year. Then, there is an abrupt change at the time of leaf expansion around May or June when hormonal activity dictates a change in the quality of the xylem, and the summer growth, or late wood, is formed. Here the wood becomes increasingly fibrous and contains much smaller vessels. Trees with this type of growth pattern are known as ring-porous, and are distinguished by the contrast between the open, light-colored early wood vessels and the dense, darker-colored late wood.

Other species of tree, such as tulip poplar (*Liriodendron tulipifera* L.), are known as diffuse-porous. Unlike the ring-porous trees, the spring vessels consist of very small spring vessels that become even smaller as the tree advances into the summer growth. The annual growth rings are often very difficult to distinguish under even a powerful microscope, and one often needs to study the medullary rays, which thicken at the ring boundaries.

Dendrochronology utilizes the variation in the width of the annual rings as influenced by climatic conditions common to a large area, as opposed to other more local factors such as woodland competition and insect attack. It is these climate-induced variations in ring widths that allow calendar dates to be ascribed to an undated timber when compared to a firmly-dated sequence. If a tree section is complete to the bark edge, then when dated a precise date of felling can be determined. The felling date will be precise to the season of the year, depending on the degree of formation of the outermost ring. Therefore, a tree with bark that has the spring vessels formed but no summer growth can be said to be felled in the spring, although it is not possible to say in which particular month the tree was felled.

Another important dimension to dendrochronological studies is the presence of sapwood and bark. This is the band of growth rings immediately beneath the bark and comprises the living growth rings which transport the sap from the roots to the leaves. This sapwood band is distinguished from the heartwood by the prominent features of color change and the blocking of the spring vessels with tyloses, the waste products of the tree's growth. The heartwood is generally darker in color, and the spring vessels are usually blocked with tyloses. The heartwood is dead tissue, whereas the sapwood is living, although the only really living, growing, cells are in the cambium, immediately beneath the bark. In the American white oak (*Quercus alba*), the difference in color is not generally matched by the change in the spring vessels, which are often filled by tyloses to within a year or two of the terminal ring. Conversely, the spring vessels in the American red oak (*Q. rubra*) are almost all free of tyloses, right to the pith. Generally the sapwood retains stored food and is therefore attractive to insect and fungal attack once the tree is felled and therefore is often removed during conversion.

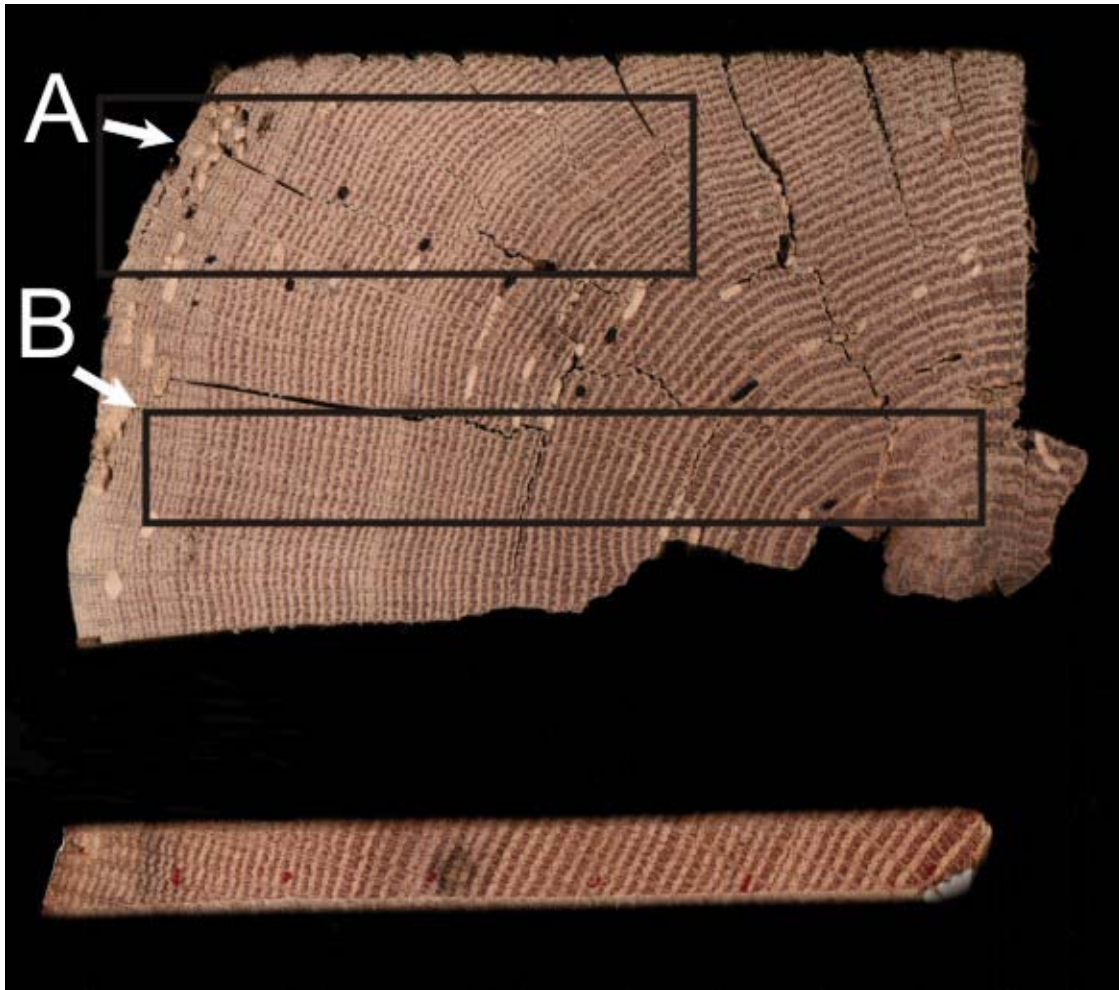


Figure 7. A cross-section of an oak timber with sapwood rings on the left-hand side (above). The boxes illustrate conversion methods resulting in **A**) a precise felling date and **B**) a *terminus post quem* or felled after date. Also pictured is a core showing complete sapwood (below).

Methodology: The Dating Process

Forty-seven timbers were sampled in total. All samples were from what appeared to be primary first-use timbers. Timbers that looked most suitable for dendrochronological purposes—those with complete sapwood or reasonably long ring sequences—were selected. Timbers were sampled through coring, using a 16 mm hollow auger. Details and locations of the samples are given in the summary tables.

The dry samples were sanded on a finisher, or bench-mounted belt sander, using 60 to 1200 grit abrasive paper, and were cleaned with compressed air to allow the ring boundaries to be clearly distinguished. They were then measured under a x10/x30 microscope using a travelling stage electronically displaying displacement to a precision of 0.01mm. Thus each ring or year is represented by its measurement which is arranged as a series of ring-width indices within a data set, with the earliest ring being placed at the beginning of the series, and the latest or outermost ring concluding the data set.

As indicated above, the principle behind tree-ring dating is a simple one: the seasonal variations in climate-induced growth as reflected in the varying width of a series of measured annual rings is compared with other, previously dated ring sequences to allow precise dates to be ascribed to each ring. When an undated sample or site sequence is compared against a dated sequence, known as a reference chronology, an indication of how good the match is must be determined. Although it is almost impossible to define a visual

match, computer comparisons can be accurately quantified. While it may not be the best statistical indicator, Student's (a pseudonym for W S Gosset) t -value has been widely used among dendrochronologists. The cross-correlation algorithms most commonly used and published are derived from Baillie and Pilcher's CROS program (Baillie and Pilcher 1973).

Generally, t -values over 3.5 should be considered significant, although in reality it is common to find demonstrably spurious t -values of 4 and 5 because more than one matching position is indicated. For this reason, dendrochronologists prefer to see some t -value ranges of 5, 6, or higher, and for these to be well replicated from different, independent chronologies with local and regional chronologies well represented. Users of dates also need to assess their validity critically. They should not have great faith in a date supported by a handful of t -values of 3s with one or two 4s, nor should they be entirely satisfied with a single high match of 5 or 6. Examples of spurious t -values in excess of 7 have been noted, so it is essential that matches with reference chronologies be well replicated, and that this is confirmed with visual matches between the two graphs. Matches with t -values of 10 or more between individual sequences usually signify having originated from the same parent tree.

In reality, the probability of a particular date being valid is itself a statistical measure depending on the t -values. Consideration must also be given to the length of the sequence being dated as well as those of the reference chronologies. A sample with 30 or 40 years growth is likely to match with high t -values at varying positions, whereas a sample with 100 consecutive rings is much more likely to match significantly at only one unique position. Samples with ring counts as low as 50 may occasionally be dated, but only if the matches are very strong, clear, and well replicated, with no other significant matching positions. This is essential for intra-site matching when dealing with such short sequences. Consideration should also be given to evaluating the reference chronology against which the samples have been matched: those with well-replicated components that are geographically near to the sampling site are given more weight than an individual site or sample from far away.

It is general practice to cross-match samples from within the same phase to each other first, combining them into a site master, before comparing with the reference chronologies. This has the advantage of averaging out the "noise" of individual trees and is much more likely to obtain higher t -values and stronger visual matches. After measurement, the ring-width series for each sample is plotted as a graph of width against year on log-linear graph paper. The graphs of each of the samples in the phase under study are then compared visually at the positions indicated by the computer matching and, if found satisfactory and consistent, are averaged to form a mean curve for the site or phase. This mean curve and any unmatched individual sequences are compared against dated reference chronologies to obtain an absolute calendar date for each sequence. Sometimes, especially in urban situations, timbers may have come from different sources and fail to match each other, thus making the compilation of a site master difficult. In this situation samples must then be compared individually with the reference chronologies.

Therefore, when cross-matching samples with each other, or against reference chronologies, a combination of both visual matching and a process of qualified statistical comparison by computer is used. For this study, the ring-width series were compared on an IBM compatible computer for statistical cross-matching using a variant of the Belfast CROS program (Baillie and Pilcher 1973).

Ascribing and Interpreting Felling Dates

Once a tree-ring sequence has been firmly dated in time, a felling date, or date range, is ascribed where possible. For samples that have sapwood complete to the underside of, or including, bark, this process is relatively straight forward. Depending on the completeness of the final ring, i.e. if it has only the early wood formed, or the latewood, a *precise felling date and season* can be given. Where the sapwood is partially missing, or if only a heartwood/sapwood transition boundary survives, then the question of when the tree was felled becomes considerably more complicated. In the European oaks, sapwood tends to be of a

relatively constant width and/or number of rings, and it is possible to estimate the approximate number of sapwood rings that are missing from any given timber.

Unfortunately, it has not been possible to apply an accurate sapwood estimate to either the white or red oaks at this time. Primarily, it would appear that there is a complete absence of literature on sapwood estimates for oak anywhere in the country (Grissino-Mayer, *pers comm*). The matter is further complicated in that the sapwood in white oak (*Quercus alba*) occurs in two bands, with only the outer ring or two being free of tyloses in the spring vessels (Gerry 1914; Kato and Kishima 1965). Out of some 50 or so samples, only a handful had more than 3 rings of sapwood without tyloses. The actual sapwood band is differentiated sometimes by a lighter color, although this is often indiscernible (Desch 1948). In archaeological timbers, the lighter colored sapwood does not collapse as it does in the European oak (*Q. robur*), but only the last ring or two without tyloses shrink tangentially. In these circumstances the only way of being able to identify the heartwood/sapwood boundary is by recording how far into the timber wood boring beetle larvae penetrate, as the heartwood is not usually susceptible to attack unless the timber is in poor or damp conditions. Despite all of these drawbacks, some effort has been made in recording sapwood ring counts on white oak, although the effort is acknowledged to be somewhat subjective.

As for red oaks (*Quercus rubra*) it will probably not be possible to determine a sapwood estimate as these are what are known as “sapwood trees” (Chattaway 1952). Whereas the white oak suffers from an excess of tyloses, these are virtually non-existent in the red oak, even to the pith. Furthermore, there is no obvious color change throughout the section of the tree, and wood-boring insects will often penetrate right through to the center of the timber. Therefore, in sampling red oaks, it is vital to retain the final ring beneath the bark, or to make a careful note of the approximate number of rings lost in sampling, if any meaningful interpretation of felling dates is to be made. Similarly, no study has been made in estimating the number of sapwood rings in tulip-poplar, black ash, or any of the pines.

Therefore, if the bark edge does not survive on any of the timbers sampled, only a *terminus post quem* or *felled after* date can be given. The earliest possible felling date would be the year after the last measured ring date, adjusted for any unmeasured rings or rings lost during the process of coring.

Some caution must be used in interpreting solitary precise felling dates. Many instances have been noted where timbers used in the same structural phase have been felled one, two, or more years apart. Whenever possible, a group of precise felling dates should be used as a more reliable indication of the construction period. It must be emphasized that dendrochronology can only date when a tree has been felled, not when the timber was used to construct the structure under study. However, it is common practice to build timber-framed structures with green or unseasoned timber and therefore construction usually took place within twelve to eighteen months of felling (Miles 1997).

Details of Dendrochronological Analysis

The results of the dendrochronological analysis for the buildings under study are presented in a number of detailed tables. The most useful of these is the summary **Table 1**. This gives most of the salient results of the dendrochronological process, and includes details for each sample, such as its species, location, and felling date, if successfully tree-ring dated. This last column is of particular interest to the end user, as it gives the actual year and season when the tree was felled, if bark or bark edge is present. If bark edge is not present, it gives a *terminus post quem* or date after which the timber was felled. Often these *terminus post quem* dates begin far earlier than any associated precise felling dates. This is simply because far more rings have been lost in the initial conversion of the timber. If the sapwood was complete on the timber but some was lost during coring, an estimated date range can sometimes be given.

It will also be noticed that often the precise felling dates will vary within several years of each other. Unless there is supporting archaeological evidence suggesting different phases, all this would indicate is either

stockpiling of timber, or of trees that had been felled or died at varying times but were not cut up until the commencement of the particular building operations in question. When presented with varying precise felling dates, one should always take the latest date for the structure under study, and it is likely that construction will have been completed for ordinary vernacular buildings within twelve or eighteen months from this latest felling date (Miles 1997).

Table 2 gives an indication of the statistical reliability of the match between one sequence and another. This shows the t -value over the number of years overlap for each combination of samples in a matrix table. It should be born in mind that t -values with less than 80 rings overlap may not truly reflect the same degree of matching and that spurious matches may produce similar values.

First, multiple radii have been cross-matched with each other and combined to form same-timber means. These are then compared with other samples from the site and any which are found to have originated from the same parent tree are again similarly combined. Finally, all samples, including all same timber and same tree means, are combined to form one or more site masters. Again, the cross-matching is shown as a matrix table of t -values over the number of years overlaps. Reference should always be made to **Table 1** to clearly identify which components have been combined.

Table 3 shows the degree of cross-matching between the site master(s) and a selection of reference chronologies. This shows the state or region from which the reference chronology originated, the common chronology name, the publication reference, and the years covered by the reference chronology. The number of overlapping years between the reference chronology and the site master is also shown together with the resulting t -value. It should be noted that well replicated regional reference chronologies, which are shown in **bold**, will often produce better matches than individual site masters or indeed individual sample sequences.

Figures include a bar diagram that shows the chronological relationship between two or more dated samples from a phase of building and any plans showing sample locations, if available.

Publication of all dated sites for English buildings occurs annually in *Vernacular Architecture*, but regrettably there is at the present time no vehicle available for the publication of dated American buildings. However, a similar entry is shown on the summary page of the report, which could be used in any future publication of American dates. This does not give as much technical data for the samples dated, but does give the t -value matches against the relevant chronologies, provides a short descriptive paragraph for each building or phase dated, and gives a useful short summary of samples dated. These summaries are also listed on the web-site maintained by the Laboratory, which can be accessed at www.dendrochronology.com. The Oxford Tree-Ring Laboratory retains copyright of this report, but the commissioner of the report has the right to use the report for his or her own use so long as the authorship is quoted. Primary data and the resulting site master(s) used in the analysis are available from the Laboratory on request by the commissioner and bona fide researchers. The samples form part of the Laboratory archives, unless an alternative archive, such as the Colonial Williamsburg Foundation in association with the Oxford Tree-Ring Laboratory, has been specified in advance.

Sampling

The Carl Sandburg Home National Historic Site was the home of the Pulitzer Prize-winning poet for twenty-two years. After his death, it was opened as an historic site to preserve his legacy. In addition to the Sandburg Residence it also contains Connemara, an award-winning goat farm run by Lillian Sandburg, Carl Sandburg's wife.

Dendrochronological analysis was commissioned on six buildings within the Connemara complex: the Buck House, the Isolation Quarters, the Buck Kid Quarters, the Main (or Goat) Barn, the Horse Barn, and the Corn Crib. This research was undertaken in an attempt to resolve individual questions relating to the construction of each building and to create a well-replicated master chronology to help date other buildings in the area.

Forty-seven timbers from the six buildings were sampled in total: five from the Buck House, eight from the Isolation Quarters, eight from the Buck Kid Quarters, seven from the Main Barn, twelve from the Horse Barn, and seven from the Corn Crib.

Summary of Dating

1. Buck House

Five timbers were sampled from the first floor of the Buck House: three studs, one rafter, and one joist. All were of Southern yellow pine. Each timber sample was given the code **cs**ha (for Carl Sandburg Home, building a) and numbered 1 to 5 (see table 1a). The position of each sample was noted at the time of sampling (see figure 8).

Bark edge survived on three of the five timbers deemed suitable for analysis. The outer wood on some of the timbers was extremely friable and therefore difficult to keep intact during coring. Multiple samples were taken from two of these timbers in order to maximize the chances of retaining a complete core. Samples from one of these timbers were found to match together successfully, with the samples being combined to form the new individual sample sequence **cs**ha2, which was used in the rest of the analysis (see table 2a). The multiple samples from timber **cs**ha3 did not match together and were used individually in the rest of the analysis.

All of the timber sequences from the Buck House were compared with each other, but none of the timbers were found to match each other. The individual samples were then compared with more than 700 dated regional reference chronologies. None were found to date, and therefore the Buck House remains undated.

2. Isolation Quarters

Eight timbers were sampled from the Isolation Quarters: four joists and one stud from the first floor and three rafters from the attic. The stud and all of the rafters were of Southern yellow pine. Two joists were of white oak, one was of American chestnut, and a fourth was of shagbark hickory. Each sample was given the code **cs**hi (for Carl Sandburg Home, Isolation Quarters) and numbered 1 to 8 (see table 1b). The position of each sample was noted at the time of sampling (see figure 9).

Bark edge survived on six of the eight timbers deemed suitable for analysis. The outer wood on some of the timbers was extremely friable and therefore difficult to keep intact during coring. Multiple samples were taken from five of these timbers in order to maximize the chances of retaining a complete core. Samples from two of these timbers were found to match together successfully, with the samples being combined to form the new individual sample sequences **cs**hi3 and **cs**ha6, which were used in the rest of the analysis (see table 2b). The multiple samples from timbers **cs**hi1, **cs**hi4, and **cs**hi5 did not match together and were used individually in the rest of the analysis.

All of the timber sequences from the Isolation Quarters were compared with each other. Two timbers were found to match each other (**csHi6** and **csHi7a2**) and were therefore combined to form the 131-ring site master **CSHlx1**.

The new site master and all of the individual timbers were compared with more than 700 dated regional reference chronologies. None were found to date, and therefore the Isolation Quarters remains undated.

3. Buck Kid Quarters

Eight timbers were sampled from the Buck Kid Quarters: three joists and one brace from the first floor and four studs from the attic. All of the timbers were of Southern yellow pine. Each sample was given the code **csHk** (for Carl Sandburg Home, Kid Quarters) and numbered 1 to 8 (see table 1c). The position of each sample was noted at the time of sampling (see figure 10).

Bark edge survived on six of the eight timbers deemed suitable for analysis. The outer wood on some of the timbers was extremely friable and therefore difficult to keep intact during coring. Multiple samples were taken from two of these timbers in order to maximize the chances of retaining a complete core. Samples from one of these timbers were found to match together successfully, with the samples being combined to form the new individual sample sequence **csHk5**, which was used in the rest of the analysis (see table 2c). The multiple samples from timber **csHk4** did not match together and were used individually in the rest of the analysis.

All of the timber sequences from the Buck Kid Quarters were compared with each other. Two timbers were found to match each other (**csHk7** and **csHk8**) and were therefore combined to form the timber mean **csHk78**. This timber mean was found to match with the sample sequence **csHk5** and the two were combined to form the 101-ring site master **CSHKx1**.

The new site master and all of the individual timbers were compared with more than 700 dated regional reference chronologies. None were found to date, and therefore the Buck Kid Quarters remains undated.

4. Main Barn

Seven timbers were sampled from first floor of the Main (or Goat) Barn: six joists and one stud. All were of Southern yellow pine, except for one of the joists, which was of white oak. Each sample was given the code **csHg** (for Carl Sandburg Home, Goat Barn) and numbered 1 to 7 (see table 1d). The position of each sample was noted at the time of sampling (see figure 11).

Bark edge survived on five of the seven timbers deemed suitable for analysis. The outer wood on some of the timbers was extremely friable and therefore difficult to keep intact during coring. Multiple samples were taken from three of these timbers in order to maximize the chances of retaining a complete core. None of the multiple samples were found to match together successfully.

All of the timber sequences from the Main Barn were compared with each other and with more than 700 dated regional reference chronologies. None were found to date, and therefore the Main Barn remains undated.

5. Horse Barn

Twelve timbers were sampled from the first floor of the Horse Barn: five joists, five studs, one brace, and one door post. Four of the joists were of shagbark hickory while the rest of the timbers were of white oak. Each sample was given the code **csHh** (for Carl Sandburg Home, Horse Barn) and numbered 1 to 12 (see table 1e). The position of each sample was noted at the time of sampling (see figure 12).

Bark edge survived on five of the twelve timbers deemed suitable for analysis. All of the timber sequences from the Horse Barn were compared with each other but none were found to match, nor were the timber sequences found to date when compared with more than 700 dated regional reference chronologies, leaving the Horse Barn undated.

6. Corn Crib

Seven timbers were sampled from the Corn Crib: two door posts, two corner posts, two studs, and a wall plate. All of the timbers were of white oak. Each sample was given the code **csbcc** (for Carl Sandburg Home, Corn Crib) and numbered 1 to 7 (see table 1f). The position of each sample was noted at the time of sampling (see figure 13).

Bark edge survived on three of the seven timbers deemed suitable for analysis. The outer wood on some of the timbers was extremely friable and therefore difficult to keep intact during coring. Multiple samples were taken from one of these timbers in order to maximize the chances of retaining a complete core. The multiple samples were found to match together successfully and were combined to form the new individual sample sequence **csbcc5**, which was used in the rest of the analysis (see table 2f).

All of the timber sequences from the Corn Crib were compared with each other. Three timbers were found to match each other (**csbcc2**, **csbcc3**, and **csbcc5**) and were therefore combined to form the 99-ring site master **CSBCCx1**.

The new site master and all of the individual timbers were compared with more than 700 dated regional reference chronologies. None were found to date, and therefore the Corn Crib remains undated.

Interpretation

Unfortunately, none of the six buildings sampled at the Carl Sandburg Home have been found to date. Several problems contributed to the difficulty in dating these buildings. Upon initial assessment, it was determined that many of the timbers within the buildings contained fewer than the minimum fifty annual rings needed for dendrochronological analysis. Of the timbers with more than fifty annual rings, a large number contained evidence of historic powderpost beetle attacks, which had left beetle galleries or voids inside of the wood. The voids caused the wood to break up on coring, and although multiple samples were taken from these timbers in an attempt to produce an intact core, an uninterrupted sequence of rings could not be collected in many cases. A number of timbers were also found to have been converted from tree species that are less reliable when used in dendrochronology, such as American chestnut, which rarely dates against available chronologies, and shagbark hickory, which has no historic chronologies with which to compare samples.

On analyzing the samples, no inter-site correlation was found for three of the buildings (the Buck House, the Main Barn, and the Horse Barn) while the inter-site correlation that was found for the remaining three buildings (the Isolation Quarters, the Buck Kid Quarters, and the Corn Crib) was very limited. Well-replicated site chronologies with robust inter-site correlation average out any anomalies from the individual samples and produce chronologies that contain a stronger climate signal, which are more likely to match with existing dated area master chronologies. In cases with weak inter-site correlation, each individual sample must be run against the master chronologies, limiting the matching potential for each sample.

The final difficulty in dating the buildings at the Carl Sandburg Home is their location in western North Carolina, at a considerable distance from the major concentration of dated master chronologies in eastern North Carolina, Virginia, and Maryland. This makes the effects of any local micro-climate more of an issue. Buildings in micro-climates tend to start dating when a large amount of data has been sampled from a sizeable number of buildings around that area, which has not yet been done for the Flat Rock area. It is

hoped that in the future, as more dendrochronological data becomes available in the western North Carolina region, it will be possible to date some or all of the Carl Sandburg Home buildings. To increase this possibility, it is recommended that during future building work at the site, any cut pieces of timber should be saved with the timber's location within the building carefully noted for further dendrochronological analysis.

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Table 1a: Summary of Tree-Ring Dating

BUCK HOUSE, CARL SANDBURG HOME, FLAT ROCK, NORTH CAROLINA

Sample number & type	Species	Timber and position	Dates AD spanning	Sapwood complement	No of rings	Mean width	Std devn	Mean sens	Felling seasons and dates/date ranges
csa1	c	PISP	Rafter 4 th from south end	-	h/w only	22	2.02	0.50	0.281
csa2a1	c	PISP	Stud center south wall	-	h/w only	16	1.75	0.42	0.285
csa2a2	c	PISP	ditto	-	C	50	1.16	0.33	0.258
csa2b1	c	PISP	ditto	-	h/w only	25	1.23	0.33	0.215
csa2b2	c	PISP	ditto	-	h/w only	8	1.23	0.23	0.176
csa2	m	Mean of csa2a2 + csa2b1	-	C	58	1.18	0.33	0.245	
csa3a	c	PISP	Joist 1 st from south	-	h/w only	22	1.05	0.32	0.319
csa3b	c	PISP	ditto	-	C	56	0.68	0.44	0.309
csa3c	c	PISP	ditto	-	½C	29	0.74	0.20	0.195
csa3d	c	PISP	ditto	-	½C	66	0.94	0.34	0.223
csa3e	c	PISP	ditto	-	h/w only	49	1.40	0.51	0.303
csa3f	c	PISP	ditto	-	½C	26	0.67	0.18	0.234
csa4	c	PISP	Stud center north wall	-	½C	62	0.76	0.41	0.250
csa5	c	PISP	Stud 3 rd from west north wall	-	h/w only	56	1.80	0.76	0.304

Key: *, †, § = sample included in site-master; c = core; mc = micro-core; s = slice/section; g = graticule; p = photograph; ¼C, ½C, C = bark edge present, partial or complete ring:
¼C = spring (last partial ring not measured), ½C = summer/autumn (last partial ring not measured), or C = winter felling (ring measured); h/w only = heartwood only- last heartwood ring date; std devn = standard deviation; mean sens = mean sensitivity; N/M=additional rings not measured; PISP = *Pinus L.* (Southern yellow pine)

Explanation of terms used in Table 1

The summary table gives most of the salient results of the dendrochronological process. For ease in quickly referring to various types of information, these have all been presented in Table 1. The information includes the following categories:

Sample number: Generally, each site is given a two or three letter identifying prefix code, after which each timber is given an individual number. If a timber is sampled twice, or if two timbers were noted at time of sampling as having clearly originated from the same tree, then they are given suffixes 'a', 'b', etc. Where a core sample has broken, with no clear overlap between segments, these are differentiated by a further suffix '1', '2', etc.

Type shows whether the sample was from a core 'c', or a section or slice from a timber's'. Sometimes photographs are used 'p', or timbers measured *in situ* with a graticule 'g'.

Species gives the four-letter species code used by the International Tree-Ring Data Bank, at NOAA. These are identified in the key at the bottom of the table.

Timber and position column details each timber sampled along with a location reference. This will usually refer to a bay or truss number, or relate to compass points or to a reference drawing.

Dates AD spanning gives the first and last measured ring dates of the sequence (if dated),

H/w only occurs on a sample that contains only the heartwood of the tree and retains no sapwood/bark edge.

Sapwood complement gives the number of sapwood rings, if identifiable. The tree starts growing in the spring during which time the earlywood is produced, also known also as spring growth. This consists of between one and three decreasing spring vessels and is noted as *Spring* felling and is indicated by a ¼ C after the number of sapwood ring count. Sometimes this can be more accurately pin-pointed to very early spring when just a few spring vessels are visible. After the spring growing season, the latewood or summer growth commences, and is differentiated from the proceeding spring growth by the dense band of tissue. This summer growth continues until just before the leaves drop, in about October. Trees felled during this period are noted as *summer* felled (½ C), but it is difficult to be too precise, as the width of the latewood can be variable, and it can be difficult to distinguish whether a tree stopped growing in autumn or *winter*. When the summer

growth band is clearly complete, then the tree would have been felled during the dormant winter period, as shown by a single C. Sometimes a sample will clearly have complete sapwood, but due either to slight abrasion at the point of coring, or extremely narrow growth rings, it is impossible to determine the season of felling.

Number of rings: The total number of measured rings included in the samples analysed.

Mean ring width: This, simply put, is the sum total of all the individual ring widths, divided by the number of rings, giving an average ring width for the series.

Mean sensitivity: A statistic measuring the mean percentage, or relative, change from each measured yearly ring value to the next; that is, the average relative difference from one ring width to the next, calculated by dividing the absolute value of the differences between each pair of measurements by the average of the paired measurements, then averaging the quotients for all pairs in the tree-ring series (Fritts 1976). Sensitivity is a dendrochronological term referring to the presence of ring-width variability in the radial direction within a tree which indicates the growth response of a particular tree is "sensitive" to variations in climate, as opposed to complacency.

Standard deviation: The mean scatter of a population of numbers from the population mean. The square root of the variance, which is itself the square of the mean scatter of a statistical population of numbers from the population mean. (Fritts 1976).

Felling seasons and dates/date ranges is probably the most important column of the summary table. Here the actual felling dates and seasons are given for each dated sample (if complete sapwood is present). Sometimes it will be noticed that often the precise felling dates will vary within several years of each other. Unless there is supporting archaeological evidence suggesting different phases, all this would indicate is either stockpiling of timber, or of trees which have been felled or died at varying times but not cut up until the commencement of the particular building operations in question. When presented with varying precise felling dates, one should always take the *latest* date for the structure under study, and it is likely that construction will have been completed for ordinary vernacular buildings within twelve or eighteen months from this latest felling date (Miles 1997)

Table 2a: Matrix of *t*-values and overlaps for same-timber mean

Components of timber mean **csa2**

Sample: **csa2b1**
Last ring
date AD:

csa2a2 5.80
 17

Table 1b: Summary of Tree-Ring Dating

ISOLATION QUARTERS, CARL SANDBURG HOME, FLAT ROCK, NORTH CAROLINA

Sample number & type	Species	Timber and position	Dates AD spanning	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens mm	Felling seasons and dates/date ranges
cshi1a	c	PISP	Stud south wall 1 st from east	-	h/w only	55	0.95	0.51	0.295
cshi1b	c	PISP	ditto	-	h/w only	61	0.75	0.28	0.272
cshi2	c	QUAL	Joist 2 nd from south wall	-	C	64	1.13	0.32	0.222
cshi3a	c	CADN	Joist 4 th from south wall	-	C	83	0.56	0.25	0.185
cshi3b	c	CADN	ditto	-	C	82	0.63	0.39	0.184
cshi3	m		Mean of cshi3a + cshi3b	-	C	94	0.63	0.37	0.157
cshi4a	c	CYOV	Joist 5 th from south wall	-	C	61	0.66	0.51	0.214
cshi4b	c	CYOV	ditto	-	C	61	0.67	0.44	0.272
cshi5a	c	QUAL	Joist 1 st from south wall	-	C	42	1.27	0.30	0.232
cshi5b	c	QUAL	ditto	-	C	41	1.17	0.29	0.201
cshi6a	c	PISP	Rafter 2 nd from south wall east side	-	½C	131	0.55	0.38	0.266
cshi6b	c	PISP	ditto	-	C	86	0.38	0.22	0.274
* cshi6	m		Mean of cshi6a + cshi6b	-	C	131	0.55	0.38	0.260
cshi7a1	c	PISP	Rafter 5 th from south wall east side	-	h/w only	17	1.04	0.25	0.187
* cshi7a2	c	PISP	ditto	-	C	115	0.49	0.31	0.240
cshi8	c	PISP	Rafter 1 st from south wall east side	-	h/w only	47	2.02	0.62	0.228
* = CSHlx1 Site Master					C	131	0.56	0.39	0.232

Key: *, †, § = sample included in site-master; c = core; mc = micro-core; s = slice/section; g = graticule; p = photograph; ¼C, ½C, C = bark edge present, partial or complete ring; ¼C = spring (last partial ring not measured), ½C = summer/autumn (last partial ring not measured), or C = winter felling (ring measured); H/S bdry = heartwood/sapwood boundary - last heartwood ring date; std devn = standard deviation; mean sens = mean sensitivity; QUAL = *Quercus alba* (white oak); PISP = *Pinus L.* (Southern yellow pine); CADN = *Castanea dentata*. (American chestnut); CYOV = *Carya glabra* (shagbark hickory)

Table 2b: Matrix of *t*-values and overlaps for same-timber means and site master

Components of timber mean **csHi3**

Sample: **csHi3b**
Last ring
date AD:

csHi3a $\frac{4.08}{71}$

Components of timber mean **csHi6**

Sample: **csHi6b**
Last ring
date AD:

csHi6a $\frac{10.20}{86}$

Components of site master **CSHix1**

Sample: **csHi7a2**
Last ring
date AD:

csHi6 $\frac{10.71}{115}$

Table 1c: Summary of Tree-Ring Dating

BUCK KID QUARTERS, CARL SANDBURG HOME, FLAT ROCK, NORTH CAROLINA

Sample number & type	Species	Timber and position	Dates AD spanning	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens mm	Felling seasons and dates/date ranges
cskh1a1	c	PISP	Joist 1 st from east end	-	h/w only	43	2.17	0.87	0.270
cskh1a2	c	PISP	ditto	-	C	54	0.71	0.29	0.282
cskh2a1	c	PISP	Joist 3 rd from west end	-	h/w only	94	0.75	0.48	0.268
cskh2a2	c	PISP	ditto	-	h/w only	40	0.87	0.42	0.312
cskh2a3	c	PISP	ditto	-	C	21	0.50	0.25	0.295
cskh3	c	PISP	Joist 1 st from west end	-	C	110	1.01	0.63	0.234
cskh4a	c	PISP	Brace west side north wall	-	h/w only	82	1.28	1.26	0.347
cskh4b	c	PISP	ditto	-	h/w only	21	0.70	0.26	0.343
cskh5a1	c	PISP	Stud west wall reset	-	h/w only	55	1.23	0.55	0.285
cskh5a2	c	PISP	ditto	-	h/w only	15	0.51	0.11	0.222
cskh5a3	c	PISP	ditto	-	C	20	0.47	0.22	0.230
cskh5b1	c	PISP	ditto	-	h/w only	75	0.88	0.41	0.256
cskh5b2	c	PISP	ditto	-	C	16	0.51	0.11	0.163
* cskh5	m		Mean of cskh5a1 + cskh5b1	-	C	75	0.97	0.49	0.260
cskh6	c	PISP	Stud west wall north of door	-	h/w only	79	0.97	0.47	0.251
cskh7	c	PISP	Stud west wall south of door	-	½C	101	0.95	0.57	0.247
cskh8	c	PISP	Stud west wall south end	-	½C	88	0.80	0.41	0.284
* cskh78	c	PISP	Mean of cskh7 + cskh8	-	½C	101	0.95	0.57	0.248
* = CSHKx1 Site Master				-	½C	101	0.97	0.58	0.226

Key: *, †, § = sample included in site-master; c = core; mc = micro-core; s = slice/section; g = graticule; p = photograph; ¼C, ½C, C = bark edge present, partial or complete ring; ¼C = spring (last partial ring not measured), ½C = summer/autumn (last partial ring not measured), or C = winter felling (ring measured); h/w only = heartwood only - last heartwood ring date; std devn = standard deviation; mean sens = mean sensitivity; PISP = *Pinus L.* (Southern yellow pine)

Table 2c: Matrix of *t*-values and overlaps for same-timber means and site master

Components of timber mean **csbk5**

Sample: **csbk5b1**
Last ring
date AD:

csbk5a1 12.10
55

Components of timber mean **csbk78**

Sample: **csbk8**
Last ring
date AD:

csbk7 10.54
88

Components of site master **CSBKx1**

Sample: **csbk78**
Last ring
date AD:

csbk5 8.30
75

Table 1d: Summary of Tree-Ring Dating

MAIN BARN, CARL SANDBURG HOME, FLAT ROCK, NORTH CAROLINA

Sample number & type	Species	Timber and position	Dates AD spanning	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens mm	Felling seasons and dates/date ranges
csHg1	c	PISP	Joist 4 th from south wall east side center bay	-	C	35	1.95	1.63	0.369
csHg2a	c	PISP	Joist 8 th from south wall east side center bay	-	C	48	1.89	0.39	0.195
csHg2b	c	PISP	ditto	-	h/w only	28	1.90	0.41	0.221
csHg3	c	QUAL	Joist 11 th from south wall east side center bay	-	C	82	0.65	0.21	0.153
csHg4	c	PISP	Joist 12 th from south wall west side center bay	-	C	56	1.45	1.02	0.270
csHg5a	c	PISP	Joist 10 th from south wall west side center bay	-	h/w only	40	1.61	0.54	0.264
csHg5b	c	PISP	ditto	-	h/w only	23	0.87	0.61	0.359
csHg6a1	c	PISP	Joist 7 th from south wall east side center bay	-	h/w only	34	2.07	0.91	0.298
csHg6a2	c	PISP	ditto	-	C	7	0.64	0.09	0.221
csHg6b1	c	PISP	ditto	-	h/w only	13	1.15	0.31	0.317
csHg6b2	c	PISP	ditto	-	C	6	0.48	0.15	0.319
csHg7	c	PISP	Stud 2 nd from south in west partition wall	-	15NM	45	1.26	0.40	0.237

Key: *, †, § = sample included in site-master; c = core; mc = micro-core; s = slice/section; g = graticule; p = photograph; ¼C, ½C, C = bark edge present, partial or complete ring: ¼C = spring (last partial ring not measured), ½C = summer/autumn (last partial ring not measured), or C = winter felling (ring measured); h/w only = heartwood only - last heartwood ring date; std devn = standard deviation; mean sens = mean sensitivity; QUAL = *Quercus alba* (white oak); PISP = *Pinus L.* (Southern yellow pine)

Table 1e: Summary of Tree-Ring Dating**HORSE BARN, CARL SANDBURG HOME, FLAT ROCK, NORTH CAROLINA**

Sample number & type	Species	Timber and position	Dates AD spanning	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens mm	Felling seasons and dates/date ranges
csshh1a1 c	CYOV	Joist 5 th from south wall	-	h/w only	21	0.80	0.15	0.215	
csshh1a2 c	CYOV	ditto	-	¼C	6	1.11	0.43	0.532	
csshh2 c	QUAL	Brace south wall east side	-	¼C	86	0.98	0.52	0.125	
csshh3 c	QUAL	Stud 1 st from south east wall	-	h/w only	91	1.02	0.37	0.230	
csshh4 c	QUAL	Stud 2 nd from south east wall	-	h/w only	57	1.52	0.52	0.164	
csshh5 c	QUAL	Stud 3 rd from south east wall	-	h/w only	133	0.54	0.13	0.164	
csshh6 c	QUAL	Stud 4 th from south east wall	-	h/w only	115	0.58	0.23	0.153	
csshh7 c	QUAL	Stud 1 st from east south wall	-	h/w only	31	2.32	0.37	0.095	
csshh8 c	CYOV	Joist 9 th from south wall	-	15NM	90	0.77	0.36	0.213	
csshh9 c	CYOV	Joist 12 th from south wall	-	½C	95	0.80	0.22	0.174	
csshh10 c	QUAL	Joist 14 th from south wall	-	5NMC	119	0.74	0.22	0.137	
csshh11a1 c	CYOV	Joist 13 th from south wall	-	h/w only	89	0.57	0.45	0.220	
csshh11a2 c	CYOV	ditto	-	h/w only	28	0.27	0.07	0.199	
csshh11a3 c	CYOV	ditto	-	h/w only	49	0.40	0.14	0.173	
csshh11a4 c	CYOV	ditto	-	C	11	0.55	0.10	0.170	
csshh12 c	QUAL	Door post east wall south of doorway	-	C	93	1.77	0.68	0.178	

Key: *, †, § = sample included in site-master; c = core; mc = micro-core; s = slice/section; g = graticule; p = photograph; ¼C, ½C, C = bark edge present, partial or complete ring: ¼C = spring (last partial ring not measured), ½C = summer/autumn (last partial ring not measured), or C = winter felling (ring measured); h/w only = heartwood only - last heartwood ring date; std devn = standard deviation; mean sens = mean sensitivity; QUAL = *Quercus alba* (white oak); CYOV = *Carya glabra* (shagbark hickory)

Table 1f: Summary of Tree-Ring Dating

CORN CRIB, CARL SANDBURG HOME, FLAT ROCK, NORTH CAROLINA

Sample number & type	Species	Timber and position	Dates AD spanning	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens mm	Felling seasons and dates/date ranges
csbcc1	c	QUAL	Door post east side north wall	-	1NM	88	1.35	0.44	0.143
* csbcc2	c	QUAL	Corner post northeast	-	h/w only	48	1.89	0.35	0.134
* csbcc3	c	QUAL	Door post west side north wall	-	h/w only	53	2.02	0.59	0.126
csbcc4	c	QUAL	Stud 4 th from north end east wall	-	C	90	1.02	0.46	0.159
csbcc5a	c	QUAL	Corner post southwest	-	h/w only	58	1.29	0.33	0.147
csbcc5b	c	QUAL	ditto	-	C	56	0.93	0.21	0.122
* csbcc5	m		Mean of csbcc5a + csbcc5b	-	C	86	1.12	0.35	0.129
csbcc6	c	QUAL	Wall plate west wall bottom	-	C	30	2.78	1.04	0.157
csbcc7	c	QUAL	Stud 1 st from south west wall	-	h/w only	66	0.84	0.29	0.175
* = CSBCCx1 Site Master			-	C	99	1.40	0.60	0.124	

Key: *, †, § = sample included in site-master; c = core; mc = micro-core; s = slice/section; g = graticule; p = photograph; ¼C, ½C, C = bark edge present, partial or complete ring: ¼C = spring (last partial ring not measured), ½C = summer/autumn (last partial ring not measured), or C = winter felling (ring measured); h/w only = heartwood only - last heartwood ring date; std devn = standard deviation; mean sens = mean sensitivity; QUAL = *Quercus alba* (white oak)

Table 2f: Matrix of *t*-values and overlaps for same-timber mean and site master

Components of timber mean **csbcc5**

<i>Sample:</i>	csbcc5b
<i>Last ring</i>	
<i>date AD:</i>	
csbcc5a	$\frac{3.58}{28}$

Components of site master **CSBCCx1**

<i>Sample:</i>	csbcc3	csbcc5
<i>Last ring</i>		
<i>date AD:</i>		
csbcc2	$\frac{6.23}{45}$	$\frac{6.29}{35}$
	csbcc3	$\frac{5.53}{43}$

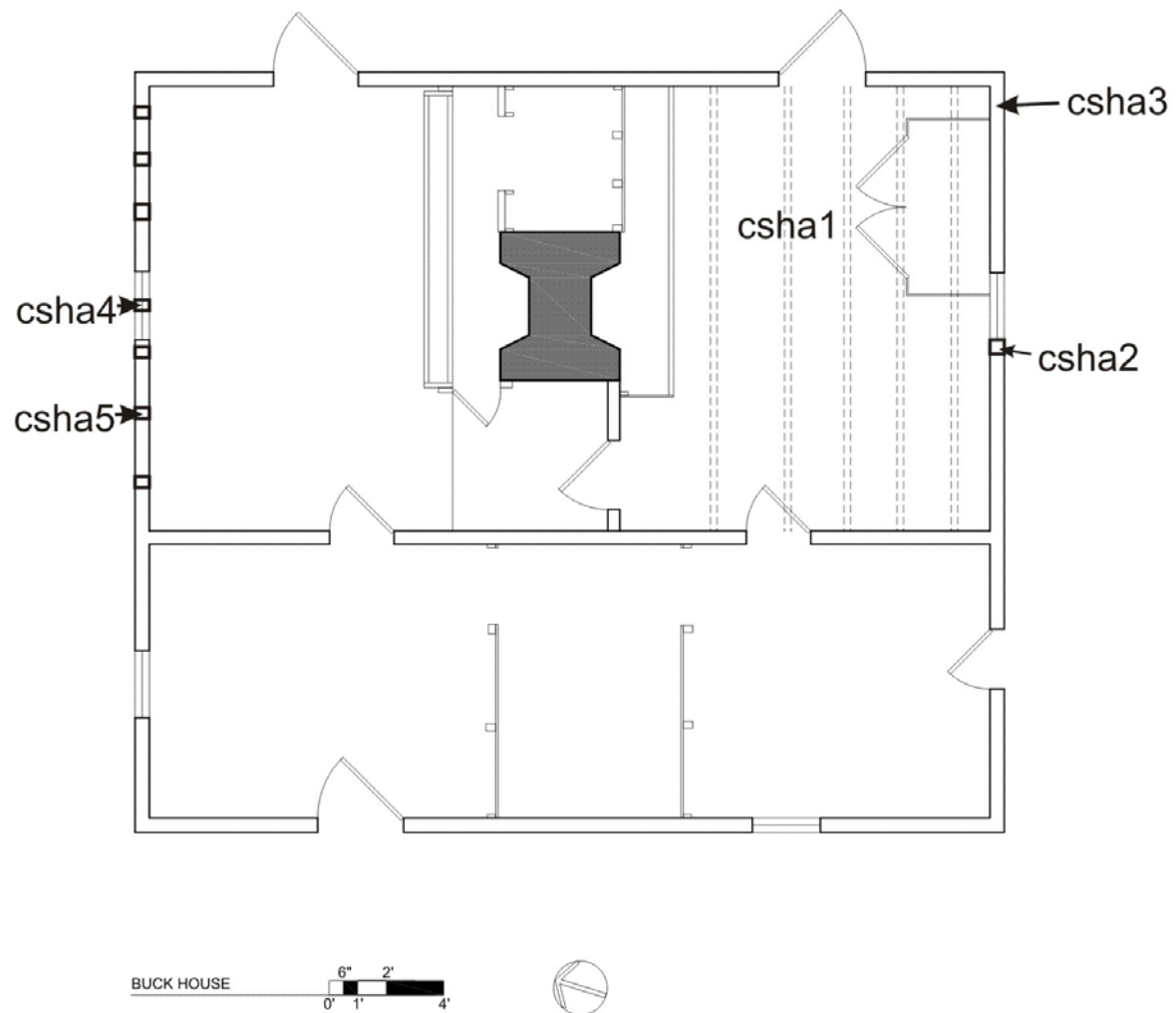


Figure 8. Drawing showing location of samples taken from the first floor of the Buck House at the Carl Sandburg Home (after Joseph K. Oppermann - Architect 2011)

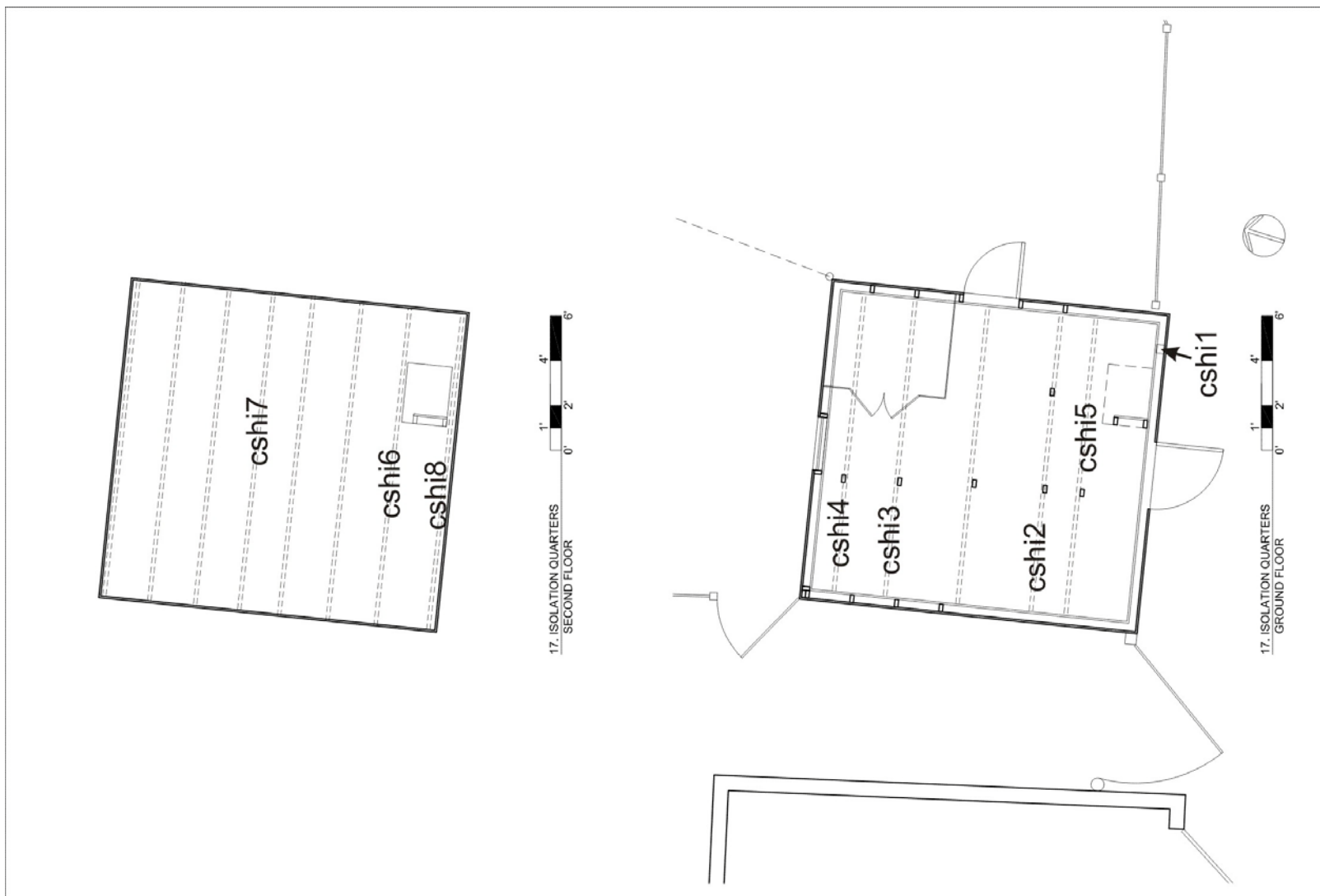


Figure 9. Drawing showing location of samples taken from the Isolation Quarters attic (left) and first floor (right) at the Carl Sandburg Home (after Joseph K. Oppermann - Architect 2011)

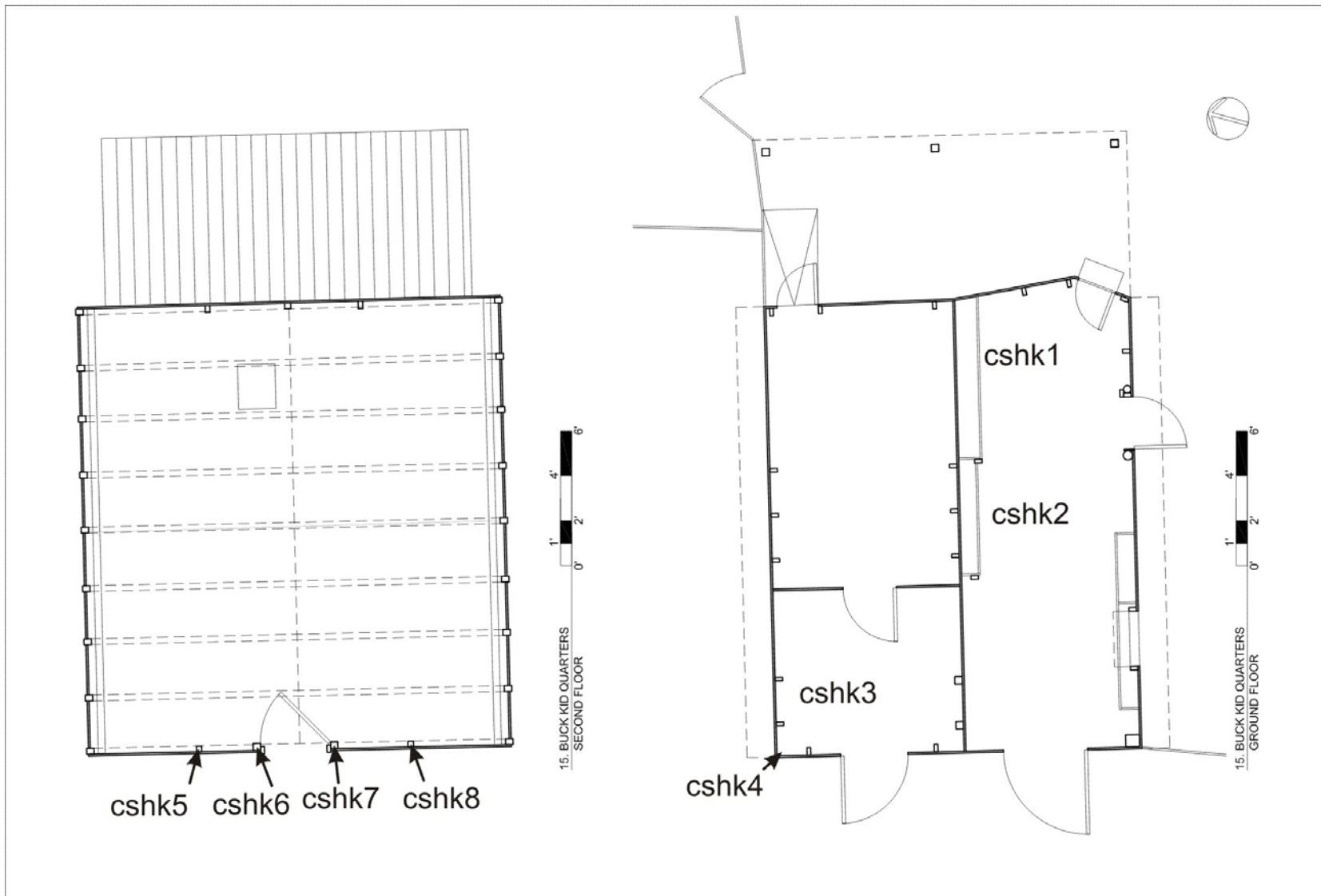


Figure 10. Drawing showing location of samples taken from the Buck Kid Quarters attic (left) and first floor (right) at the Carl Sandburg Home (after Joseph K. Oppermann - Architect 2011)

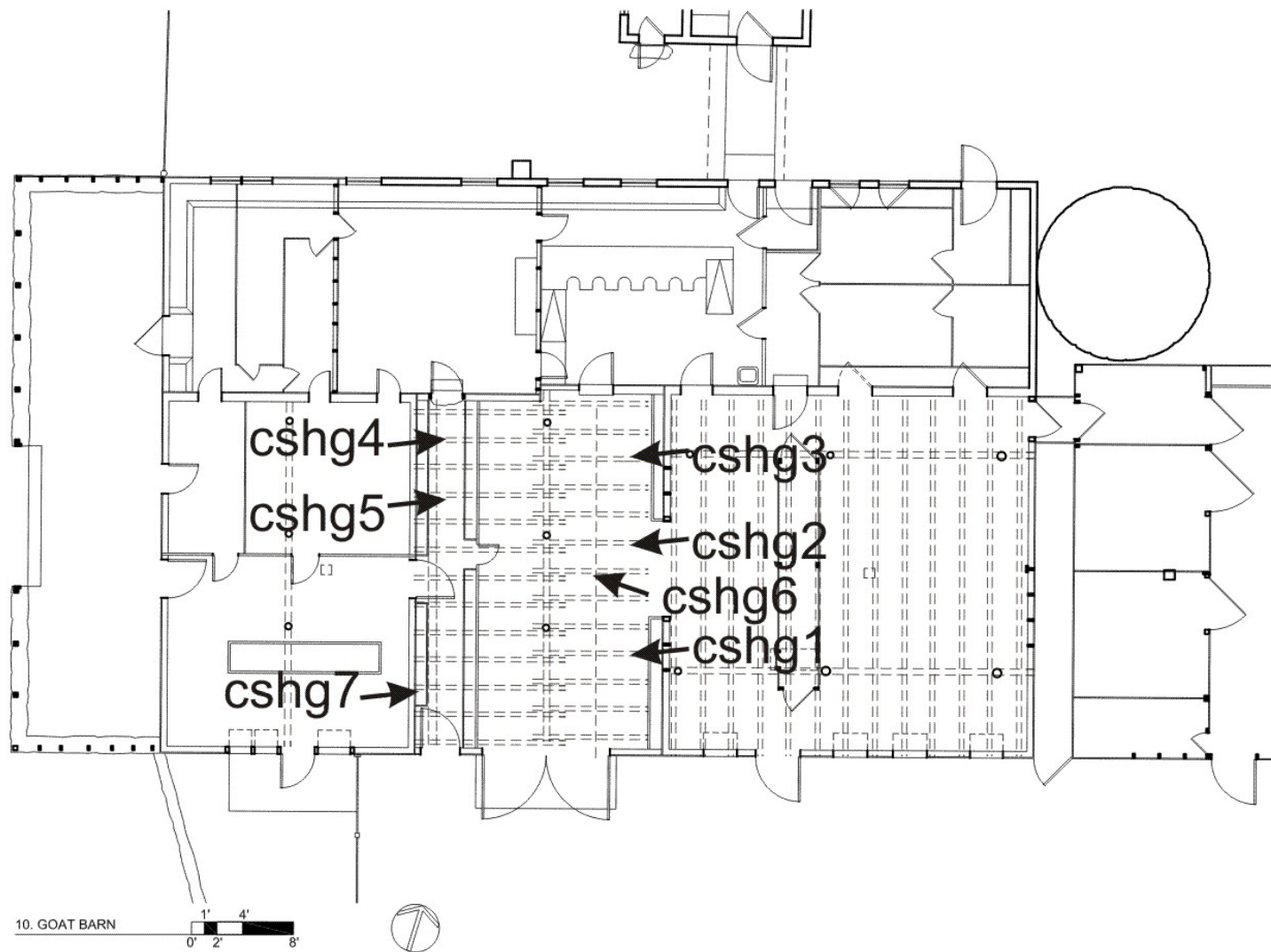


Figure 11. Drawing showing location of samples taken from the Main Barn at the Carl Sandburg Home (after Joseph K. Oppermann - Architect 2011)

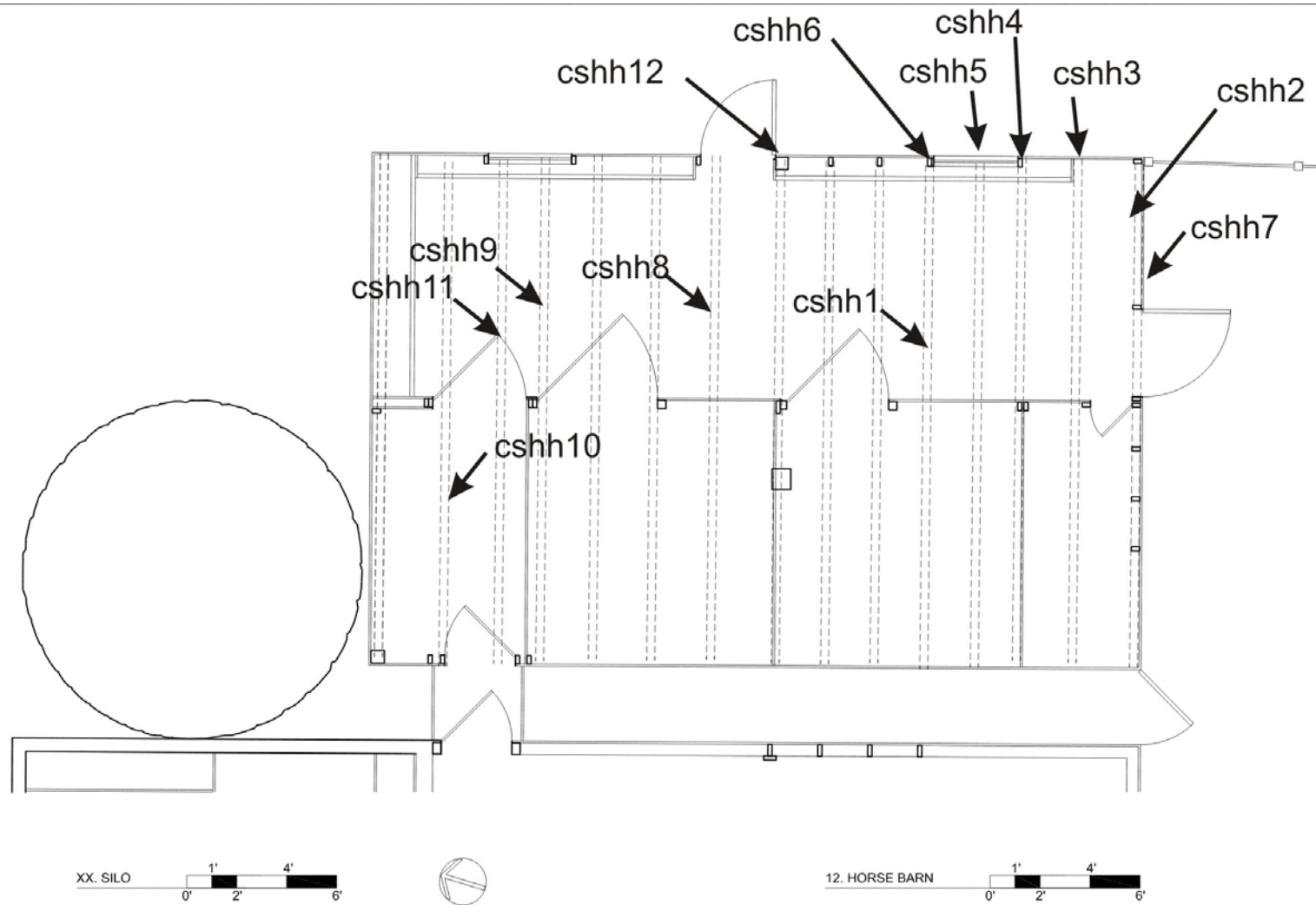
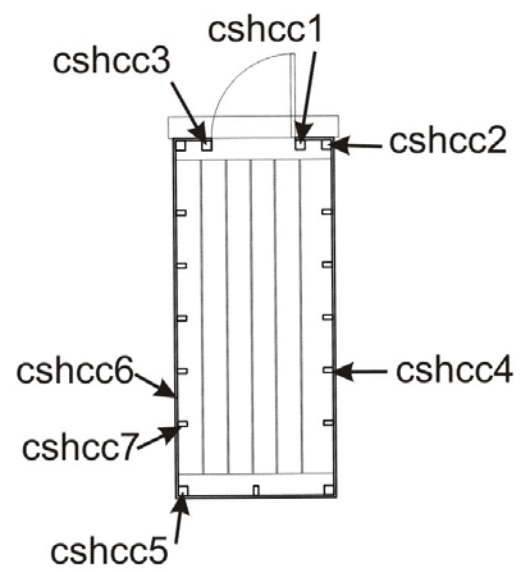
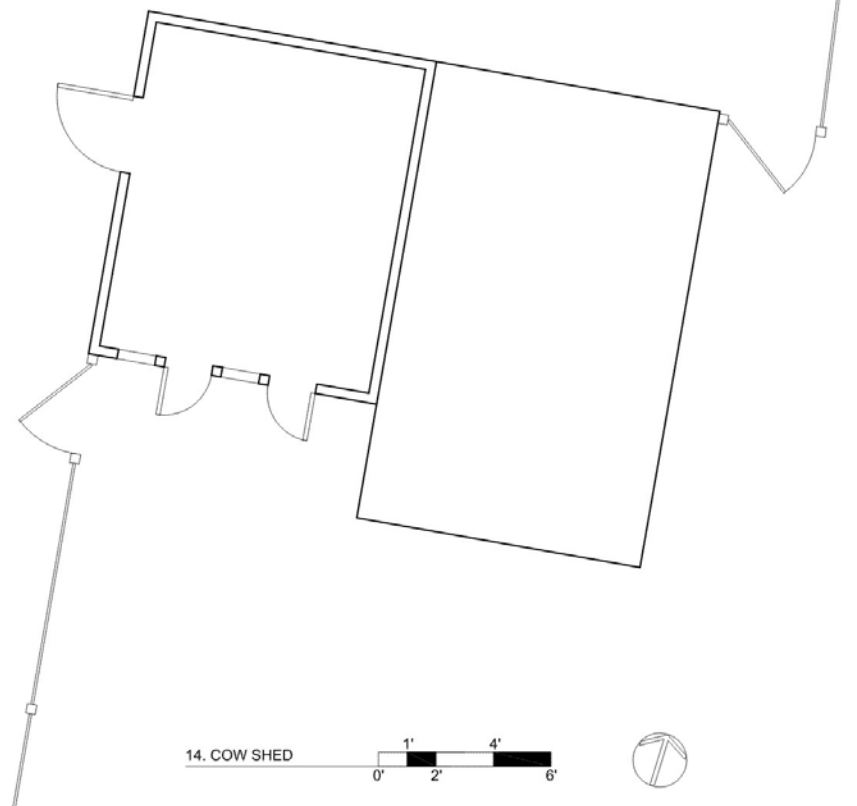
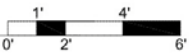


Figure 12. Drawing showing location of samples taken from the Horse Barn at the Carl Sandburg Home (after Joseph K. Oppermann - Architect 2011)



09. CORN CRIB



14. COW SHED

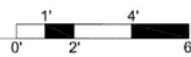


Figure 13. Drawing showing location of samples taken from the Corn Crib at the Carl Sandburg Home (after Joseph K. Oppermann - Architect 2011)