Nathan Care House & Barn

Hopewell Furnace National Historic Site

Historic Structures Report

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Part 2 – Treatment and Use

2.1-A Nathan Care House: Recommendations for Treatment

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EXECUTIVE SUMMARY

The National Park Service wishes to document the history, development and condition of the Nathan Care House and Barn, located on Clement Brooke Lane, adjacent to Pine Swamp Road (Route 345) in Union Township, Pennsylvania. The house and barn are both associated with the events that took place at Hopewell Furnace during the 19th century. Today the house serves as an interpretation of a mid-19th-century dwelling, as well as former living quarters for Park employees. The barn serves as an interpretation of a mid-19th century agricultural building, while providing storage space for the Park. As a basis for planning upcoming projects, the National Park Service commissioned the preparation of this Historic Structures Report by HDR, Inc. and John Milner Architects, Inc. (Project No. HOFU - PMIS 141610).

The scope of work for this project is to document the evolution of the structures through archival research and physical investigations, culminating in the preparation of a Historic Structures Report, as defined in Director's Order – 28, Chapter 8. Part 1 of the report will identify and document the original appearance, integrity, and historic evolution of the building while identifying the 1856 house and 1859 barn appearances, extant historical architectural materials and character-defining features. Part 2 of the report is intended to guide the preservation, use and interpretation of the Nathan Care House and Barn in the 21st century. In order to fulfill these requirements, the following primary tasks were completed:

- Archival research to retrieve information related to the significance and developmental history of the buildings.
- Architectural investigations to retrieve and document physical evidence of the chronology of development and use of the buildings.
- Assessment of existing conditions to formulate the scope of required preservation, rehabilitation and restoration work.
- Identification of work required for applicable codes including life safety and accessibility upgrades.
- Documentation and assessment of visual structural components and the capacity to support the proposed work.
- General documentation of visible mechanical, electrical and plumbing systems.

This Historic Structures Report will add to and build upon the already completed Nathan Care House HSR prepared by Benjamin J. Zerbey in April 1962. Investigation of the physical fabric was performed as much of the original material is intact. Other documents, including archaeology reports, are available at the library at Hopewell Furnace National Historic Site. The evolution of the Nathan Care House and the Nathan Care Barn is presented in a sequence of three stages for each building from original construction up to and including renovations made by the National Park Service.

It is the stated goal of the National Park Service to actively occupy the structures, while maintaining their exterior appearance as representative examples of a typical dwelling and barn in 19th-century rural Pennsylvania. It is also the goal to preserve the greatest possible amount of historic fabric. To aid in achieving this goal, this report attempts to distinguish between historic and modern components based on examination of archival documents and physical fabric. The conditions assessment provides an assessment of the buildings' existing conditions.

The treatment philosophy proposed would create a habitable residence for the Park to lease, while continuing to use the barn for storage. Character-defining features are established and described for

consideration when planning maintenance work. The preservation and use of the Nathan Care House must occur within the framework of existing building codes and accessibility regulations. As with many historic buildings, both the construction and the configuration of the house and barn are deficient to some degree in structural load capacity and accessibility, and the report illustrates several alternatives for improving compliance.

ADMINISTRATIVE DATA

RESOURCE: Nathan Care House and Barn
The house is currently unoccupied and the barn is used for storage at Hopewell Furnace National Historic Site.

LOCATION: 2 Clement Brooke Lane in Hopewell Furnace National Historic Site
Union Township, Berks County, Pennsylvania

Figure AD-1: Aerial view of Hopewell Furnace National Historic Site, Elverson, PA. The Nathan Care House and Barn are circled in red.

NATIONAL REGISTER OF HISTORIC PLACES:

Historic District:	Hopewell Furnace National Historic Site
Nomination Number:	#66000645
Resource:	Nathan Care House and Barn
Resource Status:	Contributing Site
Year Listed:	1966
Significance:	Industry, Military, Architecture
Period of Significance:	1750-1900

PREVIOUS STUDIES:

- Aero EH&S, Inc. Asbestos-Containing Materials Survey, Hopewell Furnace National Historic

Site, Elverson, PA. Ellicott City, MD: Aero EH&S, 2012.
- Apple, Russel, A. Documentation for the Historical Base Maps 1830-1840, Part of the Master Plan. Hopewell, PA: 1956.
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- Public Archaeology Laboratory. Hopewell Furnace National Historic Site Archeology Overview and Assessment, Berks and Chester Counties, Pennsylvania (Technical Report, Volume 1). July 2011.
- United States Department of the Interior. 1994. List of Classified Structures, Hopewell Furnace National Historic Site. Philadelphia: National Park Service, 1994.
- Zerbey, Benjamin J. "Historic Structures Report Part I Nathan Care House – Bldg. #25." Hopewell Village National Historic Site: National Park Service, 1962.

RECOMMENDATIONS FOR FUTURE STUDY:

- Paint analysis of interior window trim and woodwork to document historic finishes prior to any additional restorations of the building.

PART 1 – DEVELOPMENTAL HISTORY

1.0 Development of Hopewell Furnace

In 1743, William Bird established Hopewell Forge along Hay Creek in southeastern Pennsylvania. The community grew and was given its name, Birdsboro, after Bird, as he owned land in the area as early as 1737. When William died in 1762, he owned several thousand acres with three forges on Hay Creek, a furnace in Reading and a house in Birdsboro.[1] At the time of his death in 1761, he owned the "ironworks, a mill and tavern, large amounts of land, had surprisingly few debts and was probably the richest man in Berks County".[2] Bird left the forges to his eldest living son, twenty-two year old Ironmaster Mark Bird, who also owned two mines within a five-mile radius. In 1771, Mark Bird established Hopewell Furnace on French Creek in Union Township, Berks County. While the furnace site of approximately 8,000 acres was situated in Union Township, Mark Bird also owned mines in Chester County. The location was ideal as it was in close proximity to a public road that was officially opened in 1758 and connected Reading to Coventry Forge in Chester County.[3]

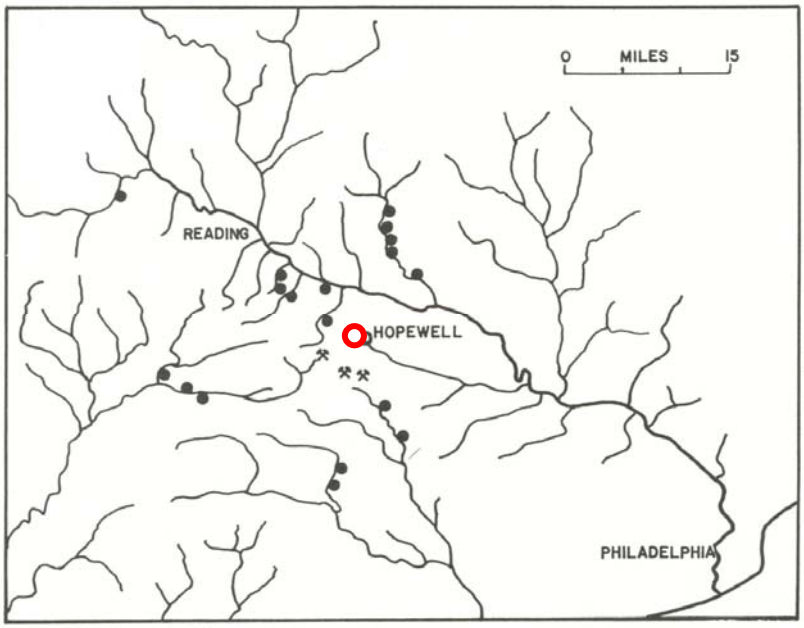


Figure 1: Map showing rivers in southeastern Pennsylvania and the numerous forges (solid circles) within a twenty-five mile radius of Hopewell Furnace (circled in red) (Gordon, p. 63).

Hopewell Furnace was a charcoal-fueled, cold-blast furnace with iron extracted from Bird's nearby mines. Water power was used to run the blast machinery and charcoal from local hardwood forests was used to smelt the iron ore. Charcoal was the main resource for pig iron and iron castings until the middle of the 19th century. The furnace was set "deep in the wooded Schuylkill Valley of Pennsylvania because

[1] Francis, David R., Historical Review of Berks County, *The Most Important Family at Hopewell: The Cares*, 124.

[2] Graham, Daniel A., *Mark Bird, Ironmaster & Patriot,* v.

[3] National Park Service, *Cultural Landscape Inventory*, Statement of Significance (2003), 2.

here existed a combination of natural features and a proximity to markets which indicated that iron making at Hopewell would be a profitable business."[4]

As the furnace prospered, skilled workers came from other furnaces in Warwick and Reading, and farmers from neighboring farms were hired part-time to cut and haul wood. Unskilled work was left to slaves and indentured servants.[5] Mark Bird quickly became the largest slave owner in Berks and Chester Counties, with as many as ten slaves working to construct the furnace. Bird was the last slave owner at Hopewell, for after him both "free African-Americans and those freeing themselves from slavery enjoyed equal pay for equal work and many rose through the ranks of furnace labor to relatively high and well paying positions."[6] Women were also employed at Hopewell with equal pay, some even working as wood cutters, colliers, or other traditionally male positions.

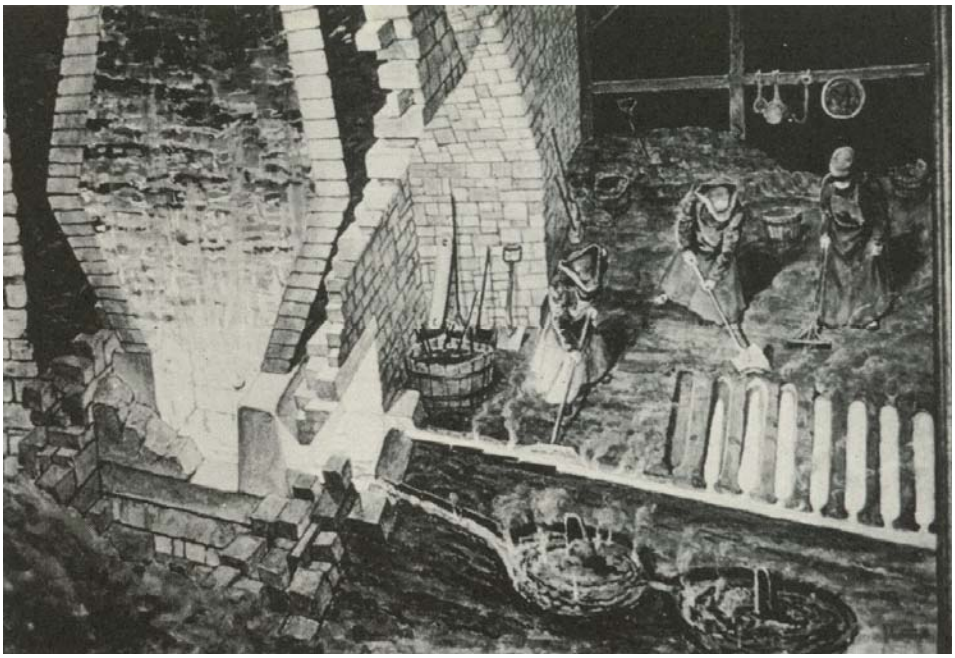


Figure 2: Molding pig iron with cross section view of blast furnace in operation (Walker, p. 235).

[4] National Park Service, *Documentation for the Historical Base Maps, Hopewell Village National Historic Site* (1956), iii.

[5] Francis, *The Most Important Family at Hopewell: The Cares*, 124.

[6] National Park Service Historic American Landscape Survey, *Written Historical and Descriptive…*, 2.

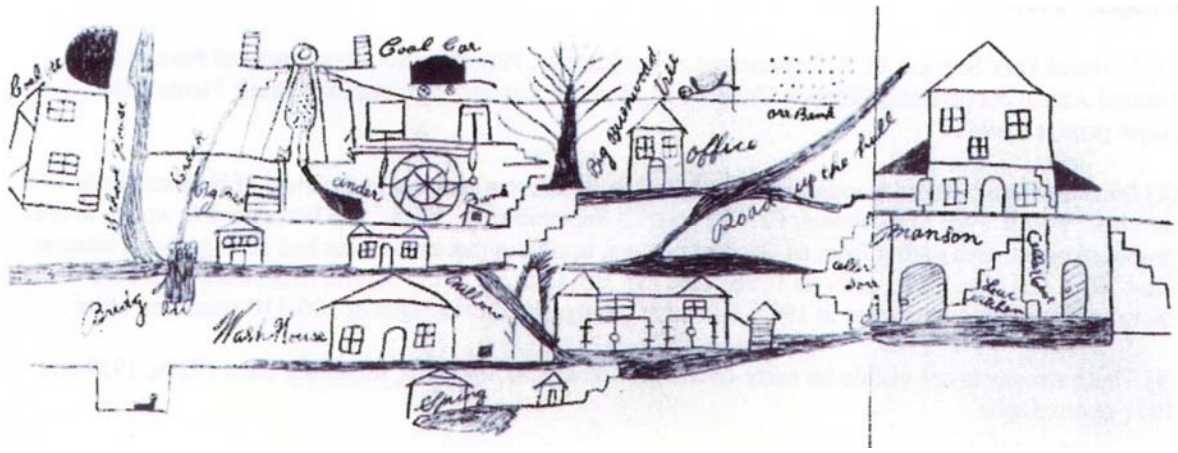


Figure 3: 1936 recollections of Lafayette Houck, Master Collier at Hopewell Furnace, showing a representation of Hopewell Furnace's working landscape from the worker's perspective (NPS Cultural Landscape Inventory, p. 14).

By the middle of the 18th century, stove plates were being produced at Hopewell Furnace, with the earliest surviving model dating to 1772.[7] 18th-century stoves were six panel or "box stoves", used to heat rooms and possibly a kettle on top. The stove was modified over time, with the introduction of an "internal oven for baking, with a large oven door in one or both side plates, which suddenly transformed them from stoves which only warmed the house, into the so-called 'Ten-Plate' stove, which cooked food and warmed at the same time." [8] The cook stove was first introduced to America at Mary Ann Furnace, one of many other prosperous furnaces in Berks County, located in Longswamp Township.[9] The stove, "though not prepared to boil, broil or fry by immediate contact of dishes with the fire, was equipped to bake meat, cakes, pies and bread on a small scale, and thus partly replaced the large household bread oven of masonry."[10] Heating and cooking stoves both had fireboxes for wood on the bottom; there was an abundance of cordwood in the heavily forested area surrounding Hopewell. The upper part of the stove was an oven with a door on each side, there was a hole on the top for the stove pipe to release the smoke and larger models had a boiling hole for a pot or pan on the top rear.

By 1784, several residents who were employed at the furnace had purchased ten-plate stoves for £5 each. Stove plate sales continued for the duration of production at Hopewell Furnace. The main items produced at Hopewell were cast stoves, hollow ware including pots and kettles, and pig iron.[11] The cast iron stove plates were fabricated with iron ore, limestone and charcoal. The first castings were flat pieces of iron with tulips, hearts, and Biblical figures. By the mid-19th century, cooking on a stove was easier, quicker and safer than an open hearth, and gave women free time to pursue activities such as joining the suffragette movement.[12]

At the height of stove plate production at the furnace, several buildings were constructed including the Cast House (1771), the Blacksmith Shop (1780) and the Ironmasters House (1800). Towards the end of the 18th century, Bird also established a slitting mill, a nailery and steel production on Hay Creek in Birdsboro, approximately six miles from Hopewell. Bird had become one of the "largest taxpayers and

[7] Walker, Joseph E., *The Dynamics of a Nineteenth Century Iron-Making Community,* 23.
[8] Mercer, Henry C. *The Bible in Iron,* 85-86.
[9] Walker, Joseph E., *The Dynamics of a Nineteenth Century Iron-Making Community,* 112.
[10] Mercer, Henry C. *The Bible in Iron,* 86.
[11] National Park Service, "Iron Plantations" Park Net National Park Service.
[12] National Park Service Historic American Landscape Survey, *Written Historical and…*, 3.

richest landholders in Berks County, and was uniquely poised to become a leader in the Revolutionary movement that eventually brought about American independence."[13]

Figure 4: Hopewell Furnace (restored and rebuilt) (left) (Bining, p. 41) and Ironmaster's House, Hopewell Furnace (right) (Bining, p. 33).

By 1775 the cast iron produced at the furnace was molded as cannon and shot for the American Army during the Revolution.[14] Bird, a colonel, loaned money to the Continental Congress, which the new country was unable to repay. After the war, he and his brother-in-law, James Wilson, borrowed $200,000 of Spanish money to pay off debts, however they were unsuccessful and in the early 1780s, Hopewell Furnace and Birdsboro forges were sold in a sheriff's sale.[15] The sale included 4,000 acres of land, 5,000 cords of wood and 800 loads of ore.[16]

> "Their vast interests, including Birdsboro, Spring Forge, and many tracts of land, were mortgaged in 1784 to John Nixon for 200,000 Spanish milled silver dollars. The properties were sold by the sheriff in 1780, although James Wilson subsequently owned a part of them. Mark Bird left Pennsylvania to live the concluding years of his life in North Carolina."[17]

Pennsylvania Ironworks were mostly unprosperous during the war. "Manpower shortages, militia call-ups, wartime inflation and a myriad of other issues plagued the ironmasters."[18] Although subsequent owners were faced with hardships such as floods and economic fluctuations, the furnace eventually became prosperous again, continuing to produce the famous Hopewell stove plates.[19] In 1785, Peter Rice and William Roads purchased the furnace, producing pig iron for stoves, pots, kettles, forges, forge hammers, castings and industrial castings. Around this time, the community was expanding and new buildings were constructed; the Store was constructed and the Bethesda Church was built by Thomas Lloyd.[20]

[13] Graham, Daniel A., *Mark Bird, Ironmaster & Patriot,* ix.
[14] Francis, *The Most Important Family at Hopewell: The Cares*, 124.
[15] Ibid.
[16] National Park Service Historic American Landscape Survey, *Written Historical and…*, 3.
[17] National Park Service, *Documentation for the Historical Base Maps…*, 129.
[18] Graham, Daniel A., *Mark Bird, Ironmaster & Patriot*, ix.
[19] National Park Service Historic American Landscape Survey, *Written Historical and…*, 2.
[20] National Park Service Historic American Landscape Survey, *Written Historical and…*, 3.

Figure 5: The preserved Ironmaster's House (1800), blast furnace (late 18th century), casting shed with bell tower and charging bridge at Hopewell Furnace (Gordon, p. 61).

Between the end of the 18th and beginning of the 19th centuries, the furnace changed ownership several times. In 1786, 5,163 acres, including a 250 tree apple orchard, were sold to Cadwallader Morris and James Old. Two years later, Morris's brother Benjamin became the sole owner of Hopewell Furnace, and various other ironworks were sold separately.[21] James Old then purchased the property in 1791 for $37,000 and soon after resold it to James Wilson. There were several more owners until 1800, when Daniel Buckley and brothers-in-law Matthew and Thomas Brooke acquired the site. Although there was a lack of working capital, the demand for iron was increasing. Between 1803 and 1805, Frederick Meck was hired as the founder of Hopewell. He was engaged in many lawsuits due to unpaid bills, and left the furnace on October 6, 1808, owing a very large debt.[22]

The furnace continued to develop into the 19th century; the public road between Birdsboro and Hopewell was opened in 1804, the Stamping Mill was erected in 1805 and the north end of the Spring House was constructed in 1806. However by 1807, the furnace was again facing hard times. The dam had burst three times that year and lawsuits against the furnace were beginning again.[23] The legal disputes continued between 1808 and 1815, resulting in the discontinuation of blast operation at the furnace. In 1816, however, extensive repairs, totaling approximately $800, were made to restart the furnace.[24] From 1816 until 1834, the following improvements were made:

- Construction of a new Cast House (1816).
- Construction of the Wheel House (1818).
- Bake oven built near Ironmaster's House (1823)
- Tenant House with excavated cellar [John Church House] constructed (1826).
- Cast House enlarged (1827).
- Formal organization of Baptist congregation at Bethesda Church (1827).
- Smokehouse built (1828).
- Possible removal of south shed and construction of new shed (1828).
- Glass purchased and Greenhouse constructed (1829).

[21] Ibid.
[22] Francis, *The Most Important Family at Hopewell: The Cares*, 192.
[23] National Park Service Historic American Landscape Survey, *Written Historical and…*, 3.
[24] Schmult, Brian, *Evolution of the Hopewell Furnace Blast Machinery*, 60.

- Furnace purchased and planted 160 apples trees (1829).
- Supposed construction of the Boarding House east addition (1829).
- Furnace purchased and planted 304 apple trees (1834).
- Public school located at furnace (1836).

Between 1800 and 1844, the main production at Hopewell was pig iron, stove plates and mixed castings. Over 40,000 stove plates were produced between 1830 and 1840, most of which were sold in Philadelphia or other local areas. "The stove plates were sent to stove dealers who supplied connecting rods, bolts, and sheet-iron components and assembled the stoves."[25] During the long blast of 1836-1837, the furnace produced nearly 1,200 tons of castings in fourteen months, including stove plates and utensils.[26]

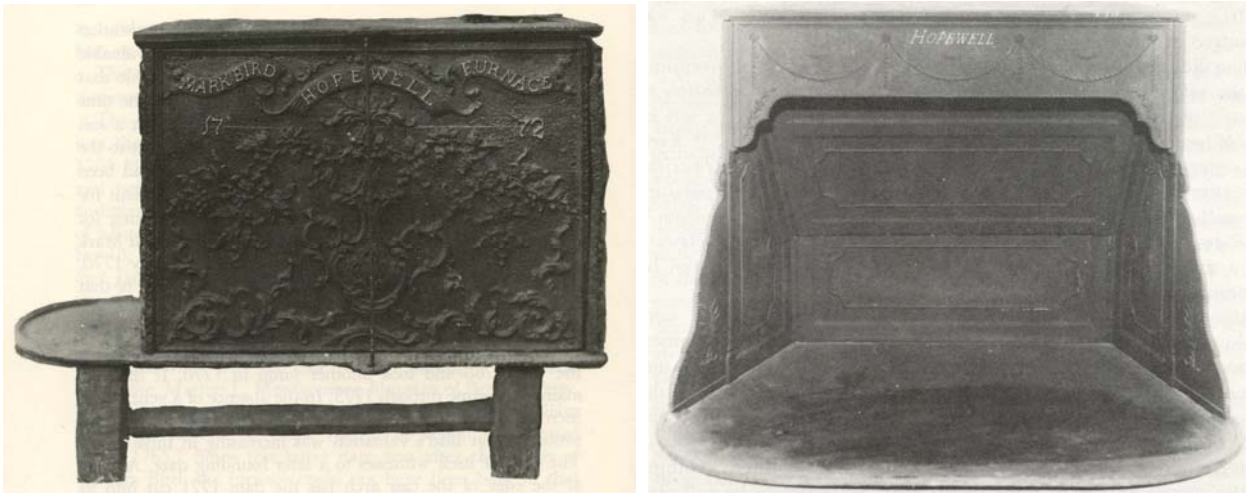


Figure 6: Six-plate stove from 1772, oldest known product of Hopewell Furnace (left) (Walker, p. 24) and Hopewell stove (right) (Bining, p. 87).

The boom was short-lived and by 1844, stove plates were no longer produced at Hopewell. The Depression of 1841 and the growth of city foundries played a large part in the decline of stove plate production. A hot-blast smelting method was introduced from England and coke was used instead of coal for fuel. Furthermore, better means of transportation were developed. Anthracite furnaces built in large cities could produce iron at lower cost, and there was no need to build furnaces with fuel supply.[27]

For a brief time during the Civil War, Hopewell's fortunes were revived, as the "skyrocketing demand for iron drove prices up so rapidly that production costs ceased to be a financial issue." [28] By 1860, the cost of pig iron jumped from 30 dollars per ton to 80 dollars per ton, and in 1864 the price reached a record high of 99 dollars a ton before prices began to rapidly decrease.[29] Though production at the furnace was in decline, activity continued throughout the area. In 1869, a new school was built along Jones Mine Road (approximately one mile west of Hopewell). A decade later, the Wheel House was rebuilt with a roof to the Bridge House. During the 1880s, improvements included repairing and rebuilding the charcoal house and shed, the installation of a steam engine and boiler (to help drive water wheel) and

[25] Yocum, Barbara, *The Furnace Group Historic Structure Report*, 19.
[26] Francis, *The Most Important Family at Hopewell: The Cares,* 124.
[27] Ibid.
[28] National Park Service, *Cultural Landscape Inventory*, Statement of Significance, p. 19.
[29] Ibid.

the introduction of an ore roaster to improve the quality of iron ore. Despite these improvements, Hopewell Furnace ceased iron-making operations permanently on June 15, 1883, after 113 years of iron production.

Figure 7: Ironmaster's family member Stokes in front of decaying Cast House Complex, 1887 (Photograph by Edward Hardin, provided by the National Park Service).

Figure 8: View of Office and Store, Barn and Ironmaster's House looking north, ca. 1890 (Courtesy of Chester County Historical Society).

Other furnaces in Berks County during the 19th century:

- Joanna Furnace
  - 9 miles south of Birdsboro
  - Between 1800-1825: 700 tons of pig iron and 100 tons of castings
  - 1825-1829: 550 tons of pig iron and 220 tons of castings.

- Reading Furnace
  - 1828-1830: 3,568 tons of pig iron and 95 tons of castings

- Mt. Penn Furnace
  - 2 miles from Reading
  - 1830-1833: 1700 tons of pig iron and 500 tons of castings

- Sally Ann Furnace
  - 5 miles south of Kutztown
  - 1828-1832: 1300 tons of pig iron and 250 tons of castings

- Oley Furnace
  - 12 miles east of Reading.
  - 1829-1832: 1050 tons of pig iron and 350 tons of castings

- Union Furnace
  - Between Birdsboro and Amity Township
  - 1829-1832: 700 tons of pig iron

Between the years of 1883 and 1896, the pig iron that was produced during the height of operations was sold. Other goods sold at the furnace during this time including iron ore, wood, farm products and draft animals. The production of materials that the owners could sell for profit continued into the late 1890s and early 1900s. "Woodcutters cut fence posts and rails from the forests, colliers produced charcoal to be sold to other furnaces, stonecutters quarried limestone, and miners dug iron ore."[30] The chief beneficiary of these sales was the Clingan family (Charles B. Clingan, Alan Hunter Clingan, and A. Louise Clingan Brooke), who purchased shares of the furnace in 1894. In 1906, A. Louise Clingan Brooke and her husband Edward sold the quarrying rights of the 3,000-acre property for $157,000, and the family continued to use the Ironmaster's House as a summer residence until 1915.[31] The family expanded their property further by purchasing approximately 1,100 acres between 1908 and 1928, including the Nathan Care property (see Section 1.1.1-A).

In the early 1900s, the land surrounding Hopewell Village, primarily owned by the Clingans, produced wheat, rye, oats, buckwheat and corn. In the 1920s, production shifted to dairy operations, and the barn adjacent to the Ironmaster's house was modified to accommodate dairy production. "The biggest change in the village landscape resulting from the move to dairy farming took place in 1926, when the Barn was completely reconstructed and doubled in size." [32]

In 1930, A. Louise Clingan Brooke donated the blast machinery from the furnace to the Franklin Institute in Philadelphia. The institute dismantled the machinery and it was placed in a new wooden shed on site for protection. By the early 1930s, the lands around Hopewell, "which had for more than 100 years provided iron ore and limestone for iron-making, wood for fuel and construction, and corn, grain, fruits, and vegetables for human and animal consumption – were considered of small economic value. Only a small percentage of the several thousand acres of land were in cultivation, and the soil was considered 'badly washed and very stony.'" Hopewell was a prime candidate for the Recreational Demonstration

[30] Hopewell Furnace National Historic Site, "Historic Resources Study Final," 59.
[31] Ibid.
[32] Ibid.

Area program, one of the New Deal initiatives under President Franklin Roosevelt. The program provided open spaces for leisure for residents, especially poor ones, of crowded East Coast cities. It also created "job opportunities for untrained young men in a time of high unemployment."[33]

In 1935, Hopewell Furnace was purchased by the Federal Government. In the years following, many changes were made. The Blacksmith Shop was restored (1950), the waterwheel and blast machinery were restored (1952), the Birdsboro-Warwick Road through Hopewell Village was closed to the public (1955), the interior of the Ironmaster's House was restored (1957) and the Bridge House was reconstructed (1957).[34] In 1958 the Visitor Center, Upper Parking Lot and Maintenance Building were constructed, along with several residences. Other modifications include:

- Tenant Barn stabilized and re-roofed (1959)
- Orchard planted (1960)
- Store restored (1961)
- Barn at Furnace restored (1961)
- Anthracite Furnace stabilized (1963 – 1964)
- Cast House reconstructed (1965)
- Bethesda Cemetery Wall restored (1965)
- Spring House restored (1965)
- Charcoal House reconstructed (1965)
- Cedar Pasture cleared of all but cedars (1973)
- Blacksmith Shop restored (1981) after fire (1980).

In 1966, Hopewell Village National Historic Site was listed as District Nomination #66000645 in the National Register of Historic Places. Hopewell Furnace National Historic Site is America's "finest example of a rural 19th century iron making plantation."[35] On August 30, 1985, it was listed in the National Register of Historic Places with its period of significance from 1771-1883 and its areas of significance as architecture, industry and military (American Revolution). Also in 1985, the Park's name was changed to Hopewell Furnace National Historic Site, and the nomination was updated.

[33] Hopewell Furnace National Historic Site, *Historic Resources Study Final*, 64.

[34] Information on the closing of Birdsboro-Warwick Road obtained from *Hopewell Village National Historic Site, Removal of Modern Highway, Restoration of Historic Roads…*, 1.

[35] 2011 Superintendent's Annual Report, *Hopewell Furnace National Historic Site*, 1.

Figure 9: 1995 view of reconstructed furnace complex (NPS Cultural Landscape Report, p. 133).

1.1.A The Nathan Care House

1.1.1.A Historical Background and Context

Early History of the Nathan Care Property

The Nathan Care property is located south of the Hopewell Furnace National Historic Site and Hopewell Village. Although it was not part of the village while the site was active, it was within walking distance and was associated with several people who were employed at the furnace. On August 26, 1818, Thomas Lloyd II acquired Tract 13, along with other Tracts, from John Hoplin, Jr. and his wife Mary.

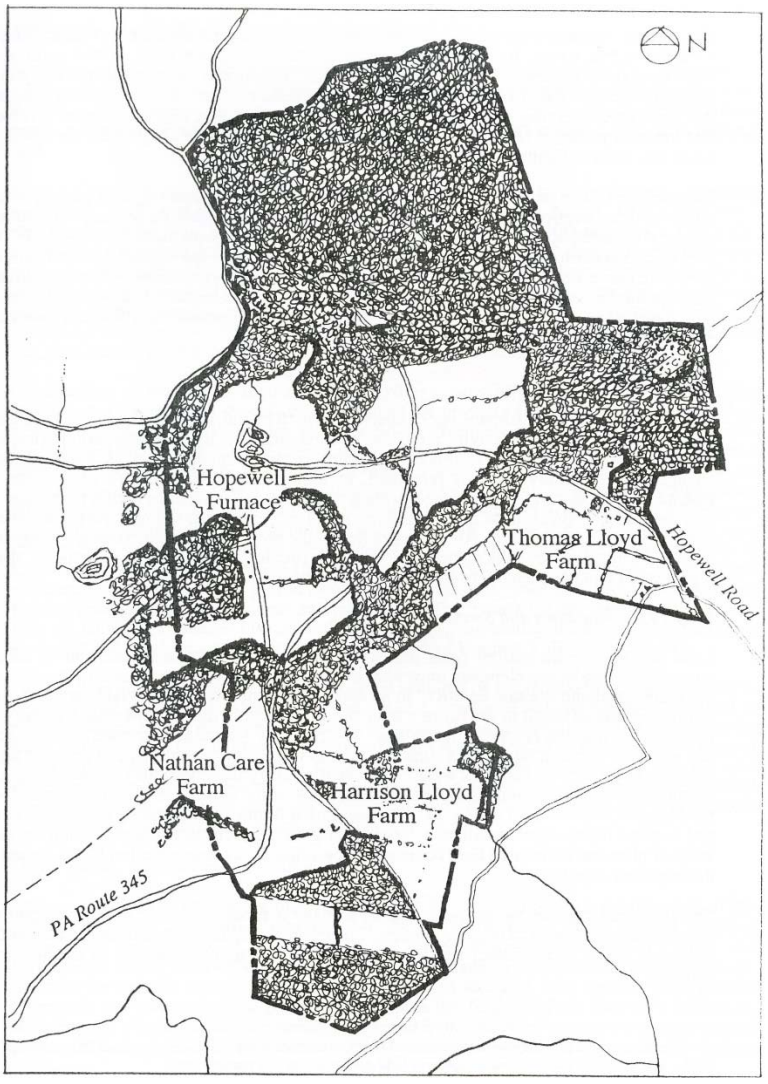


Figure 10: Map of Hopewell Furnace and adjoining farms. Areas shaded are wooded spaces (NPS Cultural Landscape Report, p. 84).

Between 1830 and 1840, the owner of the property was Thomas Lloyd (III). Evidently the land was undeveloped for "no mention is made of a messuage" in the Berks County Deed Books.[1] In 1841, Thomas Lloyd III sold Tract 13, as well as Tract 55, to John Painter, founder at Hopewell Furnace. The property sold for $525.00 and included 17 acres and 137 perches (an Old English linear measurement equal to 16.5 feet).[2] In 1856, John Painter Jr., a filler at the furnace, and his wife Margaret sold the 17-acre property, including 137 perches to Nathan Care, the last founder at the furnace.

By 1856, the land had still not been developed when Nathan Care purchased the land by deed for $90.00, "a price which probably indicates unimproved land."[3] Records indicate that between 1836 and 1840 Care held the job of moulder. In 1846, he was paid for cutting wood that was likely used to make charcoal, and by 1847 Care worked as keeper for the furnace. By 1850, six years prior to the purchase of the property, Care was not only keeper of the furnace, he was also founder. Care worked as a laborer (type unknown) between 1853 and 1859, and was also paid for putting limestone in the furnace, a critical component in the production of iron. He was the last founder at the furnace and remained in the position until 1883, the last year of operation at the furnace.

Care's responsibilities as founder included overseeing operations at the furnace and producing iron of good grade or quality. The founder was one of the highest paid employees at the furnace and according to E.S. Cook in 1898, founders were men "separated by the forces of natural selection from their fellow workmen, possessing more than ordinary natural intelligence and good judgment, quick to meet emergencies, of some mechanical skill and close observers of blast furnace phenomena."[4]

> The success of the operation of the furnace was dependent upon the knowledge and skill of the founder. The manager was expected to know how a furnace was run and to be able to solve difficult problems, but the founder was on hand for the hour-by-hour operations… Methods of making good iron and economical furnace management were passed from father to son. 'Technology was more in the heads and hands of skilled iron-workers than in technical works in print.' The Care family showed this consanguineous influence by providing founder for about sixty-five years of Hopewell Operation. [5]

When Nathan Care purchased the land in 1856, there was a whitewashed log house situated on the property midway between the Boarding House and where the Nathan Care House is now located, on the east side of Warwick Road.[6] A 1937 map lists this road as "Birdsboro-Warwick Road", originally built in 1804 to connect Birdsboro with Warwick Furnace.[7] Prior to constructing the new house, Nathan and his family resided in the log house. Nathan was married at least twice (his second wife was Rebecca Keller)

[1] National Park Service, *Documentation for the Historical Base Maps*…, Hopewell Village National Historic Site (1956), I-8.
[2] Ibid.
[3] Ibid.
[4] John Milner Associates, Inc. *Report of an Archeological Survey of Five Domestic Sites at Hopewell Furnace National Historic Site, Berks and Chester Counties, Pennsylvania*, 18.
[5] *Report of an Archeological Survey of Five Domestic Sites*…, 18.
[6] Zerbey, Benjamin J. *Historic Structures Report Part I Nathan Care House – Bldg. #25*, 3.
[7] *Report of an Archeological Survey of Five Domestic Sites*…, 9.

and had a total of 13 children.[8] Care constructed his new home between 1856 and 1857, after which the log house was used for the family cow. [9]

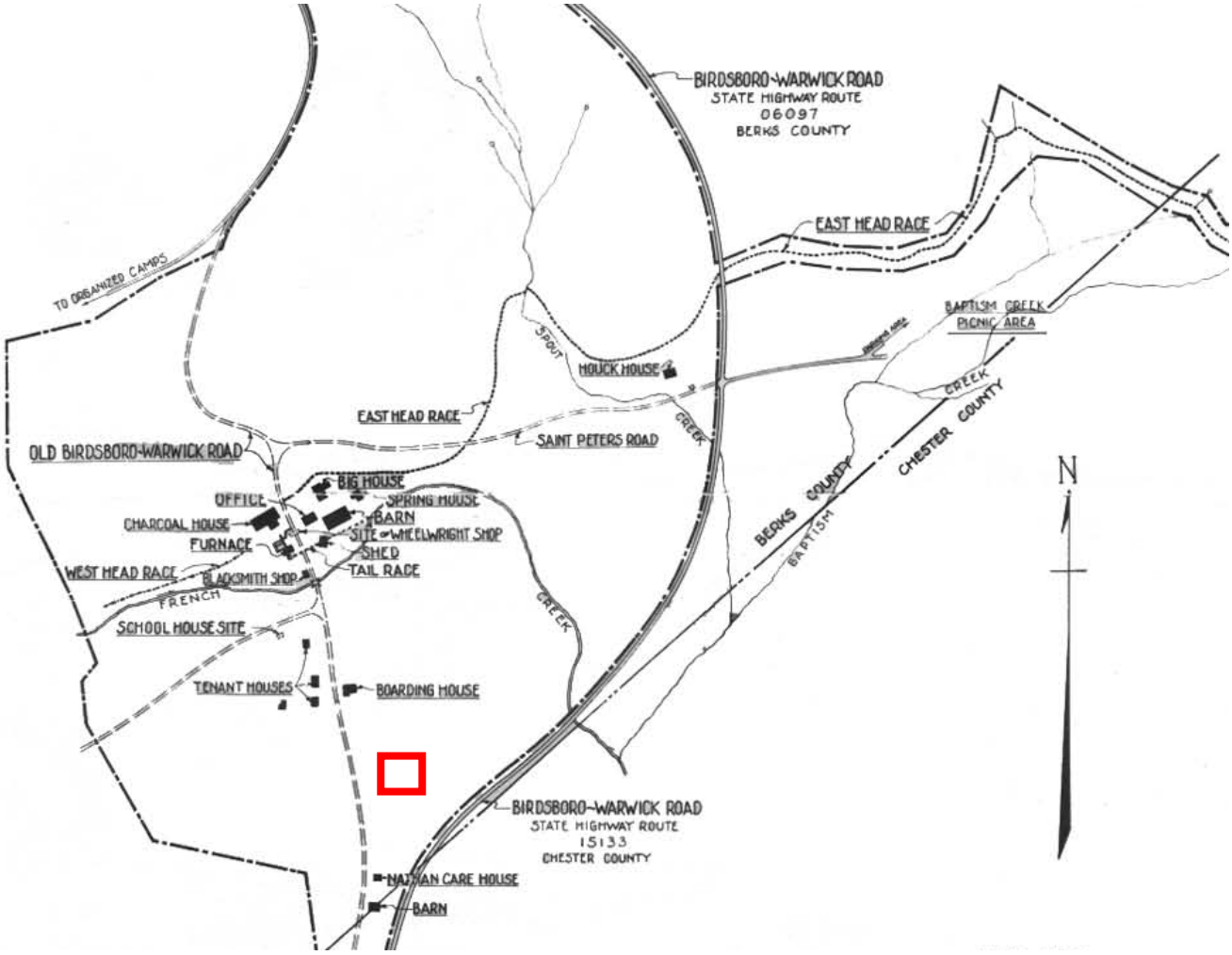


Figure 11: Hopewell Village National Historic Site. Supposed location of the Nathan Care Log House is noted by John Milner Architects with red square (National Park Service Park).[10]

The Care family continued to develop the property until it included the stone house, the barn, an outdoor bake oven, a corn crib, a smoke house, a straw house and a pig pen. Other records indicate that there was a well and hen houses also on the property.

[8] Zerbey, Benjamin J. *Historic Structures Report, Pat I Nathan Care House – Bldg. #25*, 3.
[9] *Report of an Archeological Survey of Five Domestic Sites…*, 9.
[10] National Park Service, Accessed December 7, 2016. https://www.nps.gov/parkhistory/online_books/brochures/1940/hofu/images/map.pdf

Figure 12: Windlass and Bucket at Nathan Care Well (Walker, p. 110).

By 1873, Nathan Care was listed as Farmer and Superintendent of Hopewell Furnace. The last known records of Nathan Care are from 1883-84.[11]

The Care Family in Hopewell Furnace

Nathan was not the only member of the Care family employed at the furnace. In fact, the Care family supplied the furnace with more founders than any other family in its 113 years of operation:

> Thus one can here cite two notable reasons for attaching the most important family at Hopewell title to the Cares. First, the Cares held the position of founder at Hopewell for a greater length of time than members of other families and were also able to earn high wages than any of them. And second, because of the great influence exerted by their father, these Care sons certainly had a much easier time in securing these high positions and high paying jobs at Hopewell Furnace.[12]

Nathan's father Thomas (1775-1852) was the first of the Cares employed at the furnace. He was employed by John Painter, a member of another prominent family in the area. Thomas Care first worked as a moulder and in 1816 he took over John Painter's position as founder where he remained until he retired in 1835 at the age of 62. At this time, other Cares took over as founder, including his son Thomas Care, Jr.[13]

Other members of the family were employed as carpenters, clerks, farm workers, house-workers, laborers and wood-cutters. Besides Thomas Jr., Thomas' other sons who worked at the furnace include David (reference to 1829) and Henry. Thomas Sr.'s grandson Clement (reference to 1857 and 1877) and his great grandson Grant (reference to 1889) were also associated with the furnace. In the 1830s, there is also mention of Levi and Ann Care, though their relations are unknown. Patty Care, assumed to be of relation to Nathan, may have also worked at Hopewell from November 1 to November 25, 1817.

[11] Francis, *The Most Important Family at Hopewell: The Cares*, 151.
[12] Francis, *The Most Important Family at Hopewell: The Cares*, 192.
[13] Francis, *The Most Important Family at Hopewell: The Cares*, 129.

Members of the Care family remained employed at Hopewell until acquisition by the Federal Government. The last family member to work there was Nathan Care Jr., grandson of Nathan Care, who was a custodian for 20 years.

Subsequent Owners of the Nathan Care House

Nathan Care's will of 1885, which was probated in 1888, divided his estate among his many heirs. His son John was the executor of the will. After Nathan Care's death, a man by the name of Howard Hoffman moved into the house. His relation to Nathan Care is unknown. John sold Tracts 13, 14 and 15 to his brother for $1,900 in 1892. On March 17, 1898, David sold the property to his son Charles S. Care for $1,050.

The house remained in the Care family until the beginning of the 20th century. In 1902, after 46 years of family ownership, Charles Care and his wife Emma sold the property to Charles Painter, likely related to John Painter and the Painter family. In 1916, Charles Painter sold the house to Louise C. Brooke, owner of Hopewell Furnace, for $2,500. The house was under Louise C. Brooke's ownership until 1935 when it was purchased by the Federal Government.

Figure 13: Overview of Nathan Care House and Barn, looking south (date unknown) (Walker, p. 108).

For approximately 80 years, the house was used as a private residence, more than half of which were of the Care family. Residents at the Nathan Care House, as well as other properties in the area "occupied, used and created these landscapes in a planned and orderly fashion to accommodate daily and seasonal activities that included housing, gardens, cooking and sanitation."[14]

[14] *Report of an Archeological Survey of Five Domestic Sites…*, 25.

National Park Service

The Federal Government acquired the Nathan Care House in 1935 when it purchased Hopewell Furnace (approximately 6,000 acres). In 1935, the Work Progress Administration restoration work began on site, and in 1937 the construction of a bypass road, PA Route 345, began to the east of the village. On August 3, 1938 the Park was established as Hopewell Village National Historic Site. It was created during the height of the Depression by the FDR administration as a "pleasuring ground for the people of Philadelphia."[15]

In 1941, restoration of the Furnace was complete and the Federal government deeded approximately 5,000 acres to the state of Pennsylvania while retaining 848 acres as Hopewell Village National Historic Site; the Nathan Care House remained vacant until after World War II. On October 27, 1947, the Acting Superintendent wrote a letter to the regional director of the National Park Service stating that the Park would like to use the Nathan Care House as permanent employee quarters. Between 1947 and 1948, house was rehabilitated for employee housing and officially became quarters for Park Service personnel in 1948. At this time, the kitchen was modernized, a bathroom was added, the south porch was modified, the east brick chimney was removed, and a stuccoed CMU chimney added on the east elevation.

The house was renovated further in the 1960s. An exterior door was installed, replacing a window on the north elevation. A new roof and new furnace were installed, as well as new storm windows on first floor. Rotting timbers were replaced in the basement and baseboard heating was added at the first and second floors. Cosmetic improvements continued in the 1970s including exterior paint work, electrical updates, and kitchen improvements. In the 1980s, the original wood bulkhead doors were replaced with metal, and interior finishes were updated, including vinyl sheet flooring, carpet, tile, paint, and wallpaper. Also in the 1980s, a new roof was installed, the mechanical systems were updated, the shutters were repaired and capped, the windows were reglazed, and the porch was painted. In the 1990s, a new oil storage tank was installed, and new storm windows were installed in the early 2000s.

[15] 2011 Superintendent's Annual Report, *Hopewell Furnace National Historic Site*, 1.

1.1.2.A Chronology of Development and Use of the Nathan Care House

Establishing the chronology of development for a historic structure typically follows three steps. In the case of the Nathan Care House, the first step was the identification and examination of documentary evidence associated with the structure, specifically secondary sources that were provided by Hopewell Furnace National Historic Site. The sources include reports, histories and interviews with entities associated with the house. The second step was research of architectural precedents, including the comparison of buildings in the same region, style and/or period as the subject structure. The final step was the physical examination of the building for evidence of original building fabric and changes that may have occurred since construction. The physical fabric of the Nathan Care House has been minimally altered, with the majority of original fabric extant.

Documentary Evidence

The first record of the property is from 1818, when Thomas Lloyd purchased Tract 13 from John Hoplin, Jr. By 1840, under the ownership of Thomas Lloyd III, the land was still undeveloped as there was no mention of a house or structures at this time in the Berks County Deed Books. In 1841, John Painter purchased Tract 13 for $525.00, including 17 acres and 137 perches. In 1856, Nathan Care purchased the land from John Painter and his wife Margaret. At this time, there was a whitewashed log house located on the site, but existence of any other structures is unknown or undocumented. Between 1856 and 1857, Care constructed his two-story stone house.[1] Care continued to develop the land and it eventually included the house, an out-door bake oven, a corn crib, smoke house, pig pen and a stone barn (constructed in 1859).

In 1935, Hopewell Furnace was purchased by the Federal Government. At this time, there were two brick chimneys, louvered blinds on the second floor, and wooden bulkhead doors to the basement on the east elevation. The south porch had wooden balusters, chamfered porch posts, an entry in the middle, and an entry with steps on the east side (see Figures 23 and 27). By 1951, the east brick chimney had been removed and replaced with a stuccoed CMU chimney stack, a plumbing vent was added on the south side of the roof, the louvered blinds were replaced with paneled shutters on the second floor, and paneled shutters were added on the first floor. The south porch was altered; the balusters, chamfered porch posts, and east stairs were removed. In addition, what appears to be a canvas shade was removed, which exposed the decorative brackets behind (Figure 30).

Architectural Precedent

The Nathan Care house is a mid-19th-century, southeastern Pennsylvania vernacular stucco and stone farmhouse. As described in *Stone Houses, Traditional Homes of Pennsylvania's Bucks County and Brandywine Valley*, the term vernacular describes "architecture that is 'of the place' in terms of design and materials, not superimposed, subscribing to styles and values that are foreign to the place. A modest fieldstone house by a stream is vernacular; a six-story Federal courthouse in the Beaux Arts style is not."[2] The house is a two-story, single pile masonry structure with a gabled roof and chimney on the west gable end. Cottages of furnace men, forgemen, miners, farmhands, and other workers

[1] *Report of an Archeological Survey of Five Domestic Sites*…, 9
[2] Introduction to *Stone Houses, Traditional Homes* of Pennsylvania's Bucks…, 14.

were usually "small stone structures or were built of log and plaster with stone chimneys."[3] Typically the smaller houses had two rooms with a loft above. In the "better type of workingmen's homes was an additional room or two."[4] It is not surprising that Nathan Care had a full second story in his home, as he was a prosperous founder at Hopewell Furnace.

Figure 14: Stuccoed stone house, similar in form, massing and scale, and said to have also been owned by the Cares (located approximately one half mile south of Nathan Care House). The interior has similar fireplace and winder stair configuration (above). The Square Tavern in Newtown Township, Delaware County, Pennsylvania shows similar characteristics to the Nathan Care House including form, scale, fenestration placement and mid-19th-century stucco (below).

In most 19th century homes, fireplaces were used for heat in the winter, and while not every home had a cast iron stove, the Nathan Care house likely had at least one as it was on the site of an iron furnace that produced thousands of stoves during the late 19th century. There was likely a ten-plate cooking stove in the kitchen, a six-plate heating stove in Bedroom 203 (above the kitchen) to heat the second floor, and possibly another six-plate stove in Bedroom 202. A heating stove was later added at the fireplace in the Living Room (see ***Stage 2:*** Restoration by the National Park Service (1940s) for documentary evidence of stoves in the Nathan Care House).

[3] Bining, Arthur C. *Pennsylvania Iron Manufacture in the Eighteenth Century*, p. 22.
[4] Bining, Arthur C. *Pennsylvania Iron Manufacture in the Eighteenth Century*, p. 22.

Figure 15: These 19th-century stoves from Hopewell Furnace were made using the flask method rather than open sand casting more common in the 18th century for box stoves.

Architectural Evidence

The investigation of architectural evidence in the Nathan Care House was limited to selective removal of small areas of exterior stucco, interior plaster and interior wood trim. Modern carpet was also lifted on the second story to investigate the flooring underneath. The original floors on the first floor are only visible from below in the basement as modern hardwood floors were added to the living room in the mid-20th century and tile was installed in the kitchen at the end of the 20th century. The first floor framing, attic framing and roof framing were visible. The second floor framing was not accessible due to the finished ceiling on the first floor and original floor boards on the second.

Chronology of Development of the Nathan Care House

The evolution of the Nathan Care House and Barn may be divided into the following three stages:

Stage 1: Initial construction of the House (1856);
Stage 2: Restoration and modernization by the National Park Service (1940s);
Stage 3: Subsequent modifications by the National Park Service (1960-present).

Stage 1: Initial Construction 1856

During the middle of the 19th century, Nathan Care, the last founder at Hopewell Furnace, purchased a parcel of land on Tract 13 in Elverson, Pennsylvania. The land was situated approximately 1500 feet south of Hopewell Furnace. Upon purchasing the land, Care moved into an existing log cabin on the site, and in 1856 he built a two-story stone house.

Investigation of the exterior masonry and stucco revealed no finished pointing, which indicates that the structure has been stuccoed since its construction. The pink colored stucco is typical for the area, and would have been a common finish during the middle of the 19th century. Often called “Reading

Stucco", the distinctive pink color comes from the red clay deposits of the area. The investigation also revealed that the stonework is of a quality that would not typically be exposed. There are many small stones, small "filler" stones, and very wide joints.

Figure 16: Lack of original finish pointing on the south elevation (left) and west elevation (right), indicating that the house was always stuccoed.

The interior walls of the Nathan Care House are original three-coat plaster applied directly to the exterior stone walls or to wood lath on the interior walls. The layers consist of a brown-colored scratch coat, a pink-colored "brown coat" and a white-colored finish coat under the paint. In the reconstructed wall between the kitchen and the living room, the wall consists of only two coats: a grey-colored scratch coat with a white-colored finish coat.

Figure 17: Interior plaster in Room 203 showing brown-colored scratch coat (1), pink-colored "brown coat" (2) and white-colored finish coat (3).

Three of the six interior partition walls are original or partially original to the house. The first story partition wall, running north-south, separating the kitchen and living room, was modified in the mid-20th century (see Stage 2). The partition wall directly above it on the second story, also running north-south, was modified in the mid-20th century as well (see Stage 2). The partition wall between Room 202 and Hall 201 is the original 1856 partition wall. The partition walls on the first and second floors are plaster on wood lath over staggered vertical wood plank framing. Removal of small sections of

baseboard in Rooms 202 and 203 confirm that there are original baseboards extant with cut nails consistent with mid-19th century construction.

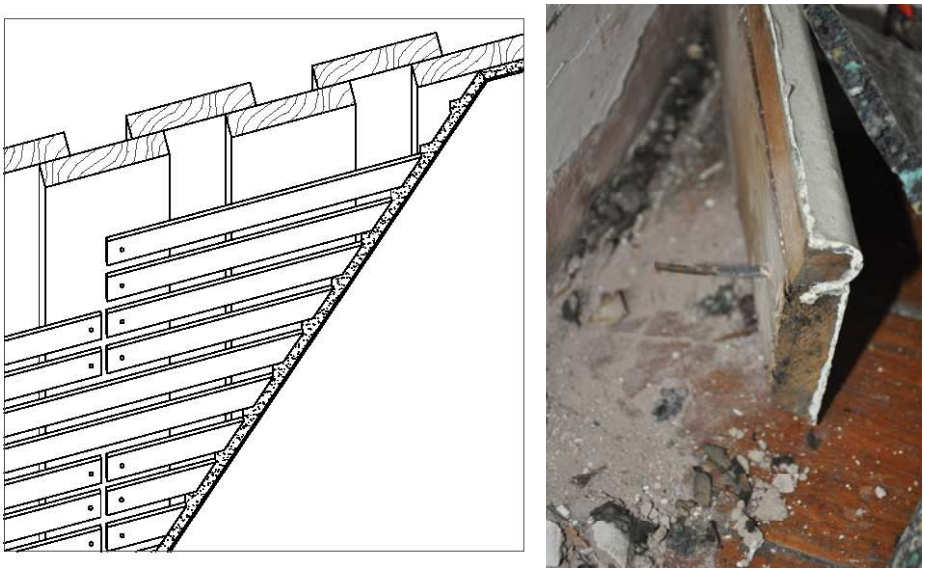


Figure 18: Sketch of staggered vertical plank framing (left) and detail of cut nail in original baseboard of Room 202.

The fireplace on the west wall is original to the Nathan Care House, however it has been infilled on the first floor and the foundation has been infilled in the basement. There was a heating stove in front of the fireplace in the living room (date unknown) that was removed sometime after 1988, as a "wood stove" was listed in the maintenance records from this year (see Stage 3: Subsequent modifications by the National Park Service (1960-present)). In 1900 the Care Log House was demolished to use the site as a field.[5]

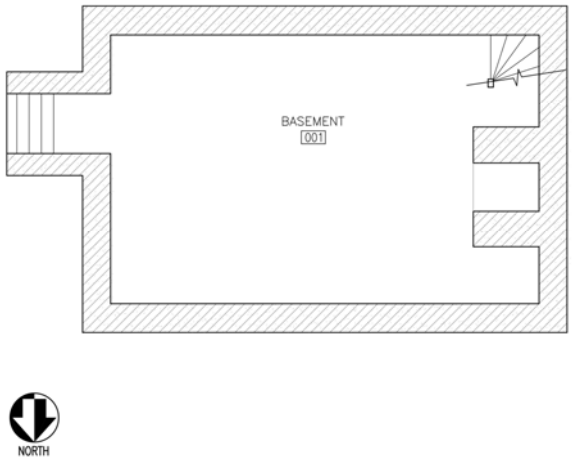


Figure 19: 1856 Conjectural Basement Plan.

[5] National Park Service, *Cultural Landscape Inventory, 2003*, 21 of 25.

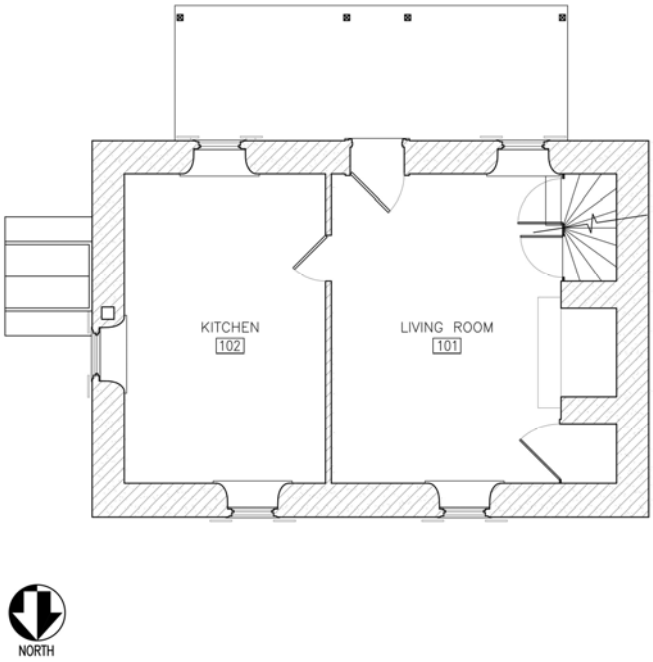


Figure 20: 1856 Conjectural First Floor Plan.

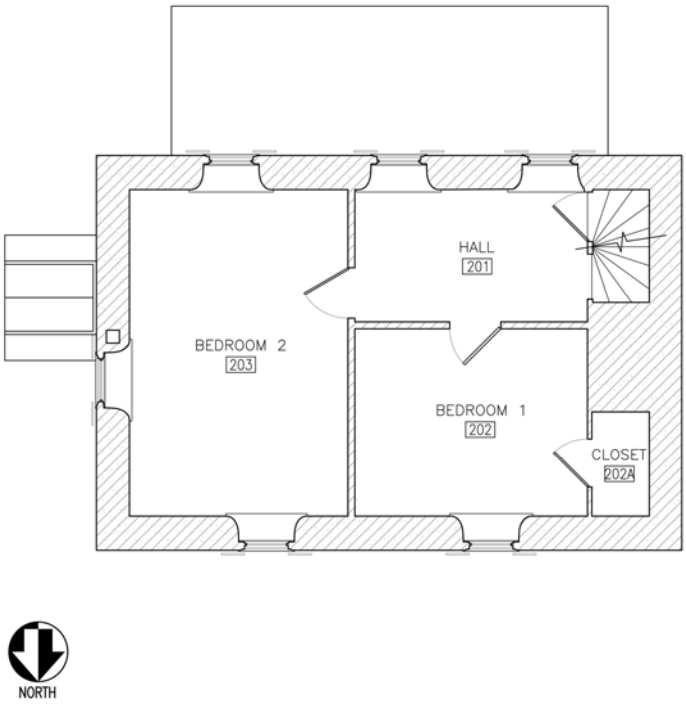


Figure 21: 1856 Conjectural Second Floor Plan.

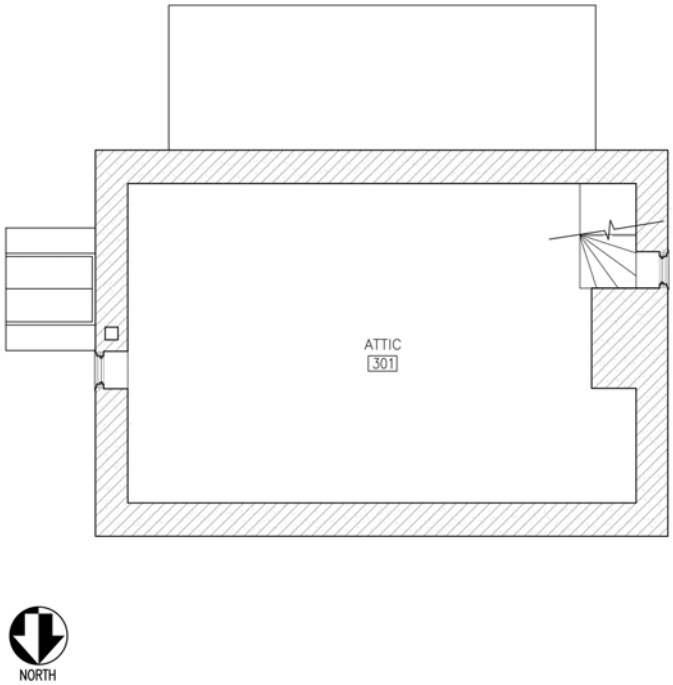


Figure 22: 1856 Conjectural Attic Plan.

Stage 2: Restoration by the National Park Service (1940s)

In 1935, Hopewell Furnace, including the Nathan Care site, was purchased by the Federal Government. One of the first changes implemented was the construction of a bypass road. In 1937 the federal government, in a "probable effort to help preserve Hopewell Furnace's village core area, began construction of a bypass road (PA Route 345) east of the village. The bow-shaped road (completed in 1939) diverted automobile traffic around the village core and connected to Birdsboro-Warwick Road on the south, below the Nathan Care barn."[6] There was no evidence of electricity or mechanical systems at the Nathan Care House prior to 1935. At this time an outhouse was still present on the south side of the house and no plumbing vent is seen on the roof. Even in the 1940 photograph of the east façade, there is no visual evidence of an electrical meter. The house remained vacant until after WWII, when it was modernized for use as employee living quarters. By 1951, both electricity and plumbing were installed as evidenced by the 1951 photograph showing an electric meter on the east elevation and a plumbing stack on the south side of the roof (Figure 30). The outhouse that was present in 1935 was removed prior to 1951 (Figures 23 and 30).

[6] National Park Service, *Cultural Landscape Inventory, 2003*, Part 2b page 11 of 20.

Figure 23: View of south elevation of the Nathan Care House in 1935.

Figure 24: View of Nathan Care site from east in 1940.

The kitchen was likely modernized at this time, including modifications of the partition wall running north-south, separating the kitchen and living room. The entire wall was replastered, and there are remnants of original pink-colored plaster under the newer grey-colored plaster. On the north side of the archway, the wall is comprised of original hand-split wood lath over staggered wood board "framing." When the wall was modified, the original door opening was framed in with wood studs and the arched opening in the center of the wall was constructed. The original door opening was likely located between the south wall and the new archway as there are sections of both sawn lath as well as drywall. A modern pipe chase, adjacent to the front door, was also added during renovations. Part of the lath north of the new arched opening was replaced during the renovations, thus there are two different wood laths, hand-split and sawn. It is possible that the 10-plate cooking stove was removed from the kitchen at this time.

Figure 25: New wood lath (left side of dashed line) and original wood lath (right side of dashed line) and plaster in Kitchen (left) and wood lath, plaster and original door opening (left side of dashed line) to Kitchen in Living Room wall (right).

A bathroom was also added at this time, on the south side of the second story. The original partition wall, running north-south, directly above the first floor partition, was modified and the bathroom projected into part of Room 203. By 1951, a plumbing stack is visible in the roof on the south elevation of the house. It is likely that the original construction of this wall matches that of the downstairs wall, plaster on wood lath over staggered wood board framing.

In 1935, there was an original brick chimney extant on the east elevation. By 1951, the original chimney was removed and a stuccoed CMU chimney was added on the exterior of the east elevation. There would have likely been a cooking stove in the kitchen, which vented through a flue in the stone wall and out the brick chimney. The flue corresponding to the brick chimney is visible at the top of the east gable wall in the attic. It is assumed that the flue runs from the first floor kitchen and it is likely that there was a stove in the room above the kitchen, providing heat for the second floor. There may have been another stove in the adjacent bedroom on the west side for an additional heat source.

Figure 26: Detail of top of masonry wall in attic on east end of house where flue is located (left) and detail of flue of original brick chimney on east side of house (right).

There have been many changes to the south porch at the Nathan Care House as seen in the historic photographs and physical evidence. It is clear that the current porch posts and roof structure are replacements but the floor structure and the porch beams are believed to be original elements. A piece of chamfered wood above the west porch door appears to be a reused portion of an early chamfered porch post. It is very similar to one of the posts present in the 1940's/c. 1935 photograph below. Based on the findings in the finish analysis, this post is not original to the house construction of 1856 but was likely installed around 1870 suggesting that the porch may not have been built until about 15 years after the house construction for reasons unknown. The earliest paint finish on the post is a dark brown oil paint; the earliest color found on the house is a dark gray oil paint with the same dark brown paint found as the second layer.

Figure 27: View of house from southeast, c. 1935, showing early or original porch with stairs and railings on the east side, wood balusters, and chamfered porch posts. Note the original wood bulkhead doors and brick chimney on the east elevation.

This first porch had openings on the south and east elevations, both with steps leading to the yard. There are existing mortises in the underside of the south porch beam corresponding to the center posts on the south side. In addition, there are mortises in the north face of the beam and a horizontal stucco patch on the north house wall indicating that there was a ceiling in the porch at one time. It is not known if the ceiling was an original feature. There is no photographic evidence that the first porch was screened and screens would have conflicted with the window shutters seen in early photos.

Figure 28: Mortises for porch posts and ceiling joist.

Figure 29: Detail showing a chamfered post that has likely been reused from an earlier porch campaign.

Sometime between 1870 and 1935, decorative brackets were added to the porch. The brackets are visible in the 1935 photograph above, and appear to have been restored or replicated when the NPS repaired the porch after acquisition in the 1940's. The brackets appear to be Queen Anne style and may have been added at the same time much of the interior door hardware was changed (see Section 1.1.3-A for physical descriptions) as an effort to update the house. In the 1940s, the stairs on the south and east elevations were removed, as well as the balustrades. The stone foundation was retained.

Figure 30: View of porch in 1951. Also visible in this photograph is the plumbing stack in center of roof and modern CMU chimney on right.

The current porch configuration is similar to the earlier porches only in the overall form. The porch has been screened in with wood panels and the door location changed (see Section 1.1.3-A for physical description of the current porch). These changes occurred sometime after 1951.

Figure 31: View of entrance to the porch on the west elevation (left) and view of south elevation of porch (right).

Stage 3: Subsequent Modifications by the National Park Service (1960-present)

After the initial restoration by the National Park Service in the 1940s, the house was used for employee housing. Further alterations began in the 1960s and continued into the 21st century. The maintenance records provided by the Park reference several projects that modernized and maintained the building. Most of the changes were subtle and did not dramatically alter the original appearance of the building. One change that did impact the appearance of the building was the addition of an exterior door on the north elevation to "provide a second route of escape in the event of a fire." [7] A window on the east side of the first story, identical to the one on the west side, was removed in the 1960s and a door was installed, "piercing that façade for the first time; prior to that date the entry to the house has been from the south."[8]

Figure 32: North elevation showing new door opening on east side.

A Historic Structures Report, written in 1962, stated that the structural system and the chimney were in very poor condition. It also recommended a new roof, a new oil furnace, and replacement of certain rotting timbers. The same year, a new roof and a new oil furnace were installed, and a fire alarm was added in 1966. More significant was the addition of baseboard heating in the 1960s.

The 1962 HSR also recommended the installation of new storm windows on the first floor. By 1951, wood-framed storm windows were in place on the south elevation as seen a dated photograph, two of which contained half-screens (Figure 30). It is unclear whether the screens were fixed or interchangeable with the storms. By 1969, aluminum triple track windows were visible in a photograph on all north and east windows. According to the maintenance records, new storm windows were installed in 2003.[9] There is no record of new storm windows after 2003.

[7] Zerbey, Benjamin J. *Historic Structures Report, Pat I Nathan Care House – Bldg. #25*, 2.
[8] *Report of an Archeological Survey of Five Domestic Sites…*, 9.
[9] *Maintenance Records of Hopewell Furnace National Historic Site*, accessed June 2016.

Figure 33: Radiator in Room 102 and baseboard heater in Room 202.

During this period, the stove in the Living Room was removed and replaced with modern heating. At some point, there was a fire in the Nathan Care house, likely caused by the stove. Damage from the fire explains the difference in flooring in the living room and the use of plywood flooring in front of the hearth (the original flooring on the first floor is extant and used as subflooring for the modern floor finishes that have been added). Further evidence of the fire can be seen in the basement where charred timbers and flooring are extant.

Figure 34: Charred floor boards and replacement floors boards (left) and charred timbers and flooring from fire visible from basement (right).

Several more improvements were made to the Nathan Care House in the 1970s indicated by the Park maintenance records. In 1973 the exterior trim was painted and the windows were reglazed.

Miscellaneous electrical updates were made in 1976, as well as various kitchen improvements, including the installation of a new countertop. In 1978 the house was "rewired" and the interior was painted. It is unknown when the house was first wired; it was likely during the 1940s renovations since there was no evidence prior to Park Service ownership, or until an electric panel and wires were present by 1951 (Figure 30). In 1982, the original wood bulkhead doors were replaced with a metal steel door unit. Several cosmetic changes were also made in 1982 including the addition of underlayment and linoleum flooring in the kitchen, carpet in the living room, tile in the bathroom, paint and wallpaper on the bath walls and ceiling, and two coats of paint on the interior walls and woodwork. The linoleum in the kitchen has been replaced with tile within the past two decades.[10]

Figure 35: View of metal bulkhead doors that replaced the original wood doors on the east elevation.

Maintenance on the house continued through the 1980s. In 1984, the exterior was painted with an alkali resistant primer and exterior linseed oil paint. In 1985, a new No. 1 Blue Label shingle roof was installed with zinc nails. The top layer of existing shingles (1962) was removed and the new shingles were installed over the first layer which still remained. Also in 1985, the shutters were repaired and capped, the windows were reglazed as necessary and the porch was scraped and painted.[11]

In 1987, several updates were made to the mechanical systems. A new boiler was installed and upgrades were made to the stove including the addition of catalytic dampers with blowers and new stove plates. A new exterior storm door was added, the chimney was cleaned and the stove was reconnected. Cosmetic work included interior paint, new carpet on the second story, tile in the bathroom and handles for the sink and bath.[12] In 1988, a ceiling exhaust vent fan was installed in the bathroom, a vent hood was added in the kitchen and one storm window was replaced. In 1989, a dehumidifier was placed in the basement.

[10] *Maintenance Records of Hopewell Furnace National Historic Site*, accessed June 2016.

[11] Ibid

[12] Maintenance record says handles for bath, however there is only a shower in the bathroom.

Figure 36: Tile floor in bathroom (left) and wall-to-wall carpet in Hall 201 and Bedroom 202 (right).

Between 1994 and 1995, a radon mitigation system was installed in the cellar of the Nathan Care House. Since the radon system involved digging up the cellar floor, an archaeological investigation took place at that time (8" dirt removed, 4" diameter, two sections perf. Pipe, 3" thick conc. slabs). At the same time, a Burnham multi-fuel burner and a New Yorker oil-fired water burner were installed and each floor was "rewired." In 1994, a 275-gallon oil storage tank was installed, and in 1996, the oil burner was replaced.[13]

Figure 37: Radon mitigation pipe protruding through brick infilled opening in basement on west elevation.

New storm windows were added in 2003 and several of the windows were reglazed (see page 29 for more information on storm windows). In 2011, a contract was prepared for repairing the exterior stone walls and painting the exterior trim of the Nathan Care House. It also called for repairing a water line break and leak on the line to the Care House.[14]

[13] *Maintenance Records of Hopewell Furnace National Historic Site*, accessed June 2016.
[14] Ibid.

1.1.3.A Physical Description of the Nathan Care House

Setting and General Plan

The Nathan Care House is located approximately one-half mile south of Hopewell Furnace National Historic Site, in Union Township, Berks County, Pennsylvania. The site is situated on the south side of Clement Brooke Lane, adjacent to Pine Swamp Road (Route 345). The house was constructed in 1856, towards the end of operations at the furnace. Although it was not originally part of the furnace complex, its association was important as it was owned by the last founder at Hopewell Furnace. The house has undergone very few changes since it was constructed. Most of the changes date to the middle of the 20th century, between 1940 and 1960, with the exception of the porch that was added in the last quarter of the 19th century. In 1935, the Federal Government purchased the property, and in 1938 the house was modified for employee quarters. The physical descriptions that follow are based on the existing visible fabric, most of which is original or from the era of the National Park Service's ownership.

Figure 38: View of Nathan Care House from Nathan Care Barn, looking north.

Exterior

General Form and Appearance

The Nathan Care House is a two-and-one-half story, rectangular building measuring approximately 30 feet by 20 feet, with a full basement and attic. The stone walls are covered with Reading stucco and the gable roof has wood shingles. Its long axis is oriented east-west, with a stuccoed CMU chimney on the east elevation and a brick chimney on the west end.

The main entrance to the house is accessed through a screened-in porch on the south elevation, measuring approximately 21 feet by 7 feet. The south elevation has three bays: a door flanked by nine-over-six windows on the first floor and six-over-six windows in each of the three bays on the second floor. The roof of the porch connects to the exterior wall just below the sills of the second floor windows. On the two-bay north elevation, a second entrance has been added to the east bay, replacing an original

window opening. A flight of four concrete steps and landing leads to the door from the concrete walkway. The west bay of the first floor has a nine-over-six window and the second floor has one window in each bay, both six-over-six windows, matching those on the south elevation. Each window has board and batten wood shutters, not original to the house.

Figure 39: South elevation of the Nathan Care House.

Figure 40: North elevation of the Nathan Care House.

The east gable elevation has three openings: a nine-over-six wood window on the first floor, a six-over-six window on the second floor and a wood louvered opening at the attic level. A set of bulkhead doors are located towards the south side of the east elevation, and lead to the basement. The original wood bulkhead doors have been replaced with metal doors. The west gable elevation has two openings: a wood louvered opening in the attic and an infilled brick opening in the basement where the radon ventilation pipe projects through to the exterior of the building. There are no other openings on this elevation as the chimney mass and staircase are located on this elevation.

Figure 41: East elevation (left) and west elevation (right) of the Nathan Care House.

Concrete/Paving

Cast-in-place concrete is used in only two exterior locations at the Nathan Care House. The first is at the entrance stoop on the north façade; the walkway, stairs and iron railing were added in the 1960s.[1] The northeast window on the first floor was removed and a new entry door was installed, requiring an exterior landing and four risers to meet grade. A concrete slab walkway extends from the stairs to the gravel drive. The second use of concrete is the poured chimney foundation on the east facade, which was installed in the 1960s for a mechanical flue.

Macadam paving is used as a walkway from the gravel road to the porch entrance. The paving stops short of the entrance and a stone slab bridges the gap to the porch door.

Masonry

There are three types of masonry used at the house: field stone, brick and concrete masonry units (CMU). The field stone foundation and exterior walls create the building envelope. Lack of evidence for finish pointing at the exterior walls suggests the structure has always been stuccoed. Stone is also used as the foundation for the basement bulkhead doors and for the south porch. Two piers and a wall at the south elevation support the wood porch framing members. The porch foundations were reused from at least one earlier porch.

The original west chimney is constructed of brick. The simple chimney form begins just under the rafters and rests on the stone chimney mass in the attic. Red clay, hand-molded bricks are laid in a running bond

[1] *Report of an Archeological Survey of Five Domestic Sites…*, 9

twelve courses high with the joints struck flush. Metal flashing is used around the base and a sheet metal cap, metal flue and vent have been added to the top of the chimney. It appears that the west chimney originally had two projecting brick drip courses, as did the east chimney (see large-scale photographs in Appendix F).

Modern machine made brick can be found at the infilled window opening at the basement stairs. These bricks are machine made, extruded red clay with concave pointing and are interrupted by a PVC plumbing vent pipe. A CMU chimney flue was added in the 1960s for the oil burning boiler. Roughly 20" wide by 17" deep, it rests against the east façade and on a concrete foundation.

Figure 42: Exposed stone wall with lack of finish pointing (left), stuccoed CMU chimney (center) and original brick chimney on west elevation (right).

Woodwork

Woodwork at the Nathan Care House is simple in design and finish. Cornices at the north and south elevations are boxed with short returns. The upper fascia board is beaded and topped with a drip cap at the returns while the lower fascia board is flat. The undersides of the eaves are also flat boards. Cut 2x4 blocks have been added to the beaded board fascia to mount fasteners for the metal gutter brackets. The cornice on the south façade is interrupted for a bathroom exhaust fan. A beaded rake board runs along the roofline of the gable ends. An approximate 1" strip of shingle molding has been added to the top of the rake to accommodate an additional layer of roof shingles installed in the 1980s.

Figure 43: Detail of cornice in northwest corner.

The existing screened-in porch at the south elevation is a modified version of an earlier porch (see Section 1.1.2-A). Four 4x4 and two 2x4 posts support rafter plates on which the rafters bear. Large wood framed screen panels infill the space between the posts. A portion of the west rafter plate has a chamfered top edge and a modern half screen door is centered on the west elevation. Board and batten siding at the east and west gables closes the triangular gap between the rafter plate and roof. The roof structure is supported on a ledger bolted to the exterior wall, and the rafters extend beyond the south rafter plate of the porch. Many of the roof rafters have straight or angled plaster marks indicating that the rafters are salvaged studs or rafters from another building. Wood shingles and 1”x3” lath are exposed on the porch interior. There are several pockets in the exterior masonry wall with embedded rafter ends that suggest a previous generation of porch roof. The porch floor is painted, 3” tongue and groove wood flooring supported by wood framing with a beaded skirt board.

Figure 44: Wood frame and screened-in porch on south elevation.

Doors and Windows

The original entrance to the Nathan Care House is through the porch in the center of the south elevation. A hollow metal door was added at the exterior face of the wall in the 1960s. This replaced an earlier storm door, likely made of wood with two vertical glazed lights (see Figure 30). Flat board casing surrounds the metal frame and a metal threshold sits on top of a wood sill. The sill is a small wood strip above a baseboard mounted against the exterior stucco. There is a finished reveal between the exterior and interior doors, with plastered and painted walls, ceiling and trim. The reveal has been modified with modern wood beaded baseboard and a wood floor that matches the style and finish of the porch. The interior door, original to the building, is a wood door with four flat panels, aluminum weather-stripping and early hardware.

A second entrance was added in the 1960s in the response to the new gravel access drive from Route 345. Door 104 now takes the place of an original window that was identical to the others on the first floor. Sashes from the removed window are currently stored in the Nathan Care Barn. The door is reached by the concrete walkway and stairs. At the face of the exterior wall is a non-original aluminum storm door with one acrylic panel and flat wood casing. Between the exterior and interior door is a small finished area with plastered and painted walls, ceiling, trim, and modern wood beaded baseboard with an unfinished concrete floor. The interior door is a nine-light, two-paneled wood door with a wood and metal threshold and contemporary hardware.

Figure 45: Original door on south elevation (left) and added door on north elevation (right).

The style and configuration of windows are original with the exception of the removed window at Door 104. The windows on the first floor are comprised of nine-over-six, true divided light, wood sashes, and the second floor windows are comprised of six-over-six, true divided light, wood sashes. Two bays of windows at the north elevation are centered on the interior rooms and there are three bays of windows on the south elevation. The windows on the first and second floors are single-hung. The upper sash track

is infilled with a full-height vertical wood piece. Since the windows do not have any type of weight and pulley or balances, the upper sash would not have stayed up if they were operable. All of the windows on the first and second floors have triple track storm windows that were installed in 2003 (see page 29). Attic windows at the east and west gables consist of four-light, true divided light, in-swinging, wood framed casements with fixed wood louvers at the face of the wall. Windows at the east elevation are off-center because of the flue located in the interior of the masonry wall. The exterior window trim appears to be original and is comprised of a simple flatboard with a beveled backband moulding. Descriptions of individual windows are detailed in the following interior room descriptions. Modifications to the operation of the windows were made in the 1960s with the addition of metal 'T' weatherstripping at the jambs and sills, and spring sash locks.

All windows on the first and second floors have mid-20th-century wood board and batten shutters with metal hinges, pintles and locks. The south elevation shutters on the first floor have been cut to accommodate the porch posts. Earlier photographs show wood blinds on the second floor, that were likely original, and no shutters at all on the first floor (Figures 1.1.A-13 and 1.1.A.15). Historically, solid raised panel shutters were called "shutters" and louvered shutters were called "blinds." Typically, shutters were on the first floor for privacy and security, while blinds were installed on the second floor for privacy but also to allow for a breeze in warmer months.[2] Shutters also provided insulation and protected interior furnishings from the sun.

Figure 46: Original first-floor window (left) and original second-floor window (right), both with later shutters.

The hardware on the Nathan Care House shutters appears to be original to the house. They are edge-mounted shutter hinges (also known as jamb hinges), mounted to the inside edge of the window casing. These Acme Lull & Porter hinges, patented in 1854, were popular at the beginning in the 19th century, and are still currently in use. They are self-locking, eliminating the need for tie backs or shutter dogs. [3]Although shutters do not appear on the first floor in early photographs, the fact that the existing hinges on both floors are the same as the 19th-century patent, it is likely that shutters were on historically present on the first floor.

[2] Wilbur, C. Keith. *Homebuilding and Woodworking in Colonial America*, 69.
[3] United States Patent and Trademark Office (Patent #10,477 A), January 31, 1854.

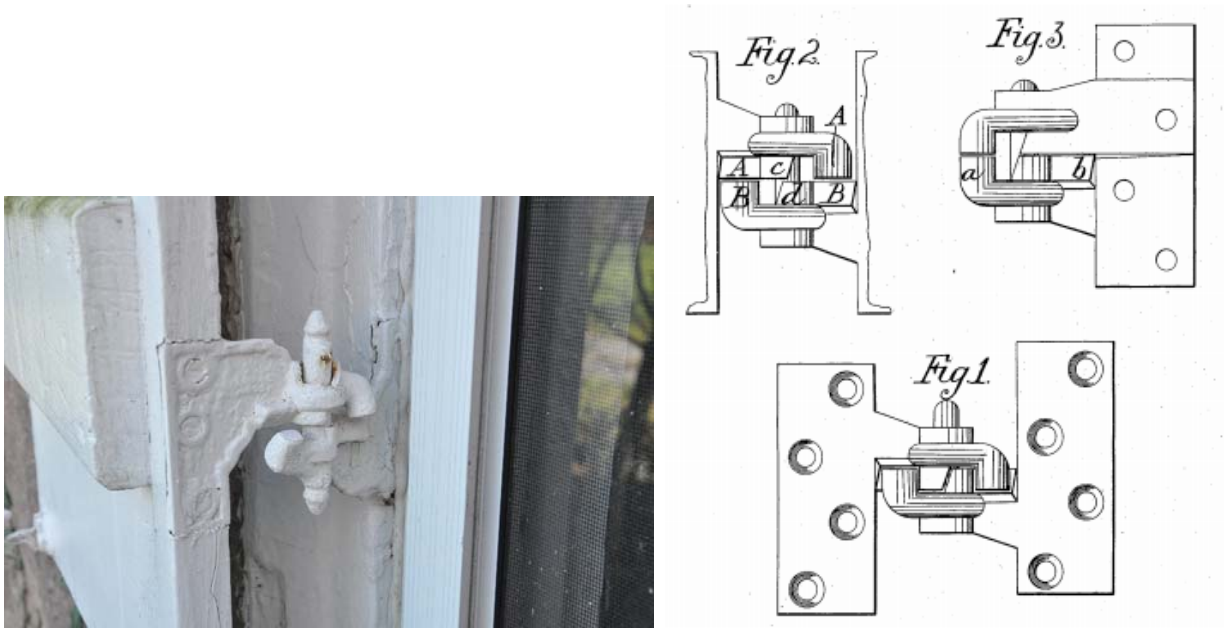


Figure 47: H. Acme Lull & Porter edge-mounted shutter hinge on first floor window (left) and Lull Shutter Hinge Patent, January 31, 1854, No. 10,477 (right).

Metal bulkhead doors resting on stone foundations and cement stairs provide exterior access to the basement at the east end of the house. The original wood bulkhead doors shown in a photograph from c. 1935 have been removed and are currently used as a half-height, stall wall in the lower level of the barn.

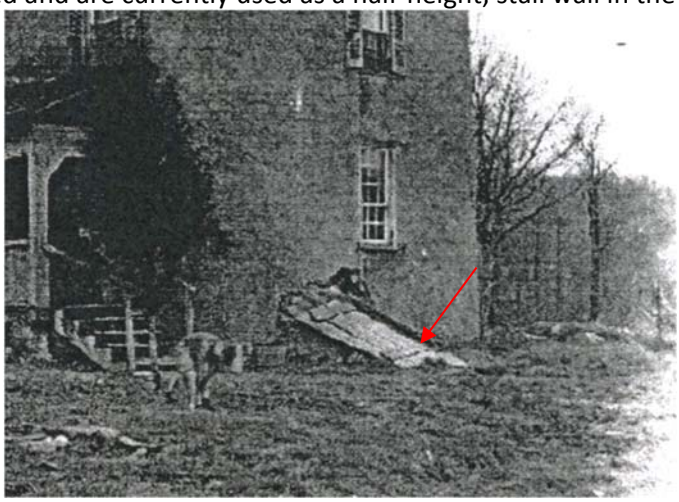


Figure 48: Overview of east elevation showing original wood bulkhead doors, c. 1935.

Figure 49: Metal bulkhead doors that replaced original doors (left) and original wood bulkhead doors from house used as a wall in lower level of barn (right).

Thermal and Moisture Protection

Although there have been multiple roofing campaigns at the Nathan Care House, it appears that the roofing material has always been wood shingles on lath. The existing roof is comprised of a layer of shingles over a layer of lath and nailers installed over an earlier layer of shingles and original 1856 lath. In 1986, the National Park service removed a layer of shingles and added lath and shingles (likely cedar) on top of the existing roof. The porch roof is also wood shingles on lath over rafters. Metal flashing is used at the chimneys and where the porch roof meets the south façade.

Water from the roof is collected in half round metal gutters, painted white, at the north and south cornices. Downspouts in the northeast and southeast corners discharge water at the base of the building. There is a small area of gravel at the discharge point but otherwise no splashblocks or other means to direct water away from the structure.

Finishes

The exterior masonry walls are covered with multiple applications of red clay stucco containing horsehair binding. The wood surfaces are painted with white paint. The porch floor is painted a light gray-blue color.

Interior

Interior Plans and General Finishes

The interior of the Nathan Care House has undergone moderate alterations since its construction 150 years ago. The house was modernized after it was purchased by the Federal Government in 1935. The first floor has two rooms, similar to the original layout. A winder stair leads to the second floor hallway, which was modified in 1948 in order to fit a bathroom. Originally, the east wall of Bedroom 203 continued to the face of the south wall, and there was a small room or hall at the top of the stairs. Stylistically, there is minimal detail and ornament throughout the house. Some of the existing interior fabric dates to later renovations, however there is evidence of historic details and original fabric throughout. The following descriptions are organized by room with elements of historic fabric identified.

Basement

The existing basement spans the entire footprint of the house, just as it did when it was first constructed. The basement is currently being used for mechanical equipment. The floor is concrete slab, replacing the original earthen floor, and the walls are whitewashed stone. The ceiling is unfinished, exposing the first floor framing and underside of floorboards. Steel and wood posts supporting girders have been added (see Structural Physical Description). A stone bulkhead with metal doors and concrete steps lead to the exterior on the east side of the house. The metal doors replaced the original wood bulkhead doors, which are being used as a wall in the Nathan Care Barn.

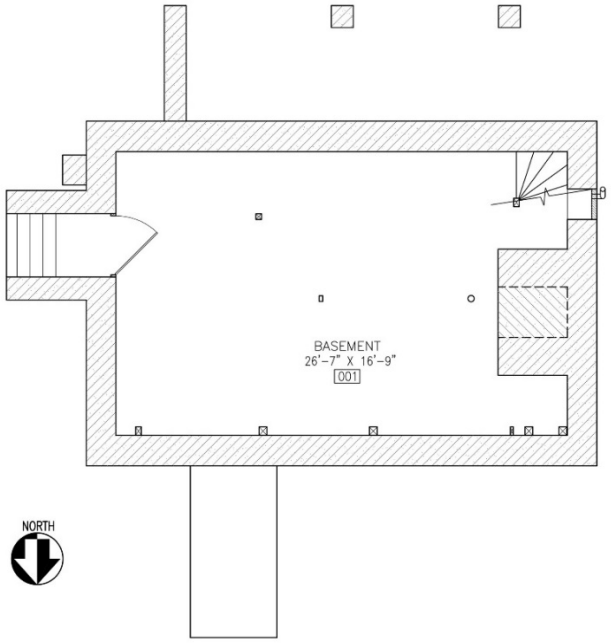


Figure 50: 2016 Basement Plan.

First Floor

The existing first floor plan is similar to its original 1856 configuration (see Section 1.1.2.A Chronology of Development and Use). There are two rooms on the first floor, as there were in 1856. The north-south partition wall has been modified. The existing partition wall has an arched cutout in the center of the room, creating more of an open concept plan. When the house was constructed there was a wall dividing the rooms with a door. The door was likely located on the south end of ~~in~~ the partition wall (see page 24). Originally, the primary entrance to the house was on the south elevation. Currently there are two entrances to the house after a door was added on the north elevation in the 1960s, replacing an original window. Two windows flank the main entrance on the south porch and one window is located to the west of the 1960s door on the north elevation. Two windows are located on the east wall as well.

Some of the original finishes are intact, while others have been replaced or modernized. The original interior plaster on the exterior masonry walls is intact. The plaster and drywall finishes on the partition between the Living Room and Kitchen are not original, however a portion of the original framing is intact. The ceilings have a mid-20th-century textured finish. A small hole from the hazardous material sampling remains in the Living Room ceiling; the plaster appears to be grey and doesn't match the original wall plaster. It was likely applied on metal or gypsum rock lath. The baseboards are a combination of original 1856 baseboards, 1940s baseboards and baseboards from the past couple of decades. The original fireplace was reduced in size by the installation of brick. The brick is extruded wire cut brick and most likely dates from the early to mid-20th century. The opening is closed off with gypsum wall board on wood framing (presumed). The hearth size is believed to be original and corresponds to the larger fireplace opening, however the brick is wire cut and not original. The mantel is comprised of an original backboard and several 20th-century pieces. The cabinetry in the northwest corner appears to be original.

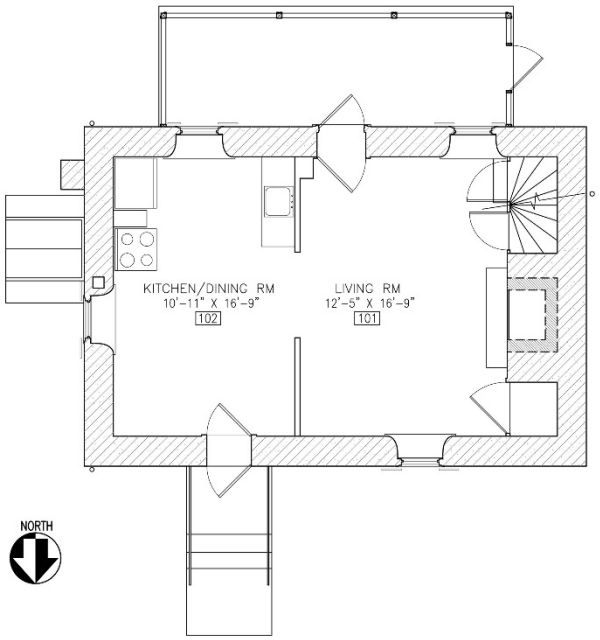


Figure 51: 2016 First Floor Plan.

Second Floor

The original second floor plan of the Nathan Care House consisted of two rooms and a hall. The 1948 renovations and modernization included the addition of a bathroom on the south side. The current second floor plan consists of two bedrooms, one on the north side and one on the east side, a bathroom on the south side, and hall at the top of the stair connecting the three rooms. The wall running north-south between Rooms 201 and 203 was altered for the construction for the new bathroom. The ceilings have a mid-20th-century textured finish, likely over grey plaster and metal or gypsum rock lath, similar to the first floor ceilings.

Figure 52: Splayed rounded plaster jambs in the bathroom. Arrows show where original partition wall joined the exterior wall in the bathroom. The partition was removed to accommodate the new bathroom.

Most of the interior finishes on the second floor are original including the plaster walls, baseboards, doors, windows and trim with the exception of the bathroom modifications. Although the second floor is currently carpeted, (except for the bathroom), selective removal of carpet revealed original 1856 floors underneath.

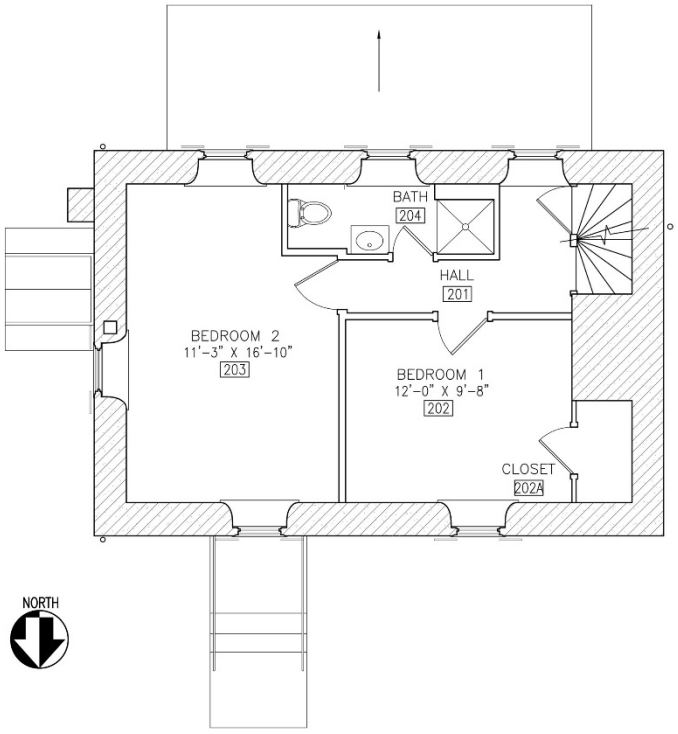


Figure 53: 2016 Second Floor Plan.

Attic

The layout of the Attic remains the same as the time of construction. It is a one-room space within the gable roof with two original, four-light, true-divided light windows on the east and west gable ends. Many of the original finishes are extant including the unfinished random-with yellow pine flooring and exposed wood rafters. The original rubble stone masonry walls are extant, and knee walls were added on the north and south sides during the mid-20th century. There is evidence of the original chimney on the east elevation that was removed in the middle of the 20th century.

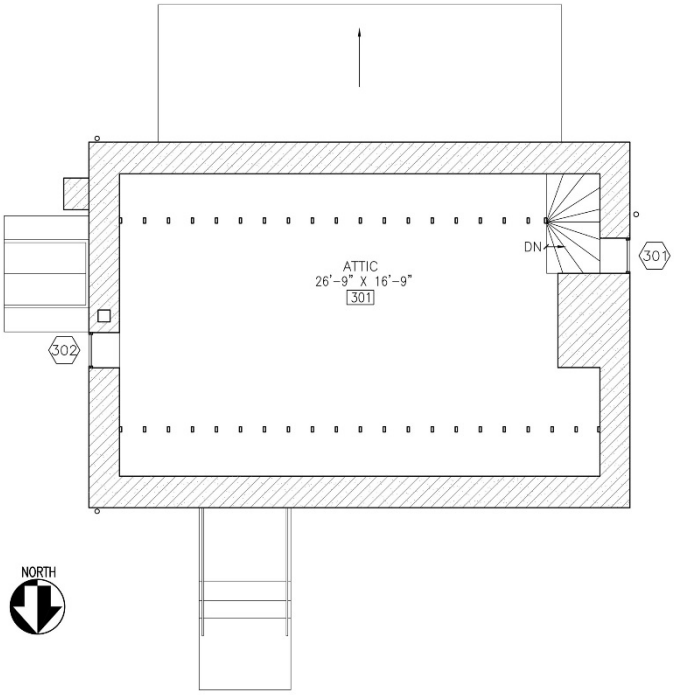


Figure 53a:2016 Attic Floor Plan.

Interior Room Descriptions

Basement

Room 001 – Basement

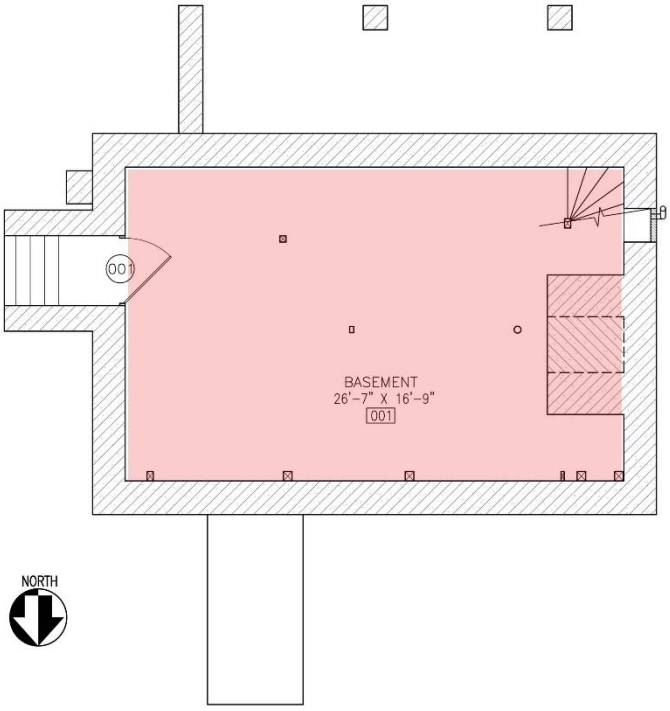


Figure 54: Exposed first floor framing and underside of floorboards (left) and mechanical equipment, rubble stone walls with whitewash finish and door leading to exterior bulkhead doors (right).

Figure 55: Overview of Basement (left) and stairs down to basement with radon piping (right).

Figure 56: Overview of stairs from basement and hot water heater (left) and infilled stone chimney foundation (right).

Historic Use(s): Storage (1856-present)
Mechanical and Storage (1948-present)

Existing Features and Finishes:

Floor: Concrete slab (1968).

Walls: North: Exposed, unpointed rubble stone with whitewash finish (1856).

East: Exposed, unpointed rubble stone with whitewash finish (1856), stone infilled masonry fireplace foundation (1940s); brick infilled (1960s) window opening with wood lintel (1856) at stairs with penetration for radon piping and electrical conduit for an exterior receptacle.

South: Exposed, unpointed rubble stone with whitewash finish (1856).

West: Exposed, unpointed rubble stone with whitewash finish (1856).

Ceiling: Exposed first floor framing, wood and steel support posts, and underside of floorboards (1856) (see Structural Section).

Windows: None.

Doors: Door 001: Unfinished wood door and frame with two screened panels covered with clear acrylic (post-1960).

Lighting and Electrical: Various joist-mounted single-lamp fixtures (post-1960), a wall-mounted fuse box at northeast corner (post-1960), various security and life safety panels mounted at west wall (post-1960) and one smoke detector (post-1960).

Mechanical: Two oil burning boilers at southeast corner (1962) and two oil tanks at northwest corner (1962). Mechanical equipment penetrate the east wall.

Plumbing: Well water pressure tank located underneath steps; electric water heater at northeast corner (post-1960).

Other: Unfinished wooden winder stairs to first floor are likely original. The stairs have circular saw marks, which can be found in buildings from as early as the 1830s.

Historic Features and Finishes (prior to 1948 restoration):

Floor: Earthen floor (1856-1968).

Walls: All walls were exposed, unpointed rubble stone with whitewash finish.

Ceiling: Exposed underside of first floor boards and framing with hand-hewn joist timbers (mid-span beams likely added later).

Windows: Window opening on east wall at stair.

Other: Wooden winder stairs to first floor.

Fireplace: Fireplace foundation. Later infill.

Figure 57: The stringer has settled, creating a gap at on the exterior stone wall.

First Floor

Room 101 – Living Room

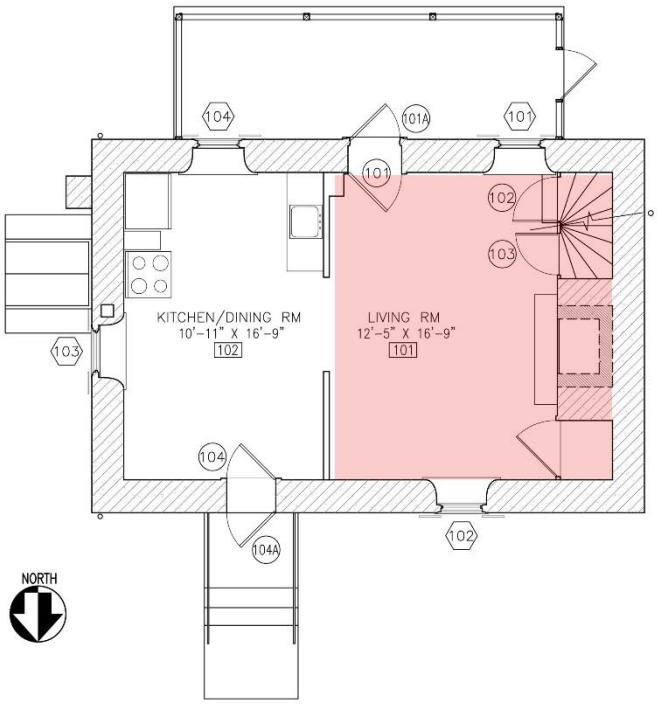


Figure 58: Overview of Living Room showing main entrance on left and doors to basement and first floor stairs on right.

Figure 59: Overview of staircases, fireplace and built-in cabinet in Living Room.

Figure 60: Overview of Window 102 in Living Room and detail of staircase (right).

Historic Use(s): Living Room (1856-present)

Existing Features and Finishes:

Floor: 2 ¼-inch oak strip flooring (1948), laid north-south, blind-nailed with polyurethane finish (1960) over random-width (4”-12”) yellow pine flooring (1856) laid east-west. There is a plywood patch (approx. 15 square feet) at fireplace hearth, likely from removal of stove and/or burned flooring (1970).

Cabinet: 3-inch oak strip flooring (1948) laid north-south, face-nailed over random-width (4”-12”) yellow pine flooring (1856) laid east-west.

Hearth: Brick running bond (north-south) (mid-20th century).

Walls: North: Plaster on masonry with painted finish, beaded wood baseboard at northwest corner (1856) and modern wood beaded baseboard at northeast corner (mid-20th century). The baseboard is interrupted by a radiator cover and the back of the board has a routed channel to accept electrical conduit.

East: North end is plaster on wood lath over vertical staggered wood plank framing (9 ¾” x 1 5/8”) with painted finish and wood beaded baseboard (mid-20th century). The back of the baseboard has a routed channel to accept electrical conduit. South end is plaster board on vertical staggered wood plank framing (9 ¾” x 1 5/8”) and wood stud framing at former door location (mid-20th century) and painted finish.

South: Plaster on masonry (1856) with painted finish and modern wood beaded baseboard (mid-20th century). The baseboard is interrupted by a radiator cover and the back of the board has a routed channel to accept electrical conduit.

West: Wood beaded board and batten doors and trim on wood framing and plaster on masonry (1856) with painted finish.

Ceiling: Textured coating (mid-20th century) over plaster (assumed) on lath (unknown) over second floor wood framing (1856) with painted finish.

Windows: Window 101 (south wall): Wood window frame with splayed rounded plaster jambs, wood stool with beaded apron and interior 3" beaded trim (1856); nine-over-six, true divided light, single-hung wood sashes (1856); weatherstripping (1968); exterior-mounted aluminum triple-track storm window (post-2000).

Window 102 (north wall): Wood window frame with splayed rounded plaster jambs, wood stool with beaded apron and interior 3" beaded-board trim (1856); nine-over-six, true divided light, single-hung wood sashes (1856); weatherstripping (1968); exterior-mounted aluminum triple-track storm window (post-2000).

Doors: Door 101: Inward-opening, four recessed flat-paneled exterior (beaded flush panels on interior) wood door (1856); Box lock with interior porcelain or enamel knob and exterior brass knob (date unknown); chain night latch and single cylinder deadbolt (all post-1948); exterior brass door knocker (date unknown); interior 3" beaded board and flat trim (1960); exterior flat trim and aluminum weather-stripping (1960).

Door 101A: Outward-opening, flat hollow metal exterior door and frame (1970); modern deadbolt and knob (1970).

Door 102: Original random width beaded board and chamfered batten wood door (1856) with beaded trim (1960) and painted finish; plain butt hinges and late Victorian-era thumb-latch set (scars from previous hardware visible).

Door 103: Original random width beaded board and chamfered batten wood door (1856) with beaded trim (1960) and painted finish; plain butt hinges and decorated late Victorian-era thumb-latch set (scars from previous hardware visible).

Lighting and Electrical: Various surface-mounted conduits, switches and outlets on all walls (1960); security and fire safety fixtures on south wall (1977); sconce at stairs to basement mounted on underside of stairs to second floor (1960); loose cable and wiring from basement to built-in cabinets (1960); one ceiling-mounted smoke detector (1977).

Mechanical: HVAC 12"x12" ceiling-mounted register (1970) open to floor register at second floor (no ductwork); radiators at north and south walls (1970).

Plumbing: Chase in southeast corner and pipe in northeast corner of built-in cabinets.

Other: Fireplace with a brick surround infilled with gypsum wall board on wood framing (presumed) (1856, infilled 1970s); wood mantel backboard (1856), simple wood block brackets and rounded trim on a beaded board mounting board capped by a flat board mantel shelf with rounded corners and edges (mid-20th century).

Built-in cupboard and lower cabinet with random width board and batten wood doors (1856), iron thumb-turn cabinet hardware (1970s) and a painted finish (post-1970).

Stairs: Wood winder stairs to second floor (1856); painted risers and stained tread finishes.

Historic Features (prior to 1948 restoration):

Floor: Random-width (4”-12”) yellow pine flooring laid east-west.

Walls: North and south: plaster on masonry; east: plaster on wood lath over wood plank framing; west: masonry on plaster with bead board wall.

Windows: Windows 101 and 102: Single-hung, nine-over-six, true divided light wood sashes, frame and trim; spring sash lock.

Doors: Doors 102 and 103: Wood board and batten doors; late Victorian-era hardware (scars from previous hardware visible).

Other: Fireplace: Original size and appearance unknown.

Stairs: Wood winder stairs to second floor.

Room 102 – Kitchen

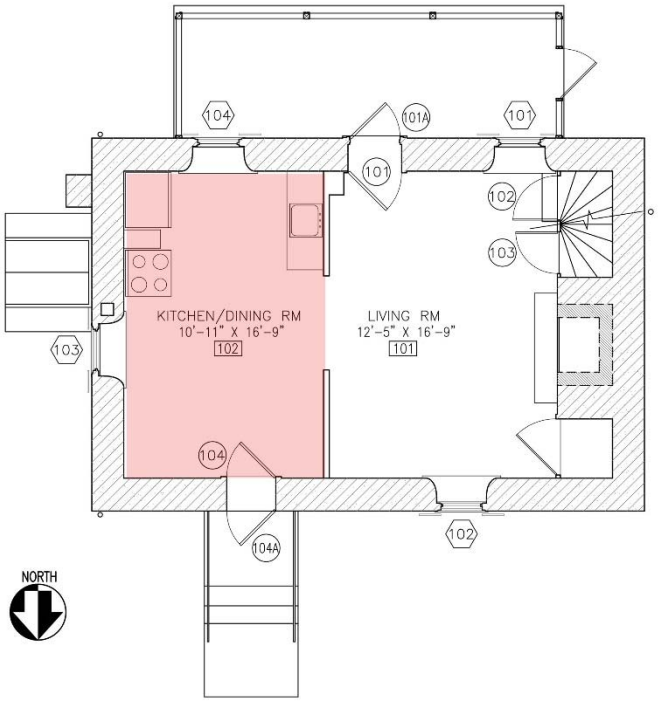


Figure 61: Overview of Kitchen and Dining Area.

Historic Use(s): Kitchen (1856-1940s)
Kitchen and Dining (1940s -present)

Existing Features and Finishes:

Floor: 12”x12” ceramic tile on thinset mortar over plywood subfloor (presumed) (mid- to late-20th century) over face-nailed random-width (4”-12”) yellow pine flooring (1856) laid east-west.

Walls: North: Plaster on masonry (1856), modern wood beaded baseboard (mid-20th century) and painted finish.

East: Plaster on masonry (1856), modern wood beaded baseboard (mid-20th century) and painted finish.

South: Plaster on masonry (1856), modern wood beaded baseboard (mid-20th century) and painted finish.

West: North end is plaster on wood lath over vertical staggered wood plank framing (9 ¾” x 1 5/8”) with painted finish and wood beaded baseboard (mid-20th century). South end is plaster board over vertical staggered wood plank framing (9 ¾” x 1 5/8”) and wood framing at former door location (mid-20th century) and painted finish.

Ceiling: Textured coating (mid-20th century) over plaster (assumed) on lath (unknown) over second floor wood framing (1856) with painted finish.

Windows: Window 103 (east wall): Wood window frame with splayed rounded plaster jambs, board stool with beaded apron and interior 3” beaded-board trim (1856); nine-over-six, true divided light, single-hung wood sashes (1856); weatherstripping (1968); exterior-mounted aluminum triple-track storm window (post-2000).

Window 104 (south wall): Wood window frame with splayed rounded plaster jambs, board stool with beaded apron and interior 3” beaded-board trim (1856); nine-over-six, true divided light, single-hung wood sashes (1856); weatherstripping (1968); exterior-mounted aluminum triple-track storm window (post-2000).

Doors: Door 104: Two-panel, nine-light, inward-opening exterior wood door with modern deadbolt and locking knob (1960s).

Door 104A: Aluminum screen door (1960s).

Lighting and Electrical: Various surface-mounted conduit, switches, and outlets on north, east, and west walls (mid-20th century); security and fire safety fixtures on north wall (1977); Ceiling-mounted fan and light (1990).

Mechanical: Radiators at east and south walls and range hood at east wall.

Plumbing: Hot and cold water supply and drain beneath sink in southwest corner.
Other: Arched opening in west wall to Living Room (mid-20th century).

Stained finish wood kitchen cabinets and laminate countertop (mid-20th century) at east and west walls with electric range and refrigerator (1990).

Historic Features (prior to 1948 restoration):

Floor: Random-width (4”-12”) yellow pine flooring laid east-west (1856).

Walls: North, east and south: plaster on masonry; west: plaster on wood lath over vertical staggered wood plank framing.

Windows: Windows 103 and 104: Single-hung, nine-over-six, true divided light wood sashes, frame and trim; upper sash stick, spring sash stop; Door 104 was added in 1948, replacing an original window.

Second Floor

Room 201 – Stair and Hall

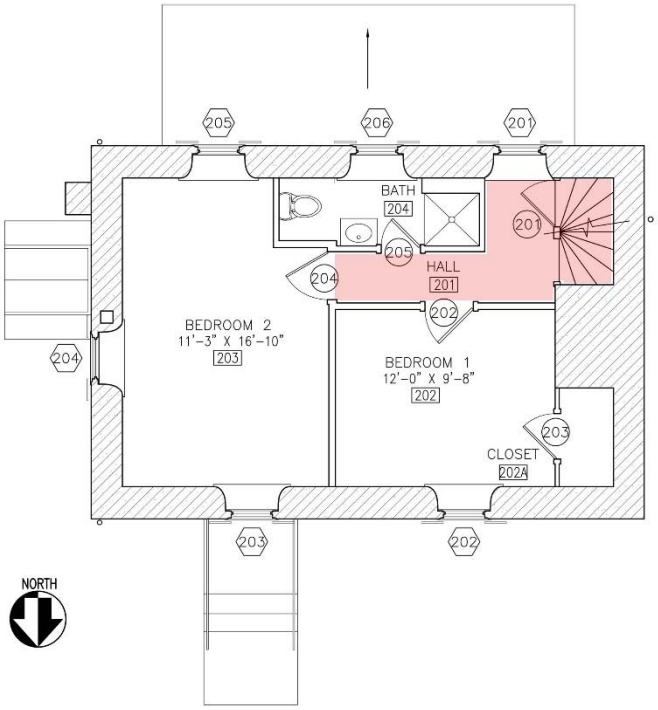


Figure 62: Overview of Hall 201 including door of Attic staircase (middle).

Historic Use(s): Hall (1856-present); size varied.

Existing Features and Finishes:

Floor: Wall-to-wall carpet over random-width (4”-12”) yellow pine flooring laid east-west (1856) face-nailed at +/- 29 inches on center; polyurethane finish (mid-20th century).

Walls: North: Plaster on wood lath over vertical staggered wood plank framing (presumed), beaded wood baseboard with cut nails (1856) and painted finish.

East Wall (south portion): Gypsum wallboard over wood framing; modern beaded baseboard (1948); painted finish.

South wall: East side: Gypsum wall board on wood framing, modern beaded baseboard (1948) and painted finish.

West side: Plaster on masonry and beaded wood baseboard with cut nails (1856) and painted finish.

West: Plaster on masonry and beaded wood baseboard with cut nails (1856) and painted finish.

Ceiling: Textured coating (mid-20th century) over plaster (assumed) on lath (unknown) over attic framing (1856) with painted finish.

Windows: Window 201 (south wall): Wood window frame with splayed rounded plaster jambs, board stool with beaded apron and interior 3” beaded-board trim (c. 1856); six-over-six, true divided light, single-hung wood sashes (mid-20th century); weatherstripping (1968); exterior-mounted aluminum triple-track storm window (post-2000).

Doors: Door 201: Original random-width beaded board and chamfered batten wood door (1856) with beaded board trim (1959) and painted finish; plain butt hinges and decorated late Victorian-era thumb-latch set (scars from previous hardware visible).

Lighting and Electrical: One wall mounted sconce (1977) at south wall; one square recessed ceiling light fixture (1977); one blank ceiling-mounted electrical plate (1977); various wall mounted fire safety and security fixtures (1977) at south wall; ceiling-mounted smoke detector (1977).

Mechanical: 12”x12” HVAC floor register (1970) open to ceiling register at first floor (no ductwork).

Plumbing: None.

Other: Stairs: Unfinished wood winder stairs to attic (1856).

Historic Features (prior to 1948 restoration):

Floor: Random-width (4”-12”) yellow pine flooring laid east-west.

Walls: South wall: plaster on masonry and wood baseboard.
North wall: Plaster on wood lath over vertical staggered wood plank framing.

Windows: Window 201: Single-hung, six-over-six, true divided light wood sashes, frame and trim; upper sash stick, spring sash stop.

Doors: Door 201: Wood board and batten doors; hardware (date unknown).

Other: Wood winder stairs to attic.

Room 202 – Bedroom 1

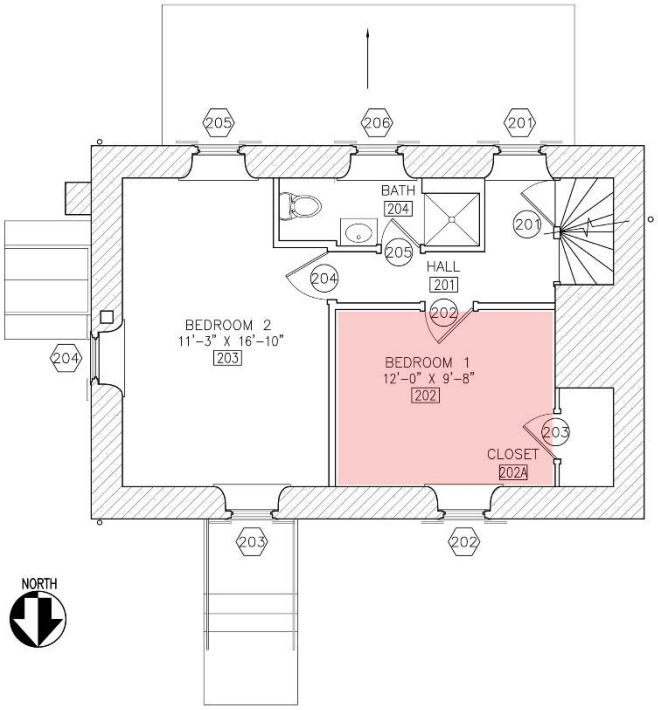


Figure 63: Overview of Bedroom 202.

Historic Use: Bedroom (1856-present)

Existing Features and Finishes:

Floor: Wall-to-wall carpet (post-1970) over random-width (4”-12”) yellow pine flooring face-nailed laid east-west (1856) and polyurethane finish (mid-20th century).

Walls: North: Plaster on masonry (1856) with a painted finish.

East: Plaster on wood lath over vertical staggered wood plank framing (presumed), beaded wood baseboard with cut nails (1856) and painted finish.

South: Plaster on wood lath on vertical staggered wood plank framing (presumed), beaded wood baseboard with cut nails (1856) and painted finish.

West wall: South side: Plaster on masonry and beaded wood baseboard with cut nails (1856) and painted finish.

North side: Plaster on saw-cut wood lath over wood framing, beaded wood baseboard with cut nails (1856) and painted finish.

Ceiling: Textured coating (mid-20th century) over plaster (assumed) on lath (unknown) over attic framing (1856) with painted finish.

Windows: Window 202 (north wall): Wood window frame with splayed rounded plaster jambs, board stool with beaded apron and interior 3" beaded-board trim (c. 1856); six-over-six, true divided light, single-hung wood sashes (1959); weatherstripping (1968); exterior-mounted aluminum triple-track storm window (post-2000).

Doors: Door 202: Wood random-width flat board and batten wood door (mid-20th century) with beaded board trim (1856) and painted finish; plain late Victorian-era butt hinges and thumb-latch set (scars from previous hardware visible).

Door 203: Wood random-width beaded board and chamfered batten wood door (1856) with beaded board trim (1856), painted finish; plain butt hinges and late Victorian-era thumb-turn latch (scars from previous hardware visible).

Lighting and Electrical: Various surface-mounted conduit, switches, and outlets on north, east, and west walls (mid-20th century); one wall-mounted sconce at south wall.

Mechanical: Hot water baseboard heater on north wall (1960s).

Plumbing: None.

Historic Features (prior to 1948 restoration):

Floor: Random-width (4"-12") yellow pine flooring laid east-west.

Walls: North wall: Plaster on masonry.

East wall: Plaster on wood lath over vertical staggered wood plank framing.

South wall: Plaster on wood lath over vertical staggered wood plank framing.

West wall: South side: Plaster on masonry and wood baseboard.

North side: Plaster on saw-cut lath on wood framing and wood baseboard.

Windows: Window 201: Single-hung, six-over-six, true divided light wood sashes, frame and trim; upper sash stick and spring sash stop.

Doors: Door 202: Flat board and batten door likely is a replacement or later installation. The discrepancies from other doors include: flat boards (no bead); flat battens (no chamfer); machine-planed; butt hinges installed with bolt on batten side versus board side; no scarring from previous hardware.

Door 203: Wood board and batten doors; hardware (date unknown).

Room 202A – Closet

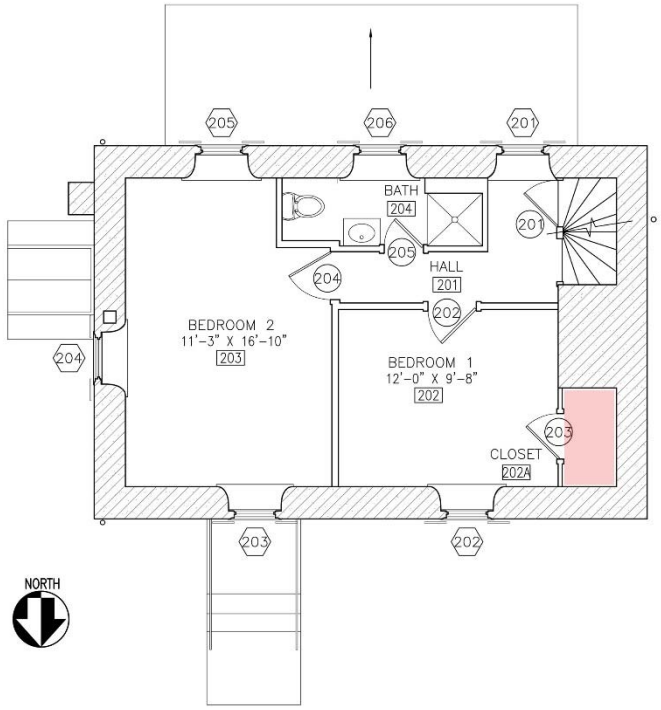


Figure 64: Overview of closet (left) and detail of closet shelving on north wall (right).

Figure 65: Details of beaded rails in Closet 202A.

Historic Use(s): Closet (1856-present)

Existing Features and Finishes:

Floor: Random-width (4”-12”) yellow pine flooring laid east-west, face-nailed with cut nails (1856) and polyurethane finish (mid-20th century).

Walls: North: Plaster on masonry (1856) with painted finish, board cleats and shelving (see below).

East: Plaster on wood lath on wood framing; beaded board chair and hat rails with cut nails and painted finish (see below).

South: Plaster on masonry chimney mass (1856) with painted finish.

West: Plaster on masonry (1856), beaded board chair and hat rails with cut nails and painted finish (see below).

Ceiling: Plaster (date unknown) on wood lath (assumed) over attic framing (1856) with a painted finish.

Windows: None.

Doors: None.

Lighting and Electrical: One square recessed ceiling light fixture (mid-20th century) and wires exposed from hole in ceiling.

Mechanical: None.

Plumbing: None.

Other: Closet Shelving System: The rail on the west wall is original and the beaded rail on the south wall is not original. The rail on the west wall continues the entire length of the wall and the south rail has been added. Though the beads on the south wall are similar, they are larger than the original beads on the west wall. The upper rail on the south wall measures 2 ¾” with a 3/8” bead and the lower rail measures 3 1/8” with a 5/16” bead. Both rails on the west wall measure 3 3/16”, each

with a 5/16” bead. The finish analysis (Appendix B) revealed a blue paint dating to the turn of the 20th century.

Historic Features (prior to 1948 restoration):

Floor: Random-width (4”-12”) yellow pine flooring laid east-west.

Walls: North, west and south: plaster on masonry; east: plaster on saw-cut wood lath and framing; beaded board chair and hat rails and cut nails.

Ceiling: Plaster on wood lath (assumed) over wood attic floor framing.

Room 203 – Bedroom 2

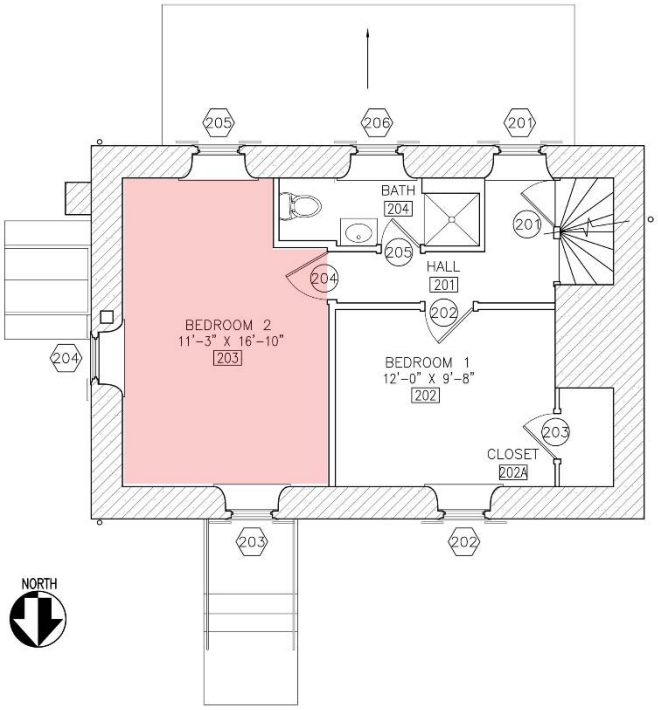


Figure 66: Overview of Room 203.

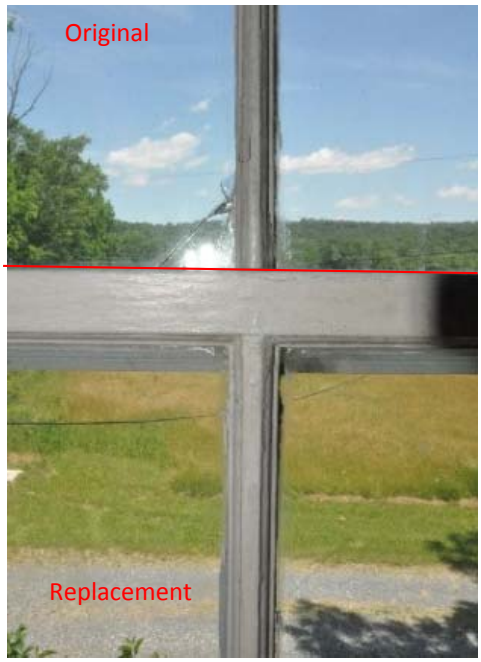


Figure 67: Detail of Window 203 showing newer muntin profile versus original.

Historic Use(s): Bedroom (1856-present)

Existing Features and Finishes:

Floor: Wall-to-wall carpet (mid-20th century) over random-width (4”-12”) yellow pine flooring laid east-west (1856) face-nailed at +/- 29 inches on center.

Walls: North: Plaster on masonry (1856) with a painted finish.

East: Plaster on masonry (1856) with a painted finish.

South wall: East side: Plaster on masonry and modern wood beaded baseboard (1948) and painted finish.

West side: Gypsum wall board on wood framing (1948) with a painted finish.

West wall: North side: Plaster on wood lath over vertical staggered wood plank framing (presumed), beaded wood baseboard with cut nails (1856) and a painted finish.

South side: Gypsum wall board on wood framing (1948) with modern wood beaded baseboard (1948) and a painted finish.

Ceiling: Textured coating (mid-20th century) over plaster (assumed) on lath (unknown) over attic framing (1856) with painted finish.

Windows: Window 203 (north wall): Wood window frame with splayed rounded plaster jambs, board stool with beaded apron and interior 3" beaded-board trim (1856); six-over-six, true divided light, single-hung wood original top sash, and mid-20th century bottom sash, that lack mortised mullions and have a larger profile than the other house windows (mid-20th century); weatherstripping (1968); exterior-mounted aluminum triple-track storm window (post-2000).

Window 204 (east wall): Wood window frame with splayed rounded plaster jambs, wood stool with beaded apron and interior 3" beaded-board trim (1856); six-over-six, true divided light, single-hung wood sashes (mid-20th century); weatherstripping (1968); exterior-mounted aluminum triple-track storm window (post-2000).

Window 205 (south wall): Wood window frame and with splayed rounded plaster jambs, board stool with beaded apron and interior 3" beaded-board trim (1856); six-over-six, true divided light, single-hung wood sashes (mid-20th century); weatherstripping (1968); exterior-mounted aluminum triple-track storm window (post-2000).

Doors: Door 204: Random-width wood beaded board and chamfered batten wood door (1856) with beaded board trim (1856) and painted finish; plain butt hinges and late Victorian-era decorated thumb latch set (scars from previous hardware visible).

Lighting and Electrical: Various surface-mounted conduit, switches, and outlets on all walls (mid-20th century); one wall-mounted sconce and recessed baseboard outlet at west wall (mid-20th century).

Mechanical: North, east and south walls: Hot water baseboard heater (1960s).

Historic Features (prior to 1948 restoration):

Floor: Random-width (4"-12") yellow pine flooring laid east-west.

Walls: North, east and south: plaster on masonry; west: plaster on saw-cut wood over vertical staggered wood plank framing.

Windows: Windows 203, 204 and 205: Single-hung, six-over-six, true divided light wood sashes, frame and trim; upper sash stick and spring sash stop.

Doors: Wood board and batten doors; non-original hardware (date unknown).

Room 204 – Bath

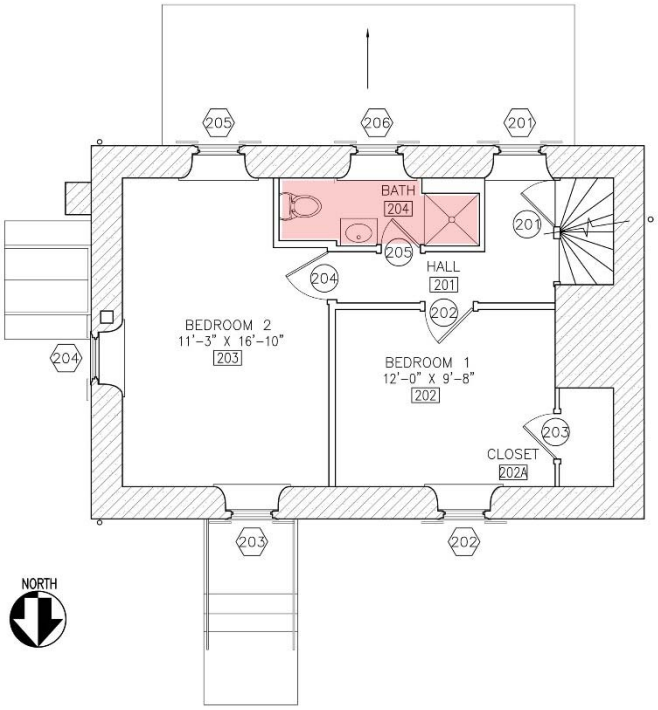


Figure 68: Overview of Bathroom 204.

Historic Use(s): NA (previously part of Rooms 201 and 203)
Bathroom (1940s – present)

Existing Features and Finishes:

Floor: 8”x8” ceramic floor tile on thin set mortar over plywood subfloor on random-width (4”-12”) yellow pine flooring laid east-west (1856) (presumed).

Walls: North: Gypsum wall board on wood framing (1948) with a painted finish and tile baseboard (late-20th century).

East: Gypsum wall board on wood framing (1948) with a painted finish and tile baseboard (late-20th century).

South: Plaster on masonry (1856) with painted finish and tile baseboard (late 20th-century).

West: Gypsum wall board on wood framing (1948) with a painted finish and tile baseboard.

Ceiling: Plaster (date unknown) on wood lath (assumed) over attic framing (1856) with painted finish.

Windows: Window 206 (south wall): Wood window frame with splayed rounded plaster jambs; board stool with beaded apron and interior 3" beaded-board trim (1856); six-over-six, true divided light, single-hung wood sashes (mid-20th century); weatherstripping (1968); exterior-mounted aluminum triple-track storm window (post-2000).

Doors: Door 205: Two, recessed flat-panel wood door with beaded board trim (1948) with painted finish, glass door knob and metal escutcheon with key lock.

Lighting and Electrical: Two square recessed ceiling fixtures (mid-20th century); wall-mounted medicine cabinet with light (mid-20th century); surface-mounted electrical conduit and switches and recessed outlet on north wall (mid-20th century).

Mechanical: One square recessed ceiling exhaust fan (mid-20th century) and hot water baseboard heater on south wall (1960s).

Plumbing: Sink and vanity with mounted faucet; acrylic shower base and walls with wall mounted controls and shower head; water closet (late-20th century).

Historic Features (originally part of Rooms 201 and 203):

Floor: Random-width (4"-12") yellow pine flooring laid east-west.

Walls: South wall: plaster on masonry.

Window 206: Single-hung, six-over-six, true divided light wood sashes, frame and trim; upper sash stick and spring sash stop.

Attic

Room 301 – Attic

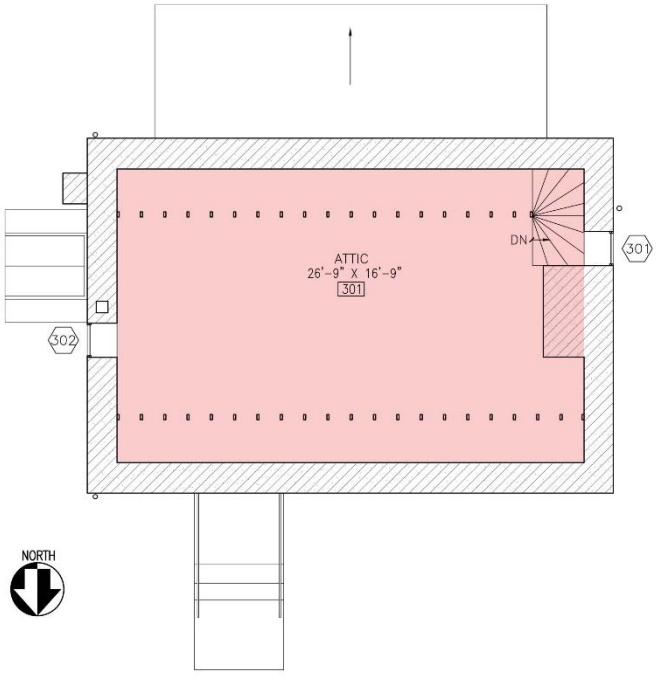


Figure 69: East gable end of attic with original window (left) and west gable end showing stair and original window (right).

Figure 70: Plumbing vent stack exits at roof (left) and ccarpenters' marks on roof rafters (right).

Figure 71: Insulation in the attic includes fiberglass and mineral wool.

Historic Use(s): Attic/storage (1856-present)

Existing Features and Finishes:

Floor: Unfinished random-width (4"-12") yellow pine flooring face-nailed and laid east-west.

Walls: North: Unfinished wood 24" high knee wall, 2'-10" high (mid-20th century); rubble stone masonry with parging (1856) and a painted finish.

East: Rubble stone masonry (1856) with parging and a painted finish.

South: Unfinished wood 24" high knee wall, 2'-10" high (mid-20th century); rubble stone masonry (1856) with parging and a painted finish.

West: Exposed rubble stone masonry (1856) with parging and a painted finish.

Ceiling: Exposed wood roof rafters and shingle lath (1856). All but two pairs of the rafters have carpenter's marks. These two pairs are butt-joined, suggesting that they are replacements. The underside of the roof is also visible.

Windows: Window 301 (west wall): Inward opening four-light, true divided light casement (1856); wood lintel and mortise and tenon frame; face mounted hinges and miscellaneous hardware for window treatments.

Window 302 (east wall): Inward opening four-light, true divided light casement (1856); wood lintel and mortise and tenon frame; face frame hinges and curtain hardware.

Doors: None.

Lighting and Electrical: Various joist-mounted single-lamp fixtures (post-1960); one smoke detector (post-1960).

Mechanical: Flexible vent pipe for 2nd floor bathroom exhaust from attic floor through to cornice (1970).

Plumbing: Vent stack penetrating from attic floor through roof (1948).

Historic Features (prior to 1948 restoration):

Floor: Random-width (4"-12") yellow pine flooring laid East-West.

All walls: Parged masonry.

Ceiling: Exposed wood roof rafters with mortise and tenon joints with carpenter's marks.

Windows: Wood, four-light, true divided light casement windows.

Structural Physical Description

General Description

The Nathan Care house is approximately 30'-1 x 20'-4". The house consists of a basement, first floor, second floor and attic. The basement foundation walls consist of mortared, rubble stone. The basement walls continue up through the house on the exterior to the roof line. Above grade, the main walls of the house are covered with stucco. The south side of the house has a wood framed screened porch approximately 21'-0' by 6'-10". The eave height of the house is approximately 18' above grade, and the ridge height is approximately 25' above grade. The first and second floors for the house are framed with wood/timber construction. The roof is wood framed with approximately an 8:12 slope.

Figure 72: Nathan Care House from northeast corner.

Exterior

The exterior walls are rubble stone with a stucco covering. On the north elevation, there are two windows upstairs, and one downstairs, with a 3' wide by 7' tall door. A door is located on the northeast corner of the house and is not part of the original construction. Below the door on the northeast corner of the house, a concrete stoop was added to access the door (Figure 73). The stoop has wrought iron hand rails. On the southeast side of the house is a chimney, not original, that services the furnace for the house. The chimney appears to be concrete masonry units with a stucco finish (Figure 74).

Figure 73: Concrete steps at north elevation.

Figure 74: Stuccoed CMU chimney on southeast corner.

Porch

The south elevation of the house includes a wood framed porch. Based on the areas that were exposed, the floor of the porch is framed with 4” wide by 6” deep dimensioned lumber spanning east-west and spaced at approximately 1’-8” on center. The beams rest on a stone masonry foundation wall on the east side, and by stone piers on the west face and at mid span of the beams. Access beneath the porch was limited to the southwest side, and inspection of the center and west piers was not possible. The floor of the porch slopes away from the house for drainage.

The roof of the porch is supported by four 4x3½ posts equally spaced on the south face of the porch (Figure 75). The main roof rafters are 2” wide by 3 ½” deep and span north-south, spaced approximately 2’-0” on center. The roof rafters are supported by 4½ by 4½ girder spanning across the top of the posts on the south face, and by a 2 ½x4 deep ledger beam on the north side. The ledger beam is anchored to the exterior face of the house by steel or cast iron bolts extending into the stone at approximately 4’-0" on center.

Figure 75: Porch on south side of house (left) and porch roof framing (right).

Basement

The basement of the house is accessible by interior stairs from the southwest corner and by exterior stairs on the east side. The basement has a concrete slab on grade floor and floor to floor height of 5'-7"+/- to the bottom of the joists. There is an 8' x 3'-6" concrete pad on the southeast side of the basement that the furnace for the house rests on. A 10" deep by 15" wide rubble stone pilaster is locate along south wall and supports a plumbing chase, but does not appear to be structural. The fireplace foundation is constructed of mortared stone also.

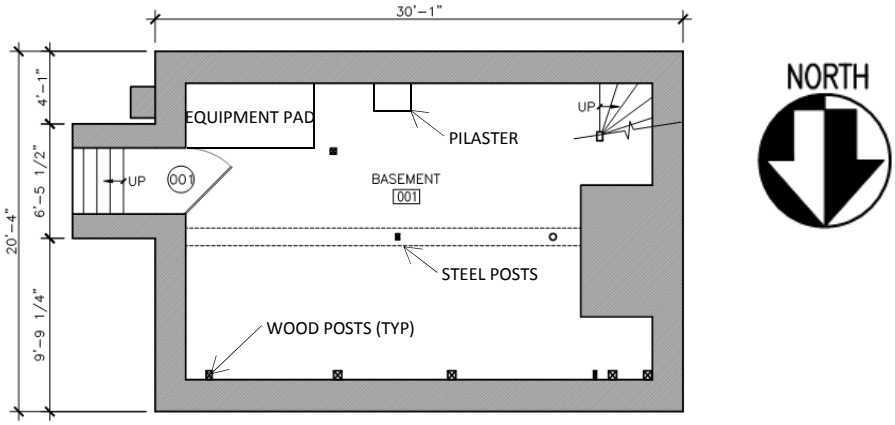


Figure 76: Basement plan.

The first floor joists are exposed and consist of 6" high by 8" wide timbers that span north-south and are spaced from 30" to 32" on center (Figure 77). The main joists are rough hewn and are likely original to the house (mid19th century). A floor girder running east-west rests approximately 7'-10" off the north wall and is 10" wide by 6" deep, and supports the joists approximately at their centerline. Similar to the joists, the girder is also rough hewn and likely original to the house (mid19th century). The girder is supported by a steel post tube measuring 4" x 2 ½" approximately at mid span. The post is connected to the girder with a ¼" cap plate, with four modern ¼" lag screws, and bears at the base on a ¼" base plate

which bears on the concrete slab. The girder is also supported by a 4 ½" diameter galvanized steel pipe on the west side. The steel pipe is connected at the top to the girder with a ¼" cap plate with four modern ¼" lag screws. The base of the pipe appears to be embedded into the concrete floor at the base. Both steel columns are not original to the house, and based on finishes, it is likely that they were added in the mid- to late-20th century. The east side of the girder is pocketed into the basement wall. The floor boards above run east-west across the floor joists and are 4" to 12" wide by 1" thick.

One of the floor joists has been cut on the south side of the house to install what appears to be a floor opening that has since been covered (Figure 77). The timber that has been cut is supported on the south by a 4" x 4" dimensioned lumber post. The post is nailed to the timber above, and rests on the concrete slab at the base. The north end of the opening is supported by the girder running east-west. This lumber framing out the opening exhibits circular saw marks (early 20th century).

Figure 77: Typical floor joist (left) and cut floor timber at blockout (right).

Along the north side of the house, the floor joists are supported by a wood beam and post (Figure 78). The beam is approximately 5 ½" deep by 6" wide, and runs the full east-west length of the house. The posts and beams do not appear to be original to the construction of the house and exhibit circular saw marks (early 20th century). Some of the posts supporting the floor joists on the north end appear to have been replaced with conventional wood framing (mid to late 20th century). The beam is dimensioned lumber approximately 6" wide by 3" deep, and rests on various posts, mostly consisting of 4" by 6" dimensioned lumber, with spacing varying from 8'-6"(maximum) to 6'-6"(minimum) on center. Additional floor joists spaced approximately half way between the original floor joists have been installed along the north side of the girder and do not appear to be original to the house construction. These floor joists, which are dimensioned lumber, are approximately 3" wide by 5" deep. It is estimated that these new floor joists were installed at the same time as the new beam running along the north wall. According to the 1962 Historic Structures Report, the joists were repaired. This report specifies that the timbers were rotting at the ends and were likely attacked by powder post beetles. The report also recommended that new floor joists should be installed, which appears to only to have been done on the north side of the house as noted above.

The winder stairs leading from the basement to the first floor are constructed with unfinished wood. The stairs are supported in the center by a 2" x 6" central post. The stairs also are supported on the

outside by 2” x 4” wood framing and posts, which extend down to the foundation slab. The center post for the stairs exhibits circular saw marks and appears to be original to the house (mid-19th century). The framing on the outside is likely not original, and appears to be conventional framing sizes (mid- to late-20th century).

Figure 78: Additional post/girder along north face, with additional framing.

First Floor

The first floor of the house consists of two rooms, the Kitchen/Dining Room on the east and the Living Room on the west side. The Kitchen/Dining Room has tile flooring that has been installed. There is a wall running north-south that divides the two rooms and is made of wood construction. A fireplace made of mortared stone foundation walls and brick veneer is located on the west end of the Living Room. The firebox has been closed off. Due to potential asbestos in the ceiling plaster of the first floor, no demolition of the ceiling was allowed during this assessment. Limited access was available for assessing the framing of the second floor.

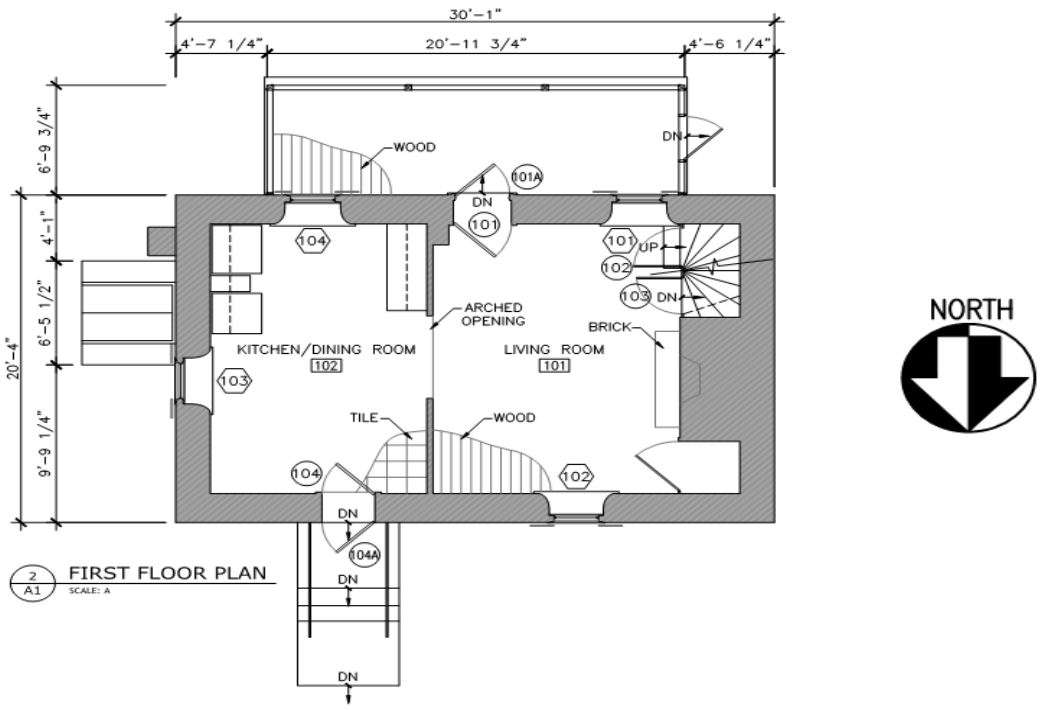


Figure 79: First floor layout.

Second Floor

Access to the second floor is by the winder staircase in the southwest corner of the house. As previously mentioned, the ceiling plaster likely contains asbestos, so information on the framing of the second floor was limited. Floor depth was measured at the stairs and through a heating register located in the hallway on the second floor. The total floor depth was measured to be 11". The floor boards were measured to be 1" deep, and the main framing was measured at 9" deep. Areas of the carpet were removed in the south west corner by the stairs and in the northwest corner of Room 202. Based on the areas exposed, the main floor boards are random-width and run east-west in the house. Nail patterns for the floor boards were also noted in these areas, indicating that the main floor joists for the house span north-south and are approximately spaced 27"-28" on center. Based on information gathered, and from framing on the attic floor, it is assumed that the floor framing is 3" wide by 9" deep; clear spanning north- south across the house to the exterior walls.

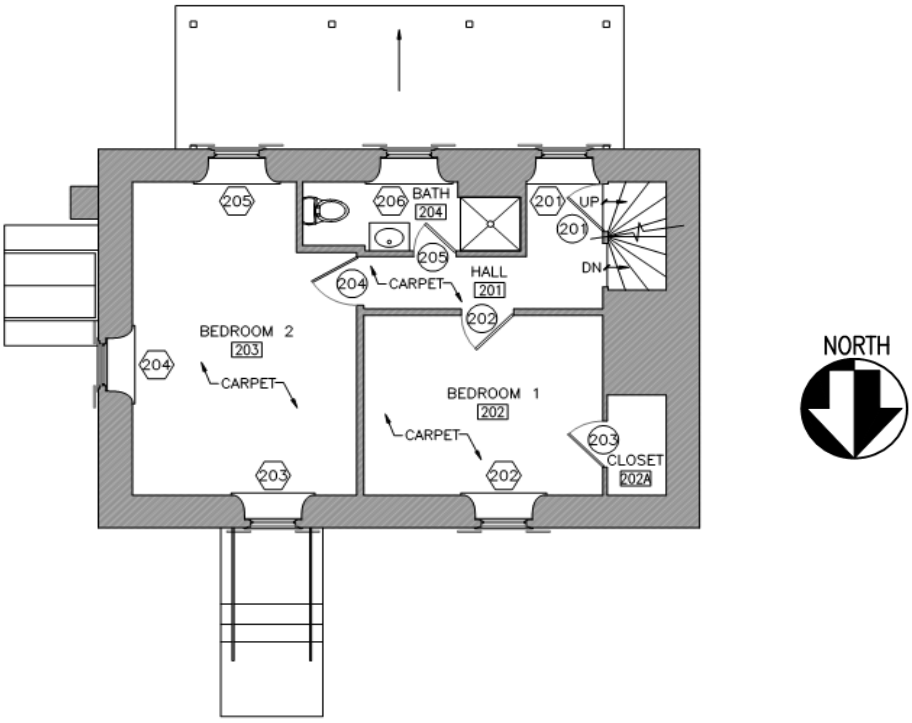


Figure 80: Second floor plan.

In the second floor hallway (Room 201) carpet was pulled up in the southwest corner. Nailing patterns indicate that framing in this area is also spaced at 28" and running north-south. The walls of the hallway are running perpendicular to framing both above and below. It is unknown if these walls are load bearing or if they are independent of the attic framing above. Further investigation is recommended into the bearing condition of these walls.

In Room 202, carpet was pulled up in the northwest corner next to the closet. Nail patterns in the floor were measured at 27"+/- in this area. In Room 203, no carpet was pulled up to see floor framing. As previously mentioned, no demolition of the ceiling plaster was allowed to expose the attic framing from below. Access to the framing and condition of this room was limited. No walls or framing were visible in this area, and no major cracking was noted.

Attic

The Attic is accessible via the stair in the southwest corner of the house (Figure 81). The Attic has a clear height at the ridge of approximately 6'-6". The roof slope was measured to be approximately 8:12 and is gabled. Typical roof rafters were measured to be 4" deep by 2 ¾" wide running north-south and spaced from 19" to 26" on center. The roof rafters are tied together at the top by a pegged mortise and tenon joint. The roofing is framed out with 1" tall by 2" wide shingle lath running east-west and spaced at approximately 8" on center. The sheathing lath is nailed with square shank nails. Based on the tool marks and nails used, the roof framing is likely original to the house (mid19th century). A knee wall has also been added to the roof faming which is not part of the original construction. The knee wall consists of a 2" x 4" nominal dimensioned lumber post at each roof rafter (mid to late 20th century), connected at

the joists with modern common nails. The knee wall rests on a 2”x4” bottom plate that runs east-west and rests on the attic floor boards.

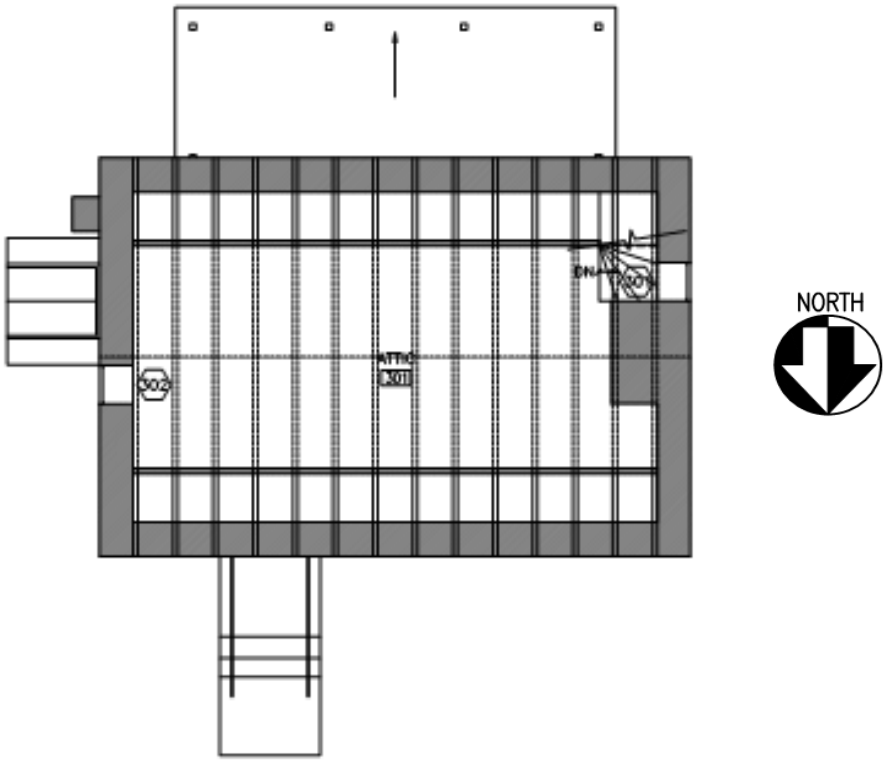


Figure 81: Attic plan/roof framing.

Figure 82: Roof framing connection at top (left) and shingle lathe, rafters, and knee wall (right).

Access to the framing for the attic floor was limited due to potential asbestos in the second floor ceiling plaster. Further investigation is recommended in this area to verify that the framing for the attic is still in good condition. Flooring for the attic spaced consists of random-width floor boards. Joists for the floors are running north-south. One of the floor boards in the southwest corner of the attic was loose and

removed to examine the floor framing (Figure 83). Floor joists at this location were measured to be 3” wide by 8” deep, and spaced at 1’-11” (+/-) on center.

Figure 83: Exposed attic floor framing.

1.1.4.A Evaluation of Significance for the Nathan Care House

The significance of historic properties is evaluated in accordance with guidelines set forth by the National Park Service and reflected in the National Register of Historic Places, the official list of those places and structures deemed most worthy of protection and preservation. The guidelines require that the resource retain the integrity of its location, setting, design, workmanship, feeling and association and that it be:

A. Associated with events that have made a significant contribution to the broad patterns of our history; or

B. Associated with the lives of significant persons present or past; or

C. Representative of the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. An existing or potential source of information important in history or prehistory.

The Nathan Care House possesses significance for contributing to Hopewell Furnace National Historic Site under Criterion A. The house is associated with the events that took place at the iron furnace from the middle of the 19th century to the turn of the 20th century. The property was owned by two people who held the 'founder' position at different times at Hopewell Furnace, John Painter and Nathan Care, and although the house was not originally part of the furnace, it has always been associated with the site.

In addition to satisfying the criteria of association discussed above, a historically significant property must also possess integrity of its location, materials, design, workmanship and association. The Federal Government acquired Hopewell Furnace National Historic Site in 1935, protecting the site from development of roads, buildings and signage. The Nathan Care House retains sufficient integrity to convey its significance.

The **Location** of the property has not changed since its construction in the middle of the 19th century. The developmental history of the building is clearly represented by surviving architectural fabric dating from the period of significance. **Materials** from the mid-19th century are extant, including exterior stone walls, a brick chimney stack, roof framing, wood floors, wood mantel backboard, wood windows and doors. The original exterior woodwork, interior wood-framed plaster partitions, the basement to attic winder stair, and interior woodwork are also extant, although some elements have been partially modified as described in the physical description section. The building's **Design** represents its appearance during its period of significance (mid-19th to early 20th century). The house retains integrity of **Workmanship** in its stonework and framing. Lastly, The Nathan Care House also retains integrity of **Association**. The property remained in the Care family for nearly half a century and the information gathered from the site reflects the building's association with the family and Hopewell Furnace National Historic Site.

1.1.5.A CONDITIONS ASSESSMENT OF THE NATHAN CARE HOUSE

The conditions assessment for the Nathan Care House included visual inspection and probing of various surfaces where accessible. The visual survey was performed at close range and by use of binoculars and high-reach lift for areas not easily accessible, including the roof. Conditions were recorded with photographs and on copies of floor plans and elevations. Typical conditions included deteriorating roof shingles, mold on interior surfaces, paint and plaster deterioration and areas of rotted woodwork. A section of baseboard, carpet and interior plaster were removed on the first and second floors to investigate existing conditions and verify original fabric. One small sample of exterior stucco was removed to determine whether there was original pointing on the exterior stone walls. The stucco was analyzed in the laboratory; it was determined that the lime-based stucco is likely original and contained coal and iron particles.

Exterior

Site

The Nathan Care House is located approximate one-half-mile south of the main buildings at Hopewell Furnace National Historic Site. The house was not originally part of the furnace, however it was owned by the founder at the furnace. The house has been modified and modernized since the Park Service purchased the house. The site has been disturbed by the rerouting of Clement Brooke Lane in the 1960s, creating direct access from Route 345. The Nathan Care House site is relatively level with the grade sloping slightly towards the east, away from the house. The drainage pattern at the site is good, with no standing water around the building or on the interior.

Figure 84: Nathan Care House site and downspout with arrows indicating the direction of water drainage.

On the west side of the house, near the entrance to the screened-in porch, the grade has been compromised. There are large gaps between the fascia board and grade. These “holes” are most likely due to wildlife crawling underneath the structure. The wood porch skirt board is in direct contact with grade at the west and south sides and could lead to rot if not addressed.

Figure 85: Detail views of the west porch entrance conditions.

Paving/Concrete

Paving at the Nathan Care site is limited to a relatively short concrete walkway leading from the gravel road to the entrance door on the north side of the house. The walkway is in fair condition with minor biological growth and several cracks.

Figure 86: Overview and detail of the cracked concrete walkway leading to the house's north entrance.

The cast-in-place concrete entranceway of the house is in poor condition. Many of the risers have shifted, cracked, and dropped significantly (approximately 3" in some areas). The landing has separated from the building and there is a horizontal crack between the landing and the door sill. The iron railing is connected to the concrete steps in six locations, however the iron is rusting, causing the connection to deteriorate. There is also significant biological growth and vegetation throughout the stair structure.

The paved macadam walkway from the gravel road to the porch is in poor condition. It is overgrown with vegetation and stops short of the porch entrance. The stone slab outside the door is in fair condition, but partially buried under dirt and vegetation.

Figure 87: Significant settlement and cracking can be seen at the concrete steps leading to the north entrance.

Masonry

The visible stone masonry at the foundation walls of the house and porch are in good condition overall. The walls appear to be plumb and there is little evidence of major cracking or settlement. The original brick chimney at the west gable shows signs of age but is in overall fair condition. The pointing of the chimney is poorly executed in some areas but is mostly intact. The brick and mortar at the exposed corners and top are exhibiting minor erosion and there are some areas of brick spalling, minor efflorescence and biological growth. Brick at the infilled basement window is in good condition.

Major spalling of the stucco has occurred at the joints of the upper, extended portion of the CMU chimney at the east gable. Obvious repairs have been made and previous cracks have been infilled. The bottom of the chimney is in better condition than the top with only minor spalling at the exposed corners. The visible areas of the chimney foundation at the east façade are in good condition with minor spalling at the corners.

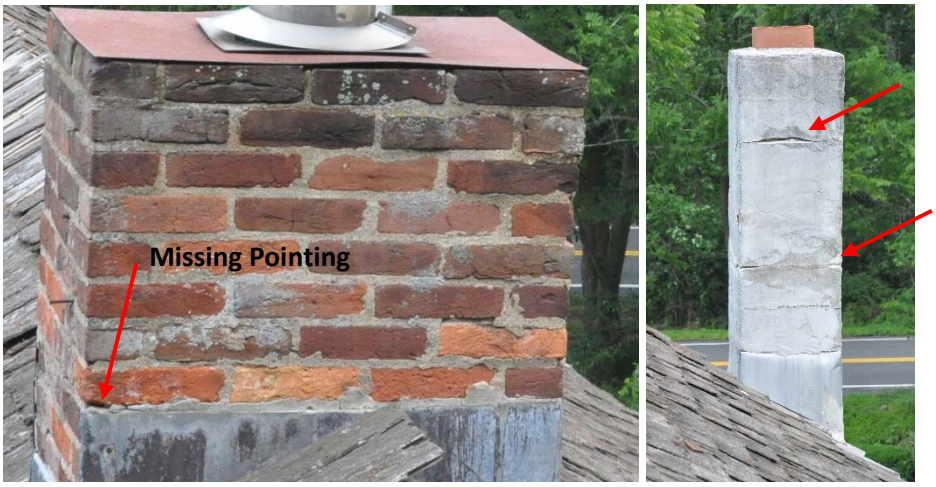


Figure 88: Detail views of the west, brick chimney with arrow pointing to missing pointing (left) and the east CMU chimney (right).

Woodwork

Woodwork at the Nathan Care House is in generally good condition. Most surfaces have been recently painted and show few signs of deterioration. Two areas that have damage are the northeast and southeast cornice returns, which have separated from the east masonry wall due to water damage (where the gutters meet the downspouts). The porch has minor peeling paint, biological growth and birds' nests. Structurally, the porch has shifted away from the south exterior wall and gaps have been filled with spray-foam insulation. There is also a large amount of vegetation encroaching on the porch structure and animals have burrowed into the dirt around the perimeter.

Figure 89: Water penetration has caused the cornice returns to rot and pull away from the exterior wall (left). Framing for the porch roof has pulled away from the exterior wall and has been infilled with foam insulation (right).

Doorways and Windows

Exterior doors at the Nathan Care House are in good to fair condition. Conditions for individual doors are detailed in the following room descriptions. The metal bulkhead doors to the basement show signs of moderate rust and paint failure. Their operating condition is unknown.

Figure 90: The metal bulkhead doors show signs of paint failure and rust.

The windows, repaired in the 1960s, are operable and protected by the exterior triple track aluminum storm windows, most recently replaced in 2003, and are in good condition. The windows are in generally fair condition. Most have one to two broken lights, small areas of rotted wood or paint failure. Common areas of wood deterioration are at the frame sills and bottom rails of the sashes. Conditions for individual windows are detailed in the following room descriptions.

The wood window shutters are in good condition but their hinges are fragile and have multiple layers of paint. The hinges on Windows 102 and 202 are broken and the shutters at Windows 101 and 104 have been modified and cut to accommodate porch posts.

Figure 91: Deterioration from moisture is prevalent at the interior wood window sills (left) and Window 202 has one of two broken shutter hinges (right) (the other broken hinge is on the north elevation).

Thermal and Moisture Protection

Despite evidence of previous leaks, the roof structure and lath still appear to be in good condition. The shingles, however, are nearly 30 years old and are severely deteriorated or missing. Daylight can be seen through the shingles in the attic and porch. Flashing at the CMU chimney on the east façade is in good condition, however the flashing at the porch and west chimney has some surface corrosion.

The downspouts and gutters have minor to moderate areas of rust and peeling paint. The gutter hangers are in good condition but a few of the metal brackets that connect the downspouts to the building have rusted through and no longer support the downspouts.

Figure 92: Wood shingles at the roof are severly deteriorated (left) and a typical example of rusting connections on the downspouts (right).

Exterior Finishes

Many areas of the exterior stucco are in poor condition. The stucco has been replaced, patched, stained, and worn away in some areas. Dark staining also appears in areas from water penetration or environmental residue.

Exterior paint has been maintained over the years at the Nathan Care House. The porch fascia board has moderate peeling paint and exposed wood. In some areas, multiple layers of paint prevent the shutter hinges from working.

Figure 93: Two types of staining (from water penetration and environmental residue) are present on the west elevation (left). Shutter hinges are typically inoperable due to multiple layers of paint and some are broken (right).

Interior

Overall, the interior of the Nathan Care house is in poor to fair condition. Abatement of hazardous materials, including mold, is needed as well as upgrades to the existing building systems. The following descriptions are organized by room and describe the condition of the exposed features in each space.

Basement

Room 001 – Basement

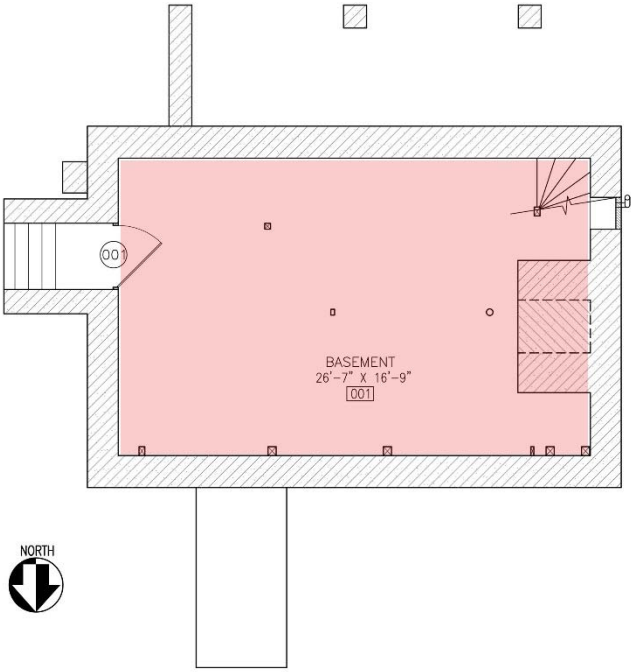


Figure 94: Detail views of the masonry (left) and exposed ceiling (right) in the basement.

Figure 95: Various electrical and mechanical equipment has been installed throughout the basement.

Floor: Concrete slab is in good condition with water stains and evidence of moisture at walls and below mechanical equipment.

Walls: The masonry walls are generally in fair condition. The walls appear wet from rising moisture and efflorescence can be seen at the fireplace foundation. The mortar and white-wash are heavily deteriorated in northeast corner. The white-wash at the stairs is in fair condition, with discoloration and cracking at the infilled window opening.

Ceiling: Exposed floorboards, joists and framing timbers are generally in good condition with splitting and minor powder post beetle activity (see structural for detailed conditions).

Windows: None.

Doors: Door 001: Door and frame are in good condition.

Lighting and Electrical: Electric and security systems are in operating condition; fixtures and exposed conduit are modern and in good condition.

Mechanical: Operating condition unknown.

Plumbing: Water service turned off in 2013.

Other: Unfinished wood stairs are in fair condition with minor efflorescence and deterioration from moisture, especially where in contact with masonry walls and concrete floor. The bottom two treads and risers are in the poorest condition.

First Floor

Room 101 – Living Room

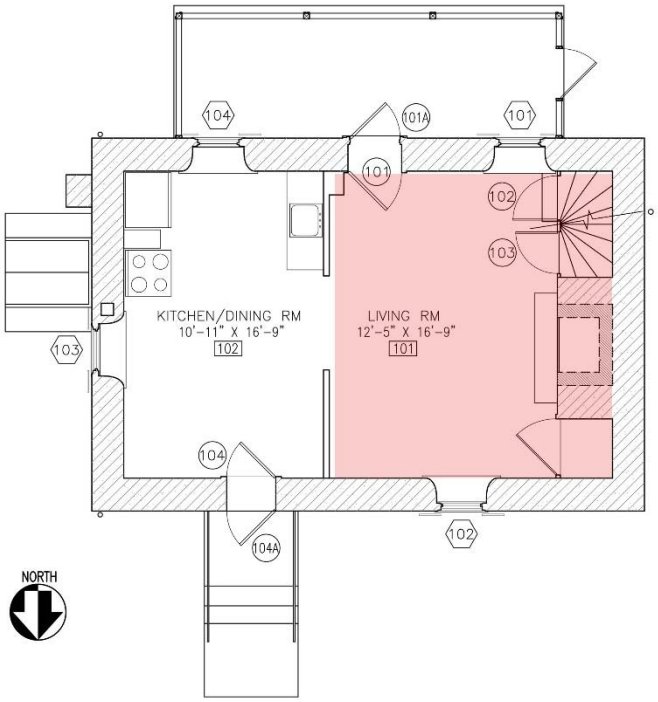


Figure 96: Infilled fireplace (left) and typical deterioration of wood windows and sills (right).

Figure 97: Detail view of stairs to second floor (bottom left) and the damaged ceiling in Room 101 (bottom right).

Floor: All wood flooring is in good condition. The brick hearth is in fair condition with severe efflorescence. The condition of the original random-width flooring below could not be assessed but is likely in poor condition since the newer floor was nailed on top of it.

Walls: North: Wall and painted finish are in good condition. The original baseboards are in fair condition.

East: Wall, baseboard and painted finishes are in good condition.

South: Wall and painted finish are in good condition.

West: Wood beaded board wall, trim, and built-in doors are in good condition with minor surface abrasions and gouges. The plaster is deteriorated and crumbling, and paint is peeling from moisture damage.

Ceiling: Ceiling is in fair condition with minor mold, water damage (most likely from leak in second floor bathroom) and cracking.

Windows: Window 101 (south wall): Sashes, storm window, frame and trim are in good condition and operable. There are minor areas of mold and peeling paint, and upper middle light of the top sash is broken.

Window 102 (north wall): Sashes, storm window, frame and trim are in fair to good condition and operable. There is minor splitting and deterioration in the upper corners of the frame and bottom sash. There is moderate paint failure throughout, a damaged muntin and the top middle light of the lower sash is broken.

Doors: Door 101: Door, frame and hardware are in good condition with moderate surface mold.

Door 101A: Door, frame and hardware are in good condition with minor rust.

Door 102: Door, frame and hardware are in good condition with minor peeling paint.

Door 103: Door, frame and hardware are in fair condition with minor surface mold, peeling paint and cracked boards. There are surface marks from previous hardware.

Lighting and Electrical: Electric and security systems are in operating condition. The fixtures and exposed conduit are modern and in good condition.

Mechanical: Operating condition unknown.

Plumbing: Water service turned off in 2013.

Other: Fireplace: Condition of firebox and flue is unknown. The brick surround is in fair condition with minor efflorescence and holes drilled in the brick. The wood mantel is in good condition with minor mold and cracking wood at joints.

The built-in cupboards are in fair condition with worn edges, moderate gouges and warping of the doors.

The wood stairs are in fair condition with severely worn treads and risers.

Room 102 – Kitchen

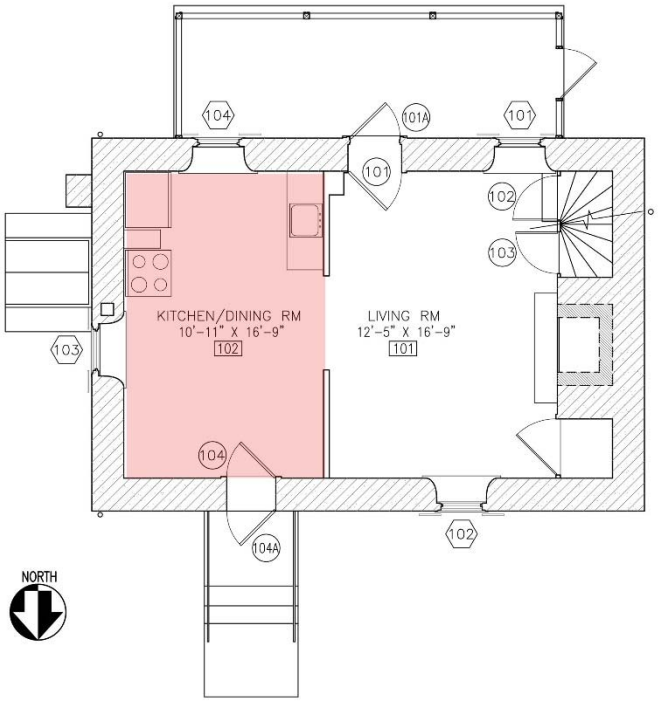


Figure 98: Detail of modern tile and baseboard in Kitchen (left) and water damage in ceiling below second floor bathroom (right).

Floor: The tile floor and grout is in good condition. The original random-width floor under the tile could not be viewed but is likely in poor condition if used as a substrate for later flooring.

Walls: North: The wall and painted finish are in good condition. The later baseboard is in good condition and routed for electrical conduit.

East: The wall and painted finish are in good condition, overall, with minor cracking above Window 103. The later baseboard is in good condition, routed for electrical conduit and interrupted by a radiator cover.

South: The wall and painted finish are in good condition with uneven texture from finish plaster. The later baseboard is in good condition and interrupted by radiator cover.

West: Wall, baseboard and painted finish are in good condition with minor cracking in northwest corner.

Ceiling: Ceiling is in poor condition with water damage from presumed leak in second floor bathroom and severe cracking in plaster finish.

Windows: Window 103 (east wall): The sashes, storm window, frame, and trim are in good condition and operable. There are minor areas of peeling paint and the lower middle light of the bottom sash is broken. The muntins of the upper sash have eroded and have been repaired with wood putty. The apron has been cut to accommodate the radiator cover.

Window 104 (south wall): The sashes, storm window, frame, and trim are in good condition and operable. There are minor areas of peeling paint, and the upper right light of top the sash is broken.

Doors: Doors 104 and 104A: Doors are in good condition with operable hardware and minor scratches.

Lighting and Electrical: Electric and security systems are in operating condition. Fixtures and exposed conduit are modern and in good condition.

Mechanical: Operating condition unknown.

Plumbing: Water service turned off in 2013. The sink is in fair condition, however the faucet has been removed.

Other: The kitchen cabinets and countertop are worn but in good condition.

Second Floor

Room 201 – Stairwell and Hall

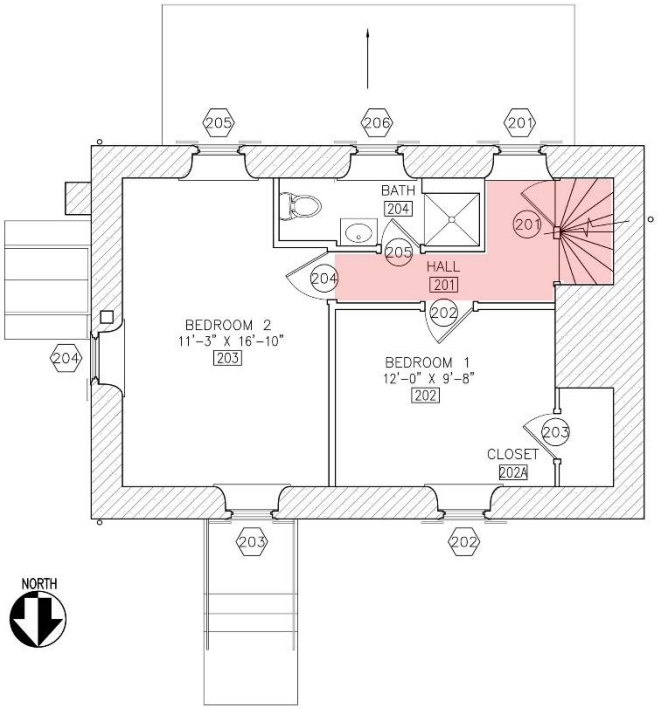


Figure 99: Original wood flooring under second floor carpet (left) and floor joists headed off for air grill in Hall 201 (right).

Figure 100: Damaged jamb at Door 201 (bottom left) and gaps at stairs to attic have been infilled with spray foam (bottom right).

Floor: Wood floor under carpet is in fair condition with carpet tack strips and paint spots. The floorboards have been cut for an HVAC register. The carpet is in poor condition and extremely dirty and stained.

Walls: All walls are in good condition with minor cracks. The original baseboard is in fair condition with minor gouges. The later baseboards are in good condition.

South portion of east wall: There is a small unfinished patch in wall board.

West portion of south wall: Moderate paint failure.

Ceiling: Ceiling is in fair condition with cracks and areas of mold.

Windows: Window 201 (south wall): The sashes are in fair condition and the storm window, frame and trim are in good condition and operable. There is minor mold and moderate checking, paint failure and exposed wood. The upper right light of the top sash is broken and the interior trim is notched out for mounting hardware for window treatments.

Doors: Doors 201: The door is in fair condition with operable hardware which has minor rust on the backplate. There is scarring from previous hardware, peeling paint and minor surface mold. The jamb and frame are in poor condition with split wood and gouges.

Lighting and Electrical: Electric and security systems are in operating condition. Fixtures and exposed conduit are modern and in good condition.

Mechanical: Operating condition unknown.

Other: The wood treads and risers of the stair to the attic are in fair to poor conditions with drilled holes in risers (approx. 2 to 3" in diameter) patched with wood. The treads are worn with moderate gouges and checking, and spray foam insulation fills gap between wood and exterior masonry walls, presumably to keep insects/bees in the attic from entering the lower floor.

Room 202 – Bedroom 1

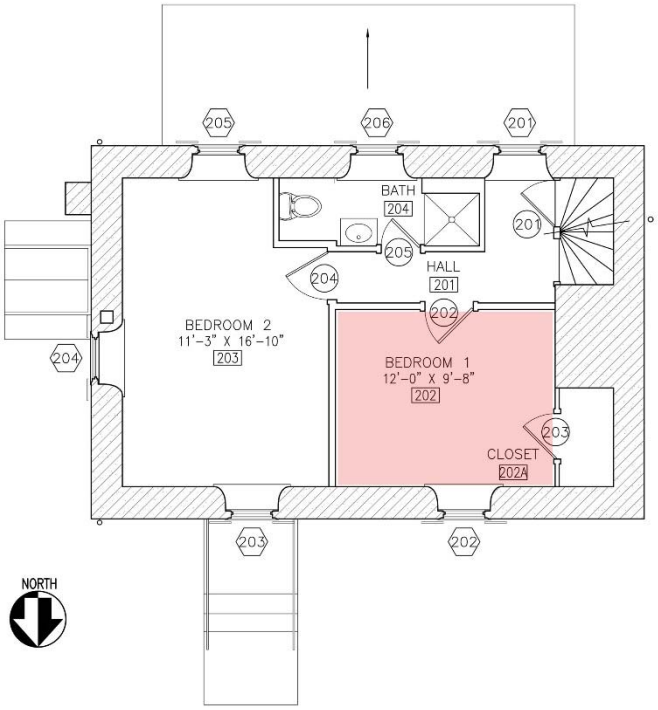


Figure 101: Detail of original baseboard and plaster on wood lath wall (left) and detail of water damage on masonry chimney wall compared to wood stud wall (right).

Floor: The wood floor under carpet is in good condition with carpet tack strips. The carpet is in poor condition and extremely dirty and stained.

Walls: North wall: The wall is in fair condition with severe paint failure, most likely due to moisture in the masonry wall. The wood baseboard has been removed for baseboard heat.

East wall: The plaster is in fair condition with moderate cracking and paint failure.

South wall: The plaster is in fair condition with moderate cracking and paint failure.

South portion of west wall: Wall is in poor condition with evidence of moisture, moderate cracking, efflorescence, and severe paint failure most likely related to flashing at or around the chimney or open flue.

North portion of west wall: The plaster is in good condition.

Ceiling: Ceiling is fair condition with minor cracking and paint failure.

Windows: Window 202 (north wall): Sashes, storm window, frame, and trim are in good to fair condition and operable. The lower right light of the bottom sash is broken and there is moderate deterioration at the window stool. There is minor mold, moderate checking and paint failure, and the interior trim is notched out for hardware for window treatments.

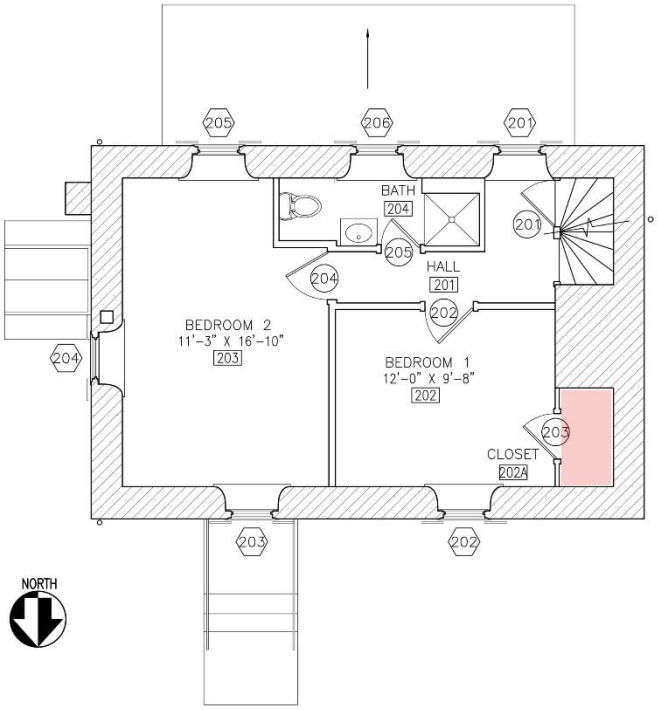
Doors: Door 202: The wood door is in good condition with operable hardware and moderate areas of surface mold.

Door 203: The wood door is in good condition with operable hardware and moderate areas of surface mold and peeling paint.

Plumbing: Baseboard heater is modern and appears to be in good condition.

Lighting and Electrical: Fixtures and exposed conduit are modern and appear to be in good condition.

Room 202A – Closet



Floor: The wood floor is in good condition.

Walls: North wall: Masonry wall is in fair condition with severe mold.

East wall: Plaster is in good condition.

South wall: Plaster is in fair condition with moderate cracking, paint failure and mold.

West wall: Masonry wall is in poor condition with cracking, paint failure and severe mold.

Ceiling: Ceiling is in fair condition with moderate cracking, mold and paint failure.

Other: The closet shelving system is in good condition with some peeling paint.

Figure 102: Mold at interior plaster walls (left) and peeling paint on beaded rails (right).

Room 203 – Bedroom 2

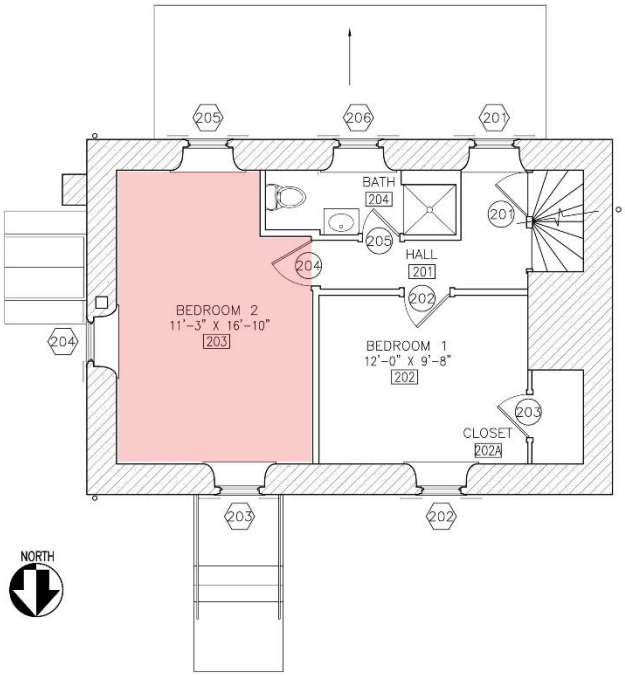


Figure 103: Mold on plaster ceiling (top), cracking at plaster ceiling and walls (bottom left), and separation of wood window frame and exterior masonry wall (bottom right).

Floor: The wood floor under carpet is in good condition with carpet tack strips. The carpet is in poor condition and extremely dirty and stained.

Walls: North wall: Plaster is in good condition.

East wall: Plaster is in fair condition with moderate paint failure.

South wall: Plaster is in fair condition with moderate cracking paint failure.

West wall: Plaster and trim are in good condition.

Ceiling: Ceiling is in poor condition with severe mold, moderate cracking and damage from water leak.

Windows: Window 203 (north wall): The sashes, storm window, frame and trim are in fair condition and operable. The lower left light of the top sash is broken and there is moderate deterioration at the stool. The replacement bottom sash is in good condition but lacks mortised mullions and has a larger profile. There is moderate mold, checking and paint failure.

Window 204 (east wall): The sashes, storm window, frame, and trim are in fair condition and operable. There is moderate deterioration at the stool, and moderate mold, checking and paint failure throughout. There is cracking and separation between the frame and interior plaster.

Window 205 (south wall): The sashes, storm window, frame, and trim are in fair condition and operable. The lower left light of the top sash and the lower right light of the bottom sash are broken. There is moderate deterioration at the stool and moderate mold, checking and paint failure throughout. The interior trim is slightly deteriorated.

Doors: Door 204: The wood door is in good condition with operable hardware and areas of moderate surface mold.

Mechanical: Baseboard heaters are modern and their operating condition is unknown.

Lighting and Electrical: Fixtures and conduit are modern and their operating condition is unknown.

Room 204 – Bath

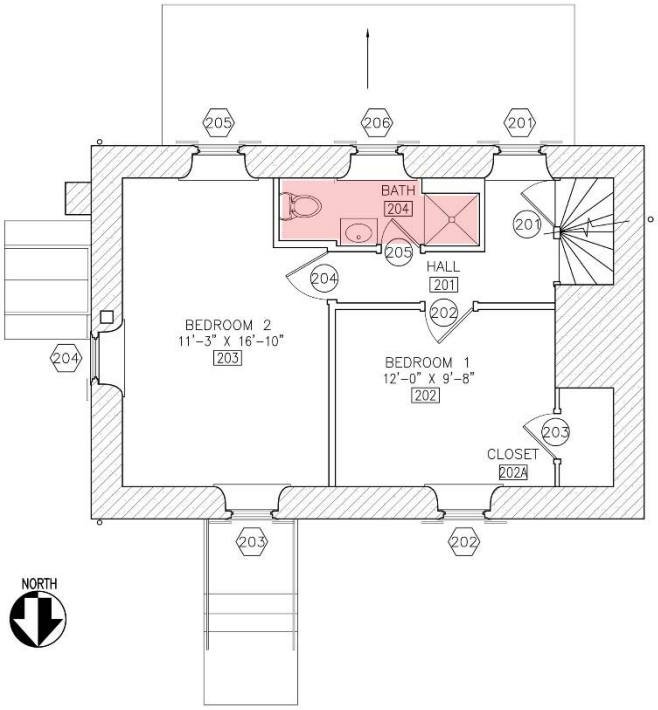


Figure 104: Damaged ceiling plaster (left) and severe rust on baseboard heater (right).

Floor: The tile floor is in fair condition. It is unknown if the original 1856 flooring exists below the tile, but if so, it is likely in poor condition due to underlayment nailing and leaks.

Walls: All walls are in good condition.

Ceiling: Ceiling is in fair condition with water damage near window.

Windows: Window 206 (south wall): The sashes, storm window, frame, and trim are in good condition and operable. The lower middle light of the top sash and the lower right light of the bottom sash are broken. There is minor paint failure throughout.

Doors: Door 205: The wood door is in good condition with operable hardware. The towel bar mounting hardware is attached to the interior side of the door; the towel bar is missing.

Mechanical: Baseboard heater is modern and its operating condition is unknown.

Lighting and Electrical: Fixtures and conduit are modern and operating condition is unknown.

Plumbing: The water closet, lavatory and shower are in fair condition with minor staining. The water service was shut off in 2013, and fixtures should be assessed before the water is turned on.

Third Floor

Room 301- Attic

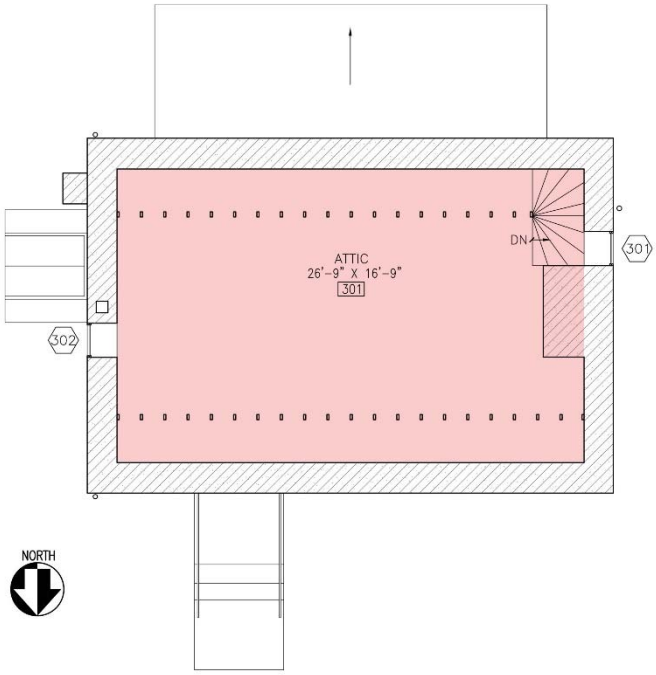


Figure 105: Deflection of lintel and masonry at Window 302 (bottom left) and exhaust fan hose from bathroom below exits at cornice (bottom right).

Floor: The wood floor is in fair to poor condition with splitting and loose boards. The boards are loose at the ends where the nails have pulled up or the end grain of the wood has become soft.

Walls: North wall: The masonry wall in fair condition with moderate cracking in the plaster finish. The wood knee wall is in fair condition.

East wall: The masonry wall is in fair condition with severe deterioration of masonry pointing and plaster above window lintel, moderate deterioration and cracking below the window sill.

South wall: The masonry wall is in fair condition and has been parged recently. Approximately four square feet of stone has been removed between the rafters for flexible vent pipe access to the exterior cornice. The wood knee wall is in good condition.

West wall: The masonry wall is in fair condition with moderate cracking in the plaster finish.

Ceiling: The exposed roof rafters are in good condition.

Windows: Window 301 (west wall): The four-light casement sash and frame and exterior wood louver are in fair condition. All components have minor peeling paint and the casement hinges are rusted. The wood lintel is split and sagging due to its size and the masonry load.

Window 302 (east wall): The four-light casement sash and frame are in fair condition with minor peeling paint and added weather-stripping. The top hinge is broken, however the window is still operable. The exterior wood louver is in good condition. The wood lintel is in poor condition and has deflected which has caused cracking in the masonry above.

Structural Conditions Assessment

An assessment of the building's structural systems (including but not limited to floor framing, roof framing, etc.) was conducted to determine the condition of the component structural members and to identify remedial work required to ensure structural stability. The structural assessment consisted primarily of visual observations of various portions of the buildings structural systems that were safely accessible without the removal of materials or staging.

Allowable Load Capacity

In order to be deemed safe for occupancy and structurally sound, the floor system and all supporting members must be capable to support at least the minimum live load requirements dictated by the building codes for the intended use. Loads are dictated by the National Park Service and are as set forth in the International Building Code (IBC) 2015 version. Live loads are given as depicted below and given by IBC Table 1607.1:

Occupancy of Use	Live Load (PSF)
Residences	
Uninhabited attics with storage	20
All other areas	40
Roofs	20

The design snow load for Hopewell Furnace National Historic Site as defined by IBC 2015 lists the park in an area where case studies are required to establish ground snow loads. Per the local code official, 30 psf is typically used for this area as the ground snow load and will be used for this report.

Due to the lack of testing, wood species was not determined for this site. The engineer assumed Spruce-Pine-Fir No.1/No.2 for dimensioned lumber with an allowable extreme fiber bending stress of 875 psi and elastic modulus of 1,400,000 psi. For timbers (5" x 5" and larger), Spruce-Pine-Fir No.1 was used with an allowable extreme fiber bending stress of 900 psi and an elastic modulus of 1,300,000 psi. By standard practice, the building code limits deflections due to live load to 1/360 of the span length.

Assessment of Live Load Capacity

This report includes an assessment of live load capacity for the floor areas where the structure was visible. The scope of work associated with this Historic Structure Report (HSR) was limited to an assessment of the structure, rather than a full structural analysis. Additionally, the full extent of the existing conditions of all the members was not fully assessed and not all member sizes, depths and spacing's were available at the time of this assessment. Due to these unknowns, it is assumed that these unknowns will be addressed in a future design phase, when plaster is removed and the framing is exposed. Actual conditions may decrease the live load capacities of the floors.

Exterior

For the majority of the house the exterior rubble stone walls appear to be in good condition. On the south face of the structure, west of the porch, a hole in the wall was noted (Figure 106). The origin of the hole is unknown, as no function was evident. Also above the windows on the porch, it appears that cracks have been repaired in the exterior, possibly at locations where an older porch structure may have rested against the house. Minor cracks were noted on the exterior of the house; however, none of them appear to be structural in nature, with the exception of the cracks above window 205. As previously noted the lintel was showing signs of deflection and it appears that the cracks extend through the lintel. On the exterior, it appears that the cracks have been repaired or sealed with new stucco (Figure 106). In the chimney on the southeast corner, horizontal cracks are evident in the chimney just above the roof line, likely due to the lack of support above.

Figure 106: Hole in wall on west side of porch (left) and cracks in lintel above Window 205 (right).

On the concrete stoop on the northeast corner of the house, a horizontal crack along the side of the stoop was noted on the east side, extending along the full face. It was also noted that the bottom step appears to be settling away from the rest of the structure, giving the bottom step a higher rise and the entire stoop has settled away from the house. The railing on the step is also heavily corroded, and pitting (Figure 107). The base plate for the railing along the bottom step has corroded to full section lost, and the railing is not attached to the bottom step. The railing in its current condition does not meet the structural requirements for railing as defined in the building code.

Figure 107: Corrosion of handrails.

The flooring for the porch on the south side of the house appears to be in good condition based on the areas that were visually accessible. The exposed foundations for the porch also appeared to be in good condition and were not showing any signs of distress. On the roof of the porch, the bolts attaching the ledger beam to the exterior face of the house are heavily corroded. It was also noted that the roof of the porch was beginning to pull away from the house on the eastern side of the porch. This appears to be due to the failure in the connection between the top of the porch framing to the south wall of the house. It appears that at one location, these bolts have been retrofitted with a separate anchor where one of the bolts has failed. With the exception of the ledger bolts, the main framing for the roof of the porch appears to be in good condition. Also noted in this area, the rubble stone has been heavily patched, and is likely where a previous porch connected to the house.

Figure 108: Corroded porch anchor.

Basement

The exterior, rubble stone walls of the basement appear to be in good condition with no major cracking noted. The base concrete slab is in good condition with only minor hair line cracking noted in the northeast corner, likely due to shrinkage during concrete curing.

The floor joists for the first floor framing, with the exception of the original floor joists on the north end of the house (as described below), appear to be in good condition. At locations where the main first floor timbers run across the girder running east-west, it was noted that some of the floor joists were not completely resting on the center girder (Figure 109), while others had been crudely shimmed and were in partial contact with the girder. The 4" x 2 ½" steel post located at the center of the girder is showing signs of corrosion, and no connection of the base plate to the concrete floor was apparent. This post does not appear to be original to the house as the concrete floor has been patched directly adjacent to the post (Figure 109). The floor structure appears to be in good condition at bearing locations along the south side of the house where they are pocketed into the basement wall, although some slight deterioration of the joist ends was noted.

Figure 109: Floor joists not in contact with girder (left) and steel post corrosion and base plate (right).

A previous conditions report of the original floor joists stated that the bearing points for the floor joists on the north wall were damaged and needed to be supported. A new girder and column line appears to have been added along the north wall to address this issue. It is assumed that this girder and column line support the loading for the flooring on the north face. The additional framing (including posts and beams), running east-west along the north wall supporting the floor joists, appears to be in good condition. In their current span condition, the joists are capable of supporting the required 40 psf live load. However, the first floor live load capacity is limited by the girders running east-west that support the floor joists both along the center of the house and along the north face of the house. Based on the current spans of these girders, the live load for the first floor is limited to approximately 16 psf which is significantly less than the code required 40 psf. See Section 2.1.4 for girder recommendations.

The center post for the winder stairs leading from the basement to the first floor is not in contact with the concrete floor (Figure 110). The post has been attached to a newer 2x6 dimensioned framing along

the back side of the post. It is likely that the post had deteriorated at the base and was replaced by this new section. It was also noted that the stairs have partially separated from the west edge of the house by approximately an inch. Framing appears to have been added below to support the stairs (Figure 110).

Figure 110: Center post for stairs (left) and stairs pulling away from wall (right).

First Floor

The floors in both rooms on the first floor are relatively level, and show no signs of distress. The tile floor in the kitchen has no cracks indicating that the floor has not deflected. The wall separating the two rooms appears to also be in good condition. The wall is likely not load bearing as it is running parallel with the floor joists below and above. The walls for both rooms have also been painted recently, so no distress was noted in the walls.

The ceilings in the living room and kitchen are heavily cracked (Figure 111). The cracks run in both the north-south direction as well as the east-west direction. Some of the cracking is likely due to deflection of the floors above. The ceiling potentially contains asbestos and no demolition of the ceiling was allowed during this investigation; therefore it is difficult to determine if the cracks in the ceiling are from structural issues or due to other causes.

Figure 111: Cracks in ceiling on first floor.

Second Floor

In the second floor hallway some slight cracking was noted in the ceiling above. The typical deflection limits for plaster ceilings is typically limited to the length of the supporting member over 360. It is likely that the framing above may have exceeded this limit, thus cracking the ceiling. The cracks are likely cosmetic in nature and do not appear to be a structural concern. In Bedroom 1, the floor boards beneath the carpet that were exposed appear to be in good condition. Heavy cracking was noticed in the plaster on the western wall (Figure 113); however these do not appear to be structural in nature and may be due to moisture in the wall. A crack was also noted in the ceiling of the bedroom, running east-west, and perpendicular to the attic framing above, about midway across the room. This may be also be due to overloading of the attic space above and exceeding the deflection limits for plaster ceilings.

Based on the assumptions of framing as 3" wide and 9" deep, clear spanning the between the main north and south walls, the framing is not capable of holding the code required 40 psf. In its current condition, assuming the framing is the correct size/spacing and is in good condition, the floor should be able to support a live load of 25 psf at Bedroom 1.

Figure 113: Cracking in western wall of Bedroom 202.

In Bedroom 2 (Room 203) permanent deflection was noted in the floor of the bedroom. The deflection appears to maximize in the center of the room and dissipate at the walls. This, in conjunction with the cracks noted in the ceiling of the kitchen, suggest that the floor joists for Bedroom 2 may be compromised. It is recommended that further investigation into the condition of the second floor framing should be conducted to verify the condition of the floor framing. No allowable loads are recommended in this bedroom due to the conditions noted above. Cracks were also noted in the ceiling in Bedroom 2 (similar to Bedroom 1) (Figure 114) running east-west, perpendicular to the attic floor joists above. These cracks may also be due to overloading of the attic space above, as previously suggested. The header/lintel above window 205 in the southwest has a vertical crack in the plaster at approximately the center of its span (Figure 114). A similar crack was noted at a similar location on the exterior of the house. A permanent deflection of approximately ½" was also measured in this lintel,

likely due to a combination of both roof and attic loading as this wall is load bearing. The cracking and deflection indicate that the lintel may be compromised. Further investigation into this header beam is recommended to determine if the lintel has been compromised, and if repairs are needed.

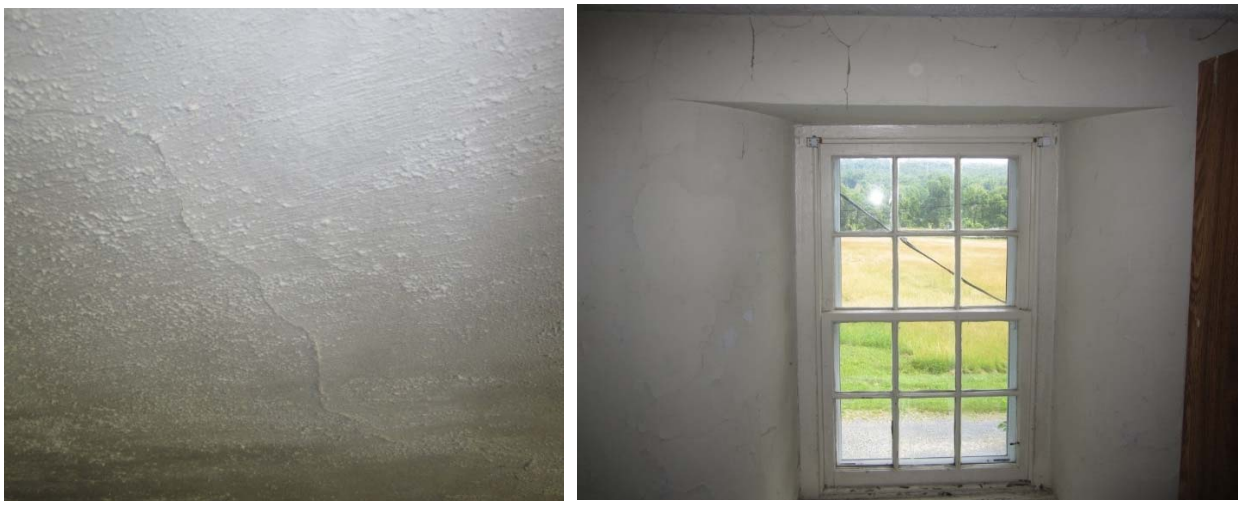


Figure 114: Cracks in Bedroom 203 ceiling (left) and cracks in lintel above Window 205 (right).

Attic

The main roof joists for the house and their connection at the top appear to be in good condition. Given their size and current condition, the engineer has calculated that the current roof framing is capable of supporting the code requirements for roof snow load (ground snow load of 30 psf). Several of the shingle lath boards that support the roofing material were noted to be damaged and need to be sistered or replaced (Figure 115).

At the location where the one of the floor boards was removed, the floor joists for the attic appeared to be in good condition. Based on the information available, the live load for the attic floor in its current state is not capable of supporting the code dictated live load of 20 psf, mainly due to the knee walls that were added to help support the roof joists. Due to the loading from the roof, the attic floor joists are limited to a live load of 15 psf in their current state assuming the joists are in good condition.

Damage to the exterior stone masonry, due to water damage and/or deflection of the lintel, was noted on the east wall above the louver (Figure 115). The mortar in this area and some of the stone has fallen out and needs to be repaired. The lintel has deflected and is compromised, likely due to deterioration caused by water intrusion and needs to be replaced. It is possible that the lintel was installed this way, but it is more likely that deflection is occurring due to the water intrusion. The lintel on west wall above the louver is in similar condition showing signs of deterioration, and needs to be replaced. It was also noted that on the south side of the house, above the bathroom, a significant portion of the wall has been removed to install the vent for the bathroom. This does not appear to have compromised the roof bearing in this area.

Figure 115: Broken shingle lath (left) and stone damage above louver (right)

1.1.B. The Nathan Care Barn

1.1.1.B Historical Background and Context

Early History of the Nathan Care Barn

In 1859, Nathan Care bought Tract 14, which included 43 perches from Richard Harrison Lloyd in order to build a barn.[1] The barn was built in the same year, 50 feet south of the Nathan Care house, measuring 35 feet by 25.5 feet (approximately 892 square feet).[2] Some speculate that because the time of purchase and construction were so close together, that Nathan built his barn and then "discovered that the land on which it stood was not in his ownership."[3]

Figure 116: Overview of the Nathan Care Barn facing southeast, c. 1940.

National Park Service

In 1935, the Federal Government acquired the Nathan Care Barn when it purchased Hopewell Furnace (approximately 6,000 acres) and all of its properties. The Work Progress Administration restoration work began on site and on August 3, 1938 the Park was established as Hopewell Village National Historic Site. It was created during the height of the Depression by the Franklin D. Roosevelt administration as a "pleasuring ground for the people of Philadelphia."[4] In 1941, restoration of the Furnace was complete and the Federal government deeded approximately 5,000 acres to the State of Pennsylvania, 848 acres of which were retained as Hopewell Village National Historic Site. On October 27, 1947, the Nathan Care House was converted into employee living quarters, and the barn was used as a garage.[5] The barn is currently used as storage for the park.

[1] National Park Service, Documentation for the Historical Base Maps…, I-9.
[2] Source says 50 feet but it is actually closer to 100 feet.
[3] National Park Service, Documentation for the Historical Base Maps…, I-9.
[4] 2011 Superintendent's Annual Report, *Hopewell Furnace National Historic Site*, 1.
[5] Based on a May 1975 photograph provided by the National Park Service (see photo on page 127).

1.1.2.B Chronology of Development and Use of the Nathan Care Barn

Establishing the chronology of development for a historic structure typically follows three steps. In the case of the Nathan Care Barn, the first step was the identification and examination of documentary evidence associated with the structure, specifically secondary sources that were provided by Hopewell Furnace National Historic Site. The sources include reports, histories, photographs and interviews with entities associated with the house and barn. The second step is research of architectural precedents, including the assessment of buildings in the same region, style and/or period as the subject structure. The final step was the physical examination of the building for evidence of original building fabric and changes that may have occurred since construction in the mid-19th century. The physical fabric of the Nathan Care Barn has been minimally altered, with the majority of original fabric extant.

Documentary Evidence

In 1856, Nathan Care constructed a two-story stone residence after purchasing the land from John Painter. When he purchased the property, there was a whitewashed log house on the site, where he lived for less than a year while the house was constructed. The property was comprised of the house, and outdoor bake oven, a corn crib, smoke house and pig pen. Three years after the house was built, the barn was constructed in 1859 (see Section 1.1.1.B, page 115). The Nathan Care Barn was an important feature at Hopewell Furnace as agriculture played a large role in the daily life of Hopewell residents. Agriculture was important "not only for what it contributed to home consumption, but also for the role it played in forging a connection to the broader regional economy."[1] There is little documentation of any changes between the time Nathan Care constructed the barn and when the Federal Government purchased Hopewell Furnace in 1935.

Architectural Precedent

While most of the mid-Atlantic region was developed under British control, the area surrounding Philadelphia was ethnically diverse, mainly settled by Germans and Ulster Scots.[2] In the early 18th century, two-level barns were being constructed throughout southeastern Pennsylvania. By the mid-eighteenth century, prosperous German farmers were building large barns, while "retaining modest log cabin dwellings – a testimonial to the priority they placed on agriculture."[3] According to Robert Ensminger, Pennsylvania barns can be classified into three categories:

I. The Sweitzer Pennsylvania Barn, 1730 – 1850
II. The Standard Pennsylvania Barn, 1790-1890
III. The Extended Pennsylvania Barn, 1790-1920

[1] John Milner Associates, Inc. *Report of an Archeological Survey of Five Domestic Sites at Hopewell Furnace National Historic Site, Berks and Chester Counties, Pennsylvania*, 21.
[2] Vlach, John Michael. *Barns,* 69.
[3] Ensminger, *The Pennsylvania Barn: Its Origin, Evolution, and Distribution in North America,* xv.

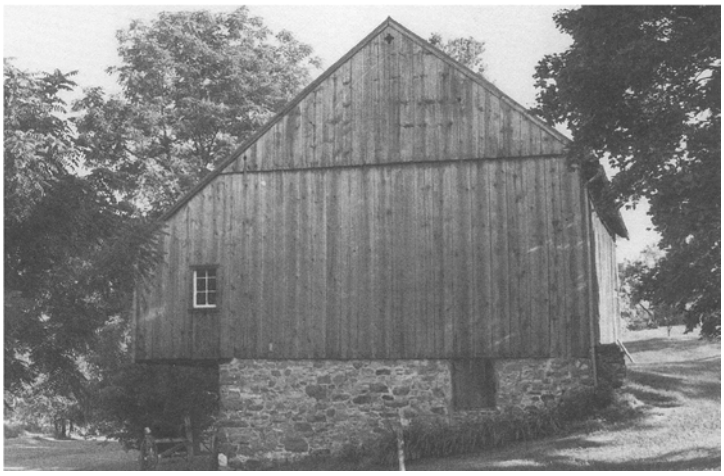


Figure 117: Frame Sweitzer barn, circa 1820, Spangsville, Oley Valley, Berks County, Pennsylvania (Ensminger, 64).

Figure 118: John Jacobs barn in Bacton, Chester County, Pennsylvania is an example of a Standard Pennsylvania Barn (Vlach, 103).

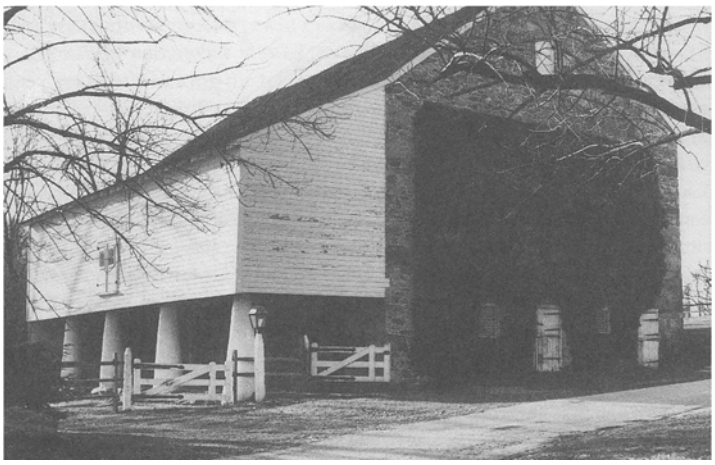


Figure 119: The Denenberg-Williams barn, dated 1806, near Phoenixville, Chester County, Pennsylvania, is an example of a Pennsylvania Extended Barn (Ensminger, 88).

Falling under the category of a Standard Pennsylvania Barn, the Nathan Care Barn is a two-level, Closed-Forebay Standard Bank Barn. Forebay bank barns had "become dominant in the southeastern part of the state by the end of the 18th century, and made a distinctive imprint upon that area's landscape." [4]

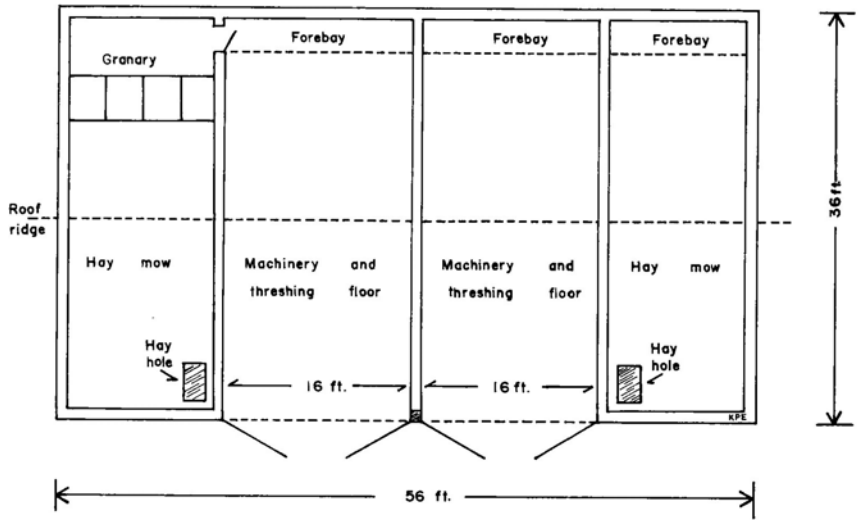


Figure 120: Plan of upper level of a typical standard four-bay Pennsylvania Barn (Ensminger, 53). This plan is similar to the original configuration of the Nathan Care Barn, however the Nathan Care Barn is a three-bay barn.

The upper floor would have been used to store hay and straw and threshing of feed grains. The grains were typically stored in bins of a granary, usually located in forebay. Many barns had ladders in order to reach the top of hay stacks that were out of reach. The ladders were installed into the wood framing with small holes carved into the side of the vertical member, as well as one side mortised into the horizontal member.

[4] Ensminger, *The Pennsylvania Barn: Its Origin, Evolution, and Distribution in North America, 1.*

Figure 120a: Typical ladder construction in a mid-19th century Chester County Barn (left) and evidence of where the ladder rungs were installed into the vertical post of the Nathan Care Barn farming.

Though built into the side of a hill, the upper level, or threshing floor, is accessed by a "bridge" or a small ramp. The ramp allowed farm machines and wagons entering into the barn. The lower level would have housed livestock including some or all of the following: cows, calves, horses, pigs, sheep, and chickens.

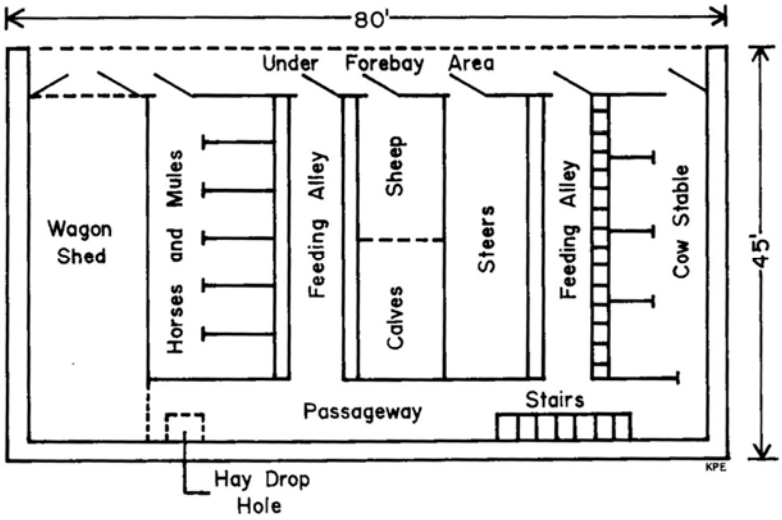


Figure 121: Typical mid-19th century lower level stable plan by Mark Heffner of Lyons, Berks County, Pennsylvania (Ensminger, 54).

The forebay was an extension over the lower level stable doors, ranging anywhere from four feet to 20 or more feet, and was a "distinctive and diagnostic feature of the Pennsylvania barn."[5] This type of barn was common in central and southeastern Pennsylvania (as well as central Maryland, Illinois, Wisconsin and Iowa) and was developed in the eastern part of the core area and prevalent in Northampton, Montgomery, Lehigh and Berks Counties.

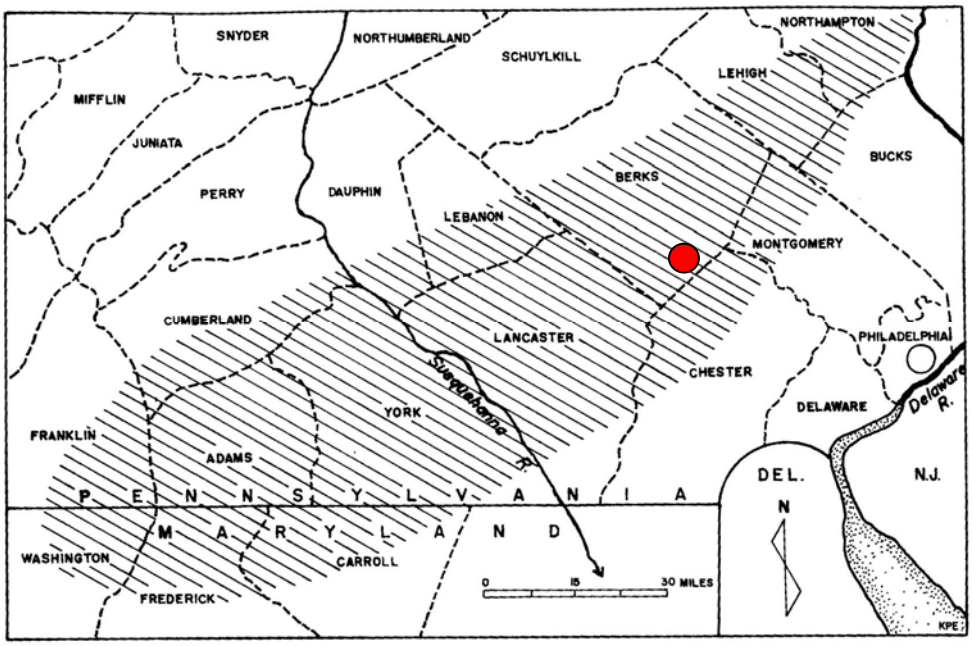


Figure 122: Pennsylvania Barn Core Region (Nathan Care indicated with red dot) (Ensminger, 52).

Figure 123: Barn at Kauffman Farm, Oley Valley, Berks County, Pennsylvania (Raymond, 97).

[5] Ensminger, *The Pennsylvania Barn: Its Origin, Evolution, and Distribution in North America, 1.*

Though early, the forebay on the Nathan Care Barn is likely not original. It appears as though the framed forebay had a separate floor structure with log joists set between the stone barn's log joists, as the existing floor structure does not appear to be cut at the ends. Several of the log joists have notches at the ends, indicating that they are at their max length, and could not have cantilevered. Furthermore, the rake board was not continuous between the stone barn and the framed forebay (see Figure 9). Finally, the last indication that the forebay was not original is the louvered openings over the existing doors on the east elevation. There would likely not have been louvered openings on an interior wall, as this wall would have been if the forebay was part of the original construction of the barn. The only drawing of the forebay is an undated sketch indicating that the forebay measured 12'-5" deep by 35'-5" wide (see sketch in Appendix H that shows "wooden leanto shed"). The forebay was removed sometime between 1940 and 1963.

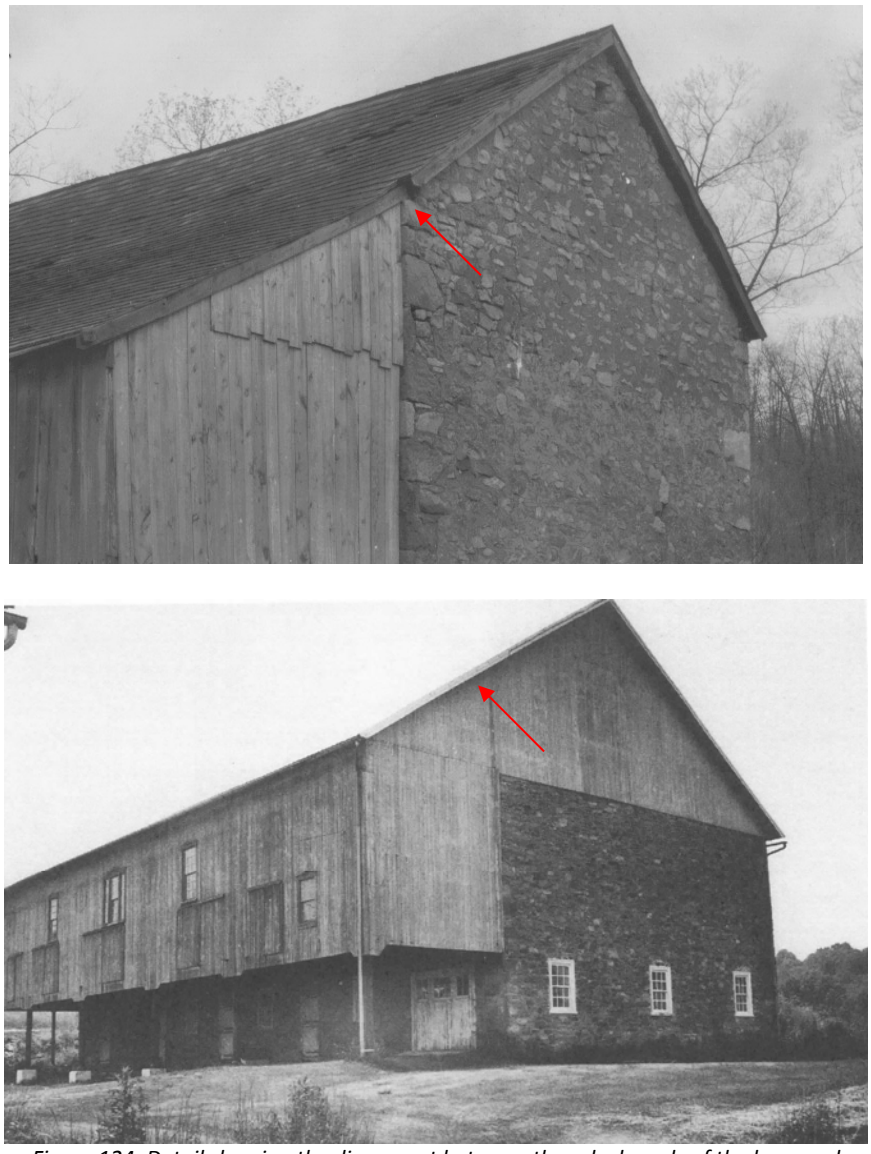


Figure 124: Detail showing the disconnect between the rake boards of the barn and forebay on the Nathan Care Barn, c. 1940 (top) and an example of a continuous rakeboard suggesting the forebay on this barn was original (bottom).

Wood louvers or bars were commonly used on both stone and wooden barns as they provided ventilation in a secure manner. Although some barns may have glazed windows, they are most likely replacements for the original louvers or bars.[6] The main door on the west elevation of the Nathan Care Barn is likely similar to the original. With the earliest American barns, the "large main door was a removable partition and often did not even have hinges. It was fastened shut all winter and taken off for the summer. Wagons were left under sheds, and the large threshing floor was kept completely free and clean."[7] Roller doors were introduced in the 1840s, and most barns have been using them for the past century. [8]

Figure 124a: View of north and east elevations of the Nathan Care Barn c. 1963.

The south and center door frames on the lower level east elevation of the Nathan Care Barn are original, however the doors are not original. The door opening on the northern end, including door, frame and ventilation transom with wood bar, are not original. Above this door, the only operating door of the three on the east elevation, cut off tenons are visible in the plate above from the original door frame (see Figure 124b). The hinges on this door, as seen in the photograph above, are not the same as the strap hinges on the current door and the hand of the door is the opposite of what is in the photo. The strap hinges and hasp are likely reproductions, and the staple holding the hasp is constructed of drawn steel wire. The frames for the two fixed doors, south of the operable northern door, are original. Holes in the frames are visible where the drive pintels for the strap hinges were located. The door on the north elevation is also not original (see Figure 123c). In the 1940s, the door was comprised of wood beaded boards and a four-light window set into the top portion of the door and the hinges do not match the strap hinges on the current door. It is unknown whether the 1940s door was original.

[6] Sloane, Eric, *An Age of Barns,* 68.
[7] Sloane, Eric, *An Age of Barns,* 86.
[8] Ibid.

Figure 124b: Original door frame mortise on lower level of east elevation (left) and cut off tenon in situ (right).

Figure 124c: Appearance of north door in 1940.

Architectural Evidence

The investigation of architectural evidence at the Nathan Care Barn was limited to visual inspection, removal of select small areas of mortar (see Mortar Analysis/Appendix E) and archaeological test pits (see Appendix D). Visual inspection was completed from the ground and from a high-reach lift. Mortar was removed from three different locations at the base of the barn.

The Upper Level floor framing consists of several different types of joists, primarily roughhewn logs that were likely salvaged from another location due to various unused mortices and notches (see Figure 126). It is quite possible that many of the logs, especially the logs that run continuously for the entire length of the barn, were salvaged from a dismantled whitewashed log structure. Most of the logs are notched in a manner consistent with log construction where interior and exterior log faces are hewn but stack surfaces are left rounded and filled with chinking and daubing.

Joists EB20, EB17, EB16 and EB15 were originally full length but the west ends have been cut off, most likely due to rot. There are two locations where it appears that the original framing consisted of two shorter salvaged logs supported by one of the north-south beams. WB02 and WB05 match

the character of the longer log joists including the shallow notches at one end. In addition, the ends of these logs, and EB19 and EB18, are aged and have fragments of whitewash which indicates they have existed for some time. This is compared to the fresh cut evident on the ends of EB15, for example. It is possible that the barn builder was making use of two different log lengths from a rectangular salvaged structure or the naturally short logs that occur due to window and door openings.

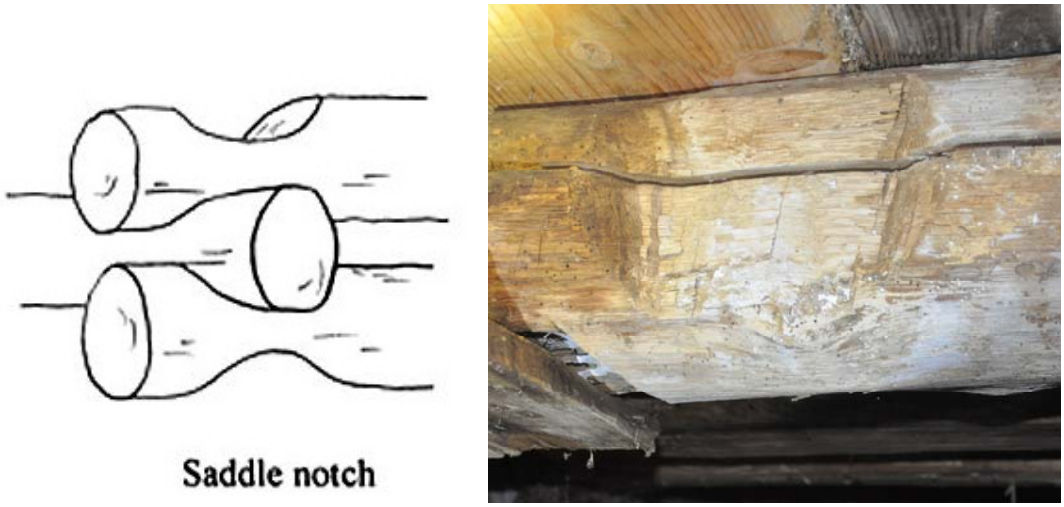


Figure 125: Diagram showing Saddle Notch construction (left) and detail of notched hewn log at the Nathan Care Barn.

The underside of the Upper Level floor boards are also visible from the Lower Level. The floor consists of random-width boards, as well as various other pieces of wood, including several doors that have been used as flooring in rotted areas. It is possible that these were the original doors that have been replaced on the north and east elevations of the lower level of the barn. It is also likely that the posts are reused from another location as well since many of them have unused mortices. The following are characteristics of each timber in the Upper Level floor framing:

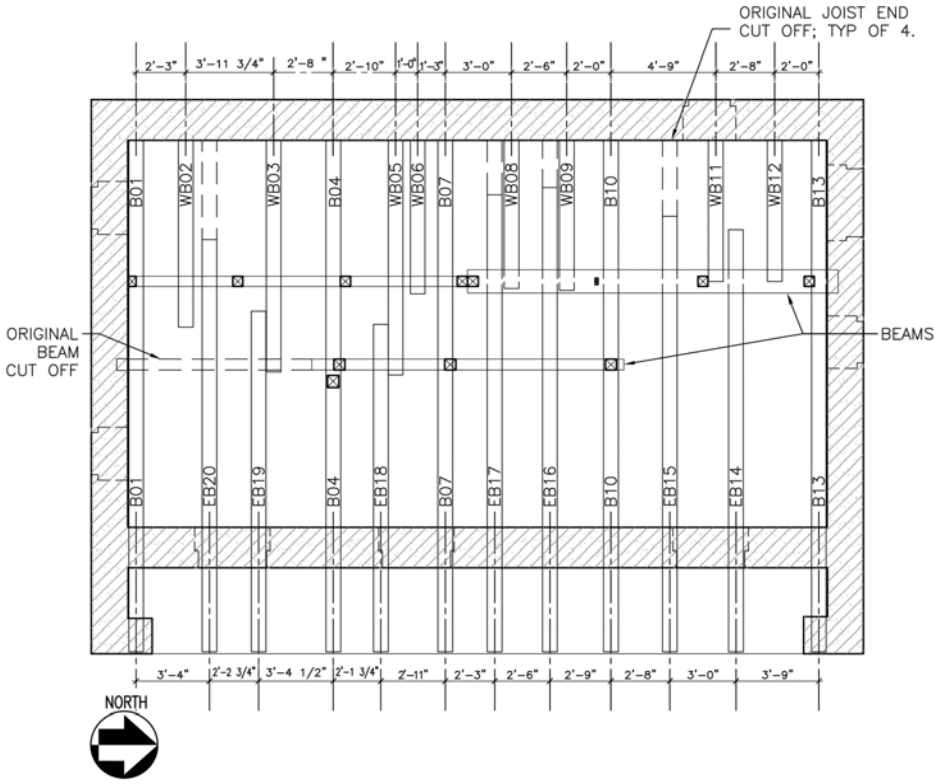


Figure 126: Lower level reflected ceiling plan of the Nathan Care Barn showing different sizes and locations of the log joists and beams.

B01: Original – Full length from east to west with a whitewash finish on the underside and north side. There is a shallow notch on east end of the log.

WB02: Replacement - End is cut and fit into west wall around stone as opposed to typical construction where the joist/beam is set and the stone is constructed around it. Squared on all four sides, out of character with other framing. Tenon on east end.

WB03: Original - The log is rotted on west end, and has a shallow notch about 18” from west end.

B04: Original – Full length from east to west with a whitewash finish. There is a peg hole for Upper Level post tenon with no peg.

WB05: Original – West end is severely rotted. Shallow notch near west end. Random mortise.

WB06: Replacement - The log is notched to fit around the existing stone.

B07: Original - Runs continuously from east to west and is similar in character to WB05. The west end is rotted, but not cut off, and the log has a shallow notch.

WB08: Replacement – Stone pocket altered for the log. No white wash.

WB09: Replacement - There is a piece of blocking from the top of the joist, and the stone pocket has been altered for the log.

B10: Original – Full length from east to west, mortised on top for structural post above and pegged. Shallow notch. Early lime mortar against log in pocket.

WB11: Period undetermined. Underside is not hewn but west end appears to be in original stone pocket.

WB12: Period undetermined. West end not visible due to electrical panel board.

B13: Original – Full length from east to west and has a shallow notch. The log is whitewashed, the bark is peeling off, the mortar is washed away, but there are definitely remnants.

EB14: Original – Does not run continuously from east to west. There are regular spaced notches in the beam and it may be a reused rafter plate or top plate of log structure.

EB15: Original - Does not run continuously from east to west and is whitewashed on all three sides with shallow notch on west end. West end may have been cut off due to rot; there is irregularity in the masonry wall in the area where the original pocket would have been.

EB16: Original - Does not run continuously from east to west, has a thick whitewash on the bark which is falling off in some places, there is a shallow notch, the east end is rotted, a piece of siding has been added next to it, as if to infill the opening between the joists.

EB17: Original - The log has a severely rotted end, a shallow notch at the west end, and a random mortise.

EB18: Original - The log has been cut in half and a new sister installed. The log also has a shallow notch.

EB19: Original - There is a significant check in the middle of the log and a shallow notch at the east end.

EB20: Original – Log cut in half at west end. Spliced with nominal wood joist. Shallow notch at east end.

Figure 127: Evidence suggesting that this log, EB14 (see diagram in Figure 126), is possibly a reused rafter plate or top plate of a log structure.

Figure 128: A salvaged door used as flooring in a rotted area.

Chronology of Development of the Nathan Care Barn

The history of the Nathan Care Barn may be divided into the following three stages:

Stage 1: Initial construction of the Barn (1859);
Stage 2: Restoration by the National Park Service (1940s);
Stage 3: Subsequent modifications by the National Park Service (1960-present).

Stage 1: Initial Construction c. 1856-1859

The Nathan Care Barn was constructed in 1859, three years after the construction of the house. By 1900, the Nathan Care Log House was demolished so the site could be used as a field.[9] This changed the landscape of the Care property. One change that was documented was the regrading of the north side of the barn in 1922, undertaken by Nathan Care Jr.[10] By 1940, the area below the forebay/overhang was infilled with vertical and horizontal siding and board and batten doors to create more interior space. The forebay is likely not original, however it was extant when the National Park Service purchased the barn in the 1930s. It is no longer extant.

Stage 2: Restoration by the National Park Service (1940s)

In 1935 the Nathan Care site was purchased by the Federal Government, who in 1937, in a "probable effort to help preserve Hopewell Furnace's village core area, began construction of a bypass road (PA Route 345) east of the village. The bow-shaped road (completed in 1939) diverted automobile traffic around the village core and connected to Birdsboro-Warwick Road, on the south, below the Nathan Care barn."[11] The site remained vacant until after WWII, when the house was modernized for use as employee living quarters, and the barn was used as a garage. The forebay was likely removed during this stage.

Figure 129: Overview of barn facing southwest in 1940.

[9] *Cultural Landscapes Inventory*, 2.
[10] Ibid.
[11] Cultural Landscapes Inventory, 11.

Figure 130: Overview of barn facing southeast in 1940.

Stage 3: Subsequent modifications by the National Park Service (1960-present).

After the National Park Service purchased the property, the barn was used as a garage by Park employees living in the Nathan Care House. By 1993, the park was using the barn for storage, which continues to be the current use of the barn. In 2007, the western red cedar roof shingles were replaced on the Nathan Care Barn. Some of the shingle lath and all of the rake boards were replaced in-kind due to rot and carpenter bee damage.[12]

Figure 131: The Nathan Care Barn in use as a garage in 1975. Note: the door is missing, along with the materials used in its construction, which indicates that the current door is a reproduction.

[12] Citadel Construction Company, Inc., 2007 and Jeffrey Finch, *Planning, Environment and Public Comment Database*, 2007.

1.1.3.B Physical Description of the Nathan Care Barn

Setting and General Plan

The Nathan Care Barn is situated approximately one-half mile south of Hopewell Furnace National Historic Site, and 100 feet south and slightly to the west of the Nathan Care House. The Nathan Care House is located on the south side of Clement Brooke Road, which connects the 1930s bypass road, PA 345, with the old Birdsboro Warwick Road. The barn was constructed in 1859, about three years after Nathan Care constructed his residence.[1] The barn has undergone very few changes since it was constructed. Though not original to the barn, the most prominent change that is visible is the removal of the framed forebay on the east elevation. Other changes include repointing and patching throughout the exterior stone work. In 1938, the Park Service purchased the property and adapted the barn first into a garage and then to a storage facility for park maintenance. The physical descriptions that follow are based on the existing visible fabric, most of which is original or from the era of the Park Service.

Figure 132: Overview of Barn facing northeast with Nathan Care House in background.

Exterior

General Form and Appearance

The Nathan Care Barn is a large rubble field stone structure with a wood-shingled gable roof and butted vertical board siding on the east elevation. There are three lower level door openings under the siding on the east elevation. The building measures approximately 35 feet x 25 feet-6 inches, and is situated into the side of a bank with its entrance to the upper level on the west elevation. A large sliding door on this west façade is accessed by a macadam ramp with rubble stone retaining wall. The north elevation has a door and small window on the west end of the lower level and the south has two windows on the lower level. The north and south elevations both have a roughly circular vent at the top of each gable.

[1] Zerbey, Benjamin J. *Historic Structures Report, Pat I Nathan Care House – Bldg. #25*, 3.

Figure 133: Overview of north and east elevations.

Concrete

A very small amount of concrete is used at the sill of the sliding barn door on the west facade. The concrete is likely used as filler for the gap between the interior wood floor and the ramp.

Earth

On the west elevation of the barn, there is a ramp leading from the sliding barn door to the gravel park road. Prior to the 1948 renovations, the ramp was an earthen ramp. The packed earth is still extant, however macadam has been installed on top.

Figure 134: Concrete sill at sliding barn door on west elevation (left) and earthen and macadam ramp on west elevation (right).

Masonry

The foundation and exterior walls at the Nathan Care barn are constructed of brown and gray-colored rubble field stone masonry. The stonework consists of modest sized stones with larger, more prominent corner stones at all corners. There are multiple layers of pointing filling the gaps between stones, the first layer consisting of a bedding mortar. The layer above the bedding mortar consists of remnants of finish pointing, however there is not enough evidence to indicate the original profile of the pointing (i.e. flush or ridge). Finally, the top layer is a barn-dash pointing, or flush pointing that fills the joint and partially covers the adjacent stones. Given the evidence of an earlier pointing mortar, it is believed that the entire barn has been repointed (date unknown). The only existing finish on the masonry is a thin layer of whitewash on the east wall at the lower level. The whitewash can only be seen on the stones, suggesting repointing has occurred after the whitewash was applied. This whitewash was possibly applied when this area was an enclosed interior space. There is also a small retaining wall at the north side of the ramp to the upper level. This masonry is dry laid (no evidence of bedding mortar).

Figure 135: Detail of masonry conditions on south elevation (left) and overview of south elevation showing masonry cornerstones (right).

Figure 136: Whitewash remnants on the stones of the peiler eck on the east elevation.

Woodwork

The Nathan Care Barn is utilitarian in design and lacks detailed finish woodwork. There is a simple flat rake board trim at the roof gables, exposed plain cut rafter tails and siding at the west elevation. The siding consists of 12" wide vertical boards butted together and face nailed with cut nails (based on visible rectangular nail heads) and a red painted finish. The boards are fastened directly to the interior timber framing.

Figure 137: Wood rake board (left) and vertical wood siding on east elevation (right).

Doors and Windows

There is a combination of original and replacement doors and windows. Descriptions of each are detailed in the room descriptions that follow.

Thermal and Moisture Protection

The western red cedar roof shingles on the Nathan Care Barn were replaced in 2007.[2] Copper strips were installed on both sides of the ridge to prevent biological growth. Some of the shingle lath and all of the rake boards were replaced in-kind due to rot and carpenter bee damage.[3] There are no gutters or downspouts on the barn.

Figure 138: Detail of roof shingles from west side of barn.

[2] Cost proposal for new roof from Citadel Construction Company, Inc., March 28, 2007.
[3] Jeffrey Finch. *Planning, Environment and Public Comment Database*, PEPC 18166 Paint Office/Store Exterior and Replace Care Barn Roof. 2007

Finishes

The finishes on the barn include paint on the doors, windows, siding and woodwork. There are remnants of whitewash on the exterior east wall within the peiler eck (recessed alcove). It is likely that the whitewash was added when the forebay was constructed as the area would have been enclosed and the east wall would have become an interior wall.

Electrical

A single-head flood light is located at the northwest eave, surface-mounted on the exposed end of the rafter plate. A second single-head floodlight is surface-mounted above the sliding door on the west elevation.

Figure 129: Single-head flood light at northwest eave.

Interior Room Descriptions

Lower Level

Room 001

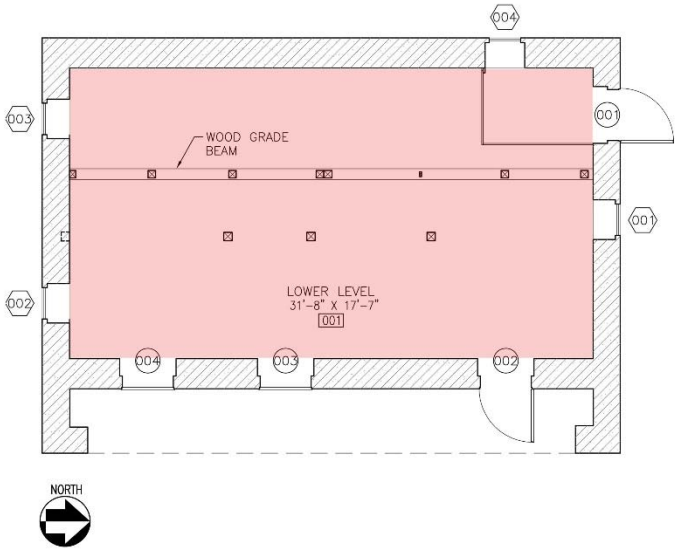


Figure 140: Lower Level Plan of the Nathan Care Barn.

Figure 141: Doorway to lower level on north elevation (left) and interior view of lower level (right).

Figure 142: Interior view of lower level (left) and window sash that has been removed from exterior (not original) (right).

Historic Use(s): Traditional farm use (1856-early 20th century)
Storage (early 20th century-present)

Existing Features and Finishes:

Floor: Compacted earth.

Walls: North: Exposed rubble stone (1859) with a whitewashed finish and no finish pointing. No evidence of a girder pocket, however it could have been infilled with stone and pointed.

East: Pointed rubble stone (1859) with a whitewashed finish.

South: Exposed rubble stone (1859) with a whitewashed finish and no finish pointing. Empty girder pocket on this wall.

West: Pointed rubble stone (1859) with a whitewashed finish.

Ceiling: Exposed framing; some areas of whitewash (see Section 1.1.2.B, Chronology of Development and Use of Barn).

Windows: Window 001 (north wall): Wood mortise and tenon frame with horizontal wood bars (1859), exposed hand-hewn wood lintel (1859) and a painted finish.

Window 002 (south wall): Wood mortise and tenon frame with horizontal wood bars (1859), exposed hand-hewn wood lintel (1859) and a painted finish.

Window 003 (South wall): Wood mortise and tenon frame with horizontal wood bars (1859), exposed hand-hewn wood lintel (1859) and a painted finish.

Window 004 (East wall): Wood mortise and tenon frame with horizontal wood bars (1859), exposed hand-hewn wood lintel (1859) and a painted finish.

Doors: Door 001: Not original. Outward swinging, random-width, butt jointed, wood beaded board and batten door with a painted finish; hasp and staple at jamb, two original iron strap hinges with bean cusp mounted on drive pintles. The bottom hinge is broken and the pintle is missing. A modern "Tee" hinge has been installed. It appears that the original hinges were reused on the

reproduction door and are attached with carriage bolts that are hammered on both sides. The battens are fastened with clinched nails.

Door 002: Not original. Outward swinging, random-width, tongue and groove wood beaded board and batten door with a painted finish; door has been scribed to look like a Dutch door; original iron strap hinges with bean cusp mounted on drive pintles. It appears that the original hinges were reused on the reproduction door and are attached with carriage bolts that are hammered on both sides. The battens are fastened with clinched nails. Wood, fixed, louvered transom above door.

Door 003: Not original. Fixed, random-width wood, beaded board and batten door with a painted finish; door has been scribed to look like a Dutch door; no hardware installed; wood, fixed, louvered transom above door.

Door 004: Not original. Fixed, random-width wood, tongue and groove beaded board and batten door with painted finish; door has been scribed to look like a Dutch door; no hardware installed; wood, fixed, louvered transom above door.

Mechanical: None.

Electrical: Electrical conduit and junction box surface-mounted on the west wall.

Plumbing: None.

Historic Features:

Floor: Compacted earth.

Walls: All walls were exposed, rubble stone with whitewash finish.

Ceiling: Exposed upper floor boards and framing with hand-hewn timber joists and beams.

Windows: Although not part of the original windows, at some point exterior four-light sashes were nailed to the exterior of the wood frames. One modified sash was found near one of the windows on the north elevation, though it is unclear if it was actually part of the window. It is currently stored in the barn (Figure 142).

Room 101 – Upper Level

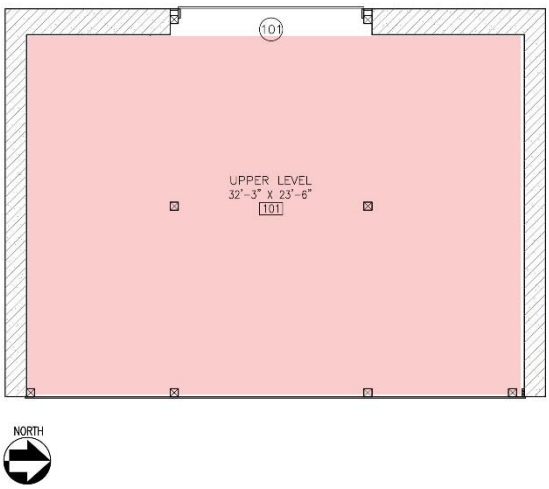


Figure 143: Upper Level Plan of the Nathan Care Barn.

Figure 144: Overview of Upper Level framing (left) and overview of north wall with roughly circular vent (right).

Historic Use(s): Traditional farm use (1859-early 20th century)
Garage (1940-1980)
Storage (1980-present)

Existing Features and Finishes:

Floor: Unfinished, loose-laid, random-width pine boards running north-south.

Walls: North: Exposed rubble stone and timber framing; no finish or finish pointing; roughly circular vent of cut stone at gable.

East: Unfinished 12” wide vertical board siding and timber framing.

South: Exposed rubble stone and timber framing; no finish or finish pointing; roughly circular vent of cut stone at gable.

West: Exposed rubble stone and timber framing; no finish or finish pointing.

Ceiling: Exposed, unfinished roof rafters, shingle lath and underside of shingles (for shingle description see page 132).

Windows: None.

Doors: Door 1/101: Non-original, 12'-0" wide x 11'-3" high sliding barn door made of 3" vertical beaded boards and battens with painted finish (post-1975); non-original rolling door track and door brackets (post-1975) (early photos show that there was a track originally); modern metal pull and padlock.

Mechanical: None.

Electrical: West wall: Electrical conduit, switch, outlet and junction box surface-mounted on timber framing.

Plumbing: None.

Other: Roughly circular air vents of cut stone surround at each gable end.
Ladder rungs.

Historic Features:

Floor: Wood floor boards.

Walls: All walls were exposed rubble stone with no finish or finish pointing; circular vents at gables.

Ceiling: Unfinished, exposed timber framing and shingle lath.

Structural Physical Description

The Nathan Care Barn is approximately 35’ by 25’-6”. It includes two main floors, a lower level and upper level, and has a gabled wooden roof. The foundation consists of rubble stone, with no mortar up to grade. Mortared, rubble stone walls extend above grade to the roof line on the north, west, and south walls. The East wall consists of a mortared rubble stone wall up to the bottom of the upper level floor. The wall framing along the East wall supporting the roof above is wood siding supported by a post and beam frame which is connected at the north and south to the main stone walls. The roof is wood framed, with a roughly 8 on 12 slope. The eave height of the roof is roughly 22’ on the east side, and the ridge height is roughly 30’-9”. The Nathan Care barn is currently being used for storage, on both the upper and lower level floors.

Figure 145: View of Nathan Care Barn from north.

Foundation

Three locations were excavated by an archaeologist in order to expose the foundation of the barn. The findings of the archaeological testing can be found in Appendix D. The first location (SPT-1) was located on the northeast corner of the barn. The excavation revealed that the foundation consisted of rubble stone, non-mortared, extending approximately 21 inches below grade (Figure 146). Below this a large rectangular stone was noted, most likely representing a purposefully-placed foundation stone, extending to approximately 28 inches below grade.

Figure 146: Excavation at northeast corner of barn.

The second location (SPT-2) was located approximately midway along the eastern wall. This location showed that the foundation was different than the foundation in the northeast corner. The rubble stone with mortar extends approximately 2 inches below the surface. Solid stones (with no mortar and

little-to-no soil in between) went down approximately 14” below grade. Below the solid stones, soil consisting mostly of clay extended beneath until the bottom of the excavation at approximately 39”.

The third location (SPT-3) was located inside the barn in the lower level on the southwest corner. This location was similar to the first, with large stones up to 12 inches in length comprising about 80% of the layers. The foundation of the barn appeared to be rubble stone without mortar, and extended 36 inches below grade.

Along the northwest corner, a dry laid rubble stone retaining wall is present, forming the northern side of the ramp extending to the upper level (Figure 147).

Figure 147: Rubble stone retaining wall on west elevation.

Lower Floor

The lower floor of the barn is accessed by a door in the northwest corner, as well as a second door on the east elevation. Originally there were three doors on the east elevation, however two of the doors are now fixed panels and no longer function as doors. The walls for the first floor consist of mortared, rubble stone walls, each extending the full height of the floor. Other openings in the basement walls include four smaller louvers (approximately 2’2” wide and 1’9” tall). There is one louver on the north elevation, two on the south elevation and one on the west elevation. Along the East wall, a 5” deep by 6” wide top plate runs the full length of the masonry wall, creating a support for the upper level framing and also serves as a lintel for the doors along the east wall (Figure 149). The other openings in the stone foundation walls are supported by a 7” wide by 4” deep timber lintels.

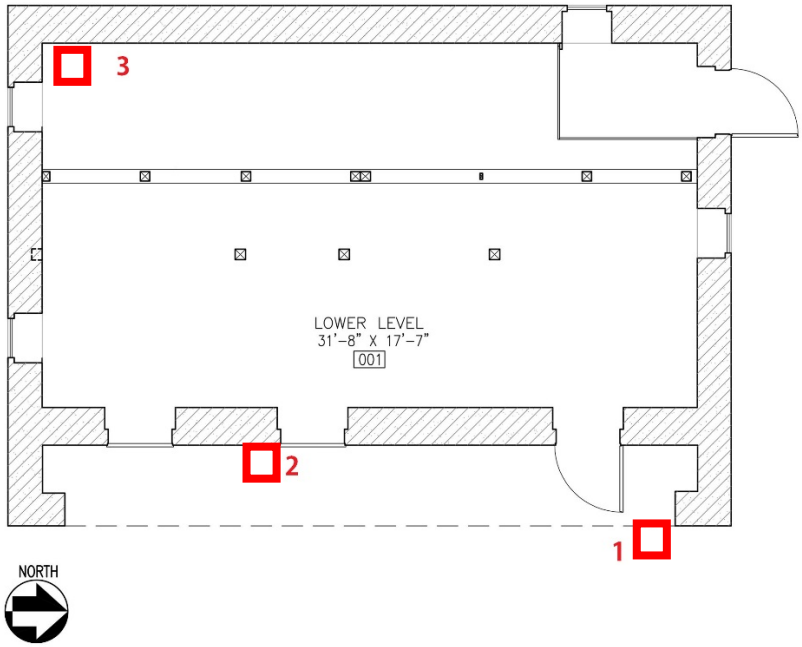


Figure 148: Lower Level plan of barn showing test pit locations (see Appendix D for more information).

Figure 149: Detail of door in north east corner.

The floor framing for the Upper level is supported by the east and west exterior stone walls as well as a wooden post and beam framing system made of various sizes and shapes. The interior foundations for the posts consist of various size stones, most approximately 1'-4" square stones of unknown depth, spaced approximately 7' to 8'. Additional stone foundations support the lower level timber wood grade beams. The lower level floor framing system consist of logs that have been roughhewn top and bottom.

The timbers span north-south between the stone foundations, and are approximately 7” wide by 6” deep and arranged in two separate column lines (Figure 150).

Posts supporting girders supporting the upper level floor rest on the wood grade beams described above, forming two column lines, one on the east side approximately 7’-4” off the eastern masonry wall, and one on the west approximately 6’-5” off the western masonry wall. The western column line includes 8 posts of varying sizes, spaced from approximately 5’ to 6’ on center. The size for the columns varies from a 2”x4” dimensioned lumber column to a 6” x 6” timber. These columns support a girder running north-south approximately 7” deep by 6 ½” wide. The eastern most column line consists of 3 columns each approximately 6” x 6” timbers, supporting a girder spanning north-south approximately 5” wide by 5” deep (Figure 150).

Figure 150: Typical post/grade beam connection (left) and typical post/girder connection (right).

Typical floor joists for the upper level consist of log timbers rough-hewn on top and bottom, spanning east-west. The timbers vary in size, mostly 6” to 7” deep, and 9” to 11” wide. The spacing of the timbers also varies ranging from 2’-9” on center to 3’-6” on center. The main floor timbers are supported by the girders described above, and are pocketed into the stone on the west wall. On the east side, the timbers cantilever out approximately 4’ to create an overhang for the flooring above (Figure 152).

Note: See Section 1.1.2-B for a detailed description of each log.

Figure 151: Typical floor joists in barn.

Figure 152: East cantilever framing.

Upper Level

The upper level is accessed by a sliding door approximately 12’ wide by 11’ tall on the west wall. Currently the upper level of the barn is being used as storage. The main flooring was not accessible in all areas due to the various items being stored in the upper level. The floor boards for the upper level that were accessible were measured to be approximately 1” deep with widths varying from 11” wide to 16” wide. The north, west, and south walls consist of mortared, rubble stone walls extending to the roof line. The west wall is interrupted by the sliding door as mentioned above. The sliding door is framed above by a 5” wide by 4 ½” deep timber header. A continuous timber tie back also extends along the top of the rubble stone walls on the west wall and along the north and south walls at the gable. The timber

tie back is 9” wide by 5” tall. An additional timber tie back extends into the rubble stone walls on the north and south walls (Figure 154) to connect the timber tie back to the north and south walls.

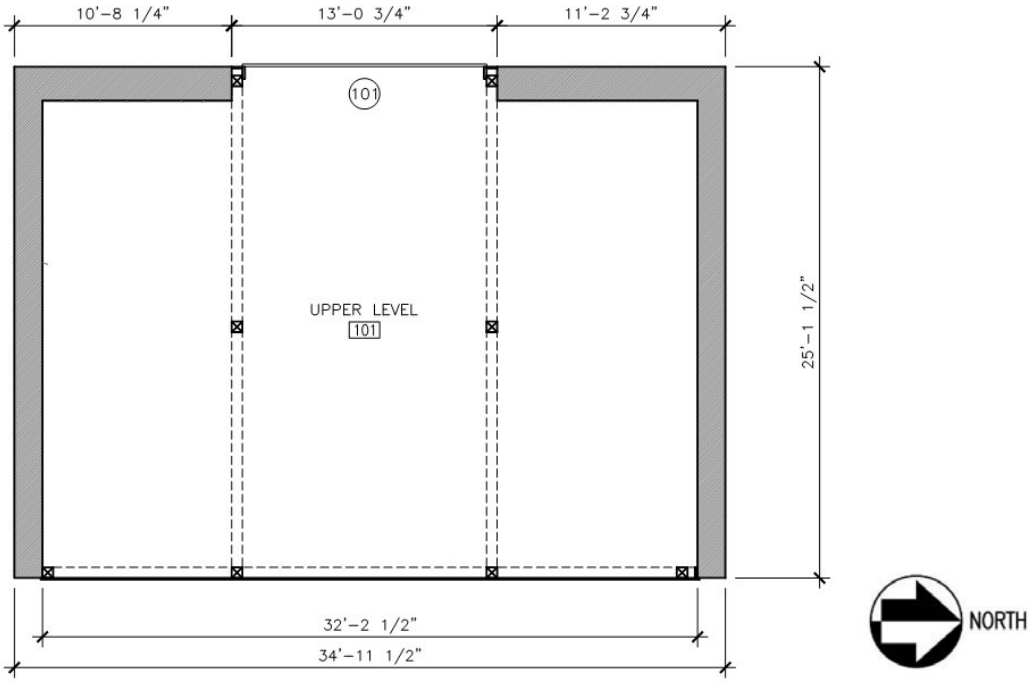


Figure 153: Upper Level plan of barn.

Figure 154: North wall with timber tie back connection.

The east wall of the upper floor, consists of a wood frame, with mortise and tenon joints. The main frame consists of four 6” x 6” timbers equally spaced. The frame is located on the edge of the overhang described above. The posts support horizontal wind girts 5 ½” wide by 2 ½” deep, spaced at approximately 3’-3” on center across the height of the frame. The wind girts support vertical siding that forms the exterior of the east wall, which is typically 1” thick by 12” wide. The top beam for the frame is approximately 7” wide by 6” tall and is tied into the rubble stone walls on the north and south, similar to

the timber tie back running on top of the west wall. A knee brace is also attached on both the north and south side of the frame, that is approximately 3 ½" by 4" and is at approximately a one to one slope. The knee brace extends down from the roof line to a post along the north and south walls.

Two post and beam frames span east-west, terminating at the jambs for the sliding door on the west wall, and are used structurally to brace the east wood-framed wall. Each frame consists of three posts, approximately 6" by 6", equally spaced. The posts are connected together at the top by two rows of beams approximately 2'-5" apart, and a third row of beams located approximately 4'-0" above the floor. The top frame beams are 6" x 6" timbers. The lower level row of beams are also 6" x 6" timbers. The top frame beam is level with the timber running along the top of the west wall and the top beam on the east wall and appears to be tied into both with a pegged mortise and tenon joint. The lower frame beam has a 3" x 4 ½" knee brace tying into the post at approximately a 1 to 1 slope. All connections of the frames are pegged mortise and tenon joints. These two additional frames do not appear to be load bearing and are primarily to support the wood framing on the east side for lateral bracing (Figure 155). There is no indication that these frames supported any type of an upper loft structure.

Figure 155: East frame (left) and east-west frame (right).

Roof

The roof framing primarily consists of roof rafters 5" deep by 4" wide, running east-west spaced at approximately 1'-10" on center. The rafters are sloped approximately at an 8 on 12 slope, and are connected at the top by what appears to be a mortise and tenon joint. Shingle lath runs along the top of the rafters spanning north-south that are 1" deep by 2" wide, spaced at approximately 8"-10". The roof shingles are western red cedar (Figure 156).[1]

Steel cables have been added to the roof system, with three cables running east-west, and one cable running north-south. The cables are not original to the barn construction, however their date is unknown. The three east-west cables tie into the timber tie backs running on the top of the west wall, and into the top of the wood frame on the east wall. The three east-west cables are roughly equally spaced between the two interior wooden frames and the north/south walls (Figure 156). Each cable terminates in a loop using a wire rope clamp. One end is attached directly to an eye bolt that is connected to the wooden timber tie backs running on top of the walls. The opposite end is attached to a

[1] Cost proposal for new roof from Citadel Construction Company, Inc., March 28, 2007.

turnbuckle which was likely used to tension the cables. The turnbuckle is then attached to an eye bolt similar to the opposite side. The cable running north-south is centered on the north and south walls, and is approximately 5’ from the top of the ridge and runs through the rubble stone walls. The cable is attached on the outside of the wall with a star bracket (Figure 156). The cables and the turnbuckles appear to be galvanized, however, the eyebolts and the star brackets are not galvanized and are likely plain-carbon steel.

The cables are likely there to help with the kick-out from the roof and appear to be fairly new. It is likely that the roof was sagging due to the east wall pushing out to some extent, and the cables were added to help with this condition. The frames running east-west may have been originally intended to take this kick-out, but they are spaced too far apart for the beam at the top to take the loads. It also could have been a result of the addition that was taken off of the east wall and how the framing might have been modified once that addition was removed.

The steel cables and turnbuckles are in good condition, showing little signs of corrosion. The eyebolts and star brackets on the outside of the structure do not appear to be galvanized and are heavily corroded.

Figure 156: Typical roof framing with east-west cable (left) and star connection of cable to rubble stone walls (right).

1.1.4.B Evaluation of Significance for the Nathan Care Barn

The significance of historic properties is evaluated in accordance with guidelines set forth by the National Park Service and reflected in the National Register of Historic Places, the official list of those places and structures deemed most worthy of protection and preservation. The guidelines require that the resource retain the integrity of its location, setting, design, workmanship, feeling and association and that it be:

A. Associated with events that have made a significant contribution to the broad patterns of our history; or

B. Associated with the lives of significant persons present or past; or

C. Representative of the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. An existing or potential source of information important in history or prehistory.

The Nathan Care Barn possesses significance for contributing to Hopewell Furnace National Historic Site under Criterion A. The barn is associated with the events that took place at the iron furnace from the middle of the 19th century to the turn of the 20th century. Although the barn was not originally part of the furnace, it became associated with the site in the middle of the 19th century when it was constructed by a prominent founder of the furnace.

In addition to satisfying the criteria of association discussed above, a historically significant property must also possess integrity of its location, materials, design, workmanship and association. The Federal Government acquired Hopewell Furnace National Historic Site in 1935, protecting the site from development of roads, buildings and signage. The Nathan Care Barn retains sufficient integrity to convey its significance.

The **Location** of the property has not changed since its construction in the middle of the 19th century. The developmental history of the structure is clearly represented by surviving architectural fabric dating from the period of significance. **Materials** from the mid-19th century are extant, including stone walls, wood floors and floor framing, roof framing, and wood window frames and bars. The building's **Design** represents its appearance during its period of significance (mid-19th to early 20th century). The barn retains integrity of **Workmanship** in its stonework and framing. Lastly, The Nathan Care Barn also retains integrity of **Association**. The property remained in the Care family for nearly half a century and the information gathered from the site reflects the building's association with the family and Hopewell Furnace National Historic Site.

1.1.5.B CONDITIONS ASSESSMENT OF THE NATHAN CARE BARN

The conditions assessment for the Nathan Care Barn included visual inspection and probing of various surfaces where accessible. The visual survey was performed at close range and by use of binoculars and high-reach lift for areas not easily accessible, including the roof. Conditions were recorded with photographs and on copies of floor plans and elevations. Typical conditions included vegetation, rotting wood elements and a deteriorated floor on the upper level. Three small samples of mortar were removed to be tested in the laboratory. Like any assessment of an existing building, particularly an historic building, certain assumptions are made that cannot be verified without invasive removal of material and extensive testing.

Exterior

Site

The Nathan Care Barn is located to the south of the Nathan Care House. Like the Nathan Care House, the barn was not originally part of the Furnace, although it belonged to the last founder at Hopewell. The site has not had any major disturbances, and the drainage pattern appears to be good, with the site sloping towards the east. There is no standing water around or on the interior of the structure.

Figure 158: Overview of the Nathan Care Barn with an arrow indicating direction of site water drainage.

The foundation appears to be in good condition with no major problems. There was an abundance of vegetation (recently removed in 2016) and two trees close to the building. The paving is limited to the ramp leading to the upper level of the barn (see concrete/paving section for conditions).

Figure 159: Detail view of abundant vegetation around the building (left) which has since been cleared, exposing the conditions of the barn (right).

Concrete/Paving

The cement sill at the barn's upper level entrance is in poor condition. There are cracks and areas of deterioration throughout the sill.

Earth

The earthen and macadam ramp on the west elevation of the barn is in poor condition. There are cracks running through each of the uneven surfaces and there is a substantial amount of vegetation throughout.

Figure 160: Detail views of cracks and vegetation in the macadam paving.

Masonry

The rubble stone masonry is in fair condition. Visual inspection and maintenance records show major repairs and stabilization efforts that have been made to the upper masonry walls. Minor cracks and biological growth can be seen throughout the exterior pointing. The retaining wall of the ramp at the upper level entrance is in good condition.

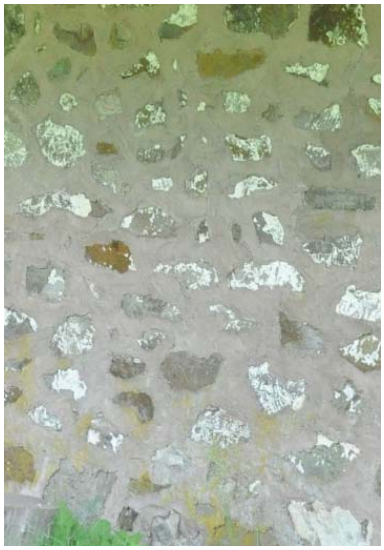


Figure 161: Iron ties have been installed to minimize masonry deflection (left). Some areas of masonry have been repointed more recently than others (right).

Woodwork

The wood siding and rake board on the Nathan Care Barn are in fair condition. Both elements exhibit mold and staining with moderate deterioration from water damage. In some areas, the siding is cupped and splitting.

Figure 162: Damaged wood rake board likely from carpenter bees (left) and split exterior siding (right).

Doors and Windows

Conditions for individual doors and windows are detailed in the following room descriptions.

Thermal and Moisture Protection

The roof was replaced in 2007. The roof shingles are overall in good condition, however there is a fair amount of biological growth and some of the rafter tails are rotting. There are no gutters or downspouts on the barn.

Figure 163: Detail of the cedar wood roof shingles (left) and rotted rafter tails (right).

Finishes

The finishes on the barn are in fair condition. The paint on the main, west barn door, as well as the paint on the east wood siding is in good condition. The paint on the doors at the lower level is in fair condition. The paint on the woodwork, including door and window frames, is in fair condition and is fading and peeling in some locations. The whitewash on the stone peiler eck (alcove under closed-forebay) is in poor condition and is mostly weathered away.

Interior

Overall the interior finishes of the barn are in fair condition, however the structure and flooring of the barn are in very poor condition, which is a concern for the current and future use of the barn.

Lower Level

Room 001

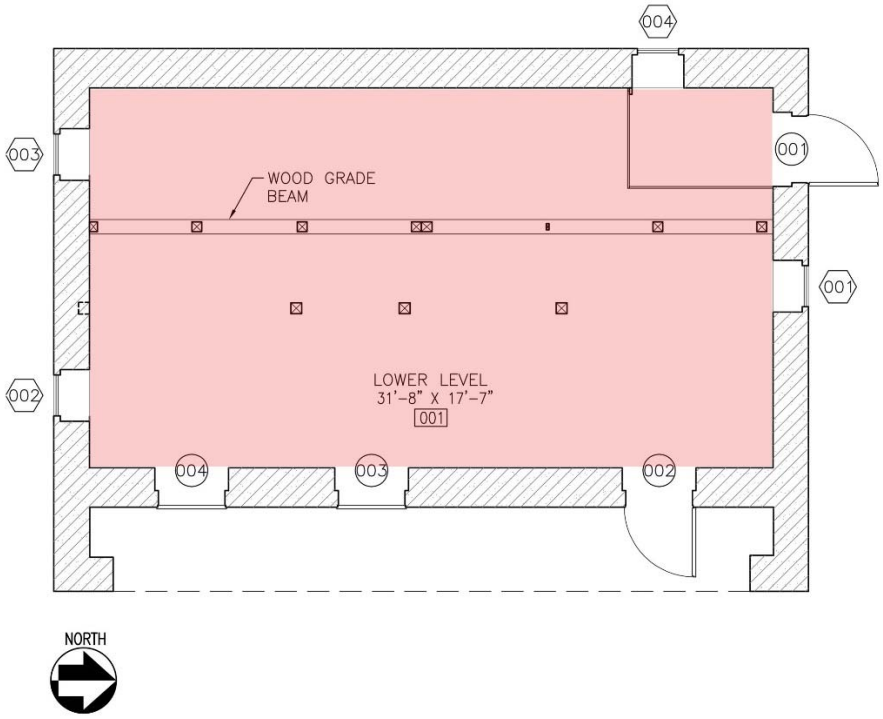


Figure 164: Detail of different masonry finishes in the lower level (left) and broken wood bars and partial casement sash at Window 002 (right).

Figure 165: Typical interior view of wood bars, lintel, and unfinished masonry (left) and exposed ceiling at lower level shows structural members for upper level floor (right).

Floor: The dirt floor is in fair condition; it is uneven and full of debris.

Walls: North wall: The wall is in poor condition. The absence of pointing has led to the deterioration of bedding mortar and there are areas of repaired mortar and biological growth. The white-wash finish is very worn and missing in areas of rising damp near the foundation.

East wall: The wall is in fair condition and has been repointed. The white-wash finish is visible on exposed stone, however not on the pointing.

South wall: The wall is in poor condition. The absence of pointing has led to the deterioration of bedding mortar. The white-wash finish is extremely worn and missing in areas of rising damp near the foundation.

West wall: The wall is in fair condition with several campaigns of pointing. The white-wash finish is visible on exposed stone, primarily at the base of the wall.

Windows: Window 001 (north wall): The wood frame and horizontal bars are in poor condition. The casement sash is also missing, although it was not original to the barn.

Window 002 (south wall): The window is in poor condition with broken bars, rotting wood, minor paint failure, and a broken casement sash frame (the sash has been moved inside the barn). The sash appears to be made from a salvaged sash as there are mortises and muntins that are not aligned and/or have no matching muntins on the opposite rail or stile.

Window 003 (south wall): The window is in fair condition with minor paint failure and biological growth. There is moderate rot at the bottom of the exposed slats. The casement sash, not original, is also missing.

Window 004 (west wall): The window is in good condition with moderate paint failure on the interior. The casement sash, not original, is missing.

Doors: Door 001: The door is in good condition. The jambs have been notched to accept the batten and there are water and rust stains from iron hardware at the unfinished interior surface. The early hardware is in poor condition, the bottom strap is broken at the barrel (the pintle has been removed from the frame), and the rivet is missing from the top strap hinge.

Door 002: The door is in fair condition with moderate mold and staining on the painted finish. The handwrought hardware is in fair condition.

Door 003: The door is in fair condition with moderate mold and staining on the painted finish. The jambs have been notched to accept the batten and there is moderate paint failure at the jamb and louvered transom. The door is fixed in place and has no hardware.

Door 004: The door is in fair condition with moderate mold and staining on the painted finish. The jambs have been notched to accept the batten and there is moderate paint failure at the jamb and louvered transom. The door is fixed in place and has no hardware.

Room 101 – Upper Level

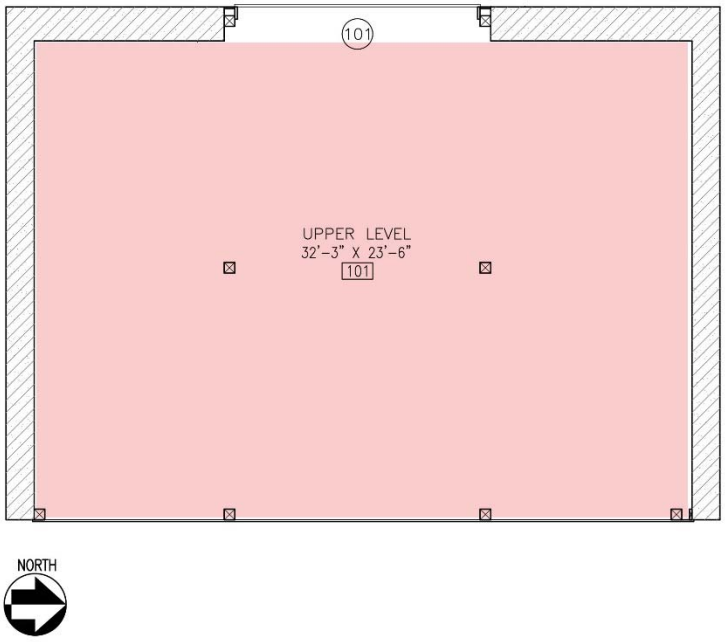


Figure 166: Unfinished interior masonry wall (left) and detail of damaged wood floor boards at the upper level (right).

Figure 167: Electrical conduit is mounted to the structural timber framing (left) and the wood sliding door is severely deteriorated at its base (right).

Floor: The floor is in very poor condition. The boards are missing and loose in several areas, specifically in the northwest corner, and there is staining from use as garage. There was a lot of rotted areas visible from below and areas where they laid the doors over rotted areas.

Walls: North wall: The wall and gable vent are in fair condition. Moisture penetrating from the exterior has led to crumbling and deterioration of the bedding mortar.

East wall: The wall is in good condition with little or no signs of deteioration.

South wall: The wall and gable vent are in fair condition. The lack of pointing has led to crumbling and deteriorating bedding mortar.

West wall: The wall is in fair condition. The lack of pointing has led to crumbling and deteriorated bedding mortar.

Ceiling: The shingle lath appears to be in good condition (for condition of roof rafters see Structural Conditions page 166 and for conditions of roof shingles see page 151).

Doors: Door 1/101: Door and door hardware are in poor to fair condition. The boards of the door are rotted and severely damaged at the base. The painted finish has minor mold and UV damage.

Electrical: The exterior lights appear to be in good condition.

Structural Conditions Assessment

An assessment of the barn's structural systems (including but not limited to, floor framing, roof framing, etc.) was to determine the condition of the structural members and to identify remedial work required to ensure structural stability. The structural assessment consisted primarily of visual observations of various portions of the buildings structural systems that were safely accessible without the removal of materials or staging.

Allowable Load Capacity

In order to be deemed safe for occupancy and structurally sound, the floor system and all supporting members must be capable to support at least the minimum live load requirements dictated by the building codes for the intended use. Loads are dictated by the National Park Service and are as set forth in the International Building Code (IBC) 2015 version. The current use for the barn is general storage. Live load given by IBC Table 1607.1 for light storage is listed as 125 psf.

The design snow load for the park as defined by IBC 2015 lists the park in an area where case studies are required to establish ground snow loads. Per the local code official, 30 psf is typically used for this area as the ground snow load and will be used for this report.

The design wind speed for the park as defined by IBC 2015 is listed as 105 mph for a Risk Category I structure. Exposure C was assumed for the barn structure, with no topographic effects.

Due to the lack of testing, wood species was not determined for this site. The engineer assumed Spruce-Pine-Fir No.1/No.2 for dimensioned lumber with an allowable extreme fiber bending stress of 875 psi and elastic modulus of 1,400,000 psi. For timbers (5" x 5" and larger), Spruce-Pine-Fir No.1 was used with an allowable extreme fiber bending stress of 900 psi and an elastic modulus of 1,300,000 psi. By standard practice, the building code limits deflections due to live load to 1/360 of the span length. It is suggested that testing be completed to determine wood properties during a later construction phase.

Assessment of Live Load Capacity

This report includes an assessment of live load capacity for the floor areas where the structure was visible as well as a structural analysis of the floor faming systems of the barn. Full extent of deterioration of all the members and their connections was not fully assessed, and not all member sizes, depths and spacing were available due to lack of accessibility. Maintenance records for repairs and retrofits of the barn were limited, and therefore some assumptions were made in calculating live load capacity. Actual live load capacities of the floors may be less than what is presented in this report.

In its current state the barn is showing severe deterioration in the floor framing and is experiencing deflections and settlement noted below in the exterior masonry walls and interior foundations. Deficiencies in the floor framing are noted in the sections below and include a missing girder previously supporting the floor framing on the southeast corner, deteriorated and/or missing floor boards on both the north and south side, and bearing failures in floor joists along the west wall. Foundation issues

include the significant deflection of the north wall which is likely causing bearing issues at the foundation level, settlement on the east corner on the south wall, and on the interior post foundations as noted below. The barn, in its current state, is not recommended for use as storage or any other use until repairs are carried out as indicated below. It is recommended that the upper level be emptied and that the structure remained unoccupied until repairs have been completed. Items in the lower level may not necessarily need to be removed; however any items that are used on a regular basis, or will be used in the near future should be removed from this area. Foot traffic in the lower level should be reduced to a minimum until further repairs are made.

Exterior

A survey of the exterior walls was done previously by Lou Schneider Architect, dated 5/7/2012. In the survey, deflections were noted and mapped on the exterior walls with contours (See Appendix E). The contours depicted on these drawings show that both the north and south walls are leaning significantly northward, with the northern wall leaning more the southern wall. The deflections for the north wall are also significantly higher on the eastern side, near the eave. These deflections for the north wall were used in comparison to the observations noted during the site assessment.

Based on visual observation, the north wall is leaning significantly outward, as indicated in the report by Lou Schneider Architect, noted above. A bulge is also visible in the middle of the wall, indicating that the outward deflection is higher at the center and upper portion of the wall. A plumb-bob was used to check the deflection of this wall. At approximately the center of the wall, mid height where the bulge appears to be at its max, it was measured that a 4 ½" offset was recorded over a 7' plumb blob. This measurement appears to be consistent with the deflections given by Lou Schneider Architect. Typical tolerances for masonry as given in ACI 530, is listed as ¼" over 10'. The deflection on this wall is significant and is likely overstressing the soils beneath the foundation. It was also noted at the top of the wall, the top plate which connects the roof to the top of the rubble stone wall is starting to lose its bearing. The roof overhang varies across the top of the wall. The roof overhang is almost even with the masonry wall, whereas on the western side, the overhang is approximately 6" (Figure 168). The top plate is recessed on the northeast corner, whereas on the northwest corner, the top plate is flush with the outside of the wall (Figure 168). The observations at the top of the wall indicate that the connection between the roof diaphragm and the top of the rubble stone wall appears to be non-existent. The cause for the deflections in the wall was not evident from site observation.

The north wall also has multiple discolorations indicative of previous crack repairs. Maintenance records were not found to confirm when cracks on this wall had been repaired or if the wall has been repointed. Most of the repaired cracks appear to be vertical, which may be a result of the wall deflecting out. It is recommended that any crack repair on this wall that is repaired going forward should be maintained and monitored to see if the cracks are reoccurring at existing or in similar locations. A vertical crack was noted at approximately the centerline of the wall beginning at mid-height and extended up the wall approximately 10 feet. This crack is not of immediate concern but should be monitored. The top plate on the top of the stone that was accessible appears to be in good condition. Damage from oak pin hole borers was also noted in the northernmost roof purlin at the roof overhang. Also some pointing was

missing at the base of the wall. Vegetation at the base of the wall likely contributed to the degradation of the pointing.

Figure 168: View of north wall from northeast corner (left) and top plate on east side (right).

The east rubble stone foundation wall extending up to the bottom of the upper level appears to be in good condition. The wall appears to have been repointed at some point, as the pointing in some locations does not match the appearance of the rest of the barn. Small holes were noted on the floor joists that cantilever off of the lower eastern stone wall. These small holes indicate oak pinhole borers within the framing members. Whether they are active is unknown (Figure 169).

Figure 169: Pinhole borer holes in exposed timbers.

The south wall did not show visible signs of inward or outward deflection as noted in the north wall. This wall was not accessible by lift and a plumb bob measurement was not taken. The south wall, similar to the north wall, showed areas of discoloration, which may indicate that previous cracks were repaired (Figure 170). No maintenance records were found for this wall for when repointing or repairs occurred. As mentioned earlier, it is recommended that records and locations of cracks be maintained and monitored going forward. Cracks in the masonry wall were observed above Window 002. Also observed was a crack on the eastern side of the south wall at the corner. The crack was noted to be on both sides of the wall and may indicate that the corner of the foundation is settling. The cracks in this area should be monitored. Additional cracking in this area may indicate the wall is still moving. Also similar to the north wall, pointing was missing in the rubble stone walls at the vegetation line between the louvers on the wall. Repointing is needed in these areas.

Figure 170: Discoloration on west side of south wall (left) and crack above Louver 002 (right).

The rubble stone walls on the west appear to be in good condition. No cracking was noted on these walls. Similar to the north and south walls, some discoloration was noted where the rubble stone pointing has been repaired. No noticeable deflection was also noted based on visual inspection on these walls. Above the door, the connection for the cables in the east-west direction is heavily corroded (Figure 171). The top plate running along top of the masonry is also showing signs of deterioration. Further investigation is recommended into the condition of the top plate to determine if replacement is necessary.

The rubble stone retaining wall on the west side is dry laid and in good condition. The wall appears to be plumb.

Figure 171: Connection for cable corroded.

Foundation

Based on the observations of the test pit excavations, the stone beneath the foundations appears to be in good condition. The depth of the stone varies from approximately 30” to 36”. Typical values for frost depth for southeastern Pennsylvania typically range between 30” and 36”; therefore, the foundation depth appears to be adequate for frost heave.

On the interior of the building, most of the stone foundations below the lower level timber beams appear to be in good condition, with the exception of the southernmost foundation on the western column line and the southern column on the eastern column line. The foundation on the southernmost column on the western column line has been undermined and the lower level timber beam is no longer in contact with the stone below (Figure 172). On the eastern column line on the southernmost column, settlement has also occurred as the column at this location is no longer in contact with the girder below and was noted to be leaning significantly and rotated freely upon touch, indicating it is no longer taking any load.

Figure 172: Foundation at western column line on south wall (left) and column leaning on eastern column line (right).

Lower Level

The wood framing supporting the upper level framing at places is showing signs of deterioration. The posts appear to be generally in good condition with a few exceptions. As mentioned, the southernmost column on the eastern column line is loose (Figure 172). Many of the original 6x6 posts have notches (approximately 1 ½" thick) cut into them where cross beams or fencing were previously attached (Figure 173). Many of the columns were off center of the girder above, by as much as 3 inches.

The girders that support the upper level floor joists running north-south appear to be in good condition, with the exception of a section at the south east column. On the east column line south of the southernmost column, the girder appears to have continued previously all the way to the south wall. A beam pocket is located where the girder previously extended to (Figure 173). The missing girder leaves two floor timbers unsupported, forcing the floor boards in the floor above to span roughly 6'-10" which is excessive and not recommended to support any live load. Several of the posts have also been replaced by 2x4 dimensioned lumber which is not adequate to support the live loading from the floor above.

The floor timbers appear to be in good condition, with the exception of the two timbers along the west wall, which show signs of serious deterioration and have failed in bearing along this wall (Figure 174). The failure is likely due to deterioration caused by water infiltration and insect damage. These areas are beneath the sliding door above, where moisture or wind driven rain may be a problem. The current live load for the upper floor framing is limited by the 2x4 posts that have been added to replace old posts. These posts currently limit the allowable live load in their areas to approximately 20 psf. If these posts are replaced, new floor boards are installed, and the girders mentioned above are replaced, the timbers should be able to carry a live load of 125 psf (See also discussion on roof level loading).

Figure 173: Notch in lower level post (left) and empty beam pocket on south wall (right).

Figure 174: End bearing failure at floor timber.

Upper Level

The floor boards for the upper level were not accessible at all locations due to the materials that were being stored on the upper level. In the areas that were accessible, the floor boards for the upper lever between the east-west frames appears to be in good condition. In both north and south of the frames that were accessible, the floor boards show signs of severe deterioration or in some cases are missing. Where boards are missing, various pieces of lumber are used as floor boards across the timbers. Figure 175 shows one location where an old door is being used as a flooring material.

The rubble stone masonry walls on the interior have no pointing, making it difficult to identify cracks in the walls. The wood framing for the east wall frame and for the frames running east-west appears to be in good condition. Three of the horizontal beams approximately 4’ off the ground on the frames running east-west framing are missing. Existing mortise joints suggest that framing was present at one time in all 4 locations, however; only the beam on the south west bay is present. The siding and wind girts also on the east wall appear to be in good condition. On the southern east-west frame, at the center column,

the mortise and tenon joint connecting the top of the column to the top beam has failed and separated likely due to settlement of the framing below, and the beam has separated from the column (Figure 175).

Figure 175: Old door as flooring (left) and failed mortise and tenon joint at top of column (right).

Roof

The main roof rafters appear to be in good condition, with the exception of one roof rafter that has completely deteriorated on the east side above the east wooden frame. This rafter has already been sistered with what appears to be a 2x6 dimensioned lumber. Given their current condition, the roof rafters are capable of meeting the current loading requirements for vertical wind and snow loadings based on stresses in the wood. However, due to the long span for the rafters, given their current size and support conditions, they are exceeding deflection guidelines for both total load (1/180 of span) and roof live load (1/240 of span).

Also noted at the top of the frame on the east wall, the connection of the top of the frame to the north rubble stone wall has failed, and the wood connection is starting to pull out of the stone. This is likely due to the movement of the masonry wall on the north wall (Figure 176). This is a major safety concern as the north wall no longer appears to be adequately supported at the roof level. The wall appears to be stable at this point; however, further investigation is needed to determine the cause of the outward deflection of the wall.

Loading for the roof on the east side is carried through a wooden frame. The frame consists of 4 posts that rest on floor timbers above the cantilevered sections of the floor framing below. These posts apply a high point load to the floor framing at a single floor joist. This point load locally exceeds the capacity of the floor framing both in allowable stresses and in deflection. Additional posts are recommended in this are to further disperse the load along the east wall to the upper level floor joists.

Figure 176: Sistered roof rafter (left) and connection at top of east frame pulling out (right).

PART 2 - TREATMENT AND USE

2.1.A Nathan Care House: Recommendations for Treatment

2.1.1.A Treatment Philosophy

The Nathan Care House is a contributing building located within the Hopewell Furnace National Historic Site. Some of the interior plan and features were altered in the 1940s to upgrade the amenities and provide living quarters for National Park Service staff. The exterior of the Nathan Care House has been maintained by the park with some limited alterations since they purchased the property in the 1930s. The majority of the original interior fabric is extant, with the exception of the areas that have been modernized. Outlined below are alternatives for establishing a treatment approach for the exterior of the building, and for the interior. These alternatives include the associated advantages and disadvantages.

Exterior

Alternative No. 1: Restore the exterior of the Nathan Care House

Advantages

- This option realizes the full potential to interpret the building for its significance as an example of vernacular architecture.
- This option improves the safety and stability of the building to permit occupancy.

Disadvantages

- Required funding may not be available.
- Removal of existing means of egress. Note: The existing means of egress is not required by code for residential use.

Alternative No. 2: Repair the exterior of the Nathan Care House

Advantages

- This option improves the stability and safety of the building to permit occupancy.

Disadvantages

- This option does not realize the full potential to interpret the building for its significance as an example of vernacular architecture.

Alternative No. 3: Selectively restore the exterior of the Nathan Care House:

Advantages

- Significant elements such as the porch and shutters will be restored, allowing for more interpretation of the mid-18th century appearance.
- The construction costs will not be as high as if the entire exterior was restored.
- The door on the north elevation will not be removed and will provide an additional means of egress.

Disadvantages

- This option does not realize the full potential to interpret the original building as an example of vernacular architecture.

Interior

Alternative No. 1: Restore the interior of the Nathan Care House

Advantages

- This option realizes the full potential to interpret the original interior building configuration as an example of vernacular architecture.
- This option improves the safety and stability of the building to permit occupancy.

Disadvantages

- Would not allow for residential or business (office) occupancy.
- Required funding may not be available.

Alternative No. 2: Repair the interior of the Nathan Care House

Advantages

- This option provides for code-compliant residential or business (office) occupancy.
- This option improves the safety and stability of the building to permit occupancy.

Disadvantages

- This option does not realize the full potential to interpret the original interior building configuration as an example of vernacular architecture.

As part of the planning initiatives outlined by the National Park Service, the interior of the building will likely be rehabilitated and used as a residence, while the exterior will be selectively restored to its appearance as part of the rural landscape of southeastern Pennsylvania during the mid-19th century. Exterior Alternative No. 3 and Interior Alternative No. 2 would both meet these goals. Exterior Alternative No. 3 would allow for more public interpretation as the building exterior will be partially restored to its period of significance. Interior Alternative No. 2 will provide code-compliant residential space that the Park can lease. These alternatives are recommended as the most appropriate means of accomplishing the stated goals of the National Park Service in interpreting and reusing the Nathan Care House. The work recommendation listed in Section 2.1.3.A are based upon the recommended alternatives.

2.1.2.A Character-Defining Features for Nathan Care House

To aid in the process of planning for the preservation, treatment and use of the Nathan Care House, a general summary of the character-defining features is provided below. The list includes existing elements that contribute to the architectural and visual character of the property. Missing interior features that would be considered character-defining are also listed where archival or physical evidence indicates that they were once present. Given that the primary significance of the Nathan Care House is tied to the period of operations at Hopewell Furnace during the mid-19th century, the features listed are those associated with that period.

Exterior Features

- Relationship of the Nathan Care House to Hopewell Furnace.
- Relationship of the Nathan Care House to its fields and barn, reflecting the agricultural use of the property.
- Stone construction.
- Scale, height, and massing of structure.
- Original red clay stucco known as "Reading Stucco."
- South porch (reconstructed).
- Original four-paneled wood door with early hardware on south elevation.
- Original single-hung, true divided light, nine-over-six wood windows on first floor.
- Original single-hung, true divided light, six-over-six wood windows on second floor.
- Original 1856 window trim.
- Simple box cornice with short returns, beaded fascia board and drip cap.
- Wood roof shingles.
- Rake board.
- Original brick chimney on the west elevation.
- Brick chimney on east elevation (no longer extant).
- Original opening to basement on east elevation.
- Wood bulkhead doors (stored in barn).

Interior Features

- Exposed first floor framing and underside of first floor random-with wood flooring (c. 1856) (modern wood flooring and tile have been added on top).
- Exposed random-width, mid-19th century pine flooring on the second floor (concealed with carpet) and attic.
- Location of interior fireplace and associated mantel.
- Built-in cupboard adjacent to the fireplace in the Living Room.
- Original 1856 window trim.
- Wood board and batten interior doors throughout the house.
- Original and early door and window hardware.
- Original wood baseboards on first and second floors.
- Original plaster walls.
- Original wood winder staircases from basement to first floor, first to second floor, and second floor to attic.

- Original pegged mortise & tenon roof rafters with carpenter's marks and timber rafter plate.
- Original painted stone walls in attic, including west end chimney mass.
- Original wide wood floor boards in attic.
- Original 4-lite casement window sash and frames.
- Exposed shingle lath.

2.1.3.A Requirements for Treatment for the Nathan Care House

Given the current condition of the house and the fact that it has been vacant for a period of time, any future occupancy will have to include repairs to interior and exterior finishes as well as upgrading of basic support utilities and MEP systems. In addition, work required to meet minimum life and fire safety criteria will be required.

Code Review

The following code review section addresses two possible uses discussed by the National Park Service for the Nathan Care House: Residential or Office/Business. Each use has distinct codes and accessibility requirements as outlined below. The review assumes that the building will remain in its existing configuration with minor changes to both the exterior and interior.

Applicable laws and codes include the following:

- The Rehabilitation Act
- The Fair Housing Act
- National Historic Preservation Act of 1966 (Section 106)
- International Existing Building Code for construction and building (IEBC 2015);
- International Residential Code (IRC 2015)
- International Building Code for construction and building (IBC);
- NFPA 101 (Life Safety Code) when the IBC is silent.
- Director's Order #58 - Structural Fire Management
- Director's Order #38 – Real Property Leasing
- Director's Order #89 – Acquisition and Management of Leased Space
- Architectural Barriers Act Accessibility Standards (ABAAS).

All of the laws and codes above acknowledge that there are challenges in meeting all modern code requirements in historic buildings without compromising significant, existing historic fabric. Alternative methods of compliance, variances or waivers must be reviewed and agreed upon by the Authority Having Jurisdiction (AHJ). The following is a summary of the most significant code concerns associated with the Nathan Care House.

Occupancy Group

Existing: Residential Group R-3. Currently, the house is not occupied, however, its use has historically been residential.

Proposed: Residential Group R-3 or Business Group B (change of occupancy).

Construction Type

Existing: Type III-B (unprotected) where exterior walls are of noncombustible materials and the interior building elements are of any materials with no fire resistance rating.

Proposed: Type III-B (unprotected).

Square Footage:

a. *Existing: Gross floor area is 1,604 SF including the first floor, second floor, attic and basement stories.*
b. *Total Occupiable Space*: 786 SF (First and second stories only per IRC 2015).

Proposed: Same.

Number of Stories and Area:

Code Requirement: The limitations for Group R-3 is four stories above grade with unlimited allowable area per story and three stories above grade for Group B with an area limit of 38,000 sf.

Condition: The building is code-compliant at two stories and 1,604 square feet.

Number of Exits:

Code Requirement:

R-3: Per IRC 2015 Section R311.2, not less than one egress door shall be provided for each dwelling unit. The egress door shall be side-hinged, and shall provide a clear width of not less than 32 inches where measured between the face of the door and the stop, with the door open 90 degrees.

B: Per IBC Table 1006.3.2(2) only one exit is required from the first and second floors if the occupancy is restricted to 29 on the second floor and 49 on the first floor. Occupancy of the third floor/Attic is not permitted.

Condition: The house is code-compliant with two existing means of egress on the first floor. Should the door in the kitchen be replaced with a window to match the original configuration, the building will still be code-compliant with one exit door on the south elevation. The south door is 2'-11" wide and the north door is 2'-8" wide.

Exit Signs:

Code Requirement:

R-3: Per IBC 2015 Section 1013.1, exception 3, exit signs are not required in R-3 Occupancy.

B: Per IBC 2015 Section 1013, exits must be marker by exit signs.

Condition: There are no exit signs currently in the building. The house is compliant for Group R-3; exit signs must be added for B occupancy.

Emergency Lighting:

Code Requirement: Per IBC 2015 Section 1008.2, Exception 1, Occupancy Group R-3 is exempt from Emergency Lighting. Emergency Lighting is required for Occupancy Group B.

Condition: There are no emergency lights currently in the building. The house is compliant for Group R-3; emergency lighting must be added for B occupancy.

Ceiling Height:

Code Requirement:

R-3: Per IRC 2015 Section 12305.1, habitable space, hallways and portions of basements containing these spaces shall have a ceiling height of not less than 84 inches. Bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 80 inches.

B: Per IBC 1208.2, Occupiable spaces shall have a ceiling height of not less than 90" (bathrooms 84").

Condition:

R-3: The first floor is compliant with ceiling heights of 85 inches. The second story, excluding the bathroom, is not compliant as the ceiling heights range from 80¾ inches to 81¼ inches in the bedrooms and hallway. The bathroom is compliant as the ceiling height is 81 inches. The ceiling height in the basement is 66¼ inches. The basement is not compliant and ideally should only be used for storage and mechanical.

B: None of the existing ceiling heights are code-compliant. A variance will be required.

Doors:

Code Requirement: R-3 and B: Per IBC 2015 Section 1010.1.2.1, pivot or side-hinged swinging doors shall swing in the direction of egress travel where serving a room or area containing an occupant load of 50 or more persons.

Condition: The building is code-compliant. All existing exterior doors swing inward against the direction of egress but occupant load is less than 50 persons.

Stairs:

Code Requirement: R-3 and B: Per IEBC 2015 Section 1205.11, for buildings less than 3,000 square feet, existing conditions are permitted to remain at all stairways.

Emergency Escape from Sleeping Rooms:

Code Requirement: R-3: As an existing building, the emergency escape and rescue openings in the Nathan Care House are exempt from dimensional requirements as stated in Section R.310.2.1 of IRC 2015.

Structural Load Capacities:

Code Requirement:

R-3: Per IBC 2015 Table 1607.1, required live load capacity for all floors except the attic is 40 PSF. For the attic, the required live load capacity is 20 PSF.

B: Per IBC 2015 Table 1607.1, required live load capacity for offices is 50 PSF.

Condition: R-3 and B: As detailed in Section 1.1.5.A, none of the floors are code compliant, and structural reinforcement will be required (see Section 2.1.4.B) for occupancy.

Sprinkler

Code Requirement: R-3: Per IRC 2015 Section R313.2, an automatic residential fire sprinkler system shall not be required for additions or alterations to existing buildings that are not already provided with an automatic residential sprinkler system.

B: Per IBC Section 903, an automatic fire sprinkler system is not required for B Occupancy. However, Director's Order #58 outlines that buildings undergoing renovation, remodeling, rehabilitation, or other alterations—and buildings with a change in occupancy—shall have automatic sprinkler systems and automatic smoke detection systems installed. Exemptions to the requirements can be granted by the Regional Authority Having Jurisdiction (AHJ). Exemption requests include: the construction type, the planned contents of the building, the importance of the structure to the mission of the Park, alternative plans for protection of the building and its occupants from fire and whether the existing water service is sufficient to support an automatic sprinkler system.

Accessibility

Per IBC 2015 Section 1103.2.3, Detached one- and two-family dwellings are not required to comply with Chapter 11 – Accessibility. Note: Any NPS specific regulations about number of accessible buildings should be reviewed.

Hazardous Materials

In addition to code deficiencies, the following are environmental concerns also present at the Nathan Care House:

Asbestos

Asbestos is a fibrous mineral frequently found in historic architectural and industrial settings. It was used mostly in the fabrication of insulation boards or pipe wrappings due to its heat and fire resistance. Asbestos fibers were also often added to enhance the cohesiveness of plaster and inhibit shrinkage cracking. Inhalation exposure to certain types of asbestos is associated with an increased risk for lung disorders, including cancer. Asbestos is still used in select industrial applications, however its use in architectural materials has been all but eliminated since the Environmental Protections Agency (EPA) enacted a phase-out rule in 1989.

A limited hazardous-materials evaluation took place at the Nathan Care House in 2012 as part of a site-wide asbestos-containing materials survey for Hopewell Furnace National Historic Site. 24 samples were taken in the house, including pipe insulation and numerous plaster locations. Asbestos was identified in two samples: One sample of pipe insulation and in a single layer of plaster in one sample. The report indicates that this plaster sample appears to date from the 1960s renovations as the character of the plaster is different from the early plaster which contained horsehair binder. The report recommends removal of all plaster (ceiling and wall) as the most conservative approach to ensure full mitigation of the asbestos and in consideration of the likely use

of the building for housing. However, the report also notes that given the historic status of the building, it may be feasible to repair the asbestos-containing plaster in lieu of removal. As part of the proposed renovations, a full asbestos survey should be undertaken by a licensed professional in order to better identify the extent of the asbestos-containing plaster and potentially allow for the retention of the majority of the historic plaster and more select removal of the later, asbestos-containing plaster.

Figure 177: Detail of damaged asbestos board (left) and detail of attic insulation that likely contains asbestos (right).

Lead

One of the primary pigments used for architectural painting throughout the 19th and 20th centuries was lead in various forms. It was valued for its hiding and adhesive qualities. White lead was the predominant white pigment until the introduction of titanium white in the first quarter of the 20th century. Lead in its burnt forms produced yellow, red and orange hues. Even in transparent finishes such as varnish, lead was introduced to improve drying and adhesion properties. Research in the middle decades of the 20th century revealed the devastating effects of chronic lead exposure, particularly in children and the use of lead in architectural paints was effectively banned in 1978.

Given the original date of construction and the renovations that took place during the 1940s, it is likely that the underlying layers of paint on the wood and possibly plaster surfaces from that period contain lead. There may be lead paint present on the porch, shutters, and windows. Indoors, lead paint may be present on the wall and ceiling plaster, windows, and trim. Though lead paint encapsulated under intact layers of later finishes poses no active hazard, precautions must be taken during any future construction work to avoid the generation and spread of lead dust. Activities such as demolition, paint stripping and sanding must be carefully monitored.

Lead was also an important component of historic window-glazing materials, primarily for its adhesive properties. It is highly likely that any surviving early to mid-20th-century glazing putty contains lead.

Figure 178: Detail of window showing damaged paint, most likely consisting of lead.

Mold

During the field investigations that took place in May and June of 2016, an abundance of mold was visible, especially in the second floor ceilings. The mold is caused by moisture from water infiltration in the attic, as well as lack of ventilation in the house. Mold within the exterior walls is unlikely as the plaster is applied directly on the stone walls. Precautions must be taken during any future construction work for the mitigation of any contaminated surfaces and correction of conditions that support mold growth.

Figure 179: Evidence of widespread mold on ceiling in Room 203.

Sustainability

Though the 1940s renovation of the Nathan Care House does not appear to have incorporated significant energy- or water-conservation measures, additional upgrades were made in recent years. The following improvements were noted during the building survey:

Energy Conservation

- Exterior triple track storm windows;
- Interior magnetic panels on all single-hung windows;
- Fiberglass and mineral wool insulation in attic floor;
- Programmable thermostats;
- On-demand hot-water heater in the second-story bathroom to replace the original summer-winter hook-up for domestic hot water;
- Use of fluorescent and self-contained compact-fluorescent fixtures for general and task lighting;

Water Conservation

- Installation of a low-consumption water closet.

Possible Conservation Measures

The proposed renovation of the Nathan Care House presents the opportunity to incorporate sustainability measures throughout the building. Items to be considered include the following:

- Improve weatherstripping on exterior doors;
- Replace of existing insulation in the attic and increase of R value.
- Install of LED bulbs;
- Install of new higher-efficiency heating and cooling equipment;
- Improve insulation of mechanical ductwork and plumbing pipes.
- Evaluate condition of the insulation and replace if it is compressed or not evenly covering the space.

The existing heating and cooling systems were not assessed by a mechanical engineer as part of this Historic Structures Report. Visual observation of the units, however, indicated that at least one unit is over 20 years old. Significantly more efficient units are now readily available to minimize energy consumption for heating and cooling and should be considered when the existing units are replaced.

2.1.4.A Work Recommendations for the Nathan Care House

The survey identified areas of deterioration affecting both the integrity and functionality of the Nathan Care House. The conditions observed range from relatively minor site-maintenance issues, the specific material failures and safety concerns.

Exterior

Alternative No. 3: Partially restore the exterior of the Nathan Care House

- Remove stuccoed CMU chimney on east elevation. Must coincide with replacement of boiler with new high-efficiency boiler and through-wall vent.
- Rebuild top of east chimney that original projected from the roof.
- Patch or repair in-kind the exterior stucco.
- Remove metal door on exterior of entranceway on south elevation.
- Repair foundation at porch.
- Restore south porch to match original appearance.
- Replace board and batten shutters on second story with louvered blinds to match original. Replace first floor board and batten shutters with raised-paneled shutters to match those that were likely in place in the mid-19th century. Though early photographs do not show shutters on the first floor, they were likely there as the hinges match those on the second floor.
- Replace roof and associated flashings, gutters, and downspouts.
- Repair damaged wood trim.
- Paint exterior trim (based on results of paint analysis).
- Repoint original chimney on west elevation and install cap.
- Repair windows as necessary.

Alternative No. 1: Full Restoration

- Replace door on north elevation with window to match original and other existing windows, and infill masonry below and around opening. Remove concrete steps, railings and walkway associated with existing door.
- Replace metal bulkhead doors with reproduction wood doors to match original doors located in the lower level of the barn.

Interior

Alternative No. 2: Repair the interior of the Nathan Care House

- Repair areas of deteriorating plaster on interior walls, including attic walls.
- Mitigate hazardous materials including asbestos and mold. Detailed recommendations cannot be made until further testing has been completed.
- Repair windows where necessary: damaged muntins, broken panes, failing putty

- Repair stairs from basement to first floor and from first floor to second; add wall-mounted handrails.
- Refinish stairs from first to second floor.
- Remove existing spray foam insulation throughout house and replace with new insulation.
- Remove all insects and nests throughout the house.
- Clean all woodwork throughout the house.
- Repair doors and frames where necessary.
- Repair broken or rusted door hardware.
- Remove existing carpet and install new carpet on second floor.
- Clean all surfaces with a mold-prevention cleaner.
- Paint all surfaces.
- Repair or replace broken radiators.
- Evaluate existing electrical systems.
- Evaluate existing HVAC systems and install new equipment. Clean any ductwork to remain.
- Evaluate existing plumbing systems including checking for leaks in bathroom.
- Turn on water service.
- Repair damaged or deteriorated plaster as required.
- Remove plywood in front of fireplace in Living Room and infill with wood flooring to match existing, then refinish entire floor.
- Replace kitchen appliances as necessary.
- Replace faucet at sink.
- Replace kitchen countertops.
- Remove debris and clean kitchen floor.
- Clean out kitchen cabinets for reuse.
- Repair unfinished patch on south portion of east hall in Hall 201.
- Clean all bathroom fixtures and replace if necessary.
- Clean tile floor and tile base in Bathroom 204.
- Replace towel bar in Bathroom 204.
- Replace baseboard heater in Bathroom 204.
- Clean debris from basement floor.
- Evaluate moisture at lower portion of walls in basement; add dehumidifier in basement.
- Paint/white-wash basement walls
- Secure splitting and loose floorboards in attic.
- Repair pointing around attic windows.
- Replace in-kind wood lintels at attic windows.
- Evaluate condition of the insulation and replace if it is compressed or not evenly covering the space.
- Install all new smoke and carbon monoxide detectors to meet current code requirements, including basement and attic.
- Install fire alarm connected to central NPS monitoring station if applicable.

Structural Work Recommendations for the Nathan Care House

The recommendations below regarding repair and modifications of the existing structure are intended to demonstrate what is anticipated to be required to bring the structure up to a residential load rating with the live loads that were discussed in Section 1.1.5.A. A structural analysis of the house was beyond the scope of this study. Additionally, the full extent of the existing conditions of all the members was not fully assessed and not all member sizes, depths and spacing's were available at the time of this assessment. Due to these unknowns, it is assumed that these unknowns will be addressed in a future design phase, when the framing is exposed. Actual conditions may decrease the live load capacities of the floors.

Exterior:

- Repair in kind the hole in the rubble stone wall on the south west corner on the west side of the porch.
    - Alternate: If similar materials cannot be found, a non-shrink grout may be used to fill the void left by the stone.
- The lintel above window 205, requires further investigation to determine the condition of the lintel and to determine what is causing the cracking and rotation of the lintel. Carefully remove the exterior and interior finish as required to expose the structural portion of the lintel. If the lintel is found to be compromised, replace the lintel with a new pressure treated dimensional lumber lintel meeting or exceeding the size of the current lintel.
- Should the door on the northeast corner be retained, remove and replace the stoop on north side of the house due to heavy cracking and settlement. The hand rails on the stoop also need to be removed and replaced due to heavy corrosion leading to section loss. Prior to installing a new door stoop, the top layer of soil needs to be removed, and compacted in order to prevent settlement issues in the future. Inspection of the subgrade by a geotechnical engineer is recommended prior to reinstallation of the stoop.
- Should the chimney on the southeast corner be retained, further investigation needs to be performed to determine the depth of the horizontal cracks. The coating on the masonry block should be removed, to examine the mortar joints on the masonry block. If the cracks do not extend into the mortar joints, then the cracks are only aesthetic, and the stucco finish on the outside only needs to be repaired. If the cracks extend into the mortar joint, then the masonry needs to be repointed and the masonry blocks (if found to be hollow) need to be grouted.
- At the porch roof framing, install stainless steel adhesive or mechanical anchors into the ledger beam between the existing, corroded bolts.

Basement:

- The existing steel post that is corroded needs to be cleaned to remove all areas of corrosion and should be painted with zinc rich paint to help prevent corrosion from occurring in the future.

- At the bottom of the stairs, the center post is not bearing on the concrete floor. The additional framing nailed to the side of the center post should be removed and a grout pad should be installed at the base of the post using non-shrink grout. Prior to pouring the grout pad, a light gage metal post cap should be installed to the post to ensure separation between the grout and the wood.
- Live load of the first floor is limited by the girders, both at the center of the house running east/west and the girder along the north face. If higher live load is desired, sampling of the existing structural framing may be conducted to get more accurate wood properties. If wood properties still reveal that the girder is deficient, then new 6x6 posts could be added to reduce the span of the girders. If the new posts are installed, a live load of 40 psf can be used.
    - Alternate: In lieu of installing new posts, the girders could be replaced with a 10 inch wide, by 8 inch deep dimensioned lumber girder, which would be capable of spanning across the current spans. This would require temporary shoring / jacking of the existing floor framing, disconnecting the existing girder, and installing a new girder. Replacement of the beam would achieve a live load of 40 psf, without adding more columns to the floor plan.
- Shim the floor joists that are not resting on the wood girders at certain locations to ensure that a positive connection is achieved. The floor joist would need to be jacked up, with the jacking location close to the girder, prior to installing shims in order to ensure load is being transferred.

First Floor:

- Further investigation of the cracking in the plaster ceiling on the first floor is necessary to determine the size and condition of the framing above. The ceiling plaster will need to be removed in both rooms to determine this. If the framing is still in good condition, the beams should be sistered with new 3x8 dimensioned lumber joists in order to increase the live load on the floor above to the required 40 psf and to help mitigate cracking in the ceiling above. If the framing is found to be compromised, the existing framing would need to be sistered with a 6x8 dimensioned lumber beam which will keep floor to ceiling depth the same to increase the live load and support the flooring above. The use of engineered lumber, such as LVLs, may be an option at the discretion of the design engineer and dependent upon the conditions found when the framing is exposed.

Second Floor:

- See first floor above for recommendations on the floor framing for the second floor.
- For repairs to the lintel above window 205, see the exterior work recommendations above.
- Similar to the first floor ceiling listed above further investigation is required to determine the cause of the cracking in the ceiling of Bedroom 2. The ceiling plaster should be removed to expose the joists for the attic framing to determine their condition. If the joists are found

to be in good condition and a higher capacity is needed for the attic space, the existing joists could be sistered with a 3x8 dimensioned lumber. Adding the beams will increase the allowable live load to the required load of 20 psf.

Attic:

- Replace damaged shingle lath strips with lath of similar size.
- Repair and repoint damaged stone masonry on the east wall.
- Replace in-kind wood lintels above the louvers on east and west walls.

2.1.B Nathan Care Barn: Recommendations for Treatment

2.1.1.B Treatment Philosophy

The Nathan Care Barn is a contributing structure located within Hopewell Furnace National Historic Site. The structure has been maintained by the National Park Service since the Federal Government acquired the property in the 1930s. Some of the exterior features were altered in the mid-20th century, however the majority of the historic fabric is intact.

As part of the planning initiatives outlined by the National Park Service, the interior will be used for storage, while the exterior will be maintained as part of the rural landscape Hopewell Furnace National Historic Site. Outlined below is a treatment philosophy for the exterior and interior of the building. These recommendations are the most appropriate means of accomplishing the stated goals of the National Park Service in interpreting and using the Nathan Care Barn.

Exterior:

Repair the exterior of the Nathan Care Barn

Advantages:

- Improves the safety and stability of the building.
- Allows for future restoration of the building by not removing any significant extant materials.
- Since the overall massing and form appear to reflect the original appearance of the barn, there is no alternative for restoration as the barn can already be interpreted for its significance as an agricultural building in rural Pennsylvania in the mid-19th century.

Interior:

Repair the interior of the Nathan Care Barn

Advantages:

- Improves the safety and stability of the building.
- Allows for future restoration of the building by not removing any significant extant materials.
- Allows for the Park to continue using the structure for storage.

2.1.2.A Character-Defining Features for Nathan Care Barn

To aid in the process of planning for the preservation, treatment and continued use of the Nathan Care Barn, a general summary of the character-defining features is provided below. The list includes existing elements that contribute to the architectural and visual character of the property. Given that the primary significance of the Nathan Care Barn is tied to the period of operations at Hopewell Furnace during the mid-19th century, the features listed are those associated with that period.

Exterior Features

- Relationship of the Nathan Care Barn to the Nathan Care House and Hopewell Furnace.
- Relationship to adjacent fields, reflecting the agricultural use of the property.
- Scale, height, and massing of structure.
- Field stone construction building walls and retaining walls.
- Original door openings with replacement random-width, beaded board and batten doors with painted finish, early metal strap hinges and transoms with wood bars above east doors.
- Sliding door mechanism hardware on west elevation.
- Butted vertical boards on the east elevation.
- Simple mid-19th century flat rake board trim at roof gables.
- Exposed plain cut rafter tails.
- Wood roof shingles.
- Windows with original pegged frames and fixed wood bars.
- Circular stone-surrounded vents at gable ends.

Interior Features

- Exposed hand-hewn heavy timber joists, beams, and rafters.
- Unfinished, loose-layed, random-width pine board flooring.
- Exposed field stone walls.

2.1.3.B Requirements for Treatment for the Nathan Care Barn

The Nathan Care Barn played an important role in the development of Hopewell Furnace National Historic Site, though it was not originally part of the site. In 1935, the Federal Government purchased the property, along with the Nathan Care House, and by the mid-20th century, the barn had been modestly altered so that it could be used first as a garage and later for storage. By 1940, the area below the original overhang was infilled with siding and doors to create more space, and it was likely around this time that the forebay was removed. The proposed restoration of the exterior and update of the interior create the opportunity to interpret the mid-19th-century exterior appearance while providing valuable storage space for the Park.

Code Review

The following code review section addresses the continued use for storage by the National Park Service for the Nathan Care Barn. The review assumes that the structure will remain in its existing configuration with minor changes to both the exterior and interior.

Applicable laws and codes include the following:

- International Existing Building Code for construction and building (IEBC 2015);
- International Building Code for construction and building (IBC 2015);
- NFPA 101 (Life Safety Code)
- Director's Order #58 - Structural Fire Management

All of the laws and codes above acknowledge that there are challenges in meeting all modern code requirements in historic buildings without compromising significant, existing historic fabric. Alternative methods of compliance or variances must be reviewed and agreed upon by the Authority Having Jurisdiction (AHJ). The following is a summary of the most significant code concerns associated with the Nathan Care Barn, primarily structural codes.

The existing physical characteristics of the Nathan Care Barn relevant to the applicable codes are summarized below, followed by a general discussion of the code requirements relative to its proposed future use.

Occupancy Group

Existing: IBC Occupancy Classification Group U – Utility and Miscellaneous.

Proposed: The barn will continue to be used as storage.

Construction Type

Existing: Type III-B (unprotected) where exterior walls are of noncombustible materials and the interior building elements are of any materials with no fire resistance rating.

Proposed: Type III-B (unprotected). There is no need to modify the construction type.

Square Footage:

a. *Existing:* Gross floor area is 1,305 SF including the lower and upper levels.
b. *Total Occupiable Space*: 1,305 SF.

Proposed: Same.

Height and Number of Stories:

Code Requirement: The height limitation for a Type III-B construction type and Occupancy Group U is two stories above grade with an allowable area of 8,500 SF.

Condition: The barn is code-compliant at two stories and 1,305 square feet.

Number of Exits:

Code Requirement: Per IBC 2015 Sections 1006.2.1 and 1006.3.2(2), in Group U occupancies, one means of egress is permitted within and from the building with a maximum occupant load of 49 where the building is not equipped with an automatic sprinkler system. The maximum common path of egress travel distance (without a sprinkler system) is 75 feet.

Condition: The lower and upper levels of the Nathan Care Barn are code-compliant. The lower level has two (2) doors that exit the building and the upper level has one (1) door that exits the building. At both levels, the anticipated occupant load and travel distance meet the requirements for a single means of egress.

Exit Signs:

Code Requirement: Per IBC 2015 Section 1013.1, Exception 3, exit signs are not required in Occupancy Group U.

Condition: There are exit signs currently in the building. The barn is compliant as it is in Group U.

Emergency Lighting:

Code Requirement: Per IBC 2015 Section 1008.2, Exception 1, Occupancy Group U is exempt from Emergency Lighting.

Condition: There are no emergency lights currently in the building. The barn is compliant as it is in Group U.

Headroom in existing building:

Code Requirement: Per IBC 2015 Section 1003.2 the means of egress shall have a ceiling height of not less than 7’6”.

Condition: The barn is code-compliant at the Upper Level where the ceiling height is approximately 21'8". The Lower Level ceiling height is 7'-1." As an existing building, the AHJ can determine the existing ceiling is not an unsafe condition.

Doors:

Code Requirement: Per IBC 2015 Section 1010.1.2.1, pivot or side-hinged swinging doors shall swing in the direction of egress travel where serving a room or area containing an occupant load of 50 or more persons.

Condition: The Lower Level is code-compliant because the doors are hinged. The Upper Level would be code-compliant if the door was power-operated. In order to enter Upper Level, the sliding door must be opened, therefore the AHJ may determine that the sliding door is not a hindrance to safe exiting since it will most likely be open while occupied.

Director's Order #58

DO-58 outlines that buildings undergoing renovation, remodeling, rehabilitation, or other alterations—and buildings with a change in occupancy—shall have automatic sprinkler systems and automatic smoke detection systems installed. Exemptions to the requirements can be granted by the Regional Authority Having Jurisdiction (AHJ). Exemption requests include: the construction type, the planned contents of the building, the importance of the structure to the mission of the Park, alternative plans for protection of the building and its occupants from fire and whether the existing water service is sufficient to supply an automatic sprinkler system. The barn is an unheated structure which would require bringing water to the structure and heat for the fire pump room, etc.

Accessibility

Per IBC 2015 Section 1103.2.4, Utility Buildings, Group U occupancies are not required to comply with Chapter 11 – Accessibility.

Hazardous Materials

Lead

Given the original date of construction and minor renovations that have taken place, it is likely that the underlying layers of paint on the wood surfaces from that period contain lead. There may be lead paint present on the siding, doors and windows. Though lead paint encapsulated under intact layers of later finishes poses no active hazard, precautions must be taken during any future construction work to avoid the generation and spread of lead dust. Activities such as demolition, paint stripping and sanding must be carefully monitored.

Mold

During the field investigations that took place in May and June of 2016, evidence of mold was found, especially on the lower level door. Precautions must be taken during any future construction work for the mitigation of any contaminated surfaces.

Sustainability

Opportunities for increasing energy efficiency at the barn are limited, and include implementing LED bulbs.

2.1.4.B Work Recommendations for the Nathan Care Barn

The survey identified a variety of deterioration mechanisms affecting both the integrity and function of the Nathan Care Barn. The conditions observed include relatively minor site-maintenance issues, specific material failures and safety concerns.

Exterior

- Remove vegetation and biological growth throughout entire structure, including roof.
- Repave macadam ramp and repair deteriorated cement sill at west door.
- Repair minor cracks in exterior masonry.
- Repoint open joints as necessary using one of two options:
    - Match original mortar mix: 1 part natural hydraulic lime and 2.5 parts sand (see Appendix E).
    - Introduce a small amount of cement to achieve a more durable yet appropriate mix for the historic nature of the structure and stone: 1 part Portland cement, 2 parts natural hydraulic lime and 9 parts sand.
- Restore or replace in kind the wood siding and wood rakeboard.
- Remove mold on wood surfaces throughout.
- Paint siding on east elevation.
- Paint doors on east elevation.
- Repair or replace in-kind the wood of the sliding door.
- Paint door on west elevation.
- Repair rotting or deteriorating windows, including wood bars, throughout structure.
- Paint all windows and wood bars throughout structure.
- Repair door hardware.

Interior

- Repair wood floor on Upper Level.
- Repair deteriorated bedding mortar on interior walls on Upper Level.
- Repair stone walls on lower level that are in poor condition.
- Reapply whitewash on lower level walls.
- Repair door hardware.
- Clean mold on wood surfaces before repainting.

Structural Work Recommendations for the Barn

Overall the barn is in poor condition. The recommendations and repairs for the structure listed below are intended to stabilize the structure and to bring the structure up to a usable occupancy.

Exterior:

- Engage an exterminator or entomologist to verify insects are no longer active. Continue investigation on an annual basis to verify the insects have not returned. If insects are found to be active, treat as necessary.
- Further investigation is required for the foundation of the north wall. A geotechnical engineer should be hired to do further investigation on the soils beneath the north wall. Based on the recommendations of the geotechnical investigation, the foundation may need to be stabilized by underpinning. This is due to the fact that the wall is leaning to the point that it has overstressed the soils beneath the foundation. Underpinning would require installing a concrete or grout apron beneath the existing foundation, installing helical anchors or an equivalent system, and jacking the wall up to engage the piles and relieve stresses off of the soil beneath the foundation. A similar geotechnical investigation should also be conducted on the southeast corner of the barn.
- Repair and repoint the masonry cracks with correctly designed mortar as discussed in the architectural treatment recommendations above.
- Begin a monitoring program of all the cracks in the stone walls of the barn, with particular attention to the cracks on the north wall and on the east corner of the south wall. The monitoring should consist of inspections of the barn done on a monthly basis for a minimum of one year by the same person to avoid discrepancies. Each inspection should include measuring crack widths, and creating elevations of each wall should be created, mapping all existing and new cracks. General weather conditions should be noted since the last measurement. If movement is continuing, further bracing of the walls may be necessary.
- Repoint rubble stone masonry joints in kind at the base of the north and south walls, where pitting is occurring.
- Clean and repaint connections between steel cables and top plate at roof level with zinc-rich, cold galvanizing paint.
- Reconnect the top plates that run along the top of the stone walls. This involves removing portions of the roofing to expose the top of the top plate. New anchors should be drilled through the top plate, and into the stone masonry with an adhesive anchoring system. Once the repairs are made, the roofing should be repaired in kind.

Lower Level:

- At the western girder, replace southernmost column and foundation stone at interior foundation that has been undermined on the southernmost column. This involves jacking up the framing for the upper floor, and installing a new foundation stone beneath the existing

wood grade beam. Fill and compact the hole beneath existing foundation stone prior to installing the foundation stone.

- At the eastern girder, replace southernmost column at interior foundation. Settlement has likely occurred which has resulted in the column no longer being in contact with the girder above. The post needs to be removed and the upper level framing needs to be jacked up close to the location of the post. A new, larger stone or concrete foundation needs to be installed. If the new foundation stone is raised, or taller than the existing stone, then the existing post may be used to support the girder above, provided it makes full contact with the girder above. If the post does not make contact, a new 6x6 post that is the proper length should then be installed and connected to the framing above and to the foundation below.
- Replace missing girder on the south side of the eastern girder. The new girder shall extend from the south wall to the existing southernmost column on the east side and shall be nailed into the existing girder. The addition of the girder will require two new posts with foundation stones, as well as the girder. The upper level framing should be jacked up prior to installing the girder in order to ensure proper load transfer.
- Replace the existing 2x4 posts along the western girder that have been installed with new 6x6 posts.
- Repair two floor timbers on west wall that have failed in bearing. Repair of the floor timbers will require installing a new 4x4 post beneath each floor timber, supported on new stone foundations. The 4x4 posts should be connected to the floor timber with a metal bracket and lag screws.

Upper Level

- Remove and replace in kind all missing or deteriorated upper level floor boards. Deteriorated boards include broken, split, or rotten boards, as well as areas that have been replaced with non-conventional framing such as barn doors. This includes floor boards both north and south of the interior wooden frames running east/west.
- Repair the mortise and tenon joint at the southern east/west frame that has failed. This should occur after the settlement and foundation issues listed in the Lower Level section have been mitigated.

Roof

- Install required additional framing on the east side of the structure to distribute the loading from the roof more evenly across the floor framing below. It is anticipated that two 6x6 columns will be required between each existing column (a total of 6 new columns). Temporary removal of the girts supporting the siding will be required to install the new columns.
    - Alternate: Additional framing could also be installed on the outside of the structure to continue the existing interior columns to grade. This would require the

installation of new wooden posts, or stone pillars that would be installed beneath the existing posts, and would rest on a new stone foundation. Note: This alternate may not be desired as these supports would be visible on the exterior.

- Repair failed connection at the top of the east wall frame. The failure of the connection is likely due to the movement of the north wall and due to the lack of connection and stiffness in the frame on the east wall. In order to fix the connection, a system of cables will be required to transfer load. It is recommended that cables be installed extending from the northeast corner to the southeast corner and from the northwest corner to the southeast corner. A steel compression strut will that will serve as a diaphragm strut will also be required on the east wall at the top of the wooden frame. Installation of the cables shall occur after the foundation has been stabilized. It is also recommended that a wood ledger beam be installed along the roof slope of the gable on both the north and south walls on the interior face. The ledger beam should be tied into the top plate at the eaves, and shall be connected into the roof at the shingle lath and shall connect to the existing stone wall with adhesive anchors.

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GLOSSARY

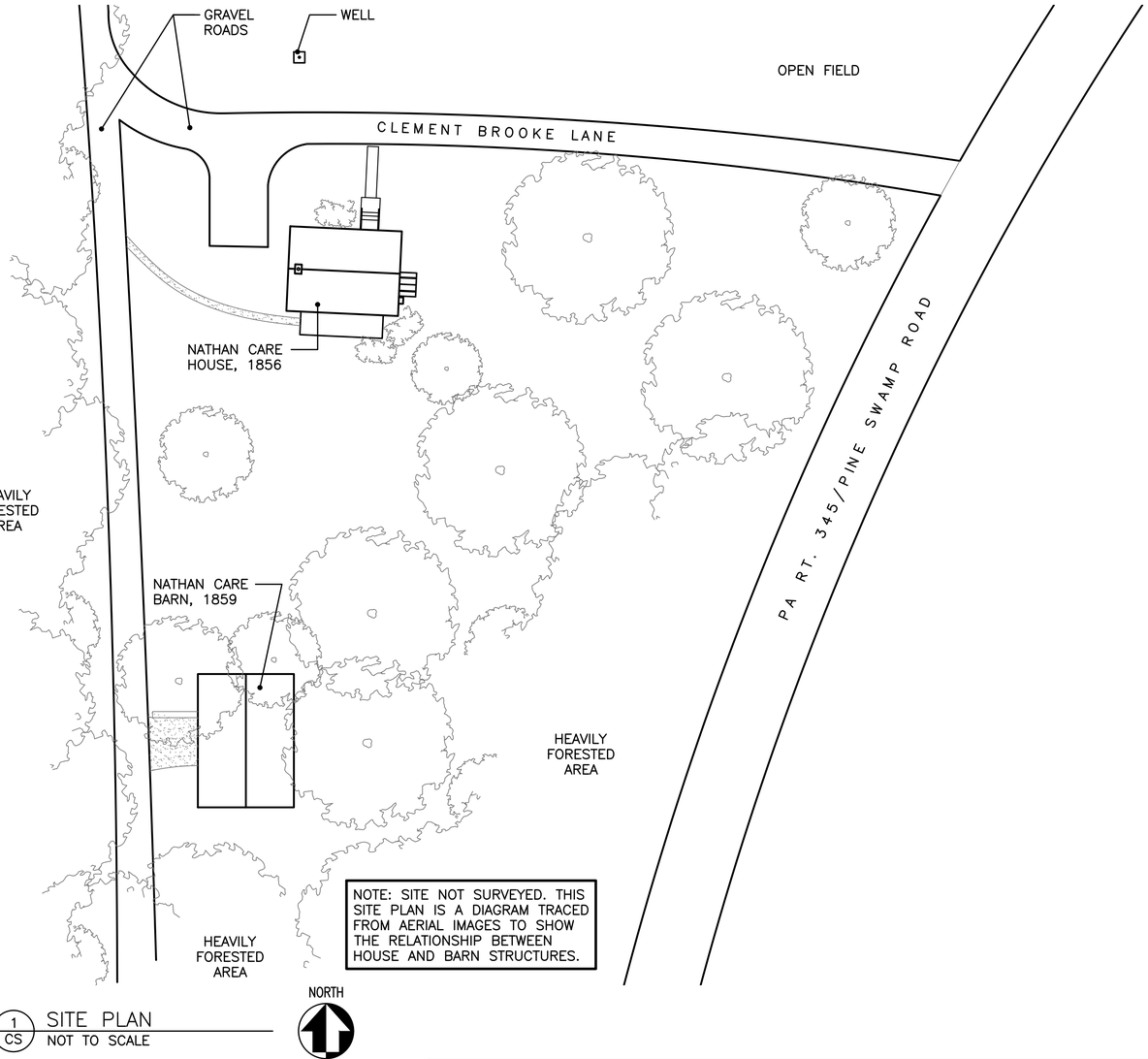
accessibility	Capable of being reached; providing access. Typically referring to ease of entry and use by disabled persons.
bay	A basic unit or module of a building defined by regularly repeated elements.
beam	A rigid structural member designed to carry and transfer transverse loads across space to supporting elements.
bulkhead	A horizontal or inclined door over a stairway giving access to a cellar.
casing	The finished, often decorative framework around a door or window opening.
cladding	A protective covering that protects the exterior structure of a building (see siding).
deflection	The displacement of a structural element under load.
double-hung window	A window having two vertically sliding sashes, each in separate grooves or tracks and closing a different part of the window.
eave	The overhanging lower edge of a roof.
fenestration	A general term used to denote the pattern or arrangement of windows on an exterior wall.
grade	The vertical elevation where the ground meets the foundation of a building. Also called *grade line*.
interpretation	A teaching technique that combines factual with stimulating explanatory information.
joist	A timber that spans the width of a building and supports the floors and, at the attic level, the base of the roof framing.
light/lite	A term for each pane of glass in a window.
load	Any of the forces to which a structure is subjected.
mortar	Masonry bonding cement usually composed of lime and sand; in the late nineteenth and twentieth centuries, of Portland cement.
moulding	A decorative recessed or relieved surface used for finishing or purely as ornamentation.

muntin	In windows, the thin bar used to hold glass panes in place; in paneled doors, the vertical central members used to hold the panels in place.
peiler eck	Pennsylvania Dutch term for “pier corner.” A pier corner is an alcove that is located at basement level of a barn.
pointing	The finish treatment for mortared joints.
rafter	The sloping framing element that is seated on a plate or a false plate and supports the roof covering.
rake	A board or molding placed along the sloping sides of a gable to cover the ends of the siding; the inclined, usually projecting edge of a sloping roof.
rehabilitation	The process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values; as defined by the Secretary of the Interior.
ridge	The line of intersection of the opposite slopes of a roof.
sash	A frame in which glass window panes are set; often subdivided by muntins.
siding	A weatherproof material, as shingles, board or units of sheet metal, used for surfacing the exterior walls of a frame building.
single-hung window	A window having two sashes, of which only one is moveable.
soffit	The exposed flat surface of any overhead building component, whether of an arch, eave, balcony, beam, cornice or lintel.
stile and rail	A term to describe a type of paneled door constructed of stiles (upright members framing panels) and rails (horizontal member framing panels). Panels are distinct sections or divisions recessed below or raised above the general level or enclosed by a frame.

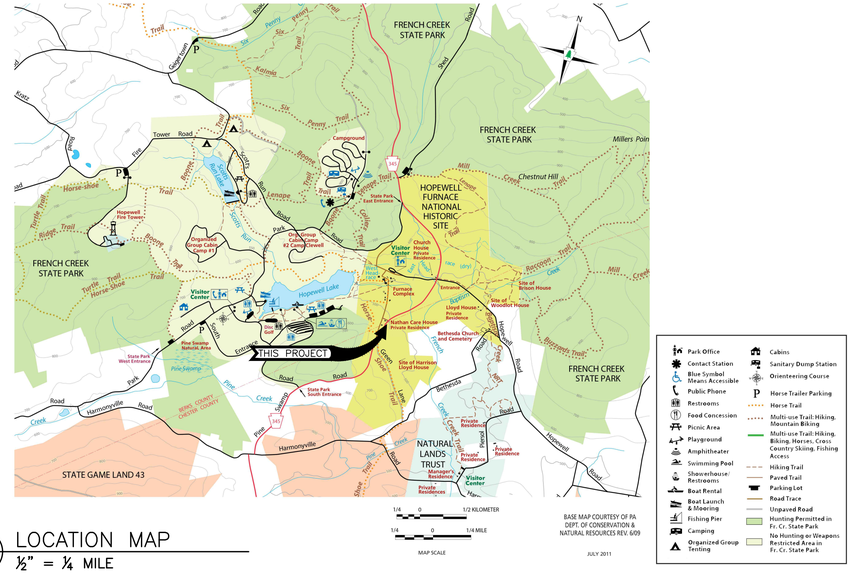
APPENDIX A

MEASURED DRAWINGS

EXISTING CONDITIONS DRAWINGS
NATHAN CARE HOUSE & BARN
HOPEWELL FURNACE NATIONAL HISTORIC SITE



1/CS SITE PLAN
NOT TO SCALE



1/4 0 1/2 KILOMETER
1/4 0 1/4 MILE
MAP SCALE
BASE MAP COURTESY OF PA DEPT. OF CONSERVATION & NATURAL RESOURCES REV. 6/09
JULY 2011

2/CS LOCATION MAP
½" = ¼ MILE

LIST OF DRAWINGS

	COVER SHEET
A–1	HOUSE FLOOR PLANS
A–2	HOUSE ELEVATIONS
A–3	BARN FLOOR PLANS
A–4	BARN ELEVATIONS

BASIC DATA:

John Milner Architects, Inc

ARCHITECT: John Milner Arch Chadds Ford, PA
CIVIL: NA
MECHANICAL: NA
LANDSCAPE: NA
STRUCTURAL: HDR Engineering Omaha, NE
ELECTRICAL: NA

Mark	Sheet	REVISION	Date	Initial

QUALITY DESIGN CERTIFICATION

- ☐ Prepared in Accordance with Design Development (Title I) _____ Drawing No.
  OR
- ☐ Variance from Design Development (Title I) Approved by Superintendent on _____ Date
  OR
- ☐ Construction Drawing Not Preceded by Design Development (Title I)

_____ Project Manager _____ Date

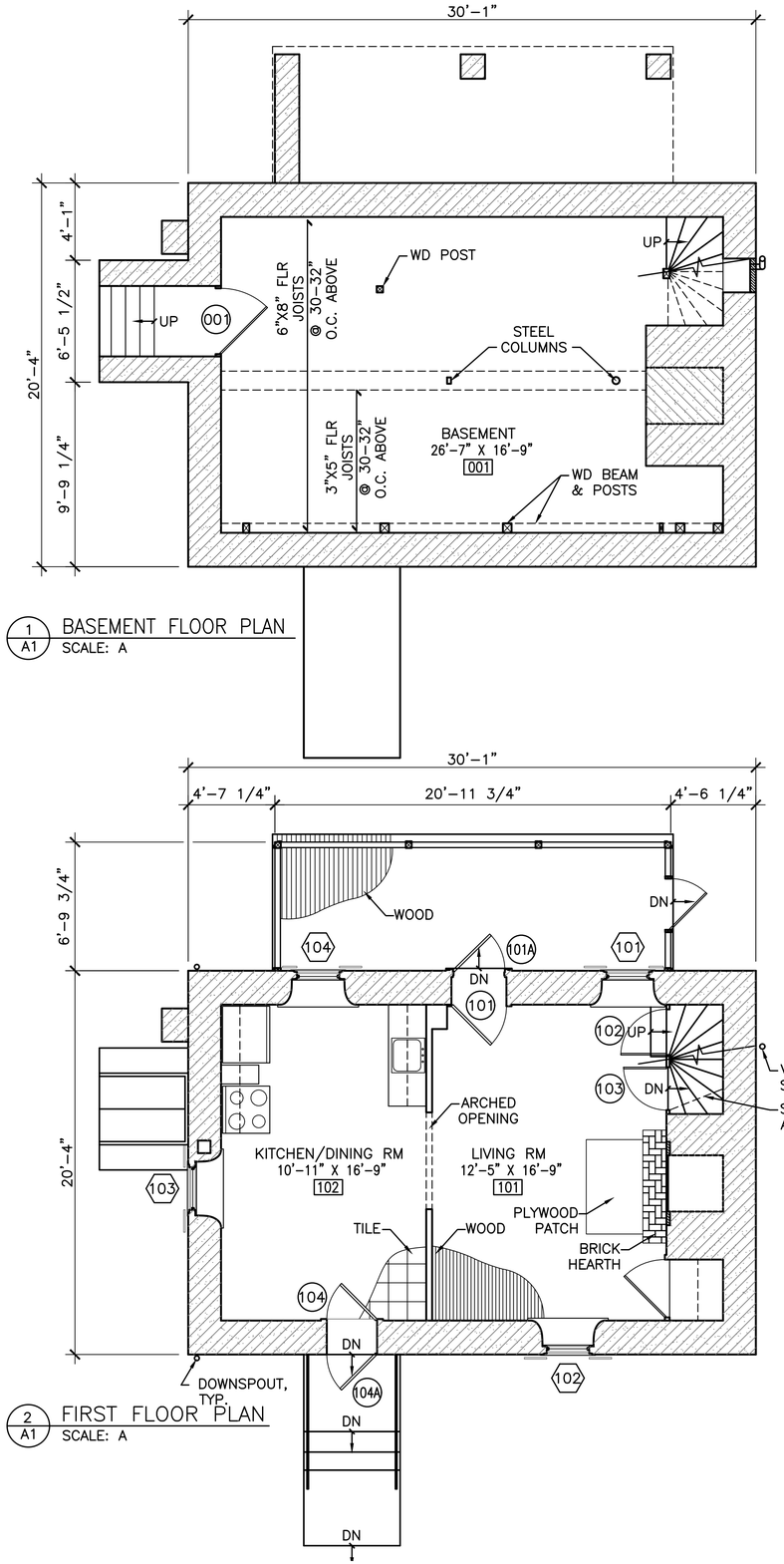
EXISTING CONDITIONS

UNITED STATES DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE
HOPEWELL FURNACE NATIONAL HISTORIC SITE

TITLE OF PROJECT
HISTORIC STRUCTURES REPORT
LOCATION WITHIN PARK
NATHAN CARE HOUSE & BARN
NAME OF PARK
HOPEWELL FURNACE NATIONAL HISTORIC SITE
REGION: NORTHEAST
COUNTY: BERKS
STATE: PENNSYLVANIA

DRAWING NO. ———
PMIS/PKG NO. 141610
SHEET 1 OF 5



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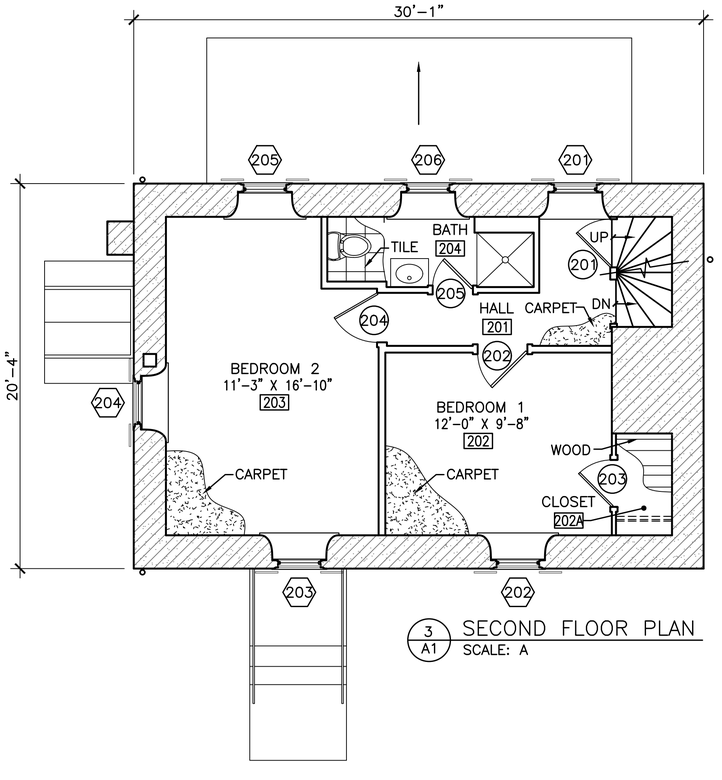

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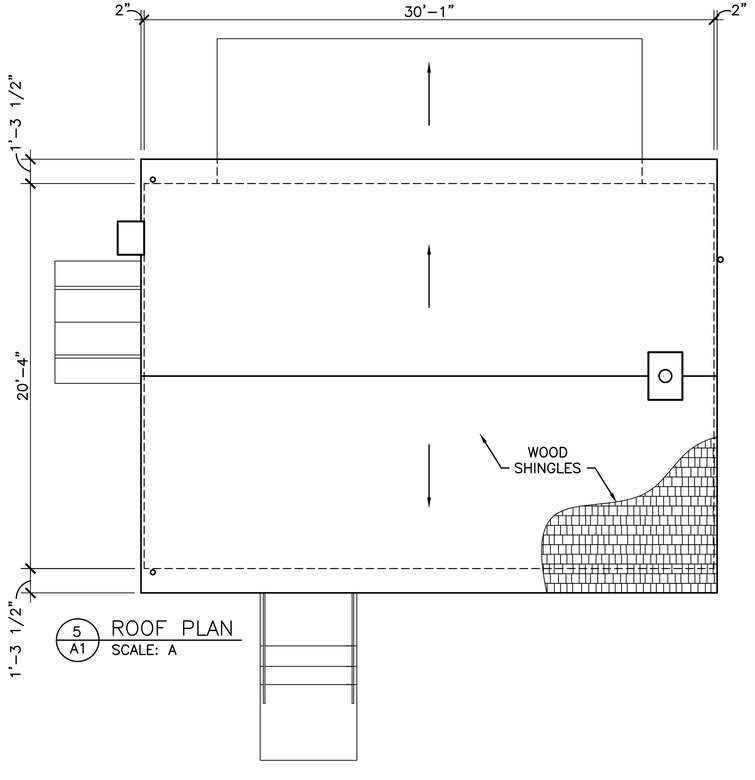

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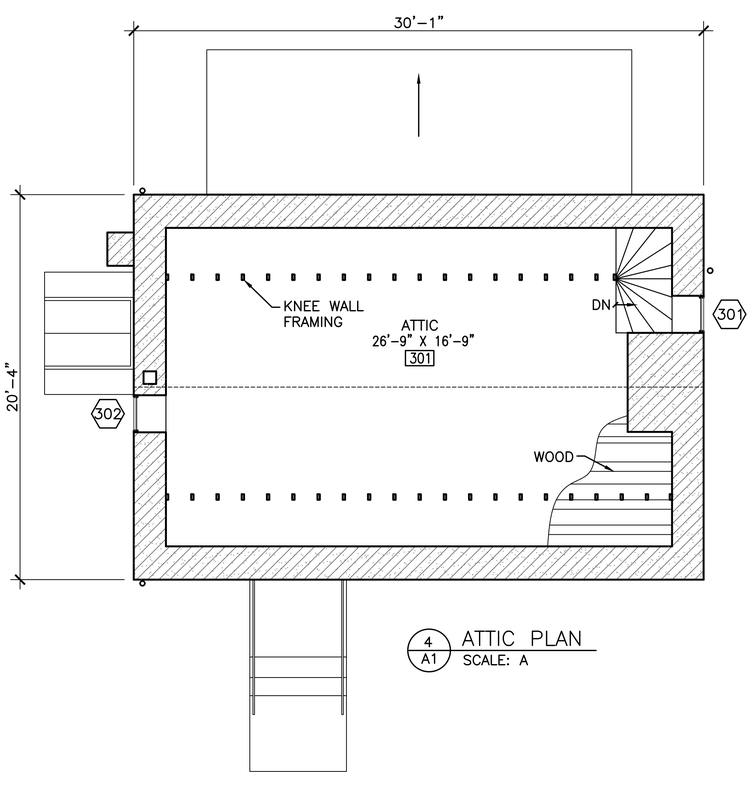
SCALE: A

2 A1 FIRST FLOOR PLAN
SCALE: A

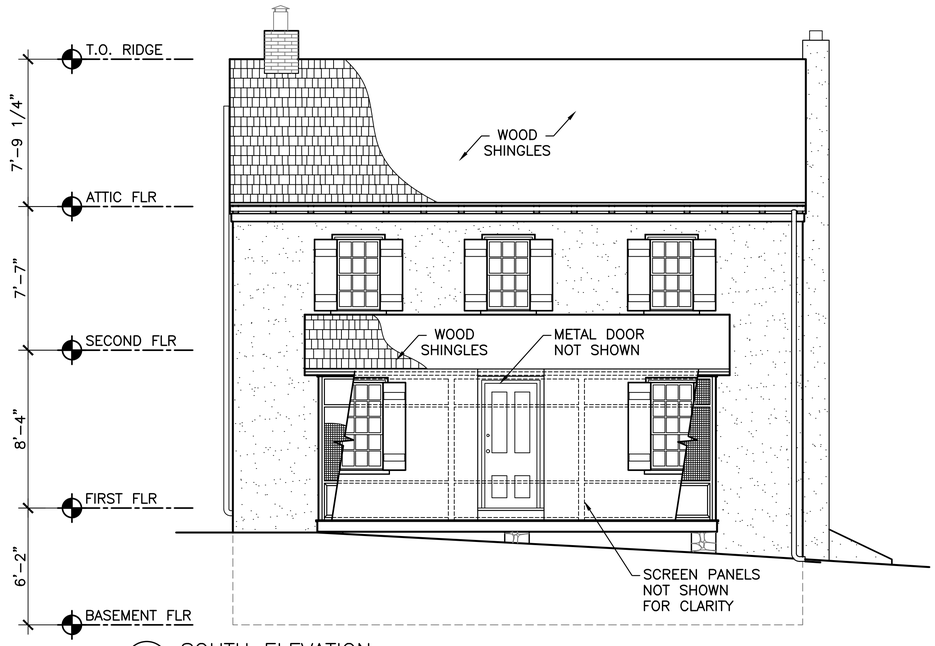


4 A1 ATTIC PLAN
SCALE: A

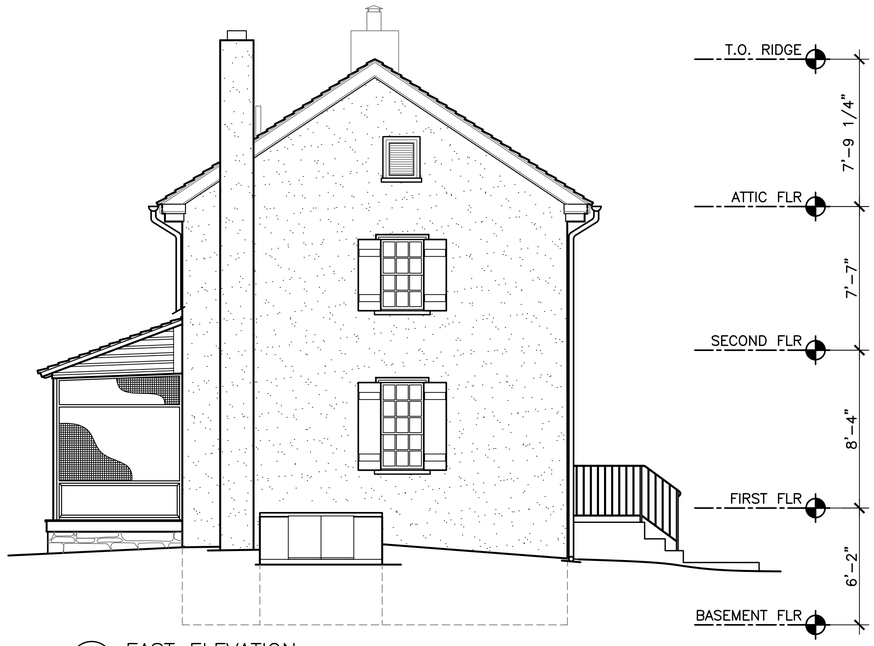
A 4 0 4 8
SCALE OF FEET

NORTH

DESIGNED: CADD KJL TECH. REVIEW: CHC DATE: 12/16/2016	SUB SHEET NO. A1	TITLE OF SHEET NATHAN CARE HOUSE FLOOR PLANS NATHAN CARE HOUSE AND BARN ELVERSON, PENNSYLVANIA	DRAWING NO. — PMIS/PKG NO. 141610 SHEET 2 OF 5



1/A2 SOUTH ELEVATION
SCALE: A



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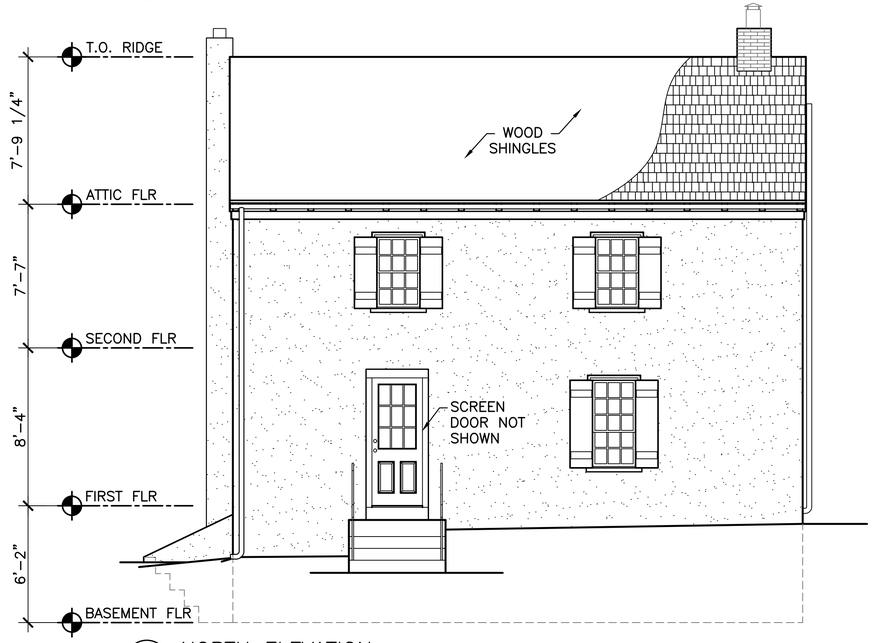

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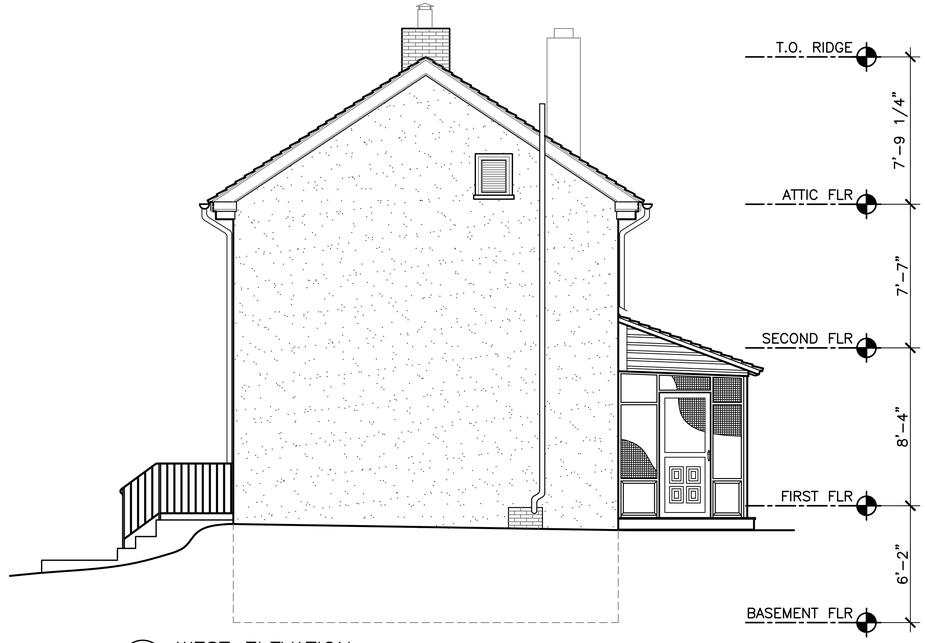
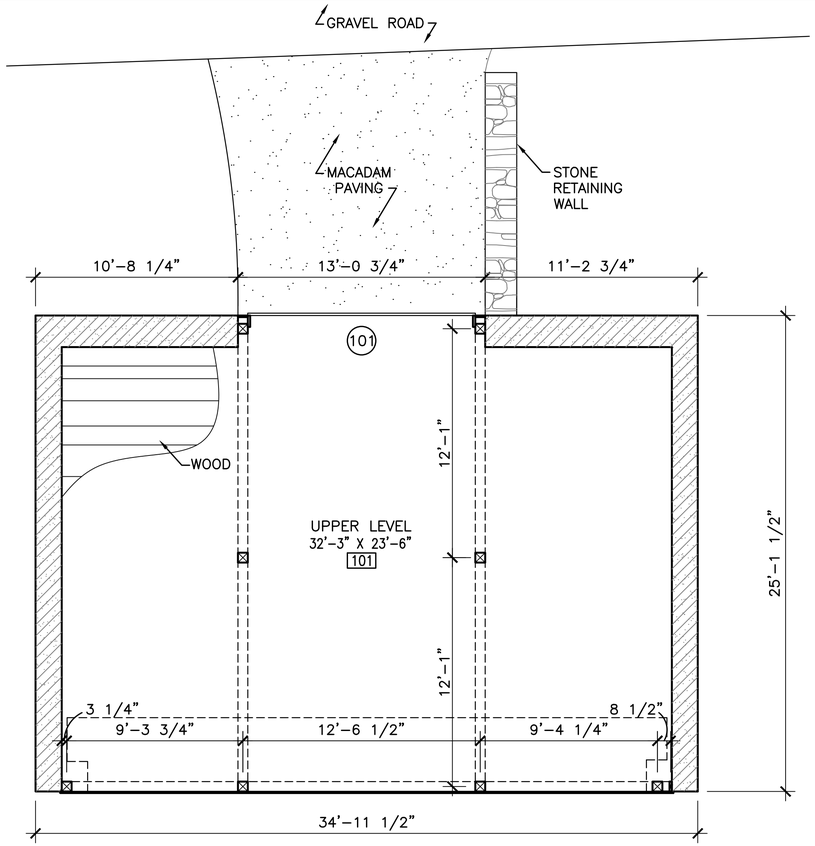


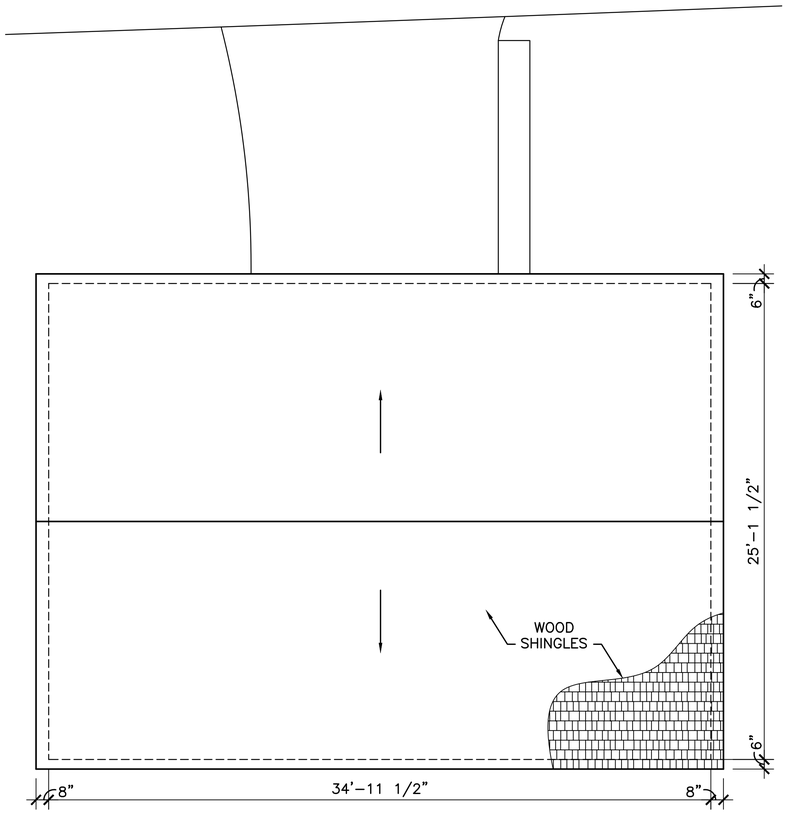
4/A2 WEST ELEVATION
SCALE: A

A 4 0 4 8
SCALE OF FEET

DESIGNED: CADD KJL TECH. REVIEW: CHC DATE: 12/16/2016	SUB SHEET NO. A2	TITLE OF SHEET NATHAN CARE HOUSE ELEVATIONS NATHAN CARE HOUSE AND BARN ELVERSON, PENNSYLVANIA	DRAWING NO. — PMIS/PKG NO. 141610 SHEET 3 OF 5



3 A3 UPPER LEVEL PLAN
SCALE: A



4 A3 ROOF PLAN
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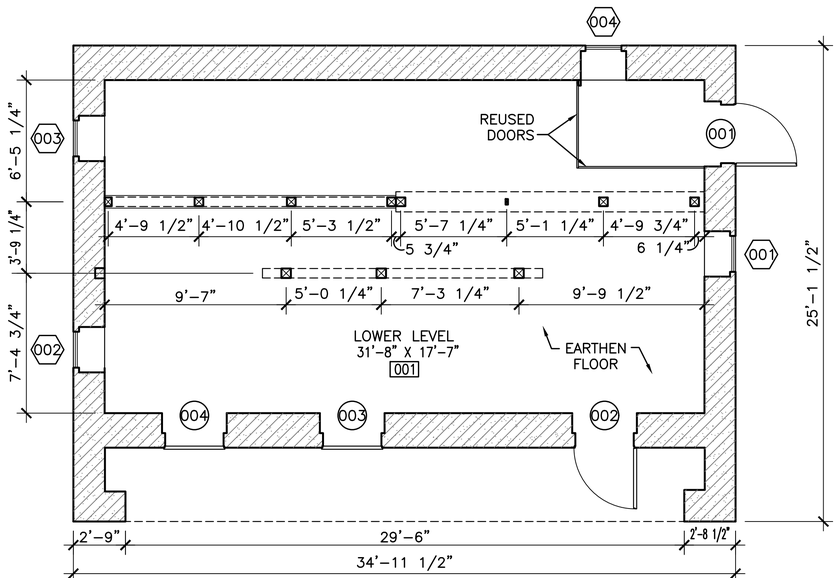

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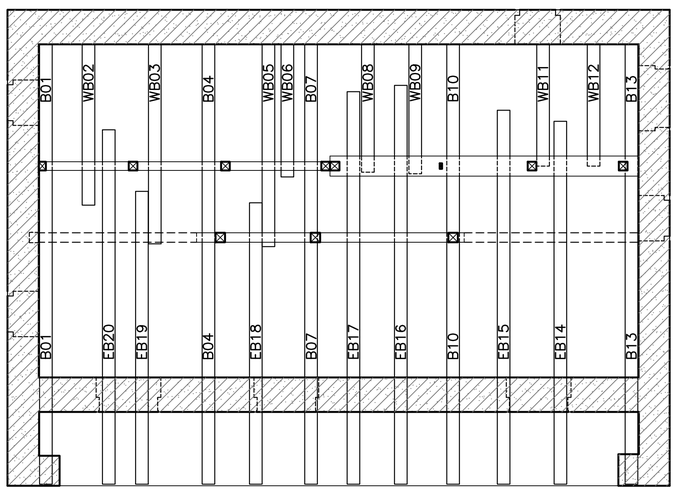
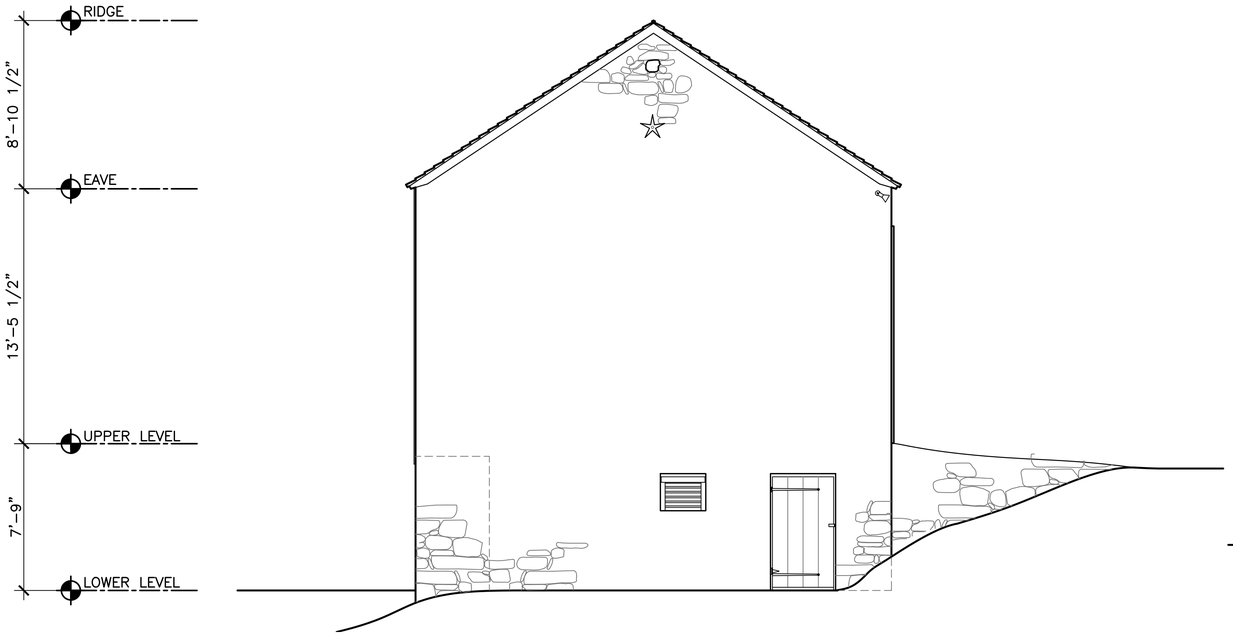


2 A3 LOWER LEVEL REFLECTED CEILING PLAN
SCALE: A

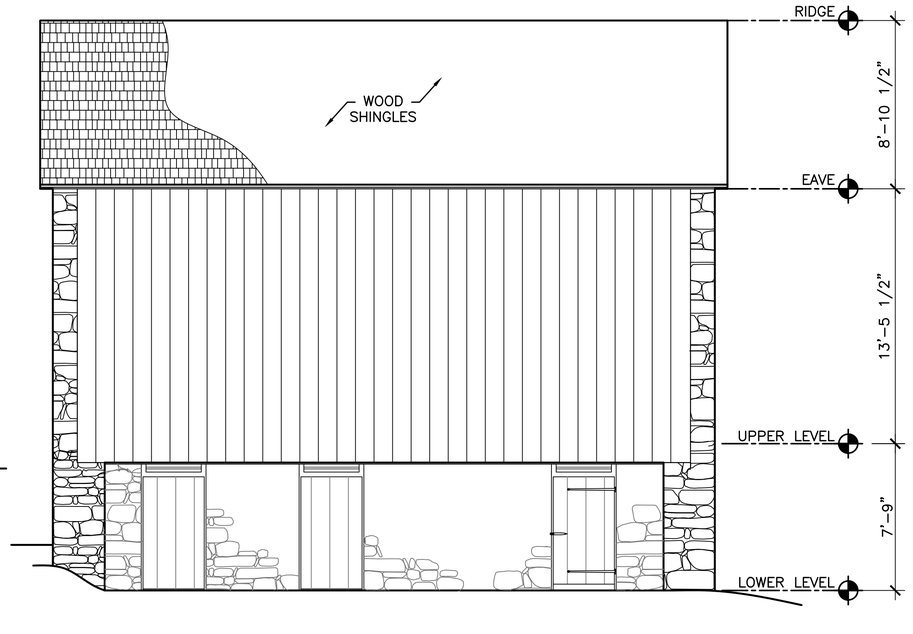
A 4 0 4 8
SCALE OF FEET

NORTH

DESIGNED: KJL TECH. REVIEW: CHC DATE: 12/16/2016	SUB SHEET NO. A3	TITLE OF SHEET NATHAN CARE BARN FLOOR PLANS NATHAN CARE HOUSE AND BARN ELVERSON, PENNSYLVANIA	DRAWING NO. — PMIS/PKG NO. 141610 SHEET 4 OF 5



1 / A4 NORTH ELEVATION
SCALE: A



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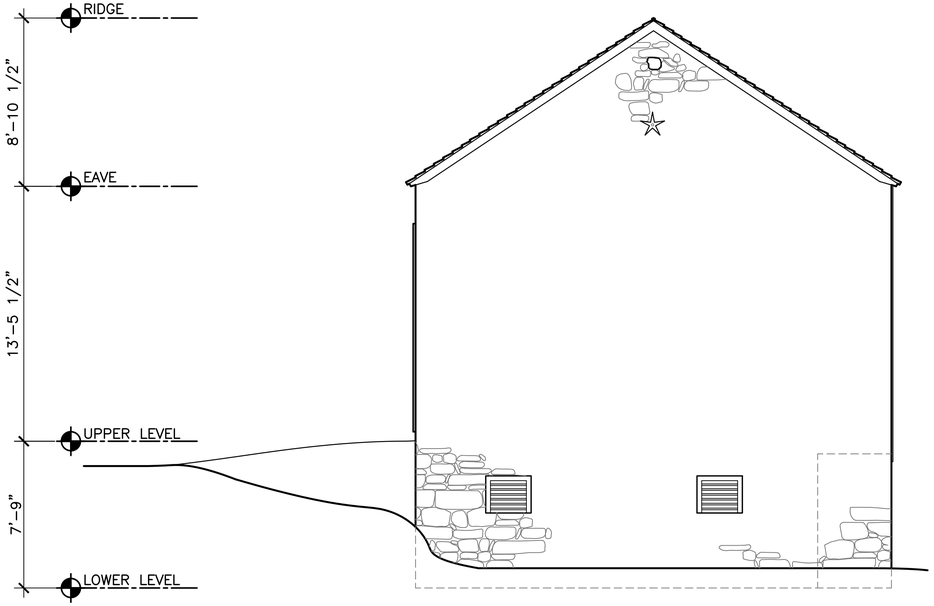

3 / A4 SOUTH ELEVATION
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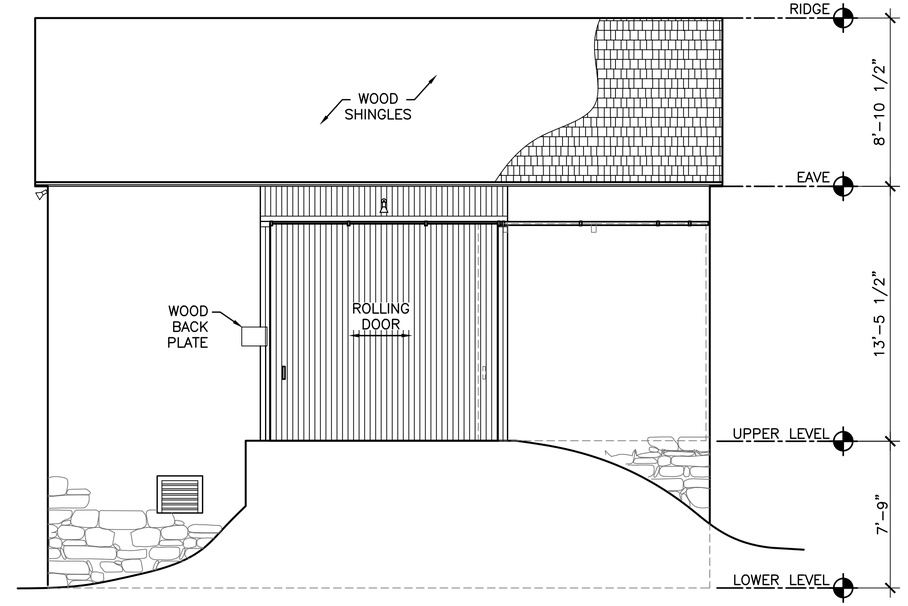

4 / A4 WEST ELEVATION
SCALE: A

A 4 0 4 8
SCALE OF FEET

DESIGNED: CADD KJL TECH. REVIEW: CHC DATE: 12/16/2016	SUB SHEET NO. A4	TITLE OF SHEET NATHAN CARE BARN ELEVATIONS NATHAN CARE HOUSE AND BARN ELVERSON, PENNSYLVANIA	DRAWING NO. — PMIS/PKG NO. 141610 SHEET 5 OF 5

APPENDIX B

FINISH ANALYSIS

INTRODUCTION

The Nathan Care House is located in the Hopewell Furnace National Historic Site in Elverson, Pennsylvania. The Hopewell Furnace site is significant as an intact example of a rural 18th-cenury iron "plantation." The site includes the furnace building, ironmaster's house and numerous ancillary structures. The Nathan Care House is a small residential structure dating to 1856.

Methodology

John Milner Architects, Inc. visited the site November 18, 2016 and extracted 9 samples from the exterior wood trim and selected interior locations. Preliminary inspection of the samples at the site indicated that the exterior wood surfaces were stripped using a torch or other heat-based method, most likely c. 1935 when the Federal Government acquired the site. Only minimal traces of earlier finishes remain. Samples were extracted using an Xacto knife and/ or scalpel from multiple locations on each architectural component, concentrating on those locations such as corners and the undersides of moldings which are least likely to have been stripped.

Due to the fragmentary condition of the paint evidence, a full stratigraphy of the exterior finishes cannot be assembled. However, enough evidence was found to identify the original finish and one or two subsequent campaigns. Finishes dating from the early 20th century are missing entirely.

All samples were dissected and examined using a 10-40X stereo-zoom microscope under halogen illumination. Samples were visually color matched under the microscope using sample decks from three paint companies. The selected color matches were adjusted visually in daylight illumination. However, due to differences in material and manufacture of modern paints versus historic paints, the preparation and review of mock-up panels of the selected color scheme is recommended prior to commencing restoration painting.

FINDINGS & RECOMMENDATIONS

The extensive stripping undertaken in the mid-20th century has removed all but the smallest traces of the original paint finishes on the Nathan Care House. The original bulkhead doors, repurposed as stall doors in the barn, retain the best evidence of the earliest finishes. These doors appear to have been moved to their present location around the turn of the 20th century. The initial finish evident on the bulkhead is a dark gray oil paint. Only the barest trace of this coating was identified on the existing wood trim still on the house (south rakeboard).

Interestingly, there is no trace of this dark gray on the porch post that is reused as a lintel in the existing screened porch. The first finish evident on this post is a dark brown, which is found as the second layer on the bulkhead doors. This would seem to suggest that the porch post-dates the bulkhead doors and that the porch may have been an addition.

The color sequences on the wood window trim and sashes do not display either of these first two finishes. The first-floor window trim sequence appears to date to the turn of the 20th century though the evidence surviving is so fragmentary that it is certainly possible that evidence of the gray and brown paints survives but was not picked up during the sampling process. The window sashes retain well-adhered evidence of late 19th-century finishes but not the gray or brown finishes. As it seems unlikely that the sashes would have been replaced within 20 years of the original construction, it would appear that the window sashes were painted white during both of these earlier schemes.

Two interior samples were taken to evaluate a blue coating visible in two locations where the wood surfaces were abraded. This blue coating appears to date to the early 20th century.

Color Match

Original Finish c. 1856

Dark Gray, oil paint; high gloss
Benjamin Moore 1615

Location of evidence: Bulkhead doors, traces on rake board

2nd Finish c. 1870

Dark Brown oil paint; high gloss
Benjamin Moore HC-70 Van Buren Brown

Location of evidence: Bulkhead doors, porch post, traces on attic rake board

DATA SHEET

Sample No. INT-01 Location: 2nd Fl Door Frame	Sample No. INT-02 Location: Closet Peg Rail	Sample No. EXT-01 Location: South Rakeboard
1-2 Dk Brown P/F oil 1856 3 Lt brnsh Pink 4-5 Med brnsh Pink 6 Med grnsh blue c. 1900 7 Dark green 8 Lt yell gray 9 Lt yellow grn 10 Med gray (discontin) 11-19 Whites c. 1935	Unpainted 1856 Traces Med Brnsh Pink Traces Med grnsh blue Same as INT-01 7-19	Wood substrate burnt from stripping Traces of dark gray, dark brown, dark brnsh red 9+ layers of Whites presumably dating from NPS ownership c. 1935
Sample No. EXT-02 **Location: Porch Post/Lintel**	**Sample No. EXT-03** **Location: Bulkhead Doors**	**Sample No. EXT-04** **Location: Window Trim 1st Floor Under Porch**
Wood substrate burnt Traces of white prime/dark brown finish Traces brownish red / brownish pink accent at chamfer Traces strong greenes Traces dark green 9+ layers Whites c. 1935	1-2 Dark gray P/F oil 1856 3-4 Dk Brown I/F 1860-70 5 Dk reddish brown 6 White I 7 Strong green c. 1900 8 Dark green 9 White	1-White 2 Strong Green 3 Dark Green 4-5 Dark Brown 6-13(+/-) Whites Sample is inconclusive due to stripping
Sample No. EXT-05 **Location: Attic Wdo Frame South elevation**	**Sample No. EXT-06** **Location: Window Sashes North elevation**	**Sample No.** **Location:**
Traces Dark Brown and Brownish Red 9+ Whites c. 1935	2+ layers White 1856 Traces brownish red c. 1870 4-5 Whites 6 Dark Brown 9+ layers Whites c. 1935	

APPENDIX C

HAZARDOUS MATERIALS REPORT

Asbestos-Containing Materials Survey

Hopewell Furnace National Historic Site
Elverson, PA

Prepared for

John Milner Architects, Inc.
104 Lakeview Drive
Chadds Ford, PA 19317

October 4, 2012

Prepared by

AERO EH&S, INC.
ENVIRONMENTAL HEALTH & SAFETY
10310B BALTIMORE NATIONAL PIKE
ELLICOTT CITY, MD 21042
(410) 480-3636

Asbestos-Containing Materials Survey Summary

Hopewell Furnace National Historic Site

Elverson, PA 19520

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APPENDIX E Damaged Material Location Drawings

Asbestos-Containing Materials Survey Summary
Hopewell Furnace National Historic Site
Elverson, PA 19520

1.0 Background

The purpose of this project was to conduct an asbestos-containing materials survey of several buildings located on the Hopewell Furnace National Historic Site grounds ("Site"), located at 2 Mark Bird Lane in Elverson, PA. Surveyed structures at the site included the Visitor Center, Maintenance Building, Building #98, the John Church House and garage, the Thomas Lloyd House, the Nathan Care House, and Tenant House #3.

The following is a brief description and history of the buildings surveyed:

1.1 Visitor Center

The Visitor Center was constructed in 1958. The ground floor, which is at grade to the south, is used for administration offices and also contains a mechanical room with a forced air unit. The upper floor, which is at-grade to the north, contains museum displays, a theatre, and visitor contact station. There are public restrooms at the west end of the building. The restrooms were renovated in 2005.

The building's exterior is constructed of mortared stone and vertical, reverse board-and-batten wooden siding. The shingles on the roof are fiberglass/asphalt type. The finishes on the interior of the building include vinyl and carpeted floor coverings, drywall and plaster walls, and spline tile and plaster ceilings.

1.2 Maintenance Building

The Maintenance Building was constructed in 1958. The single story building is built on a concrete slab and houses office space, a lunch room, restroom, garages, storage, and maintenance areas.

The building has a concrete block exterior and spray foam coated flat roof. The interior of the building consists of concrete flooring, and fiber-board walls and ceilings.

1.3 Building 98

Building 98 was constructed on a crawl-space foundation in 1958. The single story, six room building is used for housing and has an attached garage.

The exterior of the building consists of vertical tongue-and-groove wooden siding and

rubber membrane roofing. Finishes used on the interior of the building include plaster walls and ceilings with vinyl sheet flooring and carpet.

1.4 John Church House and Detached Garage

The John Church House was originally constructed in the 19th century and renovated in 1942 and is used for housing and site events. The two story house includes a kitchen and one main room on the first floor with a bathroom and three bedrooms located on the second floor. In addition, the house has an attic that is semi-finished in the older section of the house and a basement with three partially finished rooms. The heating system for the building is an oil-fired boiler with radiators.

The building's exterior is constructed of a cementitious stucco over stone with an elastomeric paint finish. The roofing consists of cedar shingles. The interior of the building consists mostly of hardwood floors, with one area that has vinyl flooring. Floors and ceilings are finished with various plasters. The John Church House has a detached garage. Similar building materials are present on the garage's exterior; however, the interior finishes mostly consist of wood framing and fiber board.

1.5 Thomas Lloyd House/Building 71

Building 71 was constructed in the first quarter of the 19th century and renovated in 1963. The two-story structure is used for housing and events. There are a kitchen and three rooms on the first floor with a bathroom and four rooms on the second floor. The attic is accessible by stairwell and is unfinished. There is an unfinished basement with an oil-fired forced air furnace.

The building's exterior is constructed of a cementitious stucco over stone with a lime paint finish. The roofing consists of cedar shingles. Finishes on the interior of the building include plaster walls and ceilings with vinyl sheet flooring as well as carpet.

1.6 Nathan Care House

The Nathan Care House is a two-story building constructed in the 1850s and renovated in the 1960s. The building is used for housing and has a kitchen and one room on the first floor with a bathroom and two rooms on the second floor. There is a basement with an oil-fired hot water boiler.

The building's exterior is constructed of a cementitious stucco over stone. The roofing consists of cedar shingles. The interior of the building includes plaster walls and ceilings with wood flooring throughout.

1.7 Tenant House #3

Tenant House #3 is a two-story building constructed in the 1840s and renovated in 1958. The building is used for housing and has a kitchen and three rooms on the first floor as well as a bathroom and two rooms on the second floor. There is a basement with an oil-fired forced air furnace and an accessible unfinished attic.

The building's exterior is constructed of a cementitious stucco over stone with a lime paint finish. The roofing consists of cedar shingles. The interior of the building includes plaster walls and ceilings with various floor coverings including both vinyl sheet flooring and carpet.

2.0 Scope of Work

2.1 Asbestos-Containing Materials Survey

An asbestos-containing materials survey was performed at each of the buildings described in Section 1.0. Surveys were performed in the following manner:

(1) Licensed asbestos inspectors conducted an AHERA compliant inspection of interior building materials suspected to contain asbestos in each building. The inspection was conducted in accordance with the AHERA regulations regarding the locations and number of samples to be collected. The survey included a visual inspection of interior materials and sampling and analysis of suspect materials to identify the presence of asbestos.

(2) Inspectors also conducted a survey of the exterior of the buildings for materials suspected to contain asbestos. The survey included a visual inspection of exterior materials, and sampling and analysis of suspect materials to identify the presence of asbestos.

(3) AERO made temporary repairs to areas from which friable samples were collected by using a filler compound, by covering with duct tape, or using other appropriate materials to complete the repair. Non-friable sample locations were not repaired.

(4) AERO collected bulk samples from each homogeneous area in accordance with EPA guidelines. Three samples of thermal system insulation, three to seven samples of surfacing material, and at least one sample of each miscellaneous material were collected.

(5) Samples were analyzed for asbestos fiber content at a laboratory accredited under the National Voluntary Laboratory Accreditation Program. The samples were analyzed by polarized light microscopy (PLM) using EPA Methods 600/M4-82-020 and/or 600/R-93/116.

(6) Based upon the analytical results and review of drawings and blueprints made available by the Client or on-site personnel, the approximate amounts, types, locations, and conditions of accessible ACM was determined.

2.2 Air Sampling

In addition to the ACM survey, AERO conducted air sampling in buildings that were occupied at the time of survey. These buildings included the Visitor Center, the maintenance building, Building 98, and the Thomas Lloyd House/Building 71. Air sampling activities consisted of the following methods:

(1) AERO conducted air sampling in accordance with NIOSH Method 7400 prior to and following the survey and bulk sampling at each occupied site.

(2) A NIOSH 582 equivalent trained AERO microscopist analyzed each of the samples for airborne fiber concentration in accordance with NIOSH Method 7400. Please note that NIOSH Method 7400 gives the airborne concentration of non-specific fibers and is not able to distinguish between asbestos and other airborne fibers.

(3) Results of the pre- and post-bulk sampling air samples were statistically compared to each other in order to determine if survey and bulk sampling had an effect on airborne fiber concentrations in the building.

3.0 Testing Results

3.1 Asbestos-Containing Materials Survey

The following subsections summarize the ACM survey findings for each building. A more detailed listing of the survey results can be found in the room-by-room inventory of suspect materials for each building, found in **Appendix A** of this report.

All bulk samples were analyzed by Scientific Analytical Institute (SAI) of Greensboro, NC using polarized light microscopy according to EPA Method 600/R-93/116 “Asbestos Analysis of Bulk Materials”. SAI participates in the National Voluntary Laboratory Accreditation Program (NVLAP). Laboratory bulk sampling reports can be found in **Appendix B** of this report.

3.1.1 Visitor Center

AERO collected 15 bulk samples of suspect asbestos-containing materials from the Visitor Center, resulting in 28 analyses due to layering.

Three of the 28 layers analyzed were determined to contain asbestos. The following table summarizes all of the asbestos-containing materials identified in the Visitor Center. All quantities are estimated from field observation. Specific locations of the identified materials can be found in the room-by-room inventory provided in **Appendix A**.

Table 1 – Visitor Center Asbestos-Containing Materials

Sample Description	Approximate Quantity	Friable	Condition	Asbestos, %
FT01 – 9”x9” Tan Floor Tile w/ White and Brown Specks	23 SF	No	Good	Tile – 5% Chrysotile Mastic – 8% Chrysotile
FT02 – Tan Sheet Flooring Under Carpet	2,976 SF	No	Good	Tile – 5% Chrysotile

SF = square feet

3.1.2 Maintenance Building

AERO collected five bulk samples of suspect asbestos-containing materials from the Maintenance Building, resulting in five analyses.

One of the five layers analyzed was determined to contain asbestos. The following table summarizes all of the asbestos-containing materials identified in the maintenance building. All quantities are estimated from field observation. The specific location of the identified material can be found in the room-by-room inventory provided in **Appendix A**.

Table 2 – Maintenance Building Asbestos-Containing Materials

Sample Description	Approximate Quantity	Friable	Condition	Asbestos, %
M03 – Gray Fire Stop Mastic	1 SF	No	Good	5% Chrysotile

SF = square feet

3.1.3 Building 98

AERO collected 10 bulk samples of suspect asbestos-containing materials from Building 98, resulting in 22 analyses due to layering.

Three of the 22 layers analyzed were determined to contain asbestos. The following table summarizes all of the asbestos-containing materials identified by AERO. All quantities are estimated from field observation. Specific locations of the identified materials can be found in the room-by-room inventory provided in **Appendix A**.

Table 3 – Building 98 Asbestos-Containing Materials

Sample Description	Approximate Quantity	Friable	Condition	Asbestos, %
S01 – Smooth Two-Coat Plaster	2,729 SF	Yes	Good	Compound – 3% Chrysotile
M01 – Transite Paneling	80 SF	No	Good	15% Chrysotile
FT01 – Granite Pattern Sheet Flooring	234 SF	No	Good	Sheet Vinyl #2 – 15% Chrysotile

SF = square feet

3.1.4 John Church House

AERO collected 19 bulk samples of suspect asbestos-containing materials from the John Church House, resulting in 36 analyses due to layering. None of the 36 layers analyzed were determined to contain asbestos.

3.1.5 Thomas Lloyd House/Building 71

AERO collected 21 bulk samples of suspect asbestos-containing materials from Building 71, resulting in 36 analyses due to layering.

Three of the 36 layers analyzed were determined to contain asbestos. The following table summarizes all of the asbestos-containing materials identified by AERO. All quantities are estimated from field observation. Specific locations of the identified materials can be found in the room-by-room inventory provided in **Appendix A**.

Table 4 – Thomas Lloyd House/Building 71 Asbestos-Containing Materials

Sample Description	Approximate Quantity	Friable	Condition	Asbestos, %
FT02 – Gold w/ Black Stone Pattern Vinyl Sheet Flooring	90 SF	No	Good	15% Chrysotile
FT03 – Vinyl Sheet Flooring w/ Gray and White Square Pattern	72 SF	No	Good	18% Chrysotile
S02 – Smooth Two-Coat Plaster	5,158 SF	Yes	Good	Compound – 3% Chrysotile

SF = square feet

3.1.6 Nathan Care House

AERO collected 15 bulk samples of suspect asbestos-containing materials from the Nathan Care House, resulting in 24 analyses due to layering.

Two of the 24 layers analyzed were determined to contain asbestos. The following table summarizes all of the asbestos-containing materials identified by AERO. All quantities are estimated from field observation. Specific locations of the identified materials can be found in the room-by-room inventory provided in **Appendix A**.

Table 5 – Nathan Care House Asbestos-Containing Materials

Sample Description	Approximate Quantity	Friable	Condition	Asbestos, %
S02 – Smooth Two-Coat Plaster	2,496 SF	Yes	Damaged	4% Chrysotile
TSI01 – Aircell Pipe Insulation	3 LF	Yes	Damaged	55% Chrysotile

SF = square feet LF = Linear Feet

3.1.7 Tenant House #3

AERO collected 13 bulk samples of suspect asbestos-containing materials from Tenant House #3, resulting in 26 analyses due to layering. Of the 26 analyses, no layers were determined to contain asbestos

3.2 Air Sampling Results

The following tables summarize the air sampling results from each building where air sampling was performed. Results are provided in fibers per cubic centimeter (f/cc). NIOSH Method 7400 is unable to distinguish between asbestos and non-asbestos fibers. Field analysis sheets can be found in **Appendix C** of this report. Room location drawings can be found in **Appendix D**.

Table 6 – Visitor Center Air Sampling Data

Sample Location	Pre-Bulk Sampling Fiber Concentration (f/cc)	Post-Bulk Sampling Fiber Concentration (f/cc)
Museum	0.004	<0.004
Lobby	<0.004	<0.004
Audio-Visual	0.004	<0.004
Lower Cubicle Area	0.006	<0.004
Lower Cubicle Area	0.004	<0.004
Average	0.004	<0.004

Table 7 – Maintenance Building Air Sampling Data

Sample Location	Pre-Bulk Sampling Fiber Concentration (f/cc)	Post-Bulk Sampling Fiber Concentration (f/cc)
Garage	<0.004	<0.004
Workshop	<0.004	<0.004
Office	<0.004	<0.004
Lunch Room	<0.004	<0.004
Garage/Storage	<0.004	<0.004
Average	<0.004	<0.004

Table 8 – Building 98 Air Sampling Data

Sample Location	Pre-Bulk Sampling Fiber Concentration (f/cc)	Post-Bulk Sampling Fiber Concentration (f/cc)
Dining Room	<0.004	<0.004
Living Room	<0.004	<0.004
Bathroom #1	<0.004	<0.004
Bedroom #3	<0.004	<0.004
Bedroom #1	<0.004	<0.004
Average	<0.004	<0.004

Table 9 – Thomas Lloyd House/Building71 Air Sampling Data

Sample Location	Pre-Bulk Sampling Fiber Concentration (f/cc)	Post-Bulk Sampling Fiber Concentration (f/cc)
Dining Room	0.039	0.067
Living Room	0.051	0.029
Bathroom #1	0.026	0.032
Bedroom #3	0.025	0.021
Bedroom #1	0.007	0.013
Average	0.030	0.033

The OSHA permissible exposure limit (PEL) is 0.1 f/cc calculated as an 8-hour time weighted average. The EPA's recommended re-occupancy level for an area that has undergone asbestos abatement of less than 160 linear, 260 square, or 35 cubic feet (also known as NESHAPs quantities) is less than 0.01 f/cc for each of five samples. While neither of these numbers directly applies to the scope of work performed for this survey, they can serve as useful numbers to compare airborne fiber concentrations.

4.0 Regulatory Summary

The following is a limited summary of applicable regulations affecting asbestos-containing materials and the management of such materials.

4.1 EPA AHERA Regulations (40 CFR 763, Subpart E)

AHERA inspections are and have been an industry standard for the determination of the presence of asbestos within a building for the more than twenty years. It is mandatory for building owners and managers to have asbestos inspections conducted that meet or exceed AHERA requirements prior to renovations

By definition, an inspector must perform the following tasks while conducting an AHERA survey/inspection:

- Visually inspect the area to identify locations of all suspect asbestos-containing building material (ACBM).
- Touch all suspect ACBM to determine whether it is friable.
- Identify all homogeneous areas of friable suspect ACBM and all homogeneous areas of non-friable suspect ACBM.

- Assume that some or all of the homogeneous areas are ACM, and, for each homogeneous area that is not assumed to be ACM, collect and submit bulk samples for analysis.

- Prepare an inspection report with the date of the inspection, signed by each accredited person making the inspection, state of accreditation, and, if applicable, his or her accreditation number.

- Provide an inventory of the locations of homogeneous areas where samples are collected, exact location where each bulk sample is collected, dates that samples are collected, homogeneous areas where friable suspect ACBM is assumed to be ACM, and homogeneous areas where non-friable suspect ACBM is assumed to be ACM.

- Provide a description of the method used to determine sampling locations, the name and signature of each accredited inspector who collected the samples, state of accreditation, and, if applicable, his or her accreditation number.

- Provide a list noting whether the homogeneous areas are surfacing material, thermal system insulation, or miscellaneous material.

- Provide the assessments made of friable material, the name and signature of each accredited inspector making the assessment, state of accreditation, and if applicable, his or her accreditation number.

4.2 EPA ASHARA Regulation (40 CFR 763 Appendix C to Subpart E)

This regulation was issued to reauthorize the EPA AHERA regulations that strictly apply to schools. Personnel training requirements for individuals conducting asbestos-related activities were extended to persons performing work in public and commercial buildings. Therefore, all persons performing inspections, designing asbestos removals, and performing asbestos removal must be “AHERA Certified”. In the Commonwealth of Pennsylvania, the certification program is administered by the Pennsylvania Department of Labor and Industry. Photo ID certification cards for each individual are issued by DLI.

4.3 EPA NESHAP Regulations (40 CFR 61 subpart M)

This section applies to specific activities that involve disturbing ACM. The key points of this standard are as follows:

- Requires that an inspection be conducted in building areas to be affected by renovation activities.

- Requires a complete building inspection prior to building demolition.

- Requires 10-day prior notification to the EPA when more than 260 linear feet or 160 square feet or 35 cubic feet of ACM are removed.

- Defines resilient floor coverings (floor tile), asphalt roofing products, gaskets, and packings as Category I non-friable materials that are considered non-regulated asbestos-containing materials unless they are rendered friable.

- Defines asbestos-containing material as material containing greater than 1% asbestos.

- Requires point count sample analysis for any sample containing 1% or less asbestos to verify that the material is not an asbestos-containing material.

4.4 OSHA Construction and General Industry Standards (29 CFR 1926.1101 and 1910.1001)

These regulations apply to management practices, specific activities that involve disturbing ACM, personal exposure, and training. Although the OSHA standards were intended to complement EPA regulations, they often conflict with one another. When regulations conflict with one another, the most stringent applies. Some of the key points of the OSHA standards are provided below:

- Requires trained/certified asbestos removal personnel for the removal of EPA Category I non-friable material.

- Requires building owners and employers to presume surfacing and thermal system insulation installed prior to 1981 to contain asbestos until testing proves otherwise. Although floor tile is not defined as a presumed asbestos-containing material (PACM), OSHA does state “Asphalt and vinyl flooring material installed no later than 1980 must also be considered as asbestos-containing”. OSHA closes its interpretation of required presumptions by stating “If the employer/building owner has actual knowledge, or should have known through the exercise of due diligence, that other materials are asbestos-containing, they too must be treated as such”. Therefore, building owners and employers are required, despite the lack of regulatory clarity, to presume all suspect asbestos-containing materials installed prior to 1981 to contain asbestos.

- Incorporates AHERA regulation inspection techniques by reference. The AHERA regulations establish the minimum of number of samples to be collected based on material type and quantity. In order to remove the presumption of a material as asbestos-containing, it must be sampled in accordance with AHERA.

- Requires building owners to notify the following persons of the presence, location, and quantity of ACM or PACM at the work sites in their buildings or facilities:

    - Prospective employers applying or bidding for work.
    - Employees of the owner who will work in or adjacent to areas containing ACM or PACM.
    - On multi-employer worksites, all employers of employees who will be performing work within or adjacent to areas containing such materials.
    - Tenants who will occupy areas containing such material.

- Requires building owners to label asbestos and post signs indicating the presence of ACM or PACM.

- Requires building owners to maintain records regarding the presence, location, and quantity of ACM and PACM.

- Requires that all custodial/house cleaning staff receive two-hour asbestos awareness training.

5.0 Conclusions and Recommendations

The following are conclusions and recommendations for each asbestos-containing material identified as a result of these surveys. Priority scores for response actions are made from lowest to highest, with the lowest number being the AERO's highest recommendation.

5.1 General Conclusions and Recommendations

(1) With the exception of smooth 2-coat plaster and Aircell pipe insulation located at the Nathan Care House, all identified ACM was observed to be in good condition and can be maintained in place in accordance with a site O&M program.

(2) AERO has prioritized response actions to the asbestos-containing materials in the following table. In addition to the proposed response action, AERO has provided an estimated cost for the proposed response actions at the time of this report.

Table 10 – Prioritized Response Actions and Associated Costs

Building	Priority	Recommendation	Material	Cost
Nathan Care House	1	Remove	2,496 SF – Smooth Two-Coat Plaster	$34,610
Nathan Care House	2	Remove	3 LF - Aircell Pipe Insulation	$3,980
Visitor Center	3	Manage in place O&M	23 SF - 9”x9” Tan Floor Tile w/ White and Brown Specks	$6,000 for O&M Program
Visitor Center		Manage in place O&M	2,976 SF- Tan Sheet Flooring Under Carpet	
Maintenance Building		Manage in place O&M	1 SF - Gray Firestop Mastic	
Building 98		Manage in place O&M	2,729 SF – Smooth Two-Coat Plaster	
Building 98		Manage in place O&M	80 SF – Transite Paneling	
Building 98		Manage in place O&M	234 SF – Granite Pattern Sheet Flooring	
Lloyd House		Manage in place O&M	90 SF – Gold w/ Black Stone Pattern Vinyl Sheet Flooring	
Lloyd House		Manage in place O&M	72 SF – Vinyl Sheet Flooring w/ Gray and White Square Pattern	
Lloyd House		Manage in place O&M	5,158 SF – Smooth Two-Coat Plaster	

(3) AERO has used open-market pricing to estimate asbestos abatement costs for each project. Due to the variability in union wages for different regions or locales, as well as defined labor categories, an addition of 20% to the listed costs would give a reliable estimate of a union scaled job.

(4) AERO recommends that a site-wide Asbestos Operations and Maintenance (O&M) Program be prepared by a qualified industrial hygiene firm. The program should include, at a minimum:

- Procedures for the identification and sampling of suspect ACM;
- Locations, quantities and conditions of any identified ACM;
- Procedures for performing response actions including operations and maintenance; and
- Required training for those persons performing response actions.

(5) In accordance with OSHA regulations, AERO recommends that all contractors, custodial, and maintenance workers who may come in contact with ACM during the course of their normal duties be informed of the locations of ACM.

(6) AERO recommends that tenants and employees be notified of the presence of all ACM at the site to reduce the possibility of disturbing these materials. Typically this notification is performed as part of an O&M Plan to reduce the potential hazard posed by the asbestos.

(7) Prior to removing any ACM from the building, a set of asbestos removal specifications should be generated by a Commonwealth of Pennsylvania Certified Asbestos Project Designer. The purpose of asbestos abatement specifications is to delineate the means and methods for completing the removal, and serve as part of the contractual agreement between the contractor and owner. Specifications and subsequent project monitoring are essential to a successful abatement project. Asbestos abatement projects differ from ordinary construction projects in that the owner needs to be equally concerned with the procedures used to complete the abatement as well as the final product.

(8) Friable asbestos-containing materials including thermal system insulations and surfacing materials were banned in the United States during the 1970s. However, many of the non-friable materials (e.g., asbestos-cement products, mastics) are allowed to contain bound asbestos fibers in their matrix. Therefore, AERO recommends that all future renovation designs include specifications for non-asbestos building materials to avoid introducing ACM to the buildings of Hopewell Furnace NHS.

5.2 Visitor Center

(1) Vinyl sheet flooring beneath carpet and 9”x9” tan floor tile with white and brown specks were identified to be asbestos-containing. These materials were in good condition where observed. EPA classifies these materials as Category I non-friable materials. The EPA regulates Category I non-friable materials (resilient floor coverings, asphalt roof products, gaskets, and packings) only when they are rendered friable.

(2) AERO recommends that these materials be maintained in good condition and reassessed periodically in accordance with an O&M program described previously.

(3) If any demolition or renovation activities are to be performed, a licensed asbestos abatement contractor must remove these materials prior to any activities that would result in their disturbance. The following table provides an estimated cost for the abatement of identified materials should it be required by renovation or demolition activities that will affect them:

Table 11 – Visitor Center Estimated Abatement Costs

Material	Square Footage	Unit Cost	Mobilization Cost	Abatement Monitoring*	Total Cost
FT01 – 9”x9” Tan Floor Tile w/ White and Brown Specks	23 SF	$3 / SF	$2,500	$1,300	$3,869
FT02 – Tan Sheet Flooring Under Carpet	2,976 SF	$3 / SF	$2,500	$3,250	$14,678
Total Estimated Cost of Abatement if Performed as One Project: $15,000					

*- Abatement costs are estimated $650/day

(4) All air samples collected were below 0.01 f/cc, the EPA’s recommended re-occupancy level for buildings that have undergone abatement of less than NESHAPs quantities.

5.3 Maintenance Building

(1) Gray firestop mastic was identified to be asbestos-containing. This material was

in good condition where observed. EPA classifies this material as Category II non-friable material.

(2) AERO recommends that this material be maintained in good condition and reassessed periodically in accordance with an O&M program described previously.

(3) If any demolition or renovation activities are to be performed, a licensed asbestos abatement contractor must remove this material prior to any activities that would result in its disturbance. The following table provides an estimated cost for the abatement of the identified material should it be required by renovation or demolition activities that will affect it:

Table 12 – Maintenance Building Estimated Abatement Cost

Material	Square Footage	Unit Cost	Mobilization Cost	Abatement Monitoring*	Total Cost
M03 – Gray Firestop mastic	1 SF	$6 / SF	$2,500	$1,300	$3,806

*- Abatement costs are estimated $650/day

(4) All air samples collected were below 0.01 f/cc, the EPA's recommended re-occupancy level for buildings that have undergone abatement of less than NESHAPs quantities.

5.4 Building 98

(1) Smooth 2-coat plaster was identified to be asbestos-containing. The material was in good condition where observed. Two-coat plaster is considered a friable surfacing material.

(2) Vinyl granite pattern sheet flooring was identified to be asbestos-containing. This material was in good condition where observed. EPA classifies resilient floor coverings as Category I non-friable materials. The EPA regulates Category I non-friable materials (resilient floor coverings, asphalt roof products, gaskets, and packings) only when they are rendered friable.

(3) Asbestos cement board, or Transite, wall paneling was identified to be asbestos-containing. This material was in good condition where observed. EPA classifies this material as Category II non-friable materials.

(4) AERO recommends that these materials be maintained in good condition and reassessed periodically in accordance with an O&M program described previously.

(5) If any demolition or renovation activities are to be performed, a licensed asbestos abatement contractor must remove these materials prior to any activities that would result in their disturbance. The following table provides an estimated cost for the abatement of identified materials should it be required by renovation or demolition activities that will affect them:

Table 13 – Building 98 Estimated Abatement Costs

Material	Square Footage	Unit Cost	Mobilization Cost	Abatement Monitoring*	Total Cost
S01 – Smooth Two-Coat Plaster	2,729 SF	$10 / SF	$2,500	$7,800	$37,590
M01 – Transite Paneling	80 SF	$6 / SF	$2,500	$1,300	$4,280
FT01 – Granite Pattern Sheet Flooring	234 SF	$3 / SF	$2,500	$1,300	$4,500
Total Estimated Cost of Abatement if Performed as One Project: $40,000					

*- Abatement costs are estimated $650/day

(5) All air samples collected were below 0.01 f/cc, the EPA's recommended re-occupancy level for buildings that have undergone abatement of less than NESHAPs quantities.

5.5 John Church House and Detached Garage

(1) No asbestos-containing materials were identified in this building or its detached garage as a result of the survey and bulk sampling.

5.6 Thomas Lloyd House/Building 71

(1) Smooth 2-coat plaster was identified to be asbestos-containing. The material was in good condition where observed. Two-coat plaster is considered a friable

surfacing material.

(2) Gold with black stone pattern and gray and white square patterned vinyl sheet flooring were identified to be asbestos-containing. These materials were observed to be in good condition. EPA classifies resilient floor coverings as Category I non-friable materials. The EPA regulates Category I non-friable materials (resilient floor coverings, asphalt roof products, gaskets, and packings) only when they are rendered friable.

(3) AERO recommends that these materials be maintained in good condition and reassessed periodically in accordance with an O&M program described previously.

(4) If any demolition or renovation activities are to be performed, a licensed asbestos abatement contractor must remove these materials prior to any activities that would result in their disturbance. The following table provides an estimated cost for the abatement of identified materials should it be required by renovation or demolition activities that will affect them:

Table 14 – Lloyd House/ Building 71 Estimated Abatement Costs

Material	Square Footage	Unit Cost	Mobilization Cost	Abatement Monitoring*	Total Cost
FT02 – Gold w/ Black Stone Pattern Vinyl Sheet Flooring	90 SF	$3 / SF	$2,500	$1,300	$4,070
FT03 – Vinyl Sheet Flooring w/ Gray and White Square Pattern	72 SF	$3 / SF	$2,500	$1,300	$4,070
S02 – Smooth Two-Coat Plaster	5,158 SF	$10 / SF	$2,500	$14,300	$68,030
Total Estimated Cost of Abatement if Performed as One Project: $68,500					

*- Abatement costs are estimated $650/day

(5) All air samples collected were above 0.01 f/cc, the EPA's recommended re-occupancy level for buildings that have undergone abatement of less than NESHAPs quantities. Air samples were below the OSHA PEL of 0.1 f/cc calculated as an 8-hour TWA.

No significant differences in pre- and post-bulk sampling airborne fiber concentration were identified using EPA prescribed Z-score statistical testing. The critical value for Z-score testing is 1.65, meaning that a Z-score greater than 1.65 indicates a statistically significant difference between the pre- and post-bulk sampling fiber concentrations. The Z-score figure has no units.

AERO concludes that there was no difference in the airborne fiber concentration at Building 71 before and after sampling. High fiber counts may be accounted for by the presence of at least three pets in the residence, resulting in high concentrations of airborne fibrous materials. NIOSH Method 7400 cannot differentiate between different fiber types.

5.7 Nathan Care House

(1) Smooth 2-coat plaster was identified to be asbestos-containing. The material was damaged throughout the building. The majority of damage observed was water damage or general deterioration. Two-coat plaster is considered a friable surfacing material. Damaged areas are identified in the drawings contained in **Appendix E.**

(2) A small section of pipe coated in corrugated paper wrap, or Aircell, pipe insulation was identified to be asbestos containing. The material was observed to be significantly deteriorated. Aircell pipe insulation is considered a friable thermal system insulation (TSI) material.

(3) AERO recommends that the damaged Aircell pipe insulation be removed by a licensed asbestos abatement contractor. An estimated cost for this response action is detailed in **Table 10** of Section 4.1 of this report.

(4) AERO recommends the removal of the damaged asbestos containing plaster by a licensed abatement contractor. While AERO appreciates the fact that this material is located in a historically sensitive building, it is more likely that the identified plaster was installed as a part of the renovation that reportedly took place in the 1960s. Most plasters from the 1800s were made with horsehair as a binding agent. Coupled with the reported use of the building as housing, AERO feels the most prudent course of action is the removal of the plaster. An estimated cost for this response action is detailed in **Table 10** of Section 4.1 of this report.

(5) If the plaster cannot be removed for historical preservation reasons, repair of asbestos-containing friable 2-coat plaster may be performed in lieu of recommended removal. The estimated cost for abatement is provided in the following table.

Table 15 – Care House Estimated Abatement Cost

Material	Square Footage	Unit Cost	Mobilization Cost	Abatement Monitoring*	Total Cost
S02 – Smooth Two-Coat Plaster	2,496 SF	$7.50 / SF	$2,500	$7,150	$27,070

*- Abatement costs are estimated $650/day

5.8 Tenant House #3

(1) No asbestos-containing materials were identified in this building as a result of the survey and bulk sampling.

APPENDIX A

Room By Room Suspect Materials Inventories

AERO EH&S, INC.
ENVIRONMENTAL HEALTH & SAFETY

Nathan Care House

Room by Room Inventory - Care House

Floor	Room		Description	Quantity	Condition	Friable?	Asbestos?
Attic	Attic						
		S03	Skim Coat Plaster Over Stone	250 SF	G = Good	☑	☐
B-Basement	Basement						
		DW	Drywall	32 SF	G = Good	☐	☐
		S03	Skim Coat Plaster Over Stone	50 SF	F = Fair	☑	☐
2-Second	Bathroom						
		S01	Smooth Two Coat Plaster	256 SF	F = Fair	☑	☑
		S01	Smooth Two Coat Plaster	48 SF	F = Fair	☑	☑
2-Second	Bedroom #1						
		S01	Smooth Two Coat Plaster	352 SF	F = Fair	☑	☑
		S02	Rough Coat Plaster	120 SF	F = Fair	☑	☐
2-Second	Bedroom #2						
		S01	Smooth Two Coat Plaster	448 SF	F = Fair	☑	☑
		S02	Rough Coat Plaster	192 SF	F = Fair	☑	☐
1-First	Kitchen / Dining Room						
		S01	Smooth Two Coat Plaster	432 SF	F = Fair	☑	☑
		S02	Rough Coat Plaster	176 SF	F = Fair	☑	☐

Room by Room Inventory - Care House

Floor	Room		Description	Quantity	Condition	Friable?	Asbestos?
1-First	Living Room						
		S01	Smooth Two Coat Plaster	448 SF	F = Fair	☑	☑
		S02	Rough Coat Plaster	192 SF	F = Fair	☑	☐
		TSI01	Aircell Pipe Insulation	3 LF	F = Fair	☑	☑
1-First & 2-Second	Stairwell & Hallway						
		S01	Smooth Two Coat Plaster	48 SF	F = Fair	☑	☑
		S01	Smooth Two Coat Plaster	464 SF	F = Fair	☑	☑
		S02	Rough Coat Plaster	45 SF	F = Fair	☑	☐

APPENDIX B

Bulk Asbestos Lab Reports

AERO EH&S, INC.
ENVIRONMENTAL HEALTH & SAFETY

Nathan Care House

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: AERO EH&S Inc.
10310-B Baltimore National Pike
Ellicott City, MD 21042

Attn: Stephen Kelly

Project: Hopewell Furnace-Care House

Lab Order ID: 1214396
Analysis ID: 1214396PLM
Date Received: 8/31/2012
Date Reported: 9/6/2012

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
082912-Care-01 *1214396PLM_1*	DW-drywall	**None Detected**	**15% Cellulose** **5% Fiber Glass**	**80% Gypsum**	White, Brown Fibrous Heterogeneous Crushed
082912-Care-02 *1214396PLM_2*	S03-Skim coat plaster over stone *skim coat only*	**None Detected**		**100% Other**	White Non Fibrous Heterogeneous Crushed
082912-Care-03 - A *1214396PLM_3*	S03-Skim coat plaster over stone *skim coat*	**None Detected**		**100% Other**	White Non Fibrous Heterogeneous Crushed
082912-Care-03 - B *1214396PLM_16*	S03-Skim coat plaster over stone *base*	**None Detected**		**100% Other**	Brown Non Fibrous Heterogeneous Crushed
082912-Care-04 - A *1214396PLM_4*	S03-Skim coat plaster over stone *skim coat*	**None Detected**		**100% Other**	White Non Fibrous Heterogeneous Crushed
082912-Care-04 - B *1214396PLM_17*	S03-Skim coat plaster over stone *base*	**None Detected**		**100% Other**	Brown Non Fibrous Heterogeneous Crushed
082912-Care-05 *1214396PLM_5*	TSI01-aircell pipe insulation	**55% Chrysotile**	**30% Cellulose**	**15% Other**	White Fibrous Heterogeneous Teased
082912-Care-06 *1214396PLM_6*	TSI01-aircell pipe insulation	**Not Analyzed**			

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agenc

Sharon Donald (24)
Analyst

Nathaniel Durham, MS or Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: AERO EH&S Inc.
10310-B Baltimore National Pike
Ellicott City, MD 21042

Attn: Stephen Kelly

Lab Order ID: 1214396
Analysis ID: 1214396PLM
Date Received: 8/31/2012
Date Reported: 9/6/2012

Project: Hopewell Furnace-Care House

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
082912-Care-07 *1214396PLM_7*	TSI01-aircell pipe insulation	**Not Analyzed**			
082912-Care-08 - A *1214396PLM_8*	S02-rough coat plaster *textured finish*	**None Detected**	**5% Cellulose**	**95% Other**	White Non Fibrous Heterogeneous Teased
082912-Care-08 - B *1214396PLM_18*	S02-rough coat plaster *base*	**None Detected**		**100% Other**	Gray Non Fibrous Heterogeneous Crushed
082912-Care-09 - A *1214396PLM_9*	S02-rough coat plaster *textured finish*	**None Detected**	**5% Cellulose**	**95% Other**	White Non Fibrous Heterogeneous Teased
082912-Care-09 - B *1214396PLM_19*	S02-rough coat plaster *base*	**None Detected**	**2% Hair**	**98% Other**	Brown Non Fibrous Heterogeneous Crushed
082912-Care-10 - A *1214396PLM_10*	S02-rough coat plaster *textured finish*	**None Detected**	**5% Cellulose**	**95% Other**	White Non Fibrous Heterogeneous Teased
082912-Care-10 - B *1214396PLM_20*	S02-rough coat plaster *base*	**None Detected**		**100% Other**	Gray Non Fibrous Heterogeneous Crushed
082912-Care-11 - A *1214396PLM_11*	S01-smooth two coat plaster *finish*	**None Detected**		**100% Other**	White Non Fibrous Heterogeneous Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agenc

Sharon Donald (24)
Analyst

Nathaniel Durham, MS or Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: AERO EH&S Inc.
10310-B Baltimore National Pike
Ellicott City, MD 21042

Attn: Stephen Kelly

Lab Order ID: 1214396
Analysis ID: 1214396PLM
Date Received: 8/31/2012
Date Reported: 9/6/2012

Project: Hopewell Furnace-Care House

Sample ID / *Lab Sample ID*	Description / *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes / Treatment
082912-Care-11 - B *1214396PLM_21*	S01-smooth two coat plaster *base*	**None Detected**		**100% Other**	Gray Non Fibrous Heterogeneous Crushed
082912-Care-12 *1214396PLM_12*	S01-smooth two coat plaster *single layer-soft material*	**4% Chrysotile**		**96% Other**	White Non Fibrous Heterogeneous Crushed
082912-Care-13 - A *1214396PLM_13*	S01-smooth coat plaster *finish*	**None Detected**		**100% Other**	White Non Fibrous Heterogeneous Crushed
082912-Care-13 - B *1214396PLM_22*	S01-smooth coat plaster *base*	**None Detected**	**2% Hair**	**98% Other**	Brown Non Fibrous Heterogeneous Crushed
082912-Care-14 - A *1214396PLM_14*	S01-smooth coat plaster *finish*	**None Detected**		**100% Other**	White Non Fibrous Heterogeneous Crushed
082912-Care-14 - B *1214396PLM_23*	S01-smooth coat plaster *base*	**None Detected**	**2% Hair**	**98% Other**	Brown Non Fibrous Heterogeneous Crushed
082912-Care-15 - A *1214396PLM_15*	S01-smooth coat plaster *finish*	**None Detected**		**100% Other**	White Non Fibrous Heterogeneous Crushed
082912-Care-15 - B *1214396PLM_24*	S01-smooth coat plaster *base*	**None Detected**	**2% Hair**	**98% Other**	Brown Non Fibrous Heterogeneous Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommended that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agenc

Sharon Donald (24)

Analyst

Nathaniel Durham, MS or Approved Signatory

BULK ASBESTOS SAMPLE SHEET

AERO EH&S, INC.
ENVIRONMENTAL HEALTH & SAFETY
10310B BALTIMORE NATIONAL PIKE
ELLICOTT CITY, MD 21042
TEL: (410) 480-3636 FAX: (410) 480-3637

Requested Turnaround Time
Immed. 24hr (3 day) 5 day
Results Needed By:

1 of 2

Project Name: Hopewell Furnace - Care House
Project Location: Elverson, PA
Client/Job Number:
Inspectors: Kelly Kurencheck
Date Sampled: 8/29/12 / 214396

Room Name/Number	Floor	Material Type	Diameter / Size	Quantity	Cond	Friable? Y/N	Sample Description	Comments	Sample Number
Basement	B	Misc	8'x4'		G	N	D01 - Drywall		082912-care-01
Basement	B	Surf.	N/A	300	F	Y	S03 - Skim coat plaster over stone	Positive Stop 1 of 3	082912-care-02
Attic	A	Surf.	N/A	300	F	Y	"	2 of 3	082912-care-03
Attic	A	Surf.	N/A	300	F	Y	"	3 of 3	082912-care-04
Living Room	1	TSI	N/A		F	Y	TSI01 - Aircell Pipe Insulation	Positive Stop 1 of 3	082912-care-05
Living Room	1	TSI	N/A		F	Y	"	2 of 3	082912-care-06
Living Room	1	TSI	N/A		F		"	3 of 3	082912-care-07
Kitchen	1	Surf.	N/A	725	F		S02 - Rough Coat Plaster	Positive Stop 1 of 3	082912-care-08
Living Room	1	Surf.	N/A	725	F		"	2 of 3	082912-care-09
Bedroom #2	2	Surf.	N/A	725	F		"	3 of 3	082912-care-10
Living Room	1	Surf	N/A	2800	F		S01 - Smooth two coat plaster	Positive Stop 1 of 3	082912-care-11
Stairwell & Hallway	1/2	Surf.	N/A	2800	F			2 of 3	082912-care-12

Accepted ☑
☐

Chain of Custody

Sampled By:	Received By:	Transported By:	Lab Custody:
Signature:	Signature:	Signature:	Signature:
Date/Time: 8/30/12 1:30pm	Date/Time:	Date/Time:	Date/Time: 8/31 1030A

BULK ASBESTOS SAMPLE SHEET

AERO EH&S, INC.
ENVIRONMENTAL HEALTH & SAFETY
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ELLICOTT CITY, MD 21042
TEL: (410) 480-3636 FAX: (410) 480-3637

Requested Turnaround Time
Immed. 24hr (3 day) 5 day
Results Needed By:

Project Name: Hopewell Furnace - Care House
Project Location: Elverson, PA
Job Number: _____

Inspectors: Kelly / Kuczenchuk 2 of 2
Date Sampled: 8/29/12 1214396

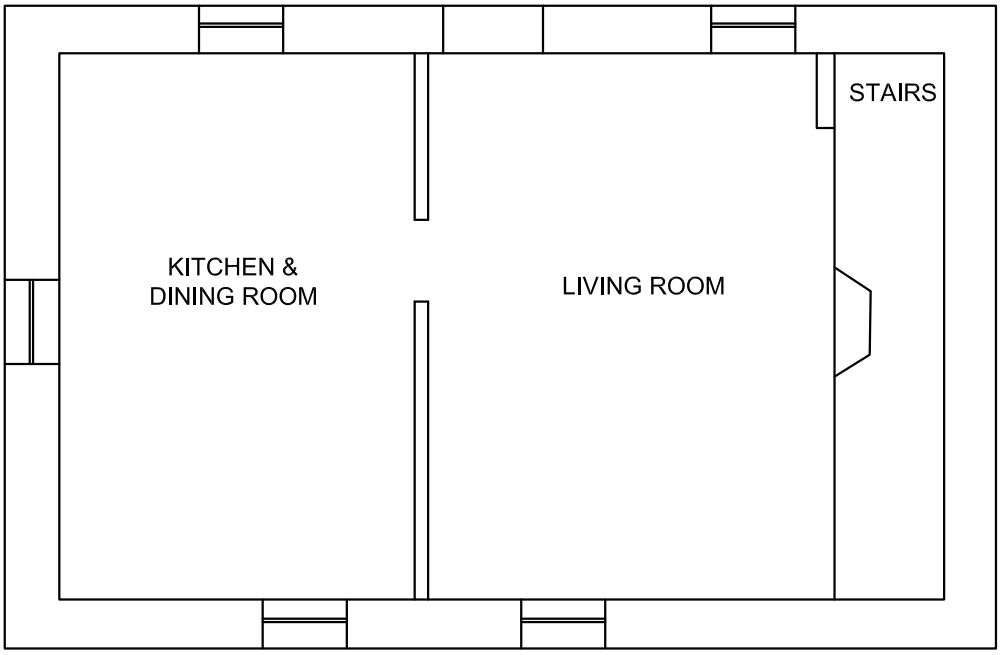
Room Name/Number	Floor	Material Type	Diameter / Size	Quantity	Cond	Friable? Y/N	Sample Description	Comments	Sample Number
Stairwell Hallway	2	Surf.	N/A	2,800	F	Y	S01 - smooth coat plaster	Positive Stop 3 of 5	0829/12-care-13
Bathroom	2	Surf.	N/A	2,800	F	Y	"	Positive Stop 4 of 5	0829/12-care-14
Bedroom #1	2	Surf.	N/A	2,800	F	Y	"	Positive Stop 5 of 5	0829/12-care-15

Chain of Custody

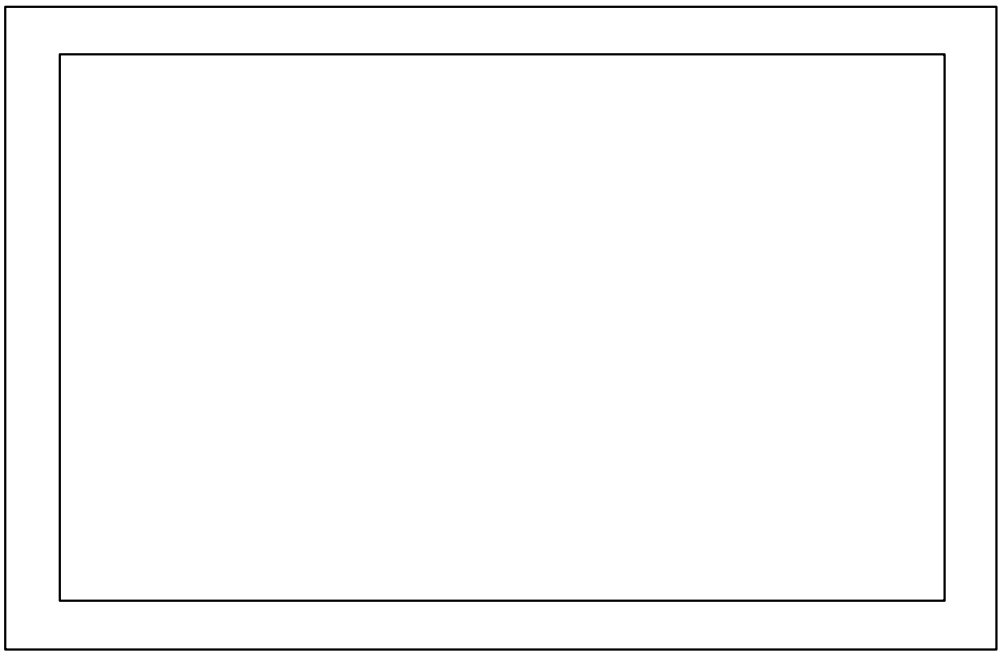
Sampled By:	Received By:	Transported By:	Lab Custody:
Stephen Kelly			
Signature:	Signature:	Signature:	Signature:
Date/Time: 8/30/12 1:30pm	Date/Time:	Date/Time:	Date/Time:

APPENDIX D

Room Location Drawings

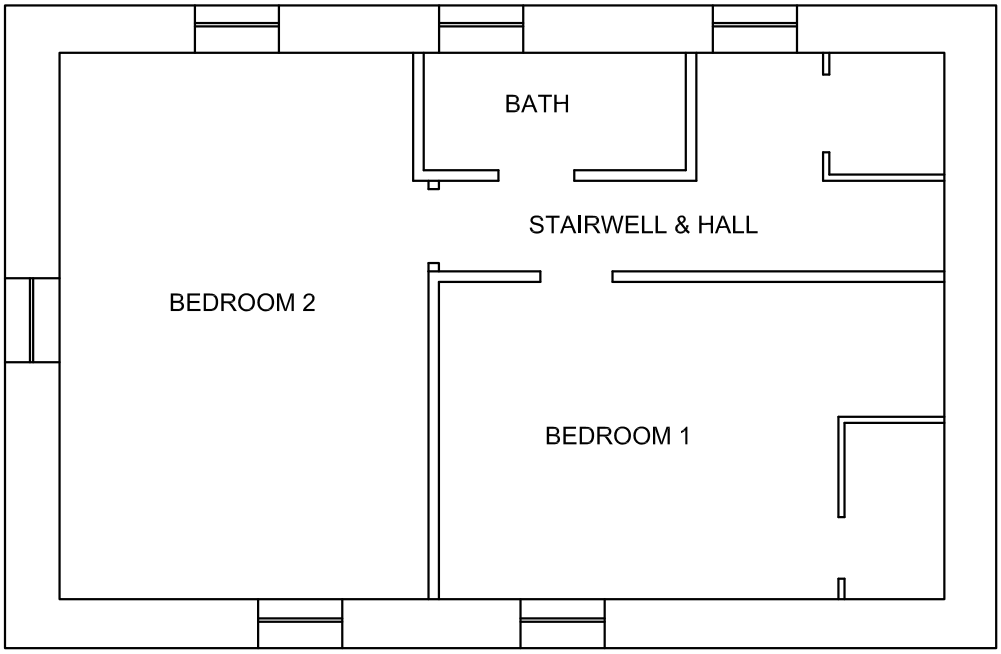


FIRST FLOOR

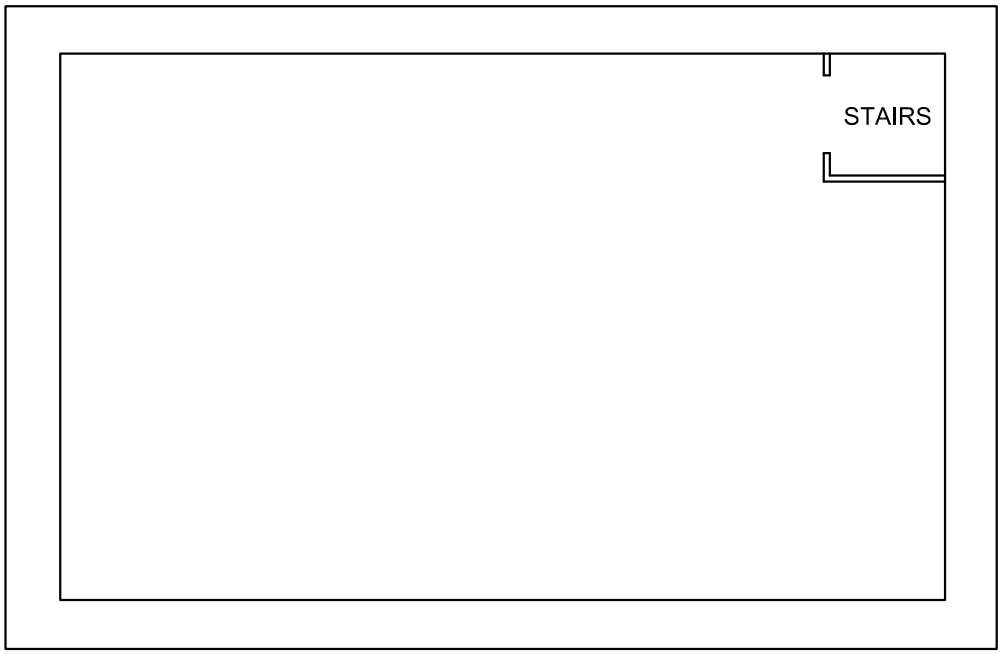


BASEMENT

HOPEWELL FURNACE NATIONAL HISTORIC SITE
NATHAN CARE HOUSE



SECOND FLOOR

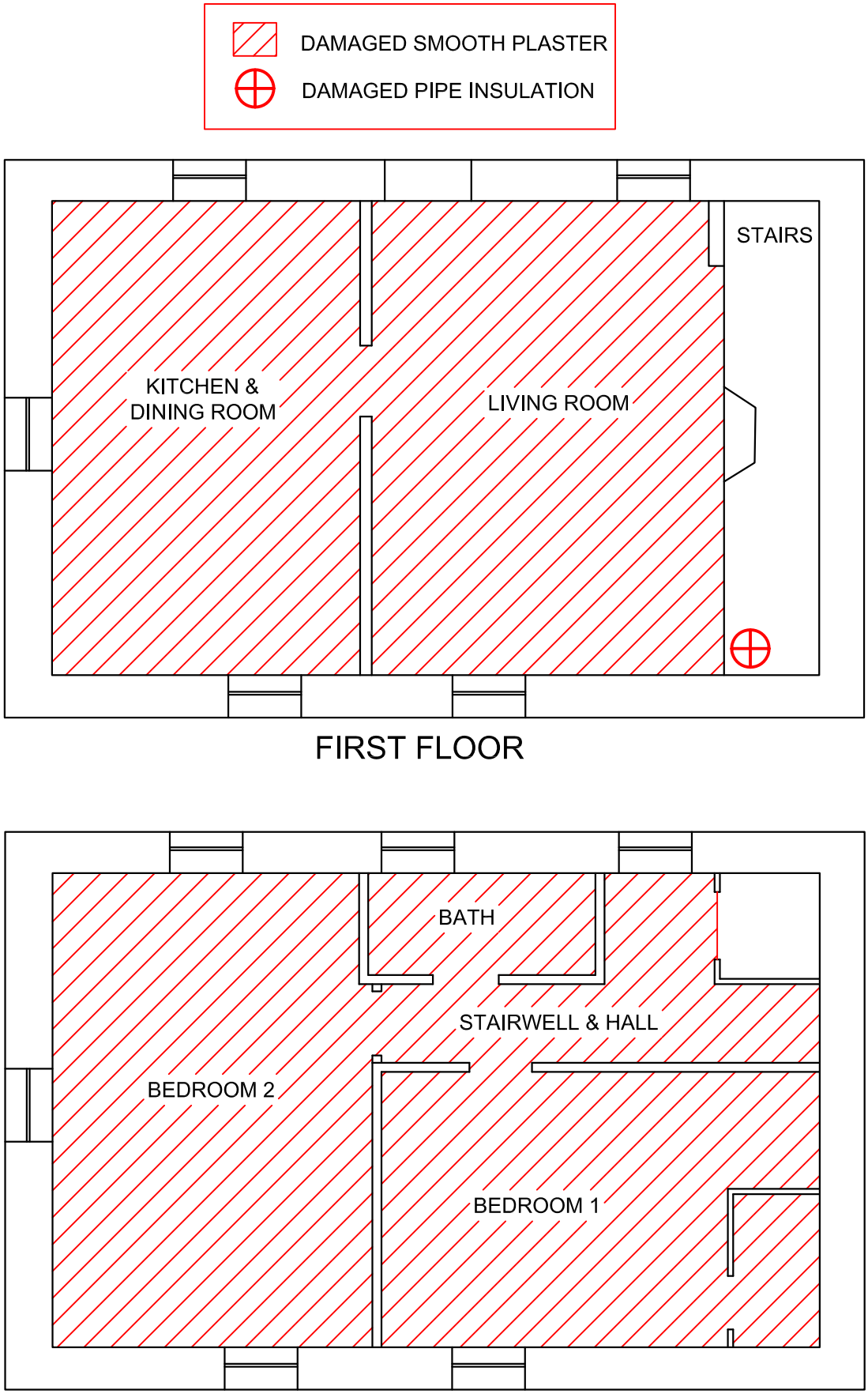


ATTIC LEVEL

HOPEWELL FURNACE NATIONAL HISTORIC SITE
NATHAN CARE HOUSE

APPENDIX E

Damaged Materials Location Drawings



HOPEWELL FURNACE NATIONAL HISTORIC SITE
NATHAN CARE HOUSE - DAMAGED ACM

APPENDIX D

PHASE IB ARCHAEOLOGICAL TESTING OF THE NATHAN CARE FOUNDATION

PHASE Ib ARCHAEOLOGICAL TESTING of the NATHAN CARE BARN FOUNDATION, HOPEWELL FURNACE NATIONAL HISTORIC SITE

DRAFT

Accession #: HOFU-1197

Prepared by:

John A. Turck, Ph.D., RPA
Archaeologist/ GIS Specialist
Valley Forge National Historical Park/ Hopewell Furnace National Historic site
1400 North Outer Line Drive
King of Prussia, PA 19406

August 2016

APPENDIX E

MORTAR ANALYSIS

November 28, 2016

Alanna Piser
John Milner Architects
104 Lakeview Dr.
Chadds Ford, PA 19317

INTRODUCTION

The following summary provides the results of a mortar analysis performed by Materials Conservation Co., LLC (MC) at the request of Alanna Piser, of John Milner Architects. Four mortar samples were extracted by the client from the Nathan Care House and Barn at Hopewell Furnace Historic Site in Elverson, Pennsylvania.

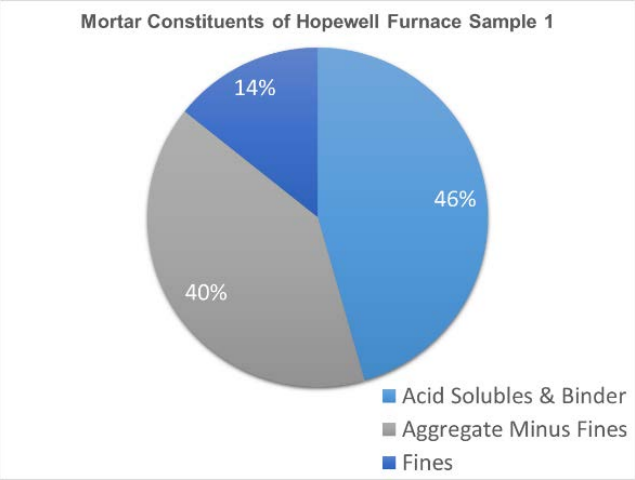
METHODOLOGY

The samples were sent by Alanna Piser to MC's conservation laboratory in Philadelphia, PA for analysis. The analysis included microscopic examination of the hand sample, dissolution of the binder using the gravimetric/acid digestion method, and characterization of the aggregate and binder components. A 15% solution of hydrochloric acid was used to perform acid digestion. Each sample was agitated for 24 hours, the fine particles filtered from the aggregate, and both were dried for 24 hours. Following the acid digestion of the binder, the dried aggregate was sieved to determine the distribution of particle sizes. All samples were studied under reflected visible light using a Leica MZ16 stereomicroscope.

Figure 1: Mortar samples were broken in several pieces to facilitate analysis (Sample 1 shown above).

SAMPLE 1: POINTING FROM SOUTH EXTERIOR WALL OF BARN

The mortar sample is dark brown in color and weak in strength, having frequent lime clumps and appearing to consist mainly of soil. It is likely that this mortar is original and survived without significant weathering. Microscopic examination of the sample under 10x magnification shows a high concentration of wood and vegetable fiber (hay) as well as inclusions of coal.



Acid Soluble Fraction: Approximately 46% of the total sample weight is acid-soluble. A vigorous reaction occurred when the solution of hydrochloric acid was added to the sample, indicating a mortar with a high lime content. The presence of medium size lime blebs indicates the inclusion of lime were in the original mix. It is possible that an acid-soluble aggregate such as crushed limestone or marble was also used, which could account for the large acid-soluble component.

Fines: Approximately 14% of the total sample weight is fines, primarily dark brown particles which resemble soil. A high concentration of wood fiber remained after acid digestion.

Aggregate: Approximately 40% of the total sample weight is aggregate comprised of green (possibly olivine), white, pink, grey (possibly Shale), and light orange particles that are angular in shape with medium spherocity (Figure 3). A high concentration of quartz, coal and slag particles were seen throughout with a few charcoal and pyrite particles. Separation of particles by size was achieved by sieving the aggregate and weighing the quantity of particles retained on each sieve pan. Between approximately 11% and 21% of the particles were retained on the 8, 16, 30, 200, and Pan/Fines sieve indicating a very poorly sorted/well graded aggregate with a large range in particle sizes.

The approximate original mix probably was a lime based mortar made hydraulic by the addition of charcoal, slag, and shale; all natural pozzolans. The variety of aggregate, rich in coal, iron slag and potentially shale indicates that the aggregate was likely sourced directly from the site. It is recommended that a naturally hydraulic mortar such as Saint Astier's NHL 2 or 3.5 be used as a replication mortar, using pit sand as aggregate that matches the original. Pigment the mix only if color match cannot be achieved solely through aggregate. The ratio recommended is 1 part NHL 2 or 3.5 and 1.5 or 2.5 parts of sand respectively, proportioned by volume. Mortar should be mixed for at least 10 minutes. Mix materials dry, to uniform color and consistency, before mixing in clean, potable water. Protect mortar from freezing, contamination, and excessive evaporation.

These findings are estimations and should not be used for project specifications.

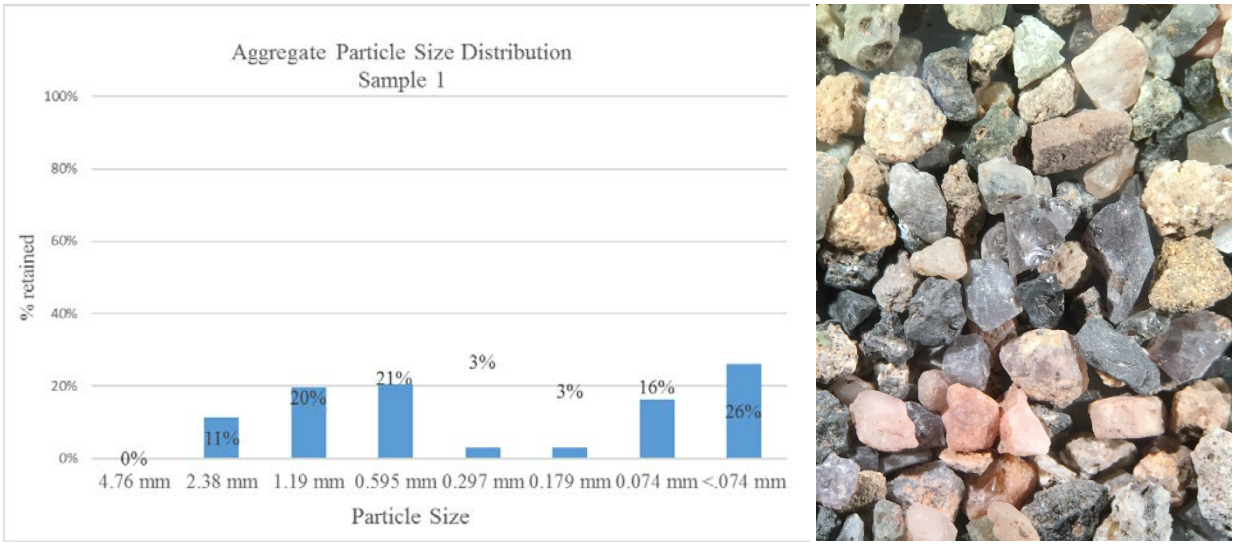
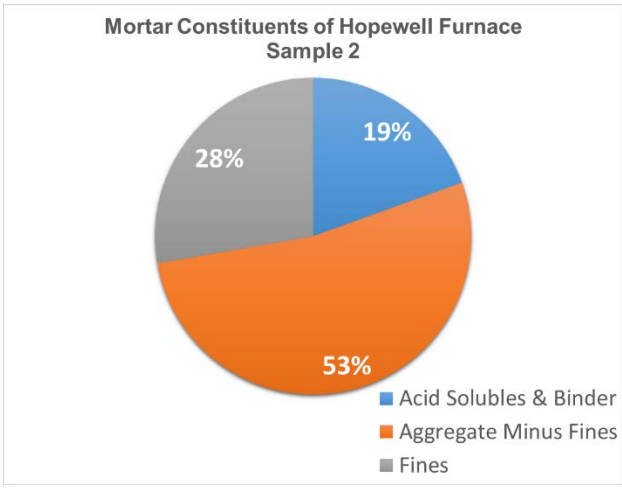


Figure 3: Particle size distribution chart (left) and aggregate at 10x magnification

SAMPLE 2: INTERIOR POINTING AT UPPER LEVEL OF BARN

The mortar sample is light medium brown in color and weak in strength, porous, and appearing to consist mainly of soil with frequent large lime blebs. It is likely that this mortar is original and survived without significant weathering. Microscopic examination of the sample under 10x magnification shows a high concentration of organic material, consisting of wood, vegetable fiber (hay), as well inclusions of coal and charcoal.



Acid Soluble Fraction: Approximately 20% of the total sample weight is acid-soluble. A moderate reaction occurred when the solution of hydrochloric acid was added to the sample, indicating a mortar with a considerable lime content. The presence of medium size lime blebs indicates the inclusion of lime were in the original mix.

Fines: Approximately 28% of the total sample weight is fines, primarily light reddish brown particles which resemble soil. Salt crystals were also visible, growing in small clumps (See figure 5). It is possible that the soil/aggregate used for this mortar was contaminated with nitrates that are commonly deposited by the decomposition of Animal manure or urine. Components of this mortar could have been harvested from the soil beneath or close to the barn. Water used to hydrate the mortar could also have had a saline content.

Aggregate: Approximately 53% of the total sample weight is aggregate comprised of white, pink, clear, and light orange particles that are angular in shape with medium to low spherocity (Figure 6). A high concentration of quartz, coal and slag particles were seen throughout. Separation of particles by size was

achieved by sieving the aggregate and weighing the quantity of particles retained on each sieve pan. Between approximately 8% and 18% of the particles were retained on the 8, 16, 30, 50, 100 200, and Pan/Fines sieve indicating a very poorly sorted/well graded aggregate with a large range in particle sizes.

The approximate original mix probably was a lime based mortar made hydraulic by the addition of charcoal, slag, and shale; all natural pozzolans. The variety of aggregate, rich in coal, iron slag and potentially shale indicates that the aggregate was likely sourced directly from the site. It is recommended that a naturally hydraulic mortar such as Saint Astier's NHL 2 or 3.5 be used as a replication mortar, using pit sand as aggregate that matches the original. Pigment the mix only if color match cannot be achieved solely through aggregate. The ratio recommended is 1 part NHL 2 or 3.5 and 1.5 or 2.5 parts of sand respectively, proportioned by volume. Mortar should be mixed for at least 10 minutes. Mix materials dry, to uniform color and consistency, before mixing in clean, potable water. Protect mortar from freezing, contamination, and excessive evaporation.

Figure 5: Salt crystal clumps in dried fines of Sample 2

These findings are estimations and should not be used for project specifications.

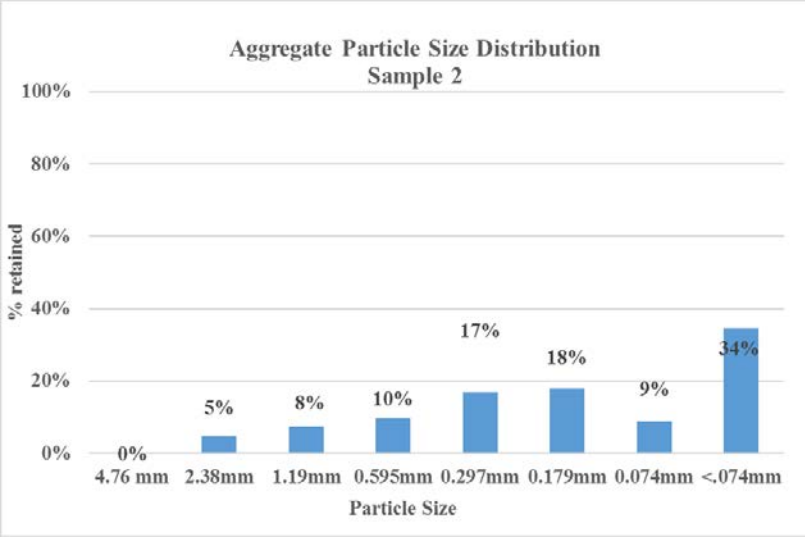
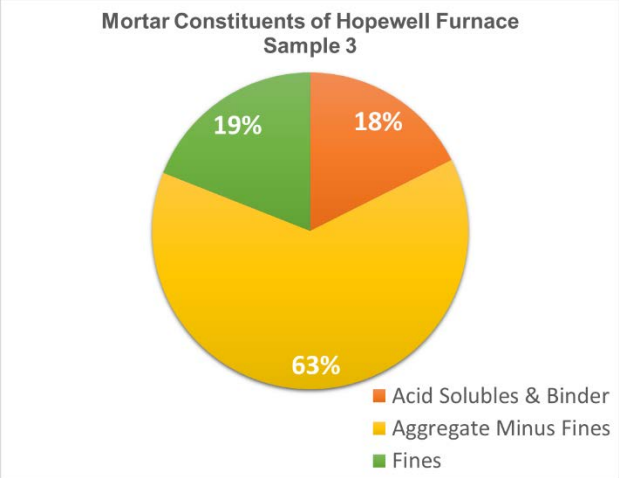


Figure 6: Particle size distribution chart of Sample 2 (left) and aggregate at 10x magnification

SAMPLE 3: WEST WALL STUCCO OF NATHAN CARE HOUSE

The mortar sample is coral pink in color and weak in strength. It is likely that this mortar is original and survived without significant weathering. Microscopic examination of the sample under 10x magnification shows the sample to be fairly well sorted with inclusions of animal hair and a small concentration of coal.



Acid Soluble Fraction: Approximately 18% of the total sample weight is acid-soluble. A moderate reaction occurred when the solution of hydrochloric acid was added to the sample, indicating a mortar with some lime content. Having a smaller acid-soluble fraction in conjunction with a moderate reaction, as opposed to a vigorous reaction to the hydrochloric acid indicates a lower lime/binder content.

Fines: Approximately 19% of the total sample weight is fines, primarily light pink particles. A high concentration of animal hair remained after acid digestion (figure 8). The animal hair was likely sourced onsite, and used to increase the tensile strength of the stucco.

Aggregate: Approximately 63% of the total sample weight is aggregate comprised of opaque white and light pink particles that are angular or sub-rounded in shape with high spherocity (Figure 9). A high concentration of quartz, with a few charcoal and coal particles are present. The aggregate was more controlled, as it is far more homogenous in composition and color than the other samples. Separation of particles by size was achieved by sieving the aggregate and weighing the quantity of particles retained on each sieve pan. A wide distribution of particle sizes was observed through sieving; however, most particles fall between the sizes of 0.595mm and 0.179mm indicating a moderately sorted/graded aggregate.

The approximate original mix probably was a lime based stucco, pigmented by the aggregate chosen. The variety of aggregate, having a few coal and iron particles indicates that the aggregate was likely sourced directly from the site and potentially sieved and sorted to achieve a more homogenous mix. It is recommended that a feebly hydraulic mortar such as Saint Astier's NHL 3.5 be used as a replication stucco, using river sand as aggregate that matches the original. The recommended ratio for a stucco finish coat is 1 part NHL 3.5 and 3 parts sand, proportioned by volume. Pigment the mix only if color match cannot be achieved solely through aggregate. It is also recommended that a small amount of commercially available hair or synthetic fiber be used to bolster the tensile strength and replicate the texture. Mix materials dry, to uniform color and consistency, before mixing in clean, potable water. Protect mortar from freezing, contamination, and excessive evaporation.

Figure 9: Microscopic view of animal hair in fines of stucco.

These findings are estimations and should not be used for project specifications.

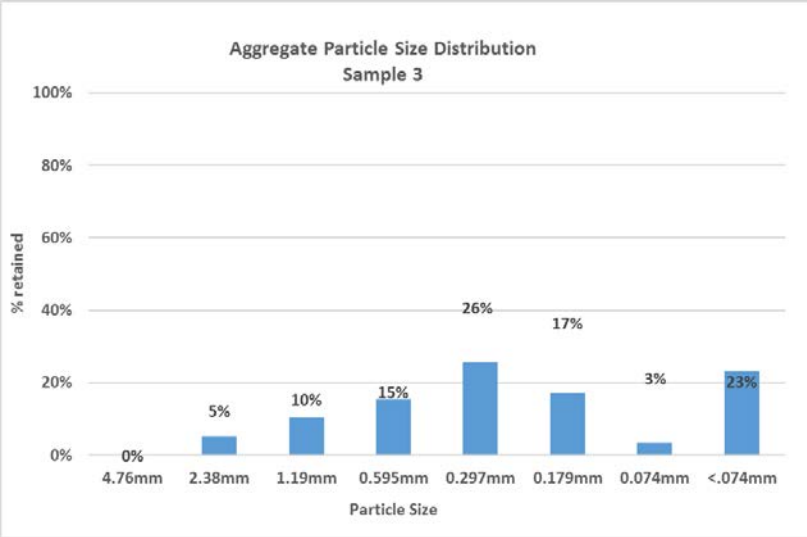
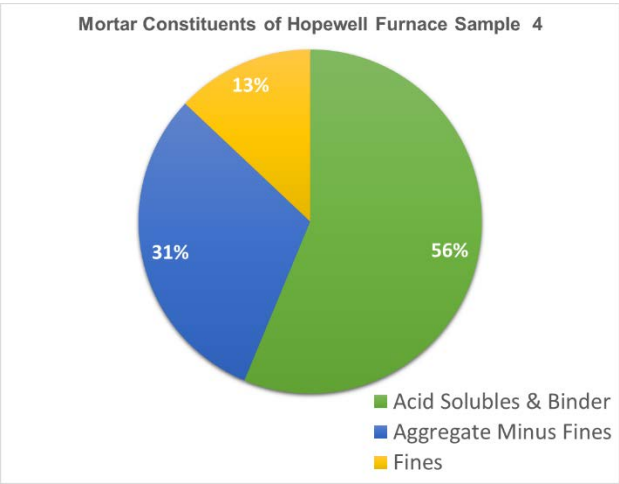


Figure 9: Particle size distribution chart of Sample 3 (left) and aggregate at 10x magnification

SAMPLE 4: BED MORTAR FROM SOUTHEAST WALL OF BARN

The mortar sample is light medium brown in color and has low-moderate strength. It is likely that this mortar is original and survived without significant weathering. Microscopic examination of the sample under 10x magnification shows the sample to be very poorly sorted aggregate in a fine matrix with inclusions of very large lime blebs, charcoal and dead insects.



Acid Soluble Fraction: Approximately 56% of the total sample weight is acid-soluble. A vigorous reaction occurred when the solution of hydrochloric acid was added to the sample, indicating a mortar with a high lime content. The presence of large size lime blebs (1/8”-1” in diameter) indicates the inclusion of lime were in the original mix. It is possible that an acid-soluble aggregate such as crushed limestone or marble was also used, which could also account for the large acid-soluble component.

Fines: Approximately 13% of the total sample weight is fines, primarily light brown particles. It was also observed that there are small clumps of salt crystals in the fines (Figure 11). This could indicate that the soil/aggregate used for this mortar was contaminated with nitrates that are commonly deposited by the decomposition of Animal manure or urine. Components of this mortar could have been harvested from the soil beneath or close to the barn. Water used to hydrate the mortar could also have had a saline content.

Aggregate: Approximately 31% of the total sample weight is aggregate comprised of opaque white and pink and clear particles that are very angular in shape with low spherocity. A high concentration of quartz, iron slag, charcoal and coal particles are present. Prior to digestion, very large lime blebs were visible, and could have acted as aggregate. Separation of particles by size was achieved by sieving the aggregate and weighing the quantity of particles retained on each sieve pan. A wide distribution of particle sizes was observed through sieving; however, most particles fall between the sizes of 1.190mm and 0.179mm indicating a poorly sorted/well graded aggregate (Figure 12).

Figure 11: Clumps of salt crystals in fines of Sample 4

The approximate original mix probably was a lime based mortar made hydraulic by the addition of charcoal, slag, and shale; all natural pozzolans. The variety of aggregate, rich in coal, iron slag and potentially shale indicates that the aggregate was likely sourced directly from the site. It is recommended that a naturally hydraulic mortar such as Saint Astier's NHL 2 or 3.5 be used as a replication mortar, using pit sand as aggregate that matches the original. Pigment the mix only if color match cannot be achieved solely through aggregate. The ratio recommended is 1 part NHL 2 or 3.5 and 1.5 or 2.5 parts of sand respectively, proportioned by volume. Mortar should be mixed for at least 10 minutes. Mix materials dry, to uniform color and consistency, before mixing in clean, potable water. Protect mortar from freezing, contamination, and excessive evaporation.

These findings are estimations and should not be used for project specifications.

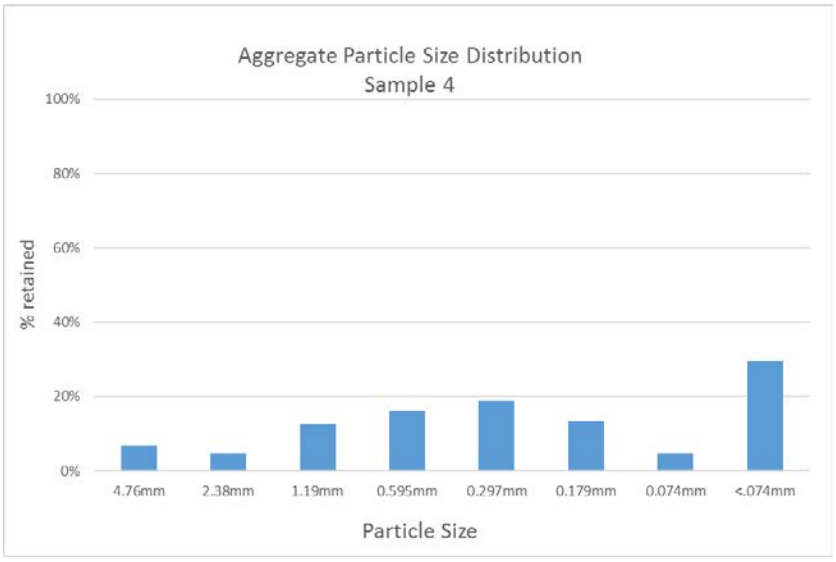


Figure 12: Particle size distribution chart of Sample 3 (left) and aggregate at 10x magnification

MATERIALS CONSERVATION CO., LLC

MORTAR ANALYSIS DATA SUMMARY

Project/Site: Hopewell Furnace/Barn			
Location: Elverson, PA	Date Sampled: Unknown		
Analysis Performed By: Casey Weisdock	Date Analyzed: 11/15/16		
DESCRIPTION OF SAMPLE			
Type/Location: Pointing from South Exterior Wall	**SAMPLE No. 1**		
Surface Appearance: Course exterior skim coat over dark, fine mortar.			
Cross Section: Interior layer is porous with a fine matrix and small aggregate besides medium blebs of lime. Skim coat is well sorted with sharp/angular aggregate. Smells of soil, organics present- Vegetable fiber (hay), wood, charcoal.			
Color: Surface Layer: 10YR 4/4 Interior Layer: 10YR 4/1	Texture: Course		
Hardness: Low	Gross Wgt: 73.8g Filter paper Wgt: 2.4g		
COMPONENTS			
Fines:	Color: 10YR 4/2	Wgt.: 10.2g	Percent of total: 14%
	Organic Matter: YES- Vegetable fiber, Charcoal, Wood		
Acid Soluble Fraction:	Wgt: 32.53	Percent of total: 46%	
	Desc. Of reaction: Vigorous reaction	Filtrate Color: light yellow	
	Composition: Organics, lime binder		
Aggregate: coal green mineral Iron ore	Color: 10YR 4/1	Wgt.: 28.67g	Percent of total: 40%
	Grain Shape: Angular		
	Screen	Weight	% Retained
	8	4.40g	11%
	16	7.60g	20%
	30	8.00g	21%
	50	1.18g	3%
	100	1.19g	3%
	200	6.30g	16%
	Pan	1.20g	26%

MATERIALS CONSERVATION CO., LLC

MORTAR ANALYSIS DATA SUMMARY

Project/Site: Hopewell Furnace			
Location: Elverson, PA	Date Sampled: Unknown		
Analysis Performed By: Casey Weisdock	Date Analyzed: 11/15/16		
DESCRIPTION OF SAMPLE			
Type/Location: Pointing/ Interior Upper Level	**SAMPLE No. 2**		
Surface Appearance: Course, poorly sorted aggregate.			
Cross Section: Dry, soft, porous, fairly well sorted/poorly graded mortar			
Color: 10 YR 5/4	Texture: course		
Hardness: Low	Gross Wgt: 75.2 Filter paper Wgt: 2.4		
COMPONENTS			
Fines:	Color: 10 YR 4/2	Wgt.: 20.2g	Percent of total: 28%
	Organic Matter: YES-lime blebs, wood, charcoal and vegetable fiber (hay).		
Acid Soluble Fraction:	Wgt: 14.2g	Percent of total: 20%	
	Desc. Of reaction: vigorous	Filtrate Color: Deep Yellow Orange	
	Composition: Organics, lime binder		
Aggregate: coal lime blebs Iron ore	Color: 10YR 5/4	Wgt.: 38.4g	Percent of total: 53%
	Grain Shape: Subrounded		
	Screen	Weight	% Retained
	8	2.80g	5%
	16	4.40g	8%
	30	5.70g	10%
	50	9.80g	17%
	100	10.5g	18%
	200	5.20g	9%
	Pan	20.2g	34%

MATERIALS CONSERVATION CO., LLC

MORTAR ANALYSIS DATA SUMMARY

Project/Site: Hopewell Furnace House			
Location: Elverson, PA	Date Sampled:		
Analysis Performed By: Casey Weisdock	Date Analyzed: 11/15/16		
DESCRIPTION OF SAMPLE			
Type/Location: Stucco/West Wall	**SAMPLE No. 3**		
Surface Appearance: Course			
Cross Section: Fine Matrix with large poorly sorted course aggregate.			
Color: 7.5 YR 7/2	Texture: Rough with course, poorly sorted aggregate		
Hardness: low	Gross Wgt: 9.5 Filter paper Wgt: 2.4		
COMPONENTS			
Fines:	Color: 5YR 6/4	Wgt.: 1.35g	Percent of total: 19%
	Organic Matter: YES- Animal Hair		
Acid Soluble Fraction:	Wgt: 1.25g	Percent of total: 18%	
	Desc. Of reaction: Moderate	Filtrate Color: light yellow	
	Composition: Organics and lime binder		
Aggregate: Dominant Quartz Few coal Few iron ore	Color: 7.5YR 6/4	Wgt.: 4.5g	Percent of total: 63%
	Grain Shape: Angular		
	Screen	Weight	% Retained
	8	0.30g	5%
	16	0.60g	10%
	30	0.90g	15%
	50	1.50g	26%
	100	1.00g	17%
	200	0.20g	3%
	Pan	0.05g	23%

MATERIALS CONSERVATION CO., LLC

MORTAR ANALYSIS DATA SUMMARY

Project/Site: Hopewell Furnace Barn			
Location: Elverson, PA	Date Sampled: Unknown		
Analysis Performed By: Casey Weisdock	Date Analyzed: 11/15/16		
DESCRIPTION OF SAMPLE			
Type/Location: Bedding Mortar/Southeast Wing Wall	**SAMPLE No. 4**		
Surface Appearance: Course			
Cross Section: Very poorly sorted aggregate in a fine matrix with a high concentration of lime blebs ranging from 1/8"-1" in diameter. A high concentration of organics present..			
Color: 10YR 6/4	Texture: Course		
Hardness: Moderate	Gross Wgt: 47.3 Filter paper Wgt: 3.4		
COMPONENTS			
Fines:	Color: 10YR 6/4	Wgt.: 5.7	Percent of total: 13%
	Organic Matter: YES- dead insects (mites), hair and charcoal		
Acid Soluble Fraction:	Wgt: 24.7g	Percent of total: 56%	
	Desc. Of reaction: vigorous	Filtrate Color: yellow orange	
	Composition: Organics and Lime		
Aggregate:	Color: 10 YR 6/4	Wgt.: 13.5g	Percent of total: 31%
	Grain Shape:		
Dominant Lime blebs Coal Iron Ore	Screen / Weight / % Retained		
	4 / 1.30g / 7%		
	8 / 0.09g / 5%		
	16 / 2.40g / 13%		
	30 / 3.10g / 16%		
	50 / 3.60g / 19%		
	100 / 2.60g / 14%		
	200 / 0.90g / 5%		
	Pan / 5.70g / 30%		

APPENDIX F

HISTORIC PHOTOS

Overview of the Nathan Care Barn facing southeast, c. 1949.

Overview of barn facing southwest in 1940.

Overview of Nathan Care House and Barn, looking south (date unknown).

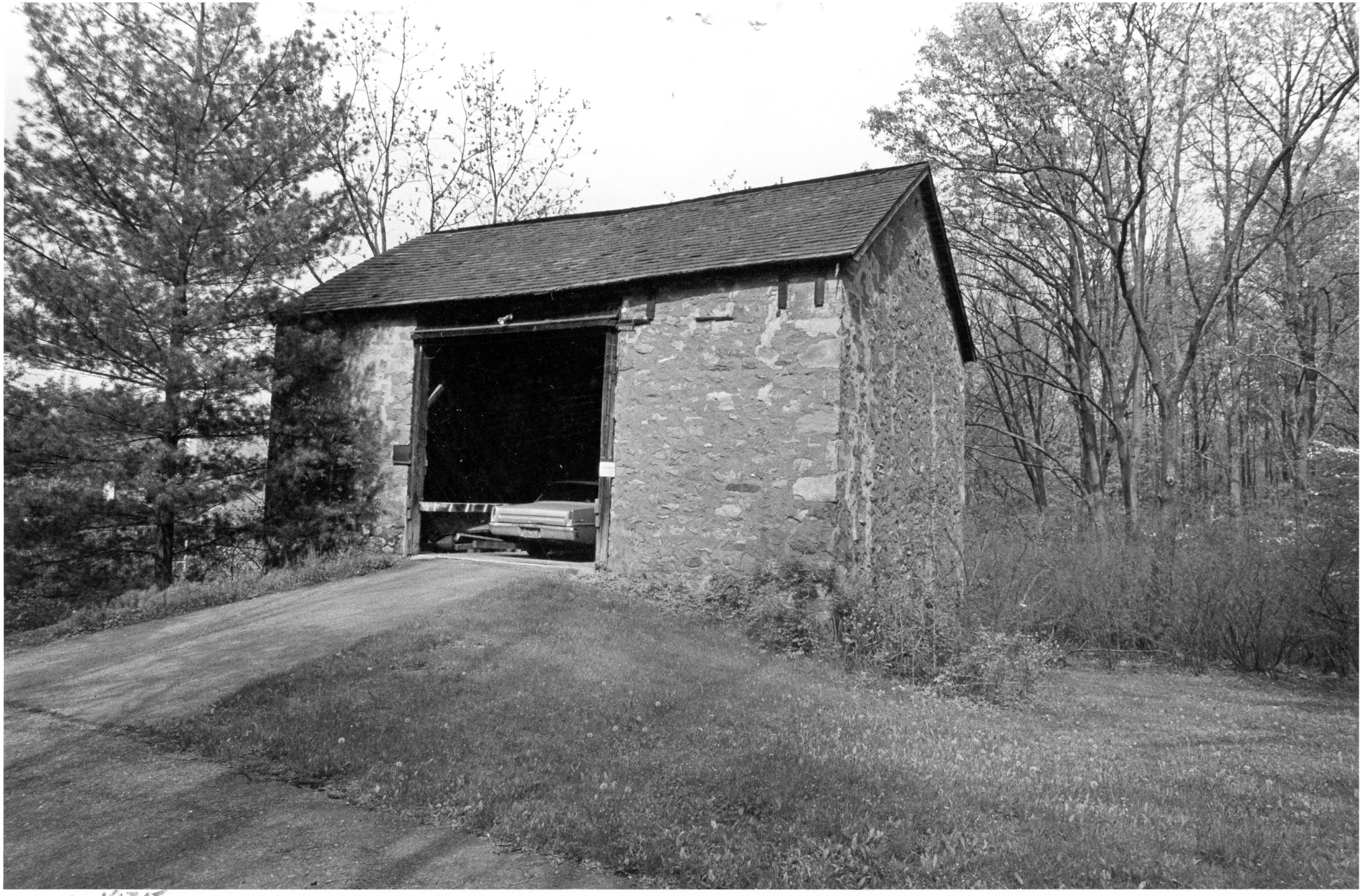
South elevation of the Nathan Care House.

JANUARY 1951

View of south elevation of the Nathan Care House in 1935.

View of Nathan Care site from east in 1940.

View of Nathan Care House from southeast showing early or original porch and original chimney (c. 1935).

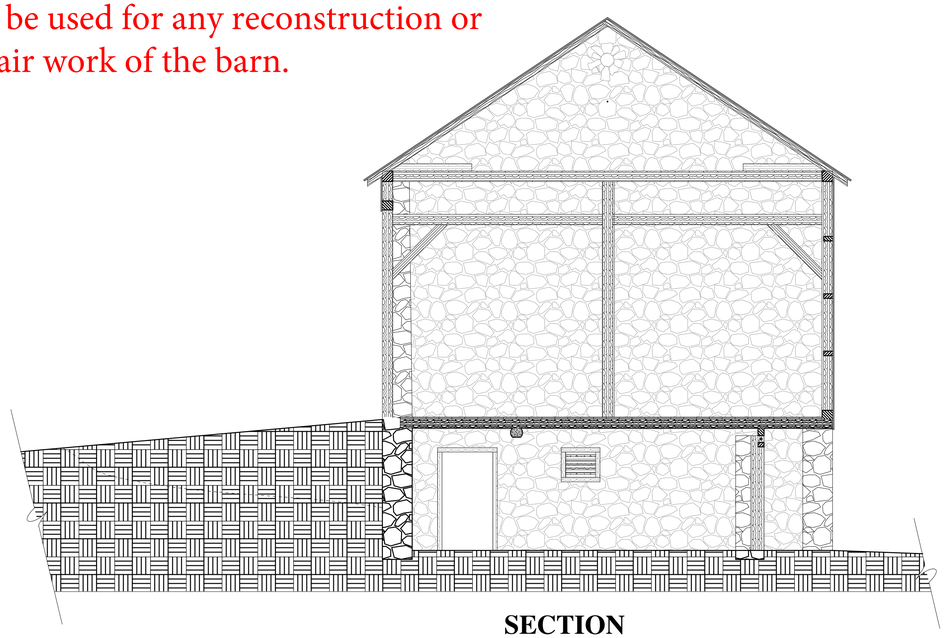


The Nathan Care Barn in use as a garage in 1975. Note: the door is missing, along with the materials used in its construction, which indicates that the current door is a reproduction.

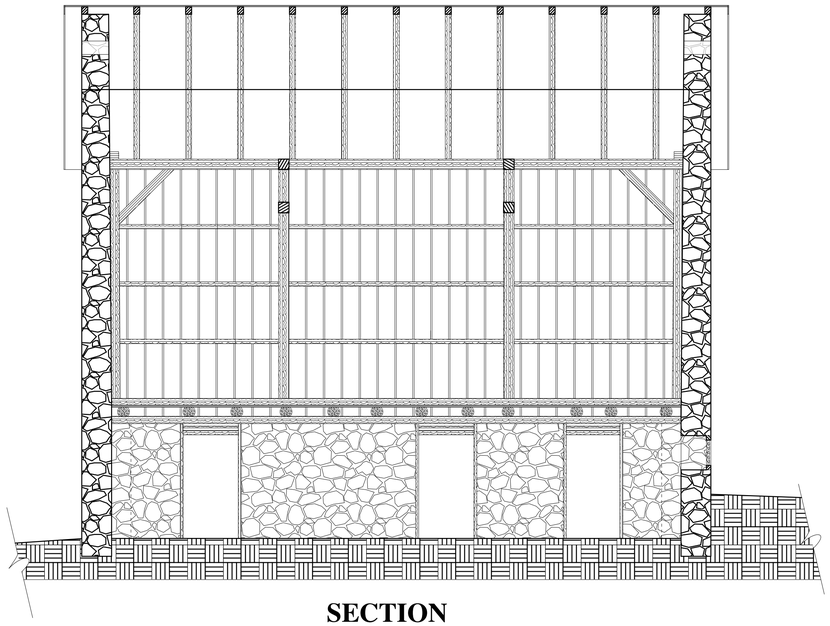
APPENDIX G

BARN DRAWINGS BY LOU SCHNEIDER

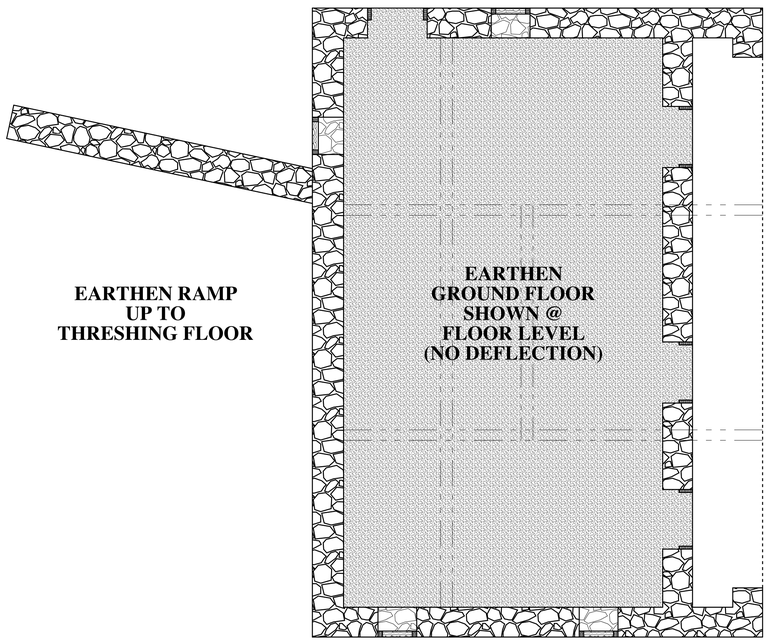
These drawings, created by Lou Schneider, are for illustration purposes only, and may not be used for any reconstruction or repair work of the barn.



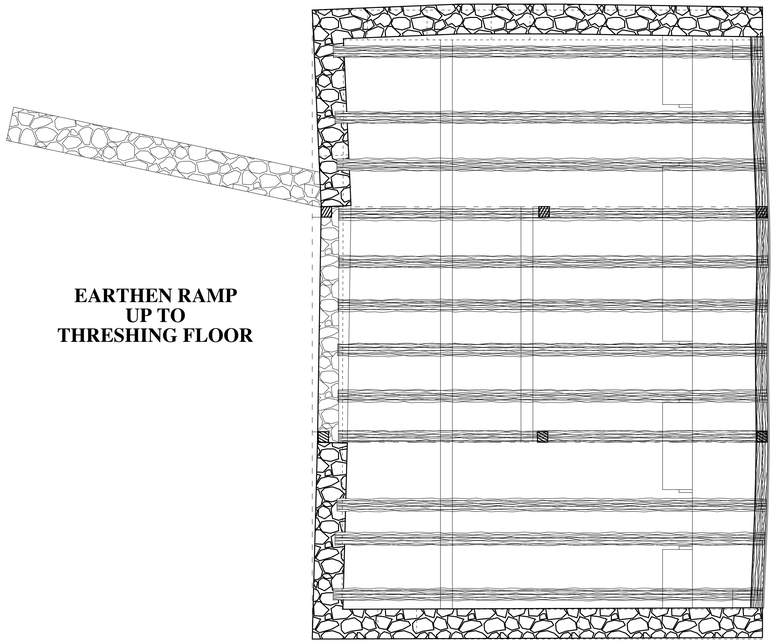
2 / A1 SECTION LOOKING NORTH
SCALE: 1/4" = 1'-0"



1 / A1 SECTION LOOKING WEST
SCALE: 1/4" = 1'-0"



4 / A1 GROUND FLOOR PLAN
SCALE: 1/4" = 1'-0"



3 / A1 THRESHING FLOOR PLAN SHOWING FRAMING
SCALE: 1/4" = 1'-0"

A-1
4-24-2012

CARE BARN
HOPEWELL FURNACE NATIONAL HISTORIC SITE
2 MARK BIRD LANE, ELVERSON, PA., 19520
UNION TOWNSHIP, BERKS COUNTY

PLANS & SECTIONS SHOWING FRAMING @ 1/4" = 1'-0"

5-7-2012

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revisions:
date/per/notes

job no: 010212
date: February 22, 2012
drawn: LS, SCS
checked:
scale: 1/4" = 1'-0"

CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL DIMENSIONS ON JOB

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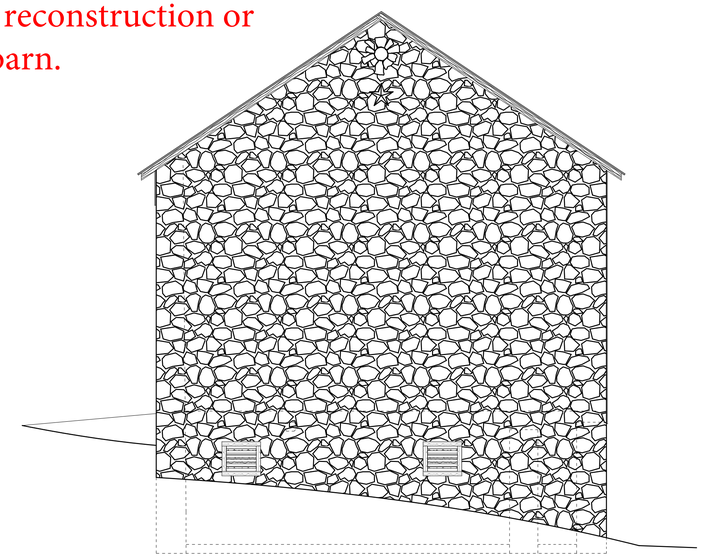
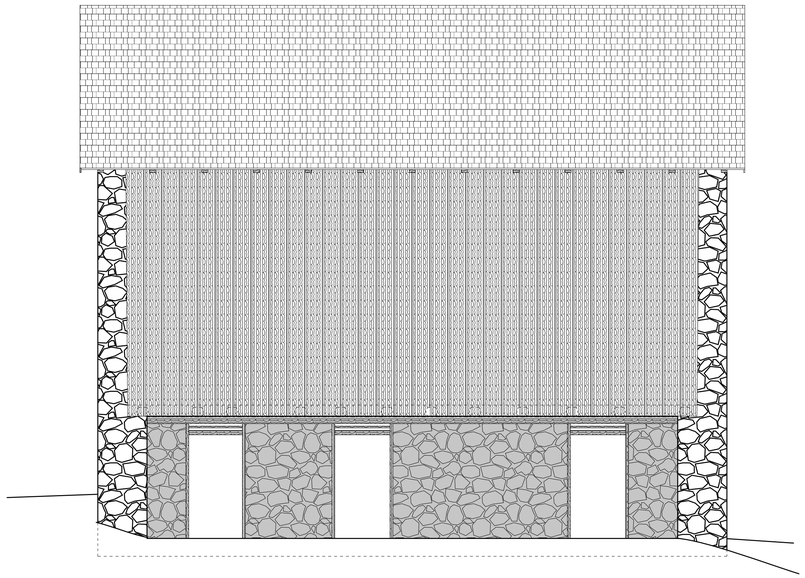
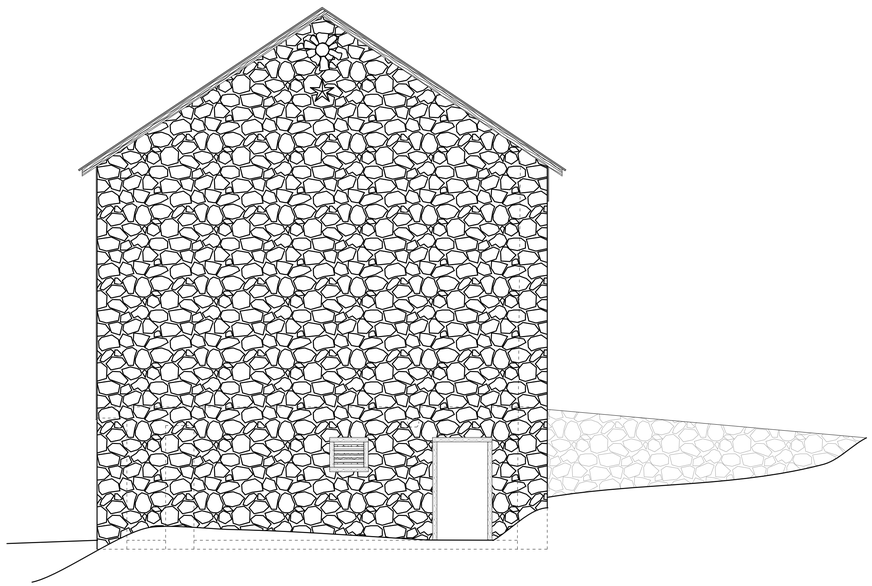


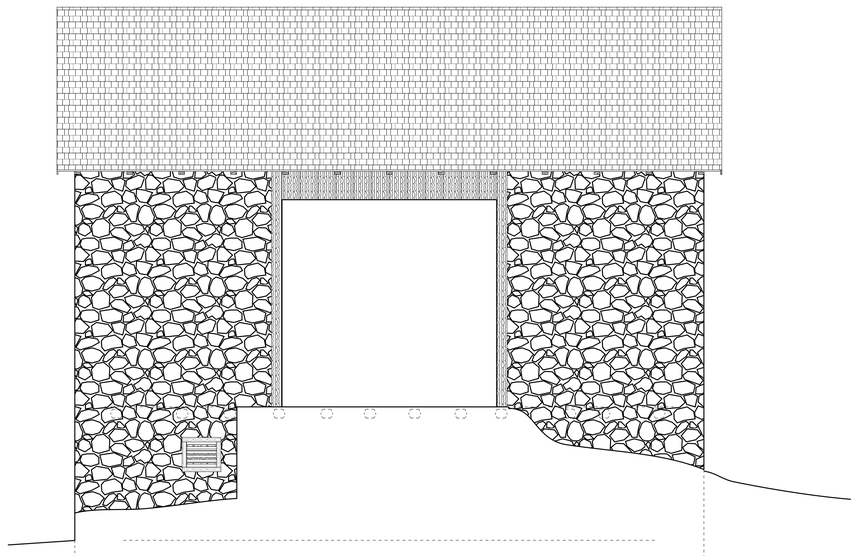
2/A2 SOUTH ELEVATION
SCALE: 1/4" = 1'-0"



1/A2 EAST ELEVATION
SCALE: 1/4" = 1'-0"



4/A2 NORTH ELEVATION
SCALE: 1/4" = 1'-0"



3/A2 WEST ELEVATION
SCALE: 1/4" = 1'-0"

A-2
4-24-2012

CARE BARN
HOPEWELL FURNACE NATIONAL HISTORIC SITE
2 MARK BIRD LANE, ELVERSON, PA., 19520
UNION TOWNSHIP, BERKS COUNTY

ELEVATIONS

@ 1/4"= 1'-0"

5-7-2012

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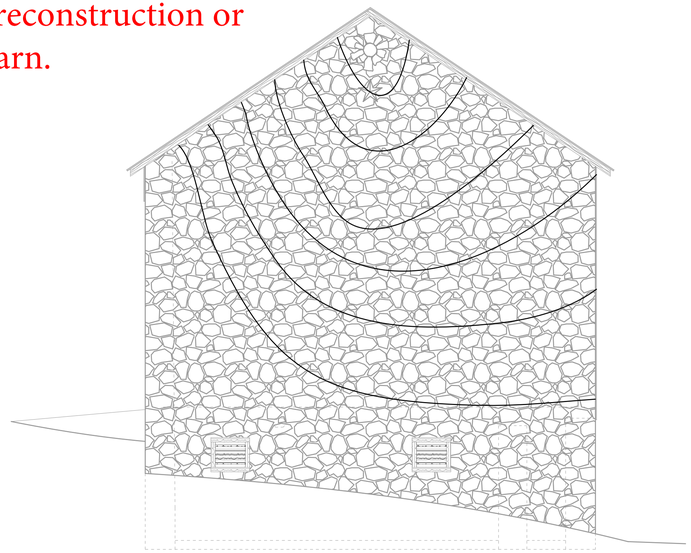
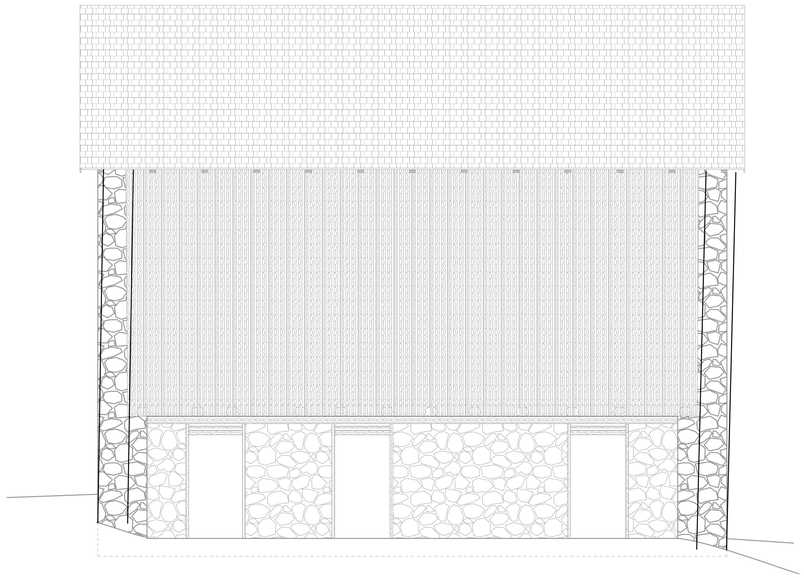
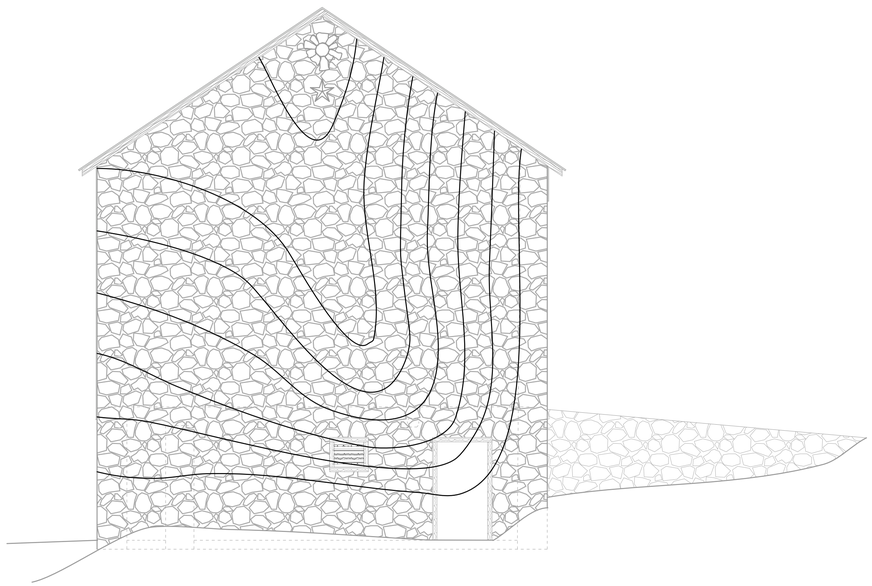


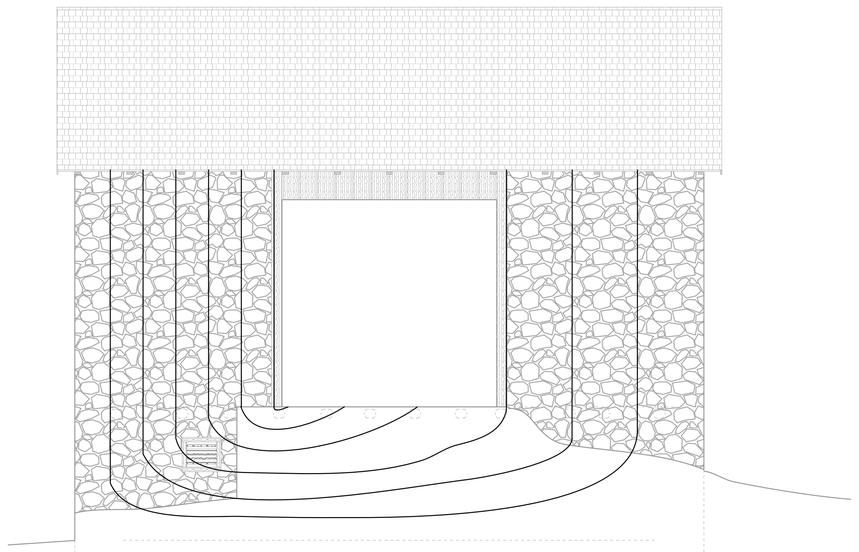
2/A3 SOUTH ELEVATION
SCALE: 1/4" = 1'-0"



1/A3 EAST ELEVATION
SCALE: 1/4" = 1'-0"



4/A3 NORTH ELEVATION
SCALE: 1/4" = 1'-0"



3/A3 WEST ELEVATION
SCALE: 1/4" = 1'-0"

A-3
4-24-2012

CARE BARN
HOPEWELL FURNACE NATIONAL HISTORIC SITE
2 MARK BIRD LANE, ELVERSON, PA., 19520
UNION TOWNSHIP, BERKS COUNTY

ELEVATIONS @ 1/4"= 1'-0"
SHOWING DEFLECTIONS
5-7-2012

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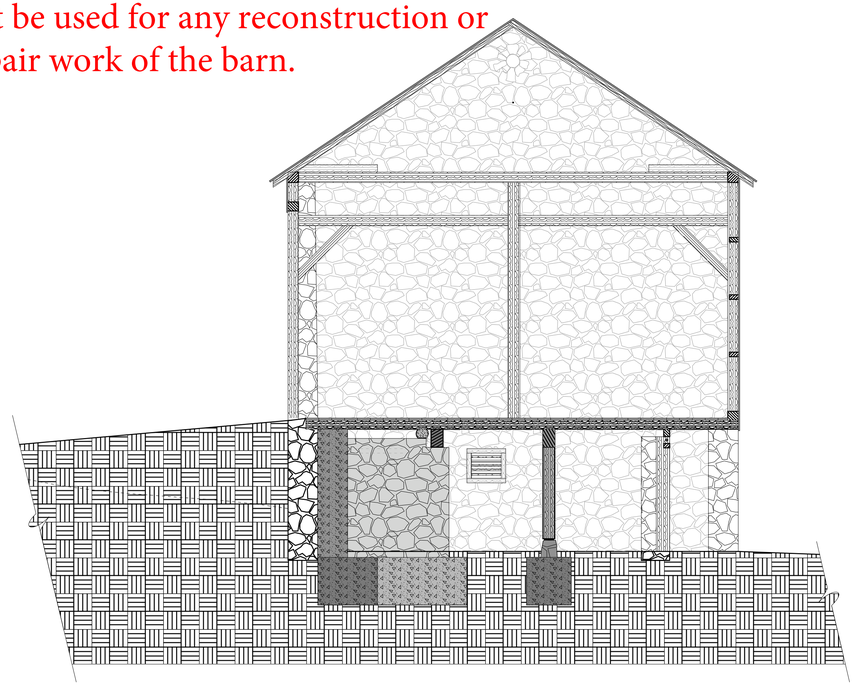
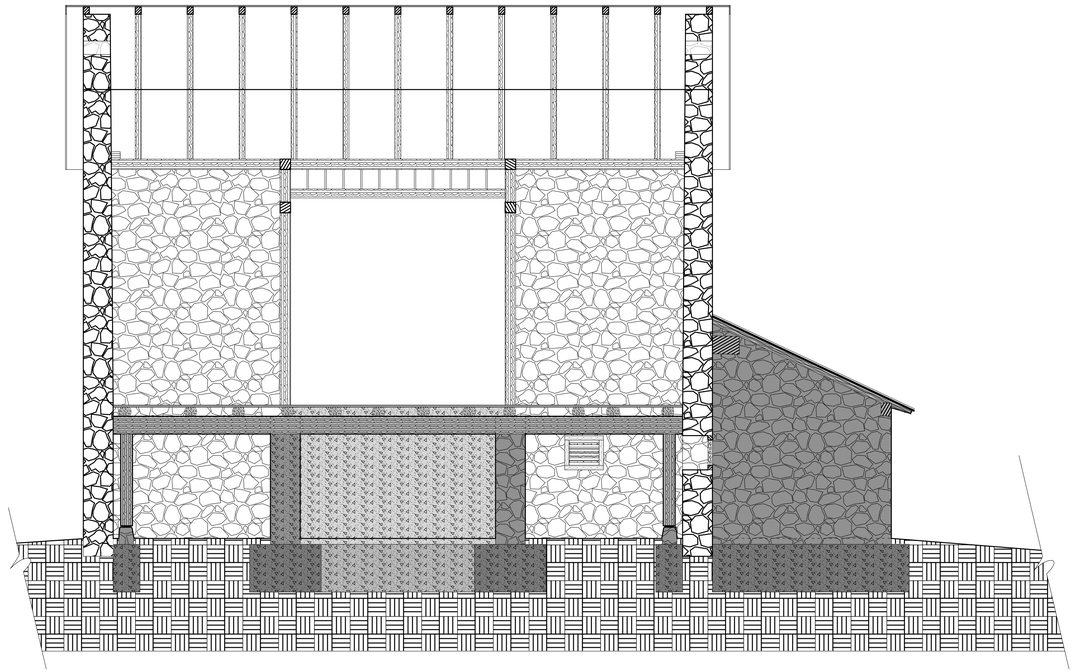
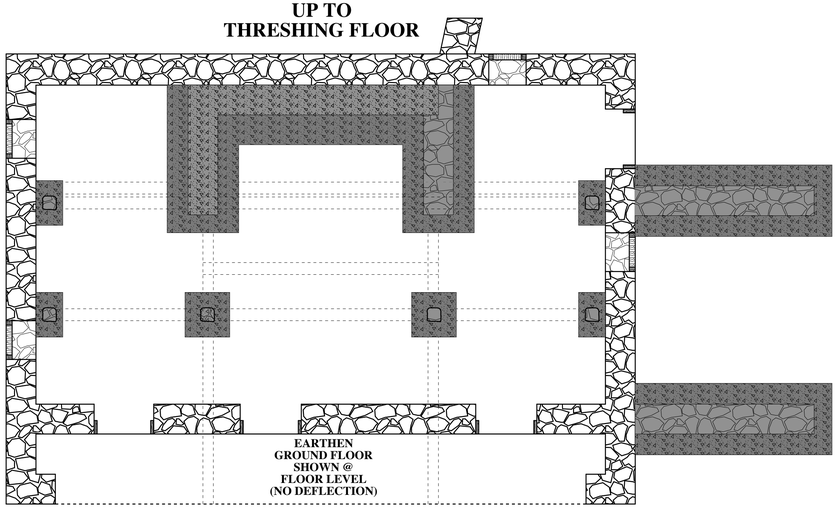


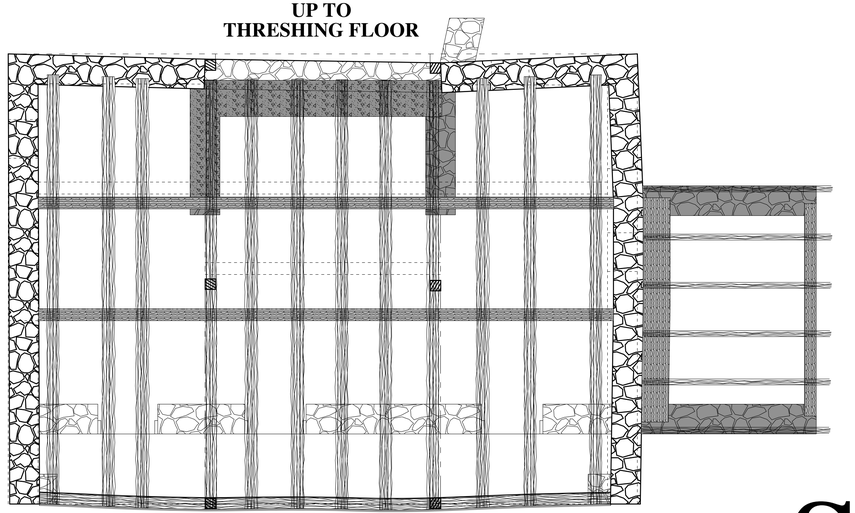
SECTION LOOKING NORTH
2/S1 SCALE: 1/4" = 1'-0"



SECTION LOOKING WEST
1/S1 SCALE: 1/4" = 1'-0"



GROUND FLOOR PLAN
4/S1 SCALE: 1/4" = 1'-0"



THRESHING FLOOR PLAN SHOWING FRAMING
3/S1 SCALE: 1/4" = 1'-0"

S-1
5-23-2012

CARE BARN
HOPEWELL FURNACE NATIONAL HISTORIC SITE
2 MARK BIRD LANE, ELVERSON, PA., 19520
UNION TOWNSHIP, BERKS COUNTY

PLANS & SECTIONS @ 1/4" = 1'-0"
SHOWING STABILIZATION
5-23-2012

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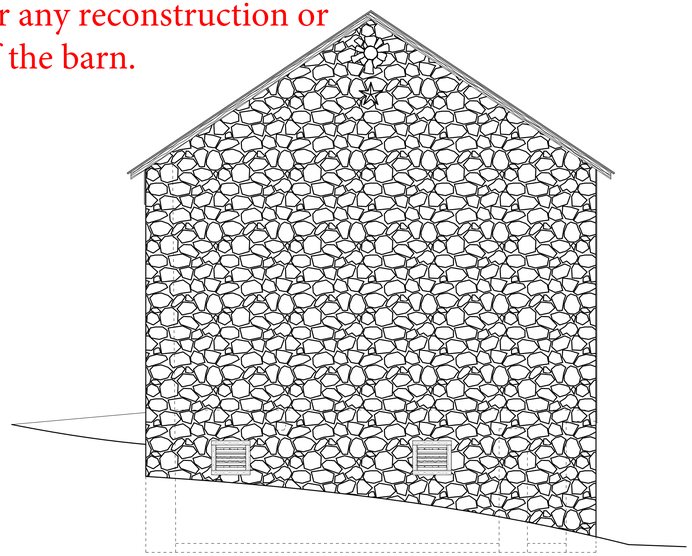
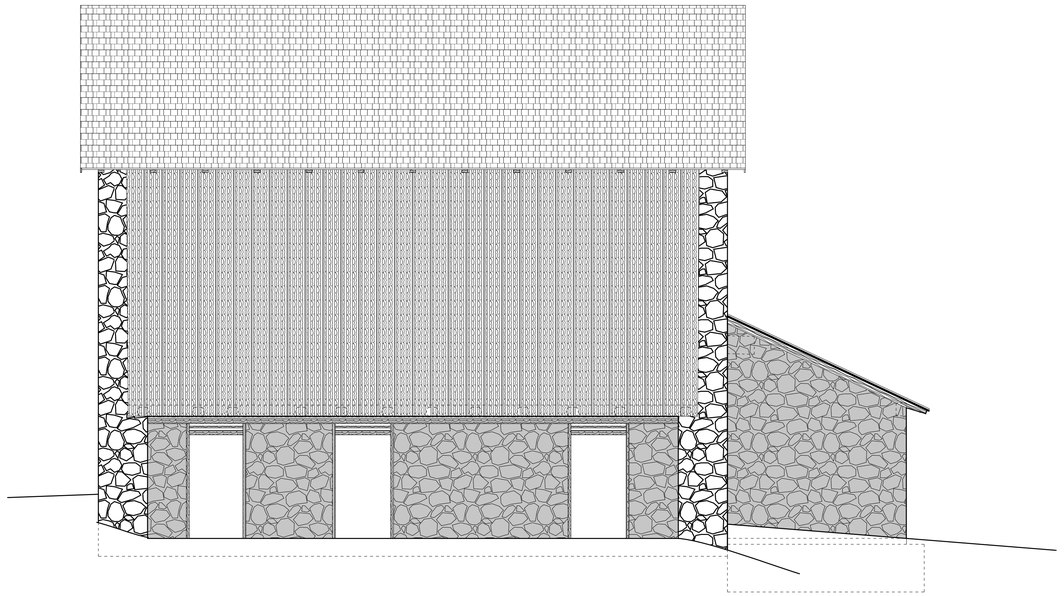
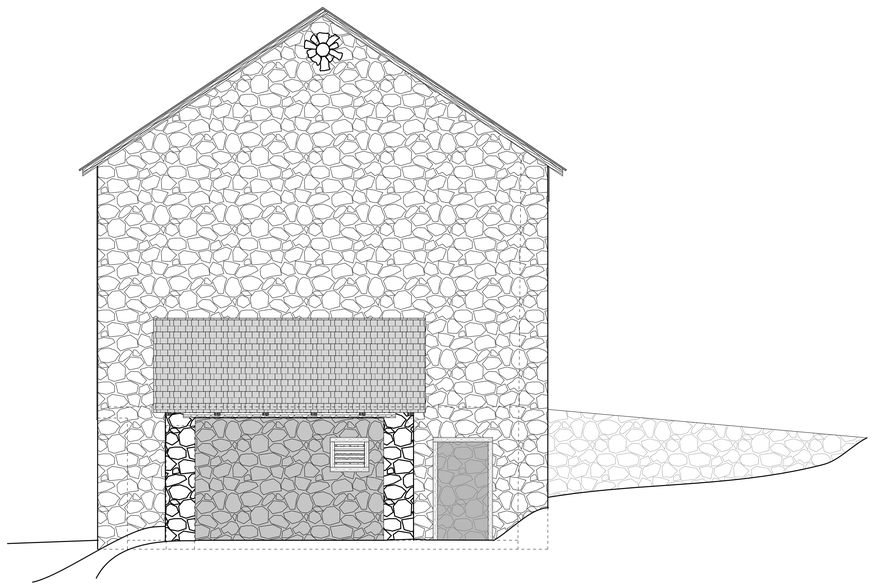


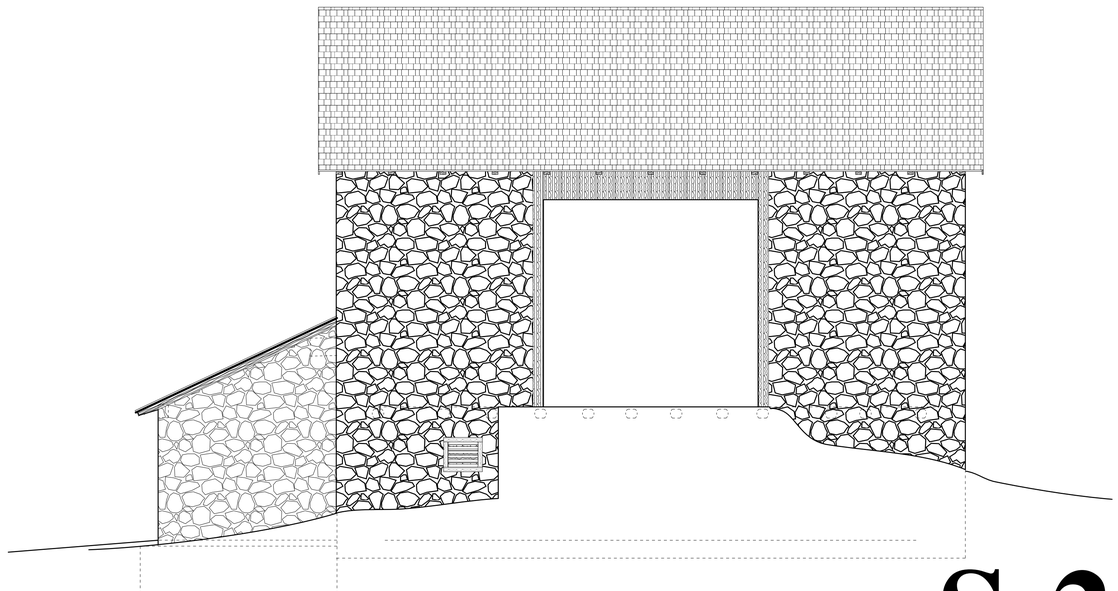
2/S2 **SOUTH ELEVATION**
SCALE: 1/4" = 1'-0"



1/S2 **EAST ELEVATION**
SCALE: 1/4" = 1'-0"



4/S2 **NORTH ELEVATION**
SCALE: 1/4" = 1'-0"



3/S2 **WEST ELEVATION**
SCALE: 1/4" = 1'-0"

S-2
4-24-2012

CARE BARN
HOPEWELL FURNACE NATIONAL HISTORIC SITE
2 MARK BIRD LANE, ELVERSON, PA., 19520
UNION TOWNSHIP, BERKS COUNTY

ELEVATIONS @ 1/4"= 1'-0"
SHOWING STABILIZATION
5-7-2012

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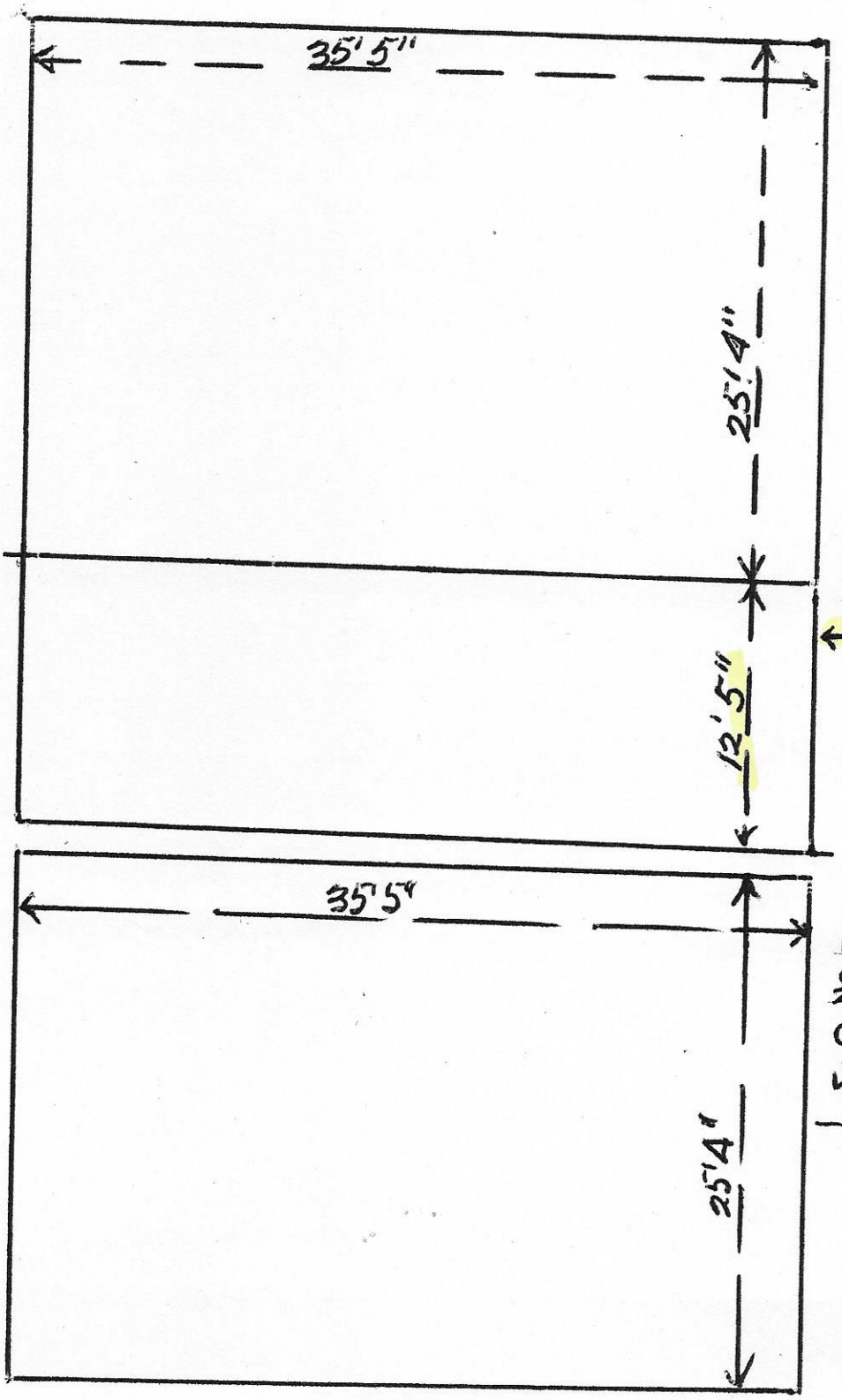
APPENDIX H

NATHAN CARE BARN SKETCH (UNDATED)

NATHAN CARE BARN



1st Floor
dirt "

Wooden leanto
← shed

Mow "
Flooring in
center section
in fair condition
- remainder poor