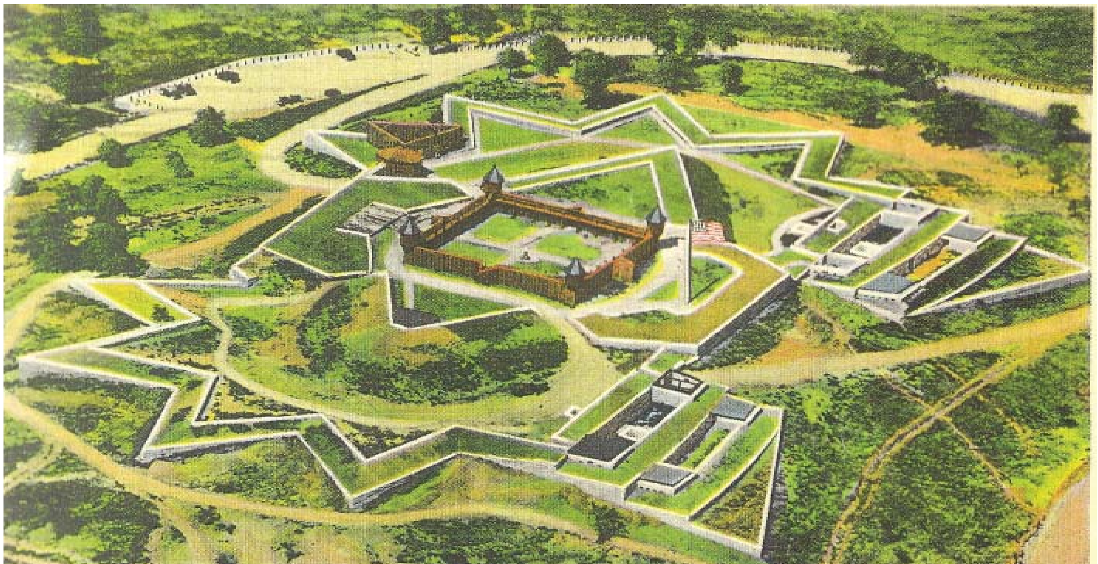

1930s postcard, Michael Emrick Collection (FNVC).

HISTORIC STRUCTURE REPORT

FORT NEGLEY

Nashville, Tennessee

PREPARED FOR

METROPOLITAN GOVERNMENT OF NASHVILLE & DAVIDSON COUNTY
Metropolitan Board of Parks and Recreation
Metropolitan Historical Commission
Sunnyside in Sevier Park
3000 Granny White Pike
Nashville, TN 37204

PREPARED BY

JOHN MILNER ASSOCIATES, INC.
471 West Main Street, Suite 200
Louisville, Kentucky 40202

FINAL REPORT (CORRECTED)
January 31, 2014

HISTORIC STRUCTURE REPORT
FORT NEGLEY

FORT NEGLEY VISITORS CENTER AND PARK
1100 Fort Negley Boulevard
Nashville, Tennessee 37203

January 31, 2014
FINAL REPORT (Corrected)

Prepared for
METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY
Metropolitan Board of Parks and Recreation
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Prepared by
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1. INTRODUCTION

Regarded as the largest inland masonry fortification constructed by the Union Army during the American Civil War, Fort Negley plays a prominent role—albeit one less well-known to the public—in the architectural and cultural history of Nashville and Davidson County, Tennessee. The fort's bomb-proofed bastions and perimeter walls were constructed in 1862 by several thousand free black and "contraband" slave laborers under the direction of army engineers using locally-quarried, unreinforced, dry-stacked limestone masonry covered with earth. After the Civil War, the unoccupied fortifications fell into disrepair until their reconstruction in one of Tennessee's largest employment projects by the Works Progress Administration (WPA) in 1936-38. Opened as a public park, the reconstructed fort again fell into disrepair and was closed to the public for 60 years until new repair efforts were undertaken in 1999. An interpretive plan, including historical markers, a paved access loop, and pedestrian boardwalks, was implemented in 2004. The Fort Negley Visitors Center and Park opened in 2007 and is operated by the Metropolitan Park and Recreation Department, which also maintains the park.

Since then, the historic redoubt and bastion walls have continued to exhibit localized areas of instability and collapse, which have resulted in life-safety hazards that now limit public access to some areas. In May 2013, Metro Nashville on behalf of the Metropolitan Historical Commission engaged John Milner Associates, Inc. (JMA) to prepare a Historic Structure Report (HSR) for the fort and the portion of Fort Negley Park within the WPA Loop Road (excluding the Visitors Center and adjacent leaseholds).

JMA has led a team of historical architects and landscape architects, archaeologists, and structural and civil engineers in preparing this guide for the treatment and use of the historic structure and site. The HSR is an outgrowth of the 1996 Master Plan and provides a basis for decision-making about preservation, rehabilitation, restoration, and/or reconstruction consistent with the historical development of Fort Negley. As a record of treatment documenting the actions previously taken to preserve the property, the HSR is also intended to be updated with new information about maintenance and repairs that will be undertaken in the future to provide a "living" management tool to guide the stewards of this unique military structure.

The HSR could not have been completed without the benefit of the considerable knowledge and keen insights of Krista Castillo, Museum Coordinator for the Fort Negley Visitor Center and Park, Zada Law, Director of the Fullerton Laboratory for Spatial Technology at Middle Tennessee State University, where she is also a doctoral candidate whose dissertation is focused on Fort Negley, and Tim Walker, Executive Director of the Metropolitan Historic Zoning Commission and the Metropolitan Historical Commission. We thank them for the unique contributions and critical support they and other members of the Fort Negley Advisory Committee have made and will continue to make as advocates for the long-term preservation of this important historic resource.

A NOTE ABOUT COMPASS DIRECTIONS USED IN THIS REPORT:

The long axis of Fort Negley is laid out along a northeast to southwest line. As a result, descriptions of the relative position of site features and portions of the fort have a high potential for confusion. This HSR uses the "plan north" or "grid north" designation adopted by General Z. B.Tower, Inspector General of Fortifications, U. S. Army Department of Mississippi, in his 1864 report, being 38-degrees west of magnetic north. Consequently, the scarp on the northwest side becomes the "North Main Works" and the projecting bastions are on the "south" side at east and west ends of the fort.

2. REPORT SUMMARY

Fort Negley is listed on the National Register of Historic Places for its Civil War era and WPA era significance and is considered the largest inland stone fortification built by the United States government during the Civil War. This Historic Structure Report (HSR) is the primary guide for the treatment and use of the structure and its park setting. It describes the chronology of Fort Negley, its current condition, and the causes of its deterioration, and provides a basis for decision-making about preservation, rehabilitation, restoration, and/or reconstruction consistent with the historical development of the site.

Much of the fort that is seen today was reconstructed during the Depression by the Works Progress Administration (WPA) as a means of employing out of work masons and laborers. The WPA walls have endured deterioration, displacement, and partial collapses. The complex star plan of the original design remains evident, but none of the earth and heavy timber construction of casemates and blockhouses from the Civil War era or the WPA reconstruction survive. Landscape features at Fort Negley, many constructed between 1935 and 1941 in the rustic style that came to characterize American public park design in those years, support visitor access and interpretation. These include the entrance gate composed of massive stone pylons and free-standing stone walls, native stone walls along the loop road and the parking area, drainage inlets and culverts, stone stairways, gravel paths, and stone edging along the road and paths.

A visual conditions survey of Fort Negley in June 2013 disclosed several typical masonry conditions in the fortification walls. The dry-stacked construction technique of gravity stone retaining walls which sped construction of the fort in 1862 also contributes to their instability. The inherent properties of the locally quarried limestone and underlying native soils, as well as external forces applied to the walls by the weight of earth fill and water saturation of that fill, have caused a high percentage of retaining wall profiles to exhibit out-of-plane movement including exterior bulges within the vertical planes and rotation, a common sign of wall overturning. Out-of-plane rotations and displacements in concentrated areas, if not temporarily shored, stabilized, or reinforced, most likely presage future partial and complete collapse of these walls. Examples of wall collapse are uniformly distributed around the outer perimeter fortification walls, including the lower redan walls and more dramatic occurrences at areas of elevated wall heights, including bastion walls and the South Main Works.

Vegetation in Fort Negley Park consists of a varying combination of forest cover (mainly dense tree canopy with woody understory), rough grass cover with scattered trees, and mowed turf with scattered trees. The surrounding forest cover comprises primarily secondary growth that has developed since the fort was reconstructed by the WPA in the 1930s. Overgrowth, especially of invasive species, has contributed to obscuring views of downtown Nashville from the fort summit.

Based upon the developmental history of the site and these physical investigations the HSR recommends *rehabilitation* as the appropriate treatment approach for Fort Negley and the surrounding parkland. Rehabilitation protects the property's historic character and resources, allows restoration of features for which there is documentary and physical evidence, and carefully addresses the needs for limited enhancement of interpretive opportunities and historic integrity.

Grounded in the principles of rehabilitation, and taking into consideration the historic significance of the site and needs associated with public access, the following recommendations for the property call for the stabilization and repair of gravity retaining walls as well as consideration of modest site improvements to enhance historic integrity and/or public use:

- Stabilize the fortification ruins to address immediate life safety hazards, maintain the highest levels of integrity of the existing historic fabric, allow reversibility, minimize the addition of incompatible materials, and promote conservation of the mechanical behavior of the antiquated structural system. First install temporary bracing to correct life safety deficiencies and limit further deterioration until repairs can be undertaken. Install soil anchors and make related localized repairs as needed. Reconstruct localized areas of collapse only where necessary for interpretive purposes.

- Control vegetation around the fortification. Regularly remove invasive species, and regularly mow to keep vegetation off of walls.

- Perform selective tree removal to open the view toward downtown Nashville from the fort summit.

- Preserve archaeological resources.

- Enhance public circulation and safety. Extend existing boardwalks to eliminate dead-ends and accommodate guided group tours. Redesign the unresolved intersection of the fort road with the top of the stone stairway and adjacent gravel path as an opportunity for rest and orientation that supports the historic character of the fort site.

- Use the parking area as an orientation opportunity and for picnicking and/or interpretive programming.

- Enhance the historic integrity of the park gateway, stone curbs and roadway retaining walls, and stone drainage inlets and culverts by performing in-kind repairs.

- Carefully consider the design and placement of any site lighting or additional toilet facilities as well as interpretive features, if desired, to minimize adverse visual impacts and provide sustainable solutions. Consideration may also be given to adding interpretation of missing timber features without reconstructing them, perhaps by erecting "ghost structures" in order to minimize archaeological impacts and allow reversal of the work without adversely affecting the historic fabric or archaeological resources.

The Historic Structure Report organizes these recommendations in three phases on the basis of urgency relative to structural integrity, with estimated costs for phased implementation:

- Phase One structural stabilization focuses on shoring and bracing of bastion tunnels threatened by collapse. This work needs to be completed within the next three months. As part of Phase One, the report also recommends conducting a geotechnical investigation as a precedent to finalizing the structural design for Phase Three permanent repairs.

- Phase Two, to be completed within the next twelve months, includes temporary structural bracing of retaining walls at the redans and bastions, the South Main Works, the East Sally Port (between the East Ravelin Ditch and the inner works), and the parking area. This phase also includes structural repairs to the main entrance gate, removal of debris from drainage inlets and culverts and rehabilitation of drainage inlets, removal of vegetation, and repairs to boardwalks and the stone stairway leading to the fort entrance.
- Phase Three permanent repairs, to be completed within the next 36 months, consist of grouted anchors to reinforce existing fortification and parking area retaining walls, removal of vegetation and other site repairs, expansion of the boardwalks to eliminate dead ends and improve circulation, and a program of annual landscape maintenance.

Each phase builds upon the work of the last. Immediate action is recommended to brace the two bastion tunnels pending repairs (Phase One). If funding is available within the next year, Phase 'Three' permanent structural repairs may be installed in lieu of some or all of the temporary stabilization measures included in Phase Two. At all phases, archaeological resources must be monitored to mitigate potential adverse impacts from the work. Construction costs (not including design fees) are summarized as follows:

Phase One (within the next three months):	
- Immediate Temporary Structural Stabilization	$ 49,680
- Structural Design Services (including geotech & monitoring)	56,500
- Landscape Recommendations	-
Subtotal	$ 106,180
Escalation @ 0%	-
PHASE ONE TOTAL	**$ 106,180**
Phase Two (within the next twelve months):	
- Temporary Structural Stabilization	$ 451,174
- Structural Design Services (including monitoring)	46,850
- Priority 1 Landscape Recommendations	104,369
- Priority 2 Landscape Recommendations	81,903
Subtotal	$ 684,296
Escalation @ 2%	13,686
PHASE TWO TOTAL	**$ 697,982**
Phase Three (within the next 36 months):	
- Permanent Structural Repairs	$ 1,074,641
- Structural Design Services (including monitoring)	71,850
- Priority 1 Landscape Recommendations	(incl. in Structural Repairs)
- Priority 2 Landscape Recommendations	259,820
- Priority 3 Landscape Recommendations	2,107,016
Subtotal	$ 3,513,326
Escalation @ 6%	210,800
PHASE THREE TOTAL	**$ 3,724,126**
TOTAL (ALL THREE PRIORITIES):	**$ 4,528,288**

Part III of the HSR provides a record of actions previously taken to document the developmental history of the site and preserve the fort to provide a "living" management tool to be updated as repairs are undertaken in the future.

3. PROJECT DATA

Project Location

1100 Fort Negley Boulevard, Nashville, Tennessee 37203
Deed Book 5145, Page 789 (RODC, TN)

Property Owner

METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY, TENNESSEE
METROPOLITAN BOARD OF PARKS AND RECREATION
47.45 acres acquired by City of Nashville from the Estate of John T. Fargason, 1928
11.93 acres acquired from Metro Development & Housing Agency, April 1977

Property Status

41.26 acres leased to Cumberland Science Museum; 18.12 acres leased to Greer Stadium
National Register of Historic Places: Listed April 21,1975 (75001748 NRIS)
Metro Historical Commission Local Landmark: Designated 5/21/2005; Ordinance No. BL2005-604
Tennessee Archaeological Site Designation 40DV189

Project Owner Participants

W. Tim Walker, Executive Director, Metropolitan Historic Zoning Commission
Krista Castillo, Fort Negley Visitors Center and Park
Zada Law, Fort Negley Technical Advisory Committee

Project Consultant Participants

Historical Architects

JOHN MILNER ASSOCIATES, INC.
Charles S. Raith, AIA, Principal (Tennessee Architect No. 00102590), Christopher Quirk, AIA, Project Manager; Laura Knott, ASLA, Landscape Architect; Christina Osborn; Joy Bunch

Structural Engineer

1200 ARCHITECTURAL ENGINEERS, PLLC
John A. Matteo, PE, FAAR; John E. Dumsick

Civil Engineer

LITTLEJOHN ENGINEERING ASSOCIATES
Andrew Wolthers, PE

Archaeologist

NEW SOUTH ASSOCIATES, INC.
Brad Botwick, Principal Investigator
Ryan Robinson, Archaeologist/Geomorphologist

Land Surveyor

THORNTON & ASSOCIATES, INC.
Scott Story; Mike Huff

Cost Estimator

INTERNATIONAL CONSULTANTS, INC.
Michael C. Funk

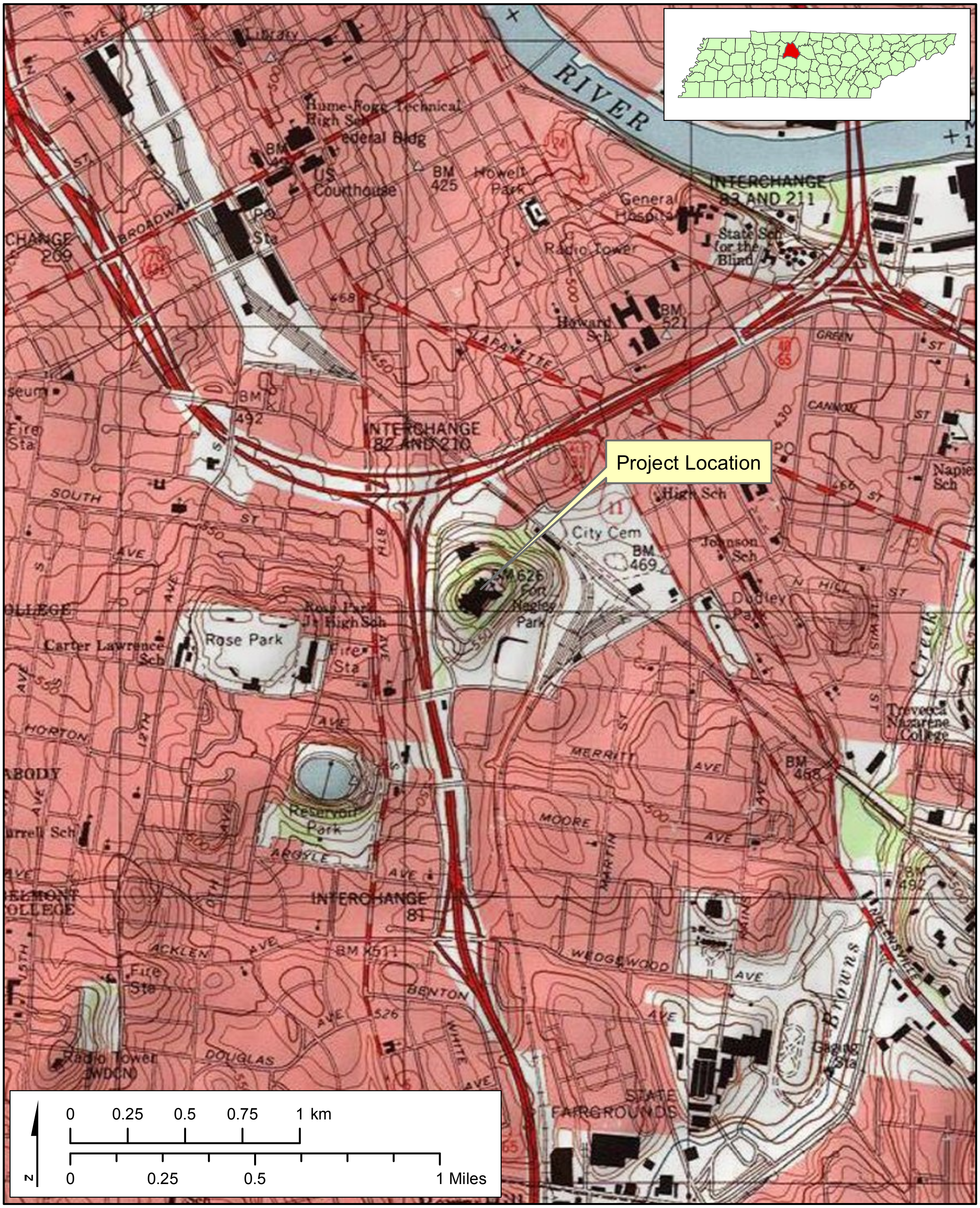
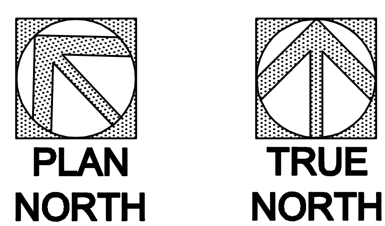


Figure 1: Project Location. 1984 USGS Nashville West, Tennessee Quadrangle (New South Associates)

Figure 2.

FORT NEGLEY SITE PLAN



4. PROJECT METHODOLOGY

Review of Available Documents

Prior to initiating the condition assessment, the team performed a review of the available documents relating to Fort Negley. Available documentation was provided by Metro Nashville through the Fort Negley Visitor Center and subsequently distributed to the project team by John Milner Associates, Inc. (JMA). These varied resources provided a summary of the fortification history, its original and restoration campaigns, archaeological investigations (in 1994, 2000, and 2007), the 1996 Master Plan and 2006 interpretive plan study, and construction documents prepared for the 1999 stabilization and repair project and the 2004 "Phase I" park improvements, and a geotechnical review of blowouts in the 1999 repairs. Unfortunately, few records of the Works Progress Administration project were discovered in previous searches of the National Archives in Washington, D. C.[1]

Site Documentation

During the week of June 10-14, 2013, the masonry fortification exterior walls were cleared of all ground cover around their perimeter by crews from the Metro Corrections Department. This measure enabled visual observation of exterior wall surfaces for documentation and engineering review. JMA team members Christina Osborn and Joy Bunch then photographed the inside and outside faces of the fort walls as they were cleared (unless otherwise unobstructed and inaccessible—bastion interiors were not photographed, for example). Using a high-resolution digital camera, a tape measure, and a graphic scale, multiple closely-spaced images were recorded parallel to the wall planes for the purpose of minimizing distortion. These images were then formed into mosaic composites of complete wall lengths using Adobe PhotoShop software to create scalable base elevations of the fort walls. These rectified photographs provide a significantly higher level of detail than is achievable in line drawings.

Concurrent with the field investigation, a Thornton & Associates survey crew performed limited spot checking to verify overall dimensions and elevations of the existing fort walls for comparison with the 2003 topographic survey and subsequently prepared an "as built" plan including the locations of boardwalks and ramps that were installed in 2004 and not documented in the earlier survey. The existing contour survey served as the base mapping for analyzing site drainage.

Archaeological Investigation

An archaeological investigation was conducted by New South Associates on June 11-18, 2013, overlapping the field condition investigation to facilitate observation by the structural consultant. Designed to expose and examine the foundation construction of existing masonry walls and to aid in determining significant periods of construction of the stone fortifications, two trench locations were selected in consultation with the structural engineering consultant. Trench #1 was excavated at the exterior side of the South Main Works midway between the bastions and at the east wall of the East Bastion (Trench #2). The base of the wall foundation was not exposed at Trench #1 due to unsafe excavation conditions, but the base of the foundation was exposed in Trench #2. Artificial berms that were adjacent and parallel to the exterior walls were sampled at both trenches. Excavators used shovels, small picks, and trowels, and all sediment and soil was screened to facilitate artifact recovery. Excavated limestone rubble was counted and weighed on site and then back-

1 Zada Law, November 28, 1995, telephone conversation with Bill Creech, Civil Reference Branch, National Archives, Washington, D. C., Zada Law Archaeological Consulting Project Files, Nashville, Tennessee. See also Jennifer A. Nelson, Archivist, Cartographic and Architectural Branch, National Archives, to Zada L. Law, January 5, 1996, FNVC files. A further search for Civil War and/or WPA architectural drawings of Fort Negley in the National Archives was also conducted in 1998 by Steven D. Smith (referenced in Chapter I.1).

filled into the trenches from which it was excavated. All recovered artifacts were transported to the New South laboratory in Stone Mountain, Georgia, where they were washed, cataloged, and analyzed.

Visual Investigation

Following the review of the available documentation, Christopher Quirk and Charles Raith, historical architects, and Laura Knott, historical landscape architect (John Milner Associates, Inc.); and John Matteo and John Dumsick, historic structural engineering consultants (1200 Architectural Engineers PLLC), visited the site during the period of June 17-20, 2013, to note conditions of the fortification walls, the retaining wall at the existing parking level along the ring road north of the fort, and cultural landscape features including the park gate, and to enhance understanding of their provenance and behavior. Andrew Wolthers (Littlejohn Engineering Associates) conducted an investigation of site drainage systems and drainage conditions during and after extreme rainfall events of August 8-9, 2013. The condition assessment included reviewing landscape features and the extant construction (including physical evidence of the 1996-98 stabilization and restoration), performing wall measurements, documenting the extent of deterioration and interpreting the mechanisms of distress, and evaluating stability of the masonry construction.

Report Preparation

The chronological development and use of Fort Negley and its significance were summarized in an overview of previous research. Current conditions and causes of deterioration were annotated on scale photographs of each accessible wall. Historic and present wall heights were compared in a renewed attempt to discern the presence of above-grade Civil War era construction. Results of the fieldwork were analyzed in consultation among team members to provide a recommended treatment approach and evaluate proposed alternatives with respect to the preservation of historic structures, the management of storm water runoff, and the integration of any new visitor amenities or pathways (with provision for accessibility). Finally, conceptual stabilization and repair strategies were prioritized and a schematic level cost estimate prepared.

PART I
DEVELOPMENTAL HISTORY

I.1 HISTORICAL BACKGROUND & CONTEXT

Civil War Context

The military history of the 1864 Battle of Nashville and the social history of Nashville during the Civil War and WPA eras have been documented in a considerable body of literature,[1] and the history of Fort Negley has been detailed in previous archaeological studies and in the 1996 Fort Negley Master Plan. Based on these sources, this synoptic review (see Appendix H - Bibliography) provides a framework for the treatment and work recommendations that follow in this Historic Structure Report (HSR). Readers are encouraged to consult the referenced reports for additional details.

In the summer of 1862, the Union Army of the Ohio, which had occupied Nashville since February, prepared to advance north to Louisville to prevent its capture by Confederate forces invading Kentucky. A small garrison would remain in Nashville under the command of Major General James S. Negley. Union General Don Carlos Buell directed Captain James St. Clair Morton, a West Point trained civil engineer and acclaimed fortification architect,[2] to plan the city's defensive perimeter. Fort Negley was designed as a "star fort on St. Cloud Hill, south of the city, between the Franklin turnpike and Nashville and Chattanooga Railroad"[3] to be part of a modified "German polygonal system" of "detached works with interlocking fields of fire" girdling the city.[4] Pre-Civil War precedents for its astral geometry can be found in North America back to the seventeenth-century at Castillo de San Marcos in St. Augustine, Florida, and the engineering principles standardized and advocated by the French military strategist Sebastien LePrestre de Vauban.[5]

Fort Negley was the largest fort in a system of redoubts, fortified bridges, and forts connected by a double line of breastworks[6] around Nashville (Figure 3). Construction on the fort began in August 1862 and was complete by the end of the year. It was named for General Negley, the Nashville post commander. That same year, Negley would also distinguish himself "for gallantry in action at [the Battle of] Stone[s] River."[7]

1 "While a considerable body of literature exists on the military history of the 1864 Battle of Nashville and the social history of Nashville during the Civil War and WPA eras, only one published scholarly article has addressed any aspect of how Fort Negley was originally built. In 1982, Bobby Lovett published an article ...on the Union army's use of black laborers to construct the defenses of Nashville including Fort Negley. Similarly, there are no published works describing the fort's reconstruction by the WPA. The Fort Negley Master Plan includes a narrative overview of the site's history drawn from the United States War Department's Official Records…. [but] did not include original archival research... In 2004, ... a previously-unknown Civil War soldier's diary that described Fort Negley in great detail came to light."(Zada Law, review of literature distributed with RFP 297344 Historic Structures Report for Fort Negley," February 2013).

2 *Fort Negley Master Plan*, 2; and, Dan Sumner Allen IV, *Report of 1999 Investigations at Fort Negley: Tennessee Archaeological Site 40DV189, A Federal Army Civil War Period Military Site in Davidson County, Tennessee,* DuVall & Associates (submitted to Leatherwood, Inc. for the Metropolitan Board of Parks and Recreation, 2000), 13.

3 "Honor to the Illustrious Dead—Naming of the Forts," New York Times, July 23, 1865, accessed August 24, 2013, http://www.nytimes.com/1865/07/23/news/honor-to-the-illustrious-dead-naming-of-the-forts.html.

4 Allen, *Report of 1999 Investigations*, 11-12.

5 Zada Law, "The Construction of Fort Negley: the Civil War Era" (paper in Historical Research Methods (HIST 6020) presented to Professor David Rowe, Middle Tennessee State University, May 8, 2009), 7-8, accessed October 30, 2013, http://zadalawportfolio.files.wordpress.com/2012/04/fort-negley-cw-construction.pdf.

6 "Fort Negley Master Plan," Hickerson-Fowlkes, Inc., Architects; The Office of Michael Emrick, AlA; Hawkins Partners, Inc.; and Zada L. Law, Consulting Archaeologist (submitted to Metropolitan Government of Nashville and Davidson County, Tennessee, November 1996), 1-2.

7 "Death List of a Day. Major Gen. James S. Negley," *New York Times*, August 8, 1901, accessed August 23, 2013, http://query.nytimes.com/mem/archive-free/pdf?res=F70915FF3A5414728DDDA10894D0405B818CF1D3.

On December 15, 1864, Federal troops advanced under cover of fog from the line of breastworks connecting Fort Negley to the Cumberland River and south-southwestward toward Hillsboro Pike to surprise Confederate forces and break General J. B. Hood's siege of the city.[8] Except for warning shots fired by its cannon,[9] no attack was made on the fort during the battle, where "the closest approach to the Confederate forward line was about 1.7 miles to the south."[10]

Renamed Fort Harker in 1865 "in honor of Maj.-Gen. C. G. Harker, who was killed in the Battle of Kenesaw [*sic*] Mountain, June 17, 1864,[11] the fort was occupied by the Union Army until 1867, when it was stripped of salvageable materials and abandoned.

Chronology of Civil War and Post-War Development and Use

"The fortification was designed by Captain Morton and built by the Army Corps of Engineers utilizing approximately 2,000 laborers including local free blacks, slaves, and contraband or runaway slaves,"[12] including women and children,[13] conscripted in the expanding African-American involvement in every facet of the Union War effort.[14] Construction required 62,500 cubic feet of stone and 18,000 cubic yards of dirt and cost $130,000 including $20,000 for adding an interior double-cased blockhouse with a parapet and other improvements ordered by General Z. B. Tower, the Inspector General of Fortifications.[15] In November 1862, John Hill Ferguson, a young Scottish immigrant in the Tenth Illinois Infantry Regiment, Company G, described Fort Negley and drew a plan of the fort (Figure 4) in his diary:[16]

> The fort is situated on a large hill about ½ mile from the center of the city. *[punctuation added here and following]* This draft shows a sketch of the foundation of the fort. [Figer *(sic)*] ... 15 and 16 Cisterns. The[y] are very large and kept filled up. The[y] ar[e] calculated to supply the regts in the fort [at] the time of action. 17 is a well not finis[h]ed yet. The[y] are drilling it through the solid rock by horse power. It is none abought 60 feet deep. They expect to run it down abought 200 feet. It is 5 in. wide at top. No. 18 is the only entrance into the fort. It will have a large iron gate between the walls when finished. No 19 is the entrance into the stockade. 20 and 21 is a magazine on each side of the stockade. 22,23,24,25 are centery [sentry] posts on top of the corners of the stockade. 26 of the tent wherein the tilagraph *[sic]* operates. 27 is a large tree which supports the wiar [wire] over the works. [I]n the top of this tree there is a platform bilt *[sic]*. [I]t is used as a lookout post. 28 & 29 are wings where artillery may be used. This stockade is built of large hewed timber 2 feet squair *[sic]* set up on end about 12 feet above ground. There is a large plate on top about 2 ½ feet wide spiked down with larg[e] iron spikes so that it is perf[ectly] soled [solid]. There is holes cut through these loggs *[sic]* about 5 feet from the ground for infantry to shoot through. [T]hose wings are made in the same manner so as to comand *[sic]* the main entrances. [T]he walls around the main fort in the out side is about 12 feet high and about 4 inside. Nos. 30, 31, 32,

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8 Jack R. Bergstresser, Shari D. Moore, and Susan L. Nielsen, *Fort Negley 130 Years Later: An Archeological Assessment*, Panamerican Consultants, Inc. (submitted to Government of Nashville and Davidson County, 1994.

9 "Fort Negley Site," Metropolitan Historical Commission of Nashville and Davidson County historical marker at Chestnut Street and Ridley Avenue/Fort Negley Boulevard (now relocated to park entrance), erected 1975.

10 Lawrence Alexander, Hanan Browning, & Carl Kuttruff, *Phase II Archaeological Investigation of Fort Negley Proposed Flagpole Installation Site, Davidson County, Tennessee*, Alexander Archaeological Consultants, Inc. (submitted to Zada Law and Metropolitan Nashville-Davidson County Parks and Recreation, December 2007), 8.

11 "Honor," *New York Times*, July 23, 1865 (see footnote 3 above). 'Kennesaw' is the contemporary spelling of 'Kenesaw' used in George B. Davis, et al., *Atlas to accompany the official records of the Union and Confederate armies,* Washington: G.P.O., 1891-1895.

12 Allen, *Report of 1999 Investigations*, 8.

13 Bobby L. Lovett, "Nashville's Fort Negley: A Symbol of Blacks' Involvement with the Union Army," in *Trial and Triumph: Essays in Tennessee's African American History*, ed. Carroll Van West (Knoxville: University of Tennessee Press, 2002), 115; and, Bergstresser et al, *Fort Negley 130 Years Later*, 9.

14 "Fort Negley Master Plan," 2.

15 Bergstresser et al, *Fort Negley 130 Years Later*, 9.

16 Gwynn Thayer, archivist, "Finding aid for John Hill Ferguson diaries, microfilm accession #1744," Tennessee State Library and Archives, Archival Technical Services, November 2, 2004.

> 33, 34, 35 is fortifications on the side hill for infantry the [that] can all be all in operation at one time as the one is above the other. [T]he[y] are faced upon both sides with hewed rock then filled in with dirt some 3 or 4 feet above the walls. [A]long in the center of these walls whar the number *[unclear]*... ar[e] placed, there is a tunnel running through under each of these walls to the main fort so that infantry can get to them or from them without exposing themselves to the enemy. These out side points are about 14 feet high on the extreme points and about 6 on the inside corners on the out side. [T]he fall of the hill makes the differance *[sic]* as the walls ar[e[about level on top. [I]n the inside they are filled up with rock and dirt within 4 or 4 ½ feet of the top all around.[17]

After it was abandoned, a stone powder magazine[18] became a "den" for the Nashville Ku Klux Klan before its disbanding in 1869, then a Sunday picnic destination[19] (Figures 5a and 5b). St. Cloud Hill became a "refuge for homeless people who built squatter homes all around"[20] the hill (possibly an extension of a nearby "contraband" camps like nearby Edgehill which evolved into postwar African-American neighborhoods[21]). A popular but unsubstantiated story said that the fort's stones were used in 1889 to build the nearby city reservoir.[22]

Works Progress Administration Context: Rustic Design for American Parks

In the latter half of the 1930s, the Works Progress Administration (WPA) helped turn Fort Negley into a public park that officially opened in 1941. The WPA workers built massive stone pylons and free-standing stone walls by the entrance, and native stone walls along the driveway and parking area. They also built drainage culverts, stone stairways, gravel paths, and stone edging along the driveway and paths. These features were all constructed in the rustic style characteristic of the 1916-1942 era of American public park design. The widespread use of the rustic style reflects the National Park Service's (NPS) strong influence on the designs of federal, state, and local parks during the implementation of its WPA and Civilian Conservation Corps (CCC) programs in the 1930s.[23]

The popularity of the rustic style in park design was due in part to the influence of Herbert Maier, the head architect for the NPS Southwest Region, and an expert on park structure design.[24] Rising from his position as architect at Yellowstone National Park in the late 1920s, Maier had absorbed the principles of the Arts and Crafts design movement and the conventions of naturalistic design from the late nineteenth century, and reinterpreted them in a western environment using locally-available materials, including native stone and timber. The methodology he developed was based on principles of design—rather than prototypes—that could be applied to any site to create park structures and furnishings that complemented the natural environment. It is said that Maier's mastery of rockwork with an emphasis on naturalism was his greatest contribution to park design.[25] The use of native materials, Maier said, was the "happiest means of blending the structure

17 John Hill Ferguson, Civil War Diaries, Book 1 (February 28, 1962 – November 10, 1862), microfilm at Tennessee State Library and Archives.

18 *The Tennessean*, July 6, 1924.

19 Lovett, "Nashville's Fort Negley," 114.

20 Bergstresser et al, *Fort Negley 130 Years Later*, 20. See also Allen, *Report of 1999 Investigations*, 15, which refers to "the hill surrounding the fort [eventually] became a refuge for homeless people who built homes and camps."

21 Bobby Lovett, "Contraband Camps," *The Tennessee Encyclopedia of History and Culture, Version 2.0*, accessed August 26, 2013, http://tennesseeencyclopedia.net/entry.php?rec=305; and, John Hill Ferguson, diary entry for November 19, 1862 (transcribed by Rob DeHart, 2008) also refers to "a large camp of about 2000 contrabands" at "the foot of ...[St. Cloud] hill on the west side."

22 Bergstresser et al, *Fort Negley 130 Years Later*, 19-20.

23 National Park Service Western Regional Office, Division of Cultural Resource Management, *Rustic Architecture, 1916-1942*, by William C. Tweed, Laura E. Soulliere, and Henry G. Law (U. S. Department of the Interior, February 1977), accessed August 20, 2013, http://www.nps.gov/history/ history/ online_books/rusticarch/introduction.htm#2.

24 Linda Flint McClelland, *Building the National Parks* (Baltimore: The Johns Hopkins University Press, 1998), 390.

25 McClelland, *Building the National Parks*, 398.

with its surroundings."[26] ` In order to efficiently disseminate Maier's principles, the NPS developed numerous loose-leaf design portfolios in binders that could be expanded to accommodate new work. These binders were the idea of Conrad Wirth, a landscape architect and head of the NPS' State Parks Division, which directed WPA and CCC work in both state and local parks. The first two portfolios focused on designs for privies and comfort stations, but were quickly expanded to include designs for entranceways, barriers, lookouts, picnic shelters, bridges, and other park buildings and furnishings. Illustrations of these designs were from the best of NPS park work—many of them designed by Maier—and presented "'concrete' ideas that could be 'used and worked out' by local technical staff."[27] The portfolio idea was soon abandoned in favor of Albert H. Good's iconic three-volume catalog, *Park and Recreation Structures*.[28]

Although there is no information available about the particular design of the WPA-era Fort Negley entrance portal and its other built features, there are several characteristics that were likely influenced by NPS design guidelines. One is the use of a stone pylon as a vertical marker indicating an entry point, an element used in national, state, and local parks constructed by the WPA or the CCC in the 1930s. *Park and Recreation Structures* illustrates a range of entrance pylon designs with varying degrees of formality based on setting, which ranged from wilderness to urban park.[29] The second characteristic is the use of long, free-standing stone walls flanking an entrance. Consistent with principles of the rustic style, the free-standing entrance walls at Fort Negley visually anchor the entrance composition to the ground, thus tying it into the landscape with strong horizontal lines. Third is the extensive use of local stone in the construction of the entrance. At Fort Negley, the WPA used the local, grey, native limestone of the Nashville Basin, which was also used for the original construction of the Civil War fort. The WPA used this material for the entrance portal and walls, the drive and parking area walls, the stone stairways, edging along the drive and interior paths, and the drainage culverts.[30] The fourth characteristic is the incorporation of local historical references in the new design. At Fort Negley, the entrance references the military use of the site by incorporating elements of a fortified castle in its arched central opening, flanking towers, and castellated parapet.

Chronology of Development and Use: WPA to the Present

Sixty years after its abandonment, only "traces of the breastworks"[31] remained. Following a failed attempt to induce Congress to acquire Fort Negley for designation as a national military park, in September 1928, Nashville's Board of Park Commissioners approved a $20,000 bond issue to purchase the property from the Farguson estate. A year later, the country plunged into the Great Depression.

Five years later, the Tennessee Emergency Relief Administration (subsequently Works Progress Administration, or WPA) decided to put jobless men to work reconstructing the fort. In 1934, authorities evicted an African-American "squatter" neighborhood[32] that had grown up on the hillsides and demolished their houses.[33] Reconstruction began after site clearing in April-May

26 National Park Service, "Proceedings of National Park Service Conference of State Park Authorities," ed. Herbert Maier McClelland, (Washington, D.C.: U. S. Department of the Interior, February 25, 1935, mimeo): 84, quoted in McClelland, Building the National Parks, 395-396.

27 McClelland, *Building the National Parks*, 426.

28 National Park Service, *Park and Recreation Structures*, by Albert H. Good (U. S. Department of the Interior, 1938, repr., New York: Princeton Architectural Press, 1999).

29 Good, "Part I-Administration and Basic Service Facilities" in *Park and Recreation Structures*, 12.

30 The use of indigenous, hand-worked stone in these designs was also a pragmatic solution, with little to no transportation costs and a construction technology that put as many people to work as possible..

31 *Nashville Banner,* April 28, 1928.

32 *The Tennessean*, May 5, 1946.

33 *The Tennessean*, April 9,1935, and June 14, 1935, quoted in Bergstresser et al, Fort Negley 130 Years Later, 20.

1935 had unearthed Civil War remains of the fort.[34] Newspaper accounts "reported that 1,150 men would be employed in two shifts of 575 workers each" to reconstruct stone walls using stone from the site (Figures 6a and 6b), timber stockade, gatehouse and bastion blockhouses, and to build a new entrance gate and gravel loop drive.[35] It was, the newspapers stated, "one of the top WPA programs in the state."[36] Completed by a work force of 2,300 men under the direction of project engineer J. D. Tyner, "the reproduction was the same as the original [based on plans found deposited at the War Department in Washington], except that it seemed unnecessary to bury the heavy steel rails used in the reinforcements and they were omitted."[37] It took longer to restore the fortifications than the original work, and previous removal of original stones made it necessary to re-quarry 2,500 perch (a total of 61,875 cubic feet with one perch equalling 24.75 cubic feet) of stone. An additional 18,000 cubic yards of dirt was also trucked to the site[38] (Figure 7). A stone monument at the park entrance records the project completion: "FORT NEGLEY Built by Federal Forces 1862 Restored by W. P. A. 1936" (Figure 8).

Park board minutes indicate that additional work continued in stages through 1940 and included new access roads, water and lighting systems, ball diamonds and bleachers, a comfort station, garage, and storehouse. A small museum was located in a reconstructed subterranean munitions magazine inside the fort on the north side. The fort received two cannon from the United States Army Watervliet (New York) Arsenal in 1937, and two other cannon were also acquired. The park opened in the spring of 1941.[39]

By August 1944, however, the park custodian had resigned and the fort had deteriorated so much that park commission voted to remove "all wood installations." The park was closed for repairs in 1945, but only the baseball diamonds reopened in spring 1946.[40] Two cannon were loaned indefinitely to Montgomery Bell Academy in 1947[41] following Tennessee's sesquicentennial year.

Fort Negley Park, aside from the re-opened baseball diamonds, fell "into disuse and…[became] something of an eyesore."[42] The Fort Negley "playfield-park" was used through the 1950s[43] and '60s. Park planners noted that there was unauthorized parking at the entrance gates and vagrants were seen camping in the fort. Although closed to pedestrian access, the fort was not physically restricted by fencing and numerous minor footpaths had developed.[44]

After the city allocated funds to the park board for a new children's zoo in 1963, as an enhancement and to avoid duplication of operating costs, the Davidson County Zoo Advisory Committee requested that the proposed project be incorporated into plans for a larger public zoo.[45] In 1964, a private Zoological Society petitioned the park board to locate the new metropolitan zoo at Fort Negley and underwrite its annual operating costs. (No mention seems to have been made of the fort's centennial or its significance in the Civil War, then being nationally commemorated.)

34 *Nashville Banner,* May 12, 1935, referenced by Allen, *Report of 1999 Investigations*, 17.
35 Allen, *Report of 1999 Investigations,* 17.
36 Lovett, "Nashville's Fort Negley," 123.
37 *The Tennessean,* May 5, 1946.
38 *The Tennessean,* May 5, 1946. Aerial photographs (November 12, 1936, and February 14, 1937) show what appears to be a quarry—possibly a source of stone for the WPA reconstruction—cut into the hillside southeast of the fort with an access road leading uphill to the loop road.
39 Bergstresser et al, *Fort Negley 130 Years Later,* 20-21, 23.
40 Bergstresser et al, *Fort Negley 130 Years Later,* 23.
41 Bergstresser et al, *Fort Negley 130 Years Later,* 21.
42 Dick Battle and Sam McPherson, "Briley: No Zoo Funds Available," undated, unsourced newspaper article on file at FNVC.
43 National Recreation Association, *A Study of Recreation and Parks in Nashville and Davidson County Tennessee* (July 1957), 60.
44 "Fort Negley Master Plan," 37-39.
45 Joseph W. Hart, chairman, Nashville Zoo Advisory Committee, letter to Nashville Park Board, March 6, 1963.

Over neighborhood objections,[46] the board unanimously approved an offer of Fort Negley Park as a temporary zoo until the Metro Planning Commission could complete a survey and make recommendations for a final location, but declined to provide any operating funds.[47] The zoo was not built.

Implementation of the Edgehill Urban Renewal Plan and construction of the inner-city interstate highway loop adjacent to Fort Negley Park, beginning in the early 1960s, led in 1977 to Metro's acquisition of vacant Urban Renewal parcels in Edgehill to add to the park property for museum development.[48] In 1967, Fort Negley Park had been leased in two sections to the Children's Museum of Nashville (later renamed the Cumberland Science Museum, now the Adventure Science Center), which relocated from downtown in 1974.[49] The museum's 50-year lease (expiring 2017) has one 50-year extension option. A second lease was to the city's minor league baseball team for Herschel Greer Stadium (2008 lease expiration with extensions), which was constructed (presumably on the site of the earlier baseball diamonds) in 1978.[50] Concurrently, the Metropolitan Historical Commission (MHC) and Metropolitan Board of Parks and Recreation (MBPR) worked together to list the site on the National Register of Historic Places in 1975 and began educating the public and its elected officials about the fort's significance and its potential role in heritage tourism development.[51]

In 1980, with growing public awareness of Fort Negley as the only "attraction available now for interpretation of the role of the city during the Civil War,"[52] MHC secured a grant from the Tennessee Historical Commission and engaged the firm of Miller, Wihry & Lee, Inc., of Nashville, Tennessee, to prepare a study of Fort Negley Park. The study recommended that the historic site be excluded from the area leased by the science museum and maintained instead by park management staff. The study also called for developing a plan for self-guided interpretation and "living history" presentations,[53] but proposed "no major effort on the fortress" itself.[54] Instead, it proposed using the park "without reconstruction of the fortifications as a prerequisite."[55] In 1982, the museum lease was revised to return the majority of the park property to the Metro Park board,[56] but the fortifications remained closed to the public.[57] MHC commissioned a 1992 condition report by local stone mason Graham Reed, and photographic conditions surveys in 1993 and 1994.[58] Other problems included vandalism and unauthorized relic hunting by individuals using metal detectors.[59]

46 Mansfield Douglas III, telegram to Metropolitan Board of Park Commissioners, April 20, 1964.
47 Bert Elmore, director of the Metropolitan Board of Parks and Recreation to the Metropolitan Legal Department, April 30, 1964, requesting a ruling by its next regular meeting on Wednesday, May 6, 1964.
48 Bill Carey, "A City Swept Clean: How urban renewal, for better and for worse, created the city we know today," September 6, 2001, accessed August 24, 2013, http://www.nashvillescene.com/nashville/a-city-swept-clean/Content?oid=1186025; and, "Fort Negley Master Plan," 6.
49 "History of Adventure Science Center," accessed August 24, 2013, http://www.adventuresci.com/default.aspx?section=aboutus&title=history&page=4.
50 "Fort Negley Park: A Study for the Metropolitan Historic Commission," Miller, Wihry & Lee, Inc. (Nashville: Revised October 1980), A-1; and, "Fort Negley Master Plan," 7.
51 Metropolitan Government of Nashville and Davidson County, "Background, RFP 297344 Historic Structures Report for Fort Negley," February 2013.
52 "Fort Negley Park: A Study," F-1.
53 "Fort Negley Park: A Study," R-1.
54 "Fort Negley Park: A Study," MP-3.
55 "Fort Negley Park: A Study," G-2.
56 "Fort Negley Master Plan," 7.
57 Metropolitan Planning Commission and Metropolitan Board of Parks and Recreation, "Inventory of Parks" (June 1985), 48; also, "Fort Negley Master Plan," 28.
58 "Fort Negley Master Plan," 28; also, "Fort Negley Condition Report Documented by Graham Reed" (1992), existing Conditions surveys for Metropolitan Historical Commission.
59 Zada L. Law memorandum to Curt Garrigan, Metropolitan Board of Parks and Recreation, November 22, 1999.

In October 1993, the MHC and MBPR together engaged Panamerican Consultants, Inc., of Tuscaloosa, Alabama, to conduct an archaeological and archival investigation of Fort Negley to determine how much of the ruin dated to the Civil War and how much to WPA-era reconstruction. The archival phase of the 1993 Panamerican investigation of the National Archives located plans of Fort Negley prepared in 1864 for General Tower.[60] The archaeologists attempted—without success—to establish reference points that might correlate to registration points on the historic plan, finding that "the WPA fort was a faithful reproduction of the overall original shape, its walls are [in reality] slightly offset from the Civil War foundations, and there are numerous variances from original dimensions" (see Figure 21A in Chapter I.2). The study concluded that "virtually all the visible surface remains were WPA vintage" but that "a good possibility exists that most of the footings and lower courses of stone work [on which the WPA walls appeared to have been laid] have survived from the Civil War" except for the stockade area where WPA activity and work in the 1940s had removed nearly all evidence of earlier construction.[61]

As the Tennessee Bicentennial approached, in 1994 Mayor Philip Bredesen renewed interest in tapping educational and tourism opportunities by appointing a Fort Negley Advisory Committee "made up of historians, preservationists, educators and other experts, and led by the Metro Historical Commission."[62] The committee made general recommendations "for the future use and enhancement" of the deteriorated fort and the surrounding park. As a matter of public safety, the committee recommended immediate stabilization and repair of stone walls while discouraging public visitors "through the use of signs and regular police patrols until repairs are carried out."[63] The committee also recommended preparing a master plan and reconstructing specific features of the fort in addition to stabilization work and other site improvements.

Metro Nashville funded the master plan study in 1995, requiring a phased schedule for site development and interpretation, including infrastructure and facilities, lighting and signage, trails and trail linkages, and vegetation management, along with the costs for capital and operation.[64] Hickerson Fowlkes, Inc., Architects of Nashville, with the Office of Michael Emrick, AIA (historical architect), Hawkins Partners, Inc. (landscape architects), and Zada L. Law Consulting Archaeologist, completed the plan in November 1996. The master plan laid the groundwork for the stabilization and restoration project implemented in 1999 and has guided subsequent work.[65] The report included guidelines for stabilization, repair, restoration, and reconstruction of stone walls and features and proposed a location for a new interpretive center immediately west of the WPA gate structure.

Other recommendations called for temporary shoring of bulging walls, selective repair and rebuilding of "blow-outs" and other areas defined as dangerous to prevent further significant masonry deterioration. Additional recommendations included archaeological assessment and monitoring, research to confirm the original design intent (with archaeological confirmation), and future selective or complete reconstruction of missing components. WPA-era components, while "important and integral" site features were considered to be of secondary concern. And the study recommended further investigation into the causes of deterioration (especially wall collapses).[66]

A 2007 supplement to the master plan, led by Moody-Nolan Architects, addressed poten-

60 Bergstresser et al, *Fort Negley 130 Years Later*, 24.
61 Bergstresser et al, *Fort Negley 130 Years Later*, ii.
62 Metropolitan Board of Parks and Recreation, "Nashville Civil War Center at Fort Negley: 2007 Supplement to the 1996 *Fort Negley Master Plan*," 3.
63 Metropolitan Historical Commission, "Report to Mayor Phil Bredesen from the Fort Negley Advisory Committee" (June 1, 1994), 3.
64 "Fort Negley Master Plan," 4.
65 Metro Nashville, RFP 297344.
66 "Fort Negley Master Plan," 29-32.

tial redevelopment of the 16.4-acre Greer Stadium site following the then-expected departure of the minor league club and stadium demolition. The report presented a campus plan incorporating the stadium site into Fort Negley Park to create the "Nashville Civil War Center at Fort Negley." It recommended an alternate location for the proposed visitor center to complement construction of a new 60-80,000 square foot Civil War museum. In other regards, the 1996 plan was reaffirmed as "a sound document… [which] should be retained to help guide management at Fort Negley [vis-à-vis treatment of the historic site]."[67]

Upon completing the 1996 master plan, Hickerson Fowlkes Architects (HFA) was again engaged by Metro government to design the stabilization and restoration of Redan No. 7 (also called the "Eastern Outer Salient"), the East Bastion interior and exterior, South Main Works, and the West Bastion exterior. Stephen D. Smith (South Carolina Institute of Archaeology and Anthropology), working from March 29 to April 1, 1998, conducted a new search of National Archives records and architectural drawings of the original construction and WPA reconstruction. No cartographic or architectural records of the WPA reconstruction were found at that time.[68] Duvall & Associates, Inc., of Franklin, Tennessee, conducted a reconnaissance level archaeological investigation of the fort during construction between February 20 and May 1, 1999, "to determine if intact Civil War-era archaeological deposits occurred within …selected…masonry [repair] zones"[69] and included auger testing of areas outside the north main works and at the main sally port, both of which yielded significant evidence of Civil War deposits.

The 1999 archaeological investigation led to the conclusion that "undisturbed deposits associated with Civil War period occupation...[inside] the fort may occur only at depths in excess of 50 centimeters below the surface" but not so deeply buried outside the fort walls. The bastions were found to be "largely reconstructed during the WPA era" with "WPA era masonry...[extending] at least 50 centimeters below the ground. " "No features or masonry suggesting the Civil War era footprint of the fort…[were encountered] around the perimeter" of the bastions and South Main Works.[70]

Reconstruction and stabilization of portions of the WPA walls, funded and overseen by MBPR, commenced on February 18-20, 1999.[71] The project consisted of removing dirt and plant materials from tops of walls and terraces at the bastions and South Main Works, shoring existing stonework, rebuilding collapsed stone walls, and securing loose stones or replacing missing or deteriorated stones. The repair design incorporated a reinforced earth approach using geo-grids. Rubble fill behind the rebuilt wall sections was partially removed to a depth necessary to achieve a stable temporary slope to allow reconstruction to proceed and a geo-textile filter was installed over the remaining rubble core to control soil intrusion into the facing. A PVC foundation drain was to be laid on top of the footing inside rebuilt walls with discharge pipes extending five feet out from the wall. New No. 57 crushed stone fill was placed behind the rebuilt wall face, capped with six to 12 inches of soil (over a geo-textile filter) up to the top of the wall, then sodded or planted. The stone fill was reinforced with geo-grids set horizontally every 24 inches, to extend midway into the horizontal joints of the facing stone and back through the new fill (typically only about 12 inches), then lapped onto the face of the rubble that remained. The project included selective tree removal and clearing of invasive vegetation, sodding of rebuilt wall terraces, and a barberry hedge planted atop the South Main Works.[72]

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67 Metro Parks, "2007 Supplement to the 1996 *Fort Negley Master Plan*," 3.

68 Steven D. Smith, "National Archives Search for Fort Negley, Nashville, Tennessee," South Carolina Institute of Archaeology and Anthropology (University of South Carolina), submitted to Hickerson Fowlkes Architects, April 3, 1998.

69 Allen, *Report of 1999 Investigations*, 15.

70 Allen, *Report of 1999 Investigations*, 70.

71 Robert Hollingsworth, "Progress Report Since Last Meeting,"submitted by Leatherwood, Inc., to Metropolitan Board of Parks and Recreation, February 24, 1999.

72 "Fort Negley Stabilization and Restoration - Combined Immediate and Phase One for the Metropolitan Board

When the project was near completion in December 1999, rain caused several repaired wall sections to collapse or begin to destabilize and bulge, prompting a geotechnical engineering investigation by G.E.C., Inc. The investigating engineer concluded that the "use of geo-grid reinforcing… [was] inappropriate for this project." The reinforcing, designed for locking geo-grids into slots in standard manufactured blocks, was not sufficiently embedded into facing stones or the rubble fill to resist pull-out when the 'sliding wedge zone' behind the wall face moved to push the wall out. Engineers found no evidence of settlement or tipping which would have contributed to the new wall failures.

G.E.C. recommended dismantling the stone wall facing and excavating a new footing trench below the level of the foundation course. After laying drainage strips and a rebar grid over the face of the exposed rubble back-up, the new footing trench would be filled with high-strength shot-crete which would also be sprayed over the rubble face. The stone facing would be dry stacked using masonry ties mortared into the back half of the dry joints. New fill would be placed over a geotextile and prepared for sod or other planting.[73] It appears that no repairs were undertaken after the engineer's report was received.

Attention shifted from the condition of the ruins toward overall park improvements in the Metropolitan Parks & Greenways Master Plan of 2002. This 20-year plan recommended funding for two phases of development at Fort Negley allowing the fort to reopen to the public in anticipation of the Civil War Sesquicentennial (2010-2015).

Phase 1 Fort Negley Historical Park Improvements were completed in 2004. Architects Moody-Nolan, Inc., designed an orientation plaza inside the WPA gate, new interpretive signage and benches along the loop road and within the ruins, wheelchair-accessible pedestrian boardwalks within the inner works and ravelin ditches, and wood observation decks marking the locations of Casemate No. 1 and Casemate No. 2 (Figure 9).[74] Plans to construct an outline of the original inner stockade location were deferred. The proposed installation of a flagpole was found to have an adverse impact on historical archaeological remains[75] and was eliminated from the project.

Phase Two was the construction of a visitor's center. The *Fort Negley Visitor's Center Interpretive Plan* was completed in November 2006 with funds provided by the Tennessee Civil War National Heritage Area. The interpretive plan outlined potential themes, programming objectives, and anticipated visitor experience for a proposed Nashville Center for the Civil War campus, of which the visitor's center was a part.[76] The new 4,600 square foot center, also designed by Moody-Nolan,[77] was sited on the west side of the Greer Stadium parking lot adjacent to the WPA gate, as recommended in the 2007 master plan supplement. At a cost of $2 million, the center opened to the public in December 2007, representing the nation's largest investment in a Civil War site by a local government.[78]

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of Parks and Recreation, Nashville, Tennessee, Metro Project No. 80PR440," Hickerson Fowlkes Architects (July 8, 1998), Drawings L1.0-L4.0, ARR1.1, A2.1, A3.1-A3.5, A4.1-A4.2, and Project Manual Section 01010 "Summary of Work."

73 Ronald Jones, P.E., "Ft. Negley Stabilization and Restoration, GEC Project No. 104-00-399," report to Jim Thompson of Metropolitan Nashville Parks Department, March 28, 2000.

74 "Project Manual Phase 1 Fort Negley Historical Park Improvements, Nashville, Tennessee, Metro Proj. No. 80PR440a," Moody-Nolan, Inc., architect (June 25, 2004),with Supplemental Drawings, August 18 & 24, 2004.

75 Alexander, et al, *Phase II Archaeological Investigation*, 51.

76 *Fort Negley Visitor's Center Interpretive Plan*, November 20, 2006.

77 "A1.01 – Floor Plan, Fort Negley Visitor's Center, Nashville, TN for Metro Board of Parks & Recreation," Moody-Nolan, Inc., architect (March 16, 2007), Sheet 11 of 49.

78 Metro Parks, "2007 Supplement to the 1996 *Fort Negley Master Plan,"* 3-4.

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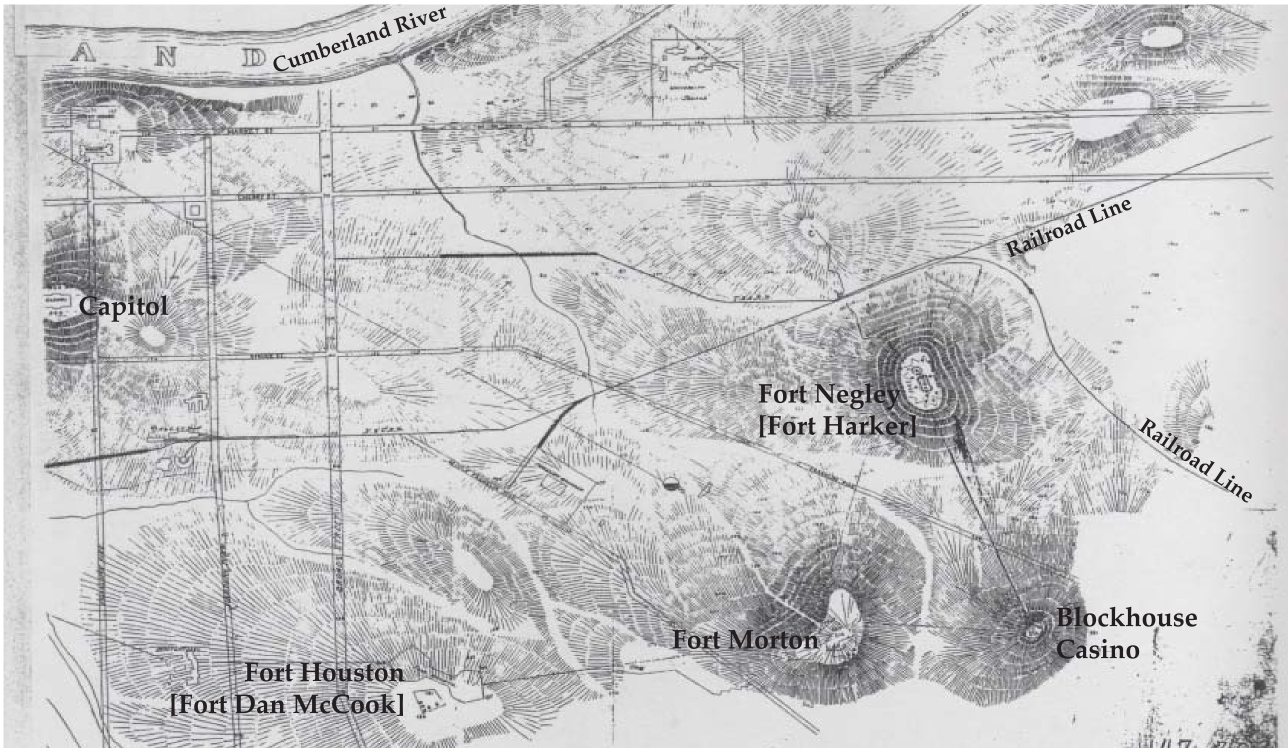
Figures 1 and 2. Included in Project Data.

Figure 3 (below). Willet's topographical map of Nashville. National Archives (FNVC). Names of fortifications added.



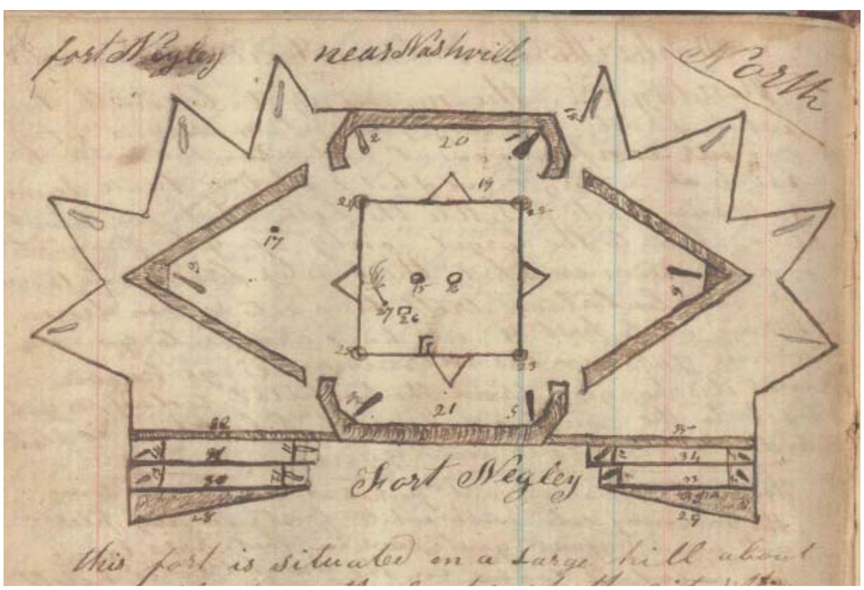


Figure 4. John Hill Ferguson's diagram of Fort Negley. Tennessee State Library and Archives microfilm of original diaries in holdings of Henry Pfieffer Library, MacMurray College, Jacksonville, Illinois (FNVC).

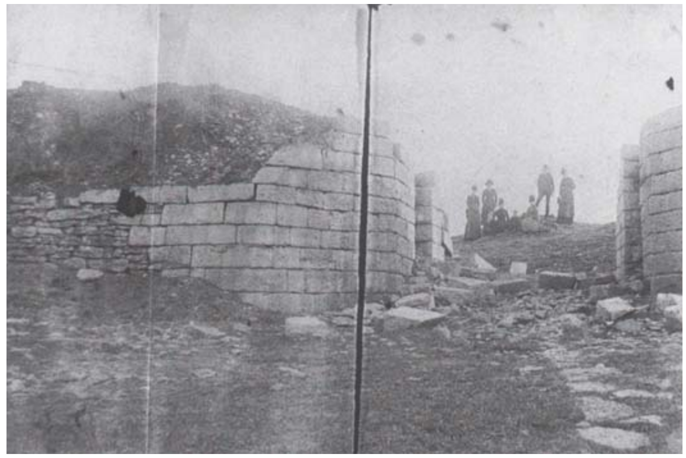


Figure 5a. Fort Negley Main Gate, ca. 1884. A Sunday outing destination. Photograph by Otto Geirs, cited in Allen, *Report of 1999 Investigations,* 16 (FNVC).

Figure 5b. Looking East from Fort Negley, Nashville, Tenn., ca. 1890 (FNVC from Robert N. Dennis collection of stereoscopic views, New York Public Library, Photography Collection, Miriam and Ira D. Wallach Division of Art, Prints and Photographs, also available online, http://digitalgallery.nypl.org/nypldigital/dgkeysearchdetail.cfm?trg=1&strucID=740820&imageID=g92f035_014f&word=Fort%20Negley&s=1&notword=&d=&c=&f=&k=1&lWord=&lField=&sScope=&sLevel=&sLabel=&sort=&total=1&num=0&imgs%20Dry-Stacked%20Stone%20and%20Earth%20Walls=20&pNum=&pos=1).

Figure 6a. East Bastion, 1930's. Photo in Tennessee State Library and Archives (FNVC).

Note temporary construction access road in foreground (also visible in Figure 7) and quantity of rubble or fill between bastions (in front of South Main Works) which appears to have been subsequently removed or regraded.

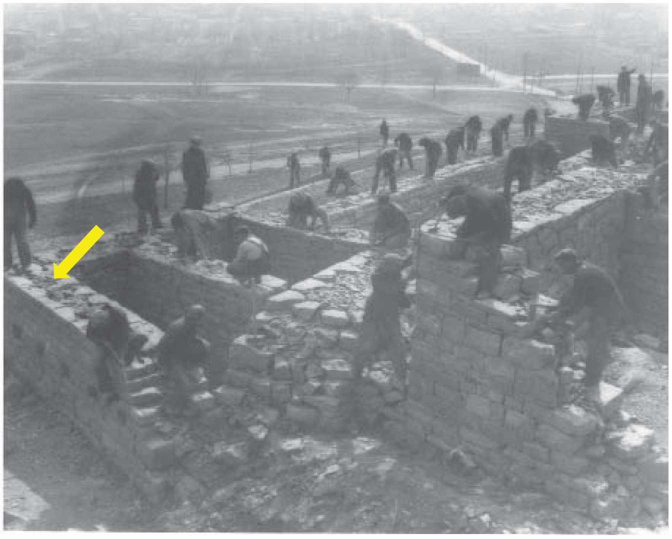


Figure 6b. WPA work crew, March 1936. National Archives (FNVC).

Note use of ashlar exterior stone coursing and interior rubble fill (yellow arrow).

Figure 7 (below). Fort Negley as restored and landscaped by WPA including the reconstructed stockade, a flagpole inside the South Main Works, and roofed circular stockade gatehouse with adjacent triangular stockade at the Main Sally Port. Postcard from Michael Emrick Collection (FNVC).

Note bollards or posts at perimeter of parking area and loop road. Note also the scarps (steeply sloped earth fill) between redans, bastions, and at the West Ravelin (yellow arrows).

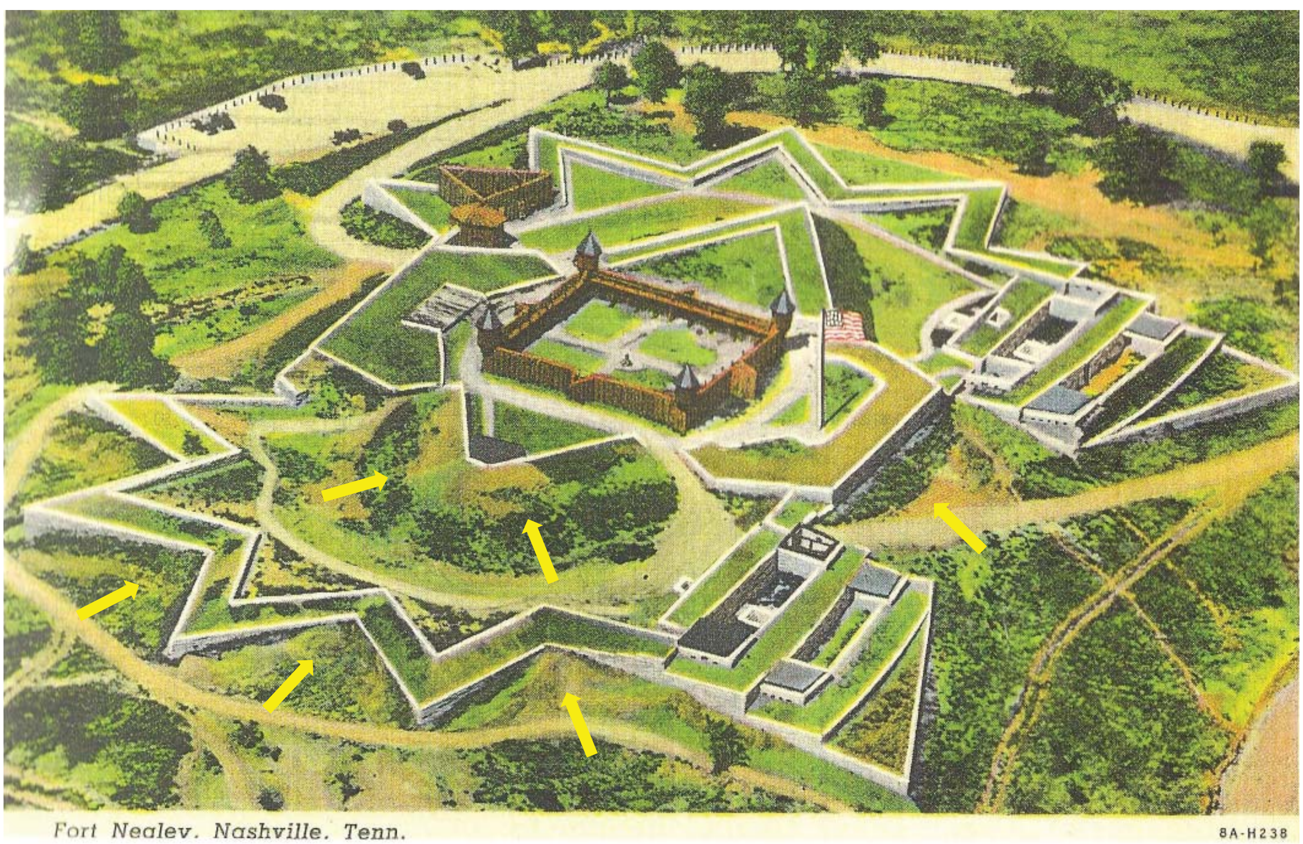


Figure 8. Fort Negley Dedication Monument. Photograph from *The Tennessean*, May 5, 1946 (FNVC).

Figure 9 (below). Fort Negley aerial view showing boardwalks constructed in 2004 (FNVC).

I.2 PHYSICAL DESCRIPTION & EVALUATION OF SIGNIFICANCE

Civil War Fortification and WPA Reconstruction

Fort Negley was constructed in 1862 with the significant involvement of African-American “contraband” conscripts[1] under the direction of Union Army engineers. Positioned “about ½ mile from the center of the city”[2] on the commanding height of St. Cloud Hill, the fort protected the southern approaches to Nashville including nearby rail lines (see Figure 3 in Chapter I.1).

The design of the fort included three lines of defense (Figure 10). The innermost line of defense at the center of the fort was a 100-foot square stockade constructed of vertical timbers, approximately 12 feet high, with four corner turrets and ravelins at the center of each wall. Two cisterns and a drilled well inside the stockade supplied water to the garrison. This stronghold housed a telegraph station and a lookout platform constructed high in a tree within the enclosure.[3]

A square earth and stone redoubt surrounding the stockade formed the second defensive line. This redoubt consisted of bracket or U-shaped walls, or “scarps,” that enclosed the magazines on the north and south sides, and V-shaped earth and stone walls, or ravelins, on the east and west. The redoubt included two casemates that were constructed of heavy timber and earth reinforced with railroad iron with one located at the southwest corner of the South Main Works and the other in the tip of the West Ravelin. Fortification walls were dry-stacked (without mortar) construction (Figure 11) of locally-quarried limestone, laid in a coursed-rubble fashion. Sally ports at each corner of the main works connected to ditches surrounding the bastion on the east and west.

The outer defensive line of the fort consisted of two half-bastions, each having two tiers of earth-filled fire banquettes and four timber and earth bomb-proofs reinforced with railroad iron. The bastions extended outward as salients at the southeast and southwest corners of the redoubt and were entered from the ravelin ditches through earth-covered stone tunnels. Four V-shaped redans (to be surmounted by cannon) enclosed the ravelin ditches and connected the bastions to the north scarp, or North Main Works. Troops were encamped in the ravelin ditches behind these outer redan parapets.[4] Wall construction typically consisted of dressed stone exterior wythes with small rubble infill. Typical interior and exterior fortification walls were covered with earth to protect the fort against bombardment. The main entrance to the fort, located at the east end of the North Main Works, was protected by a timber stockade guardhouse.

In total, the fort encompassed over one mile of wall construction.[5] The sources and influences for Captain James St. Clair Morton’s design for Fort Negley are discussed in detail in Duvall & Associates’ *Report of 1999 Investigations at Fort Negley.*[6]

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1 Bobby L. Lovett, “Nashville’s Fort Negley: A Symbol of Blacks’ Involvement with the Union Army,” in *Trial and Triumph: Essays in Tennessee’s African American History*, ed. Carroll Van West (Knoxville: University of Tennessee Press, 2002).

2 John Hill Ferguson diary, November 186 (transcribed by Rob DeHart, 2008).

3 John Hill Ferguson sketch plan and written description, November 1862, photographic copy of manuscript.

4 Bergstresser et al, *Fort Negley 130 Years Later*, 11; and, Allen, *Report of 1999 Investigations*, 10. See also description in John Hill Ferguson diary entry, November 1862.

5 Bergstresser et al, *Fort Negley 130 Years Later*, 23.

6 Allen, *Report of 1999 Investigations*, 10-13. See also Zada Law, “The Construction of Fort Negley: the Civil War Era” (paper in Historical Research Methods presented to Professor David Rowe, Middle Tennessee State University, May 8, 2009), accessed October 30, 2013, http://zadalawportfolio.files.wordpress.com/2012/04/fort-negley-cw-construction.pdf.

After sixty years of neglect following post-war salvage operations and its subsequent abandonment by the army, the Works Progress Administration (WPA) hired unemployed laborers and masons to reconstruct the historic stone walls, stockade, and blockhouses. Reconstruction methods "involved the exposure of the Civil War-era stonework and foundations... [which] seriously compromised the integrity of any Civil War-era [archeological] deposits adjacent to the walls..."[7] The wall reconstruction at the South Main Works and both bastions appears to have used different stonework than the original construction method (see Dry-Stacked Stone Gravity Walls, below). Uniform, dressed ashlar stones were used for reconstructing the exterior wythes while rubble was utilized for the interior portions of the walls similar to the original construction (see Figure 6 in Chapter I.1).

Archaeological investigations in 1994 and 1999 concluded that most (if not all) of the walls visible above ground are of WPA origin and closely follow--but may not fully align with--the original foundations of the fort.[8] "[W]hile the WPA fort was a faithful reproduction of the overall original shape, its walls are offset slightly from the Civil War foundations, and there [are] numerous variances from the original dimensions… Virtually all traces of the Civil War stockade were obliterated by the reconstruction, but inner walls of the underground magazine adjacent to the south main works wall are well preserved."[9] Comparison of Civil War-era spot elevations for the foot and top of walls on General Tower's 1864 plan of Fort Negley[10] with current survey data indicates that the overall configuration of the original fort was replicated by the WPA work, leavened, perhaps, with a little imagination, and that a number of walls were heightened.

The 1999 study also concluded that WPA stonework extended, "with no discernable changes in the coursework," to at least 50 centimeters below the surface at the bastions and south main works, and that both bastions were largely reconstructed during the WPA era. Subsurface remains in Redan No. 5 near the sally port appeared to confirm the likelihood that WPA course work was laid on top of Civil War masonry. Archaeologists found that the interior of the fort was probably scoured for artifacts (or artifacts destroyed) during the WPA restoration when workers first cleared soil and rubble away from surviving Civil War course work and foundations. In this process, the depths of building trenches may have been exaggerated, and fill thrown into ravelin ditches (nearly 30 inches deep in some places) may have resulted in the exaggerated build-up of architectural features. Efforts to sort out Civil War from WPA coursework proved to be inconclusive because of the mixing of new and old stonework in the reconstruction.[11]

Significant Features of the Fort Today

Fort Negley is listed on the National Register of Historic Places for its Civil War-era and WPA-era significance and is considered the largest inland stone fortification built by the United States government during the Civil War. The reconstructed WPA walls have endured deterioration, displacement, and partial collapses. The complex star plan of the original design remains evident, but none of the earth and heavy timber construction of casemates and blockhouses from the Civil War era survives. The WPA-reconstructed inner stockade was dismantled and removed in the 1940s, leaving an open grassy plateau within the redoubt, and it appears that the reconstructed timber blockhouses eventually rotted and collapsed into the bombproof chambers within the bastions.

7 Allen, *Report of 1999 Investigations*, 17.
8 Allen, *Report of 1999 Investigations*, 71; and, Bergstresser et al, *Fort Negley 130 Years Later*, 70.
9 Bergstresser et al, *Fort Negley 130 Years Later*, 1.
10 "Plan of Fort Negley, Nashville Tenn.," 1864 (National Archives, Cartographic Division, Alexandria, Virginia).
11 Allen, *Report of 1999 Investigations*, 70-74.

Following the WPA reconstruction effort, the fort again entered a period of neglect. By the early 1990s, several areas of the fort's exterior walls had collapsed and global stability of the walls was in question. In 1996-1999, stabilization efforts were designed and installed (see Figures 61 through 63 in Chapter I.3). The areas of repair were localized to Redan No. 7, the East Bastion, South Main Works and West Bastion. At these areas, the repair design incorporated a reinforced earth approach with geogrids (Figure 12). Portions of the repaired stone walls at the east bastion collapsed as the project neared completion in December 1999, delaying the reopening of the fort to the public.

Dry-Stacked Stone Gravity Walls

There is considerable variation in the sizes and patterns of the dry-stacked stone gravity fortification walls. Although not exhaustively hand-measured for this HSR, the differences are clearly visible in the photographic elevations. The 1996 Master Plan and archaeological studies described two types of masonry, attempting to distinguish Civil War-era work from the WPA work: regular coursed, dressed stone of similar size, and random coursed "rough-cut tabular stone"[12] of varying size. These reports all agree that the regular coursed stonework dates from the WPA reconstruction when it was probably imported to the site, but "opinions diverge... on dating of the random coursed stonework"[13] which exhibits significant stylistic variations in sizing and layout, possibly an indication of construction by different masons or work crews.

A comparison of the photo elevations is useful in understanding the variety of stone sizes, coursing, and setting techniques. Some walls have a mix of very large and medium stones. Other walls are built from smaller stones of a similar size. Some walls are uniformly coursed, while others are random. Some stones are rectangular and have squared sides while others are more boulder-like with rounded edges. Face chinking and/or leveling courses were used in some areas but elsewhere there is none. Stone faces are heavily tooled in some areas but simply split in others. Quarry drill marks are visible on some split faces.

These variations in materials and workmanship offer little definitive information for identifying WPA reconstructions and subsequent repairs. The intermingling of the various types of masonry in other walls compounds the difficulty of discerning what portions of the work visible today, if any, are original construction (Figures 13 through 16). With almost no primary documentation about the extent or condition of the stone walls at the time of WPA reconstruction, the question of how much, if any, of the Civil War-era stonework still exists at Fort Negley has, as yet, no definitive answer.

In approaching this question again for this HSR, elevations at the bases and tops of the walls and at the tops of earth berms at the inside and outside points of each redan shown on the 1864 plan of Fort Negley (see Figure 10) were compared to the 2013 elevation survey of the fortification (Appendix F). In order to compare the elevations, it was first necessary to correlate the ground elevations on the 1864 plan (elevations given in distance above the water level of the Cumberland River) to those of the 2013 survey (elevations above mean sea level established by the two U. S. Coast and Geodetic Survey monuments USCGS "Negley 1959" and "Negley No. 1 1959" atop the East Ravelin). Such a correlation relies on several assumptions, not the least of which is that the 1864 plan accurately represents the fort as it was built.

12 Allen, *Report of 1999 Investigations*, 70.
13 "Fort Negley Master Plan," Section 3.0 Architecture, 27.

Civil War surveys denote an elevation of 261 feet above the Cumberland at the center of the stockade. In 1999, archaeologists identified a hard layer of subsoil, approximately 18 inches below the current grade, as the original compacted floor of the fort at southwest corner of the stockade. Subtracting the 18-inch difference from the existing surface elevation of approximately 620 feet above mean sea level at this location, the 1864 summit elevation is calculated to be 618.5 feet above mean sea level. This value was assumed to equate with the Civil War-era grade. The difference between the 261-foot spot elevation on the Civil War plan and the 2013 survey is therefore calculated to be 357.5 feet (618.5 feet minus 261 feet equals 357.5 feet). Spot elevations on the 1864 plan were thus increased by this assumed value in order to compare the converted 1864 plan and current toe grades of the walls in a uniform manner (Appendix D).

In order to compare the configurations of wall heights and grades in 1864 and 2013, a table listing the information described above was prepared (see Appendix D, page D-2). The differences in grade and wall heights between the 1864 plan and 2013 survey were color-coded on a key map (see Appendix D, Page D-1) to illustrate and compare the height changes at each location. The following conclusions may be drawn from this comparison:

- Except for Redan Nos. 1 and 2, existing walls at all redan points are shorter than those shown on the 1864 plan, with height reductions ranging from 11 inches to 3.5 feet. (Walls at the points of Redan Nos. 5 and 6 are substantially collapsed, consequently, a comparison of heights there is not instructive.) The ground level also appears to have been raised at all the redan points, except Redan No. 2 where the grade line is now almost four feet below the 1864 mark. The differences in ground level are substantial at the points of Redan Nos. 3, 4, 5, and 6, ranging from nine inches to 3.5 feet higher than in 1864. The amount of the grade change at the points of all redans except at Redan Nos. 2, 5, and 6, strongly correlates with the reductions in wall heights at those points, while the lower grade at Redan No. 2 is offset by an increase in wall height to nominally match the original. Except for Redan Nos. 5, 6, and 8, the 2013 survey top elevations of all redan points are within six inches of the 1864 plan elevations. (See parenthetical note above regarding Redan Nos. 5 and 6.) The point of Redan No. 8 is 12 inches lower.

- Existing wall heights at intersections of redan returns are lower than the 1864 walls (except at the Main Sally Port). Height reductions range from 0.19 inches to 3.4 feet, but most of the walls are about one foot to 1.5 feet shorter. Again, the grade levels at all of the redan returns appear to have typically been raised about 1.5 feet (2.8 feet in two locations) except where redans adjoin the Main Sally Port and the East Bastion. The shorter walls and elevated grades appear to be related.

- Existing walls at the East and West Bastions are higher than the 1864 walls. The West Bastion walls are approximately 2.25 feet to three feet taller than shown on the 1864 plan and the grade level has been lowered two feet to 2.25 feet below Civil War levels. Existing east Bastion walls are more than five feet higher than those shown on the 1864 plan at the mid-point of the east wall to approximately one foot higher at the southernmost points. The ground levels appear to have been raised one foot to 1.5 feet.

- The existing ground level at the toe of the exterior face of the North Main Works is 1.6 feet lower than that shown on the 1864 plan near the Main Sally Port, but the wall is nominally the same height (four inches taller). The east end of the wall is about three inches shorter and the grade is six inches higher, close to the original dimensions. Unlike other areas where the ground level appears to have been raised, concealing Civil War remnants, it may be that the lower portion of the North Main Works wall is original Civil War construction on which missing courses were rebuilt by the WPA to match the wall heights shown on the 1864 plan.

- The existing South Main Works wall is much taller than the 1864 wall, the western end being about three feet higher and the eastern end about four feet higher. This represents an average height increase of 50%. The toe grade is six inches lower on the western end and one foot higher at the eastern end. This grade change alone does not account for such a significant increase in the wall height, which must be attributed to WPA construction.

An overlay of the topographic elevations and wall heights at Redan No. 1 from the 1864 plan onto the rectified photographic elevations of the current fortification walls depicts the dimensional relationships between the conjectural 1864 and existing walls and the topography (see the example in Appendix D, page D-3). The comparison graphically demonstrates the significant height of the earth fill shown to be piled on top of the redans in the 1864 plan.

A large portion of the Civil War fortification consisted of earth fill between stone retaining walls and parapets, with grades sloping upward to the inner walls. These berms protected the parapets and interior banquettes from cannon fire while giving the defenders a clear view of attackers (Figure 17). The weight of this fill, or surcharge, and of water saturating the fill would have quickly impacted the stability of the lower retaining walls, overturning stonework as the forces from these large mounds of earth pushed outward and raised the grades at the base of the redan walls. As reconstructed by the WPA, the berms presently bear scant resemblance to the historic profiles. Wall heights in the WPA work were increased, requiring additional quantities of fill material to supported by these dry-stacked stone walls, at the bastions and South Main Works. The presumed collapse of the original redans may also account for a shift between the alignment of the original works and the reconstructed footprint.

Bastion Tunnels and Bombproofs

The southern bastions are entered along the north side from the East and West Ravelin ditches. Stepped areaways in the ravelin ditches lead to terreplein tunnels constructed of dry-stacked stone with solid stone lintels spanning the widths of the openings and covered with earth (Figure 18). The tunnels lead to small, enclosed intermediate rooms (Figure 19) and beyond to lateral gallery-like spaces (casemates) at the lower firing banquettes (Figure 20). These galleries are open to the sky and partially filled with collapsed rubble and earth from the reconstructed casemates or later failed repairs.

Two sets of stone steps at the east and west sides lead up to the grass-covered berms atop the highest tier of each bastion (Figure 21). Adjacent to these steps, stone-walled passages (now open to the sky but once bombproofed with timber and earthen roofs) lead to square blockhouse spaces (also now open but originally bombproofed) which are filled with the debris from previous collapses.[14] Access to these spaces was limited due to the instability of the retaining walls.

14 Heavy timber and earthen bombproofs were reconstructed, along with the interior stockade, by the WPA. These fell into disrepair and the stockade was removed in the 1940s; however, collapsed remains of the reconstructed timber blockhouse structures at the bastions were still visible in 1975, as shown in FNVC file photographs.

The 1999 structural repair drawings and observation of exposed geotextile and geogrid reinforcement indicate that the East Bastion walls were repaired using the hybrid reinforced earth method described in Chapter I.3. The West Bastion walls are dry-stacked, ashlar stone used in the WPA reconstruction and incorporate shoring for the tunnel roof.

Archaeological Features[15]

Archaeological investigations in 1993 and 1999 concluded that undisturbed primary Civil War deposits are unlikely to be found above depths of 18 inches below the surface inside the fort and adjacent to exterior walls, with many of the shallower deposits likely destroyed by WPA reconstruction methods[16] or deeply buried in landscaping fill spread over the site.[17] Archaeologists have concluded that some portions of Civil War-era stone parapets and banquettes are likely to exist under WPA construction (Figure 22) but could not correlate survey reference points with any verifiable Civil War features on the 1864 plan which might indicate the locations of original construction.[18] Test units excavated in 2007 exposed a trench feature denoting the V-shaped center bastion on the east side of the stockade and the adjoining palisade walls (Figure 24) including post holes (albeit with evidence of WPA disturbance) at or above the presumed 18-inch Civil War deposit line.[19] Variations between the 1864 plan alignment and dimensions of fort walls and contemporary land surveys, analyzed again for this HSR and incorporating point data from the 2007 flagpole excavation, appear to support the conclusion that today's fort, while a faithful reproduction of its original shape, does not fully align with the 1864 plan[20] (Figure 23).

All of the studies recommend preserving the Civil War and WPA-era archaeological resources of the entire site (including the park). There may be buried evidence of the adjoining earthworks into which Fort Negley was integrated, troop quarters outside the Main Sally Port, contraband camps, and postwar freedmen encampments.[21] Efforts were made during the 1999 repair campaign and again in the 2004 park improvement project to minimize soil compaction and to monitor the work for archaeological discoveries.

Archaeological investigations were undertaken in support of the structural engineering review undertaken for this HSR (see Appendix E). The footings exposed in "Trench 2," on the east side of the East Bastion were constructed in stepped fashion to accommodate the southward slope of the hillside. The wall was built on base courses of limestone blocks placed atop limestone slabs and residuum. As in previous archaeological studies, there was insufficient evidence to establish a date of construction for any or all portions of the work.

Landscape Features

Many of the landscape features at Fort Negley related to visitor access and interpretation

15 See Appendix F for a summary of previous archaeological investigations.
16 Allen, *Report of 1999 Investigations*, ii, 71. Allen (25-26) also indicates that field notes for the 1993 "excavation exposed an archaeological feature interpreted as a hearth (Feature 1) associated with winter quarters for the fort's garrison." Sketch on graph paper titled 'A - Fort Negley "Area 6," T. McClung (Unit 29), 10-28-93, South [West Ravelin] "Ditch" shows red bricks and an iron canteen and cup at a depth of "47 cm B.S." (18.5 inches below surface).
17 Bergstresser et al, *Fort Negley 130 Years Later*, 70, although presumed cisterns were encountered slightly less than one foot below the surface, 32-33. 1993).
18 Bergstresser et al, *Fort Negley 130 Years Later*, 51-53.
19 Alexander et al, *Phase II Archaeological Investigation of Fort Negley Proposed Flagpole Installation Site*, 40.
20 Bergstresser et al, *Fort Negley 130 Years Later*, 1.
21 Allen, *Report of 1999 Investigations*, 72-73.

were constructed between 1935 and 1941 in the rustic style that characterize American public park design in those years. These features include the entrance gate composed of massive stone pylons and free-standing stone walls, native stone walls along the loop road and the parking area, drainage inlets and culverts, stone stairways, gravel paths, and stone edging along the road and paths.

Park Entrance Gate and Walls

Fort Negley's entrance gate was constructed by the WPA in the 1930s as a grand entrance into the new park. The gateway is composed of the entrance portal—a symmetrical composition of pylons and piers—and two free-standing wing walls that extend south and west in curving lines from the end piers of the portal. The imposing Gothic Revival stone entrance portal (Figure 25), with its two-story pylons, arched central opening, and crenellated parapet, suggests the towers and battlements of an ancient fortification, a design appropriate to the military character and significance of the Fort Negley site.

The portal is a symmetrical composition constructed of hammer-dressed, native limestone, arranged in a broken-ashlar pattern. Its central feature is a wide opening with a projecting V-shaped sill and crowned with a Roman arch and gable. The arched opening has smooth hammered voussoirs and keystone and is flanked on each side by a rectangular opening topped with a crenellated parapet, and then by two 25-foot pylons with inset niches backed with smooth hammered limestone slabs. Two similar pylons, freestanding to the north and south, frame the entrance and exit drives which pass between the paired pylons (Figure 26). The outer pylons connect to low walls that, with a low pier at each end, frame pedestrian openings at both sides of the portal.

Two freestanding curved wing walls extend south and west from the low piers which frame the pedestrian entrances on each side of the entrance portal. Constructed of irregularly-coursed native limestone fieldstone and terminated by low piers, their simple design references the design of the gateway pylons. The west wall extends approximately 250 feet in a generous curve to meet Fort Negley Boulevard and the south wall extends approximately 350 feet to meet the intersection of Fort Negley Boulevard and Chestnut Street. These walls once flanked the entrance and exit lanes of a "wye"-type vehicular entrance (Figure 27) that has been since replaced by a boulevard-type configuration (see Loop Road, below).

An orientation plaza, including furnishings, and signage, was added on the fort side of the entrance gate in 2004[22] with design approval by the Metropolitan Historical Commission. A flagpole (2007) is set in the lawn on the opposite side of the loop road and aligned with the central axis of the portal behind the WPA monument.

Loop Road

A half-mile-long, asphalt-paved, curving loop road leads from the entrance portal, up St. Cloud Hill, around the fort, and back to the portal (Figures 28 and 29). Constructed in the 1930s of gravel, the road is typical of loop road developments used throughout public parks influenced by the National Park Service (NPS). The park loop as a feature of twentieth-century public parks was influenced by the circular drives of estates designed in the English gardening tradition, which were designed to reveal a series of scenic views. At Fort Negley, the loop drive would have provided a series of views of both the fort structure, and of downtown and suburban Nashville when it was first constructed. In addition,

22 *Visitor's Center Interpretive Plan*.

at the northeast corner of the fort, a small gravel parking area was created to provide a scenic vista to downtown Nashville. The views and vistas that were once available along the loop road and the parking area are now screened by secondary tree growth.

As an added benefit for public parks, these loop drives allowed for a smooth flow of vehicular traffic without introducing elements like right angles or stop signs. The original intersection of the loop road with Fort Negley Boulevard was of the "wye"-type, a divided roadway with a central island that was the standard used by the NPS where side roads met a main park road (see Figure 27). This enabled traffic to leave the main road without stopping or negotiating a right-angled turn, which tended to interrupt and slow traffic; likewise, traffic leaving the loop road could merge into the main road without making an abrupt turn.[23] A comparison of topographic maps from 1964 to 1984 suggests that between 1964 and 1971, the east fork of the loop road entrance was closed. Further comparison also suggests that the "wye" intersection was replaced between 1980 and 1984 with the present 180-foot-long, boulevard-type configuration.[24]

The loop road remained gravel-paved until its central portion was resurfaced in asphalt in 2004 to improve accessibility for disabled or physically challenged visitors. The road was noted to be gravel-surfaced and ten feet wide in 1996, but it is not known if this was its original condition or if the original roadway surface extended out to its limestone edging.[25] At ten feet wide, the asphalt path is between four and fourteen feet narrower than the road width established by the location of the WPA stone curb along its edge. The unpaved portions of the original roadway are now kept in turf, gravel, or leaf mulch. Approximately 750 lineal feet of the loop road in two areas, south and east of the fort, have relatively flat profiles which inhibit storm water runoff.

Loop Road Retaining Wall

A low, random-coursed, native limestone ashlar wall runs along the outside of the Loop Road from the entrance portals to the WPA-era parking lot (Figure 30). The wall is capped with a slightly convex layer of mortar, shaped thus for positive drainage. On the inside, the height of the wall averages around twelve inches. The outer side is as much as twenty-four inches high in some locations where it functions as a low retaining wall.

The wall does not appear in aerial photographs of the site dating from 1936 to around 1940. A November 1936 aerial photograph (Figure 33a, see also Figure 7) shows bollards or posts edging the outside of the loop road between the parking area and an intersecting access road which ran downhill toward the southeast past an open quarry area. The abrupt drop-off at the top of the quarry was also edged by the same posts. A February 1937 aerial photograph (Figure 33b) shows the posts replaced by a border of upright stones. A 1940 aerial (Figure 34)[26] shows the quarry access road abandoned and the edging stones removed but does not show the current stone retaining wall on the outer edge of the loop road ascent. The present retaining wall would, therefore, appear to have been constructed after 1940, but possibly before the park was opened to the public as the stone exhibits a patina similar to that of the parking area parapet wall.

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23 McClelland, *Building the National Parks*, 214-215.

24 Historical Aerials by NETR Online, http://www.historicaerials.com/, accessed August 21, 2013; and, "Fort Negley Master Plan," Section 4.0, SITE.

25 "Fort Negley Master Plan," Section 4.0, SITE.

26 The photograph is annotated "WPA–1940" but this post-dates the completion of the WPA project.

Parking Area Retaining Wall

The WPA constructed an automobile parking area along the loop road northeast of the fort near the foot of the fort road and adjacent stone stairway (Figures 31 and 32). A November 1936 aerial photograph (Figure 33a) appears to show this parking area as a graded platform extending level with the top of the existing dry-laid stone gravity retaining wall over the downhill slope with bollards or posts bordering the perimeter as a guard or bumpers, also seen in a postcard view (Figure 7). The posts are replaced by large boulders in the aerial photograph dated February 1937 (Figure 33b).

A 1940 aerial photograph (Figure 34) shows the boulders at the parking area replaced by the current stone parapet wall, built on top of the dry-laid stone retaining wall (Figure 35). The dry-laid retaining wall was augmented by the installation of four concrete buttresses along the toe (downhill) side of the wall. Three of these buttresses are positioned on the northern half of the wall length with the remaining buttress being positioned within the southern half.

The parapet wall has an average two-foot height above parking grade on the inside face (four feet high above the top of the dry-stacked retaining wall on the outside face) and is approximately 27 inches thick, constructed of mortared, hammer-dressed, native limestone, arranged in a broken-ashlar pattern that matches that of the entrance portal with mortared rubble infill (Figure 36). The wall is capped with 31-inch wide by five-inch thick slabs of hammer-dressed limestone, around five inches thick, with a shallow reveal.

Fort Road

A short, asphalt-paved road rises steeply from the loop road near the parking area to the Main Sally Port at the northeast corner of the fort, providing access to the fort summit for pedestrians and maintenance vehicles (Figure 37). Originally a gravel road, it was also paved in asphalt in 2004. The road is lined on one side with a low limestone curb and on the other with a low, limestone retaining wall that stands between it and the stone stairway to its north.

Fort Road Retaining Wall

A low, random-coursed, native limestone ashlar retaining wall supports the fort road on its north side for most of its length (Figure 38) and is concealed by heavy vegetation.

Drainage Inlets and Culverts

A system of underground channels and drop inlets, developed as part of the WPA park improvements in the 1930s, drains overland runoff from the fort (Figure 39). Stone box inlets are regularly spaced approximately fifty-five feet apart inside the loop road, beginning at inlets adjacent to the fort road and summit stairway at the high end of the site, diverting and capturing surface run-off into one of two stone-lined and capped subsurface culverts following the arc of the road. Each leg of the culvert system descends the hill to join at the low end in a new concrete catch basin near the flagpole. This catch basin has a cast iron grated yard drain and discharges through a buried corrugated plastic drain line running under the loop road to a stone and concrete outlet in the lawn north of the entrance gate wing wall. Stormwater then flows over the lawn surface and off-site into the Nashville stormwater system (Figure 40).

Some of the drop inlets are still protected by limestone slabs set on low rubble stone corner blocks, a design consistent with the rustic style of 1930s park design (Figures 41 and 42). Only a few of these inlets are readily visible in the landscape. At many locations the limestone slabs have been replaced with precast concrete caps (Figure 43).

A drain inlet is also located in the middle of Redan No. 4 at the lowest elevation inside the fort. There is no evidence of a canal or drainage system leading to this inlet nor could an active discharge point be found.

Stone Stairways

There are two stone stairways at Fort Negley that were constructed as part of the WPA fort reconstruction project:

A 220-foot-long limestone slab stairway leads from the loop road at a point across from the parking area, up the hill at a gradient of around 8 percent, to meet the summit of the fort road (Figure 44). This summit stairway was constructed of large slabs of native limestone ranging from two to four feet in width and length. The treads of the stairs are smooth and weathered, but the risers have a hammered finish that matches that of the entrance portal and the parking lot wall. The stairs rise quickly in their lower reaches, but after a few feet begin to flatten out into long landings paved in smaller limestone flagstones (Figure 45).

A second, lower stairway leads from the loop road down toward Fort Negley Boulevard and the nearby Adventure Science Center (Figure 46). It once connected the end of the gravel footpath from the fort summit with a footpath that led into a residential neighborhood on the west side of the park. This neighborhood was demolished to make way for I-65, and the lower footpath is no longer evident in the landscape.

Gravel Pathway

A gravel pathway leads from the fort summit to the loop road and beyond to access the lower stairway. When it was first developed in the 1930s, it led to the neighborhoods to the north and west of the fort. The gravel pathway is lined with limestone flagstone set on edge; a similar treatment is seen along the edge of the loop road (Figure 47). The gravel is a mix of crushed grey limestone and quartzite river pebbles in orange, brown, and white.

Stone Edging

The loop road, the fort road, and the gravel pathway are all edged with thin, 2-4" thick limestone flagstones set on edge and placed end to end. The use of local materials for roadway and pathway edging is typical for a design influenced by the NPS rustic style.

Vegetation

Vegetation within Fort Negley Park consists of a varying combination of forest cover, mainly dense tree canopy with woody understory; rough grass cover with scattered trees; and mowed turf with scattered trees.

The forest cover comprises primarily secondary growth that has developed since the fort was reconstructed by the WPA in the 1930s, and includes hackberry (*Celtis laevigata*), locust (*Robinia sp.*), Osage orange (*Maclura pomifera*), hickory (*Carya sp.*), "gum" (sweet gum), and tree-of-heaven (*Ailanthus altissima*).

Woody understory species include primarily aggressive and invasive species, such as bush honeysuckle (*Lonicera maackii*), privet (*Ligustrum sp.*), Japanese honeysuckle (*Lonicera japonica*) and mulberry (*Morus sp.*).

The rough grass cover includes a mixture of lawn grasses, native grasses, native perennials, and invasive annuals. Mowed turf, consisting primarily of tall fescue, covers the upper level of the fort summit and the open lawns close to the entrance and Fort Negley Boulevard.

Views and Vistas

St. Cloud Hill was chosen as the site for Fort Negley during the Civil War because of its commanding height, affording unobstructed views into the Browns Creek valley to the south and the lines of Union defenses protecting the southern perimeter of Nashville (Figure 48).

Today, from the fort summit, one can also see Peach Orchard Hill, a key location in the Battle of Nashville (Figure 49), Rose Park (Figure 50), which was Fort Morton during the war, and Reservoir Park, which was the Casino Blockhouse. These viewsheds, along with the viewshed to downtown Nashville, were identified in the 1996 Fort Negley Master Plan and recommended for clearing (Figure 51).

These contributing views were enhanced with interpretive signage in 2004. During the winter, one can also see the back and roof of the Adventure Science Center and Greer Stadium with its parking lot, both large, noncontributing elements in the viewshed.

Signage

The 2004 "Phase I" Fort Negley Park improvements included installation of an orientation plaza with interpretive signage on the north side of the entrance gate and interpretive panels throughout the park. The interpretive signage has a well-designed heavy industrial aesthetic. It received a Merit Award by the Tennessee Chapter of the American Society of Landscape Architects in 2006.

Constructed of weathered steel (CorTen brand) with large bolted connections and cut-out details referencing the star-shaped fort plan, the system consists of three basic sign types: (1) free-standing steel panels (some set in tubular steel frames) welded to or bent to form flat base plates which are bolted to the pavement or wood decking, or else set on the ground with the base plates held in place by V- or redan-shaped Indiana limestone plinths to avoid ground disturbances by post holes, (2) steel plates sandwiched between and through-bolted to either triangular or rectilinear Indiana limestone "bookends" or else mounted atop cubic limestone plinths set on the ground, and (3) steel "desktop" panels with decorative bolts mounted on Indiana limestone plinths (Figures 52 and 53, and see Figures 49 and 50). Phenolic graphic sign panels mounted on the steel plates have a specified ten-year warranty, with a non-fading guarantee for 1200 hours.

A sign panel listing "visitor responsibilities" and matching the interpretive signage system is located inside the Main Sally Port adjacent to the boardwalk entering the East Ravelin ditch. Other regulatory signs—simple, white block lettering on a brown background—are mounted on the top rails of barricades and direct visitors to stay on designated paths and stay off the stonework. A rectangular sign (black lettering on white background, not matching any of the other signage) is mounted on a 4x4 post above the Visitor

Center mailboxes near the park entrance gate ("Please Help Keep Fort Negley Clean..."). A similarly-styled sign is mounted on the barricade outside the Main Sally Port to advise visitors that boardwalks are slippery when wet and to use caution.

Boardwalks and Decks

"Phase I" Fort Negley Park improvements also included a system of surface puncheon-style boardwalks providing pedestrian access to various features of the fort, including elevated overlooks at Casemate No. 1 and Casemate No. 2 and a series of interpretive nodes with benches. The boardwalks and decks, designed to evoke the timber construction details of the Civil War casemates and blockhouses, are constructed of treated 4x4 timber stringers stacked in "Lincoln Log" fashion resting atop the ground surface on gravel leveling bases to protect archaeological deposits below and allow removal without disturbing these resources.

The stacked stringers vary in height according to the topography to create level bases for the boardwalks. 2x6 treated wood decking or planking is laid across the stringers and secured by lag screws through treated 4x4 timbers laid perpendicular to the planking at the edge (Figures 54a and 54b). An elevated, treated timber ramp structure descends from the West Sally Port into the West Ravelin ditch.

At present, the boardwalk in the East Ravelin ditch terminates in a dead end loop at an interpretive panel adjacent to the East Bastion tunnel entrance, near the East Sally Port. The walkway makes a similar dead end loop at an interpretive panel and bench in Redan No. 4 adjacent to the West Sally Port.

Furnishings

The orientation plaza is furnished with custom cut redan-shaped limestone plinths complementing the interpretive signage, steel ribbon benches with arms and backs (DuMor Bench 19 with a red powdercoat finish, Figure 55) and matching steel ribbon trash receptacles (DuMor 157 Series). A steel pipe bike rack (DuMor Bike Rack 125 or 130 Series matching the bench color) for five bikes is located in front of the wing wall on the north side of the park entrance gate.

A bronze-anodized aluminum flagpole, approximately 30-foot tall with internal halyard, was installed around 2007 and set in a concrete footing within the lawn inside the loop road on-axis with the portal and an adjacent engraved stone dedication monument. The monument inscription reads "FORT NEGLEY Built by Federal Forces 1862 Restored by W. P. A. 1936."

Steel ribbon benches matching those at the orientation plaza are placed on concrete pads at intervals along the loop road and at interpretive stops along boardwalks at the fort summit (see Figure 52). The limestone plinths used to anchor interpretive signage may also be used *ad hoc* as benches. A wood picnic table is set on an aggregate pad with timber edging located west of the loop road on the "downhill" circuit approaching the park exit.

A system of barricades, designed as part of the 2004 improvements, is formed with wood sawhorses bolted together is used to control access to certain portions of the fort (Figure 56). Their character is well-suited to the setting.

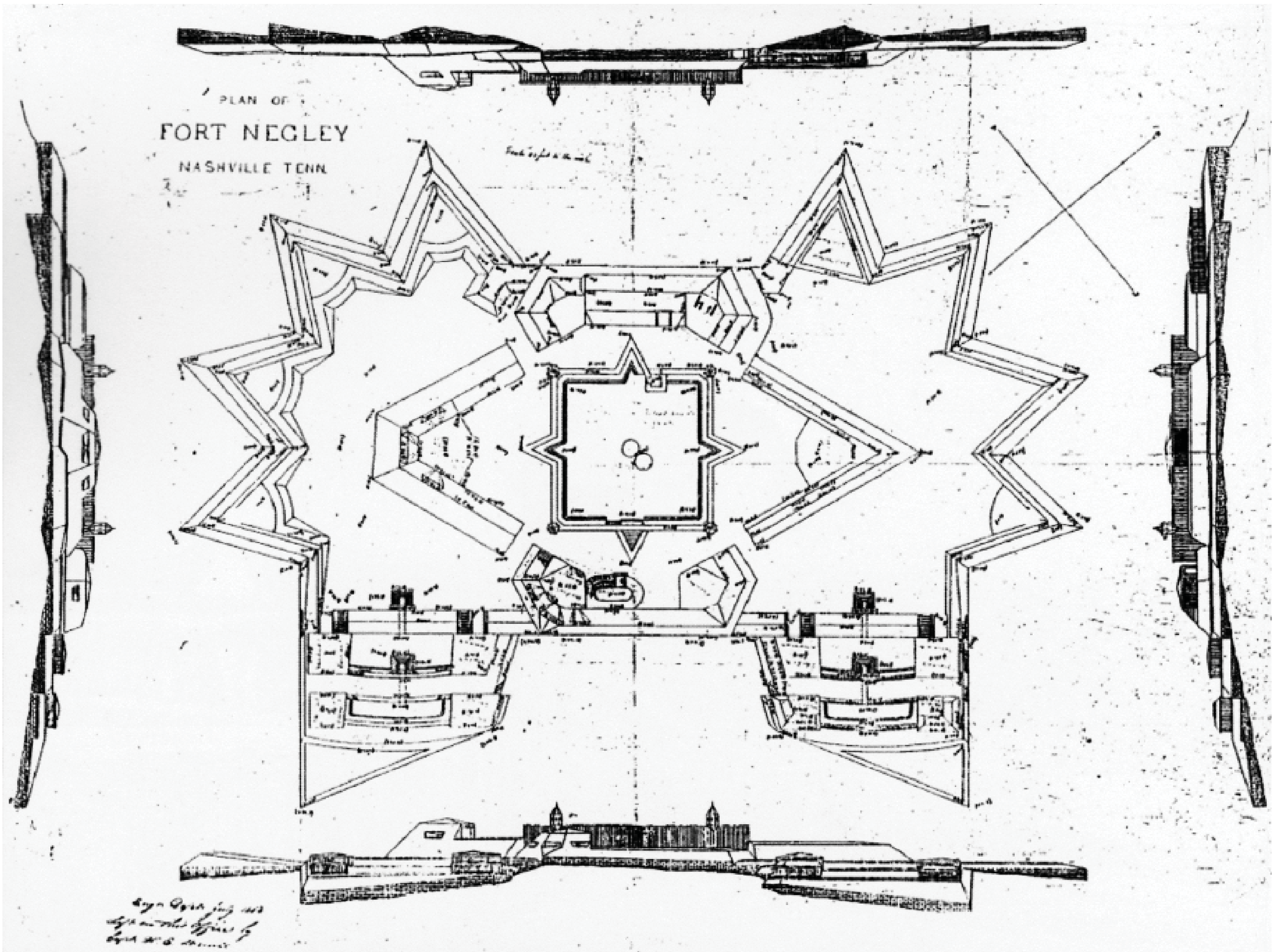


Figure 10 (above). "Plan of Fort Negley, Nashville, Tenn., Engineering Department July 1864, ...by W. E. Merrill." National Archives Cartographic Division (FNVC).

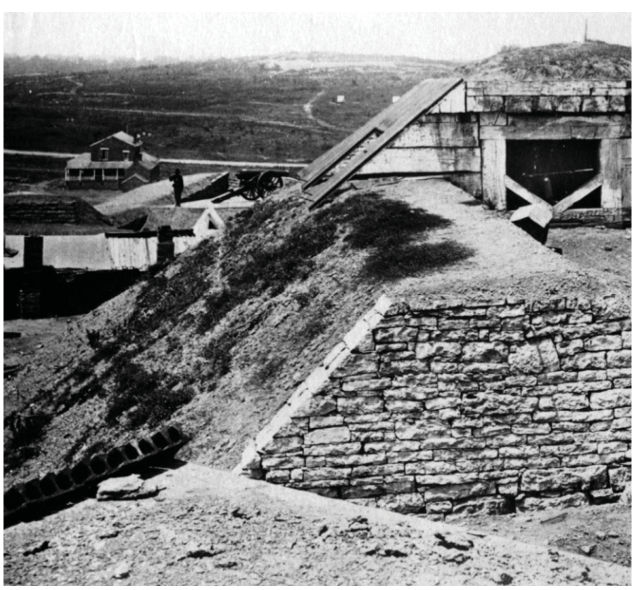


Figure 11. 1864 photograph at South Sally Port and bombproofed Casemate No. 1. Coursed rubble exterior stone facing with rough rock-faced texture. Library of Congress (FNVC).

Figure 12. Wall stabilization failure from Geologic Engineering Consultants March 28, 2000, report to Metro Parks and Recreation Board (FNVC).

Filter fabric at left installed over existing rubble fill, new gravel fill behind stone masonry, and horizontal geogrid intended to tie the stone back to the fill.

Figure 13. East Bastion, west exterior wall with earth berming (JMA, 2013).

Figure 14 (below). Inner works (West Sally Port) with earth berming (JMA, 2013).

Figure 15. Coursed rough dry-stacked masonry (JMA, 2013).

Figure 16. Coursed dry-stacked ashlar (JMA, 2013).

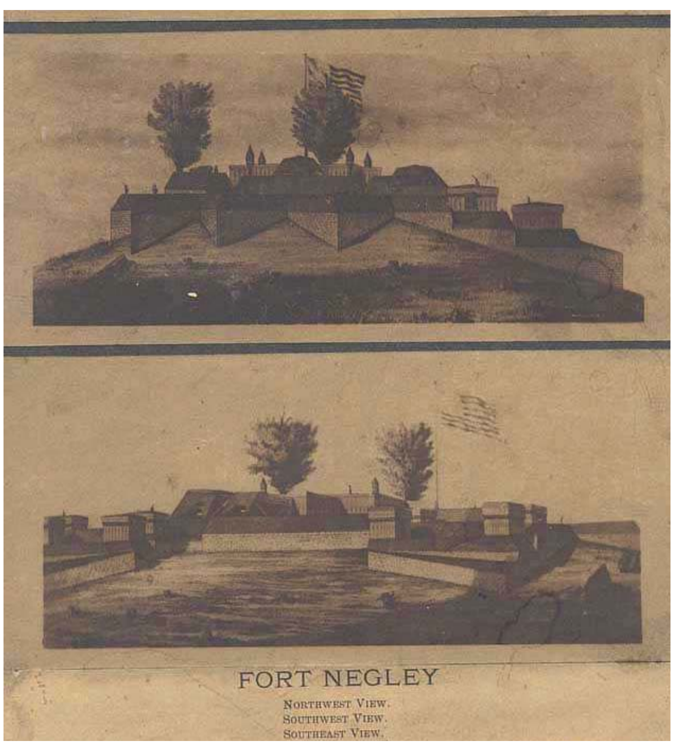


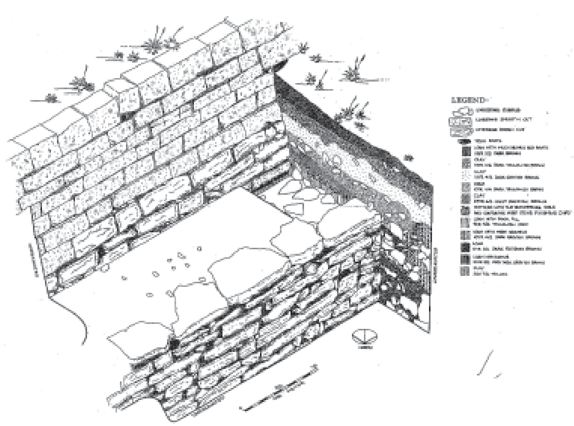
Figure 17. Illustration of earth and masonry fortifications. Tennessee State Library and Archives (FNVC).

Figure 18 (above). East Bastion Tunnel (JMA, 2013).
Figure 19 (above, right). East Bastion Tunnel (JMA, 2013).

Figure 20 (right). East Bastion, terraced banquettes at southeast corner of the fort (JMA, 2013).

Figure 21 (lower right). East Bastion, steps from East Ravelin ditch to top of inner parapet (JMA, 2013).

Figure 22 (below). Isometric view of South Main Works parapet showing WPA additions to Civil War construction at lower wall and banquette. Bergstresser et al, *Fort Negley 130 Years Later*, 50 (FNVC).



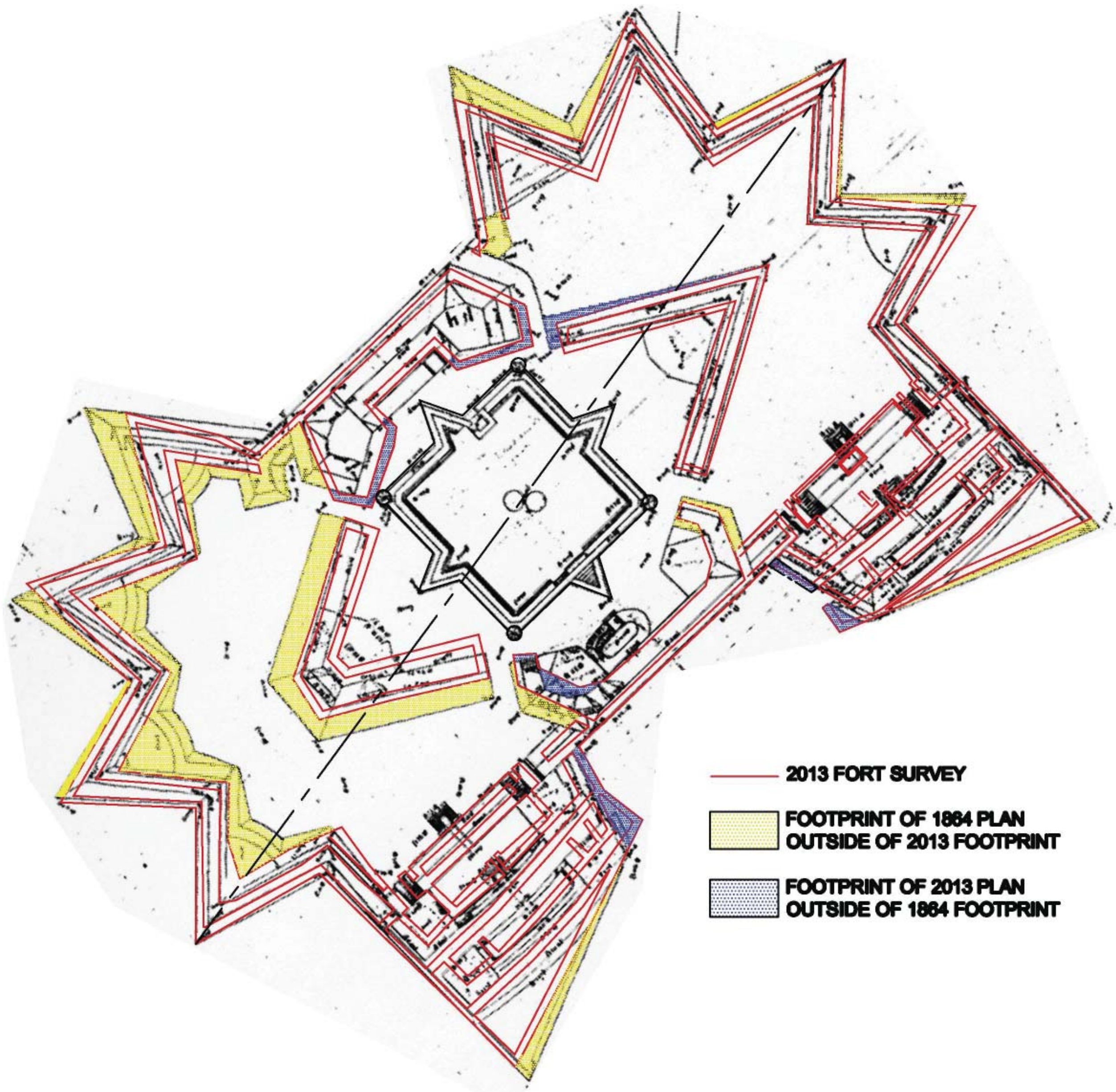


Figure 23. 1864 plan overlaid with 2013 plan survey: red outline is the 2013 survey; yellow hatch is 1864 footprint falling outside the 2013 footprint; blue hatch is 2013 footprint falling outside of the 1864 plan footprint (JMA, 2013).

The 1864 plan is scaled and rotated so that outer points of Redan Nos. 1 and 7 are contiguous with 2013 survey points in order to correlate the scale of each plan without reference to any centerpoint. This results in the alignment of the outside walls of the North and South Main Works in both plans but also reveals variances between alignments of bastions and redans as they exist in 2013 and the presumed "as built" bastions and redans in the 1864 plan. This lack of congruity was observed in the report of the 1993 "Panamerican" archaeological investigation (Bergstresser et al., *Fort Negley 130 Years Later*, 51-53). Inner stockade dimension, as re-scaled above, is 96.45 feet square.

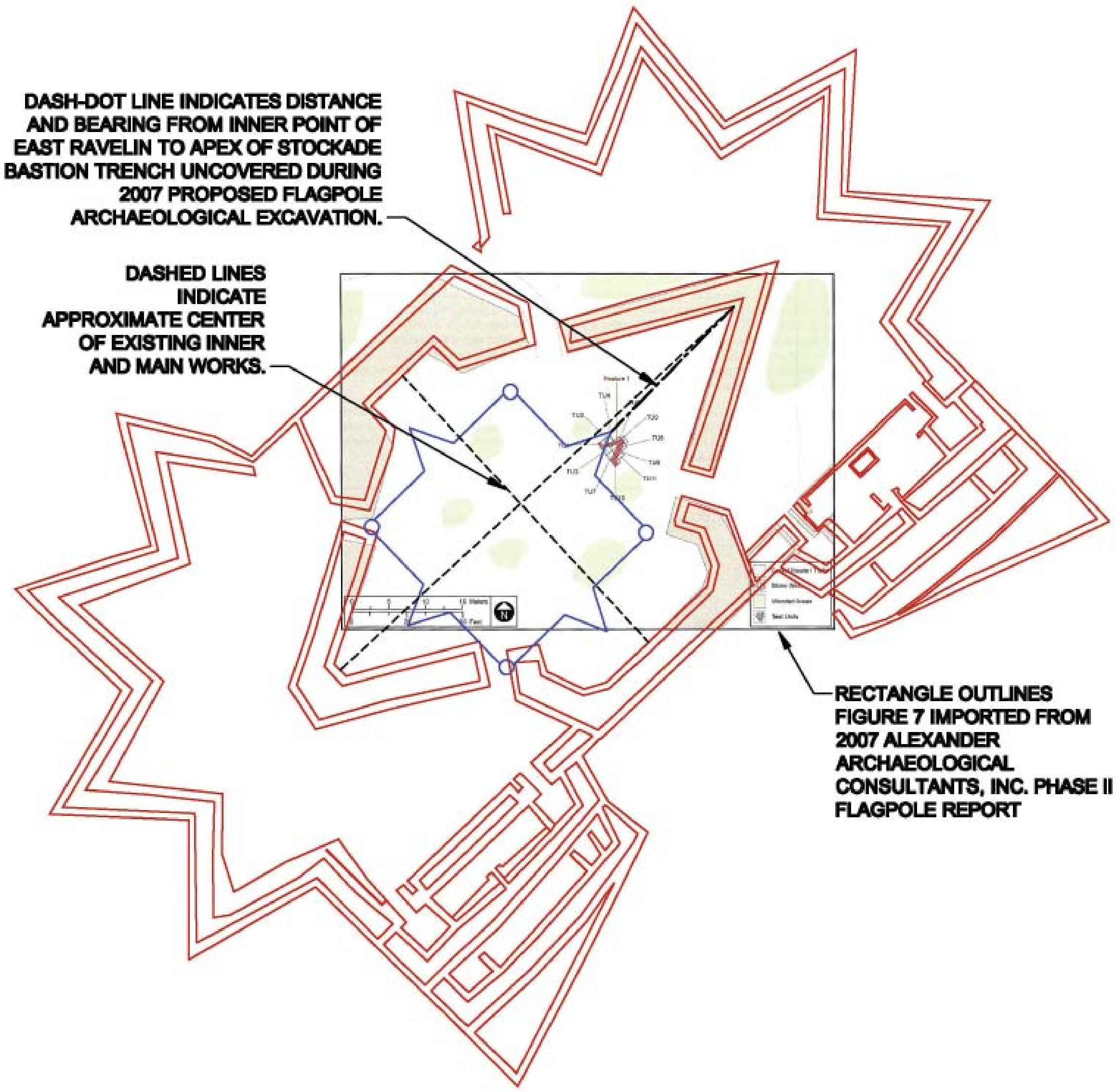


Figure 24. Overlay of 'Figure 7' from 2007 report of Phase II archaeological investigation at east stockade bastion trench (rectangular outline) on 2013 survey (red outline). Graphic scale of 2007 drawing has been matched to 2013 survey. 2013 drawing has been rotated to align with the East Ravelin in Figure 7 (JMA, 2013). This overlay and Figure 23 illustrate the problems of trying to reconcile the 1864 plan with extant construction in determining what, if any, of the existing work might date to the Civil War.

Heavy dash-dot line extending from inside corner of East Ravelin shows distance and bearing to apex of stockade bastion as recorded in GPS data provided by Middle Tennessee State University's Fullerton Laboratory for Spatial Technology. The blue stockade outline (same size shown in Figure 23) is placed to fit the GPS data, but 'Figure 7' does not align with this data. The excavated stockade is not centered in the fort as shown on the 1864 plan. Superimposing the 1864 stockade (blue line) using GPS data places the footprint too far south to correlate with the dashed centerline of the inner works as surveyed in 2013. A full understanding of these anomalies is impossible without further archaeological study.

Figure 25. Fort Negley Park entrance gate (JMA, 2013).

Orientation plaza located behind central portal feature. Flagpole erected 2007.

Figure 26. Fort Negley entrance portal, ca. 1937. WPA records at National Archives (FNVC).

Figure 27. Fort Negley entrance, February 14, 1937. Walter Williams, Jr. Collection, Nashville Metro Archives (FNVC).

Aerial photograph of original entrance road layout as "wye" intersection, typically used by National Park Service for loop road entrances to allow smooth flow of traffic into and out of a scenic area. Exit fork aligned with extension of Olympic Street, later demolished for I-65 construction. Entrance fork would have provided smooth transition from Fort Negley Boulevard.

Figure 28. Fort Negley loop road looking toward Visitor Center (JMA, 2013).

10-foot wide asphalt travelway functions primarily as walking path and maintenance access road—original gravel paving ranged from 10 to 14 feet and extended to limestone curbing on either side

Figure 29. Fort Negley loop road on north side of fort curving eastward toward parking area (JMA, 2013).

Original road narrowed in this stretch, evident in the closer spacing of the limestone curbs.

Figure 30. Low stone retaining wall parapet along the south side of loop road (JMA, 2013).

Greer Stadium beyond is partly screened by trees.

Figure 31. Fort Negley parking area approach via loop road (JMA, 2013).

Figure 32. South end of parking area wall (JMA, 2013).

End of wall also marks end of loop road retaining wall at right.

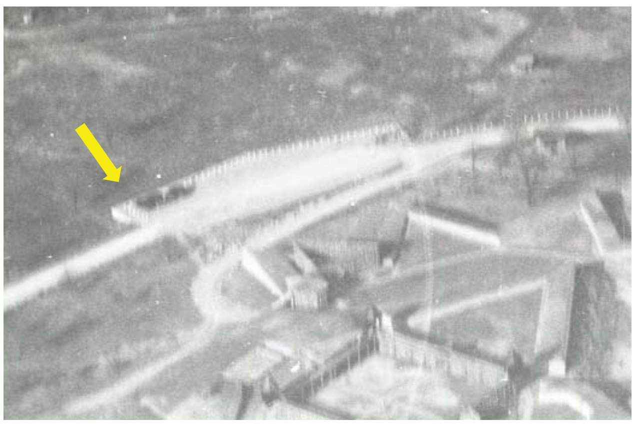


Figure 33a. Fort Negley parking area, November 12, 1936, with bollards or posts edging parking area and outer edge of loop road. Walter Williams, Jr. Collection, Nashville Metro Archives (FNVC).

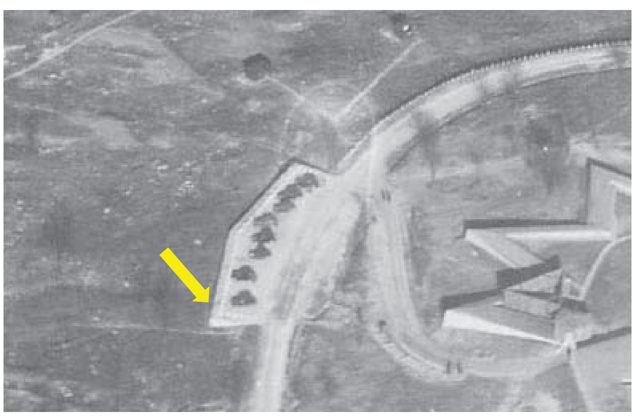


Figure 33b. Fort Negley parking area and loop road, February 14, 1937, with large stones replacing posts. Walter Williams, Jr. Collection, Nashville Metro Archives (FNVC).

Figure 34. Fort Negley parking area in 1940, border stones replaced by stone parapet around parking area. WPA photo, Walter Williams, Jr. Collection, Nashville Metro Archives (FNVC).

Figure 35. Northeast corner of parking area retaining wall and parapet (JMA, 2013). The loop road wall in the foreground abuts the southeast end of the parking area parapet.

Figure 36. Cross-section of mortared stone parapet at parking area (1200AE, 2013).

Figure 37. Fort road approaching the Main Sally Port (JMA, 2013).

Figure 38. Fort road retaining wall (JMA, 2013).

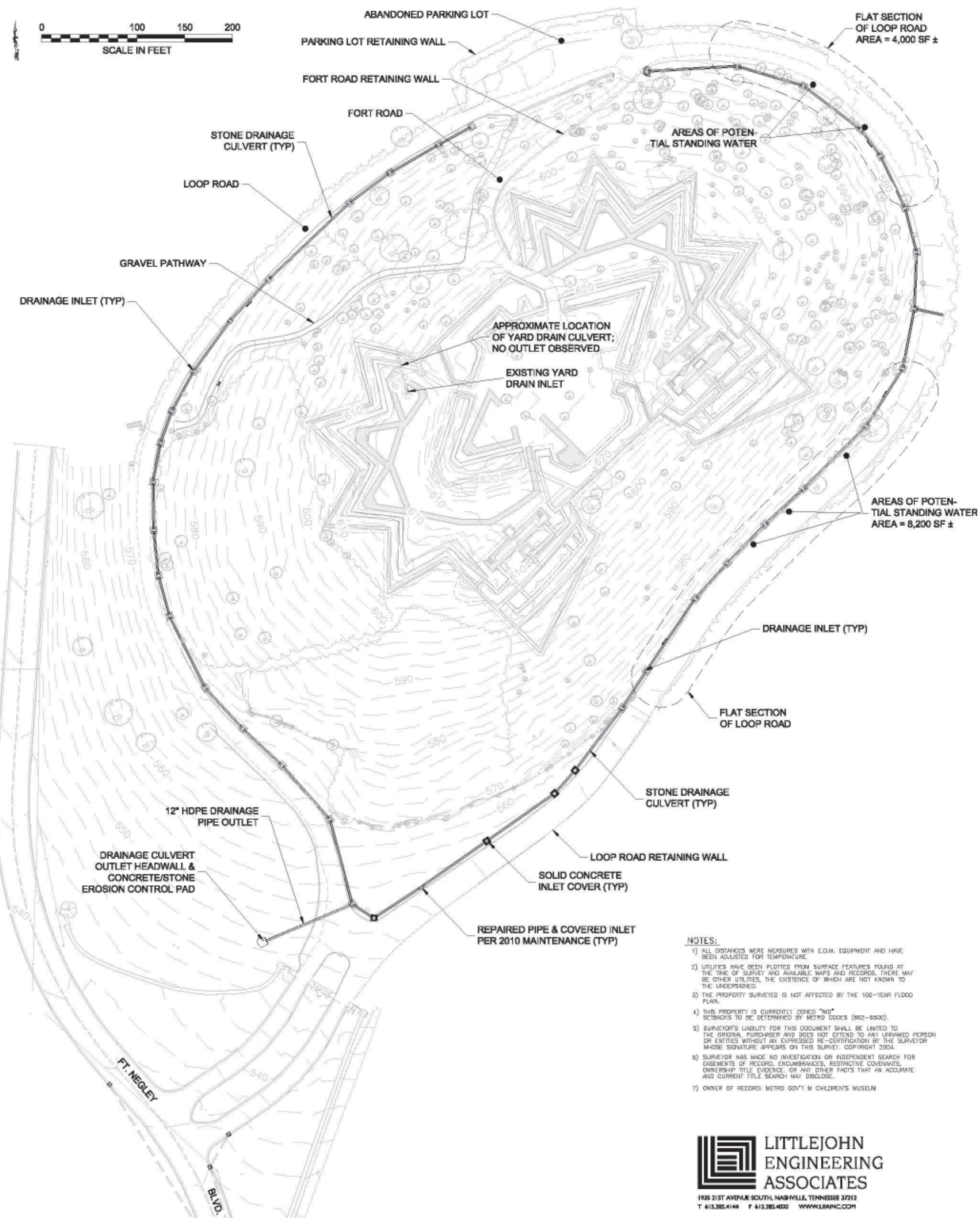


Figure 39. Drainage system layout overlaid on 2003 Hart Freeland Roberts topographic survey (Littlejohn & Associates, 2013).

Figure 40. Drainage outlet extending from concrete catch basin inside the loop road (JMA, 2013).

Figure 41. Drop inlet, cover removed (JMA, 2013).

Figure 42. Interior of stone culvert (JMA, 2013).

Figure 43. Concrete replacement cap for inlet set on stone corner blocks (JMA, 2013).

Figure 44. Limestone slab stairway leads up hill to fort structure (JMA, 2013).

Figure 45. Limestone slabs of stairway give way to flagstone landings further up the hill (JMA, 2013).

Figure 46. Lower stone stairway once led to a neighborhood footpath (JMA, 2013).

Figure 47. Gravel pathway leads from fort to lower stairway (JMA, 2013).

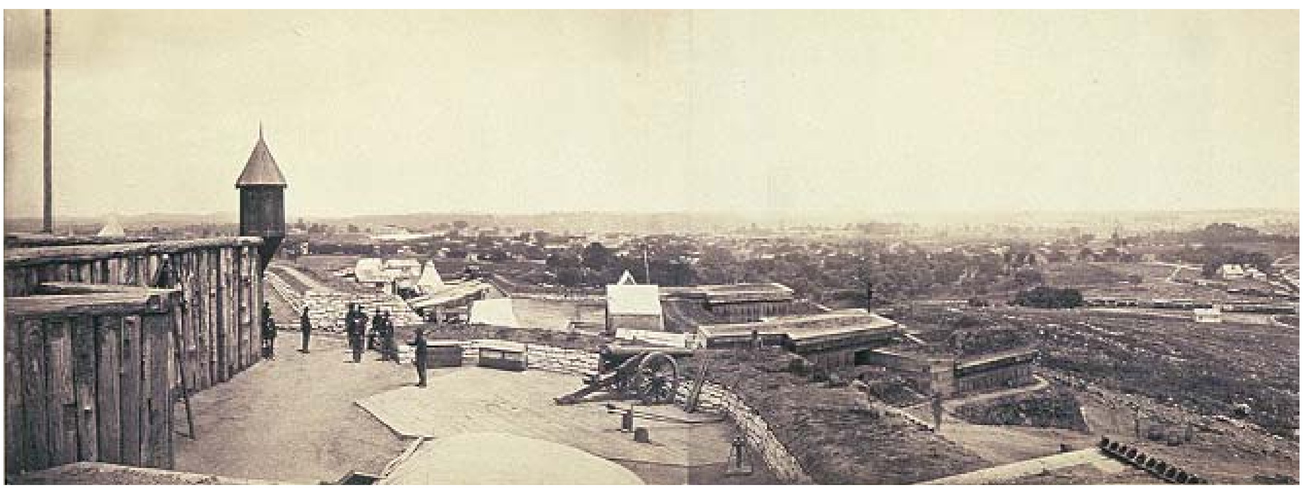


Figure 48 (above). View looking east from top of Casemate No. 2 (visible at lower edge of photograph), by renowned Civil War photographer George Barnard, 1864. Library of Congress (FNVC).

Figure 49. View to Peach Orchard Hill from fort summit (JMA, 2013).

Figure 50. View toward Rose Park (at right side of image), site of Fort Morton, from fort summit (JMA, 2013).

Figure 51 (below). Viewshed clearing plan from 1996 Fort Negley Master Plan (FNVC).

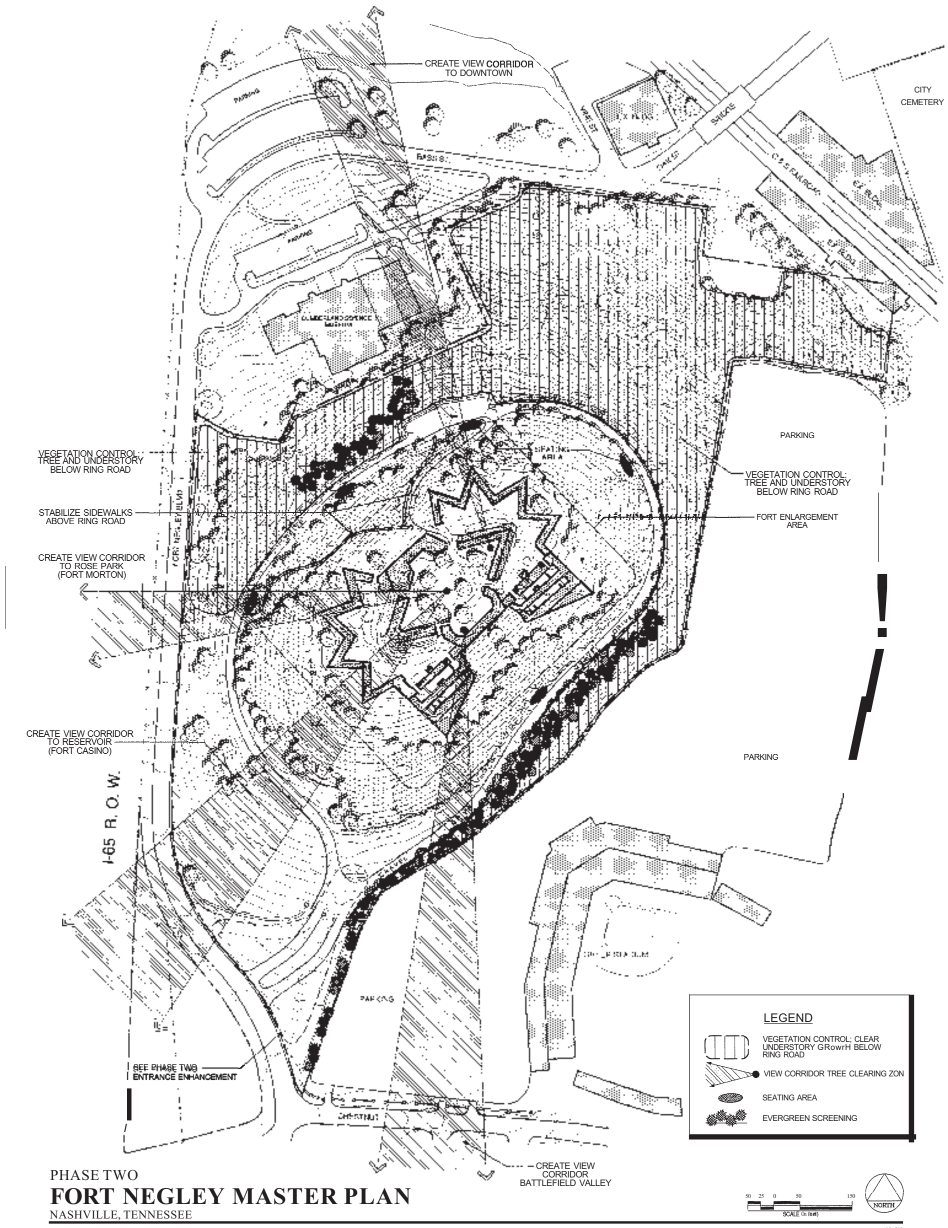


Figure 52. Framed interpretive sign panel and redan-shaped plinth, installed 2004 (JMA, 2013).

Figure 53. Steel plate with interpretive sign sandwiched between and through-bolted to plinth blocks, installed 2004 (JMA, 2013).

Signage materials provide sufficient weight to "anchor" sign in place without postholes that would disturb archaeological resources.

Figures 54a and 54b (above). Boardwalks and ramps installed 2004 (JMA, 2013).

Figure 55 (right). Bench installed 2004 (JMA, 2013).

Figure 56 (below). Barricades installed 2004 (JMA, 2013).

I.3 CONDITION ASSESSMENT

Existing Conditions of Fortification Walls

Existing fortification wall conditions are documented in annotated and rectified photographic elevations to scale in Appendix A-1 (Drawing Numbers A100 through A120) and Appendix A-2 (Drawing Numbers A201 through A220). Drawings may be printed in 24x36 sheets at 3/8" = 1'-0" scale from a supplemental digital video disc included with the report or reproduced in the attached reduced-size copies, not to scale. The locations of structural engineering wall measurements and the resulting wall geometry findings are tabulated in the attached structural diagrams SSK-0 and SSK-2, respectively (Appendix B). Similarly, wall conditions at various locations around the fortification are noted in diagram SSK-1. Diagrams relating to wall measurement nomenclature and wall behavior have been provided in diagram SSK-4. A representative wall elevation in diagram SSK-6 photographically depicts common observed conditions throughout the fortification walls.

Dry-Stacked Stone Gravity Retaining Wall Behavior

Dry-stacked (without mortar) wall construction typically consists of dressed stone exterior wythes with small rubble and soil infill for the protection of the interior of the fort against bombardments. These walls retain various levels of soil by acting as "gravity retaining walls." Gravity retaining walls depend on their self-weight or mass to resist lateral earth pressures (the horizontal outward force of retained soils) against wall overturning and sliding. But, as the authors of the 1996 Master Plan duly noted, the dry-stacked walls of Fort Negley were not built to last, but were "built quickly to provide a defensive position for troops...without traditional footings sitting on top of a steep hill that is composed of soils that should not be built on without going down to bedrock..."[1]

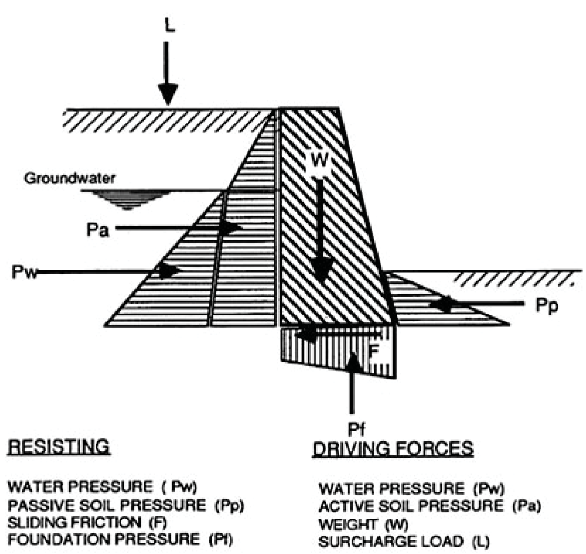


Figure 57. Forces on Gravity Retaining Wall Structures (Watershed Management Field Manual, Food and Agriculture Organization of the United Nations, 1998).

In most locations at Fort Negley, the existing stone gravity walls retain soil where the soil elevation on one side of the wall is higher than the other. Retaining walls resist the lateral earth pressure of these soils when the desired change in elevation exceeds the "angle of repose" of the soil, defined as the angle relative to the horizontal plane when material on the sloped face is on the verge of sliding (Figure 57). Typically this angle ranges from 15 to 45 degrees depending on soil typology. The lateral earth pressure depends on other soil related variables such as angle of internal friction, cohesive strength, and the direction and magnitude of movement which the structure undergoes. Higher forces result if no movement is permitted than if the structure is permitted to move. This defines at-rest and active lateral earth pressures, respectfully.

Typical dry-stacked gravity retaining walls and reinforced earth structures are understood to be flexible structures and hence active pressures are utilized for their design. Lateral earth pressures equate to zero at the top of the wall in homogenous soils and increase

1 "Fort Negley Master Plan," Section 3.0 Architecture, 29.

proportionally to maximum value at the base of the wall. If the retained soil is saturated behind the wall, this weight added to the soils must be accommodated by the retaining wall design or drainage should be provided to dissipate the added weight.

Retaining walls are traditionally designed to ensure stability against overturning, sliding, excessive foundation pressures on the underlying soils, and stone stresses (see Appendix B, details 5 and 6 on SSK-4, and structural calculations in Appendix C). The current Metro Building Code (2006 International Building Code with local amendments) requires a safety factor of 1.5 against lateral sliding and overturning.

Historically, gravity walls were empirically designed and constructed based on experience and tests. John C. Trautwine's historic engineering text, *The Civil Engineer's Pocket-Book* (New York: Wiley & Sons, 1891), specified ratios of wall thickness to height ranged from 0.50 to 0.83 for dry rubble walls, depending on the backfill soil height. For mortared rubble (i.e., undressed, rough) stone walls, ratios decreased to 0.4 to 0.73. Applying these ratios to the current 10 foot retained soil height with a flat backfill slope at the East Bastion would require a minimum five-foot wall thickness for a dry-stacked stone gravity wall or a four-foot thick mortared gravity wall. Based on the exterior wall thickness at the top of the bastion wall, it appears that the bastion walls are four feet thick, slightly less than the recommended empirical ratios. (See the analysis and calculations in Appendix C for additional information pertaining to the wall behavior.)

Gravity walls also often incorporate a battered setback to improve stability. Battering, leaning the exterior profile back towards the retained soil, shifts the center of gravity closer to the applied force and attempts to maintain the center of gravity within the middle third of the wall section. Shifting the center of gravity horizontally minimizes overturning and developing tension forces at the base of the wall.

Fortification Wall Geometry

Using a conventional measuring tape, masons rule, and a plumb-bob (or plummet) to document wall geometry and plumbness, measurements were taken in a clockwise direction around the perimeter of the fort at the top, middle and bottom of each survey location (see Figures 58a and 58b). The existing perimeter fortification walls range from 4.75 feet to 10 feet high (top of wall to elevation of lower grade). The lower height walls typically occur at the eight redans at the east and west ends of the fort, while the higher wall elevations were documented at the two southern bastions and South Main Works.

The majority of the redan and North Main Works (scarp) walls exhibit a slight batter, while both bastions and the South Main Works exhibit nearly vertical wall surfaces. Consequently, several of these vertical walls exhibit out-of-plane rotation and wall movement. Although it is not known if the nineteenth-century walls were constructed at a batter to improve

Figures 58a and 58b. Wall profile survey method with masons rule and plumb-bob (plummet) at horizontal joints at top, middle, and bottom of wall (1200AE, 2013).

wall behavior against overturning, the probability is high because various historic engineering texts of the period and dry-stack stone trade construction manuals all recommend it. A batter of 1:5 to 1:6 (horizontal project to vertical distance), equaling a slope of 0.2 to 0.167, respectively, is typically recommended for dry-stacked stone retaining walls. A maximum 0.12 surface profile was observed at Redan No. 6, which does not meet the historic and trade recommendations (see Figure 59).

A high percentage of wall profiles and wall conditions exhibit out-of-plane movement. Fifteen of the 43 wall survey locations (see Appendix B, diagram SSK-2) had exterior bulges within their vertical planes (Figure 60). Bulges were uniformly observed throughout the survey area, representative of delamination of outer-wythe masonry from the interior substrates while the masonry at the tops of the walls remains interlocked and cohesive.

Thirteen of the 43 locations surveyed within the fortification also exhibited signs of out-of-plane rotation, a common sign of wall overturning. These out-of-plane rotations and displacements (identified in SSK-2 as a negative value for global wall profile [E]) were observed in a high concentration of areas which, if not temporary shored, stabilized or reinforced, most likely presage future partial and complete collapse of retaining walls.

Twenty-three locations of wall collapse occur around the perimeter fortification walls. The most dramatic forms of collapse occur at areas of elevated wall heights, including the bastions and South Main Works walls (Figures 61 and 62), but the amount of collapse appears to be uniformly distributed throughout all areas of the outer walls including the lower redan walls (Figure 63).

Archaeological excavations at two test pit locations indicate that the base of the walls continues to a depth two to four feet below present grade (Figure 64). The bottom of footing elevations are equal to and exceed the modern code's depth of footing below grade of two feet to minimize the opportunity of vertical wall displacement due to frost heave (expansion and contraction of moisture in soils due to freeze and thaw). Wall footings at Test Pit No. 2 (southeast corner of the East Bastion) included two-foot steps in the base of the wall to accommodate the steeply sloped grade change. The exterior stones below grade have a rougher texture than the stones above grade at this location, appearing to represent a change in construction method that may date to the WPA reconstruction. The 1999 repairs on the eastern end of the East Bastion did not extend to the test pit location.

Existing Conditions of Fortification Walls

A visual conditions survey with the unaided eye (Appendix B, diagram SSK-2 for additional information) found several typical masonry conditions in the fortification walls which are shown on the representative wall condition diagram (Appendix B, diagram SSK-6). These conditions are dependent upon the inherent properties of the locally quarried limestone and underlying native soils as well as external forces applied to the walls.

Stone Delamination, Disaggregation, and Material Loss. Throughout the fort walls, stones appear to be deteriorating more rapidly in some areas than others. While some walls have no deteriorating stones, other walls have many examples and both conditions are frequently intermingled. The patterns of stone deterioration may also offer clues for discerning successive repair campaigns.

Stone delamination and associated material loss at Fort Negley is a direct result of the material's sedimentary formation. The locally-quarried Ordovician limestone is relatively soft and easily friable (Figure 65). Some of the stones can be readily seen to be delaminating along layers, or "bedding planes," of stone and sand. Deterioration appears to be ongoing throughout the natural bedrock in Fort Negley Park and in the fortification walls without regard to the sizes of the stones (Figures 66 and 67). In other instances, where the sedimentary materials are not well bonded due to high deposits of microscopic marine animals, stones have crumbling, chalky faces. These chalky stones are more porous than homogeneous, well-formed stones and thus prone to attract and hold water.

Delamination is a natural process especially common to sedimentary stone with clay-rich layers, like limestone typically occurring at the horizontal joints separating the stone courses. The clay layers attract and draw moisture into the stone and loosen the bond between bedding planes. Exfoliation of the delaminated layers follows as moisture trapped within the clay layers expands and contracts. The initiation of delamination and exfoliation (Figure 68) creates more avenues for water intrusion and entrapment in the interstitial layers, furthering distress in the stone.

The sustained presence of water enables slow material decomposition through freeze-thaw cycling as well as biological and vegetative growth. Moss is visible on almost all of the walls of the fort (visible in Figure 71) and particularly along these bedding planes which regularly retain high moisture levels on a regular basis in shaded areas, allowing the moss to survive. Walls with no moss typically face south and are dried by the sun.

Voids created through gradual stone loss can also change the bearing conditions for individual stones and lead to stress redistribution and localized overstressing in individual stones. Localized loss of stone section does not immediately destabilize the overall wall construction, but continued loss of stone would require the unreinforced masonry to arch over these areas of weakness, contributing to future instability and possible wall collapse due to excessive stress concentrations.

Chinking Loss. Two forms of chinking are visible in many fortification walls: long, thin, very flat stones placed in the wall during construction to maintain course alignments, and "face chinking" consisting of small stones set or driven into the face of a finished wall to level and stabilize large stones. There are many instances where thin chinking stones—poorly consolidated during formation and containing high levels of clay—have completely eroded (Figure 69) thereby allowing the stones above to span the resulting void between adjacent stones. At other walls, face-chinking has eroded or fallen out due to thermal expansion of the wall, destabilizing the stone above and allowing it to rotate in the wall, extending the area of instability further into the stone courses above.

Capstone Loss or Dislocation. Many areas of the fortification walls, especially noticeable at the interior parapet walls, also exhibited a loss or dislocation of capstones at the tops of the walls (Figures 70 and 74). This loss is likely due to the growth of ground vegetation, heaving due to freeze and thaw of the upper two feet of soil along the back face of the wall, and possibly (though not observed) human traffic and/or vandalism. Capstones in many areas have been pushed forward out of the vertical wall plane below and have often fallen forward onto the ground below. In many instances, stones are missing where one stone has fallen or even entire long rows are missing. This loss of capstone units reduces the overall weight of the gravity retaining wall to resist lateral soil pressure and enables water to infiltrate the interior of the masonry walls which, in addition to the deterioration mechanisms described above, also leads to the loss of fill material.

Stone Cracking and Spalling. Cracks are narrow, medium, or wide separations in a surface that extend through the unit. Cracks can occur on the top or bottom of an individual unit depending on the direction of the bending forces. Throughout the fort, individual stones have cracked while in place in a wall. Horizontal cracking (depicted by horizontal lines on the photographic elevations in Appendix A-1 and Appendix A-2) is the result of limestone bedding planes separating or other material flaws caused by freeze-thaw cycles. Other deteriorated structural conditions include vertical hairline fissures and vertical through-unit cracks (Figure 71) at bending points. Detrimental cracks promote loss of material strength and further deterioration through moisture penetration.

Cracking typically occurs where thinner facing stones are insufficiently and non-uniformly supported along their bases, causing them to span as beams. This condition is generally (but not always) found at tall walls, where weight and movement are important factors, unlike shorter parapets. Very large stones set high in a wall can accelerate cracking of stones below. In staggering vertical joints between courses, stones above may be set at the center of these spanning stones. The concentrated loads then cause excessive flexural stresses resulting in vertical cracks. This condition is easily identified by the variation in crack width (see Appendix B, details 1 and 2 on diagram SSK-6).

Localized concentrations of vertical cracks of uniform width where also observed and appear to be a result of shear failure. Shear cracks were typically located at the bearing ends of stones (Appendix B, detail 7 on diagram SSK-6). On a localized level, these flexural and shear failures and the resulting redistribution of stresses in the stone units do not represent a global instability in the wall construction. However, if the amount of cracking within a wall system becomes more pronounced in quantity, the redistribution of stress throughout the wall result in areas of overstress and potentially enable areas of collapse.

Localized spalling, caused by expansion and contraction of entrapped moisture from freeze and thaw cycling, was usually found at corners of stone units (see Figure 72 and Appendix B, detail 3 on diagram SSK-6). Similar to areas of delamination, localized losses of stone from spalling do not represent areas of instability. However, as spalling continues to develop and increase in scale, the redistribution of stress throughout the wall system could result in areas of overstress and/or future collapse.

Displacements: Bulging, Overturning, and Sliding. Localized wall displacements were observed due to bulging and to overturning (see Fortification Wall Geometry). A few localized areas of out-of-plane displacement due to sliding were also observed. Typically, these conditions occurred where the soil grades above and or below the walls were sloped (see Figures 73 and 74, and Appendix B, detail 8 on diagram SSK-6). Lateral earth pressure is increased where the top backfill is sloped upward, which effectively increases overturning and sliding forces. Where the surface of soil at the wall base is sloped downward, away from the wall surface, the cohesion and passive pressures of the underlying soils are reduced. Both conditions significantly affect wall stability.

Dry-stacked stone walls are strengthened by installing "deadmen"—stones set at right angles to extend back into the rubble or soil behind the wall. These stones tie the wall to the backup using friction to limit movement. At Fort Negley, deadmen are often small and rectangular in section. Some of these have been "edge bedded" with the deposit layers in the stone laid vertically (Figure 75), increasing their susceptibility to water saturation and delamination. Stone coursing at several locations around the fort also appears to be sagging, probably due to settlement or compaction of soils (Figure 76). Large piles of rubble on the berms at the tops of some walls have also increased loads acting on these walls (Figure 77).

Redan walls, in particular, were laid with a range of medium, large, and giant stones instead of stones of nearly uniform size. Frequently, these giant stones are placed in the upper half or third of a wall instead of lower in the wall (Figure 78) , in some cases causing crushing or cracking of the stones below by their weight and in other cases raising the center of gravity of the wall section and contributing to overturning.

Open Joints and Vertical Joint Alignment. Other displacements, symptomatic of shifting, bending, or sliding of a portion of the wall, are visible at some locations in distinct patterns of open vertical, stair-stepped, or diagonal joints (Figure 79).

Large areas exhibiting distinct patterns of open head joints (Figure 80), where stones are no longer butted end to end, indicate movement in the wall. Soil instability, the weight of the wall, and the slope of the ground adjacent to the wall all contribute to the condition. There are also many instances where head joints in successive courses align vertically (Figure 81) creating potential weakened plane joints. When one of the stones in the alignment is a boulder, the weak joint is often almost half the height of the wall. Open head joints also provide pockets for animal nesting and moisture collection which fosters moss and mold growth.

Vegetation and Animal Burrows. Overgrown vegetation in front of the fortification walls and on top of the berms was cut down to allow visual inspection of the stonework. Even after clearing, weeds, vines, and even small trees remained growing in the stone (see Figure 81). At a few locations, tree stumps were observed at the base of a wall. The growth of root systems can impact individual stones making a wall unstable. Similar to the moss and mold growing on the walls, these plants are attracted to water. They also help the stone walls hold water raising the potential for freeze-thaw damage.

Holes at the base of some walls (Figure 82) might be entrances to animal nests. In some instances the holes appear to be the locations of previous archeological probes. The loss of soil in this critical foundation area has destabilized walls and is contributing to displacement.

Reinforced Earth Structural Repairs: Existing Conditions at Redan No. 7, East and West Bastions, and South Main Works

In 1999, stabilization efforts were designed and installed at Redan No. 7 at the east side of the fort, the South Main Works, and at the bastions on the south side of the fort (Figure 83). The repair design incorporated a "reinforced earth" approach with geogrids (Figure 84). Reinforced earth has ancient origins but has only recently re-emerged in the design and construction of foundations and earth-retaining structures.

As a construction material, reinforced earth consists of soil which is strengthened by tensile elements like metal strips, non-biodegradable fabrics (geotextiles), or geogrids. These non-biodegradable fabrics are predominantly constructed of polyethylene and polypropylene. Geogrids, specifically are made of high-modulus materials which are prepared by tensile drawing to increase tensile capacity. Currently, most reinforced earth design is done with free-draining granular soil only, avoiding the deleterious effects of pore water development in cohesive soils, such as clays and silts, while maintaining the shear strength of the underlying soils.

Reinforced earth walls are defined as "flexible walls," the main components of which include granular soil backfill, geogrids, and cover at the front face of the wall. The geogrids must be designed for the tie force required by the wall due to active lateral earth pressure at the segment of the wall being supported. Geogrid reinforcement fails by either exceeding its tensile strength (breakout) or by pullout (insufficient restraint). Spacing and positioning of the ties are critical. The length of the horizontally placed ties must correspond to the soil conditions. For example, the tie must extend beyond the angle of soil friction to a sufficient depth of embedment beyond and be adequately connected to the exterior cover.

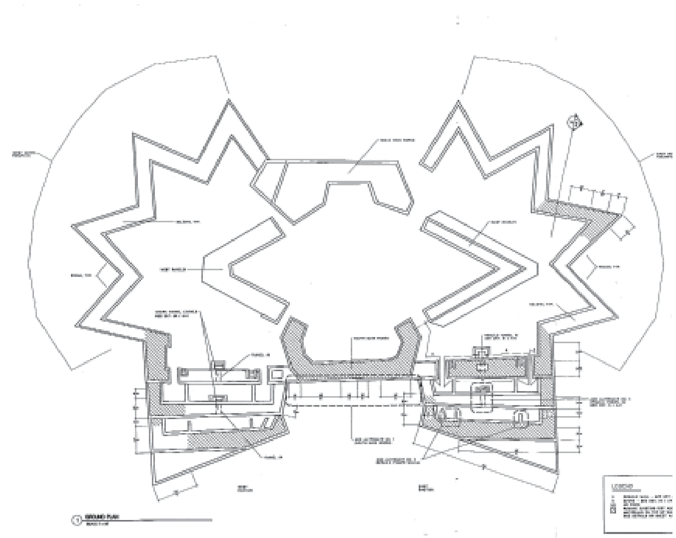


Figure 83. 1999 structural repair plan. Hickerson Fowlkes, Inc. Architects (FNVC). Hatched areas represent areas of repair.

Project meeting minutes and inspection reports indicate these structural repairs began to fail in localized areas as construction neared completion in 1999. GEC, a geotechnical consultant, was retained in early 2000 to perform an investigation of the collapses. The reported findings of the geotechnical investigation appear to be comprehensive and sound. Investigators concluded that the primary factor of wall collapse was tie pull-out failure due to the limited embedment lengths of geogrid ties beyond the soil failure plane and their lack of connection to the face stones. This lack of tension reinforcement and/or wall ties to the internal rubble substrate beyond provided minimal restraint against lateral earth pressure and forced the relatively narrow facing stones along the exterior wythe to serve as a gravity retaining wall.

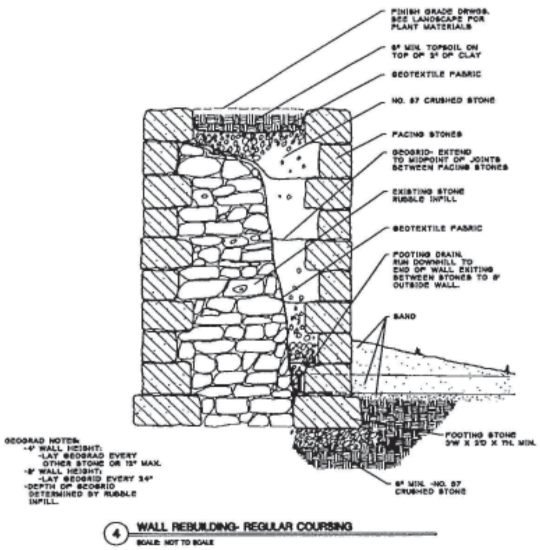


Figure 84. 1999 structural repairs detail. Hickerson Fowlkes (FNVC). Note geogrid horizontal ties extend from facing stone to face of rubble and geotextile filter fabric.

Preliminary calculations show the designed wall configuration provides insufficient support to the adjoining soils by a significant margin. The polymer reinforcement materials are also currently exposed to the sun at the areas of present collapse and at openings. These materials deteriorate rapidly due to ultraviolet radiation and may result in continued distress and subsequent collapse.

Existing Conditions of East and West Sally Ports

The sally ports adjacent to the East Bastion and Redan No. 4, respectively, provide connections between the ravelin ditches and the inner works and offer potential linkages to eliminate dead-ends in existing boardwalks. These openings are currently barricaded, partly out of concern for potential collapse of the retaining walls (notably at the East Sally Port).

East Sally Port: The East Sally Port walls, which terminate the East Inner Works (East Ravelin) and South Inner Works, exhibit similar behavior even though the construction methods are different. The south wall of the East Inner Works is constructed of large stones and appears to be a WPA-era reconstruction. The exposed filter fabric at the inside wall of the South Inner Works indicates the use of the reinforced earth method of the 1999 repairs. Both walls have nearly vertical surface profiles, without a noticeable batter, and slight bulges in their vertical planes. The west corner of the south wall of the East Inner Works shows out-of-plane displacement due to sliding (Figure 85) and stepped displacement can be observed along the joints in the corner stones.

West Sally Port: The West Sally Port walls, formed by the West Inner Works (West Ravelin) and North Inner Works, are both constructed of relatively large stones consistent with the WPA reconstruction project. There is an 8′-0″ measured clearance between wall ends at the West Ravelin ditch widening to a 9′-7″clear width at the inner works. The wall height along the West Inner Works tapers from 5′-4″ down to 2′-0″ (south to north) above present grade (Figure 86). Similarly, the shorter wall along the North Inner Works tapers in the opposite direction from 3′-0″ down to 1′-6″ (north to south) above present grade. Stone remnants about the toe of the shorter wall terminating the North Inner Works seem to indicate a previous collapse. Low wall heights may invite foot traffic and climbing.

Limited measurements indicate a vertical wall profile at the West Inner Works with no batter. Relatively large, open stepped joints and localized stone delamination were observed at the interior corner (Figure 86 yellow arrow). While these conditions are indicative of sliding and continued exposure to weather, respectively, the wall heights of the West Sally Port are low and do not demonstrate significant out-of-plane movement.

Existing Conditions of Bastion Tunnels and Bombproofs

Tunnels and the walls around them have deteriorated due to exposure to the elements and overgrown vegetation. The areas of the 1999 repair effort are exhibiting localized collapses, especially at their connection with the WPA-era exterior walls of the fort.

Stone steps leading to the tops of the inner parapets are basically intact but barricaded. Uneven riser heights and displaced or out-of-level treads make access to the top of the parapet precarious, and there is no safe walkway once the climb is finished. Stepped areaways leading down from the ravelin ditches to the stone masonry tunnels (Figure 87) are also barricaded.

East Bastion tunnel walls exhibit significant bulging and there is a localized area of collapse at the eastern end of the tunnel (Figures 88 and 89, respectively). Temporary wood bracing needs to be installed inside the East Bastion tunnel to support the walls against further out-of-plane movement. This temporary support could also serve to re-support the compromised bearings of the stone lintels above due to the localized collapse.

The East Bastion lintels appear to be sound except for the loss of bearing at the area of collapse described above. Most of these stone units have a consistent thickness, but the lintel at the western end of the tunnel has a circular cut notch (Figure 90) which apparently allowed for the bearing of a round section timber beam to support a wood-framed bombproof roof over the adjacent firing gallery. This cut reduces the effective section of the stone against flexural stress.

West Bastion tunnel walls exhibit limited bulging. In contrast to the East Bastion tunnel, each of the stone lintels supporting the masonry and earth along the full depth of the West Bastion tunnel have large vertical cracks continuous through each stone unit at mid-span (Figure 91). These vertical cracks represent failure due to excessive flexural stress. A 4x4 wood shoring beam installed during the 1999 repair campaign is supported on steel post-shores. Available construction documents indicate that, of the six steel post shores originally installed below the shoring beam, only the central post remains (Figure 92). The other posts appear to have been removed and/or deteriorated, dramatically compromising the shoring capacity and presenting a life safety hazard. The beam should be re-supported with new galvanized steel or pressure treated lumber shoring posts.

Reconstructed timber and earth casemates have collapsed into bastion rooms and passageways, partly filling these spaces with rubble debris and earth and rendering them largely inaccessible. A few wood remnants were seen along the West Bastion. Interior walls at the East Bastion are in general state of collapse following failure of the 1999 repairs. Room conditions in the West Bastion are in better condition. Here, interior room partitions do not retain large amounts of soil and those walls that do retain soil are braced by these intersecting “partition” walls and did not exhibit additional bulging or signs of further collapse.

Structural Analyses

Design Criteria and Assumptions

Soil Characteristics and Backfill Slope. The existing fortification and parking lot retaining walls retain soil. In the absence of a geotechnical study, conservative soil design parameters have been used to evaluate the existing wall constructions. (A list of the soil parameters assumed for various stability calculations is included in the calculation package in Appendix C.) Drained soil conditions were assumed along with a rubble stone masonry density of 140 pounds per cubic foot.

Before undertaking any stabilization and repair design campaign, a local geotechnical engineer licensed in the State of Tennessee should be retained during the design and construction of repairs to perform a geotechnical evaluation of the areas around existing fortification and parking lot retaining walls and to recommend various soil stabilization concepts. A mixture of borings and test pits should be performed to determine the soil parameters within the retaining walls, immediately below the base of the retaining walls, and at the underlying soils. Test results should include but not be limited to soil typology, soil friction angle, soil densities of heel and toe sides, allowable soil bearing pressures, soil slopes, presence of groundwater and saturated soils, cohesion and friction factors for soil and soil and masonry interfaces, active and passive pressure coefficients and seismic design parameters. A civil engineer should be retained to assist the design team with site drainage recommendations, if necessary.

Surcharge: Surcharges are loads applied along the surface of backfill soils behind retaining walls. Access to the top of the existing fortification walls is largely limited to landscape maintenance activities, thereby minimizing additional applied forces to the top surface of backfill soil. Accordingly, surcharge loadings were not incorporated into the present preliminary analyses. In contrast, the parking area retaining wall at the parking lot is subjected to vertical surcharge due to vehicular traffic and from equipment lay-down and storage during the previous construction activities. Hence, for these stability analyses, a 100 pounds per square foot (psf) surcharge was added to the lateral earth pressure.

Lateral Loadings in Seismic Events. The existing gravity retaining walls along the perimeter of the fortification and parking area were evaluated for stability during seismic events. Even in mild earthquakes, most retaining walls undergo limited displacement. The protocol for evaluating and designing gravity retaining walls in earthquake conditions allows for limited lateral displacement, commonly referred to as the "wall inertia effect." This effect determines the seismic weight of the wall for a tolerable displacement during an earthquake. The magnitudes of wall movements are based on the distances required to develop failure under passive conditions. These values range from 0.005 to 0.05 times the wall height (H). An allowable movement of 0.01H was assumed for loose sand and stiff clays. This lower allowed wall displacement results in higher seismic weights required to maintain stability during a seismic event.

Gravity Retaining Wall Stability Analysis for the Fortification

The following steps are performed when evaluating gravity retaining walls for stability:

1. Check for overturning about the toe.
2. Check for sliding about the base.
3. Check for bearing capacity failure of the base.
4. Check for settlement.
5. Check for stresses within the stone gravity wall.
6. Check for overall stability in earthquake (seismic) conditions.

The following summary analysis of the gravity retaining walls considers only the dry-stacked construction method of the presumed earliest walls which remain constructed at the site. While the heights of retaining walls are easy to measure, wall thicknesses are highly variable and can only be observed at the tops of the walls. These analyses are somewhat conservative and do not incorporate any batter or stepped wall conditions along the back face (heel side).

Overturning. Based on the existing soil slope variations throughout the site, stability was analyzed for backfill slopes at a level condition (α = 0 degrees) and at α = 20 degrees from the horizontal plane. Analyzing for the worst case loading condition (stone masonry wall width of 4 feet and retained soil height of 10 feet), the gravity walls have a calculated resisting moment due to self-weight and geometry of 13,440 pound-feet. Level backfill induced an overturning moment of 11,520 pound-feet while backfill angled at 20 degrees induced an overturning moment of 13,450 pound feet. The ratios of resisting moments to overturning moments are near a value of 1.0. These results indicate that the walls are stable for the applied loading but the ratios do not meet the current code requirements for new designs which require a factor of safety of at least 1.5 (150 percent).

Sliding. Applied active earth pressure is evaluated against the total self-weight of the wall, cohesive soil and friction interaction with the bottom surface of the wall and passive pressure. The wall system appears to meet the current factor of safety against sliding without relying on passive pressure.

Soil Bearing Pressure. The applied bearing pressures at the toe appear to indicate that applied stresses for both 0 and 20 degree soil slope conditions exceed 6,000 pounds per square foot (psf). These values greatly exceed the presumptive soil bearing values for clayey soils (1500 psf) and sedimentary and foliated rock (4,000 psf). Archaeological findings in the two test pits suggest that a mixture of these soil types are representative of the site soil conditions underlying the base of the walls. These overstressed soil conditions can result in settlement of the wall at the areas of high stress along the toe due to secondary consolidation of the underlying soils. This settlement is not uniform throughout the transverse section of the wall, resulting in a 'leaning' wall profile similar to out-of-plane rotation.

Applied Stresses in Stone Units. Stone units exert and resist various axial, flexural and shear stresses. Axial stress is applied normal to the stone unit, such as the stress in the stone from the weight of stone units above. Flexural stress is exerted on the stone due to bending from the applied out-of-plane lateral earth pressure (see Appendix C, Structural Calculation Sheet 2, for additional information).

Axial and flexural stresses are zero at the top of a wall and increase towards its base. The axial stress of the applied stone weights increase directly with wall height (since the wall profile is constant from top to bottom), while the applied flexural stresses increase exponentially with height. At the base of the wall, the stresses are similar to the soil bearing pressures. Compressive forces are applied to the stone units at the exterior face (toe-side), and tension occurs along the back surface (heel-side). Because the stone masonry is dry-stacked, not grouted and without steel reinforcement, the masonry along the heel side cannot resist the resulting tensile forces. Compression forces at the toe increase to accommodate the lack of restraint at the heel. As a result, the value of the applied compressive stresses increase to approximately 70 pounds per square inch (psi). This value is within the permissible compressive strength for rubble limestone masonry.

Shear forces applied within the layers of the stone units are similarly reviewed. The recommended friction coefficient for rubble limestone masonry is 0.6.[2] These friction coefficients are applied to the axial forces and also reviewed against the applied shear at each vertical segment. The original gravity wall design of rubble limestone appears to have sufficient capacity against shear with a factor of safety of approximately 1.50.

Seismic Evaluation. A seismic wall weight of 8,555 pounds per linear foot (plf) was calculated using a factor of safety of 150% (1.50) with an allowable displacement of 0.01H, or 1.50 inches

2 Frank Kidder, The Architects' and Builders' Pocket Book, 16th ed. (New York: John Wiley & Sons, 1916).

for the 12 foot wall height, and a site-specific coefficients of 0.10g for effective peak velocity-related acceleration (Av) and effective peak acceleration (As). This calculated seismic weight exceeds the calculated self-weight of 6,720 plf by a factor of 1.30. However, the base value of the seismic weight is less than the existing self-weight and would be stable in a seismic event but with a reduced factor of safety of 17 percent (1.17).

Wall Behavior in Dry and Saturated Soils. These calculations have assumed drained and dry soil conditions. The presence of clayey soils can set the stage for saturated soils which, although not observed, will add weight and increase lateral earth pressure. The added weight of saturated soil conditions in common wall construction with level backfill slope increases the applied lateral earth pressure approximately 220 percent compared to dry conditions. This significantly increases the overturning moment. The ratio of resisting to overturning moments was calculated to be 0.53, significantly lower than a value of 1.0 which relates to stability and the 1.5 ratio of the current factor of safety. Because the cohesive values in clayey soils decrease five-fold in saturated soil conditions, the factor of safety against sliding is further reduced to 0.48. Thus, in saturated soil conditions, the calculations show that the existing walls do not have sufficient capacity for sliding or overturning and reiterates the need to maintain the use of drainage and/or drainable fill.

Existing Conditions of Landscape Features

Park Entrance Gate and Walls

The park entrance gate, previously repaired in 2004, is in fair condition, exhibiting a number of condition issues that point to overall deferred maintenance rather than any obvious structural threats. Pylons and pillars exhibit hairline-to-major cracks, erosion, displaced or missing stones, inappropriate repairs of mortar joints with Portland cement, and cracking and delamination of horizontal mortar surfaces. Efflorescence and biological growth caused by water infiltration are also visible (Figures 93 through 99).

The free-standing wing wall extending west-southwest from the south end of the gateway is in good condition. A portion of this wall was removed in 2007 to make way for the driveway into the Visitor Center parking lot and the rest capped with mortar. The new mortar cap is inconsistent with the original design, but extends only to the first end pier. Neither this pier nor the wall further south along the front of the baseball field (Figure 100) were restored at the time the Visitor Center was built.

The low wall extending northwest from the gateway is in only fair condition and shows bowing and displacement in two areas, which may be damage caused by vehicle impacts (Figures 101 and 102). Problems, similar to those in the gateway but more extensive in scope, include numerous hairline-to-major cracks, erosion, displaced or missing stones, inappropriate repairs of mortar joints with Portland cement, efflorescence and biological growth caused by water infiltration, and damage from landscape chemicals (Figures 103 through 106).

The pavement, furnishings, and signage of the orientation plaza and the flagpole beyond are in good condition, although they add visual elements not part of the WPA entrance design.

Loop Road

Overall, the loop road is in good condition with only a few instances of minor cracking, but the dark gray asphalt (installed to provide an accessible path) detracts from the historic character of the site. Approximately 300 feet of loop road east of the fort and approximately 500 feet of road on the south side have relatively flat profiles (Figures 107 and 108) which may allow water to stand in the roadway during times of heavy rainfall and impede visitor access. Left unaltered, the standing water in these sections of roadway could accelerate the degradation of the asphalt surface.

The nineteen-car parking area, which was also originally gravel-paved, is now kept in rough grass—also a departure from its original design (visible in Figure 111). The area currently drains with a fairly well-defined sheet flow pattern at approximately two percent from southeast to northwest toward the collapsed corner of the parapet and adjacent parapet scuppers.

Loop Road Retaining Wall

The wall is in good condition, except for a stretch of approximately 60 linear feet where there has been extensive damage due to bush-hogging by Metro Parks grounds maintenance crews (Figure 109).

Parking Area Retaining Wall

Visual access for assessment of the toe-side of the retaining wall was limited due to the extensive foliage and debris piles along the exterior face of the wall. However, the northeast and northwest corners were accessible for measurement, a profile survey, and condition assessment.

Areas of structural distress are mostly isolated to the east and west ends of the lower retaining wall and parapet (Figures 110 through 112, and see also Appendix B, diagram SSK-1). Vertical and diagonal cracks were observed at both ends of the retaining wall, and diagonal cracks have also developed, apparently due to out-of-plane sliding displacement (Figure 113). A complete collapse has occurred at the northwest corner of the retaining wall and the parapet above, approximately 12 linear feet (see Figure 111). Partial collapses have also occurred at the ends of the parapet return walls. It appears that gravel has been placed to stabilize the soils along the top surface of the parking lot. The formation of hinge points, cracks, and areas of collapse negatively effects the tie action of the parapet to resist out-of-plane forces, and future movement should be anticipated.

Although not originally incorporated into the design of the lower retaining wall, various trees have grown in close proximity to the wall and approximately four trees are in direct contact with the walls below. Tree growth can exert high levels of stress on dry-stacked rubble stone masonry retaining walls to cause localized distress. Only minimal deterioration was observed at these locations, and it appears that the current trees are bracing the walls against further out-of-plane movement (see Figures 112 and 113). If tree removal is planned, the walls should be temporarily shored and braced prior to removal.

Parking Area Retaining Wall Geometry

The grouted parapet and the dry-stacked gravity retaining wall were documented using a plumb-bob, masons rule and tape measure. The individual survey positions are identified in the plan diagram SSK-0 (Appendix B). Measurements at each survey point are tabulated in diagram SSK-3. A graphic depiction of the survey nomenclature and the wall profiles and behavior observed are shown in diagram SSK-5. Overall, it appears that the walls retain effectively nine feet of soil with the assumption that the base of the retaining wall extends two feet below grade. While the upper parking surface is level, the downhill slope is fairly steep at the toe of the retaining wall.

The original, dry-stacked rubble stone parking area retaining wall has areas of moderate to severe structural distress. Wall profiles show a slight batter in the retaining wall but do not indicate that the parapet incorporates a batter. Where accessible for viewing, the surface of the dry-stacked wall shows significant bulging, the presence of voids, and out-of-plane displacement including rotation and sliding.

Profiles show the parapet is rotating toward the parking lot. This unique condition appears to correlate with the lateral out-of-plane movement in the lower wall but is not following the lateral outward movement in the structure below. Instead, the parapet is acting like a rigid tie, relying on the tensile strength of the grouted section and attempting to retain its profile while the wall below moves laterally (see Figures 113 and 114).

Four large concrete buttresses constructed along the toe (downhill) side of the dry-stack gravity retaining wall below were likely installed in an attempt to stabilize the wall against additional lateral movement (Figure 115). Three buttresses are positioned on the eastern half of the wall length and the remaining buttress is positioned within the western half of the wall. In this configuration, the buttresses act as primary lateral supports and the masonry retaining wall spans horizontally between them. As a result, two hinge points were observed in the top of the wall (Appendix B, diagram SSK-1) at the easternmost and western buttresses. The buttresses appear to be restricting movement in the center portions of the retaining wall allowing out-of-plane displacement (sliding) to occur at the northeast corner and along the western half of the wall.

Structural Analysis of Gravity Retaining Wall at Parking Area

Overturning. Similar to the fortification walls, the parking area retaining wall was evaluated for the applied lateral earth pressure including the vehicle surcharge. The existing composite retaining wall and parapet was calculated to have a resisting moment of 8,033 pound-feet and an overturning moment of 7,692 pound-feet. The self-weight of the wall has sufficient capacity to resist the applied soil loads but does not provide the required factor of safety of 1.50 with modern designs. For comparative analysis, the overturning moment without the 100 psf surcharge was found to be 6,600 pound-feet. This increases the factor of safety to 1.20 but still remains below the requirements of modern codes.

Sliding. The 1.65 safety factor determined for sliding exceeds the current code requirement of 1.50, assuming a level bottom slope. This safety factor would decrease to below the 1.50 margin at areas of steep bottom slopes which occur along the back (north) surface of the retaining wall. The observed structural distress and use of buttresses appear to indicate that sliding has been and is an ongoing issue at this location.

Soil Bearing Pressure. The calculated applied soil compression at the toe of approximately 7,333 psf exceeds the presumptive soil bearings for clays and decomposed/friable stone by a factor of 4.0 and 2.0, respectively. These overstressed soil conditions can result in settlement focused at the areas of high stress along the toe due to secondary consolidation of the underlying soils. This settlement is not uniform throughout the transverse section of the wall, and a similar 'leaning' wall profile similar to out-of-plane rotation could be the result.

Applied Stresses in Stone Units. The compressive stresses at the exterior face (north, or toe-side) resulting from applied axial and flexural stresses reach a maximum of 160 psi at the bottom portions of the wall. This elevated value of stress remains within the allowable compression stresses for rubble stone masonry. The calculated applied shear forces within the layers of the stone units appear to indicate that the original gravity wall design of rubble limestone has sufficient capacity against shear with a factor of safety of approximately 150 percent (1.50).

Seismic Evaluation. With allowable displacement and site seismic coefficients similar to the fortification walls, a calculated seismic wall weight of 5,940 pounds per linear foot (plf), with a factor of safety of 150% (1.50), exceeds the calculated self-weight of 5,040 plf. However, the base value of the seismic weight is less than the existing self-weight and would be stable in a seismic event but with reduced factor of safety of 127 percent (1.27).

Fort Road

While the asphalt pavement is in good condition and enhances accessibility, it does not support the historic character of the fort site. The intersection of the upper end of the road with the top of the adjacent stone stairway and the upper end of the gravel pathway that leads north and west is somewhat awkward and unresolved, creating aesthetic and wayfinding challenges. Being located at the top of a steep climb, this area presents an opportunity for rest and orientation that has not been fully realized.

Fort Road Retaining Wall

This low retaining wall is in fair condition, exhibiting some upheaval from tree growth and other signs of instability. Heavy vegetation during the field survey did not allow full assessment of the wall conditions.

Drainage Inlets and Culverts

Original limestone slab caps protecting drop inlets were set up on low limestone rubble corner blocks to allow water flow into the culvert (Figure 116). Some of the limestone slabs collapsed into the inlets or have been replaced with concrete slabs (see Figure 42 in Chapter I.2) incompatible with the rustic design. Some of the inlets were not visible for investigation.

Although most of the inlets are level with surrounding grades, some inlet elevations are higher than the surrounding grades, reducing their effectiveness in removing surface stormwater. Heavy vegetation on the site precludes a large sediment runoff load reaching the drain inlets, and high levels of sediment were not seen in the culverts or inlets, or at the ultimate culvert discharge point just north of the entrance gate. However, the existing inlet structures do allow larger debris (including some broken limestone caps, where replaced by concrete caps) to clog the inlets (Figure 117).

In areas where the loop road has positive drainage along its profile, the potential for standing water near drain inlets is mitigated by the road grades which allow stormwater to continue draining downhill with the pavement grade. A small amount of sediment was encountered at the edges of pavement where the road grade is flat, indicative of periodic ponding and poor drainage patterns in those areas. These flat areas have limited grass and ground cover growth, which also indicates standing water may be present for an extended time period, and may be appropriate locations for new drainage grates in the pavement.

The existing drain inlet at the north end of the West Ravelin ditch does not appear to be active and takes on very little site drainage at its current location and elevation. Situated at the lowest elevation point inside the fort, it may have at one time been the discharge point used, but there is no documentary or visible evidence of a canal or drainage system leading to it and no evidence of an active discharge point for the stormwater coming from the inlet. Nevertheless, the inlet should be retained in case there was some historical purpose behind its construction.

Stone Stairways

The lower stairway leading from the loop road down towards Fort Negley Boulevard and the nearby Adventure Science Center is in poor condition. The stone treads and risers are loose and displaced (Figure 118).

Gravel Pathway

Maintenance of the gravel pathway has included the addition of gravel on the top of the original surface. The compaction of this material has caused some of the edging units to splay out and dislodge. There is evidence of stormwater wash-out along the path.

Stone Edging

Some lengths of the limestone edging the loop road, the fort road, and the gravel pathway were either displaced or missing.

Vegetation

Vegetation control has been an ongoing concern at Fort Negley since its reconstruction in the 1930s and has been addressed in at least three recent campaigns, including the 1996 Fort Negley Stabilization and Restoration Plan, the 2004 Phase I Improvements plan, and native grass reseeding work conducted between 2004 and 2007 by Nashville Natives nursery. Work has included selective clearing of understory plants from the forest cover to address security and visibility, selective clearing of trees to re-open historic viewsheds from the fort summit, mechanical and chemical removal of English ivy from structures and their environs, and revegetation of portions of the site with native grasses and wildflowers. Currently, limited funding has led to a less-frequent mowing schedule and subsequent overgrowth of weeds and other volunteer vegetation that inhibits views within the site.

Views and Vistas

The Browns Creek valley (to the south), Peach Orchard Hill, Rose Park, and Reservoir Park viewsheds, along with the viewshed to downtown Nashville, were identified in the 1996 Fort Negley Master Plan and recommended for clearing. It appears as though most of the clearing was accomplished except possibly for the viewshed to downtown Nashville. The park works to keep these views clear. During the winter, one can also see the Greer Stadium and its parking lot.

Vegetative growth is the primary impediment to maintaining historic views from the fort summit. Although a wholesale vegetation clearing campaign to return the fort to its historic condition during either the Civil War or the WPA era is neither feasible nor desirable because the site is valued today as a public park, selective tree removal can help preserve the most important historic views.

Signage

The system of interpretive signage was well-designed and references the star fort in its details. It received a Merit Award by the Tennessee Chapter of the American Society of Landscape Architects in 2006. The signs appear to have weathered well, except for some chipping of limestone. The *ad hoc* caution sign outside the Main Sally Port does not match the graphic standard of the regulatory signage designed and installed as part of the 2004 “Phase I” Fort Negley Park improvements.

Boardwalks and Decks

The boardwalk and deck system is in good condition, with only a few instances of edging or decking needing replacement. Cul-de-sacs in the ravelin ditches adjacent to barricaded sally ports gave limited visibility from the inner works above, especially when plant growth obscures sightlines, and may block visitors' escape routes in emergencies. These dead ends also hinder easy circulation for larger tour groups.

Furnishings

Furnishings, including steel benches, redan-shaped carved limestone plinths (part of the signage installation), trash receptacles, flagpole, and bike rack are in good condition and do not need replacement. There are one or two instances of chipped edges on limestone plinths.

The WPA memorial stone has significant erosion and loss of the engraved inscription (Figure 119).

Other Visitor Amenities

Public toilet facilities are only available at the Visitor Center and are provided with exterior entry separated from the museum.

There is no site lighting on paths or inside the fort. The fort interior is largely open to the night sky. Moonlight and urban light pollution from nearby neighborhoods, the Adventure Science Center, and Greer Stadium likely contribute to ambient nighttime lighting levels within the park and reduce the need for or desirability of site lighting. The park is not open at night and it is an open question whether lighting could encourage vagrancy or illegal nighttime activity. Drives and paths are uncluttered by light poles.

Figures 57, 58a, and 58b. Included in text above.

Figure 59. Slight batter—0.03 horizontal to vertical—observed at scarp of South Main Works (1200 AE, 2013).

This location exhibiting out-of-plane displacement due to sliding as indicated by stepped open horizontal and vertical joints (yellow arrow) and measurements at the base of wall reporting a 4-inch change in outward displacement between grade and two feet above grade (red arrow)

Figure 60. Bulging and out-of-plane rotation along east elevation of West Bastion (center and left), vertical cracking of stones to right, and dislodged and lost capstones (1200AE, 2013).

This wall area appears to date to WPA reconstruction efforts.

Figure 61. Collapse area at East Bastion retaining wall — reinforced earth retrofit (1200AE, 2013).

Figure 62. Collapse area at East Bastion retaining wall — reinforced earth retrofit (1200AE, 2013).

Figure 63. Collapse area at Redan No. 7 retaining wall (1200AE, 2013).

Figure 64. Wall conditions above and below grade at Test Pit 2 (1200AE, 2013).

Note change of stone surface texture above and below grade and two-foot step in foundation.

Figure 65. Natural delamination and exfoliation of limestone bedrock at southern end of site, north of gated entrance (1200 AE, 2013).

Note heavy section loss at top half of bench due to increased water intrusion.

Figure 66. Various stages of delamination in exterior facing stones (1200AE, 2013).

Figure 67. Advanced decomposition in exterior facing stones and loss of material (1200AE, 2013).

Figure 68. Initial stages of delamination and exfoliation in exterior stones (1200AE, 2013).

Figure 69. Chinking loss (JMA, 2013).

Figure 70. Loss of capstone units and delamination of exterior surface of stones (1200AE, 2013).

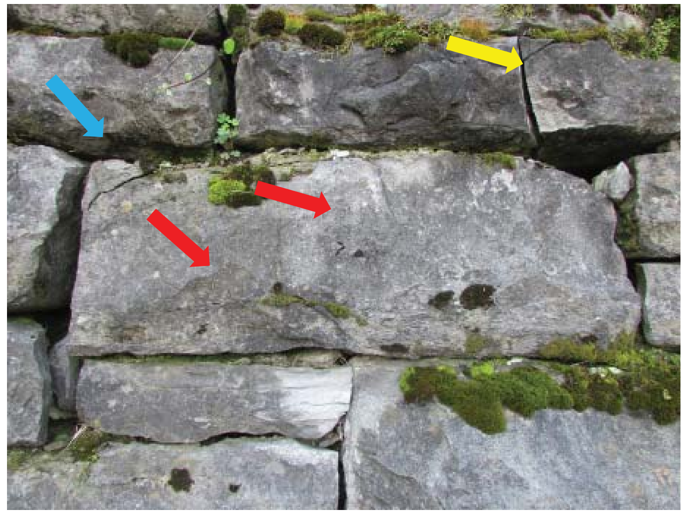


Figure 71. Vertical shear crack (yellow arrow), hairline vertical and horizontal fissures (red arrow) and spalled corner (blue arrow) (1200AE, 2013).

Note moss growth.

Figure 72. Loss of stone due to spalling and vertical flexural cracks above and below (1200 AE, 2013).

Figure 73. Typical sloped grades at top and bottom of redan walls (1200AE, 2013).

Figure 74. Localized wall displacement and missing capstones (JMA, 2013).

Figure 75. Edge bedded (bedding planes vertical) deadman (JMA, 2013).

Figure 76. Sagging wall, possibly due to poor soils, animal burrows, or undermining (JMA, 2013).

Figure 77. Stone rubble piled on top of wall (JMA, 2013).

Figure 78. Large stones laid in top half of wall alter the center of gravity, promoting wall overturning and crushing stones in wall below (JMA, 2013).

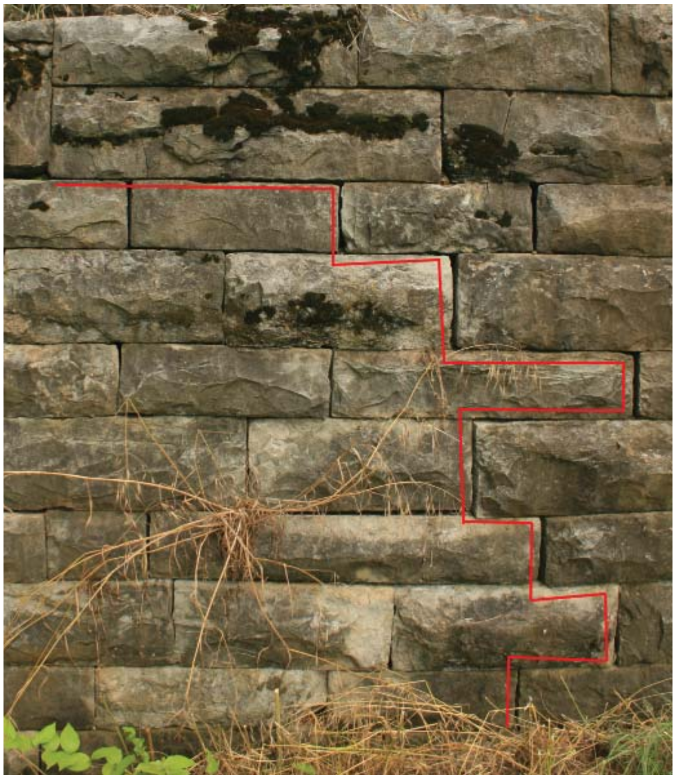


Figure 79. Step cracking indicating movement or "cold joint" between earlier construction and area of repair (JMA, 2013).

Figure 80. Open head joints (JMA, 2013).

Figure 81. Vertical joints aligned and plant growth in cracks (JMA, 2013).

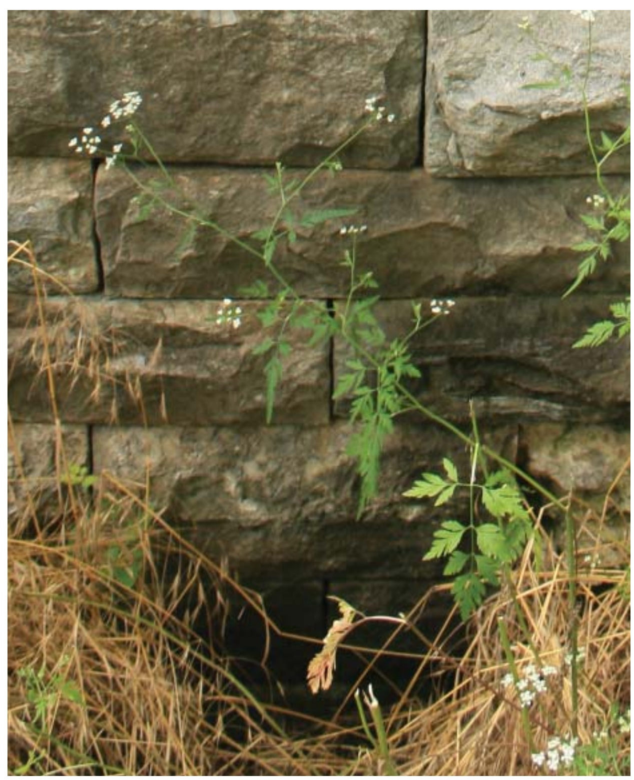


Figure 82. Animal burrow at base of wall (JMA, 2013).

Figures 83 and 84. Included in text above.

Figure 85 (above left). East Sally Port linking inner works to East Ravelin ditch and East Bastion beyond (1200AE, 2013).

Note relative soil height difference between south and north walls (left and right respectively). Note horizontal displacement in south wall of East Inner Works (yellow arrow).

Figure 86 (above). West Sally Port linking inner works to West Ravelin ditch (Redan No. 4 beyond) (1200AE, 2013).

Note tapered wall height at left and limited wall height to right. Dead-end of boardwalk beyond. Yellow arrow represents area of stone delamination.

Figure 87 (left). East Bastion tunnel with access limited due to instability of tunnel walls (1200AE, 2013).

Figure 88. East Bastion tunnel with bulging walls (1200AE, 2013).

Maximum bulging was observed at mid-height of wall.

Figure 89 (above). East Bastion tunnel (east end) with partial collapse and instability in masonry above (1200 AE, 2013).

Figure 90 (above right). East Bastion tunnel with notched lintel (1200AE, 2013).

Figure 91. West Bastion tunnel with flexure cracks in stone lintels (1200AE, 2013).

Figure 92. West Bastion tunnel with shoring installed and loss of post shores (1200AE, 2013).

Note locations of steel post caps steel anchored to beam and significant cracks in each of the stone lintels throughout length of tunnel.

Figure 93. Entrance gate pier exhibits hairline-to-minor cracking in mortar joints, some open joints, and inappropriate repair in joint below cap (JMA, 2013).

Biological growth from water infiltration and cracking of one of masonry units can also visible.

Figure 94. Open joints at top of north pylon at entrance gate with accompanying efflorescence, biological growth including moss, and erosion of natural cracks in two limestone units (JMA, 2013).

One upper unit has also spalled from water intrusion into stone.

Figure 95. Cracking in east face of north pylon at entrance gate (JMA, 2013).

Crack extends downward along joints and across one unit. Hairline cracks in units also exhibit some efflorescence.

Figure 96. Lintel over niche in north-central pylon at entrance gate cracked in two places, giving appearance that limestone inset is holding lintel in place (JMA, 2013).

Figure 97. Lintel over wall opening at entrance gate cracked in two places (JMA, 2013).

Figure 98. Cracked and broken mortar skim coat on limestone platforms at openings in entrance gate central screen wall, completely missing in some places (JMA, 2013).

Water can infiltrate between units and may lead to displacement.

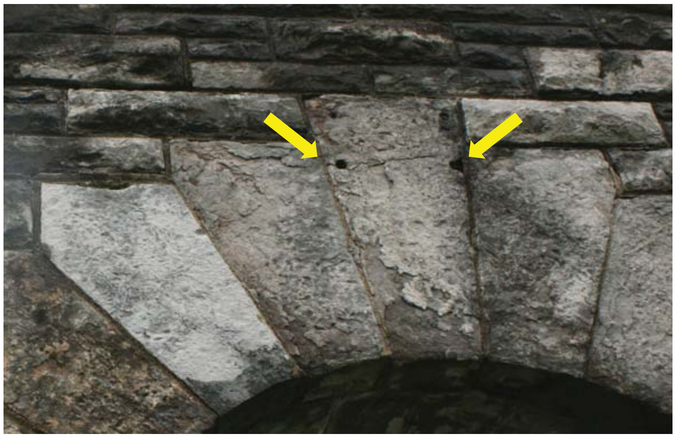


Figure 99. Drilled holes in face of stone in central arch of the entrance gateway (JMA, 2013).

Further investigation needed to determine whether there was a sign or plaque.

Figure 100. End pier of original wing wall extending from south end of gateway (JMA, 2013).

Mortar cap is cracking.

Figure 101. Bowing and displacement of southern wing wall, rear view (JMA, 2013).

Figure 102. Bowing and displacement of southern wing wall, front view, entrance gate (left) and Visitor Center (right) in background (JMA, 2013).

Figure 103. Northern pier of the northwest wing wall at entrance gate, looking west (JMA, 2013).

Damage includes missing mortar joints, inappropriate repairs, cracked and displaced masonry units, bleaching from landscape chemicals, and biological growth.

Figure 104. Water infiltration damage due to cracked or missing mortar joints at top of a portion of northwest wing wall of entrance gate structure (JMA, 2013).

Figure 105. Damage to top surface of northwest wing wall of entrance gate structure caused by water infiltration and failure of post previously mounted into top of wall (JMA, 2013).

Figure 106. Section of northwest wing wall of entrance gate structure exhibits bowing resulting from either vehicular damage or an underlying structural problem (JMA, 2013).

Vertical red line shows extent of bowing.

Figure 107. Flat profile of loop road allows water to stand (ponding) after heavy rain (LEA, 2013).

Figure 108. Damp road surfaces at edge indicate locations of ponding (LEA, 2013).

Figure 109. Damaged section of loop road retaining wall (JMA, 2013).

Figure 110. Drainage outlets built into the parapet. To the left, the wall is sagging due to structural instability (JMA, 2013).

Figure 111. Collapse at southwest corner of wall (1200AE, 2013).

Figure 112. Parapet wall construction on top of dry-stacked stone wall (yellow arrow) and collapse at NW corner of wall due to sliding of corner down the hill (1200AE, 2013).

Figure 113. Typical wall conditions at parking area retaining wall. Note bulging and out-of-plane rotation in the dry-stacked retaining wall (red arrows) and out-of-plane rotation of parapet towards interior (yellow arrow). Note position of tree and restricting additional lateral movement. (1200AE, 2013).

Figure 114. Rotation of parapet towards the interior (1200AE, 2013).

Figure 115. Loss of capstone units and delamination of exterior surface of stones. (1200AE).

Figure 116. Partially-buried limestone drop inlet cover (JMA, 2013).

Figure 117. WPA drainage inlet: stone cover replaced with precast concrete cap and culvert filled with sediment and debris (JMA, 2013).

Figure 118. View to downtown Nashville from the fort summit is obscured by hackberries (JMA, 2013).

Figure 119. Deterioration of WPA dedication monument (JMA, 2013).

PART II

TREATMENT AND WORK RECOMMENDATIONS

II.1 TREATMENT APPROACH

Recommended Treatment Approach

Historic treatment recommendations for Fort Negley have been developed in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. The Standards provide a "philosophical basis for responsible preservation practice and enable long-term preservation of … historic features, qualities, and materials,"[1] and describe four treatment approaches:

- ***Preservation*** emphasizes the ongoing maintenance and repair of materials and features to sustain the existing form, integrity, and material of a historic property, including stabilization.

- ***Rehabilitation*** makes possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.

- ***Restoration*** is the act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by removing features from other periods in its history and reconstructing missing features from the restoration period.

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

Based upon the goals of Metro Nashville Parks and the Metro Nashville Historic Preservation Commission for this HSR, rehabilitation is recommended as the appropriate treatment approach for the Fort Negley ruins and Fort Negley Park. Because rehabilitation is defined as the act or process of making possible a compatible use for a property, this approach allows for protection of the site's historic character and resources while carefully addressing the need for limited enhancement of interpretive opportunities and circulation routes, ecological maintenance and restoration, and the improvement of visitor amenities.

As part of rehabilitation, stabilization, protection, and preservation of historic and natural resources are assumed even when new uses are accommodated. Areas of the landscape that are particularly sensitive to change and disturbance, such as sites of known and potential archeological resources, should be treated with great care. In general, the HSR recommends preservation of archeological resources unless a compelling research question or informational need justifies disturbance or excavation, or mitigation to accommodate unavoidable change as necessary.

In considering the other treatment alternatives recognized by the Secretary of the Interior for the Fort Negley and Fort Negley Park, we found them inappropriate for the reasons that follow.

- Preservation is overly restrictive because it does not allow for enhancement of site interpretation and integrity.

- Restoration and reconstruction are inappropriate approaches to apply to Fort Negley. Archaeological evidence and documentary sources of both Civil War and WPA- era construc-

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1 Robert R. Page, Cathy A. Gilbert, and Susan A. Dolan, "A Guide to Cultural Landscape Reports: Contents, Process, and Techniques" (Washington: National Park Service, 1998), 82.

tion strongly suggest that the extant ruins may not accurately portray lost Civil War conditions but also represent another significant period of American history. A comprehensive restoration or reconstruction of the fort and its cultural landscape to a specific date or time period would—if there was sufficient evidence to support it— be a monumental undertaking and of questionable value to interpretation. This treatment approach is, therefore, not recommended.

The Secretary of the Interior's Standards for Rehabilitation

The ten basic principles of the Secretary of the Interior's Standards for Preservation (36 CFR Part 67) are intended to preserve the distinctive character of a site while also allowing for reasonable changes to meet new needs. The standards apply to historic properties of all periods, locations, sizes, conditions, and uses; and they create a baseline of guidance to which intended changes to the historic structure and landscape must be compared. The standards are neither technical nor prescriptive, but promote responsible preservation practices, as follows:

1. A property will be used as it was historically, or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.

2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.

3. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.

4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.

5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.

6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.

7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.

8. Archaeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.

10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

Summary of Fort Negley Rehabilitation

Chapter II.2 provides detailed work recommendations for Fort Negley which are phased for implementation. Grounded in the principles of rehabilitation, preference has been given to the selection of repair approaches which maintain the highest levels of integrity of the existing historic fabric, promote reversibility, minimize the addition of incompatible materials, and conserve the mechanical behavior of the antiquated structural system. Taking into consideration the historic significance of the site and needs associated with public access, these work recommendations may be summarized as follows:

1. Continue the use of Fort Negley as a public park, interpreting its Civil War roots and WPA heritage for the public's education and retain its now-verdant setting for passive recreational enjoyment by walkers and picnickers.

2. Control vegetation around the fortification and remove invasive species. Provide regular mowing to keep vegetation off of walls and perform selective tree removal to open the view toward downtown Nashville from the fort summit and also to reveal views of the fortification walls from the loop road.

3. Stabilize and repair the fortification ruins using soil anchors and repair damage from collapses in conjunction with the permanent bracing. Pending completion of final design and installation of soil anchors, install temporary bracing to stabilize walls for correction of life safety deficiencies and arrest further deterioration. Perform cyclical monitoring of retaining wall conditions. Re-set dislocated stones in a timely manner instead of leaving individual units unbalanced or tumbled over.

4. Preserve archaeological resources in accordance with Master Plan guidelines and recommendations. Perform archaeological investigations which will benefit further interpretation of the fort, especially at the Main Sally Port. Continue restrictions on public access to portions of the works, including tops of bastions, to prevent injuries and dislocation of historic stonework.

5. Perform in-kind repairs to the historic park gateway and walls, stone edging, steps, and retaining walls, and boardwalks. Maintain existing interpretive signage and furnishings. When repaving, select materials more consistent with the historic rustic design of the park. Maintain the historic stone culverts and drain inlets. Eliminate ponding by re-grading around inlets and providing positive slope at flat road sections.

6. Consider modest site improvements which would enhance historic integrity and/or public use, including:
   - Enhance public circulation, accessibility, and safety by extending existing boardwalks to eliminate dead-ends and accommodate guided group tours.
   - Redesign the intersection of the fort road, stone stairway, and gravel pathway at the Main Sally Port, creating an orientation plaza that will provide seating, interpretation, and a clear node from which the various walkways and roads extend.
   - Consider using the parking area as an orientation opportunity, for picnicking and/or interpretive programming.
   - Carefully consider the design and placement of any site lighting or additional toilet facilities, if desired, to provide sustainable solutions while minimizing visual and archaeological impacts.
   - Enhance interpretation of missing timber features without reconstructing them, perhaps by erecting "ghost structures" to minimize archaeological impacts and allow reversal of the work without adversely affecting the historic fabric.

II.2 WORK RECOMMENDATIONS, PRIORITIES, AND PHASING

Fortification and Parking Area Retaining Walls

Strengthening Repair Schemes

Chapter I.3 identified areas of the existing fortification and parking area retaining walls exhibiting structural instability and areas of soil overstress resulting from applied lateral earth pressures, insufficient previous structural repair efforts, and deterioration due to continued environmental exposure and lack of maintenance. The conditions promoting collapse will continue to affect the walls at these locations and the areas adjoining them until a stabilization and repair approach is adopted and executed. This chapter describes a two-step repair scheme for strengthening fortification and parking area retaining walls.

- *First,* temporarily shore or brace bastion tunnels to address the immediate threats to life safety and then shore or brace walls exhibiting bulges and out-of-plane displacements to maintain the existing wall construction wherever there is a high probability of further collapse;

- *Second,* stabilize walls with grouted stainless steel soil and masonry anchors.

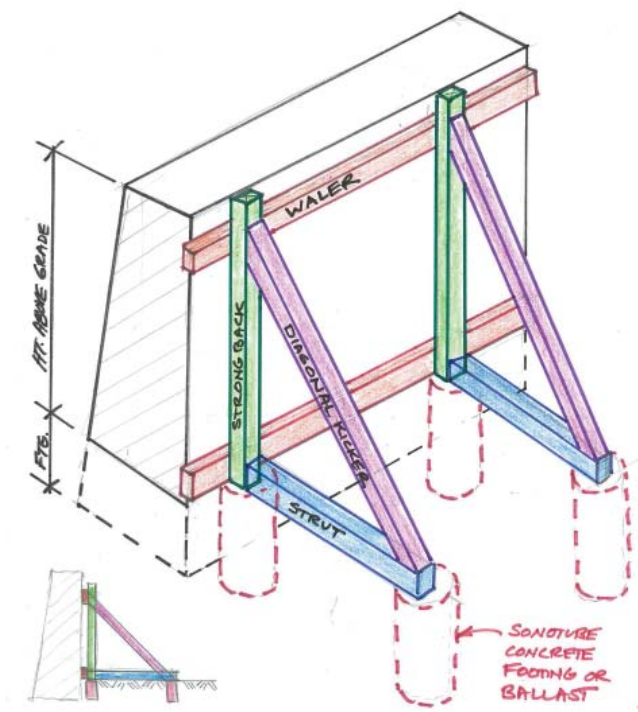

Figure 120. Temporary shoring concept (1200AE).

Two alternative repair/stabilization approaches, described below, were considered and rejected for their increasing levels of invasiveness, relative costs, and adverse visual or archaeological impacts:

- *Alternate A:* Reconstruct properly sized gravity stone walls utilizing salvaged materials.

- *Alternate B:* Reduce retained soil height.

Temporary Shoring and Bracing

Temporary (short-term) stabilization through the use of exterior bracing at current locations of out-of-plane displacements is installed to maintain the existing wall construction in its present configuration. “Shoring and bracing” is an active stabilization approach that retains the highest level of existing and historic fabric but produces adverse visual impacts. This approach also requires continued observation and maintenance to ensure that temporary supports are functioning properly, loads engaged, and new areas of deterioration addressed.

The temporary system is constructed of preservative-treated (PT) or naturally rot-resistant timbers and can be installed quickly but must be actively monitored thereafter. This approach provides a durable solution at the lowest initial cost but, with an approximate two to five-year constructed life, the cost of maintaining these structural elements must also be considered.

Bracing to resist lateral earth pressure consists of horizontal "walers" set tight to the wall surface and spanning between timber buttresses set at regular 10- to 15-foot intervals. These buttresses would be constructed in a triangulated fashion of vertical "strong-backs," laid flush against the walers, and diagonal "kickers" (rakers) with horizontal struts, similar to Figure 120 (above left). The bases of the strong-backs and the diagonal kickers would be set on small isolated concrete footings, poured in place, to resist horizontal and vertical forces. Alternatively, ballast or large precast concrete slabs could be placed on top of the soil surface to minimize disturbance to the subgrade and associated archaeological remains.

The wood bracing components will likely start to form areas of localized deterioration after two to five years. Repair and replacement to this system can be performed as required with relative ease. Even with the installation of bracing systems, visitor access to the fortification walls will need to remain limited to curtail disturbance from human activity.

Localized Stabilization with Grouted Soil and Masonry Anchors

Temporary bracing is supplanted by localized internal reinforcement of the existing wall construction and adjoining soils using grouted soil and masonry tie-back anchors, such as a Cintec Anchor, to maintain the in-situ wall construction. Instead of external bracing, existing walls are reinforced to act as cantilevers, either with vertical reinforcement or installing wall ties, to restrain further out-of-plane movements due to lateral earth pressures in lieu of the geotextiles and geogrids used in the reinforced earth method attempted in 1999.

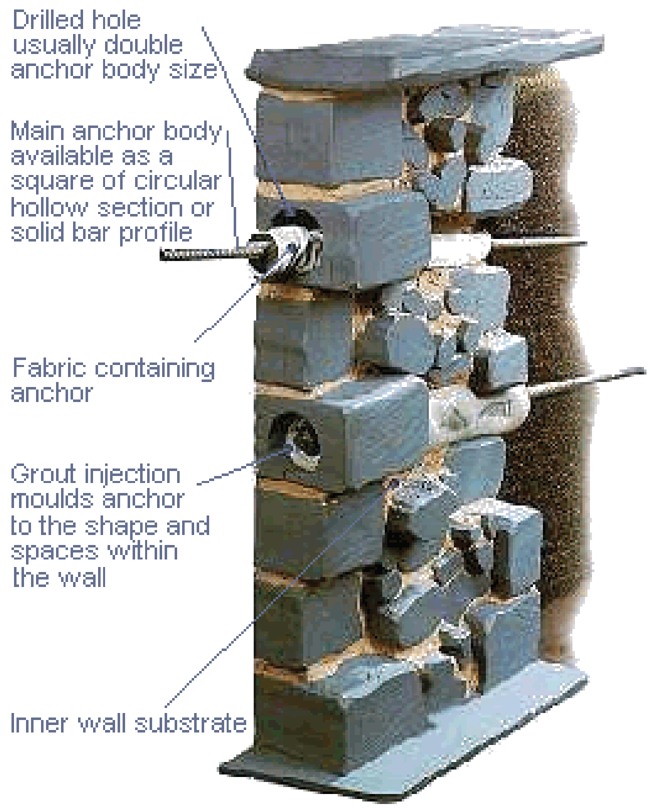

Figure 121: Components of grouted masonry sock anchoring (reproduced courtesy of Cintec Worldwide).

Similar in approach to historic stabilization techniques used since antiquity and to the 1999 reinforced earth method (had it been properly installed), grouted wall ties and tie-backs have been used successfully on numerous historic structures.[1] This approach requires the least intervention and enables reversibility with minimal damage to the original fabric. Initially more expensive than the temporary shoring and bracing of Step 1, but less expensive than Option 2A presented below, the anchor system should be installed by a qualified masonry contractor experienced with historic stone masonry structures.

An oversized hole is pre-drilled in the wall structure using a diamond coring bit which operates at low speed to minimize harmful vibration. A stainless steel anchor body (hollow pipe or tube) surrounded by a fabric sock is inserted and, following insertion, a low-pressure cementitious

1 Examples of Cintec grouted wall tie-backs in dry-stacked stone gravity walls include the Malmesbury town wall in Wiltshire, England (accessed November 6, 2013, http://www.cintec.com/media/Malmesbury%20Town%20Wall%20case%20study.pdf) and Blaise Castle, Bristol, England (see Figures 122 and 123, accessed November 6, 2013, http://www.cintec.com/media/Cintec-Pdfs/Anchoring%20of%20Earth%20Retaining%20walls/Blaise%20Castle%20Estate%20Case%20History.pdf). See www.cintec.com for other examples of applications for historic structures.

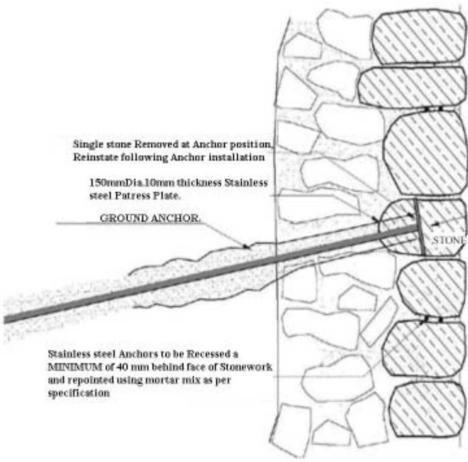

Figure 122. Grouted soil sock anchor through various substrates including dressed stone, rubble fill and soil substrates (reproduced courtesy of Cintec Worldwide).

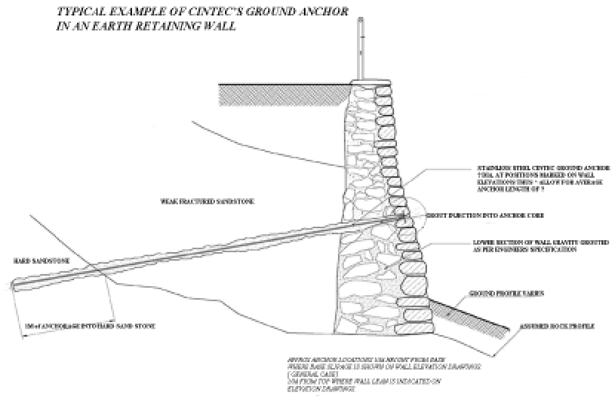

Figure 123. Example of grouted soil anchor for lateral restraint of existing rubble gravity retaining wall (reproduced courtesy of Cintec Worldwide).

grout is injected through the middle of the anchor. The grout passes through a series of clearance holes into the fabric sock, inflating the entire assembly like a balloon from the rear of the anchor forward and keying into the natural void areas of masonry, rubble infill and soils (Figure 121).

This method improves the interconnection of different structural materials, providing a mechanical connection between interstitial layers where the grout enables formation of a light chemical bond between surfaces (Figure 122). If reversibility is required, the anchors can be removed by overcoring with a slightly larger bit.

The stone anchoring system (as shown in Figures 122 and 123) can be adapted to serve as soil anchors (tie-backs) by extending the reinforcement beyond the failure planes as required by the given soil conditions. To resist out-of-plane displacement in the dry-stacked stone retaining walls, the grouted anchors would be positioned at the upper half of wall. Similar to the installation of buttresses, the anchors enable the gravity wall to span (arch) horizontally between anchor locations.

Consideration was also given to other options for permanent repair and stabilization, as follows, before recommending the preferred approach described above:

Alternate A: Gravity Wall Reconstruction

Although the most costly repair option, consideration was given to reconstructing fortification walls in a manner similar to the original construction in compliance with soil design parameters set forth by a geotechnical investigation. This method would preserve the original design intent and construction methods but, at an estimated unit cost of about $1,250 per linear foot of wall, would cost nearly twice as much as the recommended grouted anchor system.

The historic fortification walls did not need to meet current design requirements for gravity retaining walls. Preliminary analysis (see Chapter I.3) shows that the walls in a non-deteriorated state have minimal factors of safety against overturning and sliding. These safety factors of safety inevitably get reduced as the walls continue to deteriorate because of water saturation of soils, loss of stone units due to exposure, and the reduction of overall weight (such as missing cap stones and voids) which resist out-of-plane movements. Reconstructed retaining walls would be designed with suitable factors of safety against lateral earth pressures and lateral loads such as seismic and wind forces and surcharge using a drainable backfill and improved surface and subsurface drainage.

Current intact walls and salvaged stone from collapsed areas would be inventoried and evaluated for reuse. Before and during dismantling, the various construction methods used (including the historic use of front and rear battering and the presence of wall ties) would be documented and stone locations identified for reinstallation. Design and construction should be an interdisciplinary approach, with the project team comprised of masonry contractors experienced in using historic techniques, along with archaeologists, preservation architects, stone conservators, and structural, civil and geotechnical engineers.

Alternate B: Reduction of Retained Soil Height

In view of the significant structural distress of the fortification walls and preliminary analyses showing that the walls have minimal factors of safety against overturning and sliding, reducing applied lateral soil pressures by reducing the height of retained soils was also given consideration as a stabilization option. One approach would be to remove the existing soils along the "heel" side of the walls and add subsurface drainage including perforated drainage piping and dry wells. Another approach would be to add sterile soil (to avoid confusing archaeological layers) at the "toe" side, where grades slope away from the walls, to increase passive pressure against sliding and reduce lateral forces while minimizing the extent of masonry wall repairs to the areas above the new proposed grade.

Reducing retained soil height would be slightly less expensive than the recommended temporary bracing and is less than either the recommended permanent grouted anchors or Alternate A wall reconstruction, but this option has unacceptable implications for archaeological resources and site interpretation that are not reflected in this budget comparison. Access to the perimeter site walls for mechanical equipment to remove or add fill may be fairly cumbersome, and construction access could result in unacceptable compaction of existing soils to the detriment of subsurface remains. Removing soil and adding fill by manual means at these areas will escalate the labor cost associated with these tasks. Adding soil to the toe could enhance preservation of the underlying archaeological artifacts against vandalism. This method bears a resemblance to WPA reconstruction methods which have already increased grade elevations and wall heights above historical datums. While Option 2B might arguably be undertaken with an interpretive purpose to re-establish approximate relationships of wall heights from the original period of construction, the costs and trade-offs of the archaeological impacts alone make this option undesirable as a general solution for stabilization.

As alternatives for improving and sustaining the structural behavior of the wall design, both Alternate A and Alternate B would require significant modifications to the historic site through reconstruction and/or alteration to the surrounding landscape. Without further documentation to confirm the Civil War-era wall construction (wall section, overall heights, and grade elevations), any design using either of these two repair approaches would be highly speculative (thus, contrary to the Secretary of the Interior's Standards) and a distortion of the history of the site as it has evolved as a public park. These alternates are, therefore, not recommended except that limited reconstruction at localized areas of collapse might be appropriately considered solely for interpretive purposes.

Structural Stabilization and Repair Recommendations and Phasing

The strengthening and repair approach detailed below has been developed in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties. Preference has been given to the two-step temporary and permanent solutions for the reasons described above. This approach is the most viable for addressing immediate life safety hazards, maintaining the highest levels of integrity of the existing historic fabric, promoting reversibility, minimizing the addition of incompatible materials, and conserving the mechanical behavior of the antiquated structural system. The vegetation controls and drainage system maintenance discussed in the Landscape Work Recommendations, below, are also necessary to the long-term performance of the recommended structural repairs.

Phase One (within the next 3 months) — Immediate Temporary Stabilization

1. Shore West Bastion Tunnel: Install four new galvanized steel shoring posts or 6x6 PT wood posts or 10 ln. ft. of PT 2x6 stud wall, built to the underside of the existing beam supporting the cracked stone lintels. Bear the posts on a double 2x12 PT or naturally rot-resistant wood sill plates set on the existing grade.

   Tunnels in the east and west bastions differ in the details of their construction and the degree to which they have deteriorated. The West Bastion tunnel walls and lintels appear to require less extensive intervention and repairs would, therefore, be easier to implement. Thus, as an alternative to shoring the West Bastion tunnel, the cheek walls and lintels at this location could be reconstructed for interpretive purposes. (See also 'West Bastion Casemates' in discussion of Other Visitor Amenities, below.) Construct approximately 400 square feet of wall, approximately four feet thick. Replace approximately 40 square feet of lintel and parapet above the tunnel.

2. Brace East Bastion Tunnel Walls: Install four new galvanized steel shoring posts, or 6x6 PT wood posts, or 10 ln. ft. of PT 2x6 stud wall, built to the underside of existing stone lintels. Bear the posts on double 2x12 PT or naturally rot-resistant wood sill plates set on the existing grade. Brace 60 linear feet of tunnel walls which are currently bulging with PT walers and PT wood braces. Alternatively, use natural rot-resistant wood and or galvanized braces. Set the braces to the opposing bulging wall and connect them to the stud wall supporting lintels noted above.

3. Engage a geotechnical engineer to investigate the historic fortification retaining walls as a necessary precedent to development of comprehensive stabilization and repair designs by a structural engineer. The investigation may be performed during Phase Two. (See Chapter I.3, Structural Analyses, for further details.)

Phase Two (within the next 12 months) — Temporary Structural Stabilization

Fortification and parking area retaining walls will continue to exhibit increased structural deterioration making structural localized repairs more complicated and enable potential collapse(s). In addition to the items identified in Phase 1, the following work should be performed within the next 12 months. However, if funding is available, omit this temporary work and go immediately to Phase Three permanent repairs.

1. Install approximately 755 linear feet of temporary bracing at fortification walls as follows:

   - Redan 1: Approximately 10 linear feet, at the low wall on adjacent sides of partial collapse.

   - Redan 2: Approximately 10 linear feet, where overturning.

   - Redan 3: Approximately 10 linear feet plus 10 linear feet allowance, for a total of 20 linear feet, at each face of the sliding corner, nine feet high.

- Redan 4: Approximately 10 linear feet plus 10 linear feet allowance, for a total of 20 linear feet, at each face of the sliding corner, six feet high.

- Redan 5: Approximately 10 linear feet plus 10 linear feet allowance, for a total of 20 linear feet, at sliding and bulging locations, each six feet high.

- Redan 6: Approximately 10 linear feet plus 10 linear feet allowance, for a total of 20 linear feet, six feet high, at corner.

- Redan 7: Approximately 10 linear feet plus 15 linear feet allowance, for a total of 25 linear feet, six feet high, where overturning and adjacent to existing collapse.

- Redan 8: Approximately 10 linear feet plus 10 linear feet allowance , for a total of 20 linear feet, 6.5 feet high, at bulge and adjacent to existing collapse.

- East Bastion Walls (in addition to tunnel noted in Phase One):
    - North wall: Approximately 100 linear feet, up to 10 feet high.
    - East wall: Approximately 120 linear feet, up to seven feet high.

- South Main Works: Approximately 120 ln. ft., height up to 10 feet.

- West Bastion Walls (in addition to tunnel noted in Phase One):
    - East wall: Approximately 120 linear feet, up to seven feet high.
    - South Wall: Approximately 75 linear feet, up to 10 feet high.

- North Main Works: Approximately 10 linear feet plus 10 linear feet allowance, for a total of 20 linear feet, at each face of the sliding corners at Main Sally Port wall and North Sally Port.

- East Sally Port:
    - North wall: Approximately 15 linear feet plus five linear feet allowance, for a total of 25 linear feet, at each return wall at the corner.
    - South wall: Approximately 25 linear feet plus five linear feet allowance, for a total of 30 linear feet, at west corner due to proximity to collapse.
    - Alternate: In lieu of temporary bracing at this location, prepare mockups for grouted anchor system.

2. Install approximately 150 linear feet of temporary bracing at parking lot retaining wall and perform selective tree removal.

In lieu of all or portions of the Phase Two temporary bracing, if funding is available, install permanent Phase Three Structural Repairs (grouted soil anchors) in accordance with geotechnical recommendations (item 3, above).

Phase Three (within the next 36 months) — Permanent Structural Repairs

Complete the following permanent repairs within the next 36 months, after the completion of the Phase One and Phase Two temporary stabilization work. Phase Three may be accomplished in lieu of the temporary bracing in Phase Two or in combination with some of the Phase Two recommendations if funding for permanent repairs is limited.

1. Install approximately 850 linear feet of fortification wall reinforcement in areas noted in Phase Two to be shored (approximately 755 linear feet plus a 12.5 percent allowance for future areas of displacement within the next 36 months). Coordinate removal of temporary bracing as these Phase Three repairs are implemented.

    - Assume that the anchors will be positioned in a single row and spaced eight feet on-center (approximately 110 total anchors).

    - Add approximately 700 square feet of localized masonry wall repairs at voids, assuming 10 percent of the wall area to be reinforced (10 percent of 850 linear feet of wall at an average 89 feet high, for a total of 700 square feet).

    - Add area of wall reconstruction at areas of existing collapse.

2. Repair Parking Area Retaining Wall:

    - Reconstruct approximately 180 linear feet of parapet using dry-stacked masonry. If structural analysis shows dry-stacked wall to have insufficient resistance against car impact loadings, install bollards or construct concrete buttresses higher.

    - Install soil anchors spaced approximately eight feet on-center, or construct approximately three new concrete buttresses along western portion of wall and one at northwest corner, to be similar to the existing buttresses. (Note that there are access issues at the toe-side of the retaining wall. Soil anchors will require scaffolding to support workmen and coring activities.)

    - Perform approximately 200 square feet of masonry infill and repairs (assuming approximately 40 square feet for each repair area at two known locations plus another three locations assumed, for a total of five locations).

    - Infill approximately 15 cubic yards of soil lost from corner collapses.

    - Consider installing drainable fill along the heel of the retaining wall to improve drainage and reduce moisture in soils above heel. This will require excavating the parking area behind the wall.

Regular Inspection and Ongoing Maintenance Program

Until stabilization or rebuilding strategies are implemented, continue enforcement of access restrictions to the areas where structural distress (bulging wall profiles and localized collapses in adjoining walls) is most heavily concentrated, including East and West Bastion walls and tunnels and at the East Sally Port. Keep vegetation on and around the fortification walls under control and reset loose or fallen dry-stacked stone displaced by freeze-thaw action when it occurs.

Continue to restrict access to the parking area. Due to instability of walls, the parking area must not be used as a staging area for future maintenance or construction efforts. The existing trees along the back face of the retaining wall are bracing the walls and must not be removed until temporary bracing and/or structural repairs are performed.

Visually monitor the existing structure at monthly intervals and after periods of rainfall, high wind speed events, and/or seismic activity. Localized crack gauges may be inserted between horizontal and vertical cracks in exterior walls to document the activity of significant areas of distress and at areas of public access. Monitors should be recorded for review by the engineer of record.

Alternatively, survey markers can be attached to the retaining walls and recorded by land surveyors with the use of a laser total station.

Landscape Work Recommendations, Priorities, and Phasing

Landscape Work Recommendations are arranged by phase order using the same system employed for Structural Repair Recommendations above ("Phase One" within the next three months, "Phase Two" within the next 12 months, and "Phase Three" within the next 36 months). Within each phase, these recommendations are then ranked in priority levels complementing the structural repair recommendations (ranked as "Priority One").

Park Entrance Gate and Walls

Phase Two: Priority 2

- Replace cracked lintel units or stabilize in place.

- Clean, under the direction of a professional materials conservator, the entire entrance feature of grime and biological growth to reveal problem areas. Repoint all joints exhibiting cracking, efflorescence, and inappropriate repairs, matching the original mortar mix. Replace cracked or damaged masonry units that could cause structural problems if they fail. Avoid all use of landscape chemicals in the vicinity of these features, relying only on compost or other organic solution for fertilization.

Phase Three: Priority 2

- Repair, re-point and clean the end pier of the southern wing wall.

- Repair the bowed and displaced sections of both wing walls. Avoid introduction non-original design elements on the northern wall, such as the mortar cap used on the southern wall.

Phase Three: Priority 3

- Monitor and repair cracking in existing mortar cap at southern wing wall to prevent water intrusion. Consider restoring the wall by removing the mortar cap and re-pointing the masonry top of the wall to match its original condition.

Phase Three: Priority 3 (or When Funding Available):

- Investigate bolt holes in keystone. If these represent a sign or plaque that was original to the structure, consider installing a replica.

Loop Road

Phase Three: Priority 3 (or When Funding Available):

- Enhance drainage of relatively flat portions of the road surface by adding a "super-elevation" to approximately 12,200 square feet at the outer road edge (8,200 square feet on the southern flat area and 4,000 square feet at the northern area) so that stormwater can effectively sheet flow off the road to the inner road drainage system. Mill and resurface the asphalt drive at a varying depth so that the new pavement is no less than one inch thick and the high side of the pavement (outer edge) has an approximate three inch thickness of new asphalt to create a minimum one percent pavement cross slope.

- Re-grade the high and low side grass areas to have positive drainage to the inlets, requiring a small amount of excavation, re-spreading, and re-seeding for a total length of about 750 linear feet on each side (approximately 7,500 square feet).

- Selectively remove trees on both sides of the loop road to open up views to the fort and the landscape surrounding the fort.

- Consider adaptive re-use of the parking area as a picnic site after stabilization and repair of the parking area retaining wall is completed to allow safe occupancy by furnishings and pedestrians. Perform selective tree removal to re-open the vista to downtown Nashville.

- When it becomes necessary to replace the asphalt drive, consider using a double bituminous surface treatment (DBST) pavement (sometimes called tar-and-chip) incorporating a local aggregate that more closely matches the native soil and stone of the site to complement the historic character of the site. A more rustic-looking alternative would be to overlay a B-Modified binder mix of pavement, which allows more aggregate to be exposed upon weathering.

Fort Road

Phase Three: Priority 3 (or When Funding Available):
- Reconfigure the upper end of the fort road to provide a clear transition into the fort that also incorporates the stone stairway and gravel path.

- When it becomes necessary to replace the asphalt road, consider using a double bituminous surface treatment (DBST) pavement (sometimes called tar-and-chip) with a local aggregate that more closely matches the native soil and stone of the site.

Loop Road Retaining Wall

Phase Two: Priority 2
- Inspect the entire wall during the winter months, after vegetation has died back, for additional condition issues. Keep vegetation off of the wall and make regular repairs as indicated by inspection.

Phase Three: Priority 2
- Reconstruct in-kind approximately 60 linear feet of damaged loop road retaining wall. Consult a qualified geotechnical and/or structural engineer to ensure the wall is reconstructed in a manner to adequately handle the expected load conditions of the loop road.

Parking Area Retaining Wall

Phase Three: Priority 1 (see Phase Three Structural Repairs above)
- Rebuild the parapet wall in conjunction with stabilization and repairs to the retaining wall in accordance with structural recommendations.

Fort Road Retaining Wall

Phase Two: Priority 2
- Assess the conditions of this wall during the winter season after vegetation covering the wall has died back. Clear vegetation and repair wall, re-setting stones, as indicated by inspection.

Drainage Inlets and Culverts

Phase Two: Priority 1
- Remove debris clogging the existing stone-lined inlets.

- Re-set limestone inlet caps and cornerblocks and re-grade around inlets where necessary to allow stormwater flow into inlets. Replace concrete caps with limestone matching the original material. Consider adapting the existing historic limestone cap design to screen debris without compromising the historic design and materials. Install new grates and lower the top of casting elevations, where indicated, to allow runoff that currently bypasses the inlets to enter the drainage system.

Phase Two: Priority 2
- Re-grade grass and gravel surfaces adjacent to the roadway which have standing water potential so that they drain to existing inlets. Final grades should allow surface runoff, which currently bypasses the inlets, to enter the drainage system. Consider adding new drainage grates only in flat areas of pavement where regrading to an existing inlet does not handle the runoff.

Stone Stairways

Phase Two: Priority 2
- Re-set approximately 60 square feet of displaced stones on the Fort Road stairway. Re-set approximately 190 square feet of flagstone paving on the landings.

Phase Three: Priority 2
- Reconstruct approximately 80 square feet (plan area) of the lower stairway leading toward the Adventure Science Center from the fort. Incorporate the lower stairway into the design of a new accessible footpath to the Science Center.

Gravel Pathway

Phase Three: Priority 3
- Renovate gravel pathway:
  - Remove approximately 1,472 square feet of the gravel top layer and underlying original gravel down to subsoil.
  - Remove and re-set the limestone edging, replacing units that have cracked or broken (see Stone Edging, below, for measurement).
  - Fill with new gravel, using an ungraded, crushed limestone and quartzite gravel mix with fines (to match the surrounding soil) and compact in place.
- Incorporate waterbars or other drainage control devices to limit path washout.

Stone Edging

Phase Three: Priority 3
- Re-set approximately 1000 linear feet of existing limestone edging along the loop road, the fort road, and the gravel pathway.
- Replace approximately 400 linear feet of other missing and damaged limestone edging.

Vegetation

Phase Two: Priority 2 (and As Needed)
- Cut English ivy at base of shade trees to prevent it from establishing on tree trunks and damaging branches.

- Remove aggressive plant species, such as bush honeysuckle, privet, Japanese honeysuckle, euonymus, and paper mulberry. English ivy provides a ground cover in shaded areas where grass will not grow but may also be removed as an invasive species.

    - Bush Honeysuckle (*Lonicera maackii*):[2]
    Herbicidal controls may be used in late spring to late fall in areas not adjacent to historic features. Controls include foliar spray with glyphosate or triclopyr, spray of cut stumps with glyphosate or triclopyr, and the basal bark method, by which a mixture of triclopyr and horticultural oil is applied to the base of the shrub at 12 to 15 inches from the ground. In locations where the plant is adjacent to non-target plants or historic features, vines can be cut to soil level and the stem bases sprayed or painted with undiluted triclopyr or sprayed with the same in a diluted form. Avoid overspray onto historic features or non-target plants.

    - Privet (*Ligustrum sp.*)[3]

        - For areas where there are only a few plants or where plants are adjacent to historic features, privet can be controlled, but not eradicated, by repeated mowing or cutting at least once per growing season. They can also be controlled by manual removal before the plants produce their annual crop of seeds. The entire root must be removed to prevent resprouting.

        - Foliar spray of large areas of privet with glyphosate or triclopyr is appropriate in late spring to late fall but only when not adjacent to historic features. Otherwise, spray of cut stumps with glyphosate or triclopyr and the basal bark method, by which a mixture of triclopyr and horticultural oil is applied to the base of the shrub at 12 to 15 inches from the ground would be recommended. In locations where the plant is adjacent to non-target plants or historic features, vines can be cut to soil level and the stem bases sprayed or painted with undiluted triclopyr or sprayed with the same in a diluted form. Avoid overspray onto historic features or non-target plants.

    - Japanese Honeysuckle (*Lonicera japonica*) — also, English Ivy (*Hedera helix L.*) and Euonymus (*Euonymus fortunei*) Ground Covers:

        These invasive plants are most effectively controlled through the use of herbicides. Glyphosate or triclopyr can be used in a foliar application between July and October, when plants are in active growth. In locations where the plant is adjacent to non-target plants or historic features, vines can be cut to soil level and the stem bases sprayed or painted with undiluted triclopyr or sprayed with the same in a diluted form. Avoid overspray onto historic features or non-target plants.

    - Paper Mulberry (*Morus papyrifera*):
    The most effective control of this plant is through cutting to ground level, then spraying cut stumps with glyphosate or triclopyr.

Phase Three: Priority 3 (and As Needed)

- Selectively clear large trees located in the viewshed to downtown Nashville from the fort summit and parking area.

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2 Southeast Exotic Pest Plant Council Invasive Plant Manual http://dnr.state.il.us/stewardship/cd/eppc/bush-honey.html; accessed September 17, 2013.

3 Ibid.

- Re-establish and monitor program to re-vegetate portions of the site with native grasses and native wildflowers and groundcover using the mix of species and methodology for preparation and seeding or planting indicated in Nashville Natives, LLC, Revegetation Specification, Areas 1-3 (revised April 28, 2004).[4]

    - Native grasses and crop cover previously specified for flat areas: Little Bluestem (*Schizachyrium scoparium*), Side-Oats Gramma (*Bouteloua curtipendula*), Buffalo Grass (*Buchloe dactyloides*), and annual rye. For slopes: Switchgrass (*Panicum virgatum*).

    - Native woodland groundcovers previously specified include Wild Columbine (*Aquilegia Canadensis*), Wild Geranium (*Geranium maculatum*), Virginia Bluebells (*Mertensia virginica*), Blue Phlox (*Phlox divaricata*), Wild Ginger (*Asarum Canadensis*), and May Apple (*Podophyllum peltatum*).

- In cooperation with Metro Parks, establish a regular vegetation management schedule to prevent overgrowth of understory plants and volunteer trees, particularly adjacent to and on the fort structure, as well as trees located in important viewsheds.

Views and Vistas

Phase Three: Priority 3 (and As Needed)

- Continue to implement and maintain clearing plan as identified in the 1996 Master Plan.

- Selectively prune hackberry trees that currently block the view from the fort summit and parking area to downtown Nashville.

- Selectively clear brush and woody undergrowth in wooded areas around the perimeter of the loop road to open up views into the surrounding landscape.

- Preserve vegetation blocking views to Greer Stadium and the rear of the Adventure Science Center.

Signage

Phase Three: Priority 3 (or When Funding Available)

- Monitor conditions of phenolic sign panels for fading or other degradation now that warranty periods have expired. Replace panels as needed.

- Replace *ad hoc* regulatory sign at main entrance gate and at Main Sally Port with new sign panel(s) consistent with the design of other regulatory signage and mounted on railings at boardwalk access points.

Boardwalks and Decks

Phase Two: Priority 1

- Replace approximately 60 damaged deck boards (2x6, six linear feet each).

- Replace approximately 14 damaged curb units (4x4, 12 linear feet each).
- Replace approximately four bowed or damaged railing caps (2x4, six linear feet each).

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4 Refer to copy of documentation in Part III of this HSR (III.5 Fort Negley Site Surveys and Maintenance/Vegetation - Viewshed Clearing - Maintenance).

- Clean and prep approximately 16 weld joints in the galvanized steel handrail system on the boardwalk ramps and apply galvanizing primer. Paint all handrails with a zinc-rich primer and marine-grade exterior enamel paint.

Phase Three: Priority 2

- For the purposes of personal safety, emergency egress, and improved group tour traffic flow, consider constructing a new boardwalk (of matching design) through the West Sally Port to connect the inner works to the existing boardwalk terminating in the West Ravelin ditch. Consider constructing a similar new board walk through the East Sally Port after both side walls are stabilized by bracing or with soil anchors. If temporary bracing is used, incorporate the boardwalk into the bracing and footing design.

Furnishings

Phase Three: Priority 3 (or When Funding Available)

- Replace the WPA monument stone with a new stone to match original in shape, size, color, finish, and engraved inscription. Transfer the existing monument to the Visitor Center for artifact storage and/or display.

Other Visitor Amenities

The following comments are offered as guidance without recommendation for their implementation, to be considered in the context of further updates to the park master plan:

- ***Public Toilet Facilities:*** Consideration might be given to adding public toilet facilities in the vicinity of the parking area, particularly if this space is adapted for picnic use and given the distance on foot from the Visitor Center. A composting toilet system designed for relatively low use in remote park locations and on golf courses, such as a Clivus Multrum Trailhead Series unit,[5] located inconspicuously near the parking area outside of the loop road would provide a sustainable, odorless (using a solar-powered fan), and ADA-accessible option. This kind of toilet room structure can typically be installed in less than two days and requires no concrete foundation.

- ***Site Lighting:*** If pedestrian pathway or security lighting is needed or desired, consider tall pole mounted, solar-powered LED luminaires (dark-sky approved), such as GreenWay Solar Path Lighting by Sol, Inc.,[6] which does not require access to conventional power (and, thus, does not require trenching for power lines). Select pole heights to elevate fixtures out of viewsheds. Consider mounting interior fort lighting on boardwalks to avoid ground-disturbing activities. Where mounted in-ground, require monitoring of any digging by a professional archaeologist. Provide motion sensors to activate lighting and/or provide automatic dimming during low use periods.

  Ground level lighting might also be considered for highlighting features of the fort as part of nighttime programming but any evaluation of potential benefits must also consider potential disturbance to archaeological resources, especially in encampment areas outside of the fortification walls, and the likelihood of vandalism to fixtures within easy reach.

- ***West Bastion Casemates:*** Consider repairing and stabilizing or reconstructing interior spac-

5 http://www.clivusmultrum.com/products-services.php (accessed October 3, 2013).
6 http://www.solarlighting.com/products/greenway-solar-path-lighting (accessed October 3, 2013).

es in the West Bastion to enable visitors to experience the tunnels to the bastion casemates only if a second means of egress (possibly a boardwalk, in addition to the tunnel) can be provided for life safety.

Personal security of visitors must also be considered in weighing any decision to implement such a project because these semi-concealed spaces will be difficult to monitor without posting public safety personnel or providing electronic surveillance. As an alternative, consider adding a boardwalk along the top of the bastion in conjunction with the installation of a bracing system so that the structure does not bear directly on the bastion.

- ***Interpretive Feature at Main Sally Port:*** The pylon at the Main Sally Port may have been an attempt to suggest the stonework seen in Figure 5a but its mortared construction is anachronistic and bears little resemblance to the sally port shown on the 1864 plan or appearing in the background of Civil War photos. Consistent with the Treatment Recommendations in Chapter II.1, the pylon could be removed and might be replaced by an enhanced interpretive feature to be incorporated into a redesign of the site where the fort road, stone stairway, and gravel pathway all converge (see recommendations above for landscape).

  As part of this redesign, consideration could be given to providing a clearer sense of the scale of the original gate feature without actually reconstructing a feature for which there is insufficient documentation. This might include erecting a "ghost structure" to incorporate the interpretive signage. Similarly, within the inner works, a ghost structure might appropriately be incorporated into the existing boardwalk deck system to enhance interpretation of the scale of the casemates and the views from them.

PART III

RECORD OF WORK PERFORMED

NOTE

Supplemental records of previous archaeological investigations, land surveys, condition surveys, and construction documents are organized for reference on a digital video disc attached to this Historic Structure Report.