

Mapping Civil War Earthworks



*Modern surveying techniques
are used to locate historical features.*



Photo courtesy of Anderson & Associates, Inc.

One of the cannon pits has been filled with field stones gathered from the farming operations over the years. Although not seen in the photograph, faint trench remains progress away from the pit area for approximately 700 feet.

by **Timothy S. Stowe, LS, PE,** and
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Throughout Virginia's Shenandoah Valley numerous battles were fought during the U.S. Civil War. Many historians have stated that this region was the breadbasket of the Confederacy and a major turning point in the war occurred when the Union Army gained control of the Valley. Many of the cannon emplacements and troop entrenchments (earthworks) that were used in these battles still exist today. However, the con-

ditions of the earthworks are in varying degrees of deterioration. The Association for the Preservation of Civil War Sites, Inc. (APCWS) has been working diligently to document the locations of these earthworks and to preserve them and the surrounding battlefields. This article discusses how Anderson and Associates, Inc. (A&A), a consulting engineering and surveying firm in Blacksburg, Virginia, was able to assist APCWS by using modern total stations and Global Positioning System (GPS) receivers to map these historic earthworks. The mapping activity

was funded through a grant to APCWS by the National Park Service. A&A employs more than 100 people and has branch offices in Richmond, Virginia, and Greensboro, North Carolina. It has been offering civil engineering, geographic information systems, land surveying, environmental engineering, transportation engineering, and landscape architecture services since 1968.

The History

In the summer of 1864 Confederate General Jubal Early had played havoc with

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Union forces in the Shenandoah Valley, marching as far east as the outskirts of Washington, D.C., in an impressive display of force. Such actions caused much concern among the Federals and resulted in President Abraham Lincoln and General Ulysses Grant dispatching feisty General Phil Sheridan and thousands of Union troops to deal with General Early and to secure the Shenandoah Valley from the threat of the Confederates.

After defeating Early's army of 12,000 at Winchester, Virginia, on September 19, Sheridan pursued the Confederates about 20 miles to the south and again faced the Rebel forces at Fisher's Hill. Here at Fisher's Hill the Rebels had taken refuge behind the hill and prepared earthworks. In this area the Shenandoah Valley narrows to about five miles between Massanutten Mountain on the east and Little North Mountain on the west. Tumbling Run fronts Fisher's Hill, a series of rocky ridges that was described by some as the "Gibraltar of the Valley." General Early knew that Fisher's Hill was "the only place where a stand could be made." However, his 12,000 troops were thinly spaced along

a three-mile front with the western portion held only by weak cavalry.

Sheridan and his generals knew that the steep slopes and strong defensive position along the Valley Pike on the eastern portion of Early's line precluded any attack in this area. The western segment of Early's line was a different matter however. On September 22, the Sixth Corps of Sheridan's army began a demonstration of force against Early's western-most division, located on the high ground just west of present-day Interstate 81. Meanwhile, General George Crook led the Eighth Corps down the Back Road at the base of Little North Mountain, undetected, to a point in opposition to Early's defensive position. At 4

p.m. Crook attacked and swept down the Confederate line in a flank attack joined by the Sixth Corps and Federal

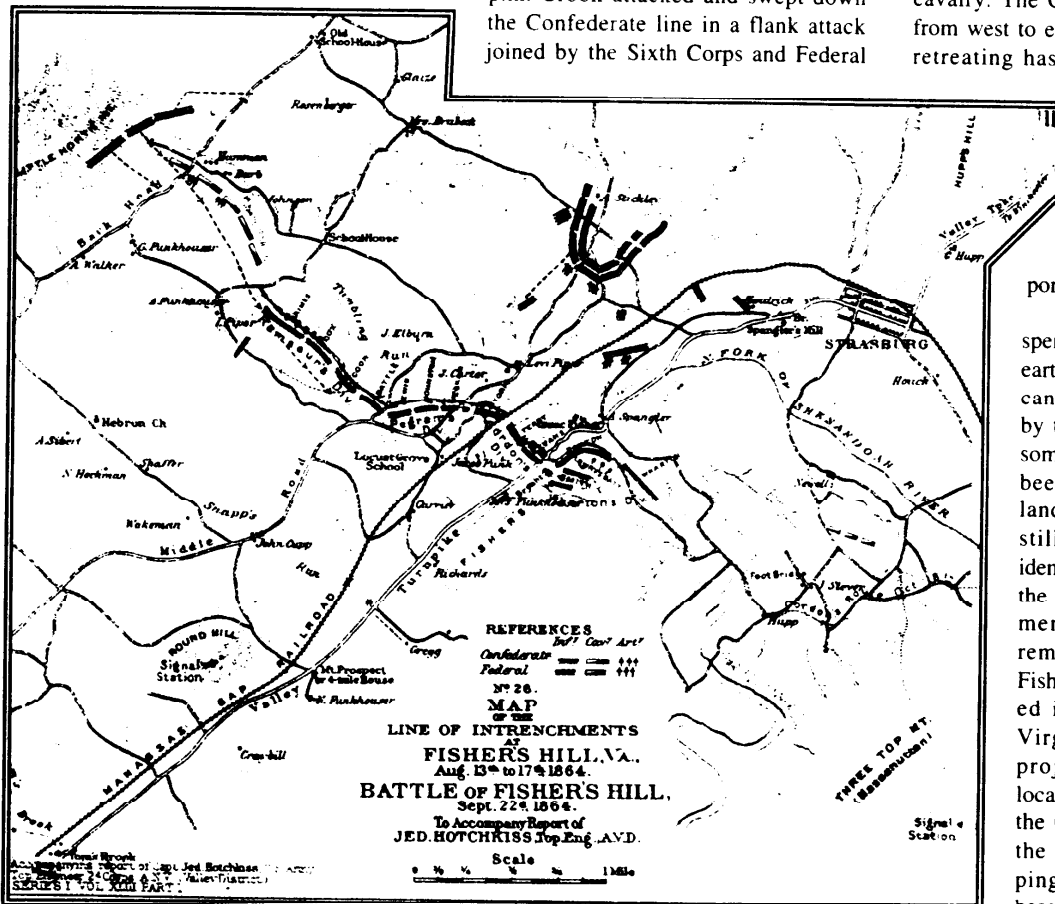
cavalry. The Confederate line unraveled from west to east with Confederate forces retreating hastily southward along the Valley Pike. The Union victory was complete and opened the Shenandoah Valley to further destruction and removal of its important economic support role to the Confederacy.

The Confederate forces spent many days preparing the earthworks for their troops and cannon before being routed by the Union army. Although some of these earthworks have been lost to agriculture and land development, many are still in place and are easily identifiable. APCWS employed the services of A&A to document the locations of the remaining earthworks at the Fisher's Hill Battlefield, located in Shenandoah County, Virginia. The object of this project was to accurately locate the earthworks used by the Confederate Army during the battle and produce mapping of the earthworks on a base map with easily recogniz-



Party Chief Neil Martin stands on top of one of the Confederate troop entrenchments and uses the "stop & go" GPS technique to locate what is left of the Civil War feature.

Photo courtesy of Anderson & Associates, Inc.



able features. Local individuals familiar with the whereabouts of some of the earthworks and detailed maps, some dating back as far as 1864, were consulted in order to verify and confirm the accuracy of trench and earthwork locations where possible. Two maps that were especially helpful were the Map of the Line of Intrenchments at Fisher's Hill, Virginia, by Jedediah Hotchkiss and the Battlefields of Fisher's Hill and Cedar Creek, Virginia, by Lt. Col. G.L. Gillespie.

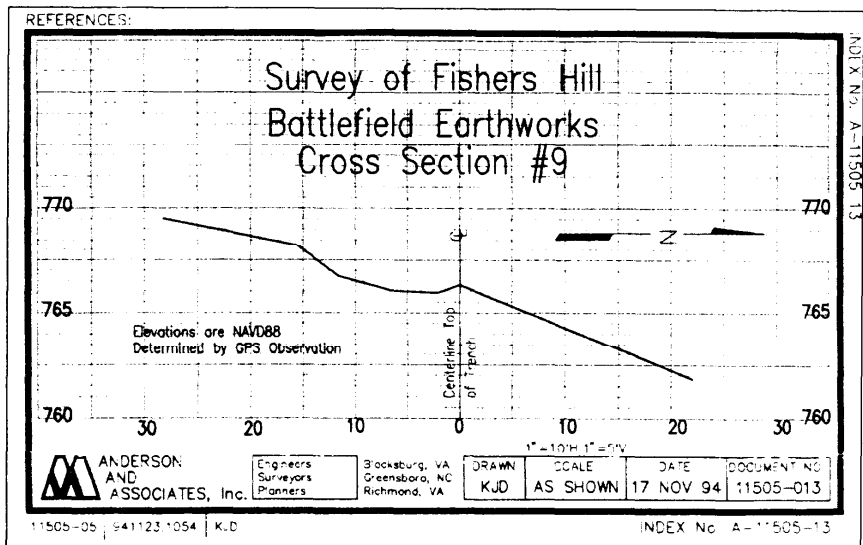
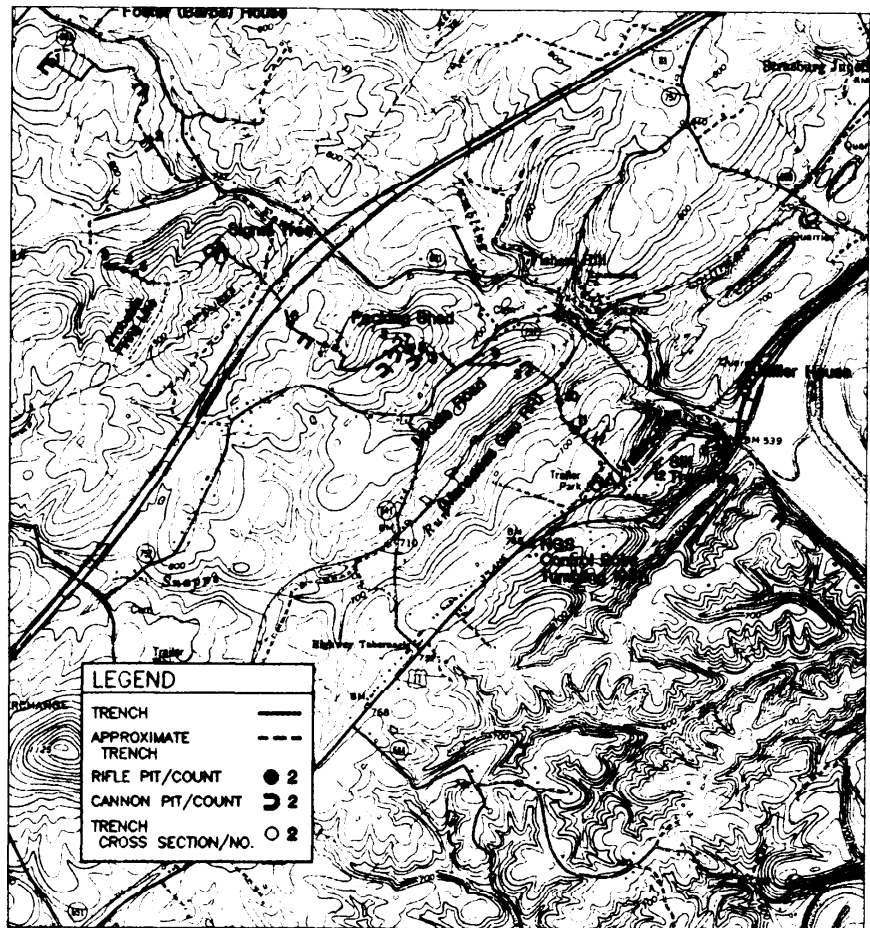
Fieldwork Procedures

To accurately locate the earthworks that the Confederate Army used, a variety of field surveying techniques were used. These efforts were supervised by A&A Survey Manager Greg Perkins, LS. The backbone of the field surveys was a control network consisting of 15 stations. The location of each station in this traverse was obtained by GPS.

The main control network was tied to the National Geodetic Survey control network at stations Tumbling (U.S. Coast & Geodetic Survey [USC&GS], 1957) and Waddell (USC&GS, 1957). Each station on the main control traverse was occupied for at least seven minutes with a Leica GPS System 200 receiver (Leica Inc., Norcross, Georgia). It took a crew of four people, split into two teams, two full days to complete the main traverse. The SKI Version 1.096 GPS reduction software was used to reduce the GPS data onto State plane coordinates. A total of 16.6 kilometers of traverse lines were measured on the main control traverse and a network closure of 1 in 250,000 was achieved.

About 4000 feet of entrenchments were located using "stop & go" (kinematic) GPS techniques, which consisted of setting up a stationary GPS receiver on one of the main traverse stations while a second receiver was roving. The roving receiver was mounted on a pole along with the controller. The operator walked to the point where data was to be collected, collected data on that point for four seconds, and proceeded to the next point. Readings were generally along the top of trenches and in the center of cannon and rifle pits. In order for this method to work properly, a clear view of the sky was needed to receive uninterrupted satellite signals. Unfortunately, much of the area consisted of small rolling hills with a lot of tree cover, which prevented or interrupted GPS satellite signal reception. Consequently, conventional surveying methods were used to field

Survey of Fisher's Hill Battlefield Earthworks



locate much of the earthworks.

The conventional methods consisted of small loop traverses that originated and terminated on the main control traverse. A Topcon GTS-304 total station (Topcon America Corporation, Paramus, New

Jersey) and Husky FS/2 data collector (Husky Computers, Inc., Clearwater, Florida) were used to determine these locations. Project requirements also called for 12 cross sections to be taken of the earthworks, for which we used conventional

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surveying methods, to enable APCWS to see the geometry (i.e., width and depth) of the entrenchments in order to document the state of preservation of the earthworks.

Approximately 19,000 feet of trenches and 21 cannon emplacements were located by conventional field surveys, with all survey data being reduced to the same datum as the U.S. Geological Survey (USGS) quadrangle maps for Toms Brook, Virginia. The local members of the Strasburg Guards Camp, Sons of Confederate Veterans, provided invaluable help since they were familiar with the area, the property owners, and the earthworks.

Mapping Procedures

The survey data was superimposed onto a digital copy of the Toms Brook quad map using the CAD Overlay (Softdesk, Inc., Henniker, New Hampshire) and AutoCAD (Autodesk, Inc., Sausalito, California) software packages. Special notes, a customized border, and a map legend were added to the digital files and the final product was plotted in color on a Hewlett-Packard (Palo Alto, California) DesignJet

650C plotter. Since the old Valley Pike (now known as U.S. Route 11) and the Manassas Gap Railroad appear on the maps prepared by Hotchkiss and Gillespie as well as on the USGS quadrangle map of Toms Brook, correlating the historic and modern features of the area was simplified. The entire project took approximately four weeks to complete.

Conclusion

Using high-tech tools to map these historic earthworks was both challenging and exciting. It was exciting in that we were using modern tools to trace history, and challenging in that we had to assess exactly where to use GPS. The use of GPS proved to be a real time saver on the project, since it was faster than conventional methods and required fewer people. By establishing a control network and developing the various data in a digital environment, the addition of future data will be greatly simplified. All in all, the use of high-tech tools on this project made it a great success and provided APCWS with a product it can continue to build upon for

years to come.

If you would like to know more about preservation of Civil War sites, contact APCWS, 613 Caroline St., Ste. 8, Fredericksburg, VA 22401; 703/371-1860. ▲

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