

## THE GREAT HOPEWELL ROAD: NEW DATA, ANALYSIS, AND FUTURE RESEARCH PROSPECTS

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### Abstract

The Great Hopewell Road is a prehistoric parallel-walled roadway that archaeologists hypothesize to have passed from the Newark Earthworks in Licking County, Ohio, to the vicinity of Chillicothe, Ross County, Ohio, a distance of about 60 miles. Its existence was proposed during the nineteenth century and it received renewed interest when Bradley Lepper of the Ohio Historical Society investigated it in the 1990s. This article reviews recent attempts to identify the Great Hopewell Road south of the Newark Earthworks, based on efforts by the Ohio Historical Society, a cultural resource management project by ASC Group, Inc., and other investigations. While evidence of the prehistoric road is convincing in some cases, in other cases the search for the signature and deposits associated with it has proved elusive. An evaluation of the strength of evidence is applied to elicit identification trends. The study concludes by commenting on the unique potential of the site to inform archaeologists about prehistoric networks and movements of people. I also comment on challenges it presents for cultural resource management archaeology.

### Introduction

The Great Hopewell Road (GHR) is a prehistoric parallel-walled roadway that archaeologists hypothesize to have passed from the Newark Earthworks in Licking County, Ohio to the vicinity of Chillicothe, Ohio, a distance of about 60 miles (Figure 1). Various scholars have speculated about its existence since the early nineteenth century and maps were made of it extending southward from the Newark Earthworks. To date surface inspection and examination of aerial photographs have provided the main basis for the study of the Great Hopewell Road, although one geophysical survey has been completed. This paper summarizes these previous investigations and presents

additional evidence in the form of remote sensing (more recent aerial photographs and another geophysical survey) and excavation profile data from a recent cultural resource management project.

Prehistoric roadways are legacies that have been left to us by many cultures, including the Anasazi (Nials et al. 1987), the Maya (Folan et al. 1983; Keller 2006), Mississippian peoples (Baires 2014), the Nazca (Aveni 2000), and others. This is an important topic for archaeology, particularly in the Eastern Woodlands, where there has been little study of such roadways. These are landscape-scale features. Prehistoric roadways provided networks by which people, goods, and ideas traveled within and between centers. The extent and kinds of interconnections in previous eras are objects of fascination (Lep-

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**Figure 1.** Map of Ohio showing projected path of the Great Hopewell Road.

per 2010; Price 2006; Romain 2000) and a major theoretical topic of interest. Particularly this is the case with Hopewell because archaeologists have long posited that the Hopewell Interaction Sphere was a means by which materials, goods, and ideas moved within the Hopewell world (Caldwell 1964; Lepper 2006; Seaman 1979; Streuver and Houart 1972). Thus, study of the Great Hopewell Road has a positive potential for archaeology in Ohio and the Eastern Woodlands as well as prehistoric archaeology more generally.

Hopewell is a Middle Woodland period (200 BC–AD 500) phenomenon extending across many regions of the Eastern Woodlands. The Scioto Valley was one of the major cultural nodes for Hopewell, as was the neighboring Licking River Valley—home of the Newark Earthworks, the largest known Hopewell earthwork complex (Lepper 2010). Large complexes also are found in or near Chillicothe, including Mound City and High Bank Works. Hopewell peoples were moundbuilders who lived in small hamlets and were what Abrams (2009) described as tribal community formations. They traded widely in exotic raw materials such as mica, ob-

sidian, native copper, and goods made from these materials. They used these goods as burial items and in rituals. Earthwork complexes, such as the Newark Earthworks, were major places of aggregation, and they served ritual and astronomical functions (Lepper 1998; Romain 2000). It has been suggested that parallel-walled roadways were important as religious procession-ways (Lepper 2006; Reeves 1936). Thus, within the context of Hopewell studies, the intensive study of the longest prehistoric roadway suspected or known would engage themes of interconnections, processions, ritual, and trade.

This article offers: (1) a review of previous studies related to the GHR, (2) a description of a cultural resource management study of small section of the GHR, (3) an evaluation of the strength of evidence supporting the GHR, and (4) a discussion of the potential challenges for GHR site identification and management. Recommendations are presented for studying and preserving the Great Hopewell Road. The previous studies have been small scale and are scattered across approximately 5.3 km of the northernmost portion of the projected path of the Great Hopewell Road, so review and evaluation of the evidence are necessary (Figure 2).

To my knowledge, there has been little if any systematic study of the Great Hopewell Road at/near Chillicothe and the earthworks there. Nor has there been much study of the intervening areas, outside of Lepper's (1995) observation of traces of it in three additional scattered locations. One other exception: an 1870 letter by a landowner to the Ohio Archaeological and Historical Society placed a graded way in Fairfield County along the general path of the Hopewell Road (Lynott 2014).

Because most previous observations of the Hopewell Road have been near Newark, it is necessary to focus on the Newark area. In this case, an evaluation of the strength of evidence of different portions of the Hopewell Road is used as a method for comparing and contrasting the results of many individual studies. The purpose is to identify patterning in the results, trends and disagreements among the results, and important

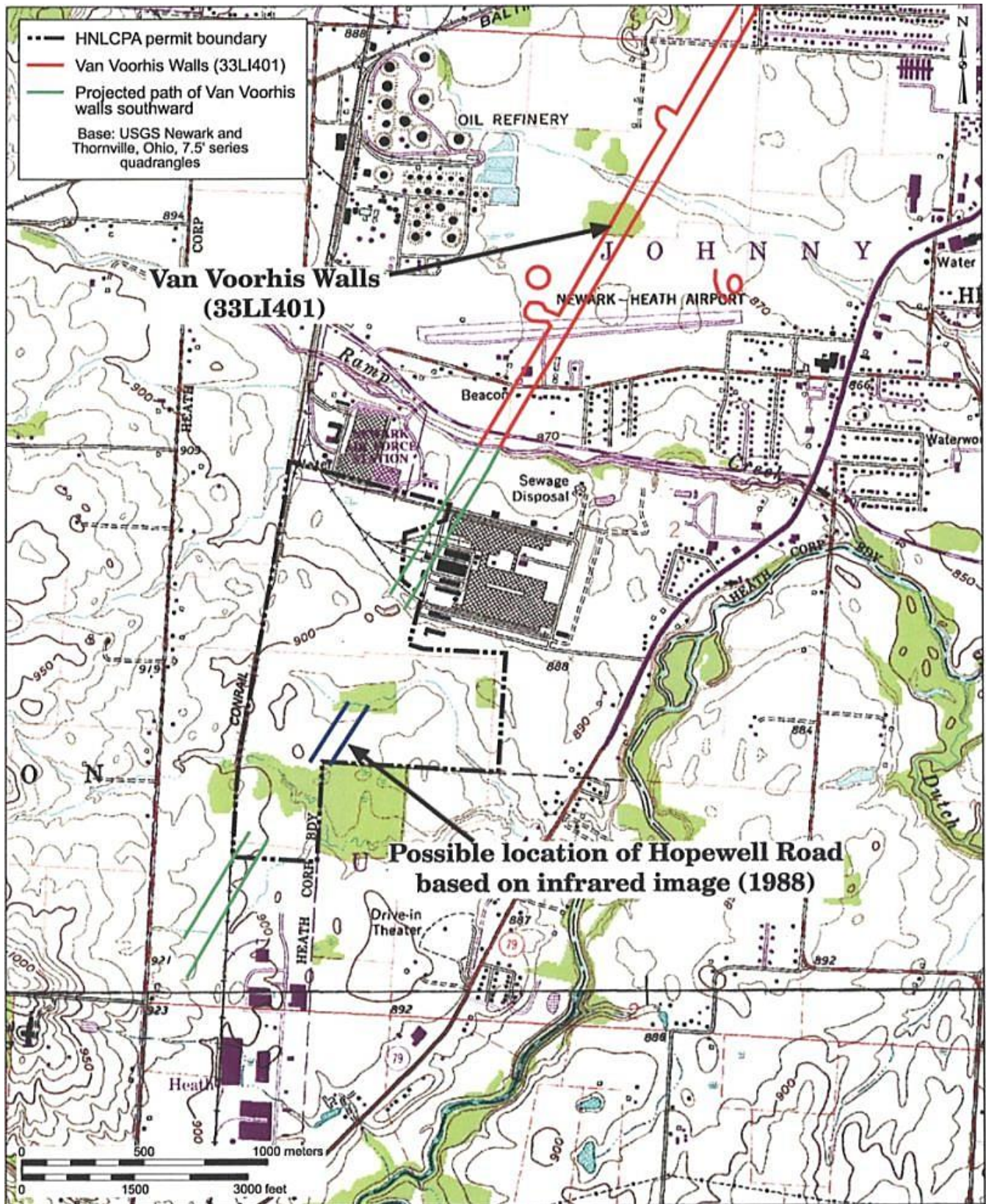


Figure 2. USGS topographic map showing the Van Voorhis Walls and possible extensions of the Van Voorhis Walls to the South (from Schwarz 2011).

relationships that previously were not recognized (Card 2011). As discussed below, the nature of the Great Hopewell Road as a linear earthen feature, stretching for miles across mostly farmed land, but including some urbanized and urbanizing areas, presents unique challenges in site identification, interpretation, and management. It is important to overcome these challenges because development is planned for at least part of this area, as described below.

### History of the Hopewell Road Hypothesis

It has been common knowledge for a long time that a parallel-walled earthen roadway extended south of the Newark Earthworks from the main group of earthworks (Atwater 1820; Squier and Davis 1848: XXV) (Figure 3). Atwater (1820) was the first scholar to describe the parallel walls of the Scioto and Ohio Valleys. In regards to the parallel walls generally he wrote:

Besides those above mentioned, there are parallel walls in most places, where other great works are found. Connected with the works on Licking Creek, are very extensive ones, as may be seen by referring to the plate which represents them. They were intended, I think, for purposes of defence, to protect persons who were travelling from one work to another. (Atwater 1820:193)

Atwater (1820) wrote specifically about the parallel-walled earthen roadway leading south from the Newark Earthworks, which he labeled C.D. on Plate II, the map of the Newark Earthworks. He stated:

I should not be surprised if the parallel walls C. D. are found to extend from one work of defence to another, for the space of thirty miles, all the way across to the Hockhocking [the Hocking River], at some point a few miles north of Lancaster. Such walls having been discovered at different places, probably belonging to these works, for ten or twelve miles at least, leads me to suspect that the

works on Licking, were erected by people who were connected with those who lived on the Hockhocking River, and that their road between the two settlements was between these parallel walls. (Atwater 1820:129)

Squier and Davis (1848) made a careful map of the Newark Earthworks. Their map showed a parallel-walled roadway extending to the south-southwest of the main body of earthworks. A marginal note on the map stated that it extends 2 ½ miles to the south, as does the map of Thomas (1894).

Salisbury and Salisbury (1862) were major proponents of a longer Great Hopewell Road. They produced a map showing the Hopewell Road running off the page to the southwest of the Newark Earthworks (Figure 4). In fact, they traced the Hopewell Road southward on foot to Ramp Creek and an additional six miles south of Ramp Creek in a straight line across fields and streams and through swamps (Lepper 1998:129).

The first pilot who claims to have seen the Hopewell Road from the air appears to have been Warren Weiant, Jr., as related by Lepper (1998). In 1931, Weiant wrote a short letter to the Ohio Historical Society following a flight during which he claimed to have seen the Hopewell Road and a previously unknown circular enclosure (at and near the Newark Airport). He also noted additional circular enclosures to the south as the Hopewell Road passed towards Millersport.

Dache Reeves was another pilot and an early pioneer of the systematic use of aerial photography to study Ohio earthworks. Among other sites, he photographed the Newark Earthworks and the southward projecting roadway (Figure 5). He wrote up his results in the *Ohio Archaeological and Historical Quarterly* (Reeves 1936). He believed that the avenue ran about 4300 yards in length, about the same as the 2.5 miles that Squier and Davis (1848) thought it to be (Figure 3). He noted that the Hopewell Road ended at Ramp Creek and speculated that it provided a

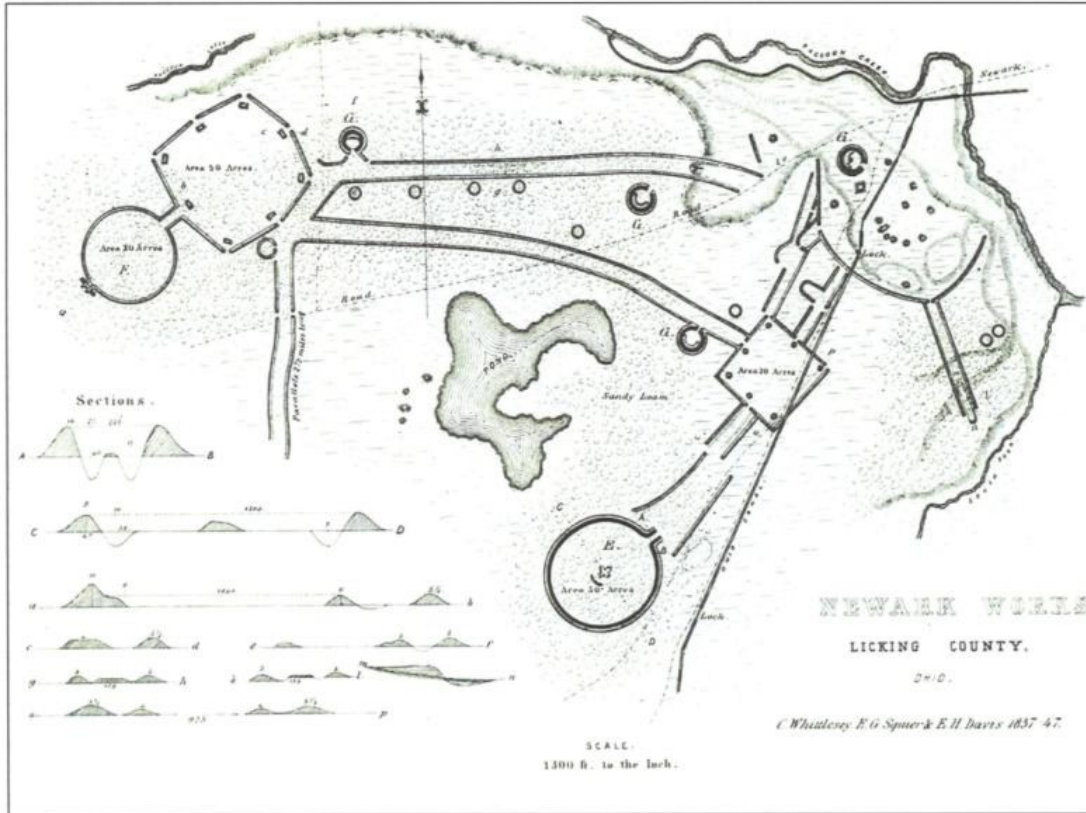


Figure 3. Map of the Newark Earthworks by Squier and Davis (1848) showing the parallel road extending to the south-southwest. A marginal note on the map states that it extends 2 ½ miles to the south.

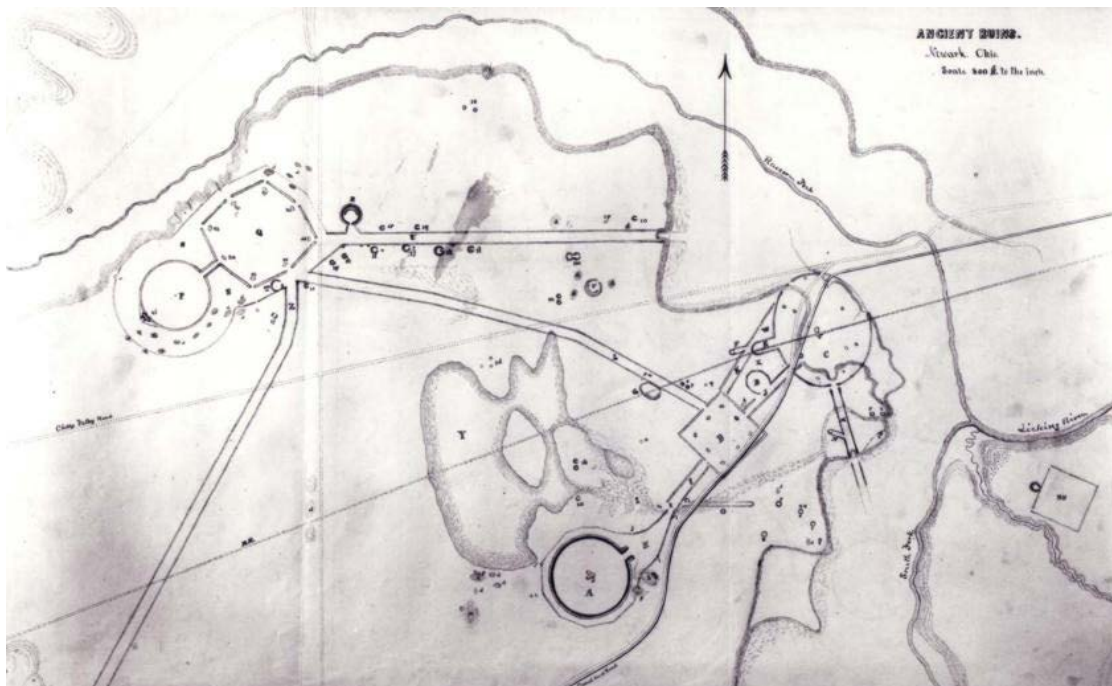
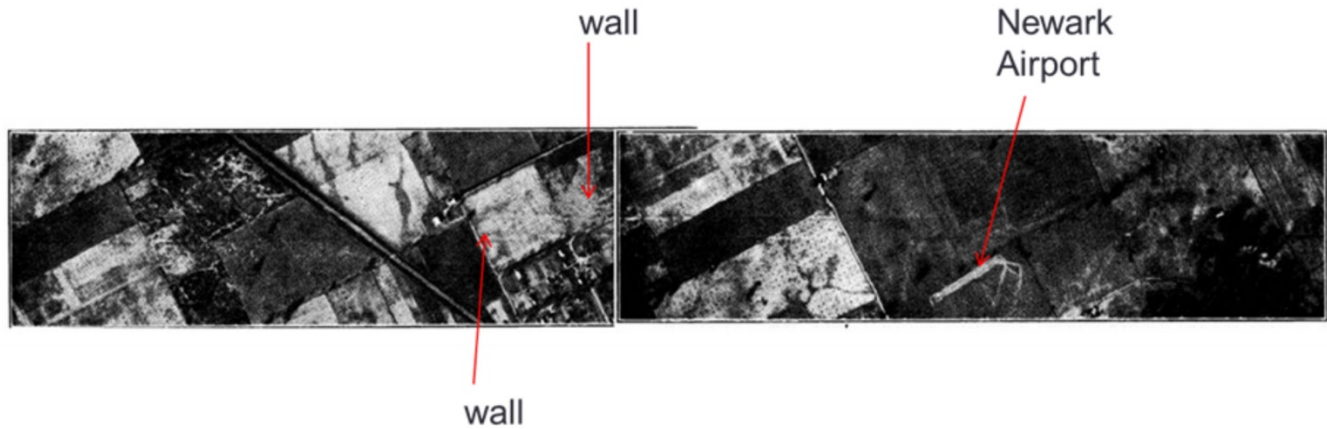


Figure 4. Salisbury and Salisbury (1862) Map of the Newark Earthworks showing parallel walls extending off the edge of the page (lower left).



**Figure 5.** Dache Reeves' (1936) aerial photograph of the Great Hopewell Road.

passageway for processions of a ceremonial or sacred character.

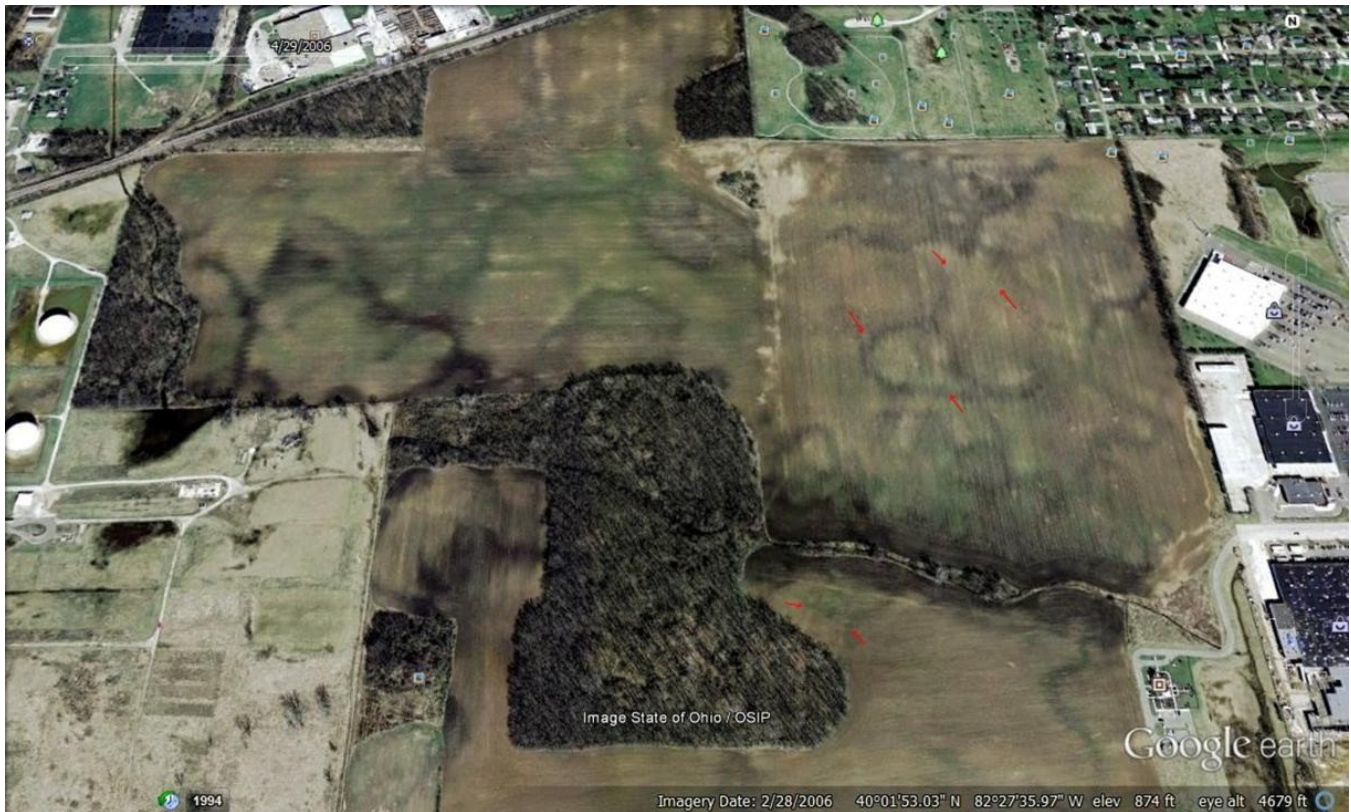
### Recent Investigations

More recently, Bradley Lepper (1995, 1996, 1998) of the Ohio History Connection examined aerial and infrared photographs to identify traces of the Great Hopewell Road. He also conducted surface inspections of suspected traces of the Hopewell Road in a wood lot, which he inventoried as 33Li1401, the Van Voorhis Walls. He found two perceptible elevated linear features running through the wood lot (Figures 6 and 7).

Building on nineteenth century scholars' efforts, Lepper proposed that the Hopewell Road actually passed from the Newark Earthworks to the area of Chillicothe, a distance of about 60 miles. Lepper (1995) developed his hypothesis from examination of nineteenth-century accounts in which Ohio antiquarians and early archaeologists speculated about the possible existence of a longer ancient roadway (Atwater 1820; Salisbury and Salisbury 1862). In Chillicothe, there are a number of important Hopewell earthworks, including High Bank Works and Mound City. There has been some interest in High Bank Works as a possible terminus of the Great Hopewell Road because it has a large octagon and circle combination similar to that of the Newark Earthworks, but Lepper (personal communication to Kevin Schwarz, November 2013)

projected the alignment of the Great Hopewell Road into the center of Chillicothe where historically an important ford of the Scioto River was located. At the behest of the Ohio History Connection, Simpson and Kvamme (2001) carried out a geophysical survey to investigate the Great Hopewell Road, where it purportedly crosses the Cynthia Street Park in Heath, Ohio, south of the Newark Earthworks. They used magnetic gradiometer and electrical resistance survey techniques across a 2,000 m<sup>2</sup> area of the park north of Ramp Creek and north of where Lepper inventoried the Van Voorhis Walls. Several likely non-archaeological anomalies were found but two linear anomalies that trend northeast to southwest through the survey area potentially could represent signatures of the earthen wall enclosures of the Great Hopewell Road (Figure 8). Simpson and Kvamme (2001) did not perform archaeological testing of their results although they recommended such testing and additional geophysical survey to identify the Hopewell Road in the park.

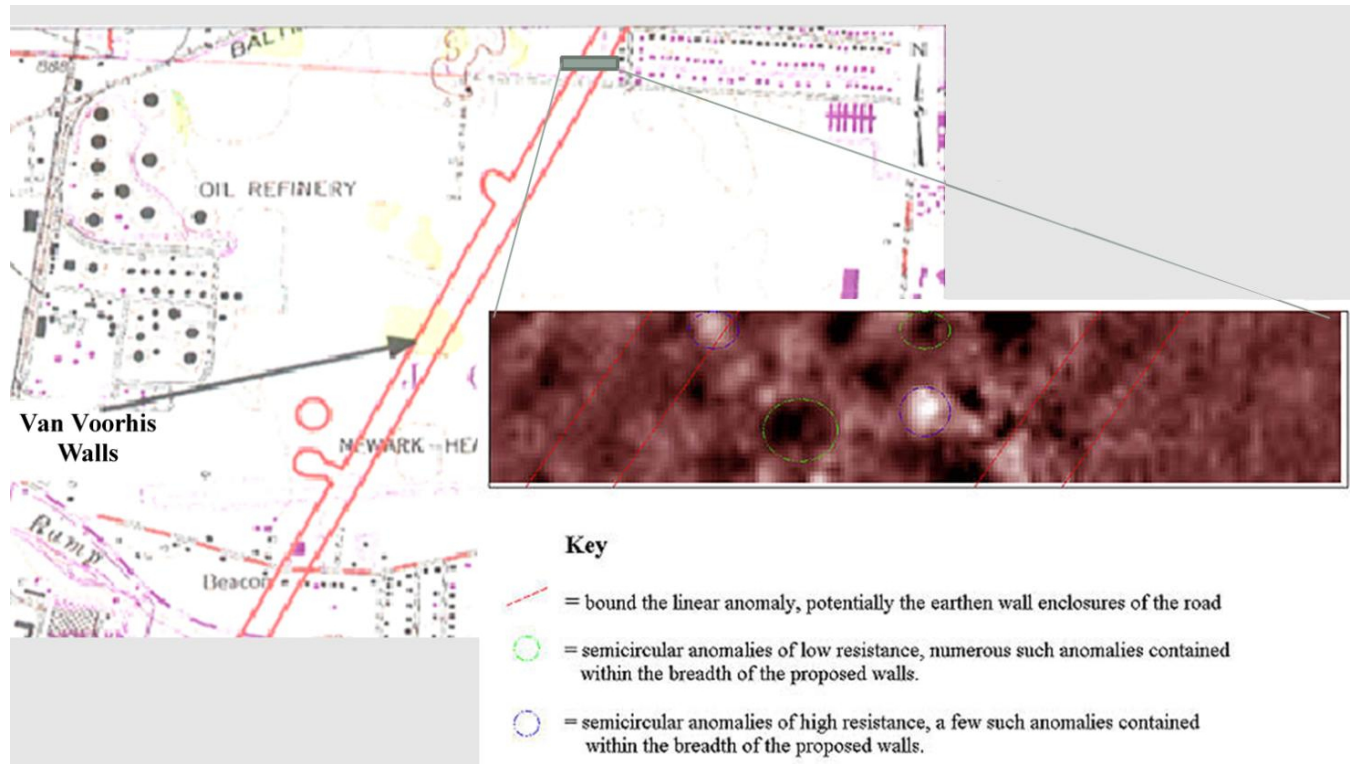
More recently, Romain and Burks (2008) examined Light Detection and Ranging (LiDAR) imagery of the area of the Van Voorhis Walls. They also reexamined Dache Reeve's 1936 aerial photographs of this portion of Licking County. They illustrate a number of visible segments of the Van Voorhis Walls north of Ramp Creek that were traceable in the 1930s and/or in 2008. The LiDAR cross-sections they created from a digital



**Figure 6.** Aerial photograph showing Van Voorhis Walls (Lepper 1991).



**Figure 7.** Aerial photograph showing skeletonized view of the Van Voorhis Walls as they cross a wood lot north of the Newark Airport. From the Ohio Archaeological Inventory Form for 33Li1401 (Lepper 1991).



**Figure 8.** Simpson and Kvamme (2000) geophysical investigation of the Great Hopewell Road

elevation model of this area are similar in form to the known cross-section of the *Sacra Via* (Squier and Davis 1848), a Hopewell parallel-walled earthwork in Marietta, Ohio (Figures 9 and 10).

It should be noted that some archaeologists are skeptical of the existence of the Hopewell Road south of Ramp Creek. In regard to the Hopewell Road providing a connection between the Newark Earthworks and earthworks in Chillicothe, Prufer (1996:416) stated that “there is, as far as I know, no concrete evidence whatsoever, in support of such a line of communication.”

### ASC Group’s Investigation of the Great Hopewell Road

ASC Group’s involvement with the Great Hopewell Road began in 2009 when we were approached by the developer of an industrial park just south of Ramp Creek in Heath, Ohio. Prior to construction of the industrial park, the United States Army Corps of Engineers, Huntington District and the Ohio State Historic Preservation

Office had asked that a treatment plan be developed to identify the Great Hopewell Road. This treatment plan was to be put into effect, pursuant to a memorandum of agreement. The Section 404 permit needed to develop the industrial park was contingent upon the negotiation and completion of a plan of research to identify the Hopewell Road, which was south of the Van Voorhis Walls, and was thought to run through the grounds of the industrial park.

At first negotiations on the contents of the treatment plan proceeded slowly with the archaeologists wanting to conduct geophysical survey across large areas and excavate trenches to locate and study the prehistoric roadway. Financial constraints and project-related contention prevented moving forward with such a plan. However, the excavation of a water main trench across the putative path of the Great Hopewell Road provided the first opportunity for fieldwork that all parties could agree on and execute together. ASC monitored and documented the excavation (Figure 11). A profile was made of the sewer line along



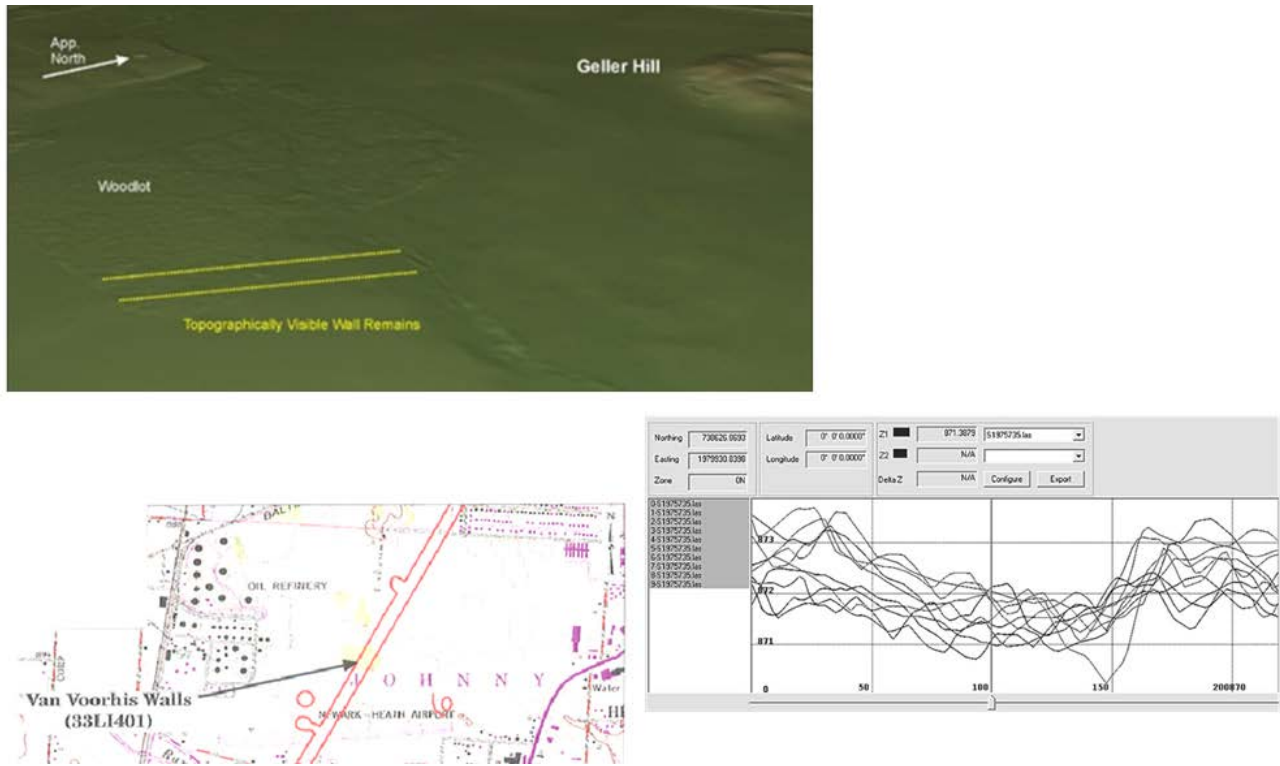


Figure 9. Romain and Burks (2008) Light Detection and Ranging (LiDAR) Study of the Van Voorhis Walls (33Li401).

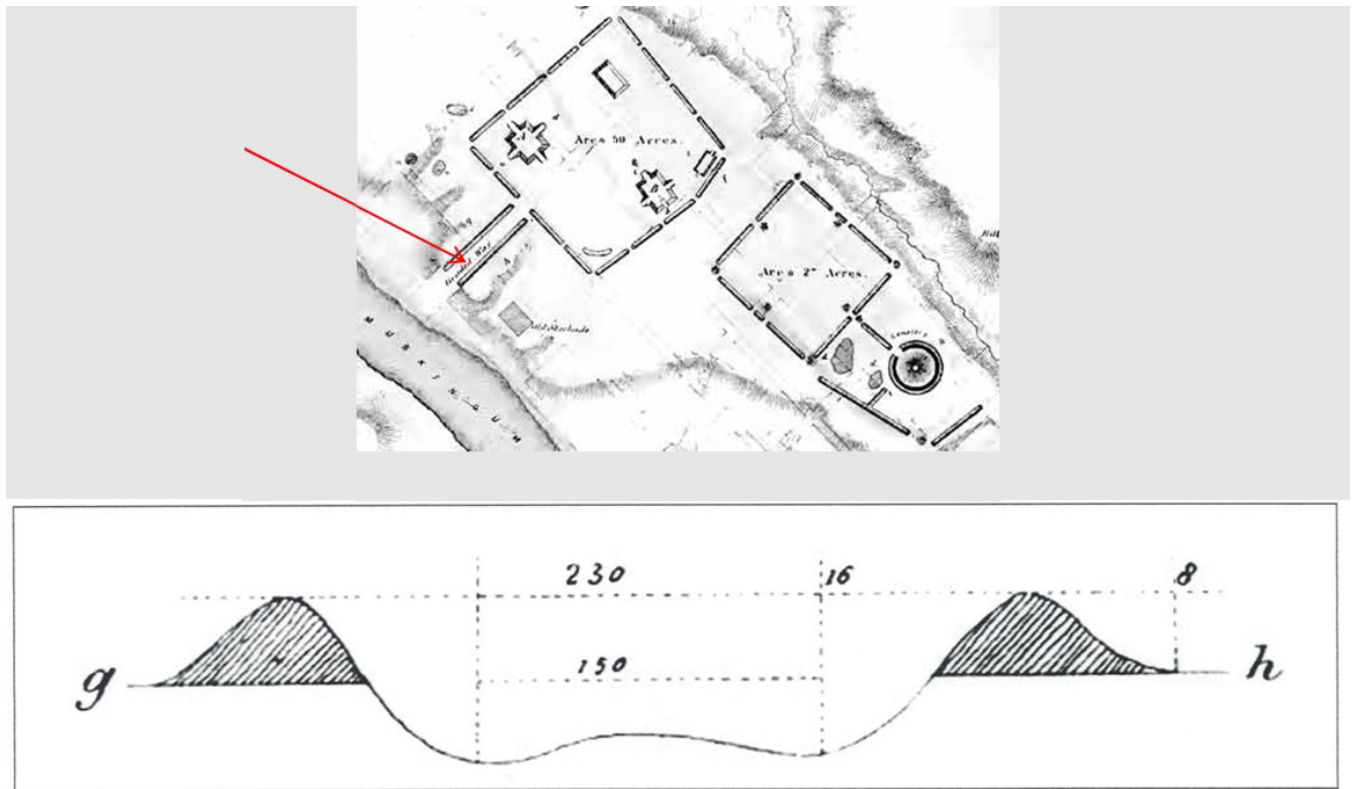


Figure 10. Map and profile of the Sacra Via, a parallel-walled earthen roadway, Marietta Earthworks, Marietta, Ohio.



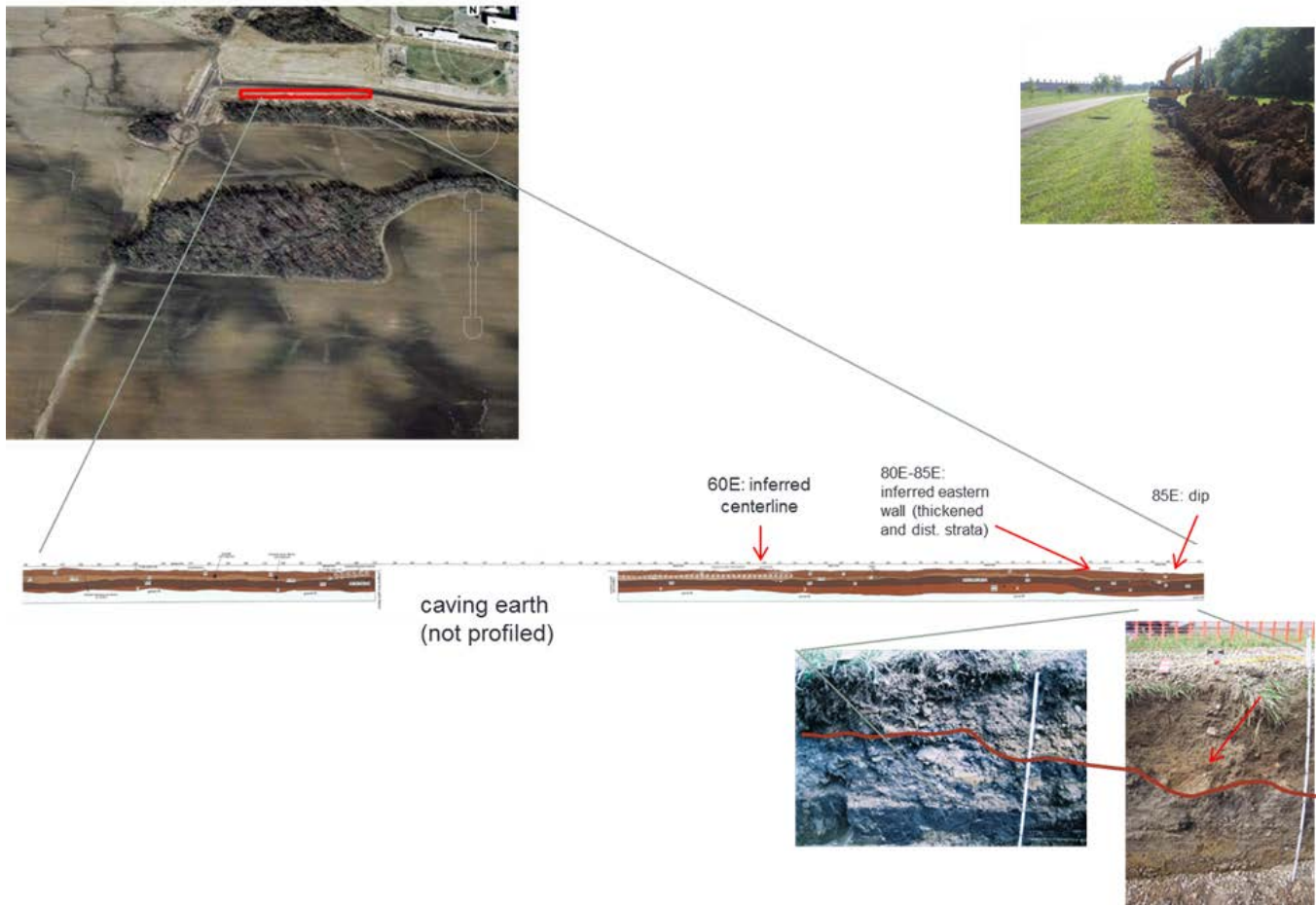
**Figure 11.** Overview of trench excavations.

a 124-m section running just south of James Parkway. A portion of the profile is shown in Figure 12.

The profile showed what appeared to be fairly standard plow zone and B horizon soils, which were underlain by glacially derived clays (Figures 13, 14, and 15A). However, closer examination of the profile identified anomalies clustered around the 60-m mark of the profile, which was projected to be the center line of the hypothesized Hopewell Road as it crossed the water main trench. For example, at 85E a noticeable dip was visible in the B3A and B4 horizons, which was not seen elsewhere in the profile and appeared to be artificial (Figures 15B and 16). The dip levels out at 86E and thus forms a trough approximately 1 m in width. It is possible this was the stratigraphic irregularity that could be

related to the plowed-down embankment wall and ditch. To the west at 80E-85E, thickened and disturbed B horizons were noted and a slight rise was detectable in the putative location of the eastern wall (Figures 15B and 16). Within the hypothesized road segment it was notable that caving earth was present from 37E-51E, due to poor drainage. This area could not be profiled. Enclosure by the walls of the Hopewell Road, which would have been separated by about 44 m-47 m, could have created a poorly drained interior section over time. It is estimated that after the parallel-walled roadway was abandoned, at some time in the post-Hopewell period, impaired drainage conditions within the walls would have created the swampy, unstable soil encountered in this section of the trench.

It should be noted that in the sewer trench wall profile between 35E-37E and 51E-62E

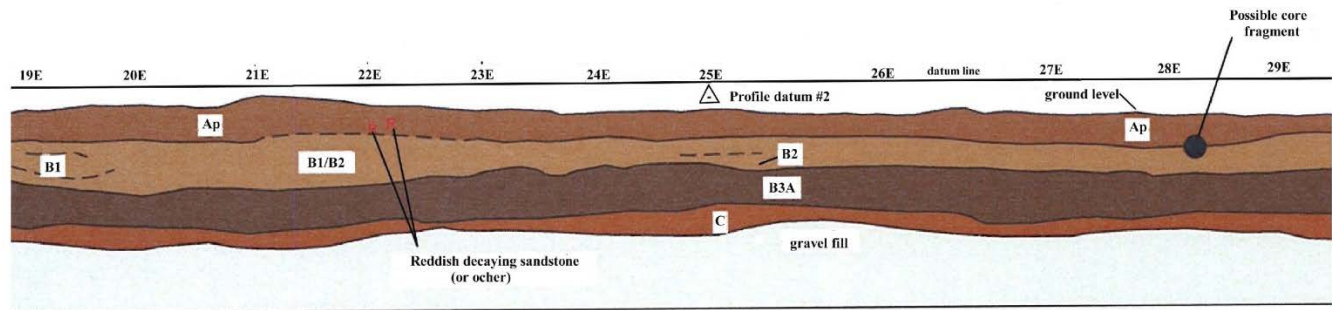


**Figure 12.** Profile of a portion of a 124-m long sewer trench crossing the possible path of the Great Hopewell Road (south of James Parkway).

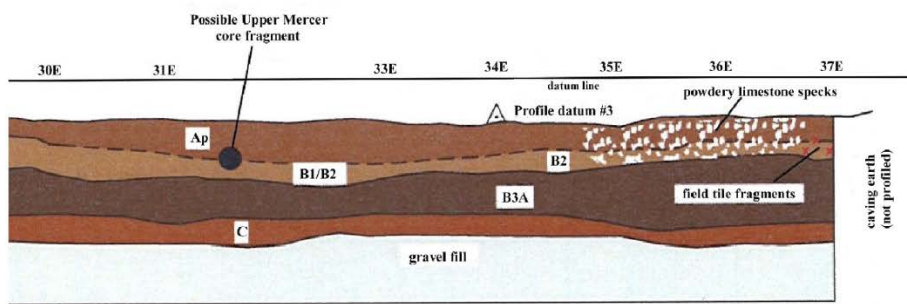
flecks of white decaying limestone were encountered in a distinct lens within the soil profile (Figures 13B and 14A-B). They were irregularly distributed between 0-75 cmbs. The limestone flecks were powdery and did not appear to be natural. At the time, it was thought perhaps the flecks were related to Hopewell pavement or top dressing for the road but no firm idea of their potential significance was determined. Upon consultation with Dr. Lepper (personal communication, December 2013), he stated that the Maya paved their *sacbeob*, or roadways, with white limestone. *Sacbe* means “white way” (Adams 1991:418) in Yucatec. More significantly, he noted that Zeisberger, regarding the Delaware, wrote:

When the chiefs among the Indians lay out a trail several hundred miles through the woods they cut away thorn and thicket, clear trees, rocks and stone out of the way, cut through the hills, level up the track and strew it with white sand, so they may easily go from one nation to another. (Zeisberger 1780, cited in Lepper 2006:127)

While I cannot know the significance of the observation, if any, based on available data, the potential correspondence with Native American practices is interesting, and, particularly in the case of the Delaware, provides insight on Eastern Woodlands native road-making behavior.

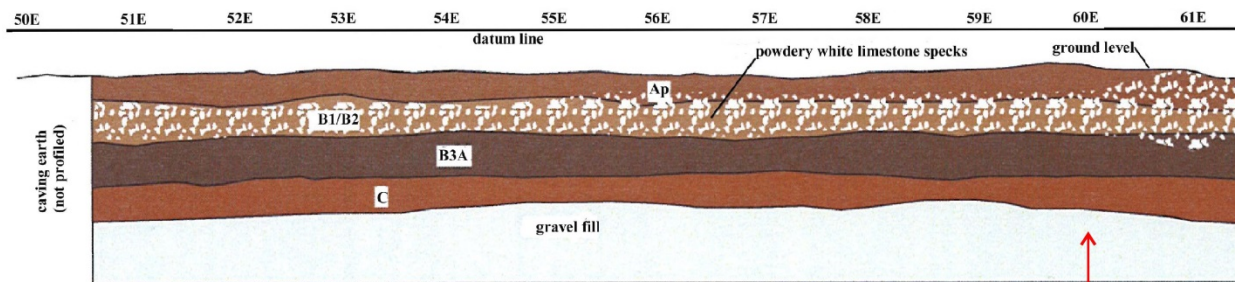


A)

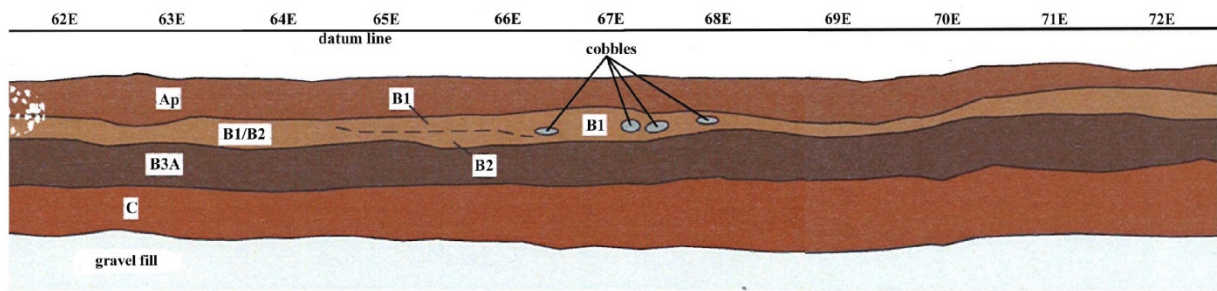


B)

Figure 13. Detailed profile of western portion the of sewer trench. A)19E-29E; B) 30E-37E.

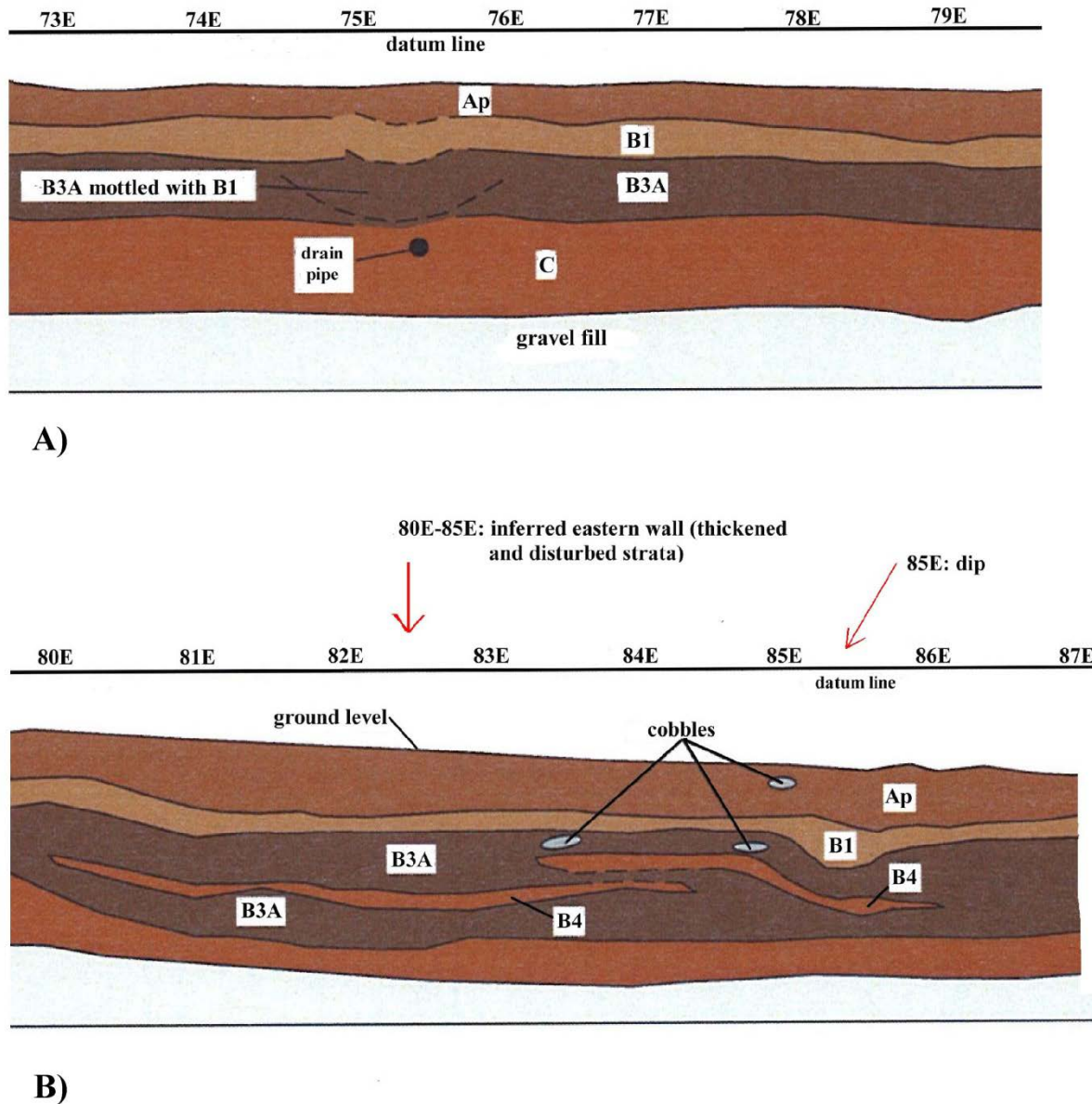


A)



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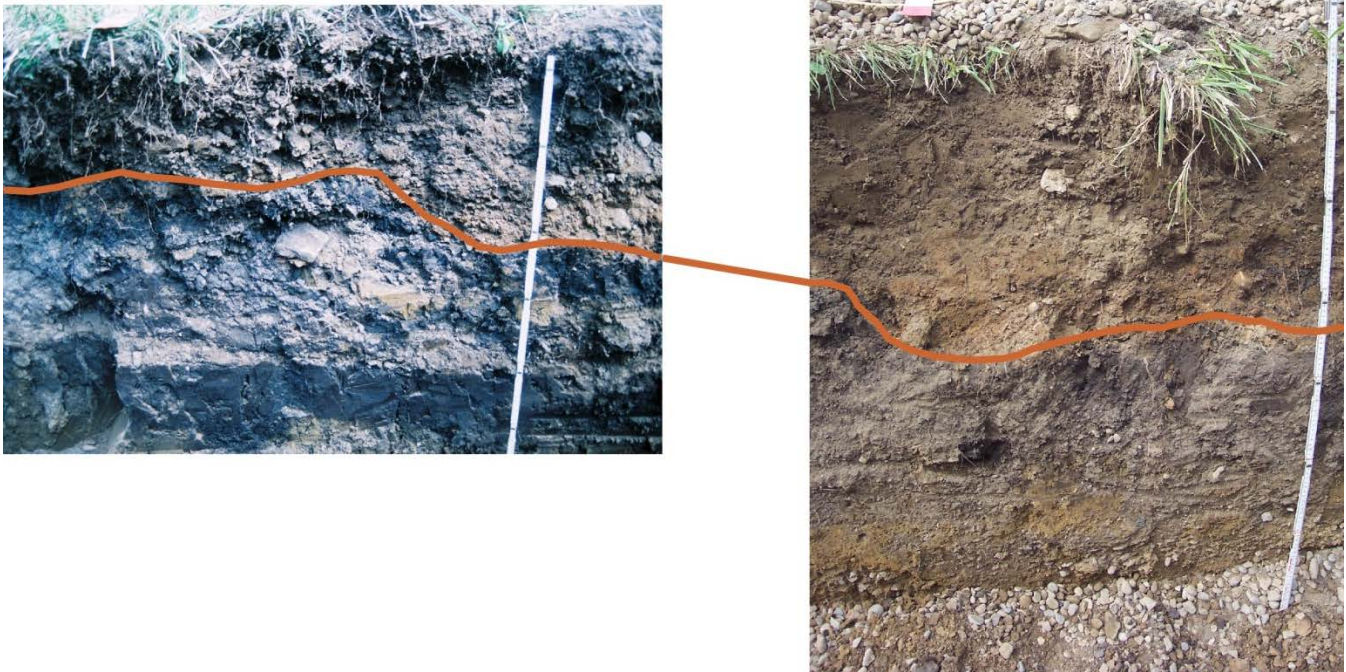
Figure 14. Detailed profile of central portion of the sewer trench. A) 50E-61E; B) 62E-72E.



**Figure 15.** Detailed profile of eastern portion of the sewer trench. A) 73E-79E; B) 80E-87E. The thickened and disturbed subsoil strata from 80E-85E may be the remnant of the Hopewell Road wall and adjacent ditch (85E-86E).

Following negotiations with the agencies and developer, it was determined that a 2000 m<sup>2</sup> block (20 m x 100 m) of an agricultural field would be surveyed using geophysical techniques (Figures 17 and 18). This block was in the location where Lepper (1995) had identified the Hopewell Road as being visibly evident in aerial and infrared photographs. ASC subcontracted Cultural Resource Analysts, Inc. (CRA) for the geophysical survey, which involved both magnet-

ic gradient survey and electrical resistance survey. Russell Quick came up to Ohio to conduct the survey (Quick 2010). He used a Geoscan FM256 fluxgate gradiometer and took magnetic readings at a rate of eight per meter along transects spaced every 50 cm. Electrical resistance data were collected with a Geoscan RM15 electrical resistance meter, with two readings collected per meter along transects spaced 50 cm apart. The data were collected and organized in



**Figure 16.** Profile photographs showing the thickened strata (possible wall remnant) and a dip in the subsoil (possible ditch remnant).

five 20 m x 20 m blocks. Quick performed the magnetic survey and made the interpretations; a noted geophysical survey expert, R. Berle Clay, examined the geophysical data, as well.

The results initially appeared to show little sign of the Great Hopewell Road, although it was noted that the size of the survey block was small, so linear feature identification would be difficult. Quick and Clay thought that the anomalies identified in the electrical resistance and magnetic data appeared to be geological rather than archaeological in nature. However, Jarrod Burks, representing the Ohio Archaeological Council (OAC) on the project, provided comments that differed with that assessment. The OAC was a consulting party to the undertaking. Burks examined the geophysical survey maps and noted that an apparently linear anomaly was running across the geophysical survey block. It was in about the right spot to be the signature of one of the parallel walls and corresponded to the location of the

western wall identified by Lepper on the infrared photograph. However, another linear anomaly that Burks identified appeared to be a possible signature of the other wall, but was outside of the area expected for the second wall, it being too distant from the first wall (Figure 19).

Since I am not a geophysical surveyor, it is impossible for me to judge the differing interpretations. Regarding my own collection of archaeological profile data along the putative route of the Great Hopewell Road, I consider the data to be suggestive of the presence of the Hopewell Road but nothing definitive could be determined. A more exhaustive review below of observations made by many archaeologists of the Great Hopewell Road elicits trends in the identification of it, and thus provides information that helps to determine whether continuing the search for the Hopewell Road has a good chance of meeting success or not.

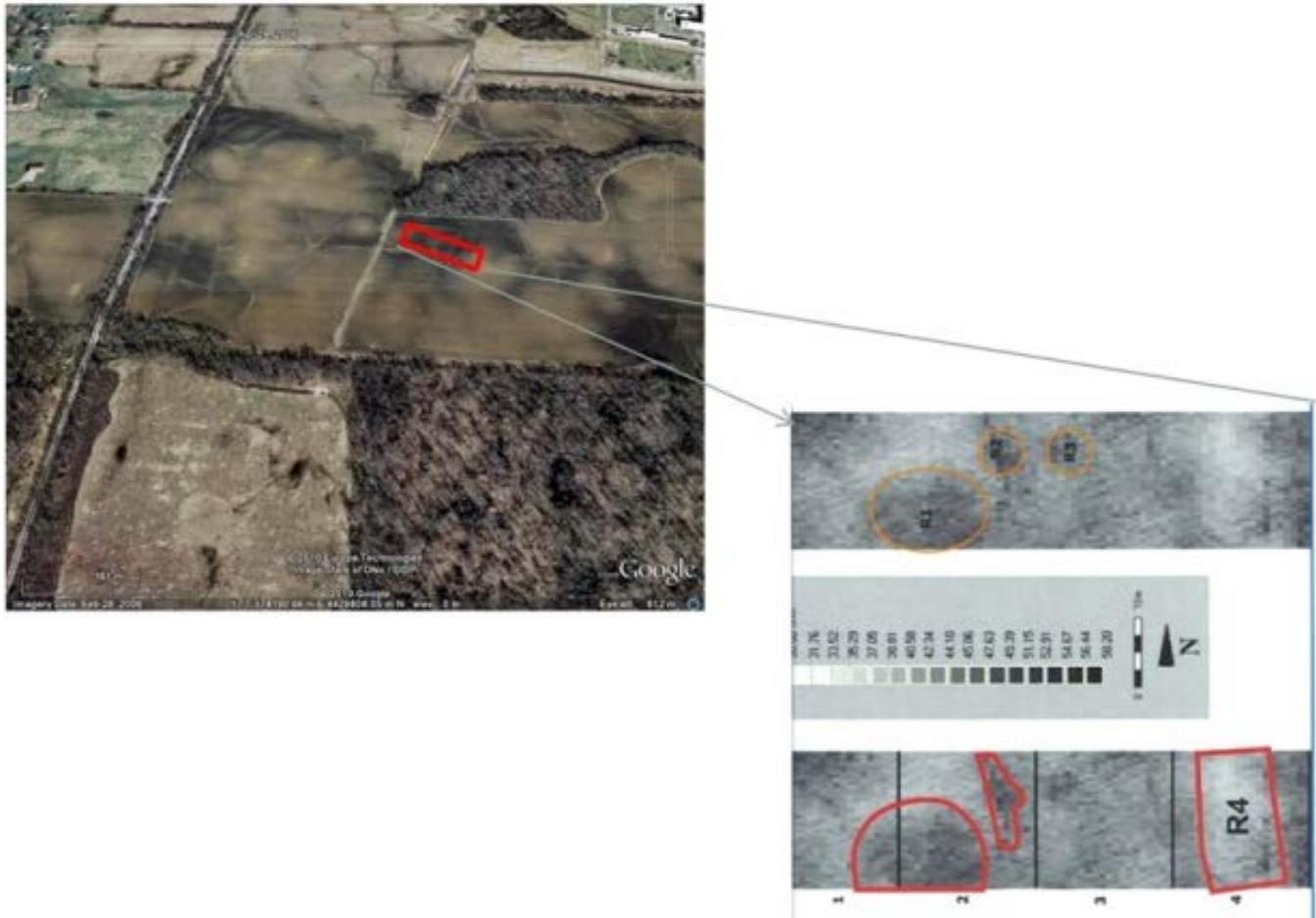


Figure 17. Geophysical survey results (Quick 2010).

### Evaluation and Interpretation

This section pulls together and evaluates the disparate observations that make up evidence of the Great Hopewell Road. At least 23 distinct observations have been made of the Hopewell Road near the Newark Earthworks (Table 1). They are organized by author (archaeologist) and distance from the Newark Octagon, which yields thirteen entries on Table 1. See Appendix A for details on how the data were collected. The study records each set of observations in terms of location on modern maps and maximum distance from the gateway at the Octagon earthwork that leads directly to the Great Hopewell Road. The observation is described briefly along with any references. If an anomaly thought to relate to the Great Hopewell Road (primarily the earthen

walls) was located, then the distance of deflection from the centerline projected across the landscape (Lepper 1995; Schwarz 2011) is recorded. Generally, each set of observations is paired on either side of the centerline although two are singular observations made by excavation. Also the table records the author's interpretation of the observation. Finally, the strength of the evidence is assessed along an ordinal scale of excellent, good, fair, and poor.

Excluding the outlier recorded during the ASC/CRA geophysical survey (Schwarz 2011), the deflection of the walls from the projected centerline of the Great Hopewell Road is highly consistent. The walls are a mean of 23.95 m from the centerline with a standard deviation of 1.22 m in 19 observations. Lepper (1991) records the total distance between the Van Voorhis Walls as

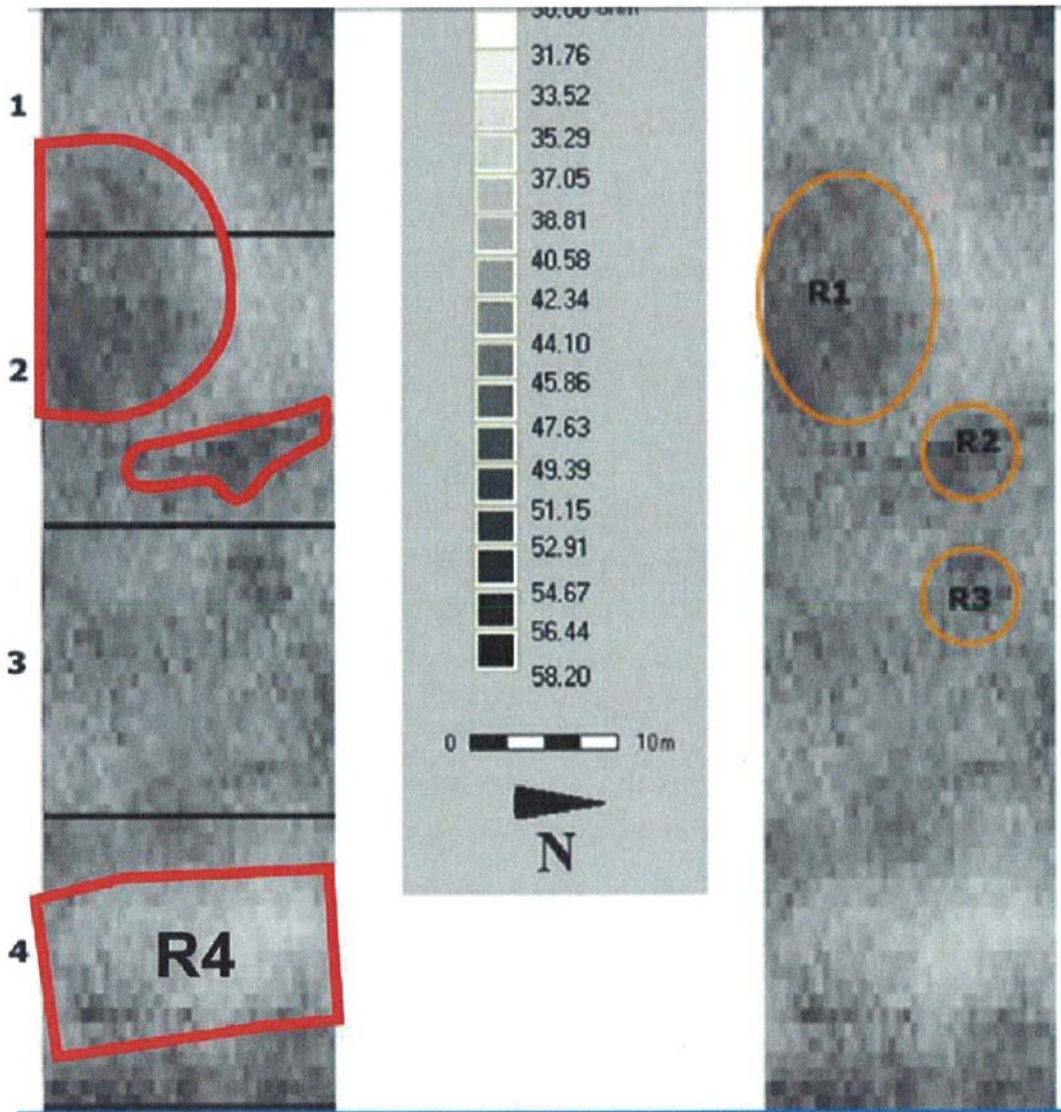


Figure 18. Detailed view of geophysical survey results (Quick 2010).

ranging from 44 m-47 m so the data are, in the main, consistent with this measure. Of course, such a statement belies a certain circularity, which is difficult to escape. Specifically, this statistic is perhaps biased in that the observations were recorded and no doubt expected to bear a relation to the projected distances the parallel walls of the Great Hopewell Road are posited to be. The outlier, an exception, was 52.5 m away from the projected centerline. A more important measure of consistency for the Hopewell Road data assesses whether the strength of evidence declines markedly south of Ramp Creek, since

most investigators consider the Van Voorhis Walls to be verified earthworks, while its existence south of Ramp Creek is more speculative.

Table 2 provides a summary of the strength of evidence for the Hopewell Road both north and south of Ramp Creek. The mode is the most frequent score in a distribution (following Hinkle et al. 1994:57); in this case the distribution is the strength of evidence data. Table 2 shows that the mode of the strength of evidence is excellent (n=8) north of Ramp Creek, while fewer observations' strengths were good (n=3). South of Ramp Creek, the mode of the strength of evidence is



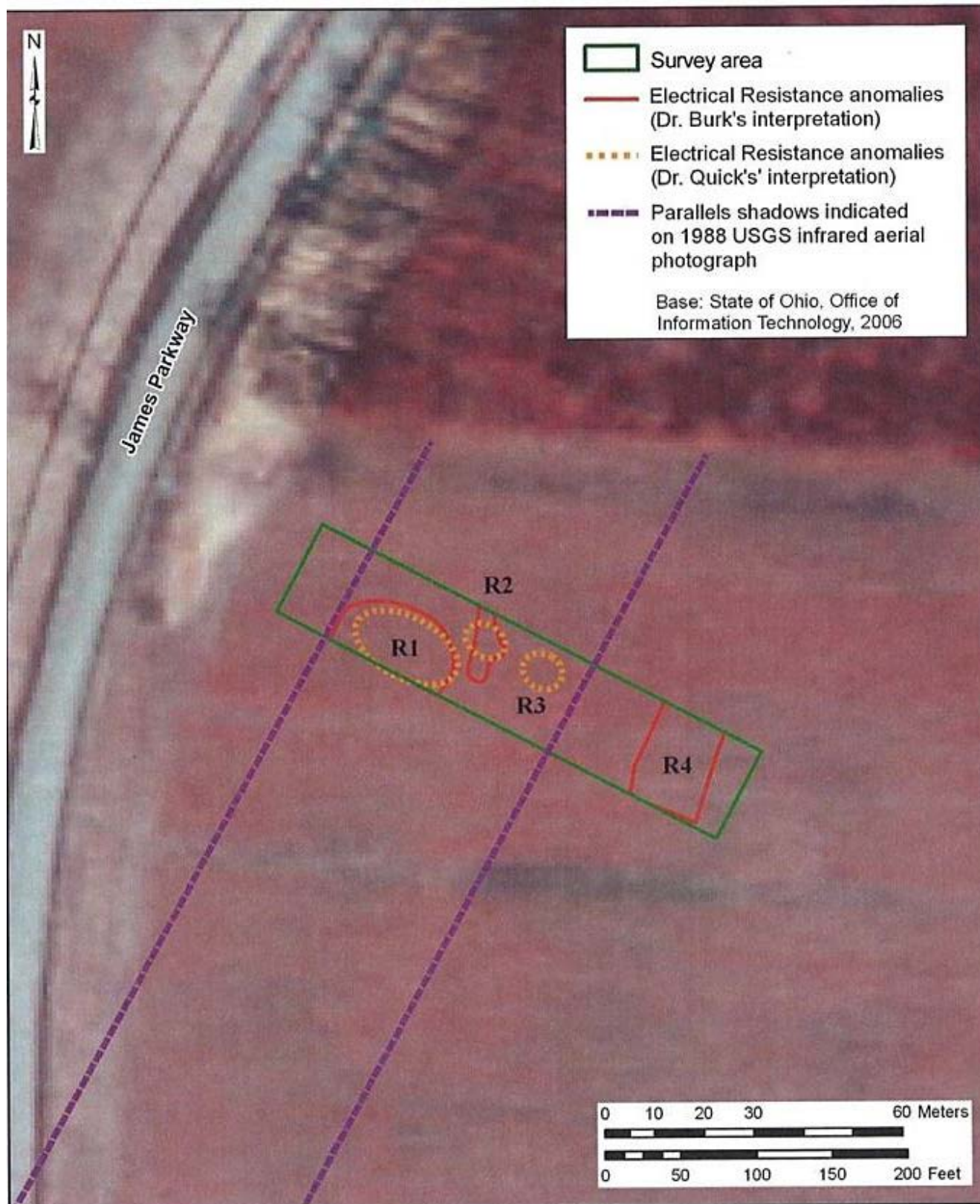


Figure 19. Aerial photograph showing electrical resistance anomalies R1-R4 with the parallel linear shadows found on 1988 infrared photograph (Schwarz 2011).

Table 1. Observations and interpretations of the Great Hopewell Road.

Location/Maximum distance from Newark Octagon	Observation(s)	Reference(s)	Deflection from Projected Centerline	Interpretation	Strength of Evidence
-North of Ramp Creek: Early Studies (3820 m)	Visual inspection, mapping, and aerial photographs (Reeves only)	Salisbury and Salisbury 1862; Squier and Davis 1848, etc.	Varies	Many authors documented parallel walls	Excellent
-North of Ramp Creek: Cynthia Street Park (2070 m)	Two linear anomalies in geophysical data trending northeast-southwest	Simpson and Kvamme 2001	26 m E and 26 m W	Possible geophysical signatures of the walls of the Hopewell Road	Good
-North of Ramp Creek: Van Voorhis Walls in Wood lot (2850 m)	Topographically detectable walls in wood lot.	Lepper 1991	Ca. 22 m E and 22 m W	Clear evidence of Hopewell Road.	Excellent
-North of Ramp Creek: Van Voorhis Walls (2850 m)	LiDAR cross-sections of walls	Romain and Burks 2008	25 m E and 25 m W	Cross-sections approximate the <i>Sacra Via</i> , a long known parallel-walled earthen roadway in the Marietta Earthworks group	Excellent
-North of Ramp Creek: south of woodlot, north of Newark Airport (3065 m)	West wall visible south of woodlot on 2006 Google Earth aerial.	This document	Unknown	Disturbance in the field probably accounts for absence of east wall	Good
-North of Ramp Creek: parallel walls cross fields near Newark Airport (3650 m)	Aerial photographs taken by a pilot in the 1930s.	Reeves 1936	ca. 25 m E and 25 m W	Excellent example of very straight and continuous traces visible at the time.	Excellent
-South of Ramp Creek: Trench south of James Parkway (4935 m)	Thickened area of subsoil with slight rise and dip.	Schwarz 2011	24 m E	Possible substrata of wall and ditch	Fair
-South of Ramp Creek: Trench south of James Parkway (4935 m)	Caved-in earth in middle of projected road	Schwarz 2011	10-23 m W	Poor drainage due to enclosing walls.	Fair
-South of Ramp Creek: Agricultural field (5350 m)	Parallel lines crossing field at 27° azimuth on 1988 infrared aerial	Lepper 1995	23.5 m E and 23.5 m W	Traces of Hopewell Road walls	Good
-South of Ramp Creek: Agricultural field (5350 m)	2005 Google Earth aerial	This document	24.5 m E and 24.5 m W	Traces of Hopewell Road walls	Good
-South of Ramp Creek: Agricultural field (5350 m)	2006 Google Earth aerial	This document	23.5 m E and 23.5 m W	Traces of Hopewell Road walls	Good
-South of Ramp Creek: Agricultural field (5350 m)	2008 Google Earth aerial	This document	23.5 m E and 23.5 m W	Traces of Hopewell Road walls	Good
-South of Ramp Creek: Geophysical survey block at location of parallel shadows on the 1988 infrared photograph (5350 m)	Electrical resistance anomalies	Burks 2010; Schwarz 2011	0-22 m W and 52.5 m E	Signature of possible road and western wall (?) and eastern wall (?)	Good and Poor

**Table 2.** Summary of strength of evidence for the Great Hopewell Road.

Observations' Location	Strength of Evidence:			
	Excellent	Good	Fair	Poor
North of Ramp Creek	8	3	0	0
South of Ramp Creek	0	9	2	1

good (n=9), while two observations are fair (n=2) and one is poor (n=1).

From these data, it can be seen that while the strength of evidence declines for observations south of Ramp Creek, the decline is not precipitous. The modal strength of evidence declines from excellent north of Ramp Creek to good south of Ramp Creek. The modal strength of evidence south of Ramp Creek is still good with three outliers (two fair and one poor). This trend, while intriguing, is not dispositive. It does not settle the issue. In other words, nothing in the collection and analysis of the Hopewell Road data in Tables 1 and 2 demonstrates any statistical significance to the observations south of Ramp Creek. In order to test the results and thus obtain greater statistical confidence, an ordinal logistic regression analysis was performed. The methods, analysis, and results are discussed at length in Appendix A. Below is a brief summary of the findings of this analysis and its importance.

The ordinal logistical regression described in Appendix A measures the association of the distance of the observation from the Newark Earthworks with the strength of evidence. For those readers interested in the details of the analysis, please see Appendix A. The analysis determined that 24.7 percent of the variability in the strength of evidence among observations is accounted for by distance from the Newark Octagon. This is not an insubstantial percentage, but that means that 75.3 percent of the variability of strength of evidence is unrelated to distance from the Newark Earthworks. In other words, the majority of the variability in strength of evidence is not correlated with the distance of the observation from the Newark Earthworks. Additionally, the strength of evidence only declines modestly over distance. The statistical analysis

indicates, in agreement with Table 2, that the decline in strength of evidence south of Ramp Creek is not great.

It is worth noting that despite the negative results obtained by Quick (2010) for the geophysical survey and the equivocal results obtained by Schwarz (2011) in profile data, examination of all data sources, including observation of aerial and infrared photographs, considerably bolsters the case for the Hopewell Road south of Ramp Creek. Additionally, reanalysis of the CRA/ASC geophysical data by Burks (2010) added peer review and a valuable reinterpretation of the findings of the geophysical study. The analysis presented here thus provides an excellent example of a situation where each individual piece of evidence may not be strong in isolation, but the combined evidence is more compelling.

Establishing that the decline in strength of evidence south of Ramp Creek is not precipitous bolsters the case made by Lepper (1995, 1998) and Burks (2010) that the Great Hopewell Road is potentially a real archaeological phenomenon beyond the Van Voorhis Walls. The Hopewell Road is worthy of further study and consideration as a potential cultural resource and more data collection warranted to confirm or deny its existence at locations south of Ramp Creek. This realization leads to a discussion below of the potential and challenges of studying the Great Hopewell Road.

### **Potential and Challenges of the Great Hopewell Road for Archaeology**

Doing archaeology on this kind of resource is a relatively new field in the study of Hopewell or Eastern Woodlands archaeology more generally.

Study of the Great Hopewell Road or parallel-walled earthen roadways as material indicators of social networks has a high potential of leading to important findings. These roads may have provided linkages between Hopewell centers (Lepper 1995, 1998) and minimally provided routes between Hopewell centers and waterways (Reeves 1936; Squier and Davis 1848). Further evidence, both direct and indirect, might be found of the flow of materials such as trade goods and ideas, particularly religious ideas, linked to use of these roads as procession-ways.

But locating the Great Hopewell Road is a challenge for archaeology and particularly for cultural resource management archaeology. The large extent of the “site,” which may extend 60 miles in length, and the difficulty of detecting the road are among the most serious problems that need to be dealt with in addressing this challenge. Monitoring of trench excavations failed to find many artifacts. It has to be expected that the Hopewell Road and other earthworks were probably constructed with stone, wooden, or shell tools and basket loads of earth (Jones and Cuttruf 1998:46). The construction of the earthworks probably did not produce many artifact discards or deposits along their length. It is doubtful intensive excavations of most sections of the Hopewell Road would yield many artifacts. Furthermore, many mounds and earthworks are severely plow damaged, even to the point of becoming invisible to the naked eye at the surface, in some cases.

These problems pale in comparison to the fragmented nature of the Section 106 process of the National Historic Preservation Act, which results in only isolated segments of the hypothesized prehistoric roadway being addressed on a project-by-project basis. The nebulous and, even to some archaeologists, hypothetical nature of the Great Hopewell Road (particularly south of Ramp Creek) has meant that it has been difficult to get traction on developing identification or research plans. Relatedly, agency officials and project proponents have been understandably questioning and had difficulties in understanding what is being searched for, what it would mean to

find the Great Hopewell Road, what would constitute evidence of it, and what a reasonable preservation or data recovery outcome would be. The refrain from the industrial park developer has been if the Hopewell Road is really 60 miles in length, then why does it need to be studied or preserved in my project area?

The key is for archaeologists to develop a clear understanding of what information we are searching for in the study of the Great Hopewell Road. How in the future will we judge and warrant data and findings in order to make interpretations, choose techniques to obtain these data, create the necessary regulatory and investigatory contexts, and develop ideas about what outcomes we are seeking? All of these involve reflection and strategic development. In conclusion, I provide an outline for what needs to be considered.

## Conclusions

Perhaps the most important first step in better understanding the Great Hopewell Road is developing a consistent strategy for National Historic Preservation Act studies, as they arise. Archaeologists potentially also should obtain funding from sources other than developer funds to study, interpret, and preserve representative sections of the Great Hopewell Road. To date, Section 106 studies of the Great Hopewell Road have been very limited in scale (only Schwarz 2011). Issues of the difficulties of grasping and studying such a large archaeological resource and issues of cost of geophysical survey have limited to date the application of broad, landscape-scale use of such techniques. Private or public entities developing projects have an obligation to consider potential effects of their projects on these kinds of non-traditional resources but such studies can only gain traction if we can convey their importance. Below are specifics for addressing these challenges.

1. Archaeologists must develop strategies for Section 106 and Section 110 investigations of the Hopewell Road. Potentially, we also

should conduct grant-funded archaeology in order to study, interpret, and preserve representative sections of the Great Hopewell Road. Federal agencies such as the National Park Service could prioritize the search for the Hopewell Road and apply Section 110 of the National Historic Preservation Act (NHPA) to locating and interpreting it. Section 110 enjoins federal agencies to proactively inventory, assess, and preserve archaeological resources within their jurisdiction, rather than acting strictly on a project-by-project basis. Section 106 practitioners could also benefit from a more synthetic best-practices approach to locating the Hopewell Road on their projects. So far the experience has been one of an ad hoc application of techniques in difficult regulatory circumstances that has only worked partially or provided suggestive but not definitive evidence (particularly south of Ramp Creek)[Schwarz 2011]. Developers would benefit from these measures because prior knowledge of the Hopewell Road's extant locations and a best practices approach would allow for them to avoid the resource if possible with their projects or know what to expect if they cannot avoid impacting Hopewell Road features.

2. Expanded use of archaeological geophysics, particularly the deployment of a cart-drawn array of multiple magnetometers, as pioneered in Ohio by Jarrod Burks, has reduced the cost and increased the area that can be surveyed and effectively studied in recent years (e.g., Burks and Schwarz 2012, 2013). Additionally, expanded use of LiDAR data, which is publicly available and increasingly used by CRM archaeologists in Ohio (Schwarz et al. 2013) has the potential to help archaeologists understand the signature of the Hopewell Road across broader sections of landscape (e.g., see Romain and Burks 2008).

3. Traditional excavation techniques (such as trenching and block excavations) should be used in specifically identified areas that have a high probability of containing stratigraphic, feature, or artifact evidence of the roadway and/or ritual deposits. Ritual areas may be circular earthworks that are linked to the Hopewell Road (Lepper 1998), or they might occur at gateways. Both of these contexts are detectable in aerial photographs, LiDAR data, or in geophysical survey data (e.g., Burks and Cook 2011). It also is worth considering the application of phosphate testing, which has been shown to be useful in identifying deposits of interest at Fort Ancient period sites with earlier earthworks (Nolan 2010) and more recently at the Hopewell period Fort Ancient site (as yet unpublished work by Kevin Nolan and collaborators).

Implementation or at least thoughtful consideration of these recommendations is particularly important because of the continuing urban/industrial development near Newark. There is also discussion that development will fall under Section 106 of the NHPA, and whether it falls under Section 106 or not, the stakes will be high. Change may be occurring soon out there and if archaeologists are going to learn anything about the Great Hopewell Road near Newark, it will be helpful to integrate these perspectives and methods as we move forward.

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### Appendix A. Statistical evaluation of the Hopewell Road evidence.

In the article above it was determined that an important measure of consistency of the Great Hopewell Road data is whether the strength of the evidence for the existence of the Hopewell Road declines markedly south of Ramp Creek. Strength of evidence was assessed on an ordinal scale as excellent, good, fair, and poor. A simple tabular analysis shows that the mode of the strength of evidence north of Ramp Creek is excellent, while the mode of the strength of evidence south of Ramp Creek is good. The comparison of modes shows that the decline over distance is not precipitous. However, such an analysis is not dispositive. It does not factor in sampling variability, which is particularly important to consider given the small sample size of the study (n=23). To answer this question more fully a more sophisticated method is needed.

An ordinal logistic regression was carried out for locations with the maximum distance from the Newark Octagon as the independent or predictor variable and the ordinal strength of evidence variable as the dependent or response variable (Hosmer and Lemeshow 2000). Ordinal logistic regression was chosen because it provides a direct measure of association between a paired set of ordinal and ratio variables that may be related, but are not necessarily related. Using the ordinal logistic regression analysis, the strength of association can be assessed via significance testing. Briefly, significance testing is a statistical means of determining whether the computed association between the variables departs from randomness. Significance testing assesses whether the measured association of the two variables most likely results from a real

association between them, rather than sampling error. The alternative to a true association is a situation where the computed association between the two variables could be spurious. The apparent association could be due to random factors (sampling error), in effect a false positive (Hinkle et al. 1994:169). Such a false positive is difficult to escape completely given the small sample size but statistical significance testing can help to quantify and thus control this risk. By controlling the risk of a false positive, called a Type II error in statistics, the analysis gains a level of quantification and cognizance of risk of error, which is missing in the evaluation presented in Table 2.

Minitab 11 was the software used for the study. This is statistical analysis software with a menu-driven graphical user interface. The menu options available include tools for descriptive statistics and tools for generating graphs. The software also has various inferential statistical tests. Ordinal logistic regression measures the linear association among groups of paired observations, where the response observations vary along an ordinal scale. The ordinal scale means sets of values that can be ordered (e.g., from worst to best or least to greatest) but do not have to be expressible as fractions or ratio values. In this case, the response variable was scored as excellent (1), good (2), fair (3), and poor (4). This scoring regime had the effect of rendering a decline in strength in evidence over distance a positive association, which provides for a straightforward interpretation.

The response variable for each set of observations was scored based on three factors:

(1) observations of the walls made by archaeologists; (2) distance of the deflection of the wall from the centerline of the Hopewell Road projected by Lepper (1995) and Schwarz (2011); and, (3) interpretation of the strength of evidence. The interpretation of the strength of evidence is primarily that made by the archaeologist, and, secondarily, made by me as the author of this study (Table 1). In the case of factor 1, strength of evidence is primarily based on visual perception of linearity and orientation, cross-section data (if available), and other possible explanations for anomalies (e.g., intermittent drainage features). Observations repeatedly made by more than one archaeologist were scored better than observations made only once.

Of course, an admittedly subjective factor played into the scoring. Observations of stratigraphic anomalies in the water line trench south of Ramp Creek (Schwarz 2011) were not scored as highly as obvious aerial views or on-the-ground surface observations by archaeologists of the well known Van Voorhis Walls. This often meant that I scored some of my observations as being not as strong evidence of the Hopewell Road as that of observations made by other archaeologists. I believe in this kind of rigorous assessment of evidence, and the notion that we should try to disconfirm the veracity of our own observations, and only provide support for observations that cannot be ruled out as other phenomena (Kaplan 1964:36-39). Falsification or disconfirmation is key to successful inference-making in archaeology (Kelley and Hanen 1984:77-79).

In regards to factor 2, the closeness of fit (and hence measures of distance) of the primarily linear evidence of raised walls is critical to current ideas and known evidence of the Hopewell Road as a walled road feature laid out across the landscape. It is recognized that if the Hopewell Road was built during a certain period in prehistory (e.g., the Middle Woodland period) that it could have been modified over time and this could have resulted in multiple walls at different distances and angles from the putative centerline. So too the Hopewell Road could have

had a bend (e.g., Figure 3), or multiple bends in it. Admittedly, these possibilities are difficult to deal with, although Reeves' (1936) aerial photograph appears to show a very straight set of parallel walls in the vicinity of the Newark Airport, perhaps indicating that, for at least this section, the assumptions of relative straightness and linearity are reasonable. Additional support is found in the account of Salisbury and Salisbury (1862) who wrote that the Hopewell Road proceeded in an undeviating course for six miles south of Ramp Creek.

Also, it should be considered that certain sections of the Hopewell Road could have been wider than other sections, resulting in differing expectations of deflections from the centerline, depending on the section. While not denying this is a possibility, I nonetheless think the best approach is utilizing the actual measured walls that Lepper (1991) documented as a primary set of expectations and only changing those expectations as new evidence arises.

Factor 3, mentioned above, is the interpretations of other archaeologists, and secondarily my observations of the data. Again there is no escaping a certain subjectivity but it is believed that the original observations of the archaeologists, tempered by my own comparative analysis, provide for a fair interpretation. Also, I factored in strengths and weaknesses of multiple data sources like aerial photographs, geophysical and LiDAR data, with my own excavated profile observations, and archaeologists' surface inspection observations.

Despite the above-described considerations of subjectivity, I think that the scoring regime provides a reasonable set of criteria for assessing strength of evidence for the Hopewell Road. It is particularly important to assess the Hopewell Road observations as one moves south, away from the known Van Voorhis Walls into areas where much less is known or confirmed.

The ordinal logistical regression analysis in Minitab 11 requires the input of the alpha level and it outputs several statistics whose interpretation provides information about the strength of association of the two variables. The alpha level,

a measure of the stringency of the test, is set at 5 percent, or .05. This means that the significance testing is run with 95 percent confidence that a positive association really is positive and not the result of sampling error. The alpha level thus allows for a 5 percent chance of such a ‘false positive’, a 1 in 20 chance that the analyst has to live with as a built-in uncertainty. An alpha level of .05 is generally considered to be fair for exploratory analyses although once a research hypothesis is better established in the literature an alpha level of .01 or lower might be applied to achieve greater certainty. One consequence is that a lower alpha level sets a higher bar for a data set to exceed to establish a significant association, which is often impossible to meet with preliminary survey data such as exists for the Great Hopewell Road.

Output for the ordinal logistic regression analysis includes various measures of association, either as measured against the alpha level (expressed as p-values) or by computing model parameters and summary measures of the regression analysis. The results of the ordinal logistic regression analysis indicate that the positive association is significant at the alpha .05 level (p=0.009). The log-likelihood ratio test indicates

a reasonable model fit (G=7.820, p=0.005) and one measure of association shows 70.3 percent concordant pairs. Summary measures (Somer’s D, Goodman-Wallace Gamma, and Kendall’s Tau) have values ranging from 0.29-0.49, indicating the model has only moderate predictive power. The regression of the scored response variable against distance yields a R<sup>2</sup> coefficient of 28.1 percent, and, accounting for small sample size of observations (n=23), an adjusted R<sup>2</sup> coefficient of 24.7 percent is computed. A fitted line plot graphically shows this relationship (Figure 20). This means 24.7 percent of the variability in the strength of evidence among observations is accounted for by distance from the Newark Octagon. This is not an insubstantial percentage but closer examination indicates that the effect is not precipitous over distance. In other words, the strength of evidence declines only modestly over distance. Examination of the observations south of Ramp Creek indicates strength of evidence is good (n=9), fair (n=2) and only one poor (Tables 1 and 2), meaning the distance “decay” in the strength of the observations is not severe (Muller 2009:140).

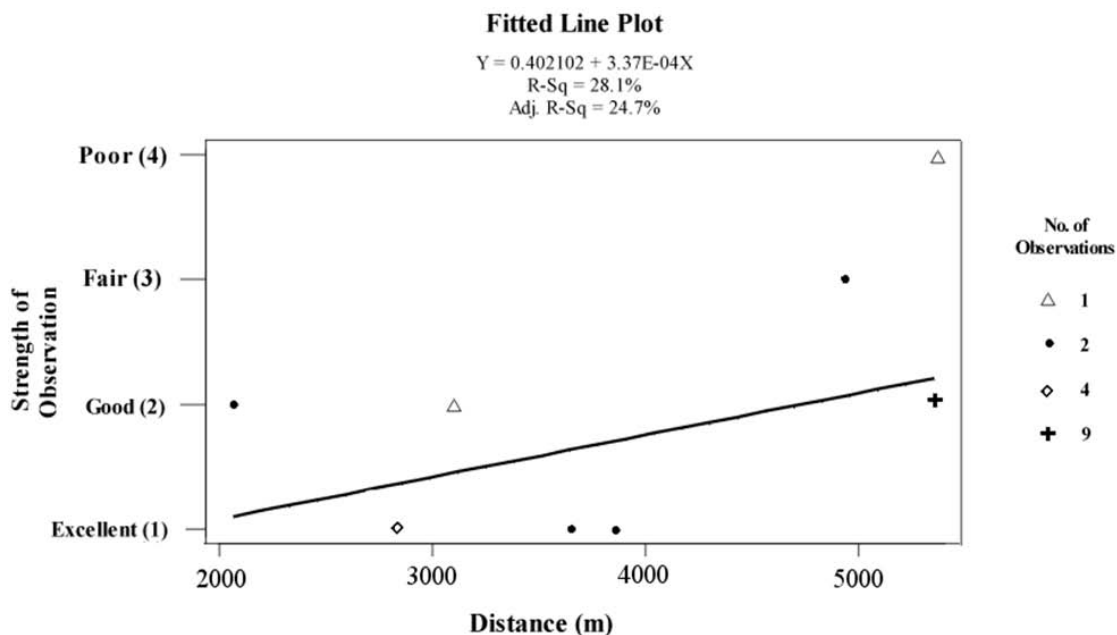


Figure 20. Fitted line plot comparing strength of observation and distance from Newark Earthworks.