An Unsettled History: Measuring Settlement Population and Sedentism in the Late Woodland Potomac River Valley

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ABSTRACT

This thesis investigates what information accumulations research can provide on settlement population and sedentism in the Late Woodland Potomac River Valley. Accumulations research is a flexible method that uses the discard equation to mathematically model the relationships between past populations and the archaeological record they leave behind. My research focuses on five archaeological sites in the Potomac River Valley, representing several of the different cultural complexes in that region during the Late Woodland Period (A.D. 900 – 1600). This study reviews the available data from these sites for several different variables in the discard equation, including settlement population, use duration (occupation length) and residential stability (seasonality), and uses the equation to evaluate the data. The results provide new insight into the cultural and demographic developments of the Potomac Piedmont's Late Woodland cultural history.

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Introduction:

This project investigates the potential for utilizing accumulations research to shed light on the intricate history of the Late Woodland Potomac Piedmont Region. Dr. Martin Gallivan applied this method with great success in the James River Valley (Gallivan 2002). By creating relative measures of sedentariness and ceramic discard behavior, which, combined with strong cases, produced estimates of site population, Gallivan's research demonstrated that both sedentariness and settlement population increased dramatically in the James River Valley after 1200 CE (Gallivan 2002). As a result, the area saw the emergence of political complexity, eventually taking the form of the Powhatan paramountcy (Gallivan 2003, 179-181). For many reasons, Dr. Gallivan's methods could not be perfectly translated to the Potomac Region. In particular, although relevant sites were selected representing the three cultural complexes in the region—Montgomery, Page (Mason Island), and Keyser (Luray) Complexes (see Table 1)—the high quality of data required for accumulations research limited the dataset's sample size. With the available data vulnerable to skewing, this project investigated different methods for measuring and calculating data on the three primary variables of interest: population, use duration, and residential stability. In this process, it was necessary to make a subjective judgment about the reliability of the different methods' results. Ultimately, this project was able to support the general applicability of accumulations research to study the Late Woodland Potomac Piedmont and provide new information about population and settlement practices that illuminates the region's eventful history.

Background:

This project specifically investigates the Piedmont region of the Potomac River Valley. The Piedmont represents the physiographic province between the Coastal Plain and the Blue Ridge Mountains; in the Potomac Valley, the Piedmont consists of Montgomery and Frederick Counties in Maryland (including the Monocacy drainage) and Loudoun County in Virginia (Dent 2007, 1-2). The region was chosen primarily for data availability, but the Piedmont is not unimportant in the Middle Atlantic's history: "the innovations of the Woodland Period, in particular the initial development of a local ceramic tradition and the later agriculturally based subsistence practices, emanate from a Piedmont hearth" (Dent 1995, 269). Indeed, this paper focuses on the Late Woodland Period, extending from 900 CE to European colonization, when the region's inhabitants first adopted maize cultivation (Dent 1995, 243-254). However, "[t]he ultimate source of both innovations probably lay in the Southeast and/or the Midland areas" (Dent 1995, 269). The Piedmont was important as a conduit for new developments, from an earlier western 'hearth.'

Site Number	Site Name	Complex	Median Radiocarbon Date	Site Type	Source
18FR14	Biggs Ford I	Montgomery	1297.5	Hamlet / Village	Hall 2021; Peixotto 2021
18FR17	Nolands Ferry	Page	1303	Hamlet	Peck 1980
18FR18	Rosenstock	Montgomery	1384.5	Village	Curry and Kavanagh 2004
18MO09	Winslow	Montgomery	1391.5	Village	Dent 2007
18MO01	Hughes	Keyser	1450	Village	Jirikowic 1999; Dent 2009
18FR14	Biggs Ford II	Keyser	1578	Village	Hall 2021; Peixotto 2021

Table 1: Sites analyzed in this project by median radiocarbon date.

At this point, the concept of archaeological cultures must be addressed. Archaeologists typically divide their evidence into archaeological typologies and cultures based on patterns of material traits, including artifact and site types (Griffith 2018, 207). This form of classification serves two purposes: "The objective is to know the people and to share that knowledge" (Griffith 2018, 211). First, these labels should describe the artifacts produced by different learning networks and communities of practice (Griffith 2018, 212; Hall 2012; Hayden 2009), thus accessing some elements of past reality. Second, archaeological typologies expedite cataloging, describe data, and standardize comparisons (Moeller 2018, 196). These labels are thus a shorthand to summarize and communicate the breadth of archaeological data.

Usually, ceramic, mortuary, and settlement practices serve as the basis for cultural labels (Griffith 2018, 209; Means and Moore 2020, 161-162). For ceramics, archaeologists often focus on temper and the twist direction of cord-marking, as will be seen. Temper refers to materials that potters mix into clay to improve its handling characteristics (Hall 2012, 110). Cord-marking refers to the use of cordage to decorate ceramics, and twist direction refers to the direction (S- or Z-twist) that fibers were spun to create the cordage (Custer 2004; Hayden 2009). For mortuary practices, as will be seen, differences in the type of internment or position might be considered significant. In terms of settlement practices, terminology for settlement types is often deployed rather loosely. Potter argued for using the terms *hamlet* and *village* as two ends of a continuum between small and large sites (Potter 1993, 28). Means and Moore used *hamlet* for “dispersed one or two family” settlements and *village* for larger, concentrated settlements (Means and Moore 2020, 165). More specific definitions have been based on numbers of households or the residence of a *werowance* (political leader) (Potter 1993, 28). As will be seen, most of this study’s sites would be considered villages (see Table 1).

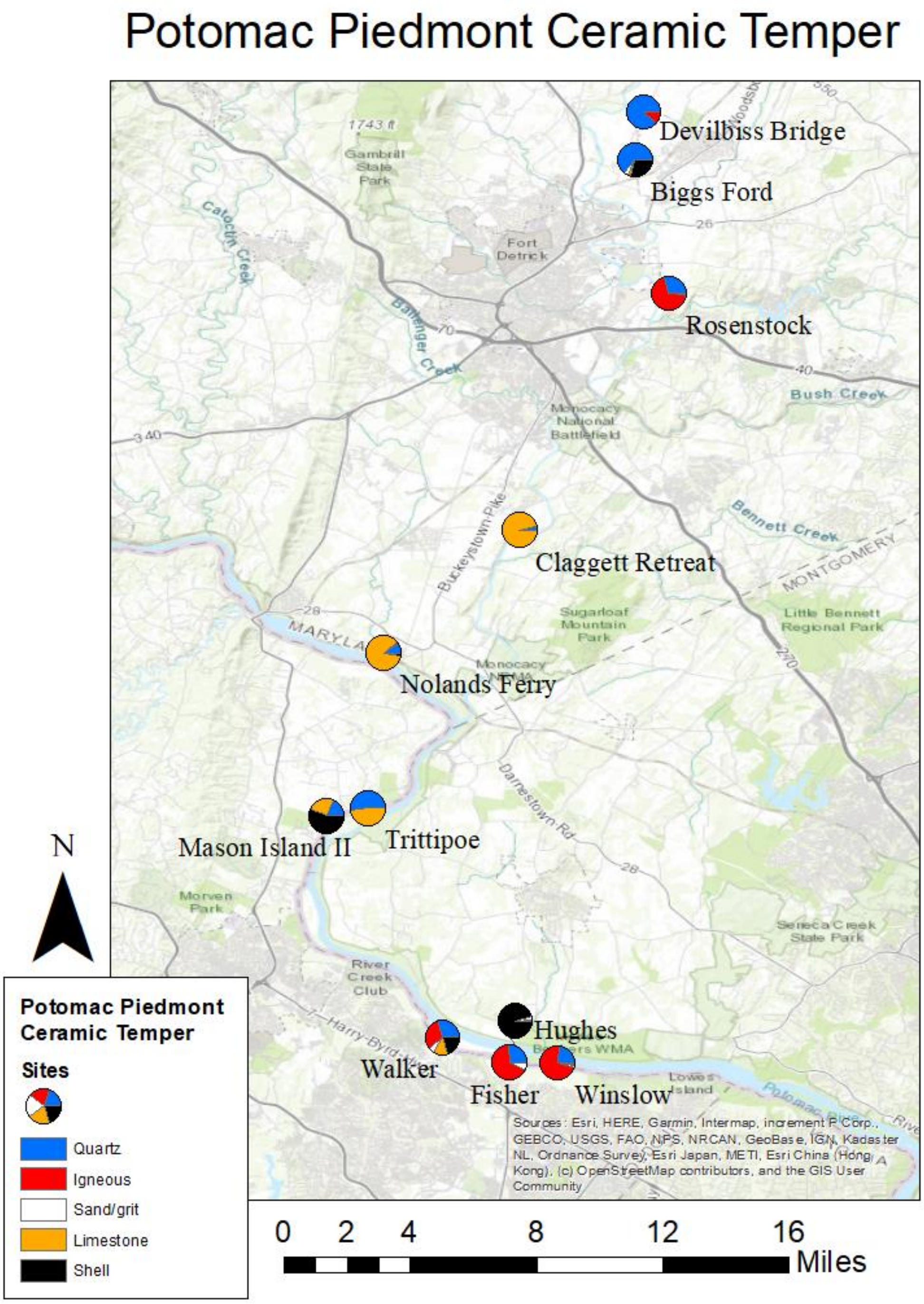

Figure 1: Potomac River Piedmont sites.

There are problems with this culture historical approach, however. Most notably, its original purpose was rather different: "The objective of culture history was to define historical societies at a given time and place by their distinct cultural or 'ethnic' characteristics" (Griffith 2018, 207). That is, archaeological cultures were equated with past cultural identities (Means and

Moore 2020, 165). This problem was further exacerbated when archaeologists ignored variation that did not fit into established definitions (Means and Moore 2020, 161), when cultural labels were presumed to be overly bounded (Feinman and Neitzel 2020, 2) or when labels were treated as animate agents in themselves (Moeller 2018, 197). A typology is “only a construct, a mnemonic device, a heuristic creation” (Moeller 2018, 197), and “one should not equate archaeological constructs to actual native cultural groups” (Means and Moore 2020, 165). Cultural identities were complex, learning network boundaries were porous, and human actors made choices about their practices (Feinman and Neitzel 2020, 4-7; Griffith 2018, 214-215).

While scholars argue over whether cultural history’s baggage has been shed (Griffith 2018, 210-216; Feinman and Neitzel 2020, 1-9), cultural labels remain in use today and remain the framework for understanding the Potomac region’s history, with the standard warning that such labels be used “cautiously” (Moeller 2018, 204; Means and Moore 2020, 165). The region was "a highly fluid landscape" with communities classified under many different cultural labels (Gallivan 2010, 296). These labels were originally defined according to the more problematic form of culture history (Dent 1995, 289), and before the advent of radiocarbon dating (Means and Moore 2020, 165). As will be seen, these labels more accurately reflect several communities of ceramic practice, cordage production learning networks, and funerary traditions. There is no reason to connect these labels with linguistic, ideological, or ethnic identities; indeed, sites may have been multiethnic communities (see Figure 1) (Gallivan 2010, 297). This paper will refer to these labels as *complexes*, though other terms like *focus* and *phase* have been used (Means and Moore 2020, 162; Potter 1993, 130; Moeller 2018, 194).

Montgomery Complex:

The Montgomery Complex is the first categorization to consider. Its ceramic style, Shepard Ware, was tempered with quartz or igneous rock (see Figure 1) and cord-marked with Z-twist cordage (Means and Moore 2020, 166-167). These potters typically buried their dead in individual, flexed burials (Potter 1993, 126). Their subsistence practices mixed maize horticulture with seasonal foraging (Means and Moore 2020, 167), and communities might move between sites as soils were exhausted (Dent 2007, 41). Indeed, some sites were transitory settlements like Biggs Ford I, but others like Rosenstock may have been inhabited for long periods (Gallivan et al. 2023). The settlement system included a mix of hamlets and villages (Kavanagh 2001, 5-6). Villages often followed a standard plan, consisting of, concentrically, a central plaza, a ring of storage pits, circular houses, and a boundary palisade (Curry and Kavanagh 2004, 29-32).

It must be noted, however, that this definition of the Montgomery Complex papers over significant internal differences and external similarities. For instance, specific tempering preferences varied between igneous and quartz material between sites (Slattery and Woodward 1992, 145-146; Curry and Kavanagh 2004, 17; Hall 2021, 11), while flexed burials were common among some other cultures (MacCord 1989). Sites falling within this classification were primarily located in the Potomac Piedmont but extended west into the Shenandoah Valley (Means and Moore 2020, 166-167). In particular, there were two clusters of sites in the Piedmont: a “Montgomery

Triangle" of Winslow (18MO9), Shepard (18MO3), and Fisher (44LD4) in southern Montgomery County (Dent 2007, 56-57); and Biggs Ford (18FR14), Rosenstock (18FR17), and Devilbiss (18FR38) in central Frederick County (see Figure 1) (Kavanagh 2001, 5-6). The Montgomery Complex sites analyzed in this project include Biggs Ford I, Rosenstock, and Winslow.

Biggs Ford (18FR14):

Biggs Ford (18FR14) is located in northern Frederick County, along the Monocacy River (Dent 2021, 1). Tyler Bastian investigated the site in 1969-1970; the Archeological Society of Maryland (ASM), with American and Towson Universities, further excavated Biggs Ford in 2013-2015 (Peixotto 2021, 24). Bastian excavated a trench 6 meters by 120 meters across the site (Hall 2021, 6), which ensured that a higher percentage of Biggs Ford was excavated than other sites. The ASM and AU excavated an additional 276 m^2 in units (Peixotto 2021, 26). With reasonably complete information available from both excavations, this paper combined the two datasets.

SITE NAME	Site Area (m^2)	Area Excavated (m^2)	Percent Excavated
Biggs Ford I-1	3959.192	396	10.00%
Biggs Ford I-2	3959.192	396	10.00%
Biggs Ford I-3	5055.608	716	14.16%
Biggs Ford I-4	5055.608	716	14.16%
Biggs Ford II-1	8659.015	790.5	9.13%
Biggs Ford II-2	8659.015	790.5	9.13%
Biggs Ford II-3	8659.015	790.5	9.13%
Biggs Ford II-4	8659.015	790.5	9.13%

Table 2: Biggs Ford area calculations per occupation and scenario.

Biggs Ford, however, is unique for having two unmistakably different occupations. The first, Montgomery occupation was a dispersed and unpalisaded settlement located in the site's southern area, with primarily quartz-tempered ceramics (Hall 2021, 10-21). The second, Keyser occupation was larger, including the northern areas, and palisaded, with shell-tempered ceramics (Peixotto 2021). Bayesian modelling suggests that the Montgomery occupation lasted from roughly 1250 to 1380 CE, while the Keyser occupation lasted from 1480 to 1650 CE (Gallivan et al. 2023).

This project divided the combined data between Biggs Ford I, representing the Montgomery Complex, and Biggs Ford II, representing the Keyser Complex. Four scenarios were created for each occupation, depending on which contexts were assigned to which occupation (see Appendix 1). The site area and percent excavated for Biggs Ford I was calculated using the distance between classified contexts, which varied between scenarios (see Table 2). In all scenarios, Biggs Ford I's area was significantly less than the nearby Rosenstock site (7,250 m^2), but also larger than the Nolands Ferry site (1,257 m^2), suggesting it fell in the middle of a continuum between hamlets and villages. Meanwhile, the Keyser occupation was reported to have a palisade 105 meters in diameter (Hall 2021, 12), so this figure was used to calculate site area and percent excavated for all scenarios at Biggs Ford II, which was unquestionably a village.

Rosenstock (18FR18):

Rosenstock (18FR18) is located on the Monocacy River in northern Frederick County, Maryland (Curry and Kavanagh 2004, 1). The Archeological Society of Maryland excavated the site first in 1979 and then again in 1990-1992 (Curry and Kavanagh 2004, 1). The site area is reported as 78,000 square feet (Curry and Kavanagh 2004, 30) or approximately 7250 m^2. Excavation covered 360 m^2, which Curry and Kavanagh interpreted as 7% of the site area (Curry and Kavanagh 2004, 1). Given their statements, this project assumed around 4.97% of the site had been excavated. The ceramics were largely cord-marked, with either igneous rock- or quartz-temper (Curry and Kavanagh 2004, 17). Excavations of the site center identified a central plaza with two probable sweat lodges and a surrounding storage pit arc, but not a palisade (Curry and Kavanagh 2004, 29). Curry and Kavanagh proposed three possible interpretations of Rosenstock's varied radiocarbon data: (1) one continuous or sporadic long-term occupation, (2) two different shorter-term occupations, and (3) contaminated radiocarbon samples (Curry and Kavanagh 2004, 26). Further research is needed to test the three interpretations, but Gallivan et al.'s model for the first option spanned roughly 1160 to 1510 CE (Gallivan et al. 2023). Rosenstock is thus one of the most prominent and least understood Montgomery Complex sites.

Winslow (18MO9):

The Winslow Site (18MO9) is located in the floodplain of the Potomac River's north bank in Montgomery County, Maryland (Slattery and Woodward 1992, 9). With nearby Fisher (44LD10) and Shepard (18MO3), the site forms the "Montgomery Triangle" (Dent 2007, 56-57). The site's palisade was ~86 meters (275 feet) in diameter and enclosed an area of 5,809 m^2 (6,604 square yards, 1.4 acres) in area (Dent 2007, 42). Winslow was initially tested in 1940-1941, and significantly excavated by the Archaeological Society of Maryland in 1959-1961, and then excavated again by the Archaeological Society of Maryland and American University in 2002-2003 (Dent 2007, 1-10). As complete data were available only for the last excavation, only that dataset was used. Over the course of these two field seasons, around 181-182 m^2 were excavated (Dent 2007, 17-19), amounting to 3.12% of the site. The ceramic assemblage was primarily igneous-tempered Shepard ware (Dent 2007, 24-26). Winslow had the prototypical Montgomery Complex site plan of an open plaza surrounded by concentric rings of storage pits, houses, and a palisade (Dent 2021, 3). Bayesian modelling suggests that the occupation lasted from roughly 1370 to 1430 CE (Gallivan et al. 2023). Winslow has for good reason been treated as the model Montgomery Complex site.

Page Complex:

The Page or Mason Island Complex is another label that organizes a highly intricate material reality based on ceramics and burial practices. Page ceramics were limestone- or quartz-tempered and cord-marked with Z-twist cordage (see Figure 1) and often smoothed over (Means and Moore 2020, 167-168; Kavanagh 2001, 9; Dent 2010, 9). Communities in this classification practiced individual extended primary burials, with some flexed internments (Means and Moore 2020, 167). Sites classified within the Page Complex are found in the Appalachian Mountains, Shenandoah Valley, and Piedmont (Potter 1993, 130-131; Wall 2001, 17-23). The Piedmont sites are found from the southern Monocacy Valley to Mason Island (Kavanagh 2001, 8-9; Dent 2010, 11-14), specifically in between the clusters of Montgomery sites (see Figure 1). Thus, Page sites were distributed over an area extending farther west than, but not quite as far east as their Montgomery Complex neighbors.

The chronology of these complexes is unclear: some authors argue that Page postdated the Montgomery Complex (Potter 1993, 131-132), while others propose that Page preceded Montgomery (Dent 2010, 33). Radiocarbon data supports neither option and instead suggests that the two complexes coexisted for long periods (Gallivan et al. 2023). Similarly, in the

Appalachian Mountains, Page overlapped with the Intermontane Culture, defined by limestone-tempered ceramics and flexed burials (MacCord 1989).

In general, subsistence practices among Page sites were similar to the Montgomery Complex's (Kavanagh 2001, 8). Villages existed in the Appalachians, but all known Piedmont sites were hamlets (Dent 2010, 8; Wall 2001, 17-20). Villages may have been more common later in time (Means and Moore 2020, 162). Some Page sites were palisaded, especially in the areas overlapping with the Intermontane Culture (MacCord 1989; Means and Moore 2020, 162), but known Potomac Valley sites were probably not palisaded (Dent 2010, 8). Settlements may have followed a similar pattern to the Montgomery Complex sites of central plazas surrounded by storage pits and domestic structures (Corson 2003, 26). Sites seem to have run the gamut from relatively transitory to long-lived settlements (Gallivan et al. 2023). In sum, the Page Complex labels a limestone-tempering community of practice with uncertain chronology, external relationships, and internal organization.

Nolands Ferry (18FR17):

The Page Complex is poorly represented in the dataset used for this project due to the challenges in finding sufficient information for most Page sites (see Table 1). The only example is Nolands Ferry (18FR17), about which a frustrated Dr. Richard J. Dent declared: "maybe the site just does not fit the norm. It happens" (Dent 2010, 13), suggesting that the site is not representative of the complex. Nonetheless, Nolands Ferry is located on the Potomac River in southern Frederick County, Maryland (Peck 1980, 2), between the two Montgomery Complex site clusters. The site was excavated in the 1970s by the Archeological Society of Maryland (Peck 1980, 4). The ceramics were primarily limestone-tempered and cord-marked, with some quartz-temper present (Peck 1980, 5-6). The site's plan is unclear (Dent 2010, 14), but the original report suggests it had a total radius of 40 meters (Peck 1980, 2), miniscule in comparison to most other sites. Indeed, it was probably a small hamlet like other Page Complex sites (Dent 2010, 8).

While record keeping was limited, arithmetic suggests that about 96.5 m^2 were excavated, or around 7.68% of the site—though lower numbers are also possible. For his research in the James River Valley, Dr. Gallivan used 100 m^2 excavated as the minimum threshold for accumulations research (Gallivan 1999, 273-276). I made the executive decision to ignore this threshold to include at least one Page representative, but the site's results should be treated skeptically. As with Rosenstock, Nolands Ferry's radiocarbon dates range widely; the investigators proposed that the site was inhabited around 1500 AD with earlier dates contaminated (Peck 1980, 14-15). However, further testing has confirmed the earliest dates' reliability, while the later ones remained unconfirmed. Bayesian modeling of all dates as a single occupation suggest the site was inhabited from 1020 to 1560 CE (Gallivan et al. 2023). This site represents the easternmost extent of the limestone-tempering tradition, whose temporal place is unfortunately unclear.

Keyser Complex:

The final complex in question is the Keyser or Luray Complex. Keyser ware was shell-tempered (see Figure 1) and cord-marked with S-twist cordage, though Z-twist was present (Means and Moore 2020, 168-169). Mortuary rites were varied, including flexed, extended, and secondary bundle burials, with individual and multiple internments (Means and Moore 2020, 168). In contrast to the ill-defined distinction between the Montgomery and Page Complexes, the Keyser Complex seems to have had an extremely distinct identity. Indeed, the people classified under this Complex are generally thought to have migrated into the region, though their original home is much debated (Means and Moore 2020, 168-169).

The Complex's settlement system was based on large, circular or oval palisaded villages (Means and Moore 2020, 168); I am not aware of any Keyser sites identified as hamlets in the Piedmont. Interestingly, it has been argued that the Keyser Complex practiced more intensive agriculture (Wall 2001, 29) and inhabited shorter-lived sites than its predecessors (Gallivan et al. 2023). Together, these two hypotheses may suggest larger, more intensive occupations that more quickly exhausted local resources. Sites fitting this description were present in the Appalachian Mountains, Shenandoah Valley, and Piedmont (Wall 2001, 17-23; Jirikowic 1999, 28-35). In the Piedmont, sites were sometimes established directly on top of preexisting Page and Montgomery settlements like at Biggs Ford (18FR14) and Mason Island II (18MO13) (Hall 2021, 6) or, like Hughes (18MO1), near earlier settlements (Jirikowic 1999, 28-35; Dent 2010, 13). Unlike the other complexes, the Keyser Complex settled in every corner of the region. In terms of representative sites for the Keyser Complex, this project uses the Hughes Site and Biggs Ford II, the Keyser occupation of that site (discussed above).

Hughes (18MO1):

The Hughes site (18MO1) is located on the north bank of the Potomac River in the Piedmont province (Jirikowic 1999, 1), in the middle of the "Montgomery Triangle" near Winslow (see Table 1 and Figure 1) (Dent 2007, 7-6). The site was originally investigated by Nicholas Yinger in 1937 and primarily investigated by American University between 1990 and 1994 (Jirikowic 1999, 1). Excavations covered 404 m^2 (Jirikowic 1999, 129-130) of a site with a diameter of 125 meters (Jirikowic 1999, 50-53)—suggesting around 3.29% of the site was excavated. Further excavations were carried out in 2006 (Dent 2009), but the dataset from these excavations was not available for this project. The majority of ceramics were shell-tempered Keyser ware, with a sand/quartz-tempered minority (Jirikowic 1999, 94-95). The site was a large, palisaded village settlement, possibly with domestic structures around a central plaza (Jirikowic 1999, 121-131)—though no actual structures have been confirmed (Dent 2009, 25). Indeed, Dr. Richard J. Dent declared that searching for house patterns at Hughes "has become my personal white whale" (Dent 2009, 25). Bayesian modelling suggests that the site was inhabited from 1420 to 1480 CE (Gallivan et al. 2023). Hughes, therefore, is a strong representative of the Keyser Complex in the Piedmont region.

Chronology:

These various cultural actors interacted with each other in an eventful history, which scholars are only beginning to unravel. Unfortunately, the opening act of that history is still obscure, despite significant recent progress in Bayesian modelling. The Page settlement at Nolands Ferry is the first attested site, possibly extending all the way back to 1020 CE (Gallivan et al. 2023). The Montgomery settlement at Rosenstock appeared next, possibly as early as 1150 CE (Gallivan et al. 2023). Activity at both sites may have continued into the sixteenth century (Gallivan et al. 2023), though possibly not continuously (Curry and Kavanagh 2004, 26). Other sites with early dates include the Montgomery sites Winslow and Fisher (Dent 2007, 54-55) and the Page Catoctin Creek site (see Figure 1) (Corson 2003). As noted, there is debate over whether the Page or Montgomery Complex was the first in the region (Potter 1993, 131-132; Dent 2010, 33). More dates will be needed to clarify the earliest events of the Potomac's Late Woodland history.

Site Name	Site Type	Median start date	Radiocarbon midpoint	Median end date
Biggs Ford I-1	Hamlet / Village	1248	1297.5	1389
Biggs Ford I-2	Hamlet / Village	1248	1297.5	1389
Biggs Ford I-3	Hamlet / Village	1248	1297.5	1389
Biggs Ford I-4	Hamlet / Village	1248	1297.5	1389
Nolands Ferry	Hamlet	1018	1303	1557
Rosenstock	Village	1162	1384.5	1499
Winslow	Village	1365	1391.5	1424
Hughes	Village	1412	1450	1486
Biggs Ford II-3	Village	1472	1578	1646
Biggs Ford II-4	Village	1472	1578	1646
Biggs Ford I-3	Hamlet / Village	1248	1297.5	1389
Biggs Ford II-1	Village	1472	1578	1646
Biggs Ford II-2	Village	1472	1578	1646
Biggs Ford II-3	Village	1472	1578	1646
Biggs Ford II-4	Village	1472	1578	1646

Table 3: Relevant sites' dates (Gallivan et al. 2023).

During the thirteenth and fourteenth centuries, the picture somewhat resolves (see Figure 1 and Table 3). There appears to have been a northern cluster of Montgomery sites active during this period, including Rosenstock and Biggs Ford I (Gallivan et al. 2023). A central cluster of Page Complex sites included Nolands Ferry (Gallivan et al. 2023), Claggett Retreat (Dent 2010), and Catoctin Creek (Corson 2003). Finally, there was the "Montgomery Triangle" in the southeast, including Fisher (Dent 2007, 54-55), Shepard, and, briefly, Winslow (see Figure 1) (Gallivan et al. 2023). At this time, there may have been a shift from smaller hamlets to more concentrated villages (Means and Moore 2020, 165), and specifically towards palisaded settlements

(Gallivan et al. 2023). The Potomac Creek Site was established in the Coastal Plain during this period (Gallivan et al. 2023), possibly as an expansion of the Montgomery Complex (Potter 1993, 126-138). Regardless, developments downstream had little effect on the ongoing dynamics in the Piedmont.

The arrival of the Keyser Complex upended this cultural mosaic, however. The Keyser settlers, whatever their origins, seem to have originally planted themselves at the southeastern Hughes Site in the early 1400s (Gallivan et al. 2023). While Hughes' occupation was relatively short, Keyser villages seem to have spread out across the region (see Figure 1), settling at Biggs Ford II (Gallivan et al. 2023), as well as several undated or questionably dated sites such as Shepard Barracks and Mason Island II (Dent 2009, 4-5). There were examples of coexistence and interaction at sites like Winslow, Rosenstock, Nolands Ferry (Gallivan et al. 2023), and Trittipoe (another Page site) remained inhabited into this period (Hranicky and MacCord 2000, 114). The arrival of Keyser communities and their interactions with local groups were the defining events of Late Woodland Potomac history.

The last act of this eventful history is also uncertain. Many authors have suggested that the Montgomery and Page Complexes abandoned the region, perhaps at different times (Kavanagh 2001, 11-12; Potter 1993, 127-137). Indeed, there was a trend toward the abandonment of Page and Montgomery sites; no representative sites from these complexes survived until 1600 (Gallivan et al. 2023). The Keyser communities' next actions are also unclear. Some scholars have argued that after settling in the Piedmont at Hughes and Biggs Ford II in the 1400s, the Keyser groups retreated to the Shenandoah Valley in the 1500s (Kavanagh 2001, 11-12; Jirikowic 1995, 341;

Dent 2009, 5). This hypothesis is uncertain; Hughes was abandoned before 1500, but Biggs Ford II may have remained inhabited until after 1600 (Gallivan et al. 2023) and contains European trade goods (Peixotto 2021, 33). Hughes and Biggs Ford II represent the only well-dated Keyser sites in the Piedmont (Gallivan et al. 2023), so further dating of the other two known sites, Shepard Barracks (18MO4) and Mason Island II (18MO13), is necessary to determine if either or both sites were outliers. Either way, the Susquehannock briefly inhabited parts of the region in the 1600s, possibly absorbing the Keyser Complex (Wall and Lapham 2003; Means and Moore 2020, 169). Regardless, by the Contact Period, the region had become a "hole in the map," with its continued occupation uncertain (Gallivan et al. 2023).

Methods:

Discard Equation:

All archaeological research inherently makes assumptions about how dynamic past activities formed the static archaeological record (Johnson 2010, 51), whether or not these assumptions are formalized. For instance, one simple assumption is that the more people living at a site for longer periods of time, the more artifacts will be discarded at that site. Such assumptions can be referred to as "middle range assumptions" (Johnson 2010, 51) or formation theory (Shott 2006). Accumulations research is one formalized means of understanding site formation processes through the interrelations of time, population size, and artifact accumulation (Shott 2006, 7-10; Varien and Ortman 2005, 132-149; Pauketat 1989, 304). Specifically, accumulations research uses the "discard equation," first expressed by Schiffer in 1970, to mathematically model the relationship between these factors, using either known or hypothesized indices (Varien and Ortman 2005, 132-133 Shott 2006, 9). That is, accumulations research attempts to establish a mathematical basis for archaeology's fundamental assumptions. However, the goal of accumulations research goes beyond simply understanding site formation (Varien and Ortman 2005, 149); it can also fill in gaps in our knowledge. Specifically, the discard equation can be solved for any unknown variable, if values exist for other variables (Shott 2006, 9; Varien and Ortman 2005, 133; Shott 2022, 797). Thus, Accumulations research has been used to study occupation length (Varien and Ortman 2005) and site population (Gallivan 2002), depending on the data available.

Before delving into an explanation and then application of the discard equation, it is worth noting some shortcomings of accumulations research. Shott states "[m]ost archaeologists acknowledge formation theory's value in the abstract" (Shott 2022, 794), and various other authors note accumulations research's usefulness (Sullivan 2009, 122). The theoretical basis of accumulations research is considered reasonably sound. As will be demonstrated in this project, however, employing accumulations research can be challenging in individual cases. Shott noted that many inputs for the discard equation's variables are poorly understood, and, therefore, archaeologists using accumulations research must often estimate variables' values (Shott 2022, 810), and these estimations must "straddle the boundary between strong induction and well-reasoned speculation" (Sullivan 1980, 30). Indeed, as will be seen below, I repeatedly had to make estimations for different variables for this project. Conclusions based on accumulations research are thus often uncertain, and, as a result, archaeologists rarely use the method (Shott 2022, 799-811). In summary, accumulations research is a methodological white elephant: sound in theory, but impractical in actual use.

The core of accumulations research—the discard equation—has been expressed in several different forms, typically with standardized symbols. The variables include total discarded artifacts in question (T_D), artifact use life (L), typical assemblage size per population unit (S), site occupation span (t), and settlement population in terms of household numbers (H) (Gallivan 2003, 80-82). The original, and still most common, expression of the equation is:

$$T_D = \frac{S \times t}{L}$$

(Shott 2006, 8; Varien and Ortman 2005, 133). Population is obviously missing from that version of the equation; a more inclusive format would be:

$$H = \frac{T_D \times L}{S \times t}$$

(Gallivan 2003, 80-81). That is, of the three original factors—time, population, and artifact accumulation—*t* expresses time, *H* is population, and the combination of *L* and *S* represents the rate of artifact accumulation (Gallivan 2003, 80-81). T_D is, of course, the actual number of artifacts accumulated at a site. Usually, only one artifact type is used for T_D, since different types can have divergent *L* and *S* values (Shott 2022).

This project applies that general foundation to the Potomac River Valley. Specifically, it applies the form of the discard equation used by Dr. Martin Gallivan in his work on the James River Valley. The most complete form of Gallivan's discard equation would be:

$$H = \frac{T_D}{C \times R_D \times U_D \times R_S}$$

Gallivan himself never wrote the equation this way, preferring the second formula given above (Gallivan 2002, 545). Still, this conceptualization is useful to understand the variables involved in this project: population, use duration, and residential stability. In terms of specific variables, T_D remains total discarded artifacts, in this case ceramics. This follows standard practice: Shott declared, “[p]ottery carries a heavy burden of archaeological inference” (Shott 2022, 794). Second, R_D refers to the rate at which ceramic artifacts were discarded, combining use life and assemblage size into a single expression of the “artifact accumulation” concept (Gallivan 2003, 81). Third, Gallivan calibrated the equation with a constant (C), without which the equation will only produce relative results (Gallivan 2003, 82).

These three variables (T_D, and R_D, and C), are the foundation needed to access the information that is of primary interest for this project. For one, H continues to represent the total settlement population expressed in number of households (Gallivan 2003, 80-81). Next, Use Duration (U_D) refers to the length of time a site was occupied over multiple years (Gallivan 2003, 77-78). This measure describes whether communities inhabited a single location for long periods or relocated regularly. Finally, Residential Stability (R_s) refers to seasonality or the length of time a site was occupied within a given year (Gallivan 2003, 77-78). The product of use duration and residential stability replaces the measure t in the equation (Gallivan 2002, 548).

In the James River Valley, Gallivan’s research focused on collecting data for total discard, discard rate, use duration, and residential stability (Gallivan 1999; Gallivan 2002; Gallivan 2003). Generally, both use duration and residential stability rose over the Late Woodland Period, suggesting that the communities in the James Valley became more sedentary (Gallivan 2002, 549-551). With this information, Gallivan solved the equation for households per settlement, which increased over time (Gallivan 2002, 546-548). These developments were correlated with the rise of political complexity, taking the form of the Powhatan Paramount Chiefdom (Gallivan 2002, 551-552).

Definitions:

Before proceeding, some clear definitions must be established, especially when so many kinds of data are involved. First, this paper will use the term *variable* for the discard equation's constituent parts, regardless of the form of data used. The external data for a variable will be referred to as the *index* (site area index, use duration index, residential stability index), while the result of solving the discard equation for a variable will be referred to as the *product*. Meanwhile, the term *input* will refer specifically to the forms of data used to create the various indices. The terms *data* and *results* will be used interchangeably for all these types of information.

This Study:

Applying this method in general and to the Potomac River Piedmont in particular required some adaptations and posed certain challenges. Some form of index data could be found for all variables (see Table 4), but there were methodological problems with each one. Some problems were common to all variables; as already noted, I had to estimate some values. Furthermore, "effective accumulations research requires careful attention to research design prior to excavations" (Varien and Ortman 2005, 149). This project did not conduct any new excavations, so its dataset was limited to sites with optimal data (including detailed record keeping). A higher standard entailed a reduced the sample size, so the dataset was especially vulnerable to skewing.

As will be discussed below, however, there were more specific problems with different variables. These problems likely rendered at least one variable's index unreliable; in theory, these indices should have all fit together into the discard equation with a single constant across all sites but solving the equation for that constant produced radically different results at each site (See Figure 2). At minimum, the different indices are incompatible with each other; most likely, all indices are probably somewhat unreliable.

Site Name	Median radiocarbon date	Site Type	Total disposal	Discard rate	Population index	Use duration index	Residential stability index
Biggs Ford I-1	1297.5	Hamlet / Village	34606	675	8.63	0.6	0.33
Biggs Ford I-2	1297.5	Hamlet / Village	48737	675	8.63	0.67	0.47
Biggs Ford I-3	1297.5	Hamlet / Village	34583	675	11.02	0.42	0.44
Biggs Ford I-4	1297.5	Hamlet / Village	24603	675	11.02	0.4	0.33
Nolands Ferry	1303	Hamlet	41231	675	2.74	0.75	0.61
Rosenstock	1384.5	Village	189932	675	15.8	0.6	0.64
Winslow	1391.5	Village	10810	675	12.66	0.25	0.69
Hughes	1450	Village	131494	675	26.75	0.35	0.69
Biggs Ford II-1	1578	Village	30069	675	18.87	0.56	0.28
Biggs Ford II-2	1578	Village	25668	675	18.87	0.52	0.53
Biggs Ford II-3	1578	Village	25610	675	18.87	0.52	0.92
Biggs Ford II-4	1578	Village	30011	675	18.87	0.56	0.08
Units	Year	Hamlet or village	Sherds	Sherds / household / year	Households	N/A	N/A

Table 4: Indices of Discard Equation Variables.

Fortunately, the discard equation was designed for precisely this situation; the equation takes the variables with the most reliable indices and solves for the one variable with the least reliable index—thus replacing that least reliable index. Basically, the discard equation synthesizes the most plausible or *least unreliable* combination of data (typically, though, the choice of variables is made in the research design phase). Ideally, the "least unreliable" indices will be actually reliable, but, even if they are not, the process should still reduce some uncertainty. In the James Valley, for instance, Gallivan determined that the most plausible combination of data was solving the equation for population using the use duration and residential stability indices. This process assumes, however, that the least reliable index can be objectively determined. The singular challenge for this project was that such an objective determination proved impossible. The specific variables' methodological problems and the results of different options will be discussed in greater detail below. In short, those problems were often not comparable, and all combinations of data produced theoretically plausible results.

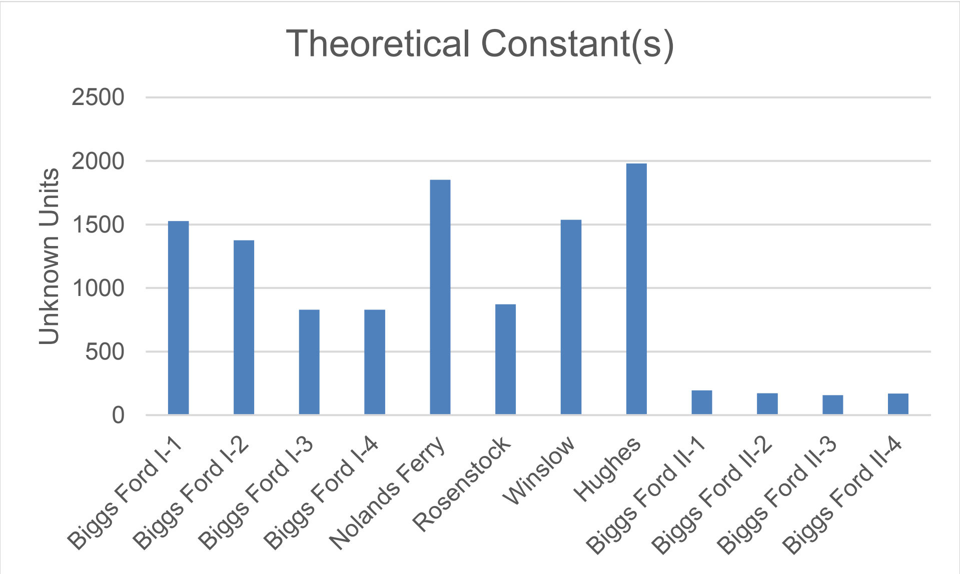

Figure 2: Products of solving for the constant at each site.

Therefore, this paper will adopt a slightly different approach. While an objective determination is not possible, I have very definite subjective opinions on which combinations of data are most plausible, largely based on the resultant data. The following sections will describe the process of calculating each variable's index, including data tabulations and enumerating the various methodological issues encountered. Each index will then be compared against the applicable discard equation product (based on the other two variables' indices), and I will explain my rationale for considering one of the two options more reliable. With my preferred combination of data laid out, this paper will then explore the conclusions that this combination suggests, including converting the use duration index into years, classifying settlement practices, and exploring trends over time. Time did not permit the exploration of all data combinations. This discussion should explain my decisions and allow readers to make their own determinations and conclusions.

Expectations:

In general, some hypotheses about expected results can be made. The Potomac Piedmont region had an eventful history during the Late Woodland Period, and the expectation is that demography and settlement practices will play a major role in these events. Groups are expected to become more sedentary as the Late Woodland progressed (Dent 1995, 249; Gallivan 2003, 78-79). As noted, the Keyser Complex may have practiced more intensive agriculture than other complexes (Wall 2001, 29). Such trends should be reflected in rising use duration and residential stability results over time, especially for the Keyser Complex. However, the Keyser sites may also have been inhabited for shorter periods than their predecessors (Gallivan et al. 2023). If so, one would expect to see residential stability rise as use duration falls. Divergent settlement practices might help explain how Keyser communities arrived in and came to dominate the region. Furthermore, in the James River area, Gallivan also found that population rose over time (Gallivan 2002, 551-552), and Potter found that the population also became more concentrated after 1300 CE (Potter 1993, 85-87). One or both processes may have taken place in the Potomac Piedmont. This project, however, focuses on the largest (and best documented) village sites in the region, where the population would have concentrated into from smaller hamlets. As such, the population of the sites in question is expected to rise, possibly representing either an overall increase in population or its concentration.

Foundational Variables:

Total Disposal Ceramics:

SITE NAME	Median radiocarbon date	Site Type	Feature Sherds	Percent of site excavated	Portion of Features Remaining	Portion of Sherds Deposited in Features	Disposal Assemblage
Biggs Ford I-1	1297.5	Hamlet / Village	1947	10.00%	75.00%	75.00%	34606.3
Biggs Ford I-2	1297.5	Hamlet / Village	2742	10.00%	75.00%	75.00%	48736.7
Biggs Ford I-3	1297.5	Hamlet / Village	2755	14.16%	75.00%	75.00%	34582.7
Biggs Ford I-4	1297.5	Hamlet / Village	1960	14.16%	75.00%	75.00%	24603.3
Nolands Ferry	1303	Hamlet	1781	7.68%	75.00%	75.00%	41231
Rosenstock	1384.5	Village	5305	4.97%	75.00%	75.00%	189932.1
Winslow	1391.5	Village	190	3.12%	75.00%	75.00%	10810.4
Hughes	1450	Village	2435	3.29%	75.00%	75.00%	131493.7
Biggs Ford II-1	1578	Village	1544	9.13%	75.00%	75.00%	30069
Biggs Ford II-2	1578	Village	1318	9.13%	75.00%	75.00%	25668
Biggs Ford II-3	1578	Village	1315	9.13%	75.00%	75.00%	25609.6
Biggs Ford II-4	1578	Village	1541	9.13%	75.00%	75.00%	30010.6

Table 5: Disposal Assemblage Calculations.

The foundation for all these calculations is the quantity of ceramics deposited at the site, though the determination thereof is not entirely straightforward. Significant differences may exist between the *behavioral assemblage*, *disposal assemblage*, *archaeological assemblage*, and *recovery assemblage* (Pauketat 1989, 291; Shott 2022, 798). This method extrapolates the total ceramic disposal assemblage from the recovery assemblage, using the portion of the settlement excavated, portion of features not truncated by plowing, and portion of ceramics deposited in features to model the different assemblage transformations (Gallivan 1999, 322-325). As can be seen, these calculations are limited to feature ceramics. While the portion of settlement excavated varied by site, all other proportions were assumed to be 75% based on Gallivan's work (see Table 5) (Gallivan 1999, 322-325).

Furthermore, selecting the best unit for measuring ceramics is also difficult: "no measurement unit universally is ideal" (Shott 2022, 811). For instance, "disembodied sherds" cannot control for a variety of processes (Shott 2022, 811). In any case, ceramic sherds represent the only measuring unit common to all datasets in this project, necessitating their use. Shott does acknowledge that archaeologists often continue to use sherds (Shott 2022, 811). In general, I am reasonably satisfied with the results of these calculations, and I plan to include them in any combination of data.

Discard Rate:

The next major variable in the discard equation is the discard rate or the annual accumulation rate. This concept measures the quantity of ceramics discarded per social unit each year (Sullivan 2009, 122), combining the use life and household assemblage size variables from other versions of the equation (Gallivan 2003, 81). The discard rate must be established with ethnoarchaeological data, using observations of contemporary ceramic use to determine hypothesized values for different variables (Gallivan 2002, 537-538). Naturally, a variety of caveats can be raised; household assemblages may vary according to socioeconomic status, numbers of resident individuals, recycling broken sherds (Pauketat 1989, 293), and seasonal movement (Sullivan 2009, 131). Also, many factors in the discard equation are interrelated (Shott 2022, 797). Most of these caveats should not be serious problems; for instance, these complexes are generally considered egalitarian (Gallivan 2010, 296), so socioeconomic status should not be an issue.

This paper adapts the disposal rate used by Dr. Gallivan in the James River Valley. Specifically, Gallivan used strong cases in southern Virginia and the Carolinas to establish the average number of jars and bowls per household, the average weight of jars and bowls, and the average weight of sherds (Gallivan 1999, 317-322). He found that sherds had an average weight of 5.2 grams and used ethnographic data to determine the breakage rates of jars and bowls (Gallivan 1999, 317-322). In total, Gallivan concluded that each household contributed 0.58 jars (2000 grams) and 1.03 bowls (300 grams) yearly, totaling 370 sherds (Gallivan 1999, 320-321).

Applying this average directly to the Potomac Piedmont presents several issues. Regional differences can exist in terms of the size and number of storage vessels per household (Sullivan 2009, 132). Indeed, calculating the average sherd weight at Hughes and Biggs Ford produced 2.16 grams (n = 47,381 sherds, weight = 102,186 grams), significantly smaller than Gallivan's 5.2 grams. The lack of identified households, however, makes reconstructing the actual number and type of ceramics per household unfeasible. This point represents the best examples of estimating values on "the boundary between strong induction and well-reasoned speculation" (Sullivan 1980, 30).

Therefore, I assumed that Gallivan's calculations were accurate unless proven otherwise: households contributed 0.58 jars and 1.03 bowls to the archaeological record per year, in the form of 2.16-gram sherds. This suggests an overall accumulation rate of 675 sherds per year per household.

In the end, the specific accuracy of this measure is a secondary concern; as it is being applied constantly across all sites, even biased results should be consistent relative to each other, and the equation produces relative results unless translated with another constant.

Constants and Strong Case:

The final variable in the equation is the constant, which must be determined using a strong case. The purpose of the constant is to calibrate the equation (Gallivan 2002, 546). As will be seen, the indices of many variables are expressed in relative values, and the discard equation will only produce relative results without a constant to translate the values. The constant should also hopefully capture any other unknown variables that may be lurking in the equation. As a mathematical construct, there is no external input to determine the constant; it must be calculated using a strong case.

The use of strong cases, "well-preserved sites of relatively brief occupation[,]" is standard procedure for accumulations research (Shott 2022, 810). Indeed, Gallivan specifically used Leatherwood Creek (44HR1) and Fredericks (31OR231) as his strong cases (Gallivan 2002, 546-548). Basically, the strong case is a site "'reasonably representative of the ancient society'" where all variables are known (Shott 2022, 810), except for the constant. That way, the equation can be solved for the constant, which can then be applied to other sites with unknown variables (Gallivan 2002, 548). As will be seen, constants could only be determined in specific cases, and this project will otherwise rely on relative measures for several of its calculations.

Population:

First, hypothetical measures of settlement population are theoretically simple, but possibly less reliable than other variables. The best measure is total household floor area, but these data are often difficult to acquire (Hatch and Bondar 2001, 150); indeed, households cannot be identified at most sites in this project's dataset. In such cases, Hatch and Bondar argued that the area enclosed by a palisade represents the best substitute (Hatch and Bondar 2001, 149-150). Unfortunately, not all sites in this dataset were palisaded, and Hatch and Bondar warned against "using these values with nonpalisaded sites" (Hatch and Bondar 2001, 167). However, for palisaded sites, the area enclosed for the palisade was used for general site area. Thus, this study will disregard Hatch and Bondar's warning and use area data for all sites, while remaining conscious of its theoretical shortcomings. Indeed, Curry and Kavanagh made rough estimates of site population at Rosenstock based on site area (Curry and Kavanagh 2004, 29-32). To an extent, the results represent a site's maximum possible population at any one time.

Strong Case: Winslow

Ideally, strong cases should be an integral part of accumulations research. As already explained, strong cases (where all variables are known) permit the calculation of the discard equation's constant and prevent the equation from returning relative variables. Similarly, site area must be translated into numbers of households to work within the discard equation, which also requires a strong case with a definite number of households for translation. The overall lack of recognizable house patterns at Potomac sites, however, makes locating a strong case challenging. Dent is already on record calling households at Hughes his ‘white whale’ (Dent 2009, 25); possible household plans were identified at Biggs Ford, but it is not clear to which occupation they dated (Hall 2021, 11).

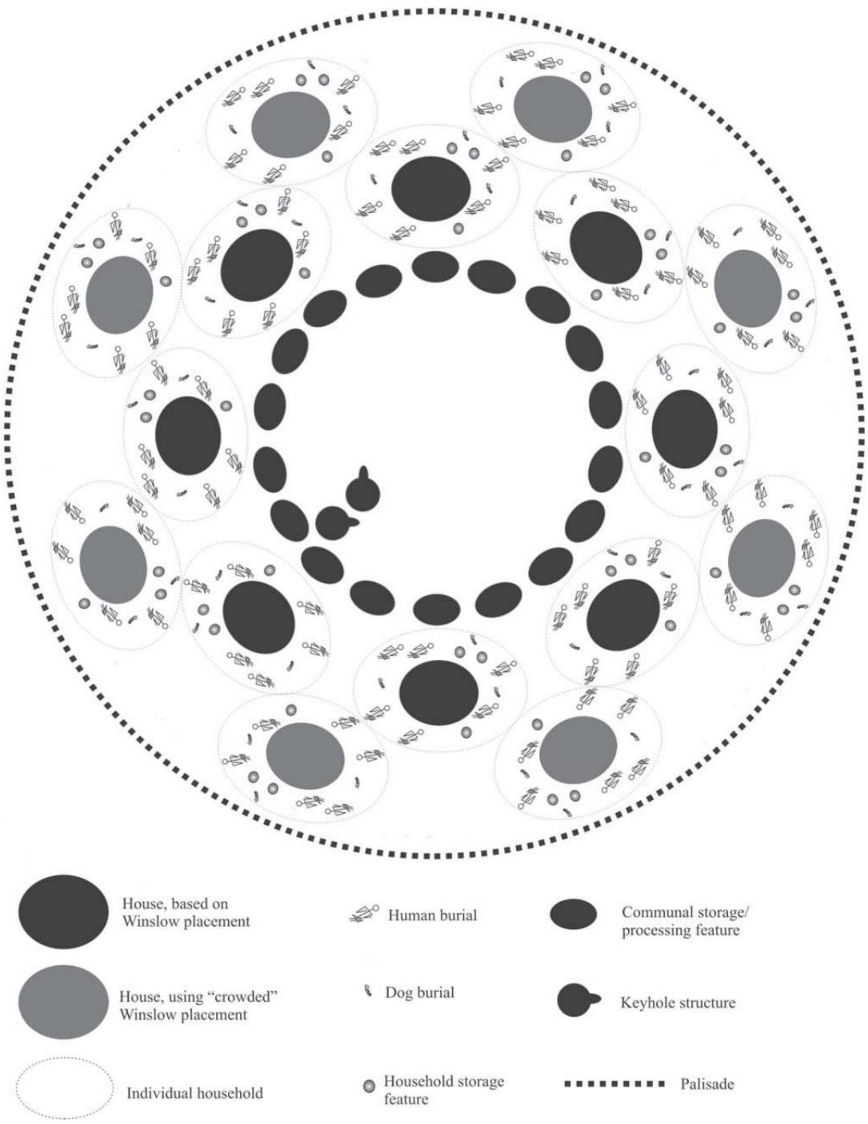

Figure 3: Montgomery Complex village plan (Curry and Kavanagh 2004, 32).

The only possible strong case is the Winslow Site (18MO9), where at least some household plans were identified (Dent 2007, 14). Unfortunately, there is still some uncertainty over Winslow’s area and number of households. In their report on Rosenstock, Curry and Kavanagh suggested that Winslow had a diameter of 70-75 meters and may have contained either 8-10 structures in a “comfortable” arrangement (1 house per 384.85-552.233 m^2), or 15 in a "'crowded' arrangement" (see Figure 3) (1 house per 256.5634 – 294.524 m^2) (Curry and Kavanagh 2004, 30). In the report on Winslow itself, Dent argued that the site's diameter was 86 meters with 18-22 structures (1 house per 264.04 – 322.71 m^2) (Dent 2007, 42-48). Dent thus argues for a larger site area and the crowded arrangement; the 'comfortable arrangement' applied to Dent's larger area returns around 10.52 – 15.09 houses.

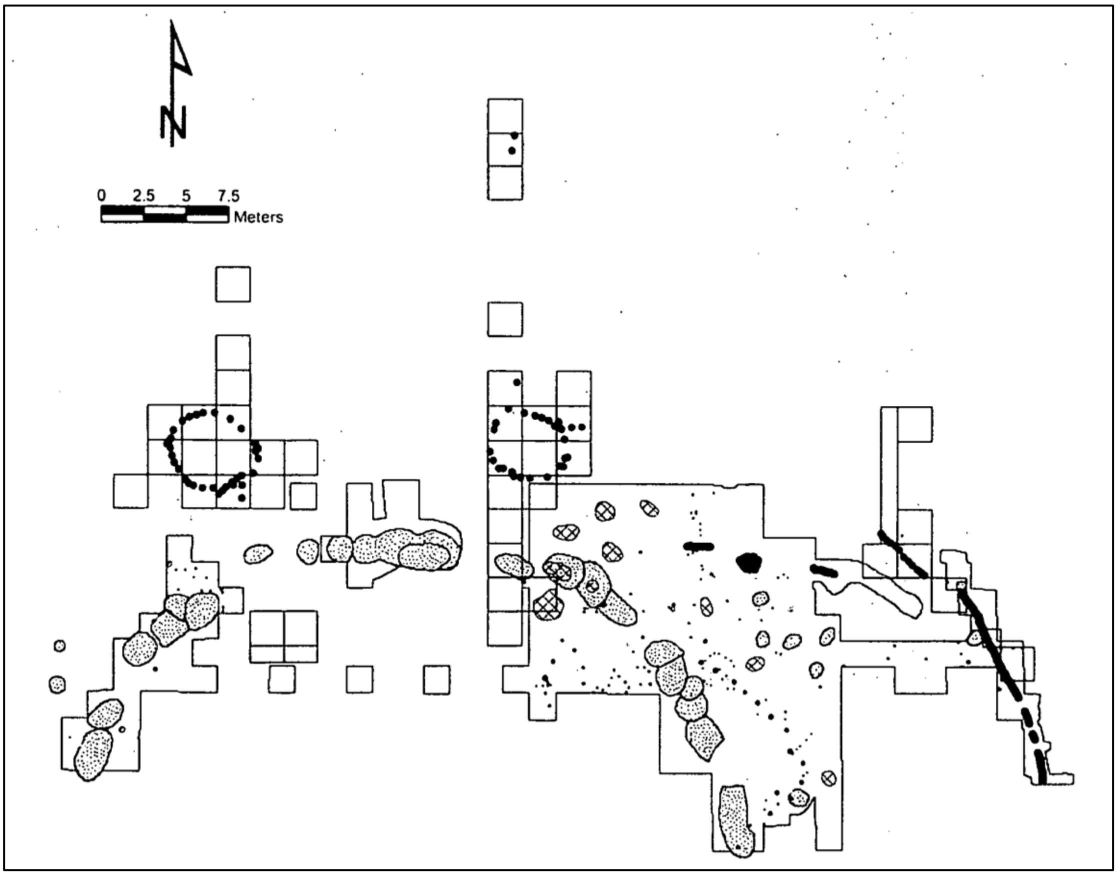

Figure 4: Winslow excavations (1959-1961 & 2002-2003) (Dent 2007, 14-15).

Dent, as the principal investigator at Winslow, is presumably more reliable on the site's size, so this project will use his larger area estimate. However, having reviewed the available maps from both documents (Curry and Kavanagh 2004, 32; Dent 2007, 14-15), I do not see why Dent adopted the crowded arrangement (see Figure 4). Both reconstructions appear equally plausible, as the presence or absence of a second ring of houses seems uncertain. For me, there is another consideration; Winslow is not an especially large site, so using the crowded density might inflate house numbers at other sites. For instance, Hughes has more than double Winslow's area (12271 m^2 as opposed to 5808 m^2), which would translate to around 38-46 houses under the crowded arrangement. While such high numbers of households are not impossible (though unlikely), this project uses Winslow's "comfortable" arrangement with an average of 12.66 households.

This single and highly uncertain strong case represents the best possible outcome; as will be seen, most other variables had no strong cases at all. For the discard equation product for population, combining 12.66 households with Winslow's total discard ceramic sherds (n = 10810), the discard rate of 675 sherds per household per year, the use duration index, and the residential stability index allows the equation to be solved for the constant necessary to fit all these variables together. The resulting constant is 60.72, which can then be applied to other sites. This constant, however, is only usable when solving for population; solving for another variable means removing that variable's index from the calculations, and a strong case must have data for *all* variables. Meanwhile, with the population index, it is also possible to convert the site area data into numbers of households; using Winslow as an example, the ratio is 1 house per 458.77 m^2. This calculation is necessary to fit the population index with the discard rate, which is expressed in sherds deposited per household per year.

Population Index, Discard Equation Product, and Evaluation:

With all that information in place, it is now possible to compare the available population index and the product of solving the discard equation for population for all sites. Once again, solving the discard equation for population requires inputting the use duration and residential stability index. Both systems seem to offer generally plausible results. The two options do sometimes align (see Table 6 and Figure 5); both generally agree on the numbers of houses at Hughes and Nolands Ferry, one of the largest and the smallest sites, respectively. When the two options disagree, they tend to suggest different, but equally plausible conclusions. For instance, the population index suggests a moderate population at Biggs Ford I, and a large one at Rosenstock. In contrast, the discard equation returns notably lower results at Rosenstock and all four Biggs Ford I scenarios (the Montgomery occupation). Since the site area index represents the maximum possible population, the equation products may thus suggest that Montgomery Complex sites (except Winslow) were quite sparsely inhabited.

The most notable difference, however, is at Biggs Ford II (the Keyser Occupation). Site area index predicts around 18-19 households, while the Discard Equation only predicts 1-2 (see Table 6). While this discrepancy could be the result of errors in the division of Biggs Ford into scenarios, the fact that the discrepancies appear in all scenarios argues against that possibility. The discrepancy also marks the first appearance of a pattern at Biggs Ford II, which returned an average total ceramic discard (lower than the smaller Biggs Ford I) with high results for all other variables. As a result, solving the equation for any one variable returns a very low value for said variable. I suspect that some of the inputs are biased slightly upwards, perhaps with one variable catastrophically biased. Ceramics may be slightly biased downwards, but I am more confident in that data. This situation is precisely where using the discard equation to replace the *least accurate* variable is helpful.

SITE NAME	Median radiocarbon date	Site Type	Site area (m^2)	Population index (households)	Discard equation product (households)
Biggs Ford I-1	1297.5	Hamlet / Village	3959	8.6	4.2
Biggs Ford I-2	1297.5	Hamlet / Village	3959	8.6	3.8
Biggs Ford I-3	1297.5	Hamlet / Village	5056	11	4.6
Biggs Ford I-4	1297.5	Hamlet / Village	5056	11	4.6
Nolands Ferry	1303	Hamlet	1257	2.7	2.5
Rosenstock	1384.5	Village	7250	16	8.4
Winslow	1391.5	Village	5809	13	13
Hughes	1450	Village	12272	27	33
Biggs Ford II-1	1578	Village	8659	19	2.1
Biggs Ford II-2	1578	Village	8659	19	1.9
Biggs Ford II-3	1578	Village	8659	19	1.7
Biggs Ford II-4	1578	Village	8659	19	1.9

Table 6: Population Data.

Assuming the site area is reasonably accurate, Biggs Ford II was one of the region's largest palisaded sites (Dent 2021, 3), larger than Rosenstock and second only to Hughes (see Table 6). The area index thus naturally predicts that it was one of the largest sites, and probably the primary Keyser population center in the northern area, analogous to Hughes further south. In contrast, the discard equation product suggests that Biggs Ford II may have been a sort of Potemkin palisaded village—a very small community that maintained the illusion of size. It is possible that Biggs Ford II was a ritually important site, perhaps as a known former Montgomery village. Palisades were generally reserved for settlements (Hatch and Bondar 2001), though, so why a ritual site would require one is not clear. Biggs Ford II's late date (c. 1480 – 1650 CE) represents another possible explanation. As noted in the chronology section, some authors have argued that Keyser peoples abandoned the Piedmont around 1500 and retreated to the Shenandoah Valley (Jirikowic 1995, 341; Gallivan et al. 2023). Under this theory, Biggs

Ford II may represent a small community left behind by their compatriots, who perhaps created a larger site to maintain their claim to the region.

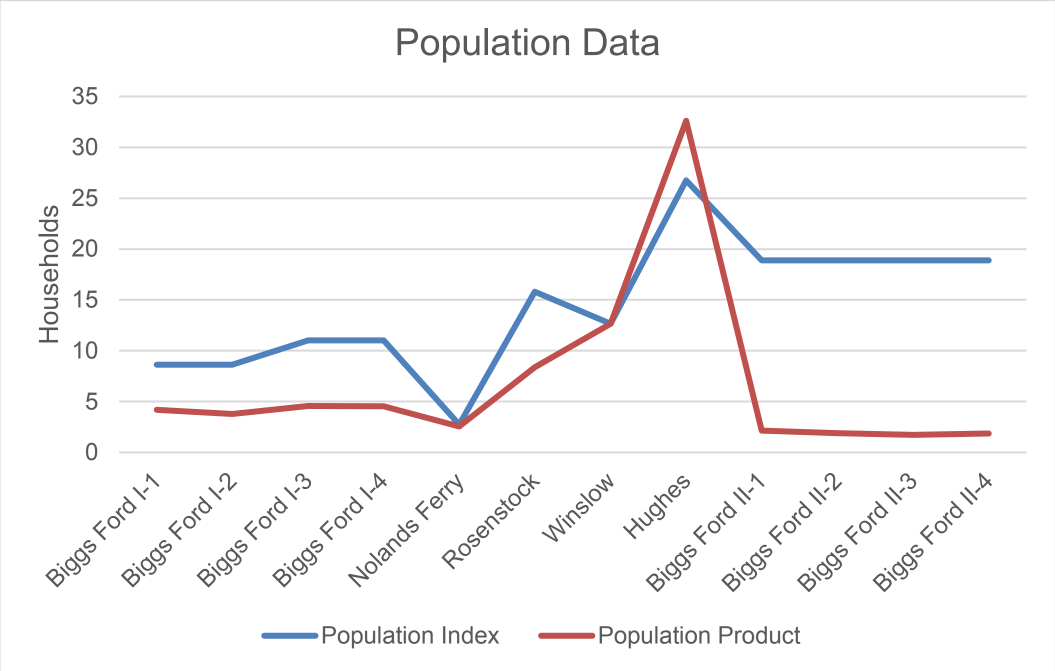

Figure 5: Comparison of population index and product.

Deciding between the index and product is difficult. Still, the hypothesis that Biggs Ford II was the large site it appears to be is significantly simpler than the Potemkin palisaded village hypothesis, which does support the population index. In the end, though, the choice between them is subjective. As it happens, I am dubious about the ‘retreat to the Valley hypothesis;’ in my view, it assumes that Hughes is more representative of Keyser’s occupation of the Piedmont than Biggs Ford II without a clear justification, as these are the only two well-dated Keyser sites in the region. I suspect that Hughes’ inhabitants could just has easily have relocated to the obscure and poorly-dated Shepard Barracks site (18MO4), which is close to Hughes (Dent 2009, 4-5). In summary, while other researchers may be more inclined towards the retreat to the Valley hypothesis (or have a better rationalization), I favor the population index over the discard equation product, so I am not going to consider the population index the *least* reliable variable in any combination.

Use Duration:

The Use duration index is the next variable to calculate. Specifically, "use duration gauges the total length of time that a location is either continuously or discontinuously occupied" (Gallivan 2002, 538). Calculating this variable is complex; it requires averaging several different archaeological attributes together to balance out flaws, skewing, or cultural particularities in any one input (Gallivan 1999, 305). As a rule, a higher density of features and artifacts correlates with a longer use duration (Gallivan 1999, 305; Sullivan 1980, 29), and, for this project, the attributes used are burial density, feature density, artifact density, and radiocarbon span (see Table 7). Four inputs was the highest number for a single index; population had only a single input, and, as will be seen, residential stability had only three inputs. This larger sample size should make the use duration index the least likely to be skewed.

Several methodological points need to be made. For one, density is typically calculated by items divided by area excavated (Gallivan 1999, 282), which requires clear definitions of both *items* and *area excavated*. The former will be addressed in the following paragraphs, but this project defined "area excavated" as the area within the site's boundaries with data for *all* inputs into the discard equation's variables. Hence, units outside of site boundaries, as at Biggs Ford, were not counted. Furthermore, there were two periods of excavation at Winslow: one in 1959 – 1961 and one in 2002 – 2003 (Dent 2007, 1). While burial data were known from both, all other available data were limited to the second excavation, so all measures, including burial density, were calculated according to the second excavation's area only.

As already noted, the first measure of use duration is burial density. The longer groups remained in one place, the more likely death and burial occurred (Gallivan 1999, 281). As such, "the density of buried individuals per excavation area in floodplain contexts is viewed largely as a product of residential permanence and settlement population size" (Gallivan 1999, 281). Specifically, density is measured "as the number of identified human burials per 100 square meters of excavated area" (Gallivan 1999, 282). That is, density is measured by individuals (not burial features) and is multiplied by an arbitrary number. There are certain drawbacks to this method. For one, it assumes that mortality rates were relatively constant (Gallivan 1999, 282), which seems unlikely in a highly fluid region. For another, cultural practices may interfere; evidence suggests that the Montgomery Complex may have exhumed and relocated burials (Slattery and Woodward 1992, 28). Ancestors were not necessarily less mobile than living people. Nonetheless, the strength of the overall index is its ability to absorb weaknesses in individual inputs.

The second measure is feature density. In general, the number of features at a site is correlated with the length of the occupation (Pauketat 1989, 303). This project, however, calculated feature density as cubic meters of feature volume per 100 square meters of excavated area. Doing so prevented sites with large numbers of small features (particularly Hughes) from swamping the index. The downside of this approach is that feature volume also represents a measure of residential stability in addition to use duration, so that factor may be cross-contaminated.

Site Name	Median radiocarbon date	Site Type	Burial Density	Feature Density	Artifact Density	Radiocarbon Span
Biggs Ford I-1	1297.5	Hamlet / Village	2.27	0.7	0.4	152
Biggs Ford I-2	1297.5	Hamlet / Village	2.78	1.71	0.25	152
Biggs Ford I-3	1297.5	Hamlet / Village	1.54	0.97	0.24	152
Biggs Ford I-4	1297.5	Hamlet / Village	1.26	0.42	0.37	152
Nolands Ferry	1303	Hamlet	4.15	5.16	0.09	539
Rosenstock	1384.5	Village	1.39	8.9	0.13	339
Winslow	1391.5	Village	1.1	0.11	0.3	57
Hughes	1450	Village	1.24	0.65	0.37	77
Biggs Ford II-1	1578	Village	1.9	1.2	0.15	158
Biggs Ford II-2	1578	Village	1.77	1.01	0.16	158
Biggs Ford II-3	1578	Village	1.77	0.99	0.16	158
Biggs Ford II-4	1578	Village	1.9	1.18	0.15	158
Units	Years	Hamlet / Village	Individuals / 100 m^2	m^3 / 100 m^2	Artifacts / 100 cm^3	Years

Table 7: Use Duration calculations.

Third, artifact density also represents a proxy for the intensity of activities (Gallivan 1999, 149) and can be used to infer occupation span (Pauketat 1989, 303). For this study, *artifacts* were defined as ceramics, culturally modified lithics, and faunal remains from features. Total feature volumes were computed to determine the density (Gallivan 1999, 149).

Finally, the last major measure of use duration is radiocarbon data. In particular, Bayesian modelling allows for individual radiocarbon dates to be combined into a model of a site's occupation span (Bayliss 2015, 688). In this area, I am indebted to John Henshaw for performing this analysis. In theory, Bayesian models represent the most direct measure of a site's use duration. There are, of course, certain drawbacks; radiocarbon testing entails significant error factors, in general. Furthermore, Bayesian models are dependent on prior knowledge (Bayliss 2015, 680), including distinguishing between different occupations—so models may combine multiple occupations and the intervening spaces between. In any case, this project used the median span of a site's Bayesian model of occupation as one measure of use duration. The Bayesian medians are shown with the other inputs in Table 7.

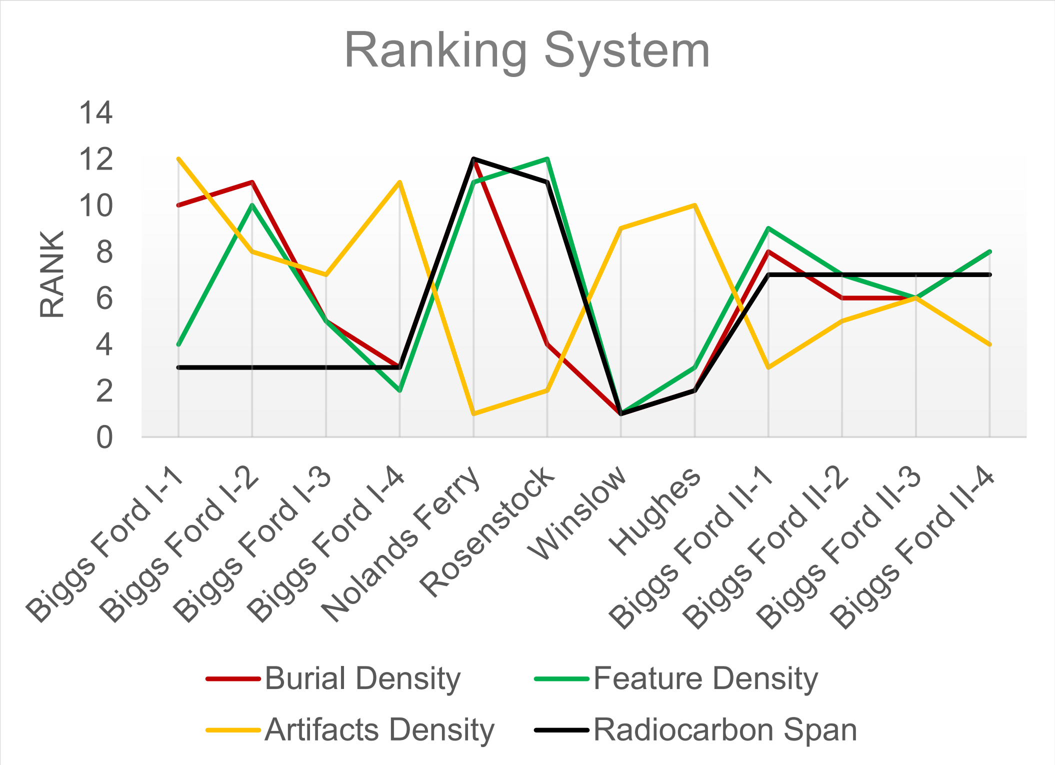

Figure 6: Ranking System.

In addition to these four inputs, Gallivan's calculations also used burial-to-house ratios and postmold density (Gallivan 1999, 305; Gallivan 2002, 543). As already noted, however, identifiable households were lacking at most of the sites in question, making the burial-to-household ratio unworkable. Postmold data were available from three sites (Rosenstock, Hughes, and Winslow), but the ranking system proved unworkable with the smaller sample size; the larger fractions skewed the three sites' average values too much.

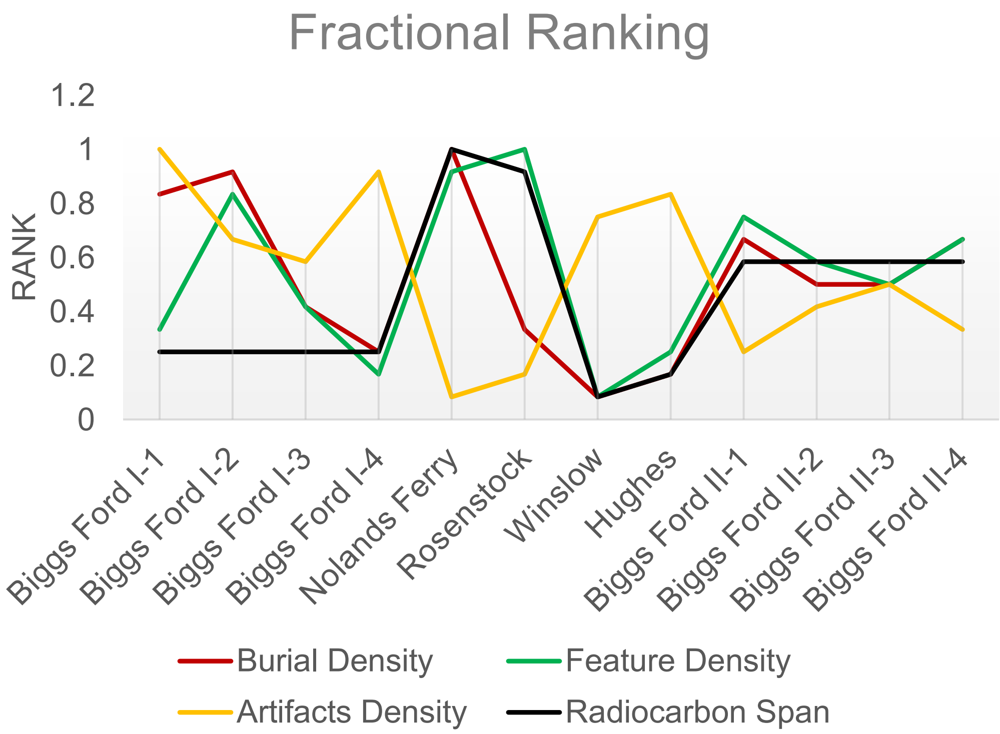

Figure 7: Fractional Ranking.

To combine these different inputs, each site's results—including the multiple scenarios at Biggs Ford—were ranked against each other (see Figure 6), converted into fractions (see Figure 7), and then averaged together (see Figure 8) (Gallivan 1999, 303-304). The actual ranking process was done in Microsoft Excel, using the RANK function, which applies the same, non-average rank to all entries with equal results. These procedures sometimes led to questionable outcomes; when ranking radiocarbon inputs, all four Biggs Ford I scenarios (Median span = 152 years) received the rank 3/12, and all Biggs Ford II scenarios (Median span = 158 years) were ranked at 7/12 (Gallivan et al. 2023). Altogether, this project combined several inputs, in the hope that the data's redundancy would correct any shortcomings.

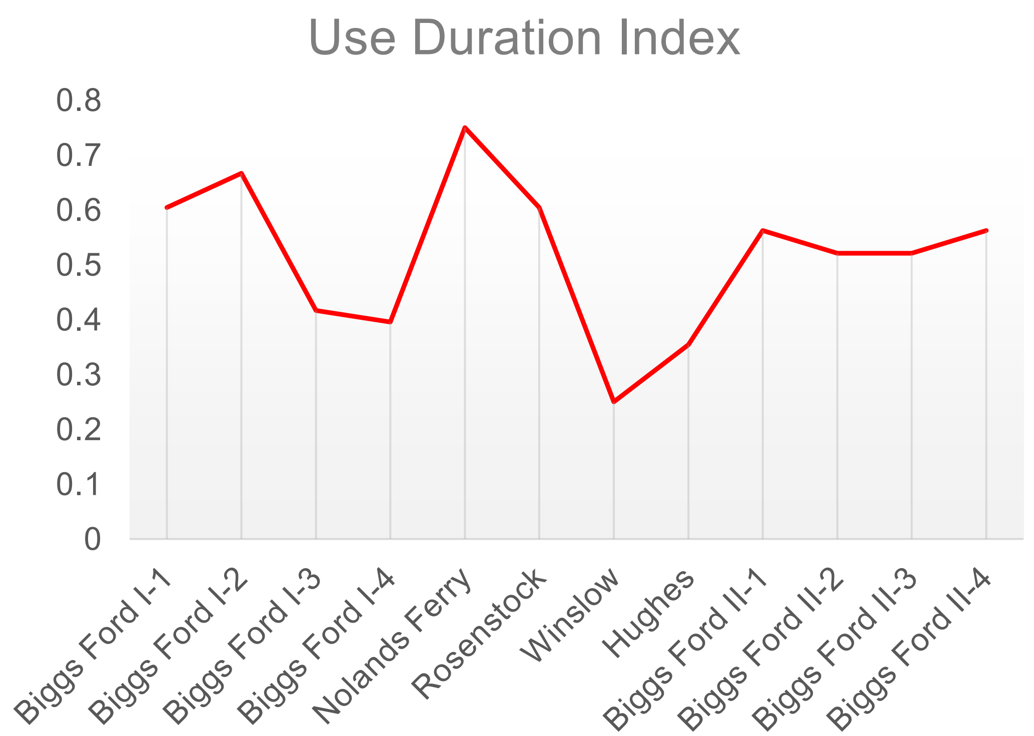

Figure 8: Use duration index.

Use Duration Index, Discard Equation Product, and Evaluation:

With the use duration index established, it can now be evaluated against the discard equation product. To solve the discard equation for use duration, of course, requires inputting the population index (addressed above) and residential stability index (addressed below). Determining the equation's constant with this variable would require a strong case where use duration is known. For this comparison, it was simpler to rank the discard equation product (technically use duration times the constant, see Figure 9) to make it comparable with the fractional use duration index. Still, possible strong cases will be explored in more detail later, when the use duration data is converted into years. Furthermore, comparing both options to the radiocarbon models may be beneficial and is easily possible since those models were ranked to create the use duration index (see Table 8 and Figure 10).

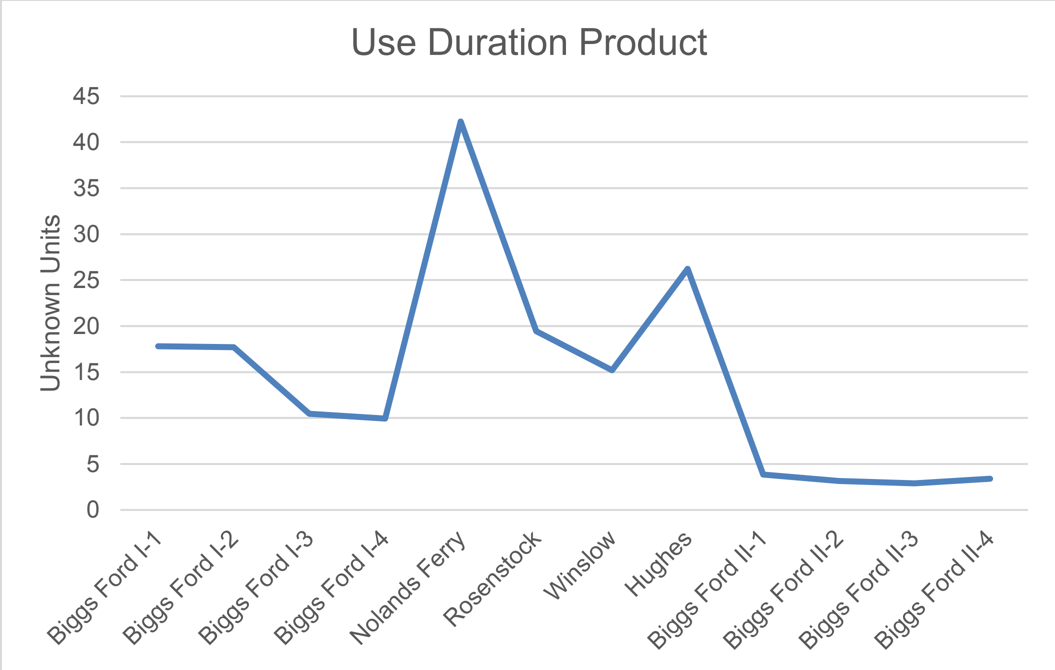

Figure 9: Use Duration Product, unranked.

Before evaluating these options, some issues with these procedures must be addressed. First, rankings and average rankings do not present a perfect comparison; the ranked data must include the highest (12/12, 1) and lowest (1/12, 0.083) values, which may not be the case with average ranks. Indeed, the ranked radiocarbon inputs are higher than the two longest-lived sites' index (Nolands Ferry and Rosenstock) and lower than the two shortest-lived sites' index (Winslow and Hughes, see Table 8). Thus, the different procedures make these two forms of aligned data appear to diverge. Second, as already noted, the ranking operation struggles when multiple sites have the same result, especially with Biggs Ford's multiple scenarios. Third, while averaging often corrects for flaws in individual inputs—the use duration index for Biggs Ford I's Scenario 3 (0.42) and Scenario 4 (0.4) is more reasonable than the ranked radiocarbon model (0.25)—sometimes it fails to do so; at Biggs Ford II, the indices (0.52 – 0.56) align with the biased radiocarbon input

(0.58), probably representing the Biggs Ford II pattern of inputs biased slightly upward. Thus, the peculiarities of calculation may distort the results.

Site Name	Median radiocarbon date	Site Type	Use duration index	Use duration product (ranked)
Biggs Ford I-1	1297.5	Hamlet / Village	0.6	0.75
Biggs Ford I-2	1297.5	Hamlet / Village	0.67	0.67
Biggs Ford I-3	1297.5	Hamlet / Village	0.42	0.5
Biggs Ford I-4	1297.5	Hamlet / Village	0.4	0.42
Nolands Ferry	1303	Hamlet	0.75	1
Rosenstock	1384.5	Village	0.6	0.83
Winslow	1391.5	Village	0.25	0.58
Hughes	1450	Village	0.35	0.92
Biggs Ford II-1	1578	Village	0.56	0.33
Biggs Ford II-2	1578	Village	0.52	0.17
Biggs Ford II-3	1578	Village	0.52	0.08
Biggs Ford II-4	1578	Village	0.56	0.25

Table 8: Use Duration index and product.

With these potential limitations in mind, the reliability of the use duration index and product can be evaluated. The index has its positives and negatives (see Table 8 and Figure 10). On the one hand, the use duration index often aligns with the radiocarbon models, which is unsurprising since those models were an input for the index. In particular, Hughes and Winslow are the sites with the most thorough radiocarbon sampling and most accurate Bayesian models (Henshaw 2023, personal communication), and both the models and use duration index predict short occupations for these sites.

On the other hand, there were some issues with the index. As noted, averaging failed to correct for bias at Biggs Ford II. Also, there were issues at Biggs Ford I. Scenarios 1 and 2 produced high results (0.6 and 0.67). The idea that Biggs Ford I's occupation was as long as Rosenstock's (0.6) is not impossible, especially if one or both sites had multiple occupations (Curry and Kavanagh 2004, 26), but unlikely, because Rosenstock was inhabited after

Biggs Ford I; Rosenstock's occupation likely overlapped with Biggs Ford II (Gallivan et al. 2023), which is not possible for Biggs Ford I and II. Thus, Scenarios 1 and 2 at Biggs Ford are likely unreliable, but this fact does not affect Scenarios 3 and 4. In summary, the use duration has definite strengths, and its weaknesses do not undermine the reliability of the entire method.

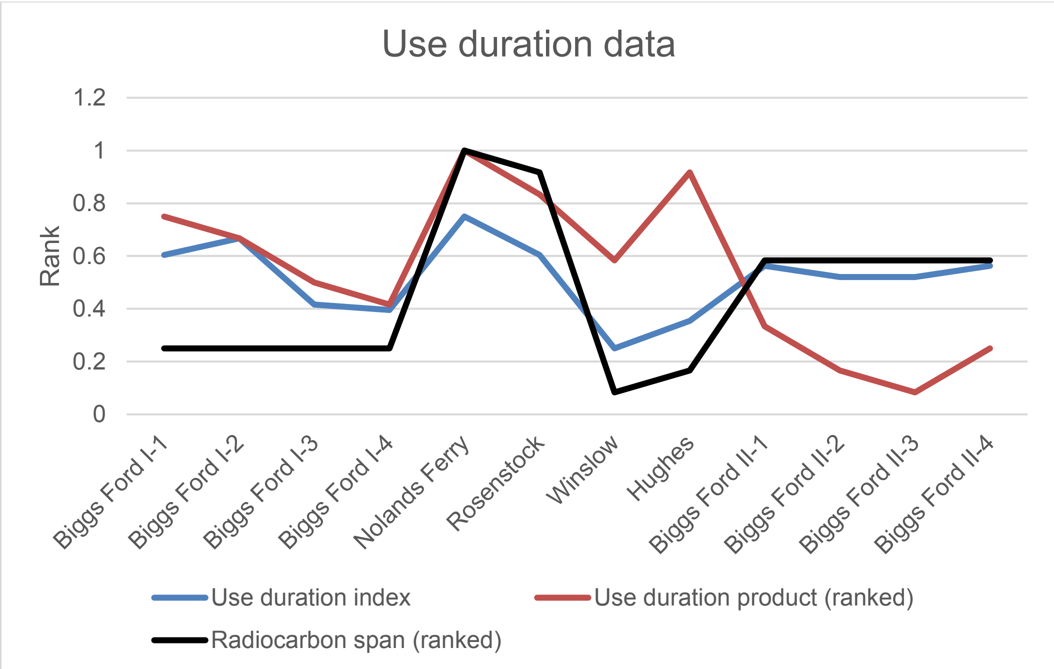

Figure 10: Use duration index, use duration product, and radiocarbon data.

Meanwhile, the discard equation product for use duration has its own problems (see Table 8 and Figure 10). As expected, the same pattern appears again at Biggs Ford II, where all four scenarios have low results. Again, high inputs are forcing the equation product down, though this problem may not affect all scenarios; Scenario 1 is a bit higher. The primary problem, though, is that the equation products for Hughes and Winslow are antithetical to those sites' Bayesian models, which are, as noted, the most reliable models in the dataset. The models predict that these sites had the two shortest occupations in the dataset, but the equation produces high results for both, on par with Rosenstock. Unlike with the index, there are no alternative scenarios at these sites, so the divergences *do* call the reliability of the equation product as a whole into question and are severe enough that I am unwilling to use that option. While the equation product cannot be ruled out, I am confident in declaring the use duration index the more reliable option.

Range:

Before concluding, it should be noted that the range of the use duration index is much more limited than the radiocarbon medians (see Table 8 and Figure 10). Winslow's median radiocarbon span is 57 years, around 10.6% of Nolands Ferry (539 years). In contrast, Winslow's use duration index (0.25) is only 33% of Nolands Ferry (0.75). There are several possible explanations for this divergence. First, the discrepancy may expose a fundamental flaw in accumulations research with such a small sample size. This smaller sample size entails larger fractions in index computations, which may inherently obscure variation. Second, given the error factors in radiocarbon dating, this divergence may not be significant. Indeed, Winslow's maximum radiocarbon span (203 years) is 59.2% of Nolands Ferry's minimum span (343 years). The medians may have overestimated the range; shorter-lived sites' occupations may have been closer to the higher end of their ranges, and longer-lived sites closer to the lower end. Third, contaminated radiocarbon dates at Nolands Ferry and Rosenstock (Peck 1980; Curry and Kavanagh 2004) could have expanded these sites' Bayesian models. Finally, Rosenstock and Nolands Ferry have had multiple occupations belonging to the same complex, which could not be separated (unlike at Biggs Ford). Indeed, Curry and Kavanagh suggested that Rosenstock might have two occupational episodes (Curry and Kavanagh 2004, 26). The use duration index may provide tentative support for multiple occupations there, though this possibility would require further study of Rosenstock and Nolands Ferry to determine if occupations can be separated. No answer is apparent, but these possibilities demonstrate how the use duration index can clarify the radiocarbon chronology.

Residential Stability:

Finally, the residential stability index was probably the most complicated to compute. This measure represents the degree to which a site was inhabited within a given year (Gallivan 2003, 77-78). A community may have relocated regularly within a year according to seasonal resource availability (Gallivan 2003, 75-78). Creating the residential stability index resembles the process for the use duration index; the different data are ranked among sites, converted into fractions, and averaged together (Gallivan 2002, 542). Gallivan used several factors: feature richness, lithic assembly diversity, house floor area, post diameter, frequency of wall posts, number of interior house features, and pit volume (Gallivan 2003, 77-78). However, the lack of households in the dataset means that several inputs are not available. Post diameter data are available from three sites, but the smaller sample size and larger fractions skewed the averages. Thus, only feature richness, lithic assembly diversity, and pit volume proved to be workable inputs.

Feature Richness:

Feature diversity is a measure of variation (Cochrane 2003, 837), specifically of "the number of classes of items present in an assemblage" (Kintigh 1989, 25). Its relevance here is that, given the seasonal round of subsistence activities, a settlement occupied for longer periods of the year should see more diverse activities and thus more diverse types of features

(Gallivan 1999, 273). In contrast, a site occupied for only one season should have more uniform activities and features, regardless of how many years these activities took place. Gallivan's research outlined certain standards for this measurement; features must belong to the same occupation, and 100 square meters excavated is the minimum sample size per occupation (Gallivan 1999, 273-276). As noted above, I ignored the second stipulation to include Nolands Ferry (96 m^2) as a representative of the Page complex.

Type	Orifice Shape	Diameter (cm)	Profile	Depth (cm)	Contents / Association
Storage	Circular	60-140	Straight-sided bell-shaped	60-130	Rock slab covering
Borrow Pit	Circular	160-280	Basin-shaped	20-60	
Structure floor	Elliptical or rectangular	500-1000	Basin- or Dish-shaped	10-40	Packed floor, associated with posts and pits
Hearth	Circular	40-100	Basin-shaped	5-15	Lined with rocks or burnt clay; associated with structure floor
Roasting Pit	Circular	100-200	Straight-sided or basin-shaped	10-60	Burnt areas or concentrations of FCR
Palisade ditch	Linear	120-180	Shallow sloping sides	30-80	Adjacent postmold alignment
Posthole	Circular	5-30	Straight sides and round to pointed bottom	10-120	May occur individually, in aligned pattern, or within narrow trench
Burial pit	Elliptical	80-160	Straight sided or undercut	50-120	Human remains
Arc Pit	Elliptical	110-450	Hemispherical	20-110	
Category X	Circular	16-54	Spherical	3-32	

Table 9: Summary of feature classes, based on Gallivan 1999, 136.

For site occupations meeting these standards, the features present must be divided into classes based on the activities that produced them (Gallivan 1999, 134-137). In general, classifying features relies on morphological attributes—diameter, depth, profile shape, and so forth—rather than artifacts (Gallivan 1999, 134). Multiple classification systems exist, but Gallivan generally drew on a modified version of Dickens 1985 (Gallivan 1999, 136; Gallivan 2002, 542). This paper uses Gallivan's basic system (see Table 9), but adds two additional categories, Arc Pits and "Category X."

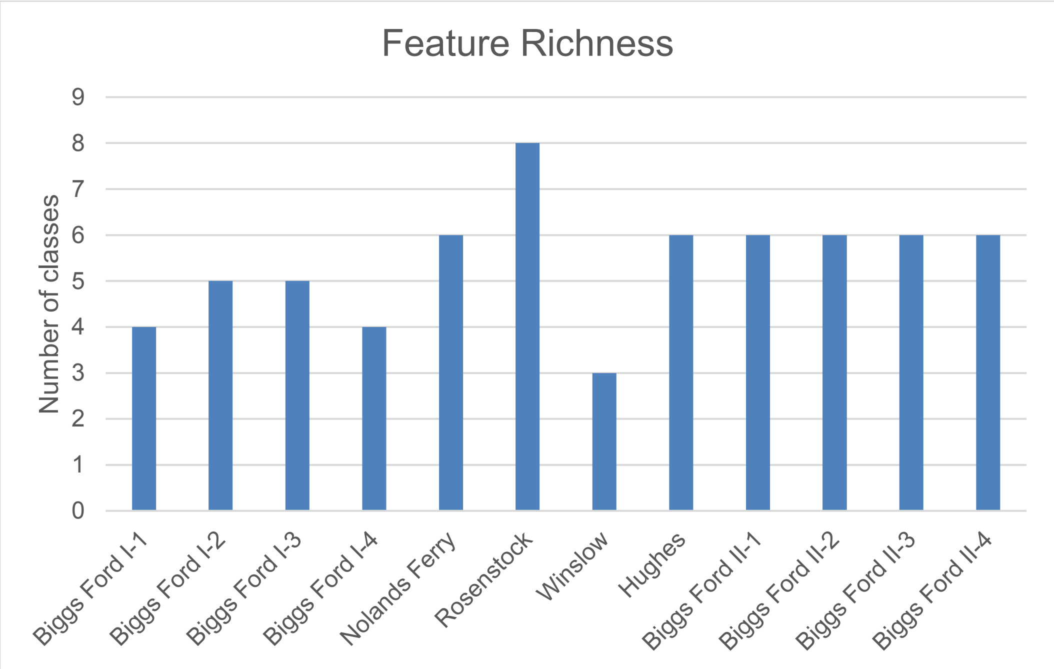

Figure 11: Feature richness data.

First, arcs of elongated storage pits surrounded the plazas of many sites, especially within the Montgomery Complex (Curry and Kavanagh 2004, 29-30). They seem to have had a particular importance beyond most storage pits. Second, many authors have remarked on the presence of small storage features in this region but disagreed on their use: potholders at Hughes (Jirikowic 1999, 71-73); "kitchen cabinet" basins at Rosenstock (Curry and Kavanagh 2004, 28); and a "kitchen basin" at Biggs Ford (Peixotto 2021, 29). Therefore, I somewhat theatrically grouped the identified features, along with similar examples at Winslow and Nolands Ferry, into the new "Category X."

Once the features are properly classified, multiple forms of measurement are possible, but Gallivan suggests that feature richness was the most reliable, referring to the number of feature classes present in an occupation (Gallivan 1999, 274; Kintigh 1989, 26; Cochrane 2003, 837), and hence is rendered as a single number (see Figure 11) (Gallivan 1999, 293). This measure is therefore relatively simple and blunt.

Pit Feature Volume:

Category	Average Depth
Arc Pit	36.88
Burial	45.16
Category X	11.12
Hearth	10.80
Midden	10.08
Palisade Trench	35.50
Roasting Pit	21.00
Storage Pit	40.88
Structure Floor	13.00
UID	26.51

Table 10: Average feature depths according to feature category.

The second measure of residential stability is pit feature volume. In general, the more sedentary a population was, the more likely it was to invest in settlement infrastructure (Gallivan 1999, 285). Thus, the volume of pit features represents “a rough gauge of the labor investment in and durability of settlement infrastructure” (Gallivan 1999, 285). Volume calculations were made according to the appropriate formula for a feature’s shape (Gallivan 1999, 149), including hemispheres, conics, frusta, pyramids, rectangles, and unidentified. Unidentified features (including Features 50-97 at Biggs Ford) were considered hemispheres, and, when depth measures were unrecorded, average depth for feature categories was used (Table 10 and Figure 12).

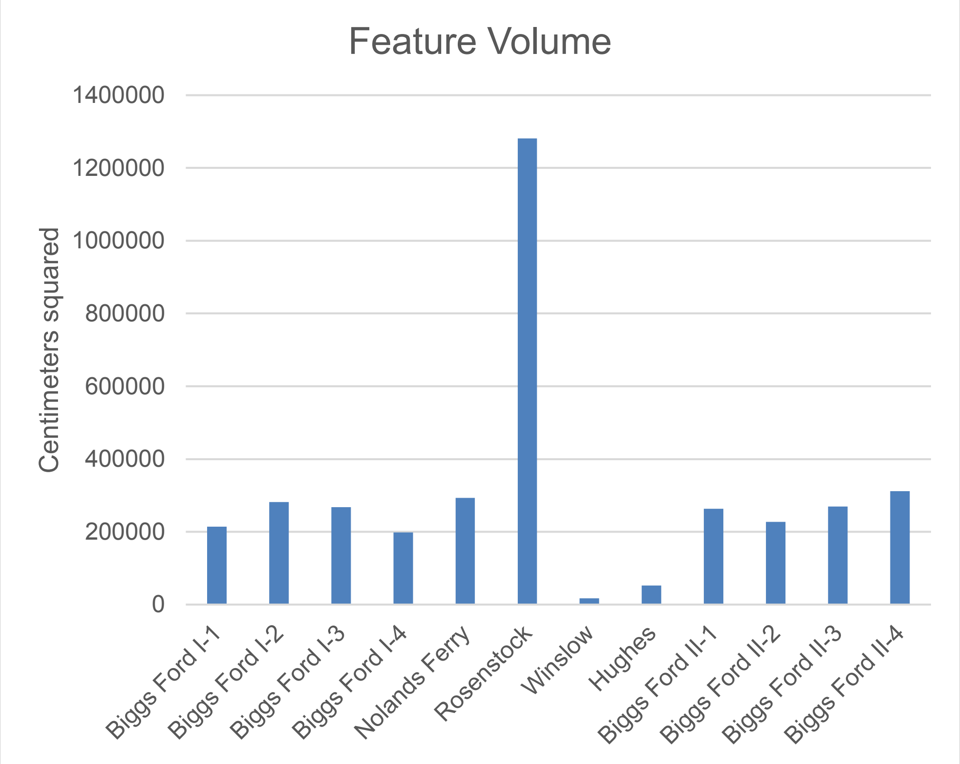

Figure 12: Average Feature Volume (cm³).

Lithic Evenness:

Lithic diversity represents another critical measure of residential stability. In this case, longer occupations during a year led to more diverse activities and thus a more diverse archaeological assemblage. This observation applies to lithic materials as well as features (Gallivan 1999, 292-297). Additionally, sedentariness is generally associated with a more diverse material culture, which lithic artifacts can measure (Gallivan 1999, 292-293). Indeed, lithic artifacts can be classified into one of five categories: fire-cracked rock, debitage, chipped stone tools, projectile points, and ground stone tools (see Figure 13) (Gallivan 1999, 293). Classification practices present issues for measuring evenness; for instance, Hughes' catalog included no fire-cracked rock in features and Winslow's lacked any ground stone tools (see Figure 13), despite the site reports noting both categories' presence (Jirikowic 1999, 168; Dent 2007, 22). These classificatory quibbles are probably biasing some sites toward marginally greater unevenness, though there probably was a dearth of these categories at Hughes and Winslow.

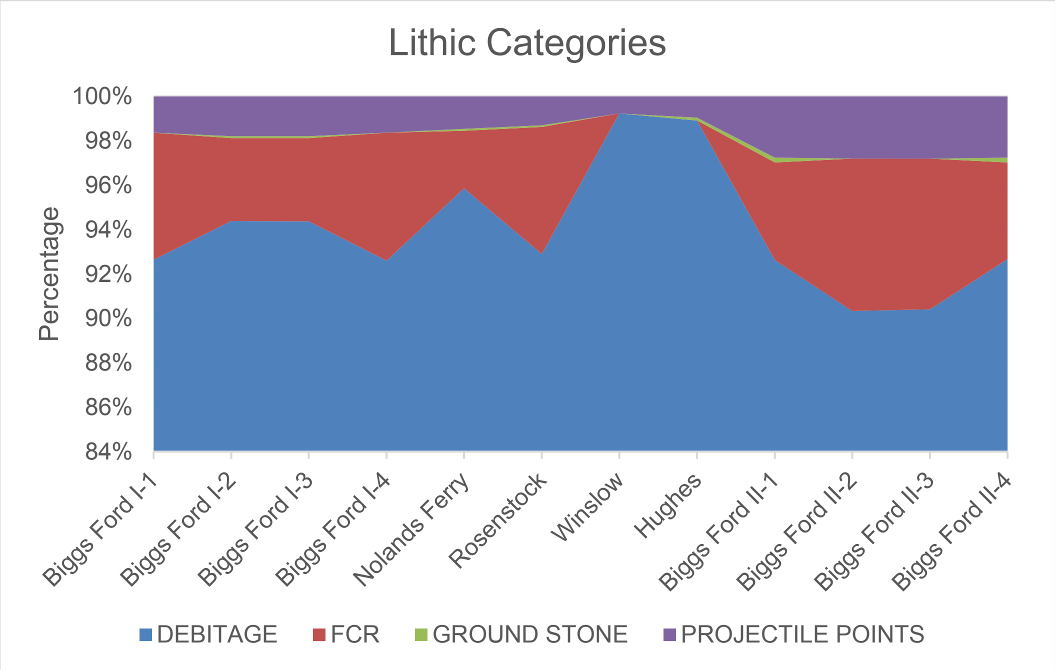

Figure 13: Percentages of lithic categories.

The preferred measure for lithics is evenness: "Evenness reflects the extent to which an assemblage of lithic artifacts includes an equal number of artifacts from each of the possible categories. A perfectly even assemblage amounts to one in which every category is present in equal proportions" (Gallivan 1999, 293-294). The method works with feature lithics, and evenness is determined through an 'information statistic,' of between 1 (most even) and 0 (single category present) (see Figure 14) (Gallivan 1999, 294; Kintigh 1989, 29). The variables in the calculation are as follows:

J = Evenness

f_i = frequency of lithic artifact category (in a feature)

k = number of categories (in this case 5)

n = sample size (total number of lithic artifacts in feature)

$p_i = f_i / n$

H_{max} = log(k)

(Gallivan 1999, 294). A Shannon-Weaver function was applied to the values:

$$H = -\sum_{i=1}^{k} pi \log (pi)$$

(Gallivan 1999, 294). Evenness (J) was calculated for features as $J = H / H_{max}$ (Gallivan 1999, 294). This equation required some translations in excel, including manually entering 0 when log(0) is undefined (Kintigh 1989, 29).

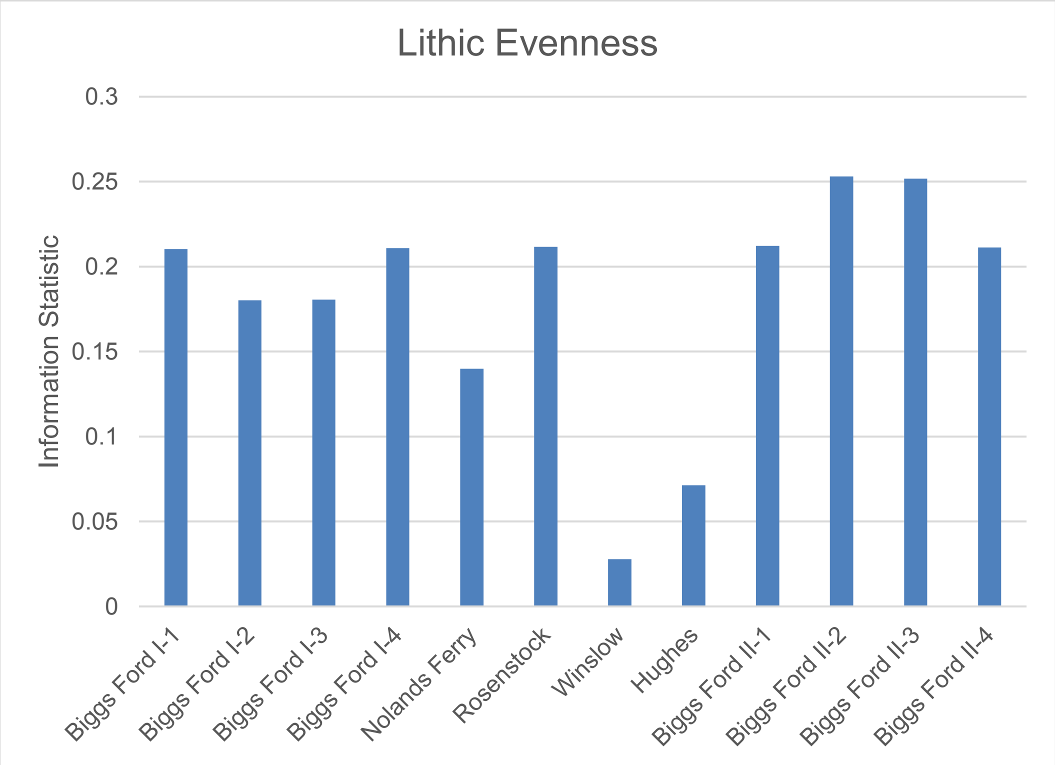

Figure 14: Lithic evenness calculations.

Residential Stability Index, Discard Equation Product, and Evaluation:

So, it is now possible to compare the residential stability index with the discard equation product, produced by solving the equation using population and use duration indices. For the equation product, there is no strong case with independently verifiable residential stability data, and hence no constant. The equation product's inscrutable numbers therefore had to be ranked for comparison to the index (see Table 11 and Figure 15). As noted, the ranking process has some internal issues.

Site Name	Median radiocarbon date	Site Type	Residential stability index	Residential stability product, ranked
Biggs Ford I-1	1297.5	Hamlet / Village	0.33	0.75
Biggs Ford I-2	1297.5	Hamlet / Village	0.47	0.67
Biggs Ford I-3	1297.5	Hamlet / Village	0.44	0.5
Biggs Ford I-4	1297.5	Hamlet / Village	0.33	0.42
Nolands Ferry	1303	Hamlet	0.53	1.00
Rosenstock	1384.5	Village	0.92	0.83
Winslow	1391.5	Village	0.08	0.58
Hughes	1450	Village	0.28	0.92
Biggs Ford II-1	1578	Village	0.61	0.33
Biggs Ford II-2	1578	Village	0.64	0.17
Biggs Ford II-3	1578	Village	0.69	0.08
Biggs Ford II-4	1578	Village	0.69	0.25

Table 11: Comparison of residential stability index and product.

Comparing the two options, interesting similarities and differences emerge. The index and product align at Rosenstock, but Hughes and Biggs Ford II have opposite results whichever option is chosen. Curiously, there may be some correlation between the two options in the variation at Biggs Ford I and Winslow, even though the actual numbers are different. This pattern may reflect the differences between ranks and average ranks. Critically, the ranges of both the index (0.08 – 0.91) and product (0.08 – 1.00) were nearly identical (contrasting with the use duration index), so both options suggest groups made the same range of seasonality decisions; the differences are in which groups made which decisions.

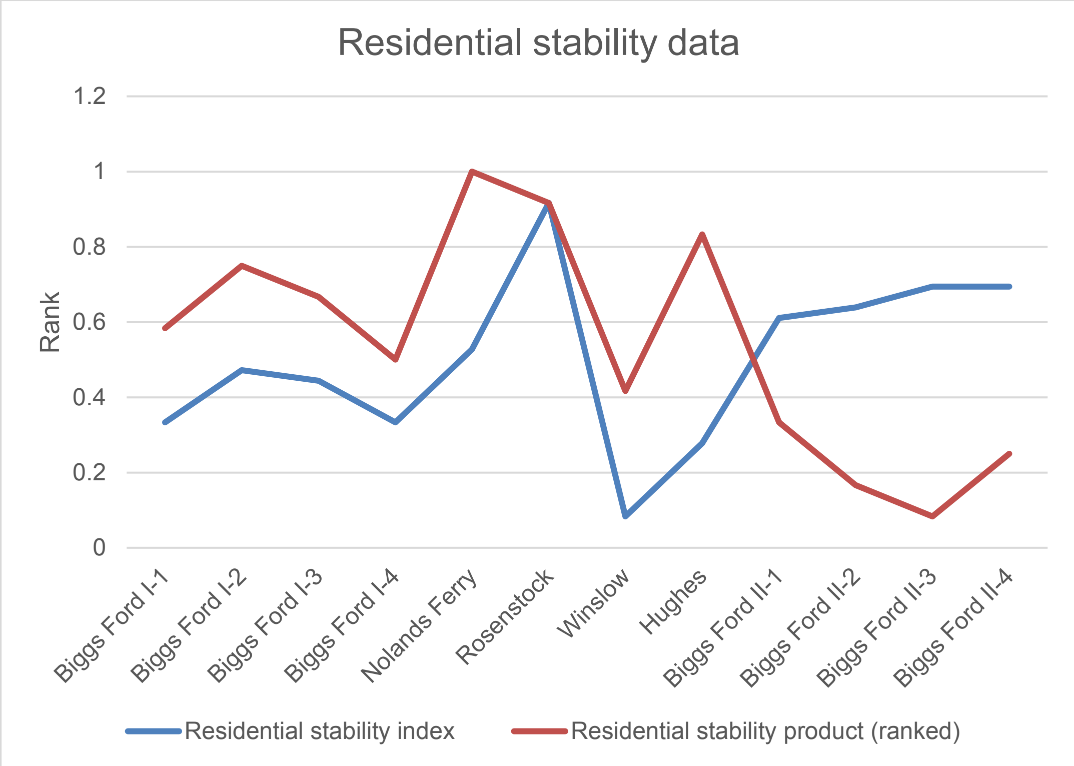

Figure 15: Comparison of residential stability index and product.

However, the fundamental roadblock for residential stability is the lack of a clear benchmark, like households or radiocarbon years. The results must be somewhere between 0 and 100% of the year, but, since those values are not known at any site, the fractions cannot be tied to a portion of the year. For instance, it is not clear if the identical ranges are 0 to 100% of the year, 0 to 50%, or some other range. Thus, there is no way to independently verify a given site's results. That fact, combined with the similarities in range, meant that I could not even make a subjective judgment about reliability. Instead, both options will have to be judged as part of an overall combination of data.

Analysis:

Combination of Data:

Given the fundamental incompatibility of the different indices, my goal was to subjectively identify the most plausible or least unreliable combination of the data (see Figure 16). As a reminder, that combination will involve using two more reliable indices to solve for the third variable's product. Again, all these indices are likely somewhat unreliable. At Biggs Ford II, for instance, I suspect most of the indices were biased slightly upward and the total discarded ceramics slightly downward. The question is a matter of degree.

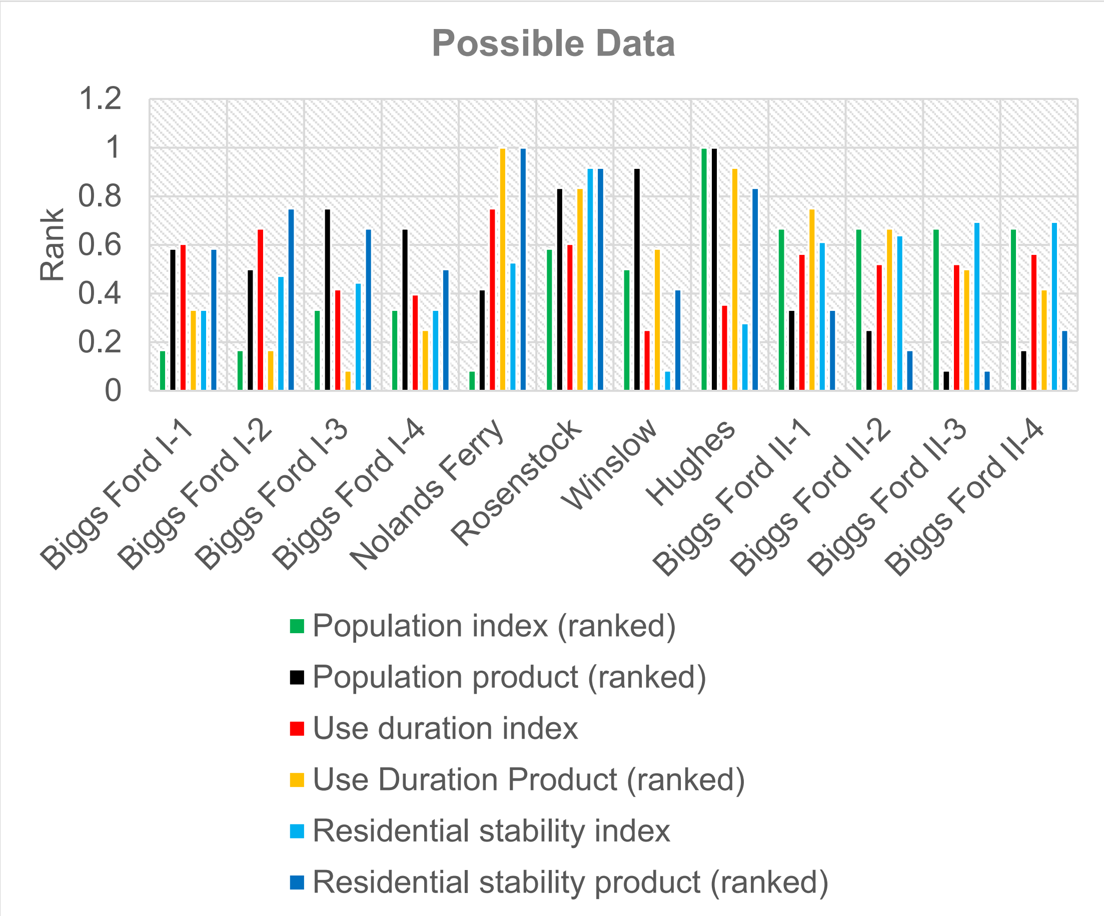

Figure 16: Possible Data.

Having laid out my views on each variables' indices, I am confident in the use duration index, favor the population index to its equation product, and cannot reach a decision on the residential stability index. Therefore, the use duration index will be used, and this decision is effectively between the population index (site area) and the residential stability index. On the one hand, the multiple inputs into residential stability should correct for skew; on the other, the site area index's household numbers are more tied to reality than residential stability's relative data (as with the debate between the "crowded" and "comfortable" arrangements at Winslow).

The choice is, in the end, a matter of opinion. In my case, that choice is between one variable where I have a definite preference (population index) and another variable where I have no preference (residential stability) for all the reasons I have outlined above. Therefore, I consider the population index more reliable, and the most plausible or least unreliable combination of data is the use duration index, the population index, and the residential stability product. That is, having affirmed two indices, I must reject the third. There could be any number of fatal flaws in the residential stability index; perhaps only three inputs were not enough to form a reliable index, or perhaps some of the assumptions in the process were faulty. Once again, this decision is a matter of opinion, and others may disagree.

With this esoteric discussion out of the way, it is possible to consider what this combination of data—again, the population index, use duration index, and residential stability product—say about the practices of Potomac Piedmont Native communities. Several basic procedures are worthwhile. First, the relative use duration index can be translated into ranges of numbers of years. Second, occupations can be organized according to different ideal settlement practices. Third, the results can be compared according to time. In doing so, trends related to geography, culture, and time can be assessed.

Use Duration, Years:

It is worthwhile to deploy the discard equation one last time to express use duration information in years. Thus far, both the index and equation product have been expressed in relative fractions, which may obscure the fact that communities inhabited these sites for a definite amount of time. Fortunately, the discard equation can be solved for use duration in any unit, including years. Such a calculation requires a population variable, a residential stability variable, and a strong case with a known chronological length of occupation (to determine the constant). This paper has already explained which forms of data I consider most reliable for each variable—the population index and residential stability product—and Bayesian models provide occupation spans for strong cases. Thus, this section attempts to translate the relative fractions into concrete amounts of time.

Site Name	Site Type	Median start date	Radiocarbon midpoint	Median end date	Min Radiocarbon Span	Median Radiocarbon Span	Max Radiocarbon Span
Biggs Ford I-3	Hamlet / Village	1248	1297.5	1389	0	152	443
Biggs Ford I-4	Hamlet / Village	1248	1297.5	1389	0	152	443
Nolands Ferry	Hamlet	1018	1303	1557	343	539	790
Rosenstock	Village	1162	1384.5	1499	139	339	553
Winslow	Village	1365	1391.5	1424	0	57	203
Hughes	Village	1412	1450	1486	0	77	160
Biggs Ford II-3	Village	1472	1578	1646	18	158	426
Biggs Ford II-4	Village	1472	1578	1646	18	158	426

Table 12: Radiocarbon Models.

Some methodological points must be made. First, this process involves *reentering* the equation product for residential stability back into the equation. Second, for simplicity's sake, these calculations used the median radiocarbon span. The radiocarbon Bayesian models are shown in Table 12; theoretically, any number between their minimum and maximum spans is usable. Third, as Table 13 and Figure 17 show, choosing a strong case here faces both an embarrassment of riches and a dearth of usable options. On the one hand, thanks to Bayesian modelling, all sites are possible strong cases, except for those with unworkable use duration indices like Scenarios 1 and 2 at Biggs Ford I. On the other, no strong case returns values within the upper and lower bounds of all sites' Bayesian models, as an ideal strong case would. Instead, the only workable strong cases at Nolands Ferry are itself and Rosenstock, both of which produce results above Hughes' maximum span. This problem is a reflection of the fact that the use duration index has a much narrower range than the Bayesian models, as was discussed in the use duration section.

SITE NAME	STRONG CASE: Biggs Ford I-3	STRONG CASE: Biggs Ford I-4	STRONG CASE: Nolands Ferry	STRONG CASE: Rosenstock	STRONG CASE: Winslow	STRONG CASE: Hughes	STRONG CASE: Biggs Ford II-3	STRONG CASE: Biggs Ford II-4
Biggs Ford I-3	152	160	299.4	233.8	95	90.6	126.4	117.0
Biggs Ford I-4	144.4	152	284.5	222.1	90.3	86.1	120.1	111.2
Nolands Ferry	273.6	288	539	420.8	171	163.1	227.5	210.7
Rosen-stock	220.4	232	434.2	339	137.8	131.4	183.3	169.7
Winslow	91.2	96	179.7	140.3	57	54.4	75.8	70.2
Hughes	129.2	136	254.5	198.7	80.8	77	107.4	99.5
Biggs Ford II-3	190	200	374.3	292.2	118.8	113.2	158	146.3
Biggs Ford II-4	205.2	216	404.2	315.6	128.3	122.3	170.6	158

Table 13: Use Duration results according to potential strong cases.

Selecting one site to use as a permanent strong case may be a matter of selective judgment. Winslow and Hughes represent the most accurate Bayesian models (Henshaw 2023, personal communication). Using them as strong cases produces plausible results for all sites except Nolands Ferry and Rosenstock (see Table 13). Winslow as a strong case for Rosenstock returns 137.75 years, close to Rosenstock's 139-year minimum span. Generally, using either Scenarios 3 or 4 at either Biggs Ford I or II as the strong case produces an acceptable answer for all sites besides Nolands Ferry.

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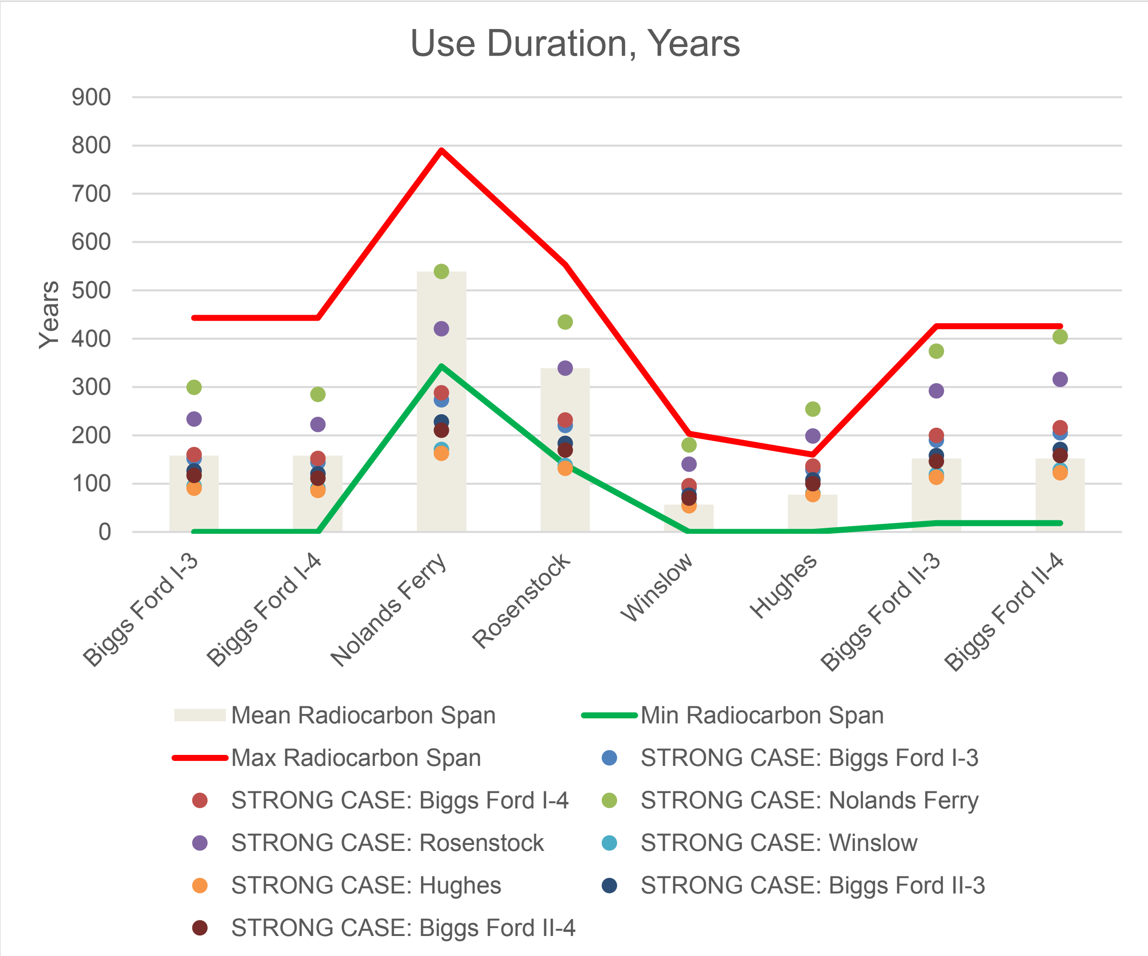

Figure 17: Radiocarbon data and use duration results, expressed in years.

Excluding Rosenstock and Nolands Ferry as strong cases, these conversions serve to generally reinforce existing conclusions. There may be some arithmetic particularities; using medians removes the lower half of variation for shorter-lived sites (Winslow is 54.4-96 years, and Hughes 77-136 years) and upper half for longer-lived sites (Biggs Ford I is 86-160 years). In general, this effect condenses all available sites into a roughly similar range, albeit with Winslow and Biggs Ford II (113.2-216 years) as outliers. These occupations were not especially long, perhaps 3 to 6 generations.

In fact, one of the (unconfirmed) explanations for the difference in range is that Rosenstock and Nolands Ferry may not have been continuously inhabited. In that case, these calculations likely represent the combined length of all occupations, while the Bayesian models lump together all occupations and the intervening hiatuses. Thus, Nolands Ferry may have had multiple occupations lasting a total of 163.1-288 years, with a hiatus of 251-375.9 years. Assuming those occupations were similar in length, then two individual occupations would be 82-144 years each, similar to the predictions for Hughes. Rosenstock, meanwhile, may have been inhabited for 131.3-232 years in total, with an intervening gap of 107-207.6 years. Two equivalent occupations might last for 66-116 years, intermediate between Winslow and Hughes. Thus, it is possible that (sometimes sequential) occupations of roughly 75-150 years could explain all sites, so there may be some general support for the multiple occupation hypothesis. Although this theory cannot be confirmed, converting use duration into actual years serves to provide new, though not radical, insights on the use duration and radiocarbon chronology.

Settlement Practices and Subsistence Strategies:

Next, the ranges of numbers found in use duration and residential stability data, whatever their exact form, can be further classified into specific settlement practices or subsistence strategies. For instance, the use duration index and residential stability product can be plotted on the X and Y axes of a graph, dividing them into quadrants between brief and year-long occupations (residential stability) and short and long occupations (use duration) (Gallivan

1999, 301). To be clear, repeated seasonal use is considered as a single (long or short) occupation, as opposed to the reoccupation of a site after a significant hiatus seen at Biggs Ford (and possibly Nolands Ferry and Rosenstock). Thus, each quadrant represents a particular form of settlement practice. This visualization omits the population index and continues using the use duration index's relative format for ease of comparison with the residential stability product. That said, Biggs Ford II-3 had a use duration index of 0.521 (possibly biased upward) and a mean radiocarbon span of 158 years, while Biggs Ford I-3 had an index of 0.42 and mean span of 152 years, so the quadrant boundary of 0.5 probably translates to around 150-160 years.

Regarding those four quadrants, a site with low values in both variables was occupied once and briefly, while a site with a low use duration and high residential stability suggests "a year-round settlement which is occupied once" (Gallivan 1999, 300). In both cases, "once" could refer to several generations of seasonal or year-round occupation. Next, a site with a high use duration and low residential stability suggests a site repeatedly, briefly occupied (Gallivan 1999, 300), suggesting that a community seasonally returned to a site for centuries. Finally, a site with high values in both variables "may be characterized as a year-round settlement that is continuously occupied for many years" (Gallivan 1999, 300); such sites were persistent places, inhabited continuously for many generations. These labels are somewhat arbitrary but represent a chance to make sense of the continuum of variation.

Sites fell into all four quadrants of the graph, as can be seen in Figure 18 and Table 14. All scenarios for Biggs Ford II unquestionably fell into the multiple, brief occupations—though, as noted, Biggs Ford II-3 is close to the dividing line. Scenario 4 at Biggs Ford I was a single, brief occupation; Biggs Ford I-3 was a single occupation on the line between brief and year-long. Rosenstock and Nolands Ferry represented multiple year-long occupations; Scenarios 1 and 2 at Biggs Ford I ended up in the same quadrant, but these scenarios are probably less accurate (see the use duration discussion). Finally, Winslow and Hughes represented the single, year-long occupation.

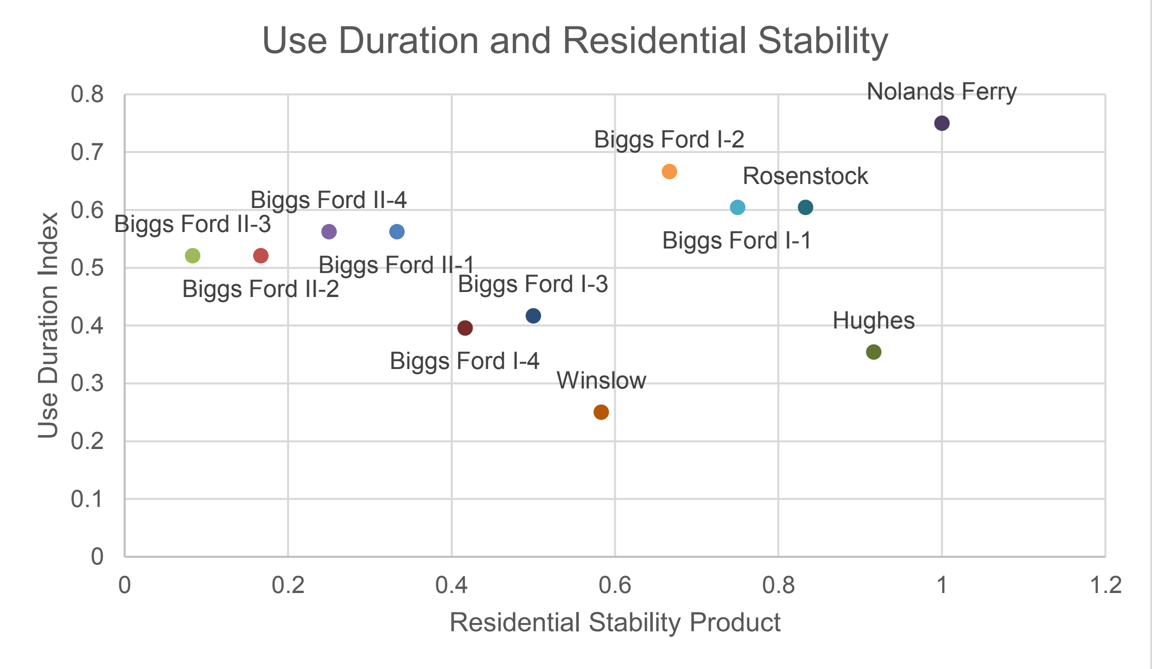

Figure 18: Plot of use duration and residential stability data.

However, there are two caveats to keep in mind. First, the results seem to be weighted toward year-long occupation (that is, high residential stability). Most likely, the fact that the ranking system must reach 1 might have biased the equation products towards year-long occupations. Second, converting the use duration index to years suggested the possibility that all sites can be explained by shorter occupations of 75-150 years—around where the 0.5 use duration index dividing line should fall. This possibility may suggest that seemingly long-occupied sites were actually re-occupied after a significant hiatus, as with Biggs Ford. If so, then all sites would fall into the shorter occupations category, except for Biggs Ford II (which, as noted above, was close to the boundary). While not confirmed, such a predominance of short occupations would not be surprising in such a highly fluid region.

	Brief Occupations	Year-long occupations
Multiple	Biggs Ford II-1-4	Biggs Ford I-1-2, Rosenstock, Nolands Ferry
Single	Biggs Ford I-4	Winslow, Hughes

Table 14: Quadrants of sedentariness plot.

In any case, no clear pattern emerges from these results in terms of culture. Indeed, variation within complexes outweighs variation between complexes. The Montgomery Complex is represented in three of the four quadrants; since that complex's results consist of five scenarios of three sites, this coverage is about the widest possible. Even if there were two occupations at Rosenstock, the complex would still be represented in two quadrants. The people of the Montgomery Complex seem to have used every settlement routine under the sun. Nolands Ferry, the only Page site, is the same quadrant as Rosenstock, suggesting that some Page and Montgomery communities had similar settlement practices. How representative those practices were of the Page Complex as a whole is unclear. Meanwhile, the two known Keyser Sites fall into opposite quadrants, so these communities practiced antithetical strategies (wider sampling might produce examples in the other two quadrants): a short, year-round occupation at Hughes (for 77 years) and repeated, seasonal occupation at Biggs Ford II (for 158 years).

Some caveats should be addressed, however. For one, Biggs Ford II's use duration index was close to the dividing line and possibly biased upward, so its occupation may not have been dramatically different from a single, brief occupation. My decision to use the residential stability product over the index plays a role here, because Biggs Ford II had a high residential stability index. If both points were correct, Biggs Ford II *would* fall in the same quadrant as Hughes. However, I stand by my decisions on both points. In any case, the Bayesian model for Biggs Ford II's span (median = 158 years) was more than twice that of Hughes' (median = 77 years), so there clearly were divergences; the only question is their significance. Thus, culture was not a determining factor in settlement strategies, diverging from expectations that subsistence would become more intensive with the Keyser Complex.

Briefly, geography also does not appear to be a major determining factor. Winslow's inhabitants probably had more in common with their Keyser neighbors at Hughes than with their fellow Montgomery villagers at Biggs Ford I or Rosenstock. The inhabitants of both sites preferred to intensively occupy their sites for short times. Given their proximity to the Fall Line cultural boundary, remaining in their sites for the entire year might have provided greater access to defenses during conflicts and exchange in peacetime. In contrast, though, the northern sites of Rosenstock, the reliable scenarios at Biggs Ford I (Scenarios 3 and 4), and Biggs Ford II each practiced a different combination of mobility and seasonality. The Monocacy sites were in contact with northern groups like Shenks Ferry and the Susquehannocks (Curry and Kavanagh 2004), so they should have had the same incentive towards intensive occupation. Thus, no clear geographic pattern emerges.

Temporal Analysis:

Analyzing the data according to time also produced some noteworthy results (see Figure 19). In particular, the use duration index and residential stability product may lack temporal as well as cultural or geographic trends.

Use duration varied back and forth over time; there were longer and shorter-lived sites like Nolands Ferry and Winslow, but the data were bookended by the moderate and nearly equivalent Biggs Ford I and II (with median Bayesian models of 152 and 158 years). If there were multiple occupations of Nolands Ferry and Rosenstock, this general continuity would be reinforced (though each occupation would need to be separately repositioned).

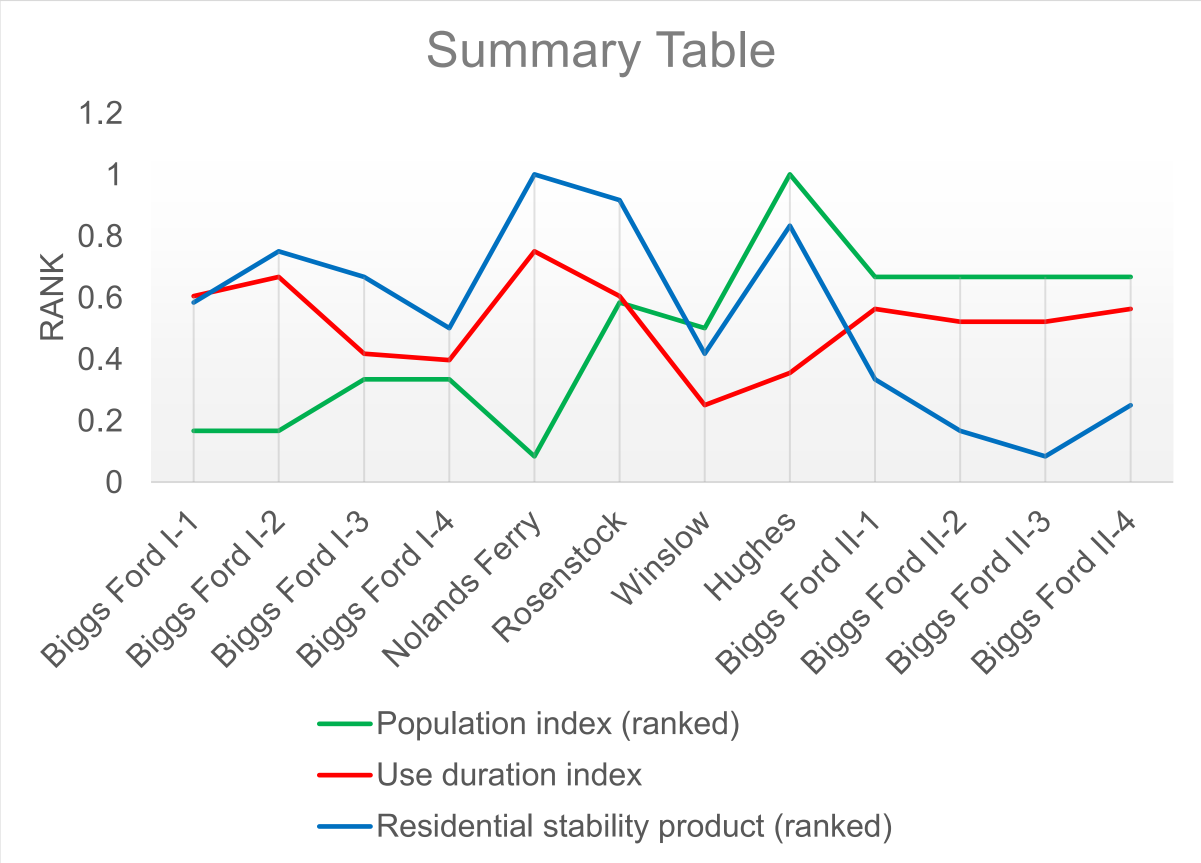

Figure 19: General data.

However, the residential stability product is more difficult to interpret. At first, there appears to be a trend over time towards lower residential stability, and thus more seasonal movement. Perhaps the instability surrounding Keyser's arrival motivated communities to exploit a broader range of seasonal resources. That said, there are some reasons to doubt this trend; as already discussed, the other late site, Hughes, has antithetical results to Biggs Ford II, including a higher residential stability product. The variability of the late

Keyser Complex's settlement practices does argue against a trend in residential stability. Furthermore, the Biggs Ford II pattern, where high indices and low total ceramics skewed equation products downward, may have exaggerated the small size of Biggs Ford II's residential stability product. Therefore, a downward trend in residential stability seems unlikely but cannot be ruled out. In summary, then, both the use duration index and residential stability product lack trends over time, culture, or geography. This observation is a clear divergence from expectations that subsistence and settlement strategies would become more intensive over time.

However, analyzing the available results over time does produce one noteworthy trend in the population (site area) index. As time went on, people lived in larger sites. Between Biggs Ford I (median mid-point 1298) and Biggs Ford II (median mid-point 1578)—the two moderate bookends of the use duration index—site area generally increased. That said, there was significant variation in between, including between Rosenstock and Winslow or Hughes and Biggs Ford II. Indeed, there appears to be a general upward trend in the population index within the Montgomery Complex sites from Biggs Ford I to Winslow. Thus, site area varied primarily over time rather than over culture, specifically rising with time. These calculations do assume no re-occupations; if there were multiple occupations at Nolands Ferry or Rosenstock, further work would be necessary to determine those different occupations' areas.

In any case, this trend may suggest an overall population increase, not surprising given the recent adoption of agriculture in the Late Woodland. The results could also suggest, however, that the population was becoming more concentrated; except for Nolands Ferry, these sites are the largest in their complex and period. Indeed, concentration may have been a response to an increasingly unsettled region after Keyser's arrival around 1400; larger settlements might have provided advantages for defense, central venues for exchange with different groups, or locations for rituals associated with group identity. Notably, if there was a decline in residential stability, it would have intersected with the population trend in interesting ways. A growing population may have chosen to intensify seasonal resource exploitation rather than agriculture; alternatively, groups may have only needed to concentrate temporarily and seasonally for defense, exchange, or rituals. Both growth and concentration are plausible, and not mutually exclusive. There is also no geographic trend in population, with differences between nearby sites with similar settlement practices like Winslow and Hughes. Thus, these sites' population varied exclusively over time—the one case where the data matched expectations for a rising population.

Summary:

Summarizing these conclusions, several points emerge. First, the sole clear development in the region was an increase in site size over time, suggesting either a growth or concentration of population. Furthermore, settlement practices varied over culture and geography. Montgomery sites include both the short-lived Winslow and long-lived Rosenstock, though long-lived sites could be multiple occupations. Likewise, the two Keyser sites had antithetical settlement practices. Hughes was a single, year-long, and intensive occupation, while Biggs Ford II saw seasonal occupations repeated for over a century. Generally, the Potomac Piedmont's inhabitants deployed a variety of settlement practices that cultural affiliation alone cannot explain.

Second, there is continuity in this variation over time as well as culture. As already noted, Hughes and Biggs Ford II had diametrically opposed settlement practices, even with their similar culture and period. Despite a possibly growing population, the Piedmont's inhabitants did not intensify their subsistence strategies by remaining at their sites for longer periods (either within or between years). If residential stability actually decreased, then there may have been a move towards *less* intensive agriculture. These conclusions certainly suggest that there was no population pressure in the region, even if the population was growing—removing one possible trigger for movement or migration. These conclusions also argue against theories that the Keyser Complex specifically practiced more intensive agriculture or shorter-term occupations. There was no single Keyser subsistence or settlement strategy; its sites practiced both seasonal and year-long occupations for long and short-terms. Indeed, while Biggs Ford II's use duration index may be biased upwards, its values (Scenario 3 = 0.52, Scenario 4 = 0.56) were not substantially lower than Rosenstock's (n = 0.60). The Keyser complex thus simply represents the logical continuation of the ongoing trends among the Complexes of the Potomac River Piedmont.

The primary overall conclusion is the lack of demographic causality. As already noted, the Late Woodland Potomac Valley had an eventful history involving many different cultural actors; significant progress has been made recently towards unraveling those events, though further work is needed. With this project, my general expectation was that demography and settlement practices would play a causal role in those events, as they did with the rise of political complexity in the James River Valley (Gallivan 1999; Gallivan 2002;

Gallivan 2003). The events of the Potomac's history are different, but they could have been explained by demographic factors too. For instance, one possible narrative could have been that the Keyser Complex arrived in a sparsely populated region and, thanks to their more intensive subsistence strategy, gradually came to dominate by absorbing or expelling the less populous Montgomery and Page communities. Depending on one's opinion of the retreat to the valley hypothesis, one could then argue either that the Keyser communities' intensive strategy exhausted soils and forced them to abandon the region for the Shenandoah Valley or that Keyser groups remained in the region until the demographic collapse brought about by European Contact. However, the data do not bear out these expectations.

Instead, the data suggest that the events of the Late Woodland Potomac's history were not caused by demographic and settlement variables. Keyser communities did not use radically different subsistence or settlement strategies, and Montgomery sites' populations seem to have been rising before Keyser arrived. The Potomac Piedmont still had an eventful history, but understanding those events will require investigation of other impetuses; the Keyser Complex's arrival in and possible dominance over the Potomac Piedmont could be explained by any number of cultural factors unique to those communities—including their use of new burial rituals (Jirikowic 1999, 108-117), games like chunkey (Manson et al. 1944), or trade connections with other areas (Barber 2020). Likewise, if Keyser did retreat into the Valley, other cultural factors, such as pressure from neighboring groups (Jirikowic 1995, 341), would be possible causes. In the end, then, this research provides important context for understanding the Potomac Piedmont's eventful history.

Conclusion:

This project was a sometimes-torturous attempt at applying accumulations research to study demography and sedentism in the highly unsettled Potomac River Piedmont. This effort faced several noteworthy obstacles in terms of data availability, reliability, and sample size, but accumulations research's inherent flexibility proved equal to these challenges. Comparing the results of different methods for calculating the three variables of interest allowed me to make a subjective judgment about which results were more reliable. Given more time, I would further explore the options that I rejected (that is, the residential stability index and population product).

In any case, analyzing the subjectively more reliable data suggested several conclusions about the eventful history of the Late Woodland Potomac. The data argued for a general lack of cultural differences in demography or settlement practices; population increased or became more concentrated regardless of cultural complex, and each complex used similarly varied settlement practices. Therefore, demography and settlement practices did not cause the events of Late Woodland Potomac history; instead, cultural factors are more likely to be responsible. Thus, with sufficiently redundant data and realistic expectations, accumulations research can be employed to study the Potomac Region. Indeed, these conclusions provide an important foundation for understanding the region's eventful history. However, this project may represent the appropriate level of investment in accumulations research for this region—if cultural or other non-demographic factors were the drivers of Piedmont history, then unraveling those cultural factors is a better way for future research to understand that eventful history.

Appendix 1, Feature Morphology:

Site Number	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Feature Number**	**Length (cm)**	**Width (cm)**	**Depth (cm)**	**Volume formula**	**Class**
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	1	76	76	10	Sphere	Hearth
18FR14	Biggs Ford II	Biggs Ford I	Biggs Ford I	Biggs Ford II	2	177	144	77	Cylinder	Burial
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	3	52	35	12	Sphere	X
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	4	459	129	30	Sphere	Burial
18FR14	N/A	N/A	N/A	N/A	5				UID	N/A
18FR14	N/A	N/A	N/A	N/A	6	109	88	23	Sphere	UID
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	7	48	39	75	Cylinder	Burial
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	8	100	87	29.5	Frustrum	Burial
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	9	82	67	50	Conic	UID
18FR14	N/A	N/A	N/A	N/A	10	110	56	4	Sphere	UID
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	11	375	138	35	Sphere	Arc
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	12	216	209	10	Sphere	UID
18FR14	N/A	N/A	N/A	N/A	13				UID	N/A
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	14				UID	N/A
18FR14	N/A	N/A	N/A	N/A	15				UID	N/A
18FR14	N/A	N/A	N/A	N/A	16				UID	N/A
18FR14	N/A	N/A	N/A	N/A	17				UID	N/A
18FR14	N/A	N/A	N/A	N/A	18				UID	N/A
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	19	97	76	35	Cylinder	Burial
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	20	93	75	20	Sphere	UID
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	21	67	30	40	Cylinder	Burial
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	22	75	68	25	Sphere	Burial
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	23	179	85	60	Sphere	Storage

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature Number	Length (cm)	Width (cm)	Depth (cm)	Volume formula	Class
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	24	226	111	30	Sphere	Arc
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	25	84	72	14	Conic	Hearth
18FR14	N/A	N/A	N/A	N/A	26	209	90	60	Sphere	UID
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	27	178	129	46	Frustrum	Roast
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	28	85	78	30	UID	N/A
18FR14	N/A	N/A	N/A	N/A	29	74	48		UID	UID
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	30	83	64	21	Sphere	UID
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	31	72	39	40.9	UID	Storage
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	32	88	52	40	Cylinder	Burial
18FR14	N/A	N/A	N/A	N/A	33	46	40		UID	UID
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	34				Cylinder	Burial
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	35				UID	N/A
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	36	107	61	17.5	Sphere	UID
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	37	89	73	8	Sphere	Storage
18FR14	N/A	N/A	N/A	N/A	38	58	50	4	Sphere	Hearth
18FR14	N/A	N/A	N/A	N/A	39				UID	N/A
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	40	434	127	80	Sphere	Burial
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	41	64	41	15	Sphere	UID
18FR14	N/A	N/A	N/A	N/A	42	350	68		UID	N/A
18FR14	N/A	N/A	N/A	N/A	43	105	58		UID	UID
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	44	83	52	40.9	UID	Storage
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	45	99	80	30	Cylinder	Burial
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	50	100	82	5	UID	UID
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	51	128	200	5	UID	UID
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	52	29	37	28	UID	UID
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	53	60	140	21	UID	Roast

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature Number	Length (cm)	Width (cm)	Depth (cm)	Volume formula	Class
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	54	140	200	42	Rectangle	Palisade Trench
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	55	110	116	10	Sphere	Hearth
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	56	72	61	54	Estimated	Burial
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	57	44	45	10.8	Sphere	Hearth
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	58	85	51	36	UID	UID
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	59	0	0	0	UID	Palisade Trench
18FR14	N/A	N/A	N/A	N/A	60	80	40	0	UID	N/A
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	61	110	110	6	Sphere	Roast
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	62	92	88	12	Sphere	Hearth
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	63	32	27	6	UID	Post
18FR14	N/A	N/A	N/A	N/A	64	17	16	6	UID	Post
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	65	20	19	14	UID	Post
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	66	21	26	12	UID	Post
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	67	30	30	26	Cylinder	Post
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	68	21	35	0	UID	UID
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	69	44	50	20	Sphere	Hearth
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	70	40	35	12	Sphere	Hearth
18FR14	N/A	N/A	Biggs Ford I	Biggs Ford I	71	64	48	10	Sphere	Hearth
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	72	143	143	45.2	Cylinder	Burial
18FR14	N/A	N/A	N/A	N/A	73	60	70		UID	Hearth
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	74	200	200	14	UID	N/A
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	75	100	200	1	UID	N/A
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	76	49	47	16	UID	UID
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	77	90	200	10	Sphere	Roast
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	78	120	80	10.1	UID	Midden

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature Number	Length (cm)	Width (cm)	Depth (cm)	Volume formula	Class
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	79	110	110	9	UID	Midden
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	80	76	80	11.1	UID	X
18FR14	N/A	N/A	N/A	N/A	81	0	0	0	UID	N/A
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	82	100	280	52	UID	Burial
18FR14	N/A	N/A	Biggs Ford I	Biggs Ford I	83	100	280	12	UID	UID
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	84	128	138	10.8	Cylinder	Hearth
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	85	25	32	5	UID	UID
18FR14	N/A	N/A	N/A	N/A	86	23	23	9	Sphere	X
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	87	86	94	7	UID	Midden
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	88	52	46	5	Sphere	Hearth
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	89	50	59	4	Sphere	Hearth
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	90	67	60	10	Sphere	Hearth
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	91	200	100	37	Cylinder	Burial
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	92	39	31	5	Sphere	Hearth
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	93	80	115	5	UID	UID
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	94	60	30	243	UID	UID
18FR14	N/A	N/A	Biggs Ford I	Biggs Ford I	95	32	40	0	UID	N/A
18FR14	N/A	N/A	N/A	N/A	96	50	29	0	Sphere	Hearth
18FR14	N/A	N/A	N/A	N/A	97	30	24	6	UID	UID
18FR14	N/A	N/A	N/A	N/A	98	26	26	14	Cylinder	Post
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	21A	81	44	32.5	UID	UID
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	7A	130	124	12	UID	UID
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	84a	21	22	5	Sphere	Hearth
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	84b	39	52	3	Cylinder	Post
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	1	43	42	2.5	UID	X
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	2	148.2	86.8	39	Sphere	Burial

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature Number	Length (cm)	Width (cm)	Depth (cm)	Volume formula	Class
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	3			0	UID	N/A
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	4			0	UID	UID
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	5	137	106	9	Sphere	UID
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	6	64	54	7	Sphere	X
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	7	131	115	17	Sphere	Roast
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	8	60	40	12	UID	Midden
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	9	80	50	45.2	Cylinder	Burial
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	10	60	40	12	Sphere	Hearth
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	11	30	25	7	UID	X
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	12	170	110	12	Sphere	Roast
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	13	205	80	8	Sphere	Midden
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	14	200	140	32	UID	Arc
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	15	174.9	55.7	12.5	Sphere	Burial
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	16	81	56	23	UID	UID
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	17	122.5	105		UID	UID
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	18	157.5	145	42.5	Sphere	UID
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	19	107.5	26	5	Cylinder	UID
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	20	269.1	269.1	80	Sphere	UID
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	1	20	16	2	UID	Hearth
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	2	290	200	12	Keyhole	Floor
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	3	40	32	20	UID	Hearth
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	4	160	160	50	Estimated	Arc
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	5	450	200	110	Estimated	Burial
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	6	170	130	40	Estimated	Arc
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	7				UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	8	300	150	20	UID	Arc

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature Number	Length (cm)	Width (cm)	Depth (cm)	Volume formula	Class
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	9	36	33	13	Sphere	UID
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	10	160	120		Estimated	Arc
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	11				UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	12	350	160	60	Estimated	Arc
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	13	200	140	40	Estimated	Arc
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	14				UID	Burial
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	15	105	70	45.2	Sphere	Burial
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	16				UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	17	600	200	60	Estimated	Arc
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	18				UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	19	46	46	32	UID	X
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	20				UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	21	35	33	17	Cylinder	X
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	22	35	33	9	Sphere	X
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	23	50	47	10	Sphere	X
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	24				UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	25				UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	26				UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	27	240	200	14	Keyhole	Floor
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	28	53	40	45.2	UID	Burial
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	29	120	114	35	Sphere	Roast
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	30	77	70	15	UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	31				UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	32	30	27	10	Cylinder	UID
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	33				UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	34	30	27	5	Sphere	UID

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature Number	Length (cm)	Width (cm)	Depth (cm)	Volume formula	Class
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	35	33	30	12	Sphere	Midden
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	36			11	UID	Midden
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	37	57	27		UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	38	34	23	29	UID	N/A
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	39	36	31	4	Cylinder	Storage
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	40	30	28	5	Sphere	UID
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	Midden		12.5		Midden	
18MO1	Hughes	Hughes	Hughes	Hughes	1	38	38	13	Sphere	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	2	32	30	14	Sphere	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	3	40	45	13	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	4	20	36	16	Pyramid	UID
18MO1	Hughes	Hughes	Hughes	Hughes	5	35	25	10	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	6	57	102	10	Sphere	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	7	46	62	46	Cylinder	Storage
18MO1	Hughes	Hughes	Hughes	Hughes	8	195	65	14	N/A	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	10	21	20	8	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	11	37	38	18	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	12	26	22	31	Sphere	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	13	47	60	12.5	Frustrum	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	14	19	21	5	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	16	29	32	3	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	17	55	32	18	Sphere	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	18	104	40	8	Frustrum	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	19	20	19	14	Sphere	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	20	28	24	8	Sphere	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	21	18	18	4	Sphere	X

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature Number	Length (cm)	Width (cm)	Depth (cm)	Volume formula	Class
18MO1	Hughes	Hughes	Hughes	Hughes	22	73	67	66	Cylinder	Storage
18MO1	Hughes	Hughes	Hughes	Hughes	23	40	51	5	Cylinder	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	24	102	82	45.2	UID	Burial
18MO1	Hughes	Hughes	Hughes	Hughes	25	20	20	8	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	26	30	77	7	Sphere	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	28	39	37	17	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	29	30	36	19	Sphere	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	30	45	59	11	Sphere	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	31	40	39	15	Sphere	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	32	21	19	9	Sphere	UID
18MO1	Hughes	Hughes	Hughes	Hughes	33	28	32	42	UID	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	34	86	80	44	Sphere	Burial
18MO1	Hughes	Hughes	Hughes	Hughes	35	70	100	36	UID	Burial
18MO1	Hughes	Hughes	Hughes	Hughes	37	48	22	4	Sphere	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	38	32	36	6	Sphere	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	39	53	55		N/A	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	40	36	35	33	Sphere	Storage
18MO1	Hughes	Hughes	Hughes	Hughes	41	50	30	14	UID	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	42	34	32	11	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	43	52	54	22	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	44	22	24	7	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	45	260	185	20	Sphere	Arc
18MO1	Hughes	Hughes	Hughes	Hughes	46	40	47	12	Sphere	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	47				N/A	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	49	30	28	9	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	50	49	46	10	Sphere	X

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature Number	Length (cm)	Width (cm)	Depth (cm)	Volume formula	Class
18MO1	Hughes	Hughes	Hughes	Hughes	51	36	35	13	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	52	40	39	10	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	53	91	91	50	Cylinder	Storage
18MO1	Hughes	Hughes	Hughes	Hughes	54	36	37		N/A	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	55	268	130	29	Sphere	Palisade Trench
18MO1	Hughes	Hughes	Hughes	Hughes	56	38	39	11	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	58	21	20	14	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	59				N/A	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	60	102	70	16	Sphere	UID
18MO1	Hughes	Hughes	Hughes	Hughes	61	25	27		N/A	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	62	28	32	8	Sphere	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	63	31	33	12	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	64	29	27	7	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	65				N/A	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	66	34	45	6	Cylinder	Hearth
18MO1	Hughes	Hughes	Hughes	Hughes	67	32	35	19	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	68	30	27		N/A	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	69	22	22		N/A	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	70	28	29	10	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	71	44	36	5	Cylinder	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	72	20	20	7	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	73	32	36	3	Sphere	X
18MO1	Hughes	Hughes	Hughes	Hughes	74	28	27		N/A	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	75	23	30		N/A	N/A
18MO1	Hughes	Hughes	Hughes	Hughes	76	16	16	3	Sphere	X

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature Number	Length (cm)	Width (cm)	Depth (cm)	Volume formula	Class
18MO9	Winslow	Winslow	Winslow	Winslow	35	37	60	0	UID	UID
18MO9	Winslow	Winslow	Winslow	Winslow	36	81	108	4	UID	Hearth
18MO9	Winslow	Winslow	Winslow	Winslow	37	89	143	10	UID	Hearth
18MO9	Winslow	Winslow	Winslow	Winslow	38	26	40	77	Conic	UID
18MO9	Winslow	Winslow	Winslow	Winslow	39	22	26	45	Conic	UID
18MO9	Winslow	Winslow	Winslow	Winslow	40	48	54	8	Cylinder	UID
18MO9	Winslow	Winslow	Winslow	Winslow	41	35	35	30	Sphere	X
18MO9	Winslow	Winslow	Winslow	Winslow	42	55	60	10	UID	N/A
18MO9	Winslow	Winslow	Winslow	Winslow	43	73.5	71	12	UID	Burial
18MO9	Winslow	Winslow	Winslow	Winslow	44	26	28.5	6	Cylinder	X
18MO9	Winslow	Winslow	Winslow	Winslow	45	30	28	9	Sphere	X
18MO9	Winslow	Winslow	Winslow	Winslow	46	31.5	33	9	Sphere	X
18MO9	Winslow	Winslow	Winslow	Winslow	47	36	43	21	Conic	X

Appendix 2, Feature Artifacts:

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature	Keyser	Page	Shepard	UID Ceramic	Chipped stone	Debitage	FCR	Ground Stone	Projectile Point	UID Lithic	Faunal
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	1	8		1	5	2	46			2	10	169
18FR14	Biggs Ford II	Biggs Ford I	Biggs Ford I	Biggs Ford II	2	89	8	71	58		684	4	4	19	221	716
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	3				0							0
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	4	1	30	332	531	3	872	2		15	502	1695
18FR14	N/A	N/A	N/A	N/A	5				0							0
18FR14	N/A	N/A	N/A	N/A	6	25			46		73			2	146	441
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	7	32		37	18	2	226	6		3	147	450
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	8	31		1	4	0	191			2	68	236
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	9				0		2			1	70	0
18FR14	N/A	N/A	N/A	N/A	10				2		25				5	13
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	11		4	7	165	4	318	9		7	43	602
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	12	25		20	60	3	237			4	4	399
18FR14	N/A	N/A	N/A	N/A	13				0							0
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	14				0							0
18FR14	N/A	N/A	N/A	N/A	15				0							0
18FR14	N/A	N/A	N/A	N/A	16				0							0
18FR14	N/A	N/A	N/A	N/A	17				0							0
18FR14	N/A	N/A	N/A	N/A	18				0							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	19	49	1	10	49	1	218	4			68	608
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	20			20	98		113			2	20	306
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	21	26		17	14		166	3		1	95	848

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature	Keyser	Page	Shepard	UID Ceramic	Chipped stone	Debitage	FCR	Ground Stone	Projectile Point	UID Lithic	Faunal
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	22			1	11		54	2			32	73
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	23				1		46				3	0
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	24	2		56	73	3	292	1		4	118	370
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	25			4	0	2	14			1	27	5
18FR14	N/A	N/A	N/A	N/A	26				3		155	3		3	94	2
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	27	63	3	45	30		219	4		4	47	328
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	28				0							0
18FR14	N/A	N/A	N/A	N/A	29				0							0
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	30				1		19			1	15	1
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	31			1	3		1					2
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	32				0							0
18FR14	N/A	N/A	N/A	N/A	33				0							0
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	34				0							0
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	35				0							0
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	36				0		15				26	0
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	37				0		1					0
18FR14	N/A	N/A	N/A	N/A	38				0							0
18FR14	N/A	N/A	N/A	N/A	39				0							0
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	40	8	6	210	528	11	1421	1		25	890	1609
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	41				35		97				52	152
18FR14	N/A	N/A	N/A	N/A	42				0							0

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature	Keyser	Page	Shepard	UID Ceramic	Chipped stone	Debitage	FCR	Ground Stone	Projectile Point	UID Lithic	Faunal
18FR14	N/A	N/A	N/A	N/A	43				0							0
18FR14	N/A	Biggs Ford I	Biggs Ford I	N/A	44				1		12					6
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	45	31	1	10	19		153				95	184
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	50	16			0			2			115	151
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	51	33		94	6			90		2	285	85
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	52				0			5			2	0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	53	30		7	8						96	254
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	54	173		21	21			25		4	710	1582
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	55	1			0			8				3
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	56	51.1		7	0					1	55	85
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	57	6			0						7	18
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	58				1							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	59				0							0
18FR14	N/A	N/A	N/A	N/A	60				0							0
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	61	2		28	2		2	25			59	124
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	62	8		25	9			30			73	162
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	63				0							0
18FR14	N/A	N/A	N/A	N/A	64				0							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	65				0							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	66				0							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	67				0							0

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature	Keyser	Page	Shepard	UID Ceramic	Chipped stone	Debitage	FCR	Ground Stone	Projectile Point	UID Lithic	Faunal
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	68	1			0			1			7	8
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	69	2		1	0						11	49
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	70	6			0						9	15
18FR14	N/A	N/A	Biggs Ford I	Biggs Ford I	71			2	0			1			24	7
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	72	174		31	7			14		8	560	1192
18FR14	N/A	N/A	N/A	N/A	73				0							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	74				0							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	75				0							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	76	13			0						19	38
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	77	11			3			1			23	22
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	78	20		1	0		7	3		3	165	139
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	79	16		4	7			1		1	131.6	75
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	80				0						1	1
18FR14	N/A	N/A	N/A	N/A	81				0							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	82	158		26	0	1		6		4	391	1035
18FR14	N/A	N/A	Biggs Ford I	Biggs Ford I	83	3		8	0						10	21
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	84	11			0						42	39
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	85				0						1	2
18FR14	N/A	N/A	N/A	N/A	86				0							2
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	87	11			0	1					16	25
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	88	4			0			1			5	9

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature	Keyser	Page	Shepard	UID Ceramic	Chipped stone	Debitage	FCR	Ground Stone	Projectile Point	UID Lithic	Faunal
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	89				0						9	2
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	90				0			1			7	4
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	91	9		1	0					1	83	51
18FR14	Biggs Ford II	Biggs Ford II	N/A	N/A	92	1		1	0						2	1
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	93	3		1	0						12	23
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	94	35		1	1	1		2			26	48
18FR14	N/A	N/A	Biggs Ford I	Biggs Ford I	95				0							0
18FR14	N/A	N/A	N/A	N/A	96				0							0
18FR14	N/A	N/A	N/A	N/A	97				0							0
18FR14	N/A	N/A	N/A	N/A	98				0							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	21A				0							0
18FR14	Biggs Ford I	Biggs Ford I	Biggs Ford I	Biggs Ford I	7A				0							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	84a				0							0
18FR14	Biggs Ford II	Biggs Ford II	Biggs Ford II	Biggs Ford II	84b				0							0
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	1		1		3		7					16
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	2	8	165	105	54	1	161	5	1	2	2	109
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	3				0							0
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	4				0							0
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	5		121	1	2		42	6				123
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	6		19	2	19		2					2
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	7	2	155	46	38		141			3		197

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature	Keyser	Page	Shepard	UID Ceramic	Chipped stone	Debitage	FCR	Ground Stone	Projectile Point	UID Lithic	Faunal
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	8		2	1	0		15	1				4
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	9	3	221	63	53	1	236			4		456
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	10			2	0							1
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	11				5		4					4
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	12		46	9	5		47	2				85
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	13		95	9	18		70			1		95
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	14		105	27	30	1	89			2	1	408
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	15		18	6	1		40			1		3
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	16		25	3	2		60			1		46
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	17				0							0
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	18		201	53	25	1	195	16		3		206
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	19		13		4		4					5
18FR17	Nolands Ferry	Nolands Ferry	Nolands Ferry	Nolands Ferry	20				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	1				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	2				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	3				0		2					3
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	4		2	544	30	2	370	3		5	1	1981
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	5	4	9	2067	239	37	3526	198	2	41	11	10961
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	6			196	18		103					309
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	7				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	8			62	7		145	1		2		234
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	9			13	0		30					11

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature	Keyser	Page	Shepard	UID Ceramic	Chipped stone	Debitage	FCR	Ground Stone	Projectile Point	UID Lithic	Faunal
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	10			13	3		102					82
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	11				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	12			999	117	15	1610	106	3	39	21	8931
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	13			181	4	1	237	12		1		585
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	14				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	15			13	1		23	4				66
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	16				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	17		1	424	43	6	799	71	1	10	10	2015
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	18				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	19				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	20				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	21				0		2	1				8
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	22				0						1	0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	23			4	3		20	2				63
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	24				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	25			1	1		6					4
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	26				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	27		1	151	26	8	353	28		4	1	619
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	28			14	0		3					42
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	29			11	3		35	3				266
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	30			13	0		8				1	102
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	31				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	32			6	0							11
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	33				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	34			3	0							0

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature	Keyser	Page	Shepard	UID Ceramic	Chipped stone	Debitage	FCR	Ground Stone	Projectile Point	UID Lithic	Faunal
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	35				0		5				2	21
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	36				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	37				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	38			5	0		8					22
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	39				0							1
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	40				0							0
18FR18	Rosenstock	Rosenstock	Rosenstock	Rosenstock	Midden, Shell	1		139	15		66	28		1	1	329
18MO1	Hughes	Hughes	Hughes	Hughes	1	5			0		45		1			0
18MO1	Hughes	Hughes	Hughes	Hughes	2	4			0		19		1			0
18MO1	Hughes	Hughes	Hughes	Hughes	3	2			0		10					0
18MO1	Hughes	Hughes	Hughes	Hughes	4	3			0		9					0
18MO1	Hughes	Hughes	Hughes	Hughes	5	2			0		32					0
18MO1	Hughes	Hughes	Hughes	Hughes	6	22			1		49					0
18MO1	Hughes	Hughes	Hughes	Hughes	7	102		1	4	2	390			5	1	0
18MO1	Hughes	Hughes	Hughes	Hughes	8	60		1	2		161					0
18MO1	Hughes	Hughes	Hughes	Hughes	10				0		6					0
18MO1	Hughes	Hughes	Hughes	Hughes	11	10			0		18					0
18MO1	Hughes	Hughes	Hughes	Hughes	12				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	13	2			0		15		1			0
18MO1	Hughes	Hughes	Hughes	Hughes	14				0		2					0
18MO1	Hughes	Hughes	Hughes	Hughes	16	1			0		4					0
18MO1	Hughes	Hughes	Hughes	Hughes	17				0		4					0
18MO1	Hughes	Hughes	Hughes	Hughes	18	2			0		6					0
18MO1	Hughes	Hughes	Hughes	Hughes	19				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	20				0							0

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature	Keyser	Page	Shepard	UID Ceramic	Chipped stone	Debitage	FCR	Ground Stone	Projectile Point	UID Lithic	Faunal
18MO1	Hughes	Hughes	Hughes	Hughes	21			1	0		3					0
18MO1	Hughes	Hughes	Hughes	Hughes	22	331		2	2	8	735			8	4	0
18MO1	Hughes	Hughes	Hughes	Hughes	23	3			3		6		1		1	0
18MO1	Hughes	Hughes	Hughes	Hughes	24	105		2	9		401			2		0
18MO1	Hughes	Hughes	Hughes	Hughes	25				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	26				0		14					0
18MO1	Hughes	Hughes	Hughes	Hughes	28	8			0	2	80				1	0
18MO1	Hughes	Hughes	Hughes	Hughes	29	4			0		32		2		1	0
18MO1	Hughes	Hughes	Hughes	Hughes	30	1			0		24					0
18MO1	Hughes	Hughes	Hughes	Hughes	31	4			0		25					0
18MO1	Hughes	Hughes	Hughes	Hughes	32	3			0		4					0
18MO1	Hughes	Hughes	Hughes	Hughes	33	3			0		12					0
18MO1	Hughes	Hughes	Hughes	Hughes	34	98		5	0	7	494			3		0
18MO1	Hughes	Hughes	Hughes	Hughes	35	62		1	5	3	510			8	2	0
18MO1	Hughes	Hughes	Hughes	Hughes	37				0		12					0
18MO1	Hughes	Hughes	Hughes	Hughes	38				0		9					0
18MO1	Hughes	Hughes	Hughes	Hughes	39	1		1	0		1					0
18MO1	Hughes	Hughes	Hughes	Hughes	40	5			0		50					0
18MO1	Hughes	Hughes	Hughes	Hughes	41				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	42				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	43	7			0	1	40					0
18MO1	Hughes	Hughes	Hughes	Hughes	44				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	45	1087		6	26	27	2081		4	18	22	0
18MO1	Hughes	Hughes	Hughes	Hughes	46				0		7					0
18MO1	Hughes	Hughes	Hughes	Hughes	47				0		1					0

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature	Keyser	Page	Shepard	UID Ceramic	Chipped stone	Debitage	FCR	Ground Stone	Projectile Point	UID Lithic	Faunal
18MO1	Hughes	Hughes	Hughes	Hughes	49				0		12					0
18MO1	Hughes	Hughes	Hughes	Hughes	50	3			0		21					0
18MO1	Hughes	Hughes	Hughes	Hughes	51	3			0		19					0
18MO1	Hughes	Hughes	Hughes	Hughes	52	8			0		66			2		0
18MO1	Hughes	Hughes	Hughes	Hughes	53	193			7	8	1067			13	11	0
18MO1	Hughes	Hughes	Hughes	Hughes	54				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	55	244			34	7	663			9	7	0
18MO1	Hughes	Hughes	Hughes	Hughes	56				0		15					0
18MO1	Hughes	Hughes	Hughes	Hughes	58				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	59				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	60	8			0		51					0
18MO1	Hughes	Hughes	Hughes	Hughes	61				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	62	4			0		4					0
18MO1	Hughes	Hughes	Hughes	Hughes	63				0		11					0
18MO1	Hughes	Hughes	Hughes	Hughes	64	4			0		11					0
18MO1	Hughes	Hughes	Hughes	Hughes	65	120			18	5	326			3		0
18MO1	Hughes	Hughes	Hughes	Hughes	66	4			0		4					0
18MO1	Hughes	Hughes	Hughes	Hughes	67	7			0		3					0
18MO1	Hughes	Hughes	Hughes	Hughes	68				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	69				0							0
18MO1	Hughes	Hughes	Hughes	Hughes	70	3			0		12					0
18MO1	Hughes	Hughes	Hughes	Hughes	71				0		5					0
18MO1	Hughes	Hughes	Hughes	Hughes	72	1			0		2					0
18MO1	Hughes	Hughes	Hughes	Hughes	73	2			0		8					0
18MO1	Hughes	Hughes	Hughes	Hughes	74				0							0

Site Number	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Feature	Keyser	Page	Shepard	UID Ceramic	Chipped stone	Debitage	FCR	Ground Stone	Projectile Point	UID Lithic	Faunal
18MO1	Hughes	Hughes	Hughes	Hughes	75				1							0
18MO1	Hughes	Hughes	Hughes	Hughes	76				0							0
18MO9	Winslow	Winslow	Winslow	Winslow	35				0							0
18MO9	Winslow	Winslow	Winslow	Winslow	36			12	2		24			1		0
18MO9	Winslow	Winslow	Winslow	Winslow	37		15	31	4		129					0
18MO9	Winslow	Winslow	Winslow	Winslow	38		1	4	0		16				3	0
18MO9	Winslow	Winslow	Winslow	Winslow	39		1	10	0		13					0
18MO9	Winslow	Winslow	Winslow	Winslow	40			2	0		1					0
18MO9	Winslow	Winslow	Winslow	Winslow	41			17	0		21			1	1	1
18MO9	Winslow	Winslow	Winslow	Winslow	42			10	0		30					5
18MO9	Winslow	Winslow	Winslow	Winslow	43		1	41	10		99					5
18MO9	Winslow	Winslow	Winslow	Winslow	44	4		28	3		71			1		1
18MO9	Winslow	Winslow	Winslow	Winslow	45				0		3					0
18MO9	Winslow	Winslow	Winslow	Winslow	46			3	2		10					0
18MO9	Winslow	Winslow	Winslow	Winslow	47			1	0		3					0

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