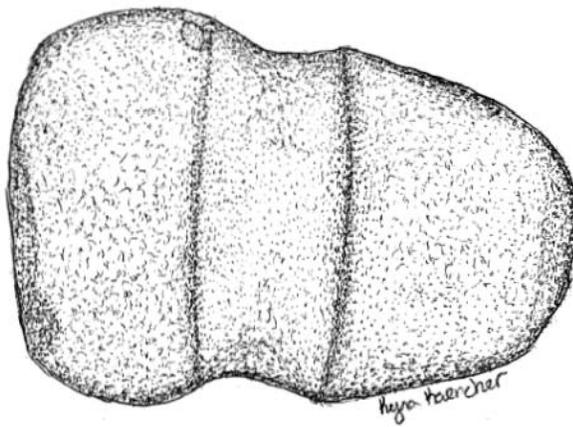


# 2010 Archaeological Reconnaissance Survey of Olmsted County, Minnesota

Co-Principal Investigators and Authors

Constance Arzigian Mississippi Valley  
Archaeology Center &

Michael Kolb Strata Morph  
Geoexploration



This project was funded by the Minnesota Arts and Cultural Heritage Fund as part of the  
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## ABSTRACT

The Mississippi Valley Archaeology Center (MVAC) at the University of Wisconsin-La Crosse (UWL) and Strata Morph Geoexploration (SMG) undertook the 2010 Olmsted County Survey. Constance Arzigian (MVAC) was Principal Investigator and author for the archaeological survey, and Michael Kolb (SMG) for the geomorphological investigations. This project was funded by the Minnesota Arts and Cultural Heritage Fund as part of the Statewide Survey of Historical and Archaeological Sites. The goals of the project were to (1) conduct an archaeological survey of Olmsted County, (2) summarize what is known about the prehistoric human occupation of the county, (3) update the site files with current information on the status of previously recorded sites, (4) find unrecorded sites through both directed and probabilistic survey, (5) evaluate the landscape for the potential for deeply buried sites, and (6) build a narrative predictive model of prehistoric site locations.

In June and July of 2010 a total of 866 acres were surveyed in 32 parcels of land. Surface reconnaissance was conducted on 845 acres, and shovel testing in eight parcels examined 21 acres, with 138 person days spent in the field, and approximately 25% of the time provided by volunteers. Arzigian spent additional time during fall 2010 and spring 2011 checking the current status of previously reported sites. Survey was conducted in the following townships: Elmira (T105N, R11W), Pleasant Grove (T105N, R13W), High Forest (T105N, R14W), Rock Dell (T105N, R15W), Dover (T106N, R11W), Salem (T106N, R15W), Haverhill (T107N, R13W), and Kalmar (T107N, R15W). The county is in SHPO Region 3W (Southeast Riverine, West).

Prior to the 2010 survey, only 38 precontact sites had been reported for Olmsted County; an additional 19 lettered sites had poorly known locations. The 2010 archaeological survey identified an additional 9 sites and investigated 5 previously reported sites. The records for the other previously reported sites were examined, and where possible, the locations were field checked to see whether better locational information could be obtained or current condition determined. The project also examined all of the Native American artifacts curated at the Olmsted County History Center and identified the source of a major collection of materials.

Nine new sites were reported: 21OL46 (lithic scatter with Middle Archaic Raddatz point); 21OL48 (single flake); 21OL49 (lithic scatter); 21OL50 (Middle Archaic axe and lithic debris); 21OL51 (single flake); 21OL52 (single flake); 21OL53 (lithic scatter); 21OL54 (single flake); and 21OL55 (lithic scatter). Work at previously reported sites included surface collection of 21OL1 (Early Archaic component identified) and shovel testing at 21OL14 (no additional material), 21OL15 (1 additional flake), and 21OL21 and 21OL22 (no additional material).

Geomorphological testing was conducted at two localities to evaluate the landscape for the potential for deeply buried sites: Schumann Locality (21OL44) and Muentner Tract (21OL21 and 21OL22). The effects of very large infrequent floods were examined using the flood of 2007 in Garvin Brook near Stockton.

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The field crew was made up of archaeological technicians from the University of Wisconsin-La Crosse hired by the Mississippi Valley Archaeology Center (MVAC) for the project, and all had at least a year of previous field experience with MVAC. The crew consisted of Lisa Jennings, Mike Lager, Lizzy Lamb, Sheila Oberreuter, Kassie Praska, and Matt Sitek. They endured much mud and many mosquitoes and still remained cheerful.

Volunteers were critical to the effort. Bill Gresens volunteered nearly every field day in June. Dave Anderson brought 21 students in the University of Wisconsin-La Crosse field school to Olmsted for a day to volunteer on the survey. Dawn Beamer volunteered for shovel testing.

At MVAC, Kathy Stevenson helped to develop field and analysis protocols, repeatedly edited the report, and provided technical assistance. Mike Bednarchuk assisted with photographing the Olmsted County History Center collections and assembled GLO and other map layers into a GIS program for analysis. Marcee Peplinski facilitated invoicing and budgeting. Joe Tiffany and Jim Theler contributed insights into artifact types and bison processing on the Plains. Kyra Kaercher did the drawing of the axe. All of MVAC staff graciously tolerated the large piles of reports and maps that ended up taking over the tables.

Mike Tenney, Assistant Area Wildlife Manager, Division of Fish and Wildlife, and Doug Rau, Olmsted County representative for the DNR, were very helpful with permits as well as information on land access.

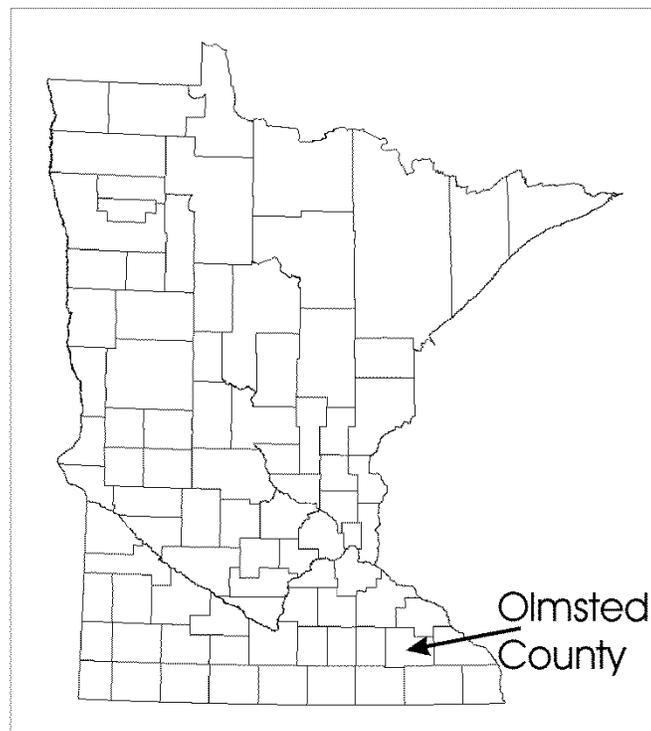
The project would not have been possible without the cooperation of the landowners and tenants. We must thank everyone who gave us permission to work on their land, as well as all of the residents who contacted us with tips on possible areas to survey.

Finally, we want to thank all the people, too numerous to name individually, who participated in this project and helped us in many ways.

## INTRODUCTION

The Mississippi Valley Archaeology Center (MVAC) at the University of Wisconsin–La Crosse (UWL) and Strata Morph Geoexploration (SMG) undertook the 2010 Olmsted County Survey. This project was funded by the Minnesota Arts and Cultural Heritage Fund as part of the Statewide Survey of Historical and Archaeological Sites. The goals of the project were to (1) conduct an archaeological survey of Olmsted County, (2) summarize what is known about the prehistoric human occupation of the county, (3) update the site files with current information on the status of previously recorded sites, (4) find unrecorded sites through both directed and probabilistic survey, (5) evaluate the landscape for the potential for deeply buried sites, and (6) build a narrative predictive model of prehistoric site locations. Figure 1 shows Olmsted county within Minnesota.

In 2010 a total of 866 acres were surveyed in 32 parcels of land (Figure 2). Surface reconnaissance was conducted on 845 acres, and shovel testing in eight parcels examined 21 acres. The grant proposal called for spending a minimum of 20 days with a crew of 4 people in field investigations, or a total of 80 person-days. The project ended up spending a total of 138 person-days conducting field survey. These were 10-hour days to maximize the time spent in the field rather than travel (a 2-hour round trip from La Crosse), so the person-days represented close to 8 hours of actual field survey each day. Approximately 25% of the labor was provided by volunteers.



**Figure 1: Location of Olmsted county within Minnesota.**

Prior to the 2010 survey, only 38 precontact sites had been reported for Olmsted County with a sufficient level of documentation to warrant receiving a site number. An additional 19 lettered sites had poorly known locations. The 2010 survey identified an additional nine sites, refined the location and recovered diagnostic artifacts from one previously reported site, and conducted subsurface testing on four sites to look for the possibility of buried deposits. Figure 3 shows the previously reported sites and the sites identified or investigated in 2010. The records for the other previously reported sites were examined, and where possible, the locations were field checked to see whether better locational information could be obtained or current condition determined. The project also examined all of the Native American artifacts curated at the Olmsted County History Center and identified the source of a major collection of materials.

Geomorphological investigations were designed to construct a preliminary model of the potential for deeply buried archaeological sites in the small drainage basins of Olmsted County. Subsurface investigations were conducted in 4<sup>th</sup> order and smaller stream valleys at two localities: the Schumann Locality and the Muentner Tract. In addition, the effects of very large but infrequent floods on floodplain stratigraphy and the archaeological record were examined using examples from the 2007 flood in the Garvin Brook valley, southwest of Stockton.

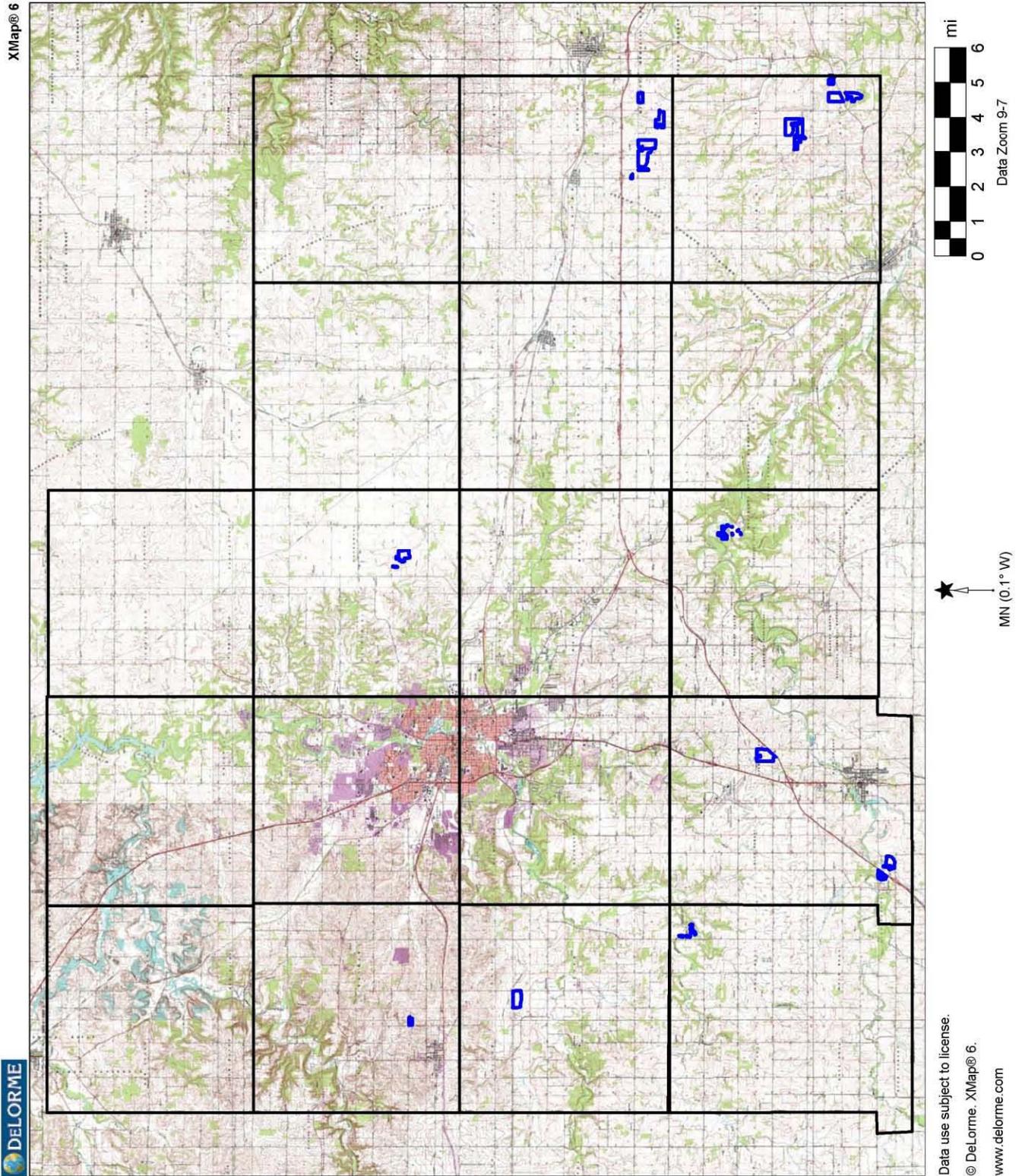
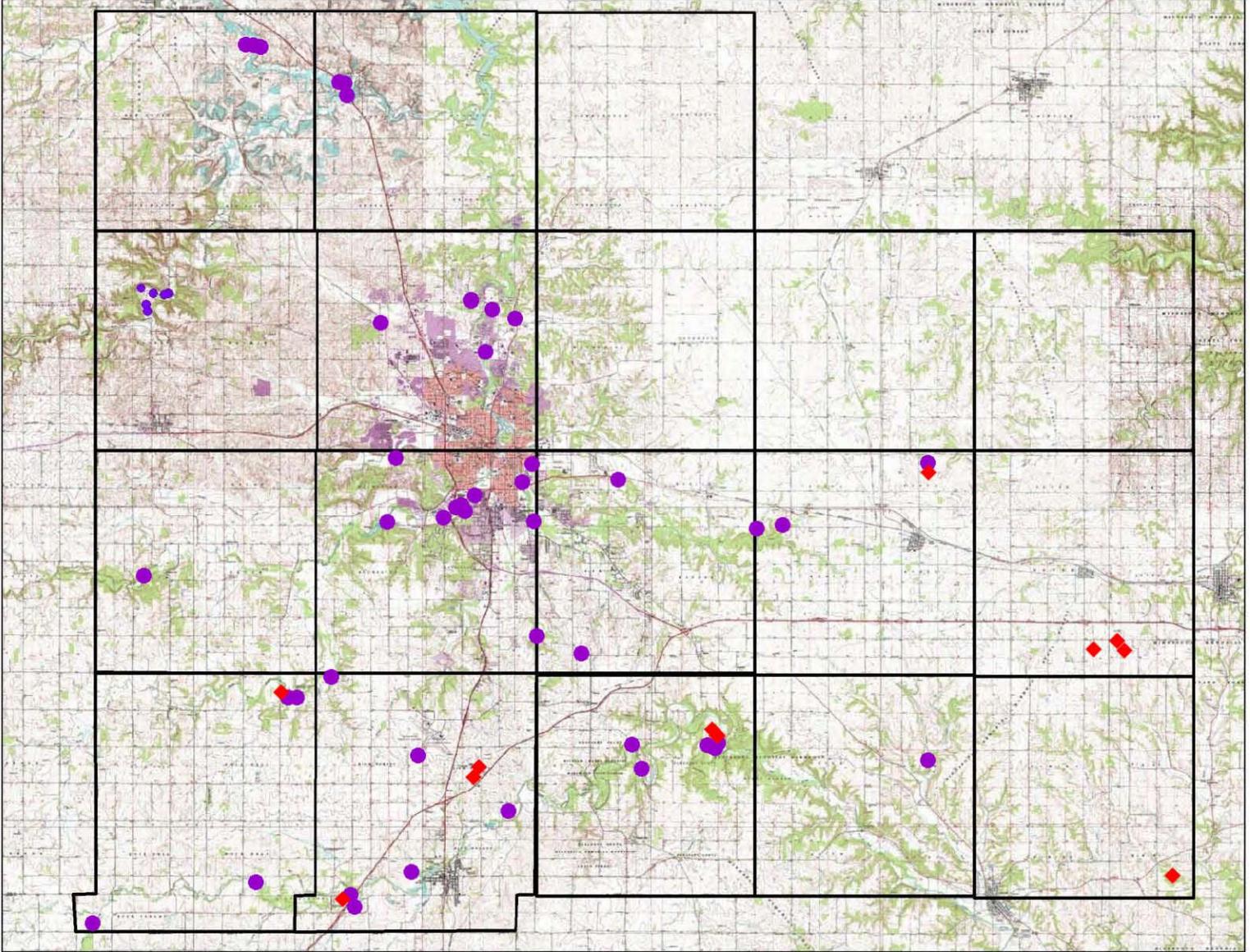


Figure 2: 2010 survey locations indicated by blue outlines.



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Figure 3: Previously reported sites (purple circles) and sites investigated in 2010 (red diamonds).

## **BACKGROUND RESEARCH**

The project began by examining all of the Olmsted County site records and previous reports available at the Office of State Archaeologist in Fort Snelling and the Minnesota State Historic Preservation Office in St. Paul. Additional records available at MVAC include those assembled for a study of Minnesota's mounds and burial sites (Arzigian and Stevenson 2003), the University of Minnesota county tip files, Lloyd Wilford records and memos, and records on each reported mound site. All of these records were scanned to PDF files, and a copy will be provided to each office at the end of this project.

Various types of reports document previous archaeological investigations in the county. Publications include an article about the Schumann Cache (Carr et al. 2008a), a set of maps entitled the Geological Atlas (Alexander and Maki 1988; Hobbs 1988; Kanivetsky 1988; Olson 1988), and mention in other publications on Minnesota's archaeology and environment. The original Public Land Survey (GLO) plat maps are available online (MnGeo 2011) and were examined for evidence of historic features and vegetation. The 1874 Andreas map of Olmsted County (Figure 4) shows the location of the earliest cities, the major river drainages, and areas of timberland. The vast majority of information comes from cultural resource management projects over the past 36 years, beginning 1975 with 1975 work on the Rochester Zumbro River flood control project, as well as other work within Rochester. The Statewide Archaeological Survey (1977–1980) did not examine Olmsted County, but a series of highway archaeology reports throughout the 1980s and 1990s examined work related to bridges and highways. In the 1990s and 2000s projects throughout the county examined areas for new sewer systems, cell towers, dredge disposal areas, and so forth. Many of the earlier projects did not employ techniques that would be considered standard today, such as systematic shovel testing, and some of the reports are limited in the amount of information provided about both the sites and the artifacts recovered. Some projects examined only areas considered to have a high probability of containing archaeological sites; thus low probability landscape settings have not been extensively examined.

All of the project reports were examined, surveyed areas and sites were marked on a set of topographic maps keyed to the individual projects, and a form was created to describe what had been done and the results. These maps were used as the basis for discussions on the previous work in each region. A database with the previously reported sites was used to generate maps of site distribution, and to overlay the sites on topographic maps and air photos.

The project also visited the Olmsted County History Center, where the curator provided complete access to all Native American material in their collection. Major components include the Peck collection and the Schumann Cache. All prehistoric artifacts were photographed and examined to evaluate what could be attributed to a specific provenience or site. Unfortunately most of the materials have no provenience or collection information and often cannot even be assumed to be from the county.

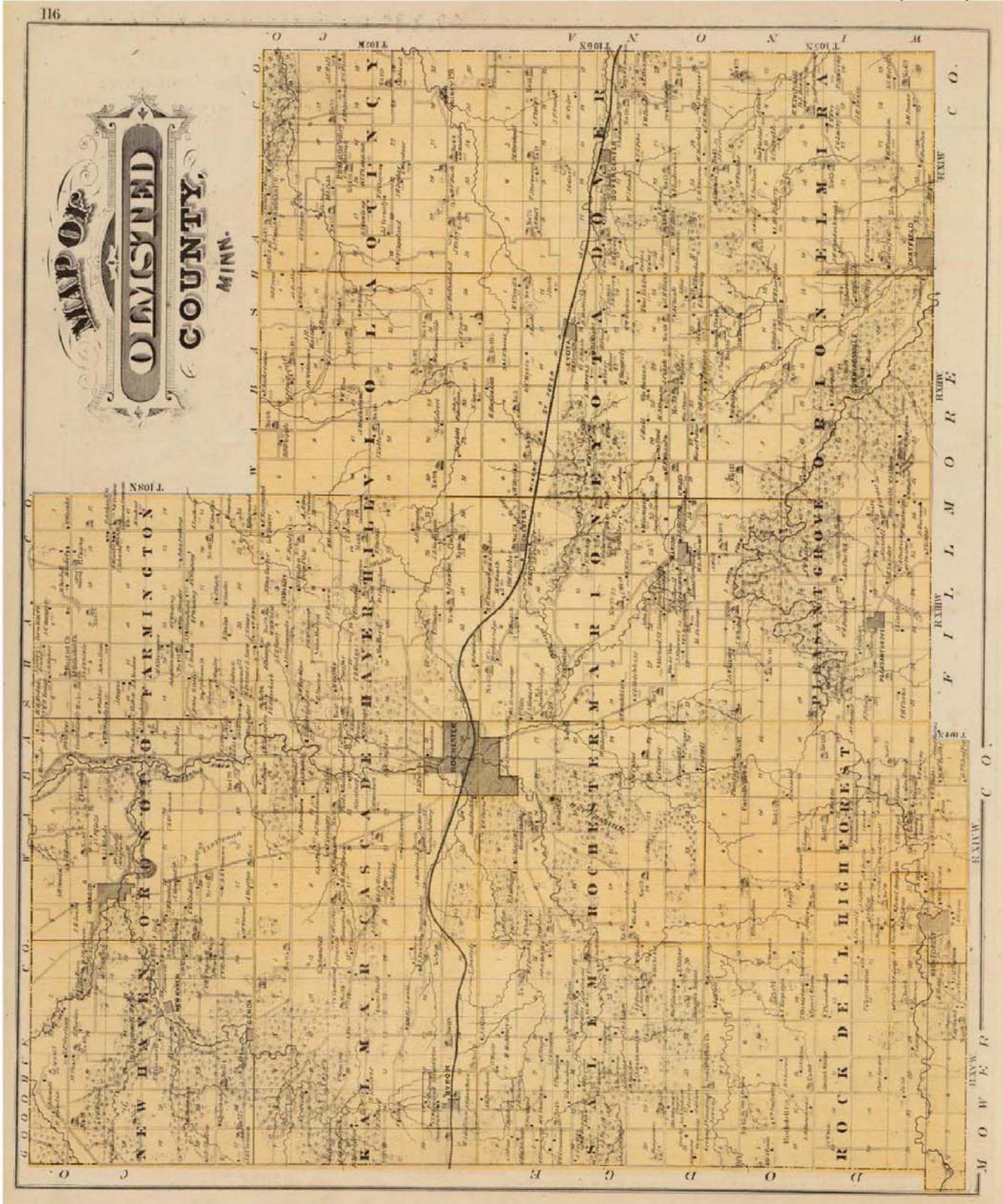


Figure 4: Map of Olmsted County in 1874, showing townships, cities and towns, and areas of timber. (Published by A.T. Andreas, Lakeside Building, Chicago. Chas. Shober & Co. Proprietors of Chicago Lith. Co.) David Rumsey Map Collection (<http://www.davidrumsey.com/>)

## **Environment and Site Identification**

Olmsted County is mapped as part of SHPO Sub-Region 3W (Southeast Riverine, West) (Anfinson 1990), with a landscape dissected by three rivers and numerous streams but no lakes. The region has the longest growing season in Minnesota, fertile soils, rock outcroppings with usable cherts, and a mixture of floodplain forests, open savanna, and patches of prairie.

The county lies within three subsections of the Eastern Broadleaf Forest Province, as defined in Minnesota's Ecological Classification System (Minnesota DNR–Division of Forestry 1999). The county is predominantly within the Rochester Plateau subsection of the Paleozoic Plateau, which consists of level to gently rolling till plain on an old plateau. The Rochester Plateau is bordered on the east by the more rugged landscape of the Blufflands subsection of the Paleozoic Plateau, which stretches to the Mississippi River. Narrow strips of Blufflands enter Olmsted County from the south along the Root River and from the north along the Zumbro River. The Oak Savanna subsection of the Minnesota and Northeast Iowa Moraine Section lies along the western border of the county and enters Olmsted along the Middle Fork and South Fork of the Zumbro River.

The landscape has been shaped by rivers both large and small. Major river drainages include the south branch of the Zumbro River, the North Branch Root River, and tributaries of the Whitewater River, all of which drain ultimately into the Mississippi River. These drainage divides are outlined in the geomorphological discussions (Figure 18). The streams are well integrated and deeply incised, with large flat bottomlands in the higher-order stream valleys and narrow V-shaped bottomlands in the lower-order valleys. Valley bottoms have loess-covered terraces with alluvium in channel belts inset into the terraces, and colluvial and alluvial fan deposits along the valley margins. Between the valleys are bedrock-cored interfluvial ridges covered with loess and colluvium over patchy Illinoian and pre-Illinoian glacial deposits (Hobbs 1988). Glacial topography has been almost completely modified by weathering and erosion. Figure 5 shows the landscape relief, with the highest elevations in the southwest. The river valleys and tributaries are visible as areas of lower elevation.

Olmsted County is quite variable in terms of its bedrock and surficial geology and the presence of karst topography and active sinkholes in the south-central part of the county (Ojakangas and Matsch 1982; Schwartz and Thiel 1976, Sims and Morey 1972).. The western one-third to one-half of Olmsted County is an area of grey drift presumed to be pre-Wisconsinan and is characterized by dissected, locally loess-covered landscape. Much of the eastern half of the county has areas of weathering residuum over bedrock, also loess covered but with remnants of highly dissected and eroded sediments and greater relief in the larger stream and river valleys (Hobbs and Goebel 1982). The karst topography in south-central Olmsted County creates a unique landscape with numerous sinkholes and potential for caves.

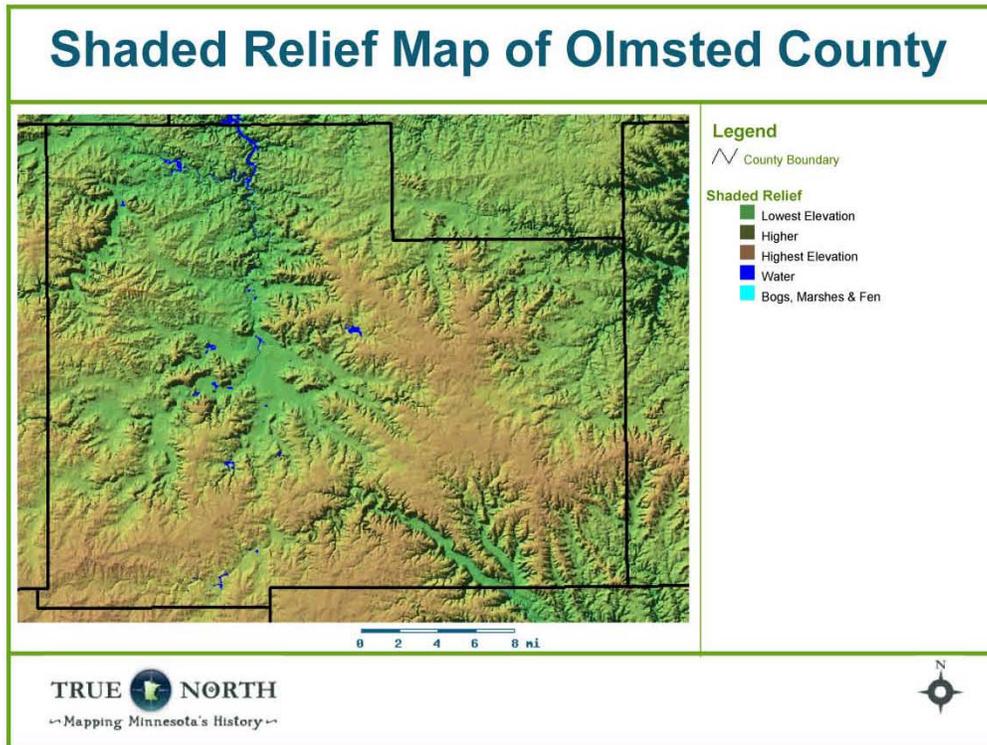


Figure 5: Olmsted county topographic relief. The river valleys and tributaries are visible as areas of lower elevation. The Root River flows east through the south end of the county, multiple branches of the Zumbro River enter from the west and flow north, and tributaries of the Whitewater are in the northeast. (Generated from TrueNorth (Minnesota Historical Society 2007, available online at <http://www.mngeo.state.mn.us/ghol/Maps.php> )

# Presettlement 1895 vegetation

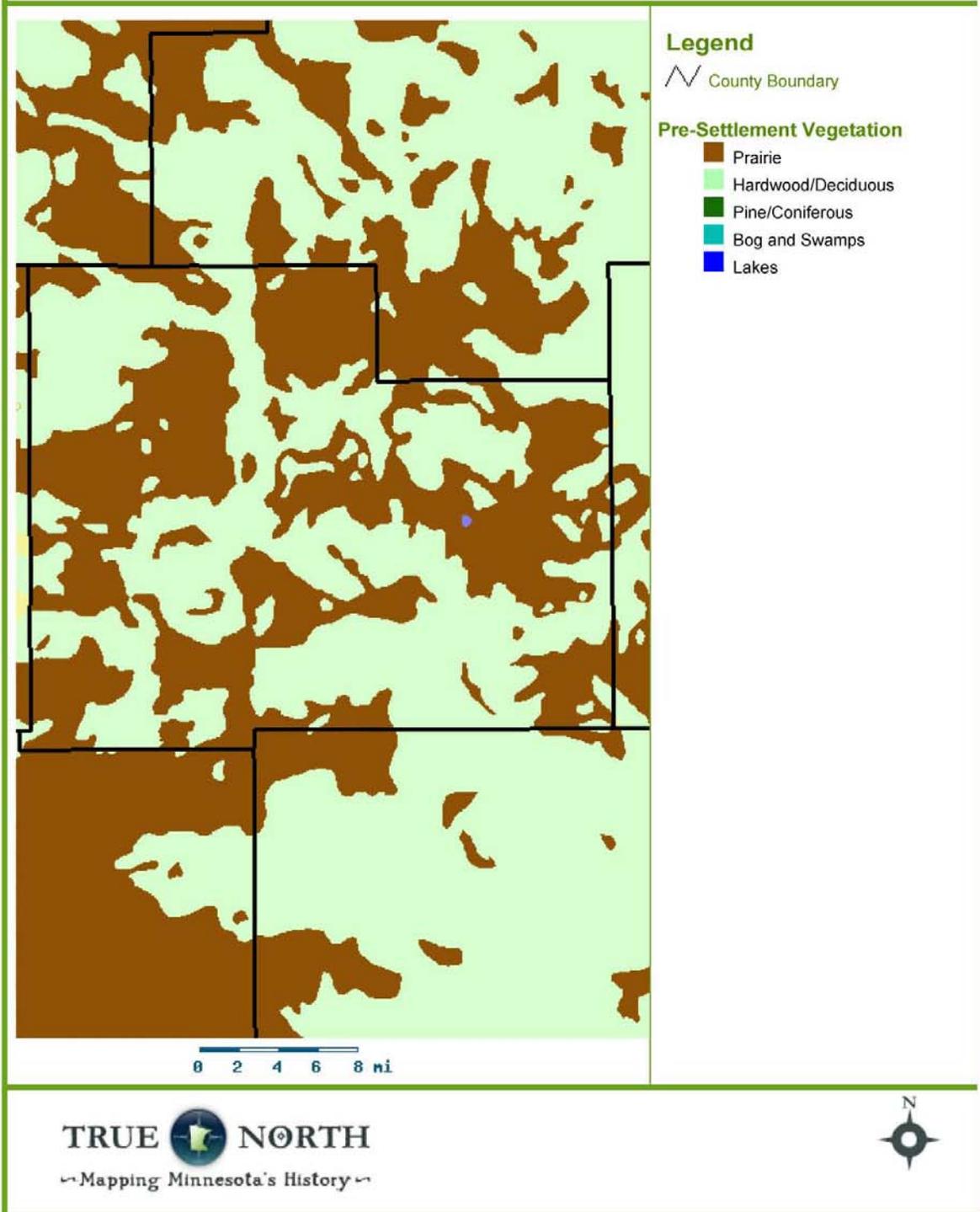


Figure 6: 1895 vegetation patterns showing intermingling of prairie and hardwood forests. (Generated from TrueNorth (Minnesota Historical Society 2007, available online at <http://www.mngeo.state.mn.us/ghol/Maps.php> )

Bedrock geology consists of various Ordovician-age limestones and dolomites (Olsen 1988). Older geological formations are more common in the north half of the county, with somewhat younger ones to the south. Across the northern half of the county Oneota and Shakopee formation dolomites of the Prairie du Chien group are common. The Prosser limestone of the Galena group is found to the south, with the Maquoketa Formation of the Galena Group in the southwest corner. Decorah shale is found in strips throughout. Bedrock outcroppings along hillslopes would have provided local raw materials including Galena and Prairie du Chien cherts that would have been available for making stone tools. Sinkholes are more common in the areas where the bedrock is near the surface, as in Pleasant Grove, Orion and Eyota Townships (Alexander and Maki 1988; Hobbs 1988).

Olmsted County at the time of Euro-American settlement in the mid-nineteenth century was covered with oak savanna, tallgrass prairie, and gallery forests along the waterways, producing a mosaic of communities (Figure 6). Fire would have been a common occurrence (e.g., Boyd 2002), and fire-dependent communities such as tallgrass prairie and bur oak savanna would have been typical. The GLO maps (MnGeo 2011) show large areas of prairie interspersed with “thickets,” shallow depressions with wetlands, and small streams, as well as the major rivers. The main animal resource on the prairie would have been bison. Plant foods would have been limited but might have included tubers such as the prairie turnip. Woodlands lining the streams and in areas protected from fires would have provided wood for fires and tools and would have supported a wide range of nuts such as hickory, walnut, hazel, and acorn, and a wide range of fruits and berries, including wild grape, blackberry, raspberry and cherry. Fauna would have included deer but also small mammals. The rivers would have provided abundant fish (Gibbon et al. 2005).

Soils reflect the diverse vegetation (MHS 2007; USDA-NRCS 2010). They are predominantly alfisols that formed under some type of forested vegetation. Mollisols that formed under prairie soils are found in an L-shaped zone through the center of the county, following a portion of the Zumbro River valley from the city of Rochester north to Oronoco, and from Rochester to the east along and to the north of the broad, level dividing ridge between the Root River to the south and the Zumbro and Whitewater Rivers to the north, where Interstate-90 now runs.

**Predicting site locations:** The landscape is gently rolling, with the uplands, consisting of the interfluvial ridges, often less than 200 feet above the valley. There are many small to large streams and creeks, many of them mapped as intermittent on modern topographic maps, and springs are common in many places. Thus, not much land is far from a potential source of water. However, this landscape has changed over the past 13,000 years of human occupation as a result of climatic change and Euro-American settlement, so that modern conditions are often not a good proxy for ancient settings and resources. In particular, changes in hydrology and fire frequency have altered the distribution and availability of critical resources, making it a challenge to predict where archaeological sites might be located. The position of Olmsted County between the prairies of southwest Minnesota and deciduous forests further east provides an opportunity to

study the relationships between environment and site location and to evaluate human use of the region through time, especially as this ecotone shifts location over time.

In addition to sites that can be identified near the surface, the potential for deeply buried archaeological deposits exists in depositional settings that are Holocene and late Wisconsinan in age (13,000 B.P.–present), such as:

1. Colluvium located on backslopes and footslopes in the uplands and along valley margins
2. Alluvium beneath alluvial fan surfaces along valley and terrace margins
3. Overbank alluvium in the fluvial channel belts and on low floodplain or terrace surfaces adjacent to the channel belts of both large and small valleys

The age of the deposits, the depositional environment, and post-depositional processes all affect the potential for locating buried archaeological deposits, as discussed later with the geomorphological investigations.

### **Environmental Changes**

Though there are glacial till deposits of pre-Wisconsin age across Olmsted County, the area was not covered by the last glaciation, and archaeological evidence indicates that humans have visited the area for over 12,000 years. Thus, the changing environmental conditions over this span of time are likely to have had a significant impact on human use of the region. Regional environmental reconstructions have been developed (Baerreis et al. 1976; Baker et al. 1992, 1998, 2002; Bryson 1998; Grimm 1981; Knox 1983, 1996; Kutzbach 1987; Walker 1966; Webb and Bryson 1972; Webb et al. 1983; Wright et al. 1963). Unfortunately, there is no paleoenvironmental information from Olmsted County itself. Stream, lake, wetland, and cave deposits from surrounding parts of Iowa, Minnesota, and Wisconsin are used to generate Figure 7, which shows a reconstruction of the vegetation history and stream activity in the larger region.

In the late Wisconsinan during the glacial maximum, Olmsted County was a tundra (Baker et al. 1999) that changed to a spruce and sedge assemblage as ice retreated, up until about 10,000 years ago. Megafauna would have been present, and mammoth tusks from a Stewartville quarry are in the Olmsted County History Center. About 13,000 years ago the first well-documented human occupation of the continent, the Paleoindian tradition, began, with fluted Clovis projectile points being the oldest point style known.

The glacial era ended about 10,000 years ago, and as the climate became warmer, deciduous forest became established in moister areas to the east, and prairies were found on the drier Great Plains. Southeastern Minnesota lies between these two major ecological zones, with the prairie-forest ecotone shifting across the region through time, though the details of that movement are elusive in Olmsted County. Investigations at Roberts Creek in northeast Iowa (Chumbley et al. 1990) and re-evaluation of older studies from the Midwest (Baker et al. 1992) have suggested a sharp ecotone (prairie-forest boundary) between the northern Great Plains down into central

Iowa (prairie) and northeast Iowa and Wisconsin (open forest or savanna) during the middle to late Holocene. The ecotone, although not precisely located, may have been in eastern Olmsted County and western Winona County during this time (Baker et al. 1992).

The dynamic nature of the ecotone is demonstrated by the establishment of prairie in central Iowa about 1,500 years sooner than in northeast Iowa (Baker et al. 1992). Prairie arrived at Clear Lake (Baker et al. 1992) and the Des Moines Lobe bogs (Walker 1966), west of the ecotone and Olmsted County, and at Kirchner Marsh and Carlson Lake (Wright et al. 1963), north of the ecotone, in the early Holocene about 8,000 years ago (Baker et al. 2002). East of the ecotone in southeastern Minnesota (Houston County) and in northeast Iowa at Roberts Creek, the prairie became established about 5,500 years ago (Baker et al. 2002). Prairie became well established at these sites during the Altithermal as a response to increasing aridity, with a particularly severe drought from 4100 to 4300 years ago, and with southeastern Minnesota and eastern Iowa reporting the maximum aridity (Figure 7). Prairie remained dominant until 3000–4000 years ago, during the Middle Archaic, at which time oak savannas were established.

Throughout these climatic shifts, the most notable effects would have been in local expansion or contraction of the prairie-forest ecotone and the bison herds, and fluctuations in the water table and in the flow rates of streams. Fires would have caused changes in the composition and distribution of the forests as well as the distribution of shrubs and savannas. Fire frequency would have been affected by local and regional climatic conditions, and possibly also by the human population. Starting about A.D. 1550, the Big Woods northwest of Olmsted County expanded at the expense of prairies as a result of changes in fire frequency in the cooler, moister Little Ice Age climate. Once prairie vegetation was established, fires would have helped to maintain it by suppressing invasion by trees. The biomass of dry prairie material would have supported regular fires, but these fires would have tended to move quickly, often in only a narrow band of fire that spread across the landscape and then died as all of the grass fuel was expended.

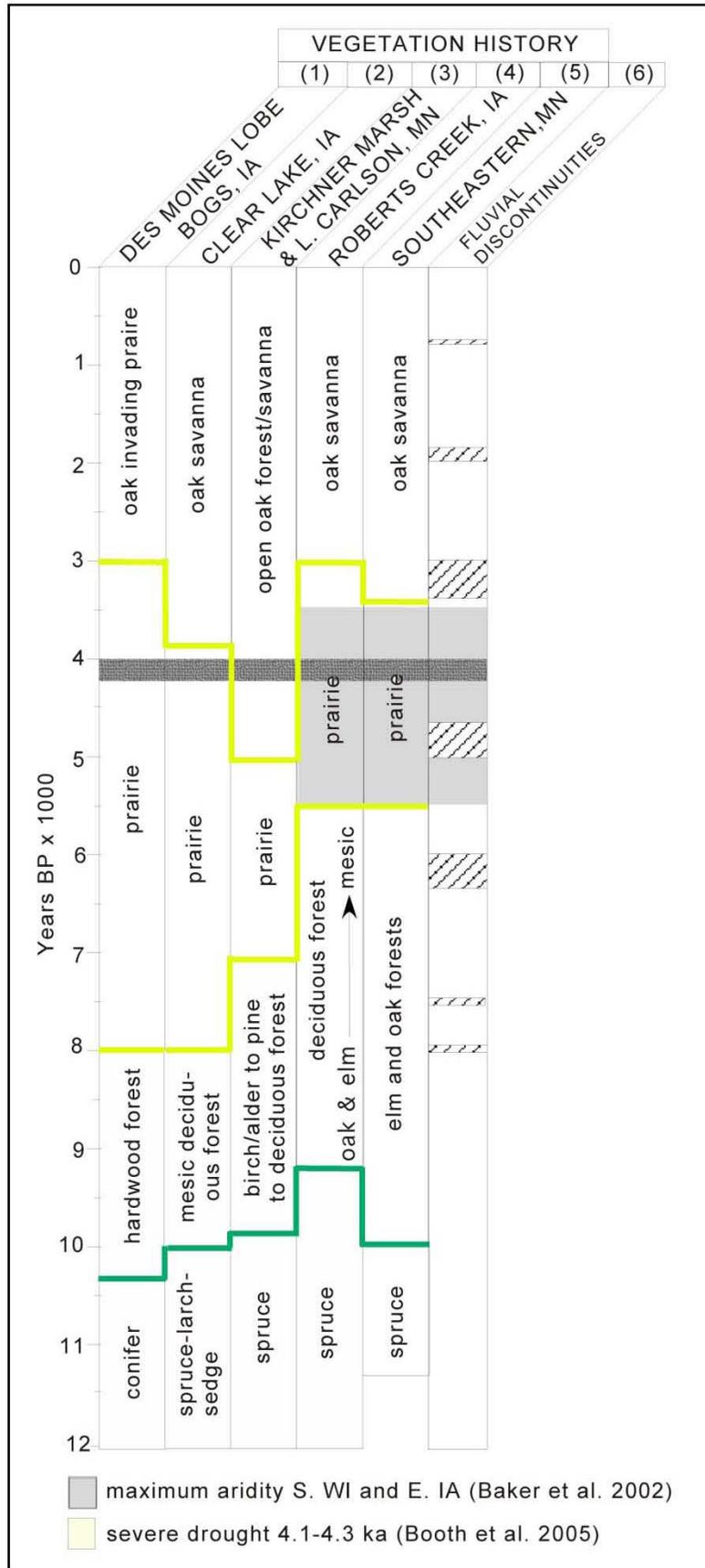


Figure 7: Vegetation history and stream activity in central-eastern Iowa, western Wisconsin, southeastern Minnesota, and northwest Illinois over the last 12,000 years. (1) Walker 1966, (2) Baker et al. 1992, (3) Wright et al. 1963, (4) Baker et al. 1998, (5) Baker et al. 2002, (6) Knox 1983 and 1996. (Figure prepared by Michael Kolb 2011)

## CULTURAL HISTORY

The cultural history of Olmsted County is not well known, and many of the cultural contexts defined for Minnesota cannot be identified in this region because of a scarcity of diagnostic artifacts and of excavations that provide a broader view of the past. Most sites in the county are known only from small scatters of artifacts, often only lithics, from the surface. Nevertheless, the diagnostic artifacts that are known indicate that people have used this area for at least 12,000 years. The following overview suggests the pattern of human adaptation to the region and how it changed through time. Information is drawn from a number of sources (Alex 2000; Anderson 1975; Anfinson 1990; Arzigian 2008; Arzigian and Stevenson 2003; Dobbs 1988; Mason 1997; Perkl 1998; 2009; Schermer et al. 1995; Stevenson et al. 1997; Stoltman 1979, 1997; Theler and Boszhardt 2003) in addition to those specifically cited below. This cultural context is used as the framework for the narrative predictive model of site location presented later.

**Paleoindian:** The first Native American occupation of Olmsted County followed the retreat of the last glaciers at the end of the Pleistocene. Migratory bands of hunters and gatherers identified as the Paleoindian tradition were present in this area beginning at least 12,000 years before present (B.P.). Paleoindian peoples lived in small, mobile hunting bands that followed the Pleistocene megafauna, including mastodon, mammoth, and extinct forms of bison.

Early Paleoindian fluted point varieties in the region include Clovis, Gainey, and Folsom. These points often occur as isolated surface finds but are sometimes associated with a limited set of tools used for skinning and butchering game. Although these point types are usually associated with megafauna procurement, Early Paleoindians no doubt hunted smaller game and consumed berries and other plant foods as well. A small number of Clovis and Folsom points are recorded for Minnesota (Dobbs 1988; Koenen 2007), including at least one point and a unique cache of biface blanks in Olmsted County.

Later Paleoindian peoples used unfluted point types of the Plano and Cody complexes. These Plains manifestations focused on hunting bison after megafauna species became extinct. The Late Paleoindian stage saw the introduction of the first ground stone woodworking implements (adzes) in the Midwest. Late Paleoindian peoples were apparently attracted to a forest and river margin habitat because of the greater ecological richness of these zones. Examples of Late Paleoindian unfluted lanceolate points include Agate Basin, Angostura, Midland, and Plainview types. Early stemmed points include such types as Scottsbluff and Eden.

**Archaic:** The subsequent Archaic tradition extended from about 9500 to 2500 B.P. Although Prairie Archaic and Eastern Archaic contexts have been defined for Minnesota (Dobbs 1988), it is difficult to attribute the Olmsted County material to specific contexts. Rather, a larger-scale overview of the process of change during this period is presented. Peoples of this tradition still relied on intensive mammal procurement, but plants and aquatic resources became more important. To adapt to the diverse resources available in the changing post-Pleistocene environment, Archaic peoples developed an increasingly varied technology. For example, they

produced a variety of stemmed and notched point types that emphasized the use of local cherts, and they using heat treating for poor quality materials. Archaic peoples also produced bone tools, copper artifacts, and ground stone implements that included adzes, axes, grinding stones, and grinding slabs. In some areas they manufactured specialized fishing gear such as hooks and harpoons and used milling stones for processing nuts and other plants. Besides a variety of points, Olmsted County has a number of axes, mauls, and other ground stone tools, as well as several copper artifacts in museum collections, and a fully grooved axe was found at a new site in 2010.

The Early Archaic stage (9500–7500 B.P.) represents a transitional period from large-game hunting to a greater emphasis on foraging. The diverse diet would have included large and small mammals, fish, waterfowl, and a variety of wild plants. Evidence for the earliest occupation of the region by Archaic peoples is sparse, but it is believed that these people lived in small, widely scattered family or extended-family groups. Projectile point types would have included lanceolate points such as Dalton and notched and stemmed points such as Thebes, St. Charles, and Hardin Barbed (Higginbottom 1996).

During the Middle Archaic stage (7500–4500 B.P.) rockshelters are more commonly used as habitation sites, and some cemeteries are known. Generalized hunting and gathering are the basis of the subsistence strategy, focused on small and large mammals, fish, waterfowl and a wide range of wild plant foods, with shellfish use becoming more common. Groundstone technology is evidenced by grooved axes and bannerstones and plant processing tools. Native copper use begins with cold-hammer manufacturing techniques, and copper becomes one element in the long-distance trade of exotic materials. Side-notched projectile points such as Osceola and Raddatz are typical of the Middle Archaic stage and are found widely throughout much of the Midwest, including Olmsted County.

By the Late Archaic stage (4500–2500 B.P.), subsistence strategies focused on gathering and foraging, particularly for nuts and deer. Population began to grow more rapidly, and territoriality increased, as did development of intergroup trading networks, local differentiation in artifact styles, and the use of communal cemeteries (Schermer et al. 1995). Copper is used less often to make utilitarian implements, but there are more decorative items. Small stemmed and comer-notched point styles appeared, with types such as Durst, Oxbow, Pelican Lake, Table Rock and McKean (Higginbottom 1996). By the end of the Late Archaic, both temporary and seasonal habitations were found in both the uplands and riverine settings. Small-scale plant cultivation of native species also began during this time, and in southern Minnesota Perkl (1998) documented the presence of squash at the King Coulee site (Wabasha County) at 2530 B.P. and 3450 B.P.

Overall, the Archaic stage is poorly known in Minnesota, with most of the available information coming from private collections or surface finds. By the late 1980s, only a few excavations had been conducted on Archaic sites, most of them in the northern part of the state (Dobbs 1988). Since then, some excavations have been conducted elsewhere, such as at King Coulee. Perkl

(2009) has studied available evidence for the Late Archaic to Woodland transition in southeast Minnesota.

**Woodland:** The Woodland tradition (2500–1000 B.P.) is generally associated with the introduction of horticulture, construction of earthen burial mounds, and the manufacture of ceramics; however, these three traits did not necessarily occur everywhere, or at the same time. Perkl has noted that for southeastern Minnesota, “reliance on the classic tripartite criteria to distinguish Archaic and Woodland cultural signatures from the existing data is problematic” (2009:1). In general, Woodland peoples relied heavily on fish and mussels in major river valleys but continued to exploit large game such as deer and elk. Increasing use of cultivated plants is evident throughout the tradition. Woodland peoples were semi-nomadic, moving to different locations at different times of the year to exploit seasonally available resources. Defining specific complexes and cultural contexts for Minnesota Woodland manifestations has been difficult (Arzigian 2008). In the Upper Midwest, the Woodland tradition is often divided into Early, Middle, and Late, and these familiar classifications are summarized briefly below, although their applicability to much of Minnesota is uncertain. At present, there is insufficient evidence to attribute specific Woodland contexts to Olmsted County except for the Southeast Minnesota Late Woodland context.

Early Woodland (2500–1900 B.P.) lifestyles were similar to those of preceding Archaic peoples, but ceramics represented a new innovation. Little is known of Early Woodland cultures in Minnesota, but Early Woodland peoples in southwestern Wisconsin, close to the project area, probably lived in small bands, exploiting food resources in both the uplands and the river valleys. Wild plant foods included walnut, hickory, hazel and acorn, and berries such as grape, raspberry, blackberry, hawthorn, sumac, and black nightshade. Projectile points had straight or contracting stems, including types such as Kramer and Waubesa. The use of ceramic vessels may have been associated with a reduction in population residential mobility, as ceramics are cumbersome to transport. Woodland vessels were usually tempered with sand or crushed rock, and often had evidence of cord-marking on the exterior (Stevenson et al. 1997).

The Middle Woodland stage (1900–1600 B.P.) is best known for Hopewellian manifestations characterized by complex art, elaborate mortuary practices, and extensive long-distance trade networks. Hopewell mounds typically occur in groups at prominent settings along major river valleys, including on floodplain islands, terraces, and bluff top overlooks (Stoltman 1979). Middle Woodland is poorly represented in southeast Minnesota.

The Late Woodland (1600–950 B.P.) stage shows evidence of rapid population growth and the development of distinctive regional ceramic and lithic styles. The Southeast Late Woodland cultural context remains poorly known, but assemblages are similar to those in Wisconsin and Iowa (Arzigian 2008). Hunting of a wide range of small and large animals, gathering of wild plants and continued crop cultivation, including some corn, are the basis for subsistence. Animal-shaped burial mounds are characteristic of this period, and this is often characterized as the Effigy Mound culture. Ceramic vessels become progressively larger and with thinner walls, and

are often decorated with complex cord patterns. Projectile points shift from larger dart points to smaller styles with the introduction of the bow and arrow.

**Mississippian:** About A.D. 1000 in central Illinois, a site called Cahokia rose to prominence, and in the space of one hundred years its influence had spread throughout the central United States. There are outposts of Cahokia along the Mississippi River and areas, such as Red Wing, where Mississippian and Late Woodland peoples interacted. An example of one characteristic type of artifact, a chunky stone, is in the Peck collection in the Olmsted County History Center, reportedly from Olmsted County.

**Late Prehistoric and Protohistoric:** Late prehistoric cultures of Minnesota are better known than earlier precontact cultures, although many questions still remain with respect to their classification and interpretation. Manifestations of this period in Minnesota include Great Oasis, Plains Village, Cambria, Blackduck, Sandy Lake, and Oneota cultures. These manifestations are identified with different regions of the state. In southeast Minnesota, the best known cultures of the Late Prehistoric period are the Oneota. Although the origins of Oneota cultures are much debated, by 900 B.P. they were spreading across much of the Midwest. Oneota peoples had a mixed hunting, foraging, and agricultural economy, and made a distinctive pottery using shell tempering. Oneota peoples are believed to have had a tribal level of sociopolitical organization, and they lived in large, permanent or semi-permanent villages. Well-known concentrations of Oneota sites occur around Red Wing, Minnesota, and La Crosse, Wisconsin, along the Mississippi River, as well as in Blue Earth County.

There are no permanent Oneota agricultural villages reported from Olmsted County, but Oneota sites in La Crosse show evidence of exploitation of the prairies in southeast Minnesota as the territory for winter bison hunts. Resources such as Grand Meadow chert from Mower County are also common in sites further east, suggesting that late prehistoric populations moved through and exploited resources in this area, probably including Olmsted County.

The Oneota were the last known precontact cultures defined in this area before Europeans arrived. Their descendants would have included the Ioway and Oto tribes now living in Kansas, Nebraska, and Oklahoma, who are closely related to the Ho-Chunk now living in Wisconsin. At the time of contact, Ioway villages were known along the Upper Iowa River and in western Minnesota and South Dakota as populations moved west in reaction to European influences from the east.

**Historic:** Contact between Europeans and Native Americans began during the 1600s when European trade goods and disease entered Minnesota from the east and south, as eastern tribes moved west, disrupting and displacing many populations. The Eastern Dakota were the most widespread Native American group in central and northern Minnesota during the historic period, along with the Ojibway peoples who moved into northern Minnesota to the Lake-Forest biome (Benchley et al. 1997:203–205). A series of conflicts between Native peoples and Euro-American settlers culminated in 1862 with the Dakota Conflict, after which most Dakota peoples

were forcibly relocated further west. There are no documented Dakota villages from Olmsted County from this period, but the area was probably part of the hunting territory.

The Minnesota Territory was formed in 1849, and Euro-American settlers began coming to what is now known as Olmsted County (Leonard 1910). Olmsted County was established in 1855 and formerly organized in 1858, at which time Rochester Township was also organized (Leonard 1910; Poch 1980). Although many of the first settlers were farmers, in the 1860s railroad construction and growing industries led to population increases, so by the 1870s, the urban population began to outnumber the rural one. The Mayo Clinic in Rochester has also had major economic and demographic effects on Olmsted County, with hotel and restaurant service adding to development and population increase (Poch 1980).

## FIELD SURVEY

In 2010 a total of 866 acres was examined in 32 parcels of land. Surface reconnaissance covered 845 acres, and shovel testing in 8 parcels examined 21 acres. Nine new sites were reported, and 5 previously reported sites were systematically investigated. The records for the remaining previously reported sites were examined, and where possible, the locations were field checked to see if either better locational information could be obtained, or if the current condition of the site could be determined. A site form was prepared for all new sites, and a site update form was prepared for almost all sites except those reported within the last 10 years for which there exists a complete site form and no additional information was available.

**Selection strategy:** Because extensive surveys for cultural resource management projects have been conducted along the Zumbro and other larger rivers (Hobbs et al. 2002:Figure 8.24.6), the current survey focused on uplands and areas not otherwise represented. Areas less well represented by past surveys are those deemed to have low potential for archaeological sites; however, if those areas are never surveyed, that assumption cannot be adequately evaluated. Furthermore, Olmsted County is located at a sensitive ecological zone with a mosaic of habitats including savanna, prairie, and woodlands, where slight climatic or environmental shifts in the past might have significantly altered local environmental conditions and changed site potentials. Thus, we tried to survey a wide range of environmental settings.

Survey areas also were shaped by whether permission for access could be obtained. For surface survey, only fields in planted in corn or widely spaced soybeans were considered, as other fields had crops too closely spaced to allow walking between rows. Shovel testing was concentrated in public lands, with a public use permit obtained for the work. Many local farmers and landowners were supportive; others, particularly near the cities of Rochester and Stewartville, would not permit access. Some large blocks of land in the county are owned by non-local groups or individuals. The residents farming these lands could not give permission for the landowners and were usually unwilling or unable to provide contact information for the landowners. Other owners were concerned about the legal consequences if we found archaeological sites, even when we explained that such finds would not automatically block further sales or development.

Finally, some farmers had recently sprayed the fields with chemicals and did not want our crew exposed to them.

Given the difficulties in getting landowner permissions, we did not select areas to be surveyed using probabilistic strategies, but instead tried to include parcels that covered different landforms and surveyed all those where we received permission for access.

**Survey methods:** Because of the approximately one-hour drive between La Crosse and Olmsted County, the crew worked in weeks of four 10-hour days and were in the field every day that weather permitted from 7 June to 21 July 2010. Surface survey was conducted during June. In July, when crops became too high for surface survey, work focused on areas that could be shovel tested, usually wooded areas near water. These included woods near a newly identified Archaic site, and other Wildlife Management Areas that were accessible.

Because many previously reported sites in the county were small and ephemeral, we wanted to maintain a survey interval that would permit these types of sites to be found. The standard field interval was usually 10–15 meters (m) but narrowed to 5 m when field conditions were not optimal for seeing longer distances, as when the corn grew taller, and when any artifacts were found. Soil profiles were recorded in areas of relatively undisturbed soils, to provide an indication of the potential for buried components. Only a sample profile was recorded during shovel testing in formerly cultivated fields and gardens where the soil was already disturbed. All soil in shovel tests was passed through ¼ inch screens, and whenever possible the shovel tests were excavated in 20 cm levels to evaluate depth of deposits.

To obtain permission to access land, we initially tried phone calls to landowners but were uniformly denied. Therefore, Arzigian spent most of June driving through the county, identifying likely fields in corn that had the same name listed in the plat book for both resident and owner (indicating a local resident), and then talked to the landowners and tenants, explained the project, and requesting permission for a crew to return and survey.

The field crew consisted of archaeological technicians hired by MVAC, as well as local volunteers. The technicians were students in the Archaeological Studies Program at the University of Wisconsin–La Crosse who had completed a field school and additional training, with the crew chiefs having had several additional years of experience. Each team had GPS units with topographic and air photo layers, as well as a draw layer with the parcels to be surveyed. These were used to mark both survey locations, shovel tests, and any possible artifact finds. We took a conservative approach to collecting materials and brought back anything even possibly cultural. Many materials collected in the field were later dismissed as non-cultural.

For each parcel surveyed, a form was completed that described the parcel, field conditions, areas not surveyed, the potential for buried soils, and survey results. Each new site had an official site form completed and submitted to receive a site number.

**Volunteers.** One person from MVAC volunteered for almost all of the surface reconnaissance survey; another who learned of us through publicity shovel tested with us for several days. In addition, the UWL college field school of 18 students and 3 supervisors visited for a day and surveyed, finding two sites. In total, volunteer labor comprised approximately 25% of the survey person-days.

**Difficulties:** The weather was not conducive to a long survey season in 2010. The project did not receive official authorization to proceed until June 3. The search for landowner permissions began immediately, and survey started the next Monday, June 7. With many days of rain, we were able to do only 10 days of surface survey by June 25. At that time the corn was over the heads of the crew, and surface visibility across rows was greatly limited. Thus, in July the crew switched to shovel testing, a much more labor-intensive effort, and spent 10 days in shovel testing, again with many days rained out. Spring 2011 proved to be even worse for survey, with abundant, late snow and heavy rains making the fields waterlogged and impassable. Thus, some previously reported sites were field checked, but no additional systematic survey could be undertaken.

**Surveyed Parcels:** Table 1 shows the parcels surveyed in 2010, listed by date. Also indicated are the township, acreage, survey method, new and previously reported sites, cultural tradition, and number of people conducting the survey. The individual parcels are discussed below by township.

**Table 1: Survey parcels, acreage, and results for 2010 survey.**

Date	Township name	parcel designation	Acreage	Survey method	# new sites	New and prev. reported sites systematically tested	Site names	Cultural Tradition	Crew size
7-Jun-10	Dover	106-11-27-1	3	surface					6
7-Jun-10	Dover	106-11-34-1	90	surface					6
9-Jun-10	Dover	106-11-34-2	8	surface	1	New 21OL46	Vermilya 1		7
9-Jun-10	Dover	106-11-35-1	50	surface					
9-Jun-10	Dover	106-11-36-1	22	surface					

Date	Township name	parcel designation	Acreage	Survey method	# new sites	New and prev. reported sites systematically tested	Site names	Cultural Tradition	Crew size
14-Jun-10	Dover	106-11-34/35-1	75	surface	2	New 21OL53 New 21OL54	Vermilya 2 Vermilya 3		22
14-Jun-10	Elmira	105-11-23-1	76	surface					7
15-Jun-10	Elmira	105-11-23-2	40	surface					7
	Elmira	105-11-22/23-1	32	surface					
16-Jun-10	Elmira	105-11-36-1	42	surface	1	New 21OL48	Hinckley site		7
	Elmira	105-11-25-1	62	surface					
	Elmira	105-11-25-2	10	surface					
	Elmira	105-11-25-3	4	surface					
17-Jun-10	Kalmar	107-15-28-1	12	surface					7
	Salem	106-15-10-2	70	surface					
21-Jun-10	Pleasant Grove	105-13-11-1	25	surface	1	New 21OL50	Axe site	Middle Archaic	6
22-Jun-10	High Forest	105-14-14/23/1	100	surface	2	New 21OL51 New 21OL52	DeCook 1 DeCook 2		6
24-Jun-10	High Forest	104-14-5-1	40	surface					7
	High Forest	104-14-5-2	3	surface					

Date	Township name	parcel designation	Acreage	Survey method	# new sites	New and prev. reported sites systematically tested	Site names	Cultural Tradition	Crew size
	High Forest	104-14-5-3	2	surface					
25-Jun-10	High Forest	104-14-5-4	8	surface					7
	High Forest	104-14-5-5	5	surface					
	High Forest	104-14-5-6	7	surface		21OL1	21OL1	Early Archaic	
	High Forest	104-14-5-7	9	surface					
28-Jun-10	Pleasant Grove	105-13-11-1	4	ST		Shovel test Axe site			6
29-Jun-10	Pleasant Grove	cont		ST					4
30-Jun-10	Pleasant Grove	105-13-11-2	0.15	ST	1	New 21OL49	Buster's garden		4
6-Jul-10	Pleasant Grove	105-13-11/14-1	0.23	ST					2
7-Jul-10	Pleasant Grove	105-13-11/14-2	0.2	ST		21OL22			4
	Pleasant Grove	105-13-11/14-3	0.2	ST		21OL21			
	Pleasant Grove	105-13-11/14-4	0.4	ST					
8-Jul-10	Haverhill	107-13-22/26/27-1	2.8	ST					3
9-Jul-10	Haverhill	cont	50	surface					2
13-Jul-10	Rock Dell	105-15-1-1	13	ST	1	New 21OL55 21OL14 21OL15	Keller III Keller I Keller II	Woodland	6
15-Jul-	Rock	cont		ST					6

<b>Date</b>	<b>Township name</b>	<b>parcel designation</b>	<b>Acreage</b>	<b>Survey method</b>	<b># new sites</b>	<b>New and prev. reported sites systematically tested</b>	<b>Site names</b>	<b>Cultural Tradition</b>	<b>Crew size</b>
10	Dell								
21-Jul-10	Rock Dell	cont		ST					6
<b>Total:</b>		<b>32</b>	<b>866</b>		<b>9</b>				<b>138</b>

## SUMMARY BY TOWNSHIP

For each township, the basic topography, surficial geology (Hobbs 1988), topographic relief, the presence or absence of springs (Kanivetsky 1988) and sinkholes (Alexander and Maki 1988) are presented. Previous archaeological surveys and investigations that evaluated intact deposits are briefly discussed. Previously reported sites, areas surveyed in 2010 and new cultural resources are described.

Unless otherwise specified, site specific info is derived from site forms on file at the Minnesota State Historic Preservation Office and Office of the State Archaeologist.

### **Southeast Olmsted County**

#### **Elmira Township 105N, 11W**

**Overview:** This township is within the upper reaches of the Root River drainage. Tributaries of Trout Run Creek extend into Elmira Township from Saratoga Township in Winona County to the east, and Lynch and Day Creeks run north/south through the township. Springs are common and undoubtedly contribute to the numerous intermittent streams that dissect the landscape. The mapped intermittent channels are predominantly wetter areas within the agricultural fields and pastures, often with grassy vegetation rather than crops, but may not always have flowing water

With loess-covered bedrock and colluvium on slopes, this township has a dissected, rolling landscape. Bedrock in this area consists of St. Peter Sandstone and Decorah Shale formations of the Prairie du Chien Group. The maximum relief in the township is about 120 feet.

**Previous archaeological investigations:** Only limited archaeological work has been done in the township. As part of the Municipal and County Highway Archaeological Survey (Anfinson 1980 supplement), inspection for a bridge replacement along Lynch Creek on County Road 110 involved limited terrain disturbance, and a limited walk-over with poor visibility identified no cultural materials.

**Previously reported precontact sites:** None.

**2010 surveyed areas:** Seven parcels were surveyed for a total of 266 acres (Table 2). The survey areas within Sections 23 and 25 were along lower reaches of intermittent streams, and no cultural material was recovered. Survey in Section 36 covered the upper reaches of the intermittent stream, and a site was found near the stream's point of origin. The site was in the bottomlands beneath a hillside at 1200 feet ASL where a stream, probably spring-fed, originated and drained. The other surveyed parcels were within similar bottomlands, with parcel #105-11-25-1 going up to 1140 feet ASL onto a gentle hilltop. In Section 25, survey parcels 2 and 3 (#105-11-25-2 and 105-11-25-3) were near the permanent stream fed by the series of intermittent streams, but had no cultural material.

**Table 2: Parcels surveyed in Elmira Township.**

<b>Parcel #</b>	<b>Acreage surveyed</b>	<b>Field methods</b>	<b>New sites reported</b>
105-11-23-1	76	surface	
105-11-23-2	40	surface	
105-11-22/23-1	32	surface	
105-11-36-1	42	surface	21OL48
105-11-25-1	62	surface	
105-11-25-2	10	surface	
105-11-25-3	4	surface	
<b>Total acreage</b>	<b>266</b>		

**Sites found in 2010:** 21OL48 (Hinckley site), a single flake of local chert found in a cultivated field near the origin of an intermittent stream tributary to an unnamed creek that runs into Trout Run. The field with the site lies at the base of a gentle slope.

**General Observations:** The parcels with negative results were near midpoints on the streams, rather than near the origin like the one site identified.

## **Orion Township 105N, 12W**

**Overview:** The North Branch Root River runs diagonally through Orion Township from northwest to southeast, and Mill Creek runs parallel to the east. The two join at Chatfield. Relief ranges from 1000 feet ASL along the Root River and 1040 feet ASL along Mill Creek to over 1240 feet ASL in the divide between them, with steep slopes present. Springs occur along the divide between the North Branch Root River and Mill Creek, and drain down to each creek along the slopes. Additional springs on the slopes west of the Root River drain down the hillslopes through unnamed creeks. As with Elmira Township, the landscape consists of loess over bedrock with colluvium along the slopes. Sinkholes are common in Orion Township, especially in a cluster north of the Root River; they also occur at a lower density south of the river.

**Previous archaeological investigations:** A highway project, a bridge replacement and a streambank stabilization project examined areas along the Root River, a major creek, and uplands.

A stretch of TH 52 from Marion to 2.62 miles north of Chatfield (spanning townships 105N 12W and 13W, and 106N, 12W and 13W) was examined for minor upgrading up to 50 feet outside the right-of-way in 10 small areas. Three areas were in steep ravines or had been channelized, but cultivated fields adjacent to the construction zone, and the turn lanes, were examined. No area was considered to have a high potential for archaeological sites, and no sites were found (Anfinson 1980).

Shovel testing and reconnaissance survey in 1990 examined a bridge replacement over Mill Creek in Sections 11 and 14. Surface survey was conducted from the bridge to 250–300 feet west, within a field north of a bend in Mill Creek. Six shovel tests were excavated in pasture from 100 to 350 feet east of the bridge. These shovel tests went down 60–75 cm below the ground surface and found “very dark grayish-brown silt loam down to 35–70 cm below surface, in some tests overlying very light brown silty clay loam beginning at depths ranging from 40 to 60 cm” (Peterson et al. 1991:351). No cultural material was identified. This survey was at the north end of the quarter-quarter section that is the reported location of 21OLal, but it was north of the creek, rather than to the south where the informant had reported finding artifacts.

Another survey in October 2006 (Allan and Magner 2007a) surveyed 22 acres for a streambank stabilization project along the North Branch Root River in Sections 21 and 28. Surface examination of the exposures indicated a high-energy environment within the floodplain, leaving no evidence of an intact stable land surface and no potential for archaeological sites.

**Previously reported precontact sites: 21OL40, the Raynard Johnson site,** was recorded in the floodplain of Mill Creek in 2006, as a result of work done for the Minnesota DNR for habitat improvements along the creek. Surface reconnaissance and shovel testing in the floodplain indicate both colluvial and alluvial deposition within the valley (Allan and Magner 2007b). The site is east of the creek, within the lower reaches of the Mill Creek valley, 8 km from its junction

with the North Branch Root River. The site is in the valley but lies near upland slopes 50 m high. One utilized flake and six waste flakes were recovered, representing Grand Meadow, Galena, Cedar Valley and Prairie du Chien cherts, all local. Surface survey found three flakes, including one retouched flake of Galena chert. Five shovel tests in the colluvial toe slope found five flakes from 15 to 75 cm deep. The investigators argued that the artifacts on the slope might have been mixed due to colluvial movement and erosion, and that those in the floodplain were in secondary context, redeposited from the uplands or from farther upstream. The site is mapped as 0.3 acres, with artifacts coming from the gently sloping uplands and from exposures on the valley floor. An abandoned railroad grade runs through the site, and subsequent cultivation has led to colluvial redeposition of materials in the area.

**Unnamed 21OLal** was reported based on an informant's report in 1990 as part of the Municipal and County Highway Survey: "A local resident reported that the former landowner of the property south of the road and creek had collected many projectile points and other tools from somewhere within the NE 1/4 of Section 14" (Peterson et al. 1991:351). A field check in spring 2011 indicated that there were several cultivated fields that might be the source of the reported artifacts in the floodplain of Mill Creek, including fields near the confluence of an unnamed creek with Mill Creek. Wet field conditions precluded survey in 2011.

**2010 investigations:** No new field survey was conducted in Orion Township. Discussions with local residents while seeking permission to survey fields provided the name of a local resident with a collection and anecdotal indications that artifacts had been found along the floodplain of the Root River

**Previously recorded sites revisited:** A field check on conditions at 21OLal in spring 2011 (see above) indicated that the area was still undeveloped and had potential for finding sites, but field conditions were too wet for survey.

**New sites identified:** None.

**General observations:** Two projects in this township addressed the question of stable land surfaces near the rivers. The North Branch Root River meanders through a wide floodplain with cultivated fields in the floodplain, and trees lining the river itself. Highway 30 follows the floodplain margin out of Chatfield. One survey along the banks of the river itself (Allen and Magner 2007a) indicated that the immediate floodplain environment did not contain a stable land surface. The floodplain farther from the bank, however, would have high archaeological potential.

Mill Creek is another high-probability area for human occupation, with a broad floodplain that Highway 52 follows north from Chatfield. Survey along the stream also indicated that the floodplain deposits might be redeposited from higher elevations or farther upstream, but one site was reported, 21OL40-Raynard Johnson that might have intact deposits on the toeslope.

### **Pleasant Grove Township 105N, 13W**

**Overview:** The North Branch Root River runs east/west across the northern half of the township, with Partridge Creek, Nichols Creek, and several unnamed creeks flowing north to the Root, and Whitney Creek flowing east to the Root. At the north end of the township are the upper reaches of tributaries that flow north to the Zumbro River. Kinney Creek originates along the divide between the Zumbro and Root Rivers and flows south to the Root.

Springs are common in the township and drain to the North Branch Root River from both the north and south. Springs are mapped along Whitney Creek and the upper reaches of Kinney Creek as well as unnamed tributaries to the Root. The landscape consists of loess over till, particularly in the south where the springs are common. Bordering the Root are areas of loess over bedrock and colluvium. Sinkholes are less common than farther east, but Sections 1 and 18 have high concentrations. Terrain has roughly 200 feet of relief from valley bottom to uplands.

**Previous archaeological investigations:** A Phase I survey in 1997 (Magner 1997a, 1997b) reported sites 21OL21 and 21OL22 in state forest lands near the Root River, and also reported an informant's mention of artifacts and possible mounds, 21OLag, as discussed below with the individual sites.

Phase I investigations along CSAH 1 for road a realignment, and Phase II investigations of historic site 21OL42, were done in 2007 for the Olmsted County Department of Public Works (Pratt 2007). The survey examined CSAH 1 in the center of Section 17 as it curves to the west, in uplands to the west of the Root River. Surface survey along steep slopes with eroding bedrock and shovel testing to 30 cm depths along the new roadway alignment found no cultural material, and indicated that the soils had been severely eroded and deflated after a century of cultivation.

Two additional lettered sites, 21OLaa and OLad, were reported based on informant reports, as listed in the site files.

**Previously reported precontact sites:** There are five previously reported sites, 21OL21, OL22, and three lettered sites 21OLaa, OLad, and OLag.

Two artifact scatters, **21OL21 (Muentner I)** and **21OL22 (Muentner II)** were reported in 1997 in the Minnesota State Forest Lands (Magner 1997a; 1997b). They were revisited in 2010 for this project; the results are discussed below and with the geomorphological investigations. A third site in the same area, **21OLag**, was based on an unverified informant's report that "mounds and artifacts" had been found near the junction of Partridge Creek and the Root (Magner 1997a:2). DNR Forestry personnel suggested in the site form that these possible mounds were between 21OL21 and 21OL22, in woods. In the summer of 2010 shovel test survey near this area did not find any signs of mounds or artifacts, as discussed with parcel 105-13-11/14-4, but the woods were thick with undergrowth, limiting visibility, and Partridge Creek flowing through the parcel made the area wet.

The **Raygor site (21OLaa)** is an area where a local resident reported seeing Indian campfires (letter to T. Trow, 1979 in 21OLaa site files). The area remains in woods along the Root River and was not visited in 2010.

The **Simpson site (21OLad)** is recorded at the Maple Valley Country Club golf course.

**2010 investigations:** Thirty acres of land in Sections 11 and 14 were examined, including visits to two previously reported sites (Table 3). Survey consisted of both surface collection (25 acres) and shovel testing (5 acres).

**Table 3: Parcels surveyed in Pleasant Grove Township.**

<b>Parcel</b>	<b>Acreage surveyed</b>	<b>Field methods</b>	<b>New sites reported and previously reported sites investigated</b>
105-13-11-1	25	surface	New site: 21OL50, Axe site
Same	4	ST	same
105-13-11/14-1	0.23	ST	New site: 21OL49, Buster's Garden
105-13-11/14-2	0.2	ST	21OL21 and 21OL22
105-13-11/14-3	0.2	ST	same
105-13-11/14-4	0.4	ST	same
<b>Total acreage</b>	<b>30.03</b>		

**New sites identified:** Two new sites were discovered. The **Axe site (21OL50)** was discovered through surface survey in parcel 105-13-11-1 and follow-up shovel testing in the woods. This site is on a terrace of the North Branch Root River within a bend in the river. The site is generally flat except for the eastern and southern sides, which slope down to the North Branch Root River. The site is roughly 200 m from the river, with a difference in elevation of 120 feet. The areas to the northeast, east, southeast, south, and southwest of the site are heavily forested, and within 15 to 20 m of the edge of the site there is a steep drop-off down to the river.

Just outside the northern bounds of the site is a small sinkhole; however, shovel tests immediately by the sinkhole were negative, so its relation to the site is unknown.

MVAC conducted a surface survey on 21 June 2010 with a crew of six people. A walkover was conducted at 5 m intervals in the agricultural field designated parcel 105-13-11-1. A lithic scatter was detected in the eastern corner of the field, and when artifacts were discovered, the survey interval was reduced to 1 m. The corn was knee height at the time, and visibility was relatively good (about 60–80 percent).

The lithic scatter was on the eastern end of the parcel and produced 33 pieces of lithic debris (30 flakes and three pieces of shatter), all local cherts, including Galena, Grand Meadow, Prairie du Chien and Cedar Valley, one piece of fire-cracked rock (FCR) that weighed 178.1 g, and a fully grooved ground stone axe. This stone axe (Figure 8) dates to the Middle Archaic and is made of granite. The groove extends all the way around the specimen; however, one lateral margin shows some flattening, suggesting similarities to the side of a three-quarters grooved axe. One end of the axe exhibits extensive battering, while the working end has polish that extends approximately 2 cm from the edge. The axe is 140 mm long, 70 mm thick at base, 20 mm thick at approximately 2 cm off the cutting edge (point), and 56 mm thick in the groove. It weighs 1280.3 grams.



Figure 8: Groundstone axe from site 21OL50.

MVAC personnel returned to the site on 28–30 June 2010 and conducted a series of shovel tests in the forested areas of the site east of the cultivated field. Two rows of shovel tests were dug with 10 m between the rows and 15 meter intervals within the rows. Excavations were done in 20 cm levels, with all material screened through ¼ inch screens. Excavations continued down below 60 cm, or until rocks or heavy clay loam soils were encountered. The shovel-test transect began at the northern border of the Pearson property and continued along the tree line for several hundred meters.

A total of 16 flakes were located in five shovel tests. The positive shovel tests were concentrated located in the southeast portion of the site, expanding the boundaries of the site to include the wooded area. Artifacts were found mostly within the top 20 cm of soil in the woods, but one flake was found about 40 cm below the ground surface.

**Positive Shovel Tests:**

**Shovel Test 5**

0–13 cm below ground surface (cmbgs), 10YR 3/2 silt loam, granular structure

9 flakes

13–19 cmbgs, 10YR 4/3 silty clay loam

3 flakes

20–42 cmbgs, 10YR 4/4 silt clay loam, fine weak subangular soil structure

43–52 cmbgs (probe) 10YR4/4, roots stopped probe

**Shovel Test 6**

0–13 cmbgs, 10YR3/2 silt loam, weak granular structure

1 flake

14–28 cmbgs, weak soil structure, grey zone, silt loam

29–50+ cmbgs, stronger soil structure, silt loam

**Shovel Test 7**

On a slight slope below the corn field

0–7 cmbgs, 10YR3/2, granular soil structure

7–17 cmbgs, gray layer, weak structure, silt loam

1 flake 0–20 cm

17–46 cmbgs, stronger rectangular soil structure, silt loam

**Shovel Test 8**

0–25 cmbgs, 10YR 3/2 silty loam, granular soil structure

26–30 cmbgs, 10YR3/3 silty loam

31–50 cmbgs, 10YR4/4 clay loam, weak/fine sub-angular soil structure

1 flake found ~40cm

50+ cmbgs, rocks

### Shovel Test 23

No slope; on field edge

0–40 cmbgs, 10YR3/3, silty loam, plow zone, no fracture, granular soil texture

1 flake found 0–20 cm

41–100 cmbgs, 10YR4/4 blocky angular soil structure, clay loam with clay skins

**Negative Soil Profiles:** examples of soil profiles

### Shovel Test 2

(This soil profile is common among the deeper shovel tests in areas of limited erosion.)

0–8 cmbgs, 10YR3/2 silt loam

9–11 cmbgs, mixed boundary zone, mottled (50/50)10YR 3/2 and 10YR5/6

12–25 cmbgs, 10YR4/4 silty clay loam

26–95 cmbgs, 10YR5/6 clay loam, angular blocky peds with clay skins

### Shovel Test 20

(This soil profile is typical of the shovel tests on a slope.)

0–14 cmbgs, 10YR 3/1 silty loam, granular soil structure

8–13 cmbgs, 10 YR 3/2 silty loam, granular soil structure

13–54 cmbgs, 10 YR 4/2 clay loam, weak subangular blocky soil structure

54 cmbgs, bedrock

The second newly recorded site was **Buster's Garden (21OL49)**. The landowners indicated that others had recovered artifacts from the area of a former garden, although they did not know what had happened to the artifacts. At the time of the 2010 survey, the area was in tall grasses. It is on a terrace above the North Branch Root River, on a gently sloping surface adjacent to woods that border the river to the east. The site lies northeast of the Pearson spring, with woods on the north and east sides. Only the garden area was shovel tested because of the possibility of utilities in the yard elsewhere, but the site might extend beyond the garden. This survey is listed in the project report with parcel 105-13-11-1.

MVAC visited the site with the landowner on 28 June 2010 and shovel tested the garden on 30 June. A total of 16 shovel tests were excavated at 10 m intervals. All shovel tests were excavated in 20 cm levels, with all material screened through ¼ inch mesh. At least the upper 20 cm, sometimes more, had been disturbed by the previous garden. Seven shovel tests produced cultural material. Materials were concentrated in the upper 25 cm or so of soil, although testing continued down to 45 or 50 cm and one-inch soil probes were used at the bottom of several shovel tests to look for evidence of soil changes down to about 70–85 cm.

**Typical soil profile: Shovel test 48**

On very slight slope

- 0–14 cmbgs, 10YR2/2 silt loam, granular structure
- 14–25 cmbgs, 10YR3/1 silt loam, granular structure
- 25–45 cmbgs, 10YR3/3 fine weak subangular blocky structure
- 45–70+ cmbgs (probe), 10YR3/3 silty clay loam

**Artifacts recovered**

(all raw materials are local cherts: Galena, Grand Meadow, Prairie du Chien)

- Shovel test 48: Level 1 (0–20 cmbgs): 2 tertiary flakes
- Shovel test 49: Level 1 (0–20 cmbgs): 1 secondary flake, 1 tertiary flake
- Shovel test 50: Level 2 (20–40 cmbgs, but flake found near top of level): 1 tertiary flake
- Shovel test 51: Level 1 (0–20 cmbgs): 1 secondary flake, 1 tertiary flake
- Shovel test 56: Level 2 (20–40 cmbgs, but flake found near top of level): 1 tertiary flake
- Shovel test 58: Level 1 (0–20 cmbgs, flake found near base of level): 1 tertiary flake
- Shovel test 59: Level 1 (0–20 cmbgs): 1 tertiary flake

**Previously recorded sites revisited:** Two previously reported sites, Muentner I (21OL21) and Muentner II (21OL22) were revisited in 2010 to evaluate the potential for buried deposits, and to verify site boundaries. The two sites lie at the junction of Partridge Creek with the North Branch Root River, with Muentner I along Partridge Creek and Muentner II a slight distance to the east, just north of Partridge creek and west of the Root (Magner 1997a, 1997b).

Surface collection and shovel testing in 1997 at **21OL21 (Muentner I)** recovered 21 artifacts, including five grit-tempered body sherds with cord-roughened or indeterminate surfaces, a Prairie du Chien chert point fragment, a Galena chert core, and flakes of Galena, Grand Meadow and Cedar Valley chert. Shovel testing produced artifacts down to 60 cm but predominantly from 0 to 30 cm. The 1997 investigations suggested that the site might extend south to the edge of the valley wall, and the site boundaries are drawn to include this area. To test this, in 2010 four shovel tests were placed at 15 m intervals near the southern boundary of the site, in Section 14 near the base of the valley wall. These are indicated in the maps by parcel designation 105-13-11/14-1. Additional testing was done along the floodplain area of Partridge Creek (8 shovel tests in parcel 105-13-11/14-4) and north of the site (5 shovel tests in parcel 105-13-11/14-3). No cultural materials were recovered from any of the shovel tests. This might mean that the site does not extend this far south, or, equally likely, that the site material is of low density and was not detected by the shovel tests.

In 2010 the area was covered with thick undergrowth and trees. A typical soil profile (from shovel test 1 at the east end of the transect) is as follows:

- 0–14 cmbgs, 10YR2/2 silt loam, granular
- 14–37 cmbgs, 10YR3/3 silty clay loam, granular

37–60 cmbgs, 10YR4/4 silty clay loam, weak granular to no structure  
60–90+ cmbgs (probe), similar

The second site, **Muenter II (21OL22)** lies on a terrace on the west side of the North Branch Root River, just north of its junction with Partridge Creek. It was reported in 1997 as a result of surface collection and shovel testing. That project recovered 36 grit-tempered sherds, most with cord-roughened exteriors, as well as some smoothed and fabric impressed sherds, one flared rim and a body sherd with a single row of tool impressions, all of which were interpreted to relate to Madison ware ceramics (Magner 1997b:6). There were 32 lithics artifacts, including one obliquely side-notched point made of Cedar Valley chert, five bifaces (two Galena chert, one Grand Meadow chert, two Hixton silicified sandstone), two scrapers (Galena and Maquoketa cherts), one Grand Meadow chert uniface, one chert core, 18 flakes (Galena, Grand Meadow, Cedar Valley and Prairie du Chien cherts), a possible hammerstone, and five burned and one unburned bone fragment (Magner 1997b).

In 2010, four shovel tests were placed in the north end of the site within the floodplain of the North Branch Root River, just west of the spring that currently lies about 500 feet farther north and drains into the North Branch. The whole area in 2010 was covered with thick vegetation, including trees, brush, and dense undergrowth. The spring has been channelized, but work was done to the west of the channel. This area is designated parcel 105-13-11/14-2 on the maps. No cultural material was recovered. Four additional shovel tests were dug to the west of the 1997 site boundaries, in the floodplain of Partridge Creek (parcel 105-13-11/14-1), but no cultural material was recovered.

A typical shovel test from parcel 105-13-11/14-2 is as follows:

0–80 cmbgs, 10YR2/2 silt to sandy loam, granular texture  
80–105 cmbgs (probe), no change  
Appears to be flood deposits.

In some shovel tests a band of 2.5YR5/2 sticky clay loam with a blocky structure was encountered between 85 and 90 cmbgs, with other tests having gleyed and mottled soils below about 60 cmbgs.

**Museum artifact collection:** The History Center of Olmsted County (HCOC) has a collection of Archaic and Woodland points, other lithics, and several potsherds that overlaps the two newly recorded sites and the two previously reported sites. This board with mounted artifacts (Figure 9) is labeled “Artifacts from old S. Campbell Farm, on Root River 3 mi. S. of Marion Minn found by Harold E. Whiting 1919-1920, Pleasant Grove township (1914) Section 11 and 14” (HCOC accession number 1985.131.3). A plat map from 1920–21 shows the land owned by S. S. Campbell as overlapping this site as well as several others. Thus, the HCOC artifact collection might derive in part from the newly reported Buster’s Garden site or the Axe site, as well as from

previously reported sites 21OL21, 21OL22, and 21OLag, all of which are on the original Campbell property. Raw materials from the collection are similar to those seen with the known sites, and consist of locally available Prairie du Chien, Galena, Grand Meadow, and Cedar Valley cherts.



Figure 9: Harold Whiting collection from Olmsted County History Center.

**General observations:** The cluster of precontact sites in Pleasant Grove Township lies within a bend in the North Branch Root River and a bend in Partridge Creek that together may have served as a fire break, providing a protected area for woodlands in the past. The presence of the axe at 21OL50 suggests that there were trees available for harvesting. The density of artifacts, including potsherds, suggests that this was a favored location for habitation during both the Archaic and Woodland periods. The combination of springs, a large creek, and the North Branch Root River would have provided a highly favorable setting for occupation. The meandering river and creek might have created a microhabitat that provided protection from fire as well as fresh water and both woodland and riverine resources.

**Dover Township 106N, 11W**

**Overview:** Dover Township lies predominantly in the headwaters of the South and Middle Branches of the Whitewater River, but the southern margin includes the drainage divide with the North Branch Root River. The landscape is predominantly till with some loess cover, outcroppings of bedrock, and few sinkholes except in the southwest corner of the township. There are a large number of springs mapped in the township, especially along the southern tier of sections

**Previous archaeological investigations:** No formal surveys have been conducted here.

**Previously reported precontact sites:** Only historic archaeological sites have been previously reported from this township.

**2010 investigations:** The 2010 field survey examined 248 acres in six parcels (Table 4) along the drainage divide between the South Branch of Whitewater River to the north and the North Branch Root River to the south. Three new sites were reported, all of them lithic scatters. One produced a Middle Raddatz Side-Notched point.

**Table 4: Parcels surveyed in Dover Township.**

<b>Parcel</b>	<b>Acreage Surveyed</b>	<b>Field Methods</b>	<b>New sites reported</b>
106-11-27-1	3	surface	
106-11-34-1	90	surface	
106-11-34-2	8	surface	New site Vermilya 1, 21OL46
106-11-35-1	50	surface	
106-11-36-1	22	surface	
106-11-34/35-1	75	surface	New site Vermilya 2, 21OL53 New site Vermilya 3, 21OL54
<b>Total</b>	<b>248</b>		

All of the survey parcels were within an area mapped as having several springs that probably drain through the intermittent channels in the fields. While conducting survey, these areas were notably wet and very difficult to walk through because of the sticky soil.

**Parcel 106-11-27-1** was a thinly vegetated hayfield of 3 acres that was surveyed through surface reconnaissance at 10–15 m intervals, but no cultural materials were found. This field is not adjacent to any water sources and could therefore be considered to have low archaeological potential for archaeological resources.

**Parcels 106-11-34-1 and 106-11-34/35-1** were contiguous fields that overlapped intermittent streams draining north to the Whitewater River, marked as wetlands within the field. The land is gently rolling. The soil was dark brown with abundant amounts of glacial till and plow damaged pebbles, making identification of cultural lithic material somewhat difficult, so it is possible that additional cultural materials were missed. A total of 165 acres were surveyed in a cornfield at 5–15 m intervals with 80–90% visibility. Two sites were identified in this parcel.

The larger site, **Vermilya 2 (21OL53)**, consisted of a scatter of lithic debris on a very low ridge. Fifteen pieces of lithic debitage were recovered, 14 of tertiary flakes and one secondary flake, including one flake of Hixton Silicified Sandstone, as well as local Prairie du Chien, Galena, Grand Meadow cherts.

The second site, **Vermilya 3 (21OL54)**, was identified by a single tertiary flake of Grand Meadow chert found just east of the landowner's house and other farm buildings.

**Parcel 106-11-34-2** consisted of 8 acres on a terrace about 10 m above a small tributary stream of the South Fork Whitewater River. The parcel had an east/west trending ridge on the south half, a fence and tree line running the extent of the field on the west half, and a stream on the east side. The field was in short corn, well washed, and was walked at 7–10 m intervals. A lithic scatter, **Vermilya 1 (21OL46)**, was identified at the south end of the field on the highest elevation. When cultural material was found, survey intervals were tightened to less than 1 m intervals to verify the site boundaries. A total of 35 lithic artifacts were recovered: two bifaces (one Raddatz Side-Notched projectile point base of Prairie du Chien chert, and one biface fragment); and 33 pieces of debitage (10 tertiary flakes, 21 secondary flakes, and 2 chunks/shatter), all of local cherts, including Prairie du Chien, Grand Meadow, Cedar Valley and Galena.

**Parcel 106-11-35-1** was 50 acres of rolling cornfield with ridges running north/south, and evidence of erosion from the hilltop and deposition at the base of the ridges. The field was walked at 15 m intervals, with visibility at 90%. An intermittent stream flowed to the southeast corner of the parcel. No cultural material was recovered.

**Parcel 106-11-36-1** consisted of 22 acres of relatively flat cornfield that was walked at 10–15 m intervals, with visibility of 90%. No cultural material was recovered.

**Observations about site location:** The 2010 survey in this township was both extensive and intensive, with survey units placed near the headwaters of intermittent streams at the divide between two major drainages, the South Branch Whitewater River and the North Branch Root River. Three sites were identified, with the only diagnostic artifact being a Middle Archaic Raddatz point from Vermilya 1 (21OL46). This was also the largest site of the three and was on a low terrace above a permanent stream, while the others were on high elevations near intermittent stream drainages. The interfluvium between the major river systems could be seen as a useful route for travel, minimizing the movement up and down valleys. The location of scattered small sites along the interfluvium, with a larger site adjacent to permanent water, suggests both movement along this corridor, and campsites near the best water sources in the area, with briefer episodes of hunting or refurbishing tool kits or shorter-term camps in other areas.

## **Eyota Township 106N, 12W**

**Overview:** Eyota Township sits along the divide between three major river drainages, the Whitewater River flowing to the east, the Root River flowing south, and Bear Creek flowing to the Zumbro River to the west. Springs are mapped for the township, generally flowing west to Bear Creek. There are many sinkholes, especially in the center of the township. Bedrock is mostly Prosser limestone with some Decorah Shale. Elevations range from about 1100 to 1290 feet. The surficial geology is comprised of till and bedrock in the center and south of the township, with loess covering both in the north.

**Previous archaeological investigations:** A 1976 survey for the South Zumbro Watershed Project (Oothoudt 1976:10-13) overlapped Eyota Township and led to the reporting of sites 21OL11 and 21OL17, described below. A more recent survey (Vermeer 2007) for the MinnErgy Ethanol Plant west of Eyota found only disturbed sediments in the project areas.

**Previously reported precontact sites:** Four sites are recorded for Eyota Township, two within the Zumbro watershed and two within the Whitewater watershed. Two lithic scatters were identified during Oothoudt's survey for the South Zumbro Watershed Project: Sand Bank (21OL11) and unnamed site 21OL17. One cache of bifacial blanks related to the Paleoindian Clovis occupation of the area, the Schumann Cache (21OL44), has also been documented. An additional but unrelated biface found near the cache was given a separate site number as the Schumann Biface site (21OL45). Site designation 21OLy had also been assigned based on an anecdotal reference to the Schumann cache, but this should be supplanted by the current site number, 21OL44.

The **Sand Bank site (21OL11)** was identified as part of the South Zumbro Watershed Project (Oothoudt 1976:10–11). Surface collection in eroded gullies along a terrace edge identified lithic debitage and a bifacial tool, possibly a knife or scraper. The site is in the valley bottom on a sand terrace south of Bear Creek. At the time of Oothoudt's survey, the terrace had a thin cover of soil and grass, but the stream was undercutting the loose sand, creating deep gullies where the lithics were found. Shovel tests found no buried deposits. Oothoudt thought this site had already been heavily disturbed and would be inundated by the permanent pool behind the proposed dam, further degrading the terrace and site.

Oothoudt also reported **unnamed 21OL17** during the South Zumbro Watershed Project (1976:12-13). Artifacts were found from the edge of a bluff “north of the proposed dam and west of the confluence of the three branches of the creek in the valley below” (Oothoudt 1976:12). Most came from an area 10 × 5 m in size. The artifacts included one broken point tip of Prairie du Chien chert (described in the report as oolitic local chert), a crescent-shaped knife-like tool, 41 flakes of Prairie du Chien chert, and 2 flakes described as chalcedony and not local. Shovel tests found no intact buried deposits, and bedrock was encountered between 65 and 75 cm. After construction of the Zumbro projects, the site was to be planted in grasses and left to return to natural cover, which might help to stabilize the surface.

The **Schumann Cache (21OL44)** lies near the headwaters of a small stream that drains directly into the Middle Branch Whitewater River, near the divide between the Whitewater, Zumbro and Root River drainages. This was cache of 65 bifaces and flakes of silicified sandstone, some with red ocher staining, found within 6 inches of the ground surface in the 1940s by Adolf Schumann while plowing. He and his brother Alfred collected the tight cluster of stones and kept them until 1965, when he donated them to the Olmsted County History Center, where they were cataloged and inventoried. Oothoudt prepared a memo on the Schumann collection, noting “numerous, large quartzite artifacts many as bifacial blanks,” and the site was reported as 21OLy. The significance and age of the cache were not recognized until 2008. The initial site form (prepared by Robert Boszhardt in 2008) describes the process of recognizing the significance of the cache:

*Andrew Bloedorn, while doing a museum studies internship at the Olmsted County History Center in the summer of 2007, came across the boxes of silicified sandstone artifacts in storage and recognized their distinctive nature. He contacted Boszhardt and other archaeologists, who verified that the assemblage appears to represent a Clovis cache. Mr. Bloedorn conducted archival research and tracked down the original cache discoverers and conducted an interview which provided details of the discovery and the location. Mr. Bloedorn then prepared a report for the Olmsted County History Center, which describes the history of the discovery (a tight cluster of silicified sandstone artifacts found while plowing in the 1940's and subsequent donation to the County museum in 1965). Boszhardt coordinated subsequent analyses, which included detailed descriptions by Dillon Carr and XRF analysis by Dan Winkler. As of the spring of 2008, Mr. Carr has drafted a summary report of his initial analysis, but has subsequently conducted a more thorough analysis. In early June of 2008, Boszhardt visited the find location with Alfred Schumann and found a single silicified sandstone biface fragment in a freshly planted corn field, thereby verifying the specific site location.*

An article published in *Current Research in the Pleistocene* (Carr et al. 2008a:66-67) describes why the authors interpret the cache as being Paleo in age:

*Technological characteristics of the Schumann Cache bifaces indicate a consistent pattern of biface thinning involving the sequential removal of large expanding bifacial thinning flakes. Several of these bifaces display the regular use of overshot (outré passé) flaking during thinning. Subsequent to thinning, a clear pattern of collateral flaking is observed on a number of the bifaces, and in two instances fine pressure flaking occurs along the entire lateral margins. Remnant striking platforms imply the regular use of heavy (often very heavy) grinding. Although related technologically, the cached bifaces, including four extremely large specimens, vary considerably in both overall size and gross morphology. Very large specimens such as these are commonly found within Paleoindian-age caches (Carr and Boszhardt 2003; Frison and Bradley 1999; Morse 1997).*

*Because the cache lacks diagnostic tool forms, its age must be inferred largely through technological similarities with other caches of known cultural affiliation. Technological characteristics such as the extreme size of the bifaces, occurrences of overshot and collateral flaking, and heavy platform grinding all suggest a probable Paleoindian age for the cache. Moreover, these characteristics indicate the cache may have closer affinities with an early-Paleoindian, rather than late-Paleoindian/early-Archaic occupation. In fact, late Paleoindian silicified sandstone caches known from the region typically comprise finished bifaces that were intentionally damaged prior to being deposited (Buckmaster and Paquette 1988; Carr and Boszhardt 2003; Mason and Irwin 1960; Ritzenthaler 1972). This suggests that the Schumann Cache may be related to early-Paleoindian biface caches known from the northern Plains and northwest United States rather than the western Great Lakes region.*

*Visual inspection of the silicified sandstones suggests the use of two high-quality sources that outcrop in western Wisconsin: Hixton Silicified Sandstone (HSS) and Cataract Silicified Sandstone (CSS). The preferential use of an HSS source is a common trait among Paleoindian lithic assemblages in the eastern Great Lakes region (Carr and Boszhardt [Carr et al. 2008b] Loebel 2005). However the more common use of CSS observed in the Schumann Cache deviates from the regional pattern, but may be due, in part, to the cache's location outside the normal range of movement for Paleoindian artifacts manufactured from HSS.*

The preliminary results of Niton EDXRF analysis to distinguish the two sources suggested that two of the bifaces were of Hixton Silicified Sandstone while the others were Cataract Silicified Sandstone (Carr et al. 2008b).

A small unit was excavated in 2008 and completed in 2009 at what was thought to be the original find spot for the cache, but excavation to subsoil found no artifacts or features. Surface reconnaissance at 2 meter intervals across the cache find location was also negative (Koenen 2009 site form update, 21OL44).

The cache is now on exhibit at the Olmsted County History Center. It contains one biface blade, 22 bifacial blanks, and 41 flakes, some with evidence of use as tools. The blade and some bifaces are shown in Figure 10. Some of the flakes have red ocher staining, which suggests some ritual component to the preparation or burial of the cache (Figure 11).

The **Schumann Biface site (21OL45)** was reported based on the 2008 find of an isolated biface made of Galena chert, discovered while surveying the field where the Schumann cache had been found. It was about 160 m from the reputed location of the cache, and because of the distance and the difference in raw material, it was given a separate site number from the cache (21OL45 site form, Koenen 2009).



Figure 10: Bifacial blade and several blanks from Schumann Cache (Olmsted County History Center exhibit).



Figure 11: Flakes from Schumann Cache with spots of red ochre (Olmsted County History Center exhibit).

**2010 investigations:** No archaeological survey was conducted in this township, but geomorphic investigations targeted the Schumann site to evaluate the potential for buried sites.

**Observations about site location:** The Schumann Cache and the Schumann Biface site are both near the headwaters of the Middle Branch Whitewater River, which flows eastward, ultimately to the Mississippi River. But these sites are also less than one mile from the interfluvium separating the Whitewater drainage from the westward-flowing Zumbro drainage. Proximity to this major divide might have been a significant factor in site location.

### **Marion Township 106N, 13W**

**Overview:** Marion lies just east of the city of Rochester. Badger Run and Bear Creek flow from east to west and drain into Bear Creek, which will enter the Zumbro in Rochester. Bear Creek's valley is more deeply incised with about 140 feet of elevation difference between valley bottom and the hillside above. Marion's surficial geology is a complex mixture of bedrock, till, loess, alluvium and terraces, with loess to the north and south, and the two major stream channels through the middle. Its bedrock geology is as complex, with Galena and Prairie du Chien group dolomites and limestones dominating but with strips of St. Peter Sandstone and Decorah Shale. There are few springs mapped for the area, and those that are present flow west towards the Zumbro.

**Previous archaeological investigations:** There have been seven major surveys in the township that examined significant portions of land, including several areas considered to have a high probability of finding archaeological sites, and one that monitored deep excavations to evaluate the area for buried sites. The only site identified in Marion Township in any of the surveys was lithic scatter 21OL12. This site was identified in 1978 when the South Zumbro Watershed Project (Oothoudt 1976) examined areas to be inundated by several dams.

The 1983 Trunk Highway Archaeological Reconnaissance Survey (Peterson and Yourd 1984) examined two bridges over Willow Creek, but surface reconnaissance and seven shovel tests at 30 m intervals in non-flooded areas were all negative. Wet silt and sand loam floodplain sediments were encountered, and the water table was encountered 60 cm below the surface. Also in 1983, the Municipal and County Highway Archaeological Reconnaissance Study (Anfinson 1984) conducted a surface survey of one-tenth of a mile of land over Bear Creek. The land was low and wet, with exposed alluvial soil, and no cultural material was identified.

A survey of the Pinewood dredge disposal area in 1993 for the Corps of Engineers examined a 12-acre area at the junction of Willow and Badger Creeks with Bear Creek (Arzigian 1993), an area considered to have a high probability of containing archaeological deposits. Soils were deep mollisols indicative of development under prairie grasses, with an A horizon extending down 30–60 cm, over fine sands. Shovel tests at 15 m intervals, with all soil screened, were negative, as was a surface survey at 3 m intervals of an adjacent cornfield.

A 2001 survey for the proposed Badger Run Trunk Sanitary Sewer for the City of Rochester (Harrison 2001) covered 1.5 miles of mainly low and poorly drained creek and floodplain, with four shorter lines on higher ground. Surface examination of bank exposures and shovel testing of one higher terrace were all negative.

A survey in 2006 of 85 acres along a proposed Alignment Corridor along 20<sup>th</sup> Street in Rochester (Dowiasch 2006) involved surface survey and excavation of approximately 350 shovel tests at 15 meter intervals along Bear Creek and a tributary, both of which would be classified as having a high probability of having archaeological sites. Soils encountered in some shovel tests showed

75–90 cm of black soil down to the subsoil, suggesting some flood deposits along the creek. No precontact cultural material was encountered.

Finally, survey in 2006 involved monitoring in the Bear Creek floodplain as part of the Bear Creek Sewer Alignment (Ollendorf 2006b) that crosses Bear Creek in at least three places. Manhole sewer trenches were monitored down to 4–7 m to ensure that no deeply buried sites would be impacted. Topsoil from each trench was screened to detect any artifacts. No deeply buried soil horizons were identified and no cultural materials were recovered.

**Previously recorded precontact sites:** Three sites have been recorded in Marion Township. Unnamed site **21OL12** was reported by Oothoudt (1976:8-9) as part of the South Zumbro Watershed Project through artifacts found on old gopher burrows. The site is on a low terrace along a stream tributary to Willow Creek, a tributary to Bear Creek, which flows into the Zumbro River. Eight lithics artifacts were found: one chert scraper, six chert flakes, and one quartzite flake. The site had been plowed and eroded, with evidence of flood deposits but no signs of a buried cultural component. Preservation was not recommended and the site was expected to be destroyed by the permanent pool as well as borrow pit construction.

The **Trapp mounds (21OLx)** have not been relocated or verified as mounds, despite visits by a number of archaeologists over the years to the area an informant had reported as having mounds (Mark Dudzik 2002 correspondence in OSA site file for 21OLx). The area has since been developed with houses.

The **Stroebel site (21OLab)** was reported based on information from the daughter of Mr. Pike, who donated his collection to the Olmsted County History Center. The Pike collection at the Olmsted County History Center is extensive, but unfortunately does not have provenience information. However, this memo suggests that at least some of it comes from this location. Due to imprecision in the location information, the mapped location for 21OLab in the site files encompasses half of Section 32, but none of this area lies particularly close to water, though there is an intermittent stream mapped within 400 feet of the east edge of the half-section. Otherwise the land is higher ground, lying between the intermittent streams that drain to Badger Run and those that drain down to Willow Creek. Both are tributaries of Bear Creek.

**2010 investigations:** no additional survey was undertaken in Marion Township in 2010, since several intensive surveys of high-probability areas had been undertaken by recent projects.

**Observations about site locations:** The absence of sites or deeply buried deposits within areas considered high-probability, such as along Bear Creek and Willow Creek, is curious. It may indicate that these areas were subject to either flood deposition or erosion that has removed cultural material, or that human occupations did not favor these low settings on smaller streams. The possible location of artifacts in the Pike collection places that site on higher ground between two creek drainages. However, the one verified site found in the township is located along just such a creek. This suggests that the creeks were used, but not intensively.

## Southwest Olmsted County

### **High Forest Township 104-105N, 14W**

**Overview:** This irregularly shaped township overlaps the cities of Stewartville and Rochester. The North Branch Root River runs across the southern half, through Stewartville. The northern half drains north to the Zumbro River, making the center of the township the divide between these two drainages. The landscape consists of loess over till, with areas of bedrock and colluvium along the river valleys. Mapped springs are not as common in High Forest Township as farther to the east, but the aquifer is shown as having a strong flow. Springs are reported from Sections 14 and 15, near surveyed parcel 105-14-14/23-1. The township has about 200 feet of elevation difference, but tends to be somewhat higher than further east, with the uplands around 1060 to 1280 feet ASL.

**Previous archaeological investigations:** Previous archaeological investigations have been concentrated in the south half of the township, near the communities of Stewartville and High Forest.

In 1978, survey of proposed water and electrical lines, a road, a parking lot, a shelter, and toilet facilities for a park was conducted at Stewartville (Caine and Howard 1978) in a general uplands setting of the Rochester Till Plain near modern Lake Florence, an artificial impoundment. The survey included surface reconnaissance and 22 shovel tests down to 40–100 cm below the surface. Higher areas of land had shallower soil profiles, with topsoil ranging from 18 to 35 cm, and lower areas near Lake Florence had a topsoil layer of 40–70 cm, reflecting either less erosion than the higher elevations, or perhaps deposition of material (Caine and Howard 1978:5). Three artifacts interpreted by the investigators as of possible cultural origin were identified. The find was later reported as unnamed site 21OL16.

In 1980 Harrison (1980b) conducted a survey for a wastewater treatment facility and interceptor sewer routes. Portions of the survey were in previously disturbed areas, but a 15-m wide transect cut across higher elevations north and south of the North Branch Root River and included surface collection, inspection of existing exposures, and shovel testing. The survey found no cultural materials.

In 1992 (Johnson 1992b) a Phase I surface survey examined 60 acre borrow and disposal area for the Soil Conservation Service, on a broad terrace west of Carey Creek and south of the North Branch Root River. This was part of a larger project for soil erosion control and water improvement for the Root River. Although the project's setting suggests a high probability of finding sites, no cultural materials were identified.

Additional investigations in the township encountered previously disturbed areas (e.g., Peterson et al. 1990, 1994), so that the presence or absence of cultural material cannot be reliably inferred.

**Previously recorded precontact sites:** There are seven previously reported precontact sites. Two are in T104, R14 (unnamed 21OL1 and High Forest, 21OLae), and the remaining five are in T105N, R14W Engel, 21OL3; unnamed 21OL16 and 21OL19; Koenig, 21OL43; and Oehlke, 21Olaf).

Unnamed site **21OL1** was a lithic scatter initially reported as encompassing a large area that extended from east of I-90 to west of a cemetery, based on a Wilford memo, dated 16 May 1952. The site was revisited in 2010, as is described below.

The **High Forest site (21OLae)** was first reported based on a memo from T. Trow that described a spot where a knife, small ax, pecking stones and about 10 points had been found along with some “burnt lime.” As discussed below, a large area from which the artifacts might have been obtained was surveyed in 2010 but no cultural material was recovered.

The **Engel site (21OL3)** was first reported in a 1970 memo by Jerry Oothoudt that describes two mounds in Mr. Engel’s field that had been plowed down for many years. The field is a high terrace east of the Root River. The landowner was reported to collect artifacts in this field after he plowed. D. Nystuen updated the records in 1971 to indicate two plowed-down mounds, but it is unclear whether he had visited the site or just prepared a new form. In 2010 the field in question was still under cultivation but was not rechecked.

Unnamed site **21OL16** was a lithic scatter identified during 1978 testing (Caine and Howard 1978, discussed above). Artifacts included a broken scraper of white chert, a possible orange jasper flake, and a possible gray chert core. The site form for 21OL16 was prepared in 1995 and listed the location as the entire SW-NE quarter-quarter section of Section 33, putting the UTM centerpoint coordinates on the west side of the creek feeding into the Root River. In 2010, the site records for 21OL16 were reexamined. Based on the maps in the original report, it appears that the location of the site can be more precisely identified as east of the unnamed creek that enters the Root River, in the area subsequently constructed as a parking lot. If this is correct, then the site area has been destroyed by the construction.

Unnamed site **21OL19** was an Archaic lithic scatter first identified in 1974 as part of the South Zumbro Watershed Archaeological Survey (Hudak 1974). It was on a knoll at 1100 feet ASL, and a 1080 foot ASL terrace adjacent to the South Fork Zumbro River. The report illustrates a fully grooved axe and two other groundstone objects recovered from the site by a collector, who also found projectile points. Surface collecting produced debitage (not tabulated). In 2010, air photos suggested that the 40 acres designated as the possible site location remains in cultivation and woods, but it was not revisited.

The **Koenig site (21OL43)** was identified from a single lanceolate Paleoindian point of Cedar Valley chert reported in 2008, when the landowner discovered it in a recently tilled garden. It is similar to a Browns Valley or Midland point. The site is within the city of Stewartville, about 500 meters from the Root River.

The **Oehlke site (21Olaf)** was reported based on an informant's report that mounds 2 feet high and 16 feet in diameter were found in a neighbor's field. In 1978 they were reportedly undisturbed with oak trees growing in them. Based on landowner records in 1974, they were placed to Section 16, but further locational information was not available. This area now includes one runway from the Rochester airport. It was not rechecked in 2010 due to restricted access.

**2010 investigations:** The 2010 survey examined 174 acres in sections 4 and 14/23 (Table 5). Two new sites were identified, and two previously recorded sites visited. Parcels are discussed below with the sites they investigated.

**Table 5: Parcels surveyed in High Forest Township**

Parcel	Acreage surveyed	Survey Methods	New sites reported and previously reported sites investigated
105-14-14/23-1	100	surface	New site: 21OL51 DeCook 1 New site: 21OL52 DeCook 2
104-14-5-1	40	surface	21OLae not relocated
104-14-5-2	3	surface	
104-14-5-3	2	surface	
104-14-5-4	8	surface	
104-14-5-5	5	surface	
104-14-5-6	7	surface	21OL1 relocated;
104-14-5-7	9	surface	21OL1 collected
<b>Total</b>	<b>174</b>		

**New sites identified:** Parcel 105-14-14/23-1 was located predominantly in Section 14, with a corner extending into Section 23. It was situated along the divide between the Root River and the Zumbro, with unnamed creeks draining south to the Root and north to the Zumbro. Two sites were identified, **DeCook 1 (21OL51)** and **DeCook 2 (21OL52)**, both from isolated flakes of local chert. They were both on high points of land at 1280 feet ASL, the highest elevation in the area.

**Previously recorded sites revisited:** Unnamed site **21OL1** was revisited in 2010 when its precise location could be verified, and several Early Archaic artifacts were recovered. Surface survey in 2010 produced a surface scatter of lithics on a terrace east of the North Branch of Root River, on the hillside leading down to the banks of the river. The site extends along the slope of

the terrace and might extend onto the top of the terrace where a cemetery now sits, as well as to the west, past the edge of the field, to the river's edge. The site was found during survey of parcels 104-14-5-4 (cemetery), 104-14-5-5 (soybean field east of cemetery), 104-14-5-6 (soybean field west of cemetery), and 104-14-5-7 (soybean field south of cemetery). The soybean fields were walked at 10–15 m intervals, with excellent visibility, and natural exposures in the cemetery were examined. Most of the cultural material was found high on the slope at the north end of the site, in parcel 104-14-5-6, with scattered material lower on the slope. Cultural material was concentrated on the higher elevations above the terrace. No cultural material was found east of the cemetery in parcel 104-14-5-5 or in the cemetery itself (parcel 104-14-5-4).

On top of the terrace is a cemetery currently in use, but local informants said that the oldest part of the cemetery (headstones not graves) had been moved to this location. Therefore, if the site extends under the cemetery, portions might be intact in areas where only headstones were transferred.

Surface survey of this site was completed on 24 and 25 June 2010. A soybean field was surface collected at 10–15 meter intervals. The soybeans were relatively short (one foot or less) and soil was well washed, with 70–80% visibility. When the lithic scatter was identified, survey intervals were tightened to less than 5 m, with each row of soybeans examined to determine site boundaries.

The artifact assemblage from the 2010 collection of 21OL1 consisted of 134 lithic artifacts. They included four bifaces: a Late Paleoindian/Early Archaic projectile point similar to a Kirk Corner-Notched, made of Prairie du Chien chert, the midsection of a projectile point made of Grand Meadow chert, a knife of Prairie du Chien chert, and a Stage II biface of Cedar Valley chert (Figure 12). Other artifacts included two unifaces, three bifacially modified end scrapers, three cores (two platform, one bipolar), and 122 pieces of debitage (31 secondary, 82 tertiary, and nine chunks/shatter), all of local cherts, including Grand Meadow, Galena, Cedar Valley and Prairie du Chien. An apparently unmodified iron nodule (cultural?) also was found.

The 2010 field investigations also surveyed within the boundaries of site **21OLae**. Most of the quarter-quarter section plotted as the possible location of this site is now owned by Mathy Construction of Onalaska, Wisconsin, and a large quarry operation lies to the northeast, as well as a smaller operation in the west half of the quarter-quarter section. Portions of this quarter-quarter section outside of the quarry operation area were examined through surface reconnaissance to try to relocate the site.



**Figure 12: 21OL1 artifacts. Left to right, top row: Early Archaic point; point midsection; two end scrapers (left of Prairie du Chien chert; right of Grand Meadow chert). Middle row: Knife, biface (Cedar Valley chert). Bottom row: bipolar core (Grand Meadow chert); two platform cores. All artifacts are of Prairie du Chien chert unless otherwise noted.)**

Three of the survey parcels that overlap 21OLae's quarter-quarter section location were surveyed on 24 June 2010. Surface reconnaissance at between 5–15 m intervals examined the cultivated fields to the east, west, and north of the residence and farm buildings. Visibility in the soybean fields was excellent, but no cultural materials were identified. The current occupant of the house had no knowledge of artifacts found on the property. The yard and area around the buildings were not shovel tested.

Parcel 104-14-5-1 (40 acres) was a large soybean field east of the house. There were abundant small rocks and glacial till, and several intermittent streams crossed the field, making several areas wet and sticky. The second parcel, 104-14-5-2 (3 acres), was west of the house and driveway. Survey intervals in that parcel were 5–10 meters apart. This field is part of a terrace with the North Branch Root River at its northern end. The field was rocky and flat. Parcel 104-14-5-3 (2 acres) was north of the house in a low-lying floodplain setting along the North Branch Root River and showed evidence of frequent flooding by the river. Survey intervals were 10 m apart in soybean fields with excellent visibility.

No cultural materials were identified in any of the fields surveyed in 2010 within the mapped area of 21OLae. It is possible that the reported artifacts came from the area of the house and other structures, or from the quarry or floodplain to the northwest of the river. It is also possible that some cultural materials are buried in the floodplain in the northern parcel.

**Observations about site location:** Newly reported sites DeCook 1 (21OL51) and DeCook 2 (21OL52) are both isolated flakes found in uplands along the watershed divide between the Zumbro River and the North Branch Root River. Previously reported sites 21OL1, 21OL3, and 21OL43 are above the North Branch. Site 21OL16 was near the junction of a creek with the North Branch, and 21OL19 was adjacent to the South Fork Zumbo River. The two previously reported sites that can be dated are Paleoindian (21OL43) and Archaic (21OL19). Diagnostics obtained in 2010 from 21OL1 are also Late Paleo to Early Archaic. These distributions might indicate an emphasis by early cultures on the major waterways, but also with lighter use of the major drainage divides. Areas surveyed that were away from both major water sources and that were not near even intermittent drainages, such as the parcels within the previously reported site area for 21OLae, produced no cultural materials.

**Rock Dell Township 105N, 15W and High Forest West Panhandle 104N, 15W**

**Overview:** Like High Forest Township, Rock Dell Township and the six sections that encompass the High Forest West Panhandle at the southern end of the county span the interfluvium between the South Fork Zumbro River drainage to the north and the North Branch Root River drainage to the south. Most of the township, including the areas surveyed in 2010, is along the Zumbro River. Few springs are mapped in the township. Bedrock geology is predominantly Middle Ordovician in this part of the county, with Maquoketa, Dubuque and Stewartville formations of limestone and dolomite. The landform is higher and more level than further east, with maximum relief about 100 feet, and hilltops at about 1360 feet ASL. The surficial geology is predominantly till with only small areas of loess cap in the northeast, and alluvial systems along the Root and Zumbro rivers

**Previous archaeological investigations:** Two previous archaeological field investigations were conducted in Rock Dell Township, one along the North Branch Root River for a bridge replacement, and one within the Keller Wildlife Management Area on the South Fork Zumbro River.

A 1990 Minnesota Municipal and County Highway survey (Peterson et al. 1991:349-351) examined a stretch of land along CSAH 3 over the North Branch Root River, 4.5 miles west of High Forest, for a bridge replacement. This location would seem to have a high probability of finding archaeological sites, given its placement adjacent to the Root River, but surface survey for 500 m north and south of the bridge produced no cultural material. However, only a narrow stretch of land was examined.

In 1990 a Phase I survey, including shovel testing and surface survey, was conducted in the Keller Wildlife Management Area for a proposed trail system (Withrow 1990). The survey examined hillsides, uplands, and low terrace floodplain settings along the Zumbro River and along Goose Creek at its junction with the Zumbro. Two sites were identified: Keller I (21OL14) and Keller II (21OL15). These sites were reexamined in 2010, as discussed below.

A 2003 Phase I surface survey and shovel testing for a Northern Natural Gas pipeline project examined a terrace along the North Branch Root River and reported site 21OL34 (21OL34 site files).

**Previously recorded precontact sites:** Four sites have been previously reported, three in Rock Dell Township (21OL14, 21OL15, 21Olan), and one in the High Forest West Panhandle (21OL34). **Keller I (21OL14)**, a lithic scatter, and **Keller II (21OL15)**, a Woodland tradition artifact scatter, both were found during the 1990 Phase I survey in the Keller Wildlife Management Area. They are discussed further with the 2010 investigations.

Unnamed site **21OL34**, a lithic scatter, was reported in 2003 as a result of Phase I surface survey and shovel testing for a Northern Natural Gas pipeline project. The site is on a terrace west of the North Branch Root River. Most of the material was found on the surface, but one flake came

from a shovel test, from 0–35 cm deep. The area had been heavily disturbed by cultivation and a pipeline, suggesting no site integrity.

Unnamed site **21OLan**, a lithic scatter, was reported based on information from an informant who said that large and small points, although no scrapers, had been found along the bank of the North Branch Root River. In 2010 the area remained agricultural, but alfalfa crops precluded additional survey.

**2010 investigations:** On 13, 15, and 21 July 2010, shovel testing was conducted in the Keller Wildlife Management Area (Table 6). Goals were to examine areas not previously surveyed and to shovel test around two previously reported sites to recover additional diagnostic artifacts, examine the extent of the sites, and test for the potential for buried deposits in the vicinity.

**Table 6: Parcels surveyed in Rock Dell Township.**

Parcel	Acreage surveyed	Survey Methods	New sites reported and previously reported sites investigated
105-15-1-1	13	Shovel test	21OL14, 21OL15 21OL1 New site: 21OL55 Keller III
<b>Total</b>	<b>13</b>		

**Previously reported sites revisited:** The **Keller I site (21OL14)**, as noted above, was first reported in 1990 as a result of surface survey along proposed public trails in the Keller Wildlife Management Area (Withrow 1990). In 2010, the site was revisited and shovel testing was conducted. This area was designated Olmsted County Survey parcel #105-15-1-1. No additional cultural material was recovered in 2010.

The site lies on an outwash terrace south of the South Fork Zumbro River 100 m upstream from the confluence with Goose Creek, which joins it from the southwest. The South Fork Zumbro River is 90 m north of the site; an unnamed tributary stream lies 60 m east of the site. The 1990 fieldwork within Area B

*examined eroded slope areas along north side of terrace. Gullies eroded as results of poor contour plowing and use of areas north of site as snowmobile trail... Artifacts found on terrace, in eroded gullies along the north slope at east end of field and as redeposited outwash on low field to the north....Entire site under cultivation. Wooded fringe at east end of field may hold undisturbed deposits. Northern slope of terrace is badly eroded with gullies created as result of planting row crops perpendicular to slope. [Withrow 1990:2-3]*

Since the 1990 survey was only a surface collection in this area, the 2010 shovel testing was designed to evaluate the depth of deposits and examine areas within the woods closer to the Zumbro River. Although shovel testing was conducted along both banks of the Zumbro for 200 meters above and below the site, no cultural material was identified. There is some evidence of overbank deposition near the river that might have buried cultural material.

**Soil profile of shovel test #56 (east of site along river edge of terrace):**

0–35 cmbgs, 10YR2/2 sandy silt loam, granular structure  
35 cmbgs, hit root layer  
No cultural material

**Soil profile of shovel test #54 (west of site):**

0–30 cmbgs, 10YR3/3 sandy silt loam, granular structure  
30–50 cmbgs, 10YR4/2 silty sand loam, granular structure  
Gravel deposits and large rocks found throughout excavation  
No cultural material

West of the mapped site area, in the vicinity of shovel test #54, signs of several backfilled excavation units were observed in 2010, although no units were reported excavated in 1990.

The **Keller II site (21OL15)** was identified in 1990 in the same Keller Wildlife Management Area survey. In 2010, the site was revisited and additional shovel testing conducted. This area was within Olmsted County Survey parcel #105-15-1-1. One additional flake of Grand Meadow chert was recovered in 2010. The site is on a terrace south and east of the South Fork Zumbro River, downstream from where Goose Creek enters the river.

During the 1990 field work, “Tests were placed in a tight grid pattern designed to evaluate the highest areas on the terrace. Streambank exposures revealed no evidence of eroding site material or features” (21OL15 site form p. 2). A total of 17 shovel tests were excavated 6 of them positive and 11 negative. Withrow also noted: “Found several small crumbs of thin-walled (3-5 mm) cord-roughened, grit-tempered pottery. Only 1 plain rimsherd with rounded lip” (21OL15 site form p. 2) The site was suggested to be undisturbed and date to the Late Woodland period. The 1990 examination of stream cutback exposures revealed no eroding site materials, but Withrow argued that continued erosion would ultimately affect this site. Based on his shovel tests, Withrow concluded that the cultural concentration was confined to 20–35 cmbgs

The 2010 survey was extended beyond the 1990 shovel test area to see whether there would be more deeply buried deposits, or other cultural material. The 1990 shovel tests went out to 180 feet from the river. This was the most prominent part of the landform. Testing in 2010 extended beyond this higher elevation to examine areas up to 100 meters away from the river. One flake was recovered from a shovel test near the center of the site, in level 1, from 0–20 cmbgs, but

nothing was found in the more distant shovel tests. Thus, the site appears to be confined to the highest portion of land close to the river.

**Typical soil profile: Shovel test #53-2**

0–19 cmbgs, 10YR2/2 sandy loam, granular

1 flake found

19–30 cmbgs, silty band of light soil

30–53 cmbgs, 10YR2/1 sandy loam

53–90+ cmbgs, granular soil, appears to be flood deposits, abundant gravel

**Newly identified site:** One new site, **Keller III (21OL55)**, was identified during shovel testing of a long ridge overlooking the Zumbro. This area was designated Olmsted County Survey parcel #105-15-1-1. Surface survey in 1990 in cultivated fields south of this location did not find any cultural material, but the survey did not extend as far north as the Keller III site.

Shovel testing on 13 July 2010 was conducted along a high ridge of prairie that runs north/south. Shovel tests were at 15 m within the single transect. Two flakes of Grand Meadow chert were found in each of two shovel test pits at the north end of the high terrace overlooking the South Fork Zumbro River, which lies approximately 100 m to the east. The terrace lies within a meander of the river. The area was probably cultivated in the past, though it is now in prairie grasses. The absence of materials from the 1990 surface survey to the south indicates that the site is concentrated at the northern end of the ridge, closest to the river. It might extend farther to the east by the river; this area was in thick brush in 2010 and was not shovel tested. The site might continue to the north, onto private property, if it extends to the edge of the terrace. The soil profiles and cultural materials from the two positive shovel tests are as follows:

**Shovel Test 12 (south end of site):**

0–9 cmbgs, 10YR 3/2 silt loam, granular soil structure

9–28 cmbgs, 10YR 3/4 sandy loam, granular soil structure

2 flakes found, 0–20cm

28–56 cmbgs, 10YR3/6 gritty clay loam, moderate structure

**Shovel Test 13 (north end of site):**

0–30 cmbgs, 10YR 3/2 silty sandy loam, granular structure

2 flakes found, 0–20cm

30–50 cmbgs, 10 YR3/4 sandy silt loam, granular structure

50 cmbgs, bedrock encountered

**Observations about site location:** The sites in this township are all near significant water courses, either the Root River or the Zumbro River; however, not many areas off of the main rivers have been surveyed.

## **Rochester Township 106N, 14W**

**Overview:** Rochester Township is dominated by fluvial systems. The Zumbro runs from northeast to southwest through the City of Rochester, with Bear Creek and Willow Creek entering from the east, and Cascade Creek from the west. These areas have terrace systems and extensive alluvial deposits. There are no springs mapped within the township, and there are a few sinkholes to the west of the city. Rochester's surficial geology is dominated by the fluvial environment and consists predominantly of terraces and alluvial sediments with smaller areas of bedrock and till. Relief is about 200 feet, with the highest point of land about 1200 feet ASL. One of these few higher points of land that has not been developed exists at Indian Heights Park.

A major flood in 1978 led the Corps of Engineers, the USDA Natural Resources Conservation Service (NRCS), the City of Rochester, Olmsted County, and the Olmsted Soil and Water Conservation District to construct a flood control project, built from 1984 to 1995: "The Corps project deepened and widened the Zumbro River channel and Bear and Cascade Creeks to handle major flood flows. The NRCS project installed 7 flood storage reservoir structures.... These reservoirs provide the flood protection for Silver Creek, and reduce flood flows on Bear Creek, Cascade Creek, Willow Creek and the Zumbro River" (City of Rochester 2011). Archaeological surveys were conducted prior to construction and provide some of the best coverage along major waterways.

**Previous archaeological investigations:** Since 1975 there has been extensive archaeological work in and around Rochester, particularly for the Rochester flood control project and related activities. Fifteen major projects that adequately surveyed intact areas are discussed below.

Hudak (1981:11-14) summarized the archaeological work done in the Rochester area during the first five years of the project. The first survey done in 1975 (Strachan 1975) was a surface reconnaissance with limited subsurface testing of proposed construction and disposal areas on the South Fork Zumbro River and its tributaries. One part of the survey included Bear Creek from its mouth to where Willow Creek and Badger Creek enter, in the southeast corner of Section 12, T106N, R14W. Strachan identified two surface find locations for prehistoric artifacts, G and H, in cornfields east of Bear Creek. These were first reported as separate sites (21OL13 and 21OL6) but have now been combined in the site files. They were reexamined by Caine (1978) as part of a survey of Bear Creek Park for a bike trail. Caine found no sites in surface reconnaissance or subsurface testing along the bike trail; however, she reported that deposits on the east side of Bear Creek were at least 4 feet deep, built up from repeated flooding, and that archaeological deposits may have been buried more deeply than the 2 foot deep shovel test pits she employed. Harrison (1980a) examined Zumbro and Essex Parks in the City of Rochester and relocated a prehistoric site (21OL5) along the Zumbro River.

In addition to a literature search, Hudak (1981) conducted field survey of three previously reported historic sites and 11 additional areas. He examined areas along the South Fork Zumbro River, Cascade Creek, and Bear Creek, but all of his survey areas were close to the center of the

City of Rochester. He found that most of the areas were already heavily disturbed, and identified no new sites.

Keith Ryder (1982) conducted a surface survey through cultivated fields along the route of the proposed levee 5 feet above Bear Creek on the west bank. Although the project area is across the creek from previously reported site 21OL6/13, no cultural material was found. Residents indicated that the area flooded frequently, and soil auger tests found dark silt loam to a depth of almost a meter, underlain by stiff sand and clay.

Three reports were prepared by Corps of Engineers archaeologists. Sikkink (1987) attempted to relocate five of the sites initially recorded by Strachan and tested three of them. Only one site was identified as having prehistoric artifacts (21OL5). Eight flakes and three tiny sherds were derived from the upper 30 cm of soil, but the concentration was sparse and the site was not considered significant (Sikkink 1987:3). One other historic site was on the National Register of Historic Places and would not be impacted. Two other 1991 Corps reports (O'Mack 1991a, 1991b) were prepared for four dredge disposal areas and an equipment storage area. In mid-June the Rodney Younge property was examined and site 21OL18 was reported based on a bifacial knife found in the floodplain of Cascade Creek (O'Mack 1991a). The other 1991 survey areas along the Zumbro River (O'Mack 1991a, b) located no prehistoric sites.

A 1991 Minnesota Municipal and County Highway reconnaissance survey (Peterson et al. 1992) examined a bridge replacement through surface survey and shovel testing along the South Fork Zumbro River. Survey in cultivated fields out to about 25 m from the river found no cultural materials. Shovel testing along the river found areas of reworked soils and abandoned channels.

A 1992 Minnesota Municipal and County Highway reconnaissance survey (Peterson et al. 1993:314) also tested the area for a bridge over the South Fork Zumbro River but found largely disturbed contexts. Two shovel tests to 80 cm found no cultural material.

In 1998 surface survey along the proposed TH63 south corridor from TH52 to 48<sup>th</sup> Street SW (Stewart 1998) examined agricultural fields along a creek tributary to Willow Creek. No cultural resources were identified.

In 2001 portions of the TH63 South Corridor to 48<sup>th</sup> Street in the City of Rochester were surveyed (Twinde-Javner and Kooiman 2001), with 70 acres examined, including deep trenching in a low area near Willow Creek. Subsoil was reached in shovel tests at 35–90 cmbgs, indicating deep soils and the potential for buried deposits. One isolated, broken Durst projectile point, reported as site 21OL23, was found during shovel testing.

Also in 2001, Kelley and Madigan (2001a) conducted pedestrian survey along the approach road for a bridge replacement on CR125 near a dam on the South Fork Zumbro River within the Mayowood National Register Historic District but found no archaeological deposits and concluded that the area had been previously disturbed.

In 2002 MnDOT conducted a Phase I survey for a bridge replacement over the South Fork Zumbro River and realignment of the CR125 approaches to the bridge (Johnson and Abel 2002). Shovel testing identified one lithic scatter, 21OL26, east of the river but the authors argued that it had been redeposited, possibly during construction of the road or landscaping of the Mayowood grounds.

A 2003 survey was undertaken along a portion of Highway 52 for the Lake George haul road and gravel pit (Justin and Halverson 2003). This undulating floodplain located adjacent to the South Fork Zumbro River was considered to have high potential to contain archaeological sites. Approximately 9 acres were shovel tested. A single cord-marked sherd was found and reported as 21OL33. Because it was an isolated find and was on a floodplain terrace that had changed over the last 50 years, the sherd was presumed to represent secondary redeposition, and no additional archaeological investigations were recommended.

**Previously recorded precontact sites:** Ten precontact sites have been reported in Rochester township, with diagnostic artifacts from 21OL5 (a Woodland potsherd), and 21OL23 (a Late Archaic Durst Stemmed point). Unconfirmed reports note a short side-notched point from 21OLah that could be either Archaic or Woodland. Possible mounds reported at an eleventh site (21OL9) might be remnants of historic construction activities.

Unnamed site **21OL4** was Site K in Strachan's survey (1975:48, 60). He identified it as a prehistoric habitation site, heavily sodded, with dispersed trees and low brush, on relatively flat terrain. The soil was very wet black humus. An unnamed, currently filled-in creek lies to the north. Strachan found burned bone, chert flakes, and red ocher. A field check of the area in spring of 2011 suggests that the site may remain in woods along a stream. There is a bike path through the woods and a shopping mall on the margins.

Unnamed site **21OL5** was Strachan's Site J (1975:47, 59). This site was on a grassy knoll with deciduous and coniferous trees, and found eight flakes and a scraper of oolitic chert. O'Mack (1991b:2-3) described the setting as on a knoll formed by the western extension of the terrace line, with precipitous slopes separating the site location from the floodplain of the Zumbro River below. Sikkink recovered 10 flakes and 3 sherds, presumably grit-tempered Woodland sherds since the estimated date is after 500 BC (Sikkink 1987:3). A field check in spring of 2011 suggests that the site might still exist in woods in back or on a levee bordering the river, above one of the flood control dams, but a gravel quarry might be encroaching.

Unnamed site 21OL6 (now part of **21OL6/13**) was Site H in Strachan's survey (1975:56, 61). It was interpreted as a possible prehistoric habitation on the east side of Bear Creek, in a cornfield. Burned bone, chert flakes (some possibly worked), and historic ceramics were recovered. Site 21OL6 has been combined with 21OL13, which was Site G in Strachan's survey (1975:49, 68) and was described as a possible prehistoric habitation site in a cornfield on the east side of Bear Creek, with a concentration of chert flakes, some worked. A field check in spring 2011 suggested

that the site area is within a woods on the floodplain of Bear Creek. The area was flooded at the time of the site visit.

The **Younge site (21OL18)** was reported based on a bifacial knife of Hixton silicified sandstone found along the floodplain of Cascade Creek. This level field, planted in soybeans, was on the narrow floodplain of Cascade Creek. The creek that used to run to the northwest of the field had been channelized west of the site. Surface reconnaissance resulted in the recovery of one fragment of a bifacially worked knife of Hixton silicified sandstone. Five shovel tests in the area of the surface find failed to find any additional artifacts. The soils in this area included a 25–40 cm deep plow zone over 15–20 cm of a light brown sand or sandy clay, over coarse sand with small pebbles. There was no evidence of post-settlement alluvium to the north, immediately along Cascade Creek. On the Rodney Younge property, less than 20 cm of intact deposits existed in the area between the plow zone and the underlying alluvial deposits. In the absence of additional artifacts, this site was deemed not significant (O'Mack 1991a).

Unnamed site **21OL23** represents an isolated Archaic Durst point made of Burlington chert, broken from an impact fracture. It was found during shovel testing on a slight slope in a wooded area (Twinde-Javner and Kooiman 2001) near a tributary of Willow Creek.

Unnamed site **21OL26** was reported in 2002 (Johnson and Abel 2002). Three of four shovel tests dug for a bridge replacement over the Zumbro produced lithics, including one biface and 12 flakes of Grand Meadow and Prairie du Chien cherts, found 0–60 cm below the ground surface, with a concentration between 30 and 50 cmbgs. However, an abrupt boundary at 50–55 cm indicated that the culture-bearing deposits were not in primary context but had instead been redeposited, possibly during construction of the road or landscaping of the Mayowood grounds.

The **Zumbro Pit site (21OL33)** was reported in 2003 (Justin and Halverson 2003) from a single Woodland cord-marked sherd, but the sherd was determined to be out of primary context and redeposited.

Unnamed site **21OLah** was recorded based on a single one-inch long side-notched point eroding out of the bank along the Zumbro River and collected by a local resident who could not be located. A field check in spring 2011 suggests that the find spot might still exist in woods adjacent to a road and a dam, though the original location was too poorly defined to be certain.

Unnamed site **21OLai** was reported on the basis of a point tip found on the pebble beach along the Zumbro River and collected by a local resident who could not be located. A field check in spring 2011 indicates that this area is now covered by a high berm surrounding the flood control dam.

Unnamed site **21OLam** was reported based on a mention of a chert flake in a collection, referenced in the University of Minnesota files, but with very poor locational information.

Two sites initially reported by Strachan (1975), Site C and Site E, have been determined not to be cultural, or of questionable prehistoric origin. Unnamed site **21OL9** was Strachan's Site E (1975:55, 61). It was described as three ridges about 3 feet above the rest of the area, and a mound about 50 feet from Bear Creek on the east site. Strachan recovered bone fragments beneath several feet of fill. Sikkink tested this site with a shovel test in each ridge and concluded that they relate to historic construction (Sikkink 1987:2-3). A field check in 2010 indicates that the area is within woods in back of a shopping mall, but thick vegetation precluded a field check. Unnamed site **21OL7** was Strachan's Site C (1975:50, 62). It was described as a possible prehistoric site with burned bone found in a cornfield south of Cascade Creek, but has since been determined to not be an archaeological site. This has been pulled from the official site database and is not included in site counts.

**2010 investigations:** No additional survey was conducted in Rochester Township, given the extensive previous investigations of high-probability areas for a variety of construction and flood control projects. Several previously recorded sites were visited in spring 2011, as described by site above.

**Observations about site locations:** Despite the intensive survey of the Zumbro River and its major tributaries, especially Bear Creek, only 10 definitely precontact sites have been recorded, and they are all directly associated with waterways, especially the Zumbro. Of these 10 sites, however, six are single artifact finds (21OL18, 21OL23, 21OL33, 21OLah, 21OLai, and 21OLam), while another two sites (21OL26 and 21OL33), were interpreted as redeposited or in secondary context, leaving only three lithic scatters (21OL4, 21OL5, and 21OL6/13) found along the Zumbro, Bear Creek, and a tributary of Bear Creek. It is interesting that the three largest sites are not associated with the largest bodies of water, but instead are found with various-sized creeks and rivers. The small size of even these "largest" sites is also significant, as only a few flakes and a limited number of tools were found at any site.

**Salem Township 106N, 15W**

**Overview:** The Zumbro River runs along the east edge of Salem Township, with tributaries Salem Creek running through the center of the township and Cascade Creek running through the northern third. There are no springs or sinkholes mapped for the township. The township is a mixture of till, bedrock, loess over till and bedrock, alluvial and terrace deposits, and some pockets of upland sand and gravel.

**Previous archaeological investigations:** Hudak (1974) investigated areas within Salem township as part of the South Zumbro Watershed Project and identified site 21OL20. Several projects were conducted in 1992 for the Minnesota County and Municipal Highway Archaeological Reconnaissance Study (Peterson et al. 1993). The 1992 work examined bridge projects, including two over the Zumbro where the adjacent cultivated fields were examined but no cultural materials were found.

**Previously reported precontact sites:** Only one Archaic lithic scatter, **21OL20**, is known from Salem Township. This site was reported by Hudak (1974:10-11). Cultural material including debitage and animal bones was found on a low terrace above Salem Creek, and the landowner had collected at least five Osceola type points from the area. Phosphate testing suggested that the site was present on both sides of the creek, but it is unclear whether artifacts were found on both sides. A field check in spring 2011 indicated that it remains in woods along the creek, but high water levels precluded access.

**2010 investigations:** One parcel of 70 acres was examined on a low and higher terrace over Cascade Creek (Table 7). No cultural material was recovered.

**Table 7: Parcels surveyed in Salem Township.**

<b>Parcel</b>	<b>Acreage surveyed</b>	<b>Survey Methods</b>	<b>New sites reported</b>
106-15-10-2	70	surface	0
<b>Total</b>	<b>70</b>		

Parcel 106-15-10-2 consisted of 70 acres of cornfield, surveyed through surface reconnaissance at 15 m intervals, with 60–70% visibility. The field had sloping ridges running north/south, with glacial till on the top of the slopes and brown soil in between, suggesting some downslope erosion. It lay less than 150 m south of Cascade Creek. This parcel was neither immediately adjacent to the creek nor on the highest point of land in the area, which might account for the absence of cultural material.

**Observations about site locations:** The only known site is along Salem Creek. The low density of sites, and the absence of sites in the surveyed parcel, might suggest that these areas were not favored for occupation. One possibility might be that because all of the major creeks run east/west, none can serve as a firebreak, so the distribution of woodlands and therefore of woodland resources such as nuts, berries, and animals such as deer might be limited. The supply of firewood also might have been limited.

## **Northern Half of Olmsted County**

### **Quincy Township 107N, 11W**

**Overview:** This township has the North Fork Whitewater River flowing across the northeast corner, and the Middle Fork Whitewater River running across the southern and central portions of the township. No springs are reported except for the southwest corner, where they and the aquifer flow northeast to the corner of the county and the Whitewater River. The township has some areas of upland sand and gravel, but predominantly the landform is loess over bedrock or over glacial till, similar to the townships to the south. Stream valleys are wide with gradual slopes where the hilltops are about 100 to 150 feet higher than the river valleys.

**Previous archaeological investigations:** No modern archaeological investigations were identified for this township. However, a 1997 survey in Whitewater State Park, less than two miles into Winona County (Nienow 1997), examined 85 acres through surface survey in different topographic settings. This project found no sites in the blufftop/upland settings, but found one site on a terrace, described as a butchering/processing site that produced a knife, two end scrapers, and 77 pieces of lithic debitage made from local cherts.

**Previously reported precontact sites:** None.

**2010 investigations:** No field survey was conducted in this township in 2010.

**Viola Township 107N, 12W**

**Overview:** The upper reaches of the Middle Branch Whitewater River flow west and then north through Viola Township. The southwest corner enters the Zumbro river drainage. Springs are common, flowing to the north to the Whitewater drainage. The landform is loess over bedrock or over glacial till, similar to the townships to the south. Hilltops in this area are somewhat higher than to the east, but valleys are not as deep, producing less relief, sometimes less than 100 feet between valley and hilltop, as the upper reaches of the tributaries of the Whitewater are reached.

**Previous archaeological investigations:** A 1991 survey for the Minnesota Municipal and County Highway Archaeological Reconnaissance Study (Peterson et al. 1992) examined 0.13 miles around a bridge replacement over the North Fork Whitewater River north of Viola. Surface survey in the adjoining cultivated fields found no cultural materials.

**Previously reported precontact sites:** None.

**2010 investigations:** No field survey was conducted in this township in 2010.

### **Haverhill Township 107N, 13W**

**Overview:** The northeast corner of Haverhill Township has the upper reaches of the Whitewater River, and the southwest portion is in the Zumbro drainage, with Silver Creek flowing across the southern third of the township to drain west to the Zumbro. There are a number of springs mapped for Haverhill Township, and they tend to flow north and west from a centerpoint in Section 25. The landform is similar to farther south, with loess over glacial till and bedrock, and with alluvial and terrace systems along the major rivers. Relief in the area is greater than seen in the headwaters of the Whitewater river to the east. Here, streams that flow to the Zumbro are more deeply cut and there can be 200 feet difference in elevation between stream bottom and ridgetop.

**Previous archaeological investigations:** A 1991 survey for the Minnesota County and Municipal Highway Archaeological Reconnaissance Study (Peterson et al. 1992) examined a bridge over Silver Creek, 2.5 miles east of Rochester. Shovel testing and surface reconnaissance over 0.23 miles examined low terraces and level ground near the creek. Two shovel tests were excavated to 60 cm through dark brown and brown silt loam. No cultural material was identified.

In 1992 a survey for TH63 reconstruction (Johnson 1992a) looked at 300 feet on either side of the centerline of the highway, with shovel testing in areas thought to have the potential for archaeological sites. The survey went through Section 6 of this township, as well as Cascade and Farmington Townships, and would have crossed several streams and general upland settings. No cultural material was identified in this township, although a flake was found in Cascade Township.

In 2005 a Phase I survey for the Silver Creek Sanitary Sewer Sub-Trunkline Project resulted in the reporting of the Hruska site (21OL39), where a local resident had been collecting Clovis points.

**Previously recorded precontact sites:** The **Hruska site (21OL39)** is north of Silver Creek, on a low south-facing terrace near where a stream drains from the hillside into Silver Creek. This Paleoindian Clovis workshop came to the attention of professional archaeologists when plans by the City for the Silver Creek Sewer project in 2004 prompted a resident to report that he had been collecting artifacts from the project area for years. These artifacts included a Paleoindian Clovis point, the midsection of a fluted point, a drill, and other tools (Figures 13 and 14). This discovery led to systematic survey of the area by The 106 Group, when two flakes and the midsection of a point were recovered (Vermeer 2005), and the project was redesigned to avoid the site. The artifacts were predominantly from local raw materials, including Cedar Valley and Grand Meadow cherts (Koenen 2007:4). Limited testing in August 2006 by the Office of the State Archaeologist and NRCS consisted of a 1 × 1 m excavation unit, shovel tests, and soil cores. Only limited artifacts were recovered, and they appeared to be concentrated at the interface of the A and B soil horizons, which is also near the base of the plow zone. Soils

consisted of a plow zone over 40 cm of subsoil, with a cobble layer at 60 cmbgs. Thus, it is unclear whether there are intact archaeological deposits beneath the plow zone (Anfinson 2007).



**Figure 13: 21OL39 Hruska site artifacts from Lonny Asher collection [Vermeer 2005; Koenen 2007] From left: midsection of biface or point; point sharpened into drill; fluted point; nine unidentified lithics that may be scrapers and utilized flakes; possible pecked stone**



**Figure 14: 21OL39 artifacts from Lonny Asher collection photographed in 2006 (Koenen 2007).**

**2010 investigations:** Parcels within the Haverhill Wildlife Management Area were targeted for surface survey and shovel testing in July 2010. The area surveyed lies along several tributaries to Silver Creek, with shovel-tested tracts on higher ground over the stream and a large area of surface collection on a gentle slope above another tributary (Table 8).

**Table 8: Parcels surveyed in Haverhill Township.**

<b>Parcel</b>	<b>Acreage surveyed</b>	<b>Survey methods</b>	<b>New sites reported</b>
107-13-22/26/27-1	2.8	ST	0
same	50	surface	0
<b>Total</b>	<b>52.8</b>		

Parcel 107-13-22/26/27-1 had a variety of landforms, and was covered with tall prairie grasses near the creek and on a high ridge, and woods in the northwest section. These areas were tested with a line of shovel tests at 15 m intervals on each landform, while 50 acres of flat corn and bean fields were surface collected, also at 15 m intervals. No cultural materials were recovered.

**Observations about site locations:** The presence of a Clovis workshop, probably the oldest site in Olmsted County, verifies the long-term use of the region. The presence of exotic raw materials indicates that people were in contact or traveled great distances to obtain lithic raw materials. The presence of the Hruska site on a small tributary 2 miles from the Zumbro River suggests movement cross-country, not just along major waterways.

### **Cascade Township 107N, 14W**

**Overview:** The Zumbro River flows south through the east half of Cascade Township, with tributaries such as Cascade Creek flowing to the southwest and Silver Creek to the southeast. Other unnamed creeks flow west to meet tributaries of the South Branch Middle Fork Zumbro River. This area has no springs mapped, except along the border with Haverhill Township. The landscape consists of loess over glacial till or bedrock, similar to adjoining townships. Relief is often less than 100 feet between stream bottom and hilltop.

**Previous archaeological investigations:** Many of the previous archaeological projects that examined areas around the Zumbro River for various flood control projects were discussed earlier with Rochester Township. These included work by Strachan (1975), Harrison (1980a), Hudak (1981), and Sikkink (1987) and a number of municipal and trunk highway surveys. Additional projects in Cascade Township include the following:

Phase I survey for the expansion of a segment of TH 63 shovel tested non-cultivated portions of the right-of-way and found undisturbed soil but no cultural material (Peterson 1981).

A Phase I survey of the 55<sup>th</sup> Street NE corridor in Rochester (Pratt 1989) included surface survey and shovel testing at 15 m intervals. Survey included areas along the east bank of the Zumbro River. A lithic scatter consisting of three flakes and one bone fragment was found near a beach ridge interpreted as redeposited. This location was subsequently designated 21OLaj.

A 1992 survey for TH63 reconstruction (Johnson 1992a) looked at 300 feet on either side of the centerline of the highway, with shovel testing in areas thought to have the potential for archaeological sites. The survey went through Cascade Township as well as Haverhill and Farmington Townships. A single flake of Hixton silicified sandstone was reported (21OLak) from a cultivated field on the edge of the project.

In 1993, the Furlow Farm project area just south of Cascade Creek was investigated for use as a disposal site for the Corps of Engineers (Arzigian 1993). Post-settlement alluvium up to a meter thick was documented through backhoe trenches excavated down to the prehistoric land surface and into the subsoil. No cultural materials were identified.

In 1993 a Phase I inventory was conducted along TH14/52 for 10 miles between CSAH 14 and TH63 but did not identify any areas likely to contain precontact archaeological deposits (Bourgerie et al. 1994).

In 2006 more than a mile of floodplain of the South Fork Zumbro River and Rocky Creek was examined for a sewer alignment (Ollendorf 2006a). Because of the possibility of deeply buried sites, six backhoe trenches up to 4 m deep were excavated, and five were found to have buried soil deposits, but no cultural materials were recovered.

**Previously recorded precontact sites:** Five sites are recorded for Cascade Township; four have only letter designations. Unnamed site **21OL8**, a lithic scatter, lies on a high bank on the east side of the South Fork Zumbro River. Artifacts were found in brush. The **Rossi site (21OLac)** was recorded based on a find of an Archaic grooved axe by a collector, in the creek by Northbrook Golf Course, but the precise location is unknown. Unnamed site **21OLaj** was based on three flakes and one small mammal bone fragment found near a beach ridge on the far end of a terrace over the Zumbro River (Pratt 1989). These materials were interpreted as redeposited. Unnamed site **21OLak** consists of a single flake of Hixton silicified sandstone (Johnson 1992a) found during surface survey on a terrace above a creek tributary to the South Fork Zumbro River. At the **Truax site (21OLz)**, a single side-notched projectile point found by the landowner in a garden was reported during survey for a bridge replacement but intensive surface survey by archaeologists did not find additional cultural material in the area (Anfinson and Peterson 1989:175-176). The site lies near the junction of a stream with the Zumbro River.

**2010 investigations:** No formal field survey was conducted in 2010. However, Arzigian met several times with local residents and city officials concerning Indian Heights Park. Historic narratives suggest that several Native Americans had been buried on bluffs overlooking the Zumbro River, but the remains were subsequently washed away. Local plans to construct trails through the park have prompted efforts to document and protect any possible burials or other cultural resources relating to both Native Americans and early white settlers.

**Observations about site locations:** Sites in this township have been reported by both professional survey and by collectors. All seem to be associated with either the Zumbro River or one of its major tributaries.

### **Kalmar Township 107N, 15W**

**Overview:** Kalmar Township lies entirely within the Zumbro River drainage, with the South Branch Middle Fork of the Zumbro flowing across the north and west, and a tributary, Thompson Creek, flowing from the southwest to join it. Otherwise the county is a dendritic system of unnamed intermittent and small streams. Springs on the western edge of the township flow down to the Zumbro. There are some sinkholes in Sections 4, 5, 8, and 17, near where the South Branch Middle Fork Zumbro River makes a loop or oxbow. As with neighboring areas, the landscape is dominated by loess over bedrock or over till. Relief here is relatively low, similar to Cascade township, except on the west by the Zumbro river where the valleys are more deeply incised and there may be 200 feet difference between stream bottom and hilltop.

**Previous archaeological investigations:** Two previous projects led to the identification of six sites, including four within the Oxbow Park area on the Zumbro River. In 1977 a survey of the 600 foot wide Byron outfall sewer line (Benn 1977) crossed the Zumbro and overlapped Oxbow Park. Surface collection and shovel testing identified two sites (21OL2 and 21OL10), and two others were reported based on information from a local informant (21OLu, and 21OLv).

An initial survey for the Northern Natural Gas Company Rochester Rehab Project Corridor (Breakey and Dobbs 1995; Cater and Dobbs 1995) extended through Olmsted County, but found no cultural materials, although the project tested areas near Masten's Creek and other drainages. Some areas were disturbed, and the investigators argued that other drainages were the result of Euro-American activities.

Phase I survey for a bridge replacement and road realignment on CR-105 (Kelley and Madigan 2001b) included shovel testing near the Zumbro River just east of Oxbow Park. Two sites, 21OL24 and 21OL25, were reported but were interpreted as ineligible to the National Register, and the SHPO concurred. Based on current air photos the sites now appear to be beneath the road.

**Previously recorded precontact sites:** The only recorded sites in this township are the six reported in the above surveys. Unnamed site **21OL2** is an artifact scatter that now lies within Oxbow Park and Zollman Zoo (Benn 1977). Earlier shovel testing produced a point blade fragment and a long bone fragment with butchering cuts described as coming from a stone tool, both from 0–20 cm below the surface. Surface finds included 20 chert flakes, three sherds (one cord roughened, one cord-wrapped stick stamped), four biface fragments, a piece of fire-cracked rock, a canine tooth (possibly from a bear), and a long bone fragment. The decorated sherd helps associate the site with the Southeast Minnesota Late Woodland cultural context. Although cultural material was recovered only from the plow zone (0–20 cm depth), Benn argued that undisturbed materials might exist on the west side of the site on a talus slope. It is unclear from the site files whether construction avoided impacting this site. A field visit to Oxbow Park in 2010 showed that the site is now within woods with the Sumac Trail encircling it.

Unnamed site **21OL10** was a lithic scatter also identified in Oxbow Park (Benn 1977) on a terrace of the Zumbro River. The park ranger had collected two side-notched “eared” points and a retouched bifacial blade. Additional material collected from shovel tests (all in plow zone) included eight flakes, a retouched flake, and a hammerstone. Benn argued that the soils appeared degraded by cultivation and erosion, and all of the cultural material from shovel tests was found within the plow zone. It is unclear from the site files whether construction avoided impacting this site. A field check in 2010 suggested that the site is within a grassy and wooded area between the river and the main road through the park, with a trail running nearby.

Unnamed site **21OL24** was identified from a single flake recovered from the surface of a low terrace of the Zumbro River (Kelley and Madigan 2001b). The investigators argued that the site was not eligible to the National Register and SHPO concurred; based on air photos the site appear to be now beneath the road.

Unnamed site **21OL25** was a lithic scatter recovered during bridge realignment over the Zumbro river east of Oxbow park (Kelley and Madigan 2001b). As noted earlier, the investigators argued that the site was not eligible for the National Register and the SHPO concurred. Current air photos suggest that the site is now beneath the road.

Unnamed site **21OLu**, a concentration of chert flakes, was reported based on collections made by the Oxbow Park ranger but not field checked (Benn 1977). Materials came from a terrace on the east side of the Zumbro River in a sod-covered picnic area that could not be field checked. This area was outside the boundaries to be impacted by sewer construction. According to a 2010 field visit, this site is still in a campground and picnic area within the park.

The sixth site, unnamed **21OLv**, was another concentration of chert flakes reported based on collections by the Oxbow Park ranger but not field checked (Benn 1977). This site was on a low ridge in an alfalfa field between a farmstead-zoo and a parking lot. This location was outside the area to be impacted by sewer construction. In 2010 this area appeared to still be within a cultivated field near the zoo.

**2010 investigations:** Some of the previously recorded sites were revisited during the 2010 project, as noted in the previous section. One 12-acre parcel was surveyed in 2010 (Table 9).

**Table 9: Parcels surveyed in Kalmar township.**

Parcel	Acreage surveyed	Survey methods	New sites reported
107-15-28-1	12	surface	0
<b>Total</b>	<b>12</b>		

Parcel 107-15-28-1 represents one of the last agricultural fields on the outskirts of Byron. The area has been heavily developed, with housing subdivisions that all appear very recent. The parcel lies along the headwaters of an intermittent stream that drains to the north. The land was generally flat, with a slight slope upward to the east. The soil was dark brown throughout, suggesting minimal erosion or redeposition. A surface survey interval of 5 m was used because visibility in this well-washed cornfield was only 40–50%.

**Observations about site location:** There is a cluster of sites within an oxbow of the Zumbro River. This area would have offered fresh water, transportation, and riverine resources. The sites lie east of the river or east of curves in the river, and these curves might also have created a protected niche where the river served as a firebreak from any prairie fires from the west. This protection could have encouraged the growth of woody vegetation, providing additional plant resources and attracting a wide range of mammals. This cluster of sites is also within the sections mapped as having sinkholes, although none were mentioned by archaeologists or reported by the park ranger in the vicinity of the park.

**Farmington Township 108N, 13W**

Overview: Farmington is dominated by tributaries of the Zumbro river, with Silver Creek flowing north to join the Zumbro in Wabasha County. The southeast corner has upper tributaries of the North Branch Whitewater river. No springs have been reported for the township, and the landscape is dominated by loess over bedrock and till, with some pockets of upland sand and gravel and a few sinkholes. Relief is relatively low, similar to townships to the south.

**Previous archaeological investigations:** In 1992 a survey for TH63 reconstruction (Johnson 1992a) looked at 300 feet on either side of the centerline of the highway, shovel testing areas thought to have the potential for archaeological site. The survey went through Farmington township, as well as Haverhill and Cascade. No cultural material was found in this township.

**Previously reported precontact sites:** None

**2010 investigations:** No fields were surveyed. This township had many hayfields that could not be examined, and at the time of the survey many of the cornfields had just been sprayed with herbicides, so that the crew were not permitted entry.

### **Oronoco Township 108N, 14W**

**Overview:** Oronoco Township lies entirely within the Zumbro River drainage, with the river flowing south to north along the eastern third of the township, and the Middle Fork entering from the west. There are no springs in the township; a few sinkholes have been recorded. The land is covered with loess over till and bedrock, with pockets of upland sand and gravel. Relief is relatively flat except along the Zumbro river where there can be more than 150 feet difference between the valley and hilltop.

**Previous archaeological investigations:** Four recent projects that examined areas in Oronoco Township found much disturbed land, particularly around the city of Oronoco. Phase I and II archaeology and geomorphology along TH52 between Pine Island and Oronoco (Kluth 2002) identified three sites in this township and an additional three in New Haven Township. A 2005 survey for a cell tower in a general uplands setting northeast of Oronoco (Holtz-Leith 2005) included surface survey at 5 m intervals and one shovel test that showed subsoil 38 cm below the ground surface. No cultural resources were identified. In 2006 a survey was conducted for a canoe access point along the north side of the Middle Fork Zumbro River in the City of Oronoco, for the Minnesota DNR Trails and Waterways Cultural Resources Program. Surface survey and shovel testing found no precontact cultural material or buried deposits (Tumberg 2009). Finally, in a 2009 survey for a water system improvement project for the City of Oronoco (Harrison 2009) straddled the Middle Fork Zumbro River and found heavily disturbed soils and no cultural materials.

**Previously reported precontact sites:** Three sites were reported by Kluth (2002) on Shady Lake, west of Oronoco. The **Davis site 21OL29** consisted of a flake of Cedar Valley chert and a small Matanzas-like point of heat-treated Swan River chert found in shovel tests on a river terrace over the Middle Fork Zumbro River (now on a lakeshore formed by damming of the river) (Kluth 2002:38). Despite intensive shovel testing, no additional artifacts were recovered, and the site was not recommended as eligible for listing on the National Register.

The **Shady Lake site (21OL30)** was an artifact scatter found on a terrace a few feet above Shady Lake, a dammed portion of the Middle Fork Zumbro River (Kluth 2002:41). Three shovel tests produced 11 flakes of Prairie du Chien chert. The site was recommended for further testing as potentially eligible for listing on the National Register. Subsequent Phase II investigations consisting of two 1 x 2 meter units found 68 pieces of lithic debris and two tools but no prehistoric features. The site was considered to not be eligible to the National Register and no additional work was recommended (Kluth 2002:64-69).

The **South Branch site (21OL32)** was a lithic scatter found in a wooded lot on a high ridge overlooking the floodplain of the South Branch Zumbro River. It appeared to be previously disturbed (Kluth 2002:52).

**2010 investigations:** No field survey was conducted in this township in 2010.

**General observations:** The three sites reported along Shady Lake match the expected distribution of sites in areas of high probability. They are on higher points of land adjacent to major rivers. Even these sites are not large or dense with artifacts.

### **New Haven Township 108N, 15W**

**Overview:** This township is dominated by the Middle Fork Zumbro River, which crosses the township east and west, and its tributaries. The only springs reported for this township are in the southwest corner. The landform is dominated by loess over till and bedrock with some alluvial deposits along the river and pockets of upland sand and gravel. Relief is generally gradual except along the Zumbro river where there are bluffs lining the river that are more than 100 feet high.

**Previous archaeological investigations:** Phase I and II archaeology and geomorphology along TH52 between Pine Island and Oronoco (Kluth 2002) examined segments on terraces of the Middle Fork Zumbro River, and reported three sites in New Haven Township, described below.

**Previously recorded precontact sites:** A cluster of three sites was found along the Middle Fork Zumbro River. The first, **Traxler I.F. (21OL27)**, was a single flake of Prairie du Chien chert found in a shovel test in a residential yard, 80–90 cm below the ground surface in a narrow finger of land between the main channel of the Zumbro and a small but deep channel that enters the river (Kluth 2002:32). The second site, **Middle Zumbro Terrace (21OL28)** is a lithic scatter on a higher terrace overlooking the Middle Fork Zumbro River and its floodplain (Kluth 2002:35); it was identified through four positive shovel tests that produced 17 flakes. Due to the amount of material in a small area, Phase II investigations were conducted, consisting of 21 shovel tests and four 1 x 2 meter units. These produced a total of 41 flakes from 12 positive shovel tests, and 218 artifacts, primarily lithic debris of Prairie du Chien chert, as well as one flake of Cedar Valley Chert and three flakes of an unknown chert, and 7 tool or core fragments, including three preforms, one spoke shave, one edge scraper and two core fragments, all of Prairie du Chien chert, as well as some fire-cracked rock from two units. Only 42 artifacts came from below the plow zone. Because most material was from the plow zone and there were no features or diagnostic artifacts, the site was argued to have been severely impacted by cultivation, and was not recommended as eligible to the National Register (Kluth 2002:58-64).

The third site, **Middle Zumbro I. F. (21OL31)**, consisted of a single flake of heat-treated Hixton silicified sandstone found in a cultivated field at the top of a high ridge overlooking the floodplain and terrace of the Middle Fork Zumbro River. It was not recommended as eligible for the National Register (Kluth 2002:50)

**2010 investigations:** No field survey was conducted in this township in 2010.

**Observations on site locations:** As with the township just to the east, there is a cluster of three small sites on low and high terraces over a major river; two of these sites are single artifact finds. The largest site was on the edge of the highest terrace, almost 1000 feet from the river.

## NARRATIVE PREDICTIVE MODEL

### Previous predictive models

Previous predictive models and discussions on site location have been generated for the region. The 1977–1980 Statewide Archaeological Survey (SAS) (Minnesota Historical Society 1981) found that in general sites were associated with shorelines, but the nature of the water varied by region. Where present, lakeshores were more significant than rivers, but Region 3 has no lakes, and thus, rivers would be the most important feature. Where rivers were deeply incised, sites tended to be further from the water. Sites away from water tended to be small and occur at low densities. Finally, the Driftless Area of southeastern Minnesota was found to have sites less tightly associated with shorelines and more widely dispersed through the landscape.

No survey was conducted in Olmsted County as part of the 1977–1980 SAS (Minnesota Historical Society 1981), but based on adjacent counties, Anfinson (1990:156) predicted site locations in archaeological Region 3:

*Base camps should be located on terraces in major river valleys, especially where streams or springs are present. Temporary camps should be on rivers or streams. Subsistence-oriented resource procurement sites could be anywhere, depending on the resource being utilized (e.g., upland fauna, fishing, acorn gathering). Lithic resource procurement sites could be at appropriate major bedrock exposures along river valley walls or upland locations. Special use sites could be anywhere, with mound sites on hills or high terraces in the proximity of base camps.*

Region 3 includes the Root River, and Anfinson notes that “of all the SAS surveys in Minnesota, the Root River area had the only high correlation between sites and away-from-water locations” (Anfinson 1990:157). This may also apply to Olmsted County, and as will be discussed below, might be a result of numerous springs that could draw people into areas distant from permanent streams.

Mn/Model (Hudak et al. 2002) included Olmsted County as part of three modeled zones: Rochester Plateau, which contained most of the county, as well as strips of Blufflands and Oak Savanna. Due to a lack of sufficient sites to use for modeling, the site data from the Rochester Plateau (81 sites) and Blufflands (554 sites) were combined to create the Rochester Plateau model. In that model, a large part of the southwest half of the county is rated as high or medium probability, but this is because the model cannot eliminate much land from consideration because of lack of previous surveys. Areas mapped as high for their adequacy of previous surveys (Hobbs et al. 2002:Figure 8.24.3; see Figure 15) are within the northern half of the county, particularly along US Highways 52 and 63, and CSAH 55, as well as along the Zumbro River in Rochester, with the rest of the county having a low rating, indicating insufficient survey.

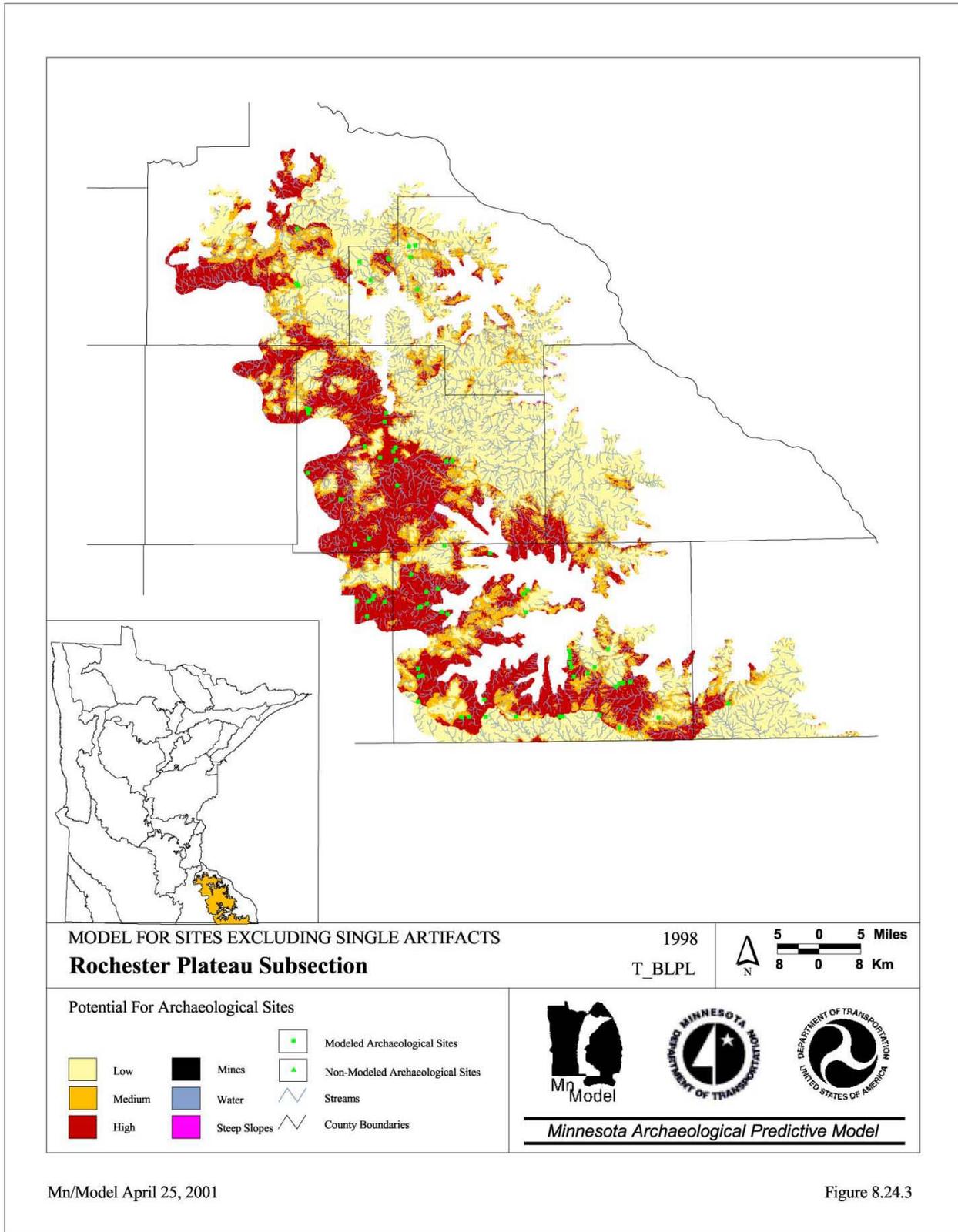


Figure 15: Mn/Model model for Rochester Plateau subsection, showing potential for archaeological sites (taken from Hobbs et al. 2002:Figure 8.24.3).

Based on work throughout the whole Rochester Plateau and Blufflands, Mn/Model identified four variables associated with archaeological sites that had a correlation coefficient above 0.3. These were (1) *distance to nearest major ridge or divide*, (2) *elevation*, (3) *distance to edge of nearest swamp*, and (4) *distance to glacial lake sediment* (Hobbs et al. 2002:8.24.2.3.1). The strongest correlation was found with the variable *distance to edge of nearest swamp*. Mn/Model notes that

*Swamps in this subsection are in river valleys and often serve as segments of rivers in the digital data. It may identify certain kinds of places in river valleys, perhaps wider and flatter places, that are associated with both swamps and archaeological sites. It may also indicate the value of swamps for protection from fires and as a source of firewood [Hobbs et al. 2002:8.24.2.3.1].*

Mn/Model also notes that sites tend to be further from the nearest major ridge or divide than random points, supporting the idea that sites are associated with the river valleys. Sites are also found in the larger watersheds, further from conifers, and further from prairies than random points. However, it should be noted that many of the previous surveys in Olmsted County were done in the larger watersheds, so that inadequate representation of other components of the landscape may be affecting Mn/Model's results.

Strips of the Blufflands subsection enter Olmsted County from the south along the Root River, from the north along the Zumbro, and from the east along the Middle Branch Whitewater drainage. Mn/Model results suggest that in the Blufflands subsection sites are associated with large streams and rivers and tend to be on more level land, somewhat closer to major and minor divides, lower in elevation and closer to water than are random points.

The Oak Savanna subsection enters Olmsted County on the west, along the Middle Fork Zumbro River drainage. Mn/Model predicts zones of high and medium site potential around the margins of lakes, wetlands, areas of organic soil, and river valleys, with sites scattered along river courses (Hobbs et al. 2002:8.21.2.1). Sites also tend to be somewhat higher than their surroundings and to be in areas of vegetation diversity (Hobbs et al. 2002:8.21.2.3.1).

Thus, previous predictions of archaeological sites for Olmsted County have not been robust. They have focused on water features, particularly swamps and major rivers, and elevation, tending to be at lower elevations but higher than the immediate surroundings. As Anfinson's 1990 discussion indicates, site locations will vary by the type of site, with some types being very difficult to predict as they are responsive to impermanent or mobile resources such as fauna or patches of productive nut-bearing trees.

## Archaeological Sites

Prior to the 2010 survey only 38 prehistoric sites had been assigned archaeological site numbers in Olmsted County; another 19 unnumbered sites have poorly known locations. None of these sites has been professionally excavated, although some have been tested. Of the 57 previously known sites, most are artifact or lithic scatters, with 6 reported as mound sites (though none of the mounds has been verified) and 15 as single-artifact find spots.

In 2010, nine new sites were located and one previously recorded site's location was pinpointed and diagnostic artifacts were recovered. The project also reviewed the reported information on all of the known sites and was able to make suggestions for more specific cultural determinations. Table 10 lists all of the prehistoric sites in Olmsted County, with the type of site, the tradition, and the context. The basis for the tradition attribution is also indicated, and an attempt has been made to narrow down the period for sites where diagnostic artifacts were recovered or reported. These attributions are not all firm, as some sites are based on informants' reports rather than original fieldwork, but these are the best estimates based on the known information.

**Table 10: List of previously reported and new sites (IN CAPS) with description, cultural tradition, and context. Previously reported sites in *bold italics* were investigated in 2010 through archaeological or geomorphological investigations.**

Site Number	Site Name	Descript	Tradition	Context
<i>21OL1</i>		<i>Lithic scatter</i>	<i>EARLY ARCHAIC [KIRK-LIKE POINT]</i>	<i>Archaic</i>
21OL2		Artifact scatter	Woodland [pottery]	Southeast Minnesota Late Woodland
21OL3	Engel	Earthworks, artifact scatter	Woodland –based on possible mounds	
21OL4		Lithic scatter		
21OL5		Lithic scatter		
21OL6	(same as 21OL13)	Artifact scatter		
21OL8		Lithic scatter		
21OL9		Earthworks [MODERN?]		
21OL10		Lithic scatter		
21OL11	Sand Bank	Lithic scatter		
21OL12		Lithic scatter		

Site Number	Site Name	Descript	Tradition	Context
<i>21OL14</i>	<i>Keller I</i>	<i>Lithic scatter</i>		
<i>21OL15</i>	<i>Keller II</i>	<i>Artifact scatter</i>	<i>Woodland [pottery]</i>	<i>Late Woodland?</i>
21OL16		Lithic scatter		
21OL17		Lithic scatter		
21OL18	Younge	Single artifact		
21OL19		Lithic scatter	Middle Archaic [fully grooved axe]	Archaic?
21OL20		Artifact scatter	Middle Archaic [Osceola points]	
<i>21OL21</i>	<i>Muenter I</i>	<i>Artifact scatter</i>	<i>Woodland [pottery]</i>	<i>Southeast Minnesota Late Woodland?</i>
<i>21OL22</i>	<i>Muenter II</i>	<i>Artifact scatter</i>	<i>Archaic? [obliquely side-notched point]; Woodland [pottery]</i>	<i>Archaic? Southeast Minnesota Late Woodland</i>
21OL23		Single artifact	Late Archaic [Durst Stemmed]	Prairie Archaic
21OL24		Single artifact		
21OL25		Lithic scatter		
21OL26		Lithic scatter		
21OL27	Traxler I. F.	Single artifact		
21OL28	Middle Zumbro Terrace	Lithic scatter		
21OL29	Davis	Lithic scatter	Late Archaic [Matanzas-like point]	Riverine Archaic
21OL30	Shady Lake	Artifact scatter		
21OL31	Middle Zumbro I F.	Single artifact		
21OL32	South Branch	Lithic scatter		
21OL33	Zumbro Pit	Single artifact	Woodland [pottery]	

Site Number	Site Name	Descript	Tradition	Context
21OL34		Lithic scatter		
21OL39	Hruska	Lithic scatter	Early Paleoindian	Clovis
21OL40	Raynard Johnson	Lithic scatter		
21OL43	Koenig	Single artifact	Paleoindian	Lanceolate Point/Plano
<b>21OL44</b>	<b>Schumann Cache</b>	<b>Lithic scatter</b>	<b>Paleoindian</b>	<b>Clovis?</b>
21OL45	Schumann Biface	Single artifact		
<b>21OL46</b>	<b>VERMILYA I</b>	<b>LITHIC SCATTER</b>	<b>MIDDLE ARCHAIC [RADDATZ POINT]</b>	
<b>21OL48</b>	<b>HINCKLEY</b>	<b>SINGLE ARTIFACT</b>		
<b>21OL49</b>	<b>BUSTER'S GARDEN</b>	<b>LITHIC SCATTER</b>		
<b>21OL50</b>	<b>AXE SITE</b>	<b>LITHIC SCATTER</b>	<b>MIDDLE ARCHAIC [FULLY GROOVED AXE]</b>	
<b>21OL51</b>	<b>DECOOK 1</b>	<b>SINGLE ARTIFACT</b>		
<b>21OL52</b>	<b>DECOOK 2</b>	<b>SINGLE ARTIFACT</b>		
<b>21OL53</b>	<b>VERMILYA 2</b>	<b>LITHIC SCATTER</b>		
<b>21OL54</b>	<b>VERMILYA 3</b>	<b>SINGLE ARTIFACT</b>		
<b>21OL55</b>	<b>KELLER III</b>	<b>LITHIC SCATTER</b>		
21OLaa	Raygor	Artifact scatter		
21OLab	Stroebel	Artifact scatter		
21OLac	Rossi	Single artifact	Middle Archaic? [grooved axe]	
21OLad	Simpson	Earthworks	Woodland-based on possible mounds	
21OLae	High Forest	Lithic scatter		
21OLaf	Oehlke	Earthworks	Woodland-based on	

Site Number	Site Name	Descript	Tradition	Context
			possible mounds	
21OLag	Muenter	Earthworks, artifact scatter	Woodland—based on possible mounds	
21OLah		Single artifact		
21OLai		Single artifact		
21OLaj		Lithic scatter		
21OLak		Single artifact		
21OLal		Lithic scatter		
21OLam		Single artifact		
21OLan		Lithic scatter		
21OLu		Artifact scatter		
21OLv		Artifact scatter		
21OLx	Trapp Mounds	Earthworks	Woodland? —based on possible mounds	
21OLy	Schumann	Lithic scatter		
21OLz	Truax	Single Artifact		

Of the 65 sites now reported from Olmsted County, three are Paleoindian, nine are Archaic, and five are Woodland (excluding sites attributed to Woodland based only on the reported presence of mounds—see discussion on mounds below). Because of climatic changes and evolution of the landscape during the post-Pleistocene era, the people living during each cultural period likely had to adapt to different environmental conditions and may have shown varying strategies. Therefore the periods will be examined separately before some generalizations about site locations are presented.

### **Cultural chronology and site location**

**Paleoindian.** Of the three known Paleoindian sites, one includes a Clovis point associated with other lithics, one is a cache of bifaces and flakes that is probably associated with Clovis, and the third is an isolated lanceolate point. These sites are in three different townships throughout the center of the county and along three different drainages. The Schumann Cache is on an upper tributary about one mile from its junction with the Whitewater River. It is also near the interfluvium separating the Whitewater drainage, which flows east, from the westward-flowing Zumbro River. The Koenig site (21OL43) is on a terrace overlooking the Root River, and the Hruska Clovis point find (21OL39) is on a terrace about 900 feet from Silver Creek, two miles (measured straight) from its junction with the Zumbro. The locations of all three sites within two

miles of a major waterway may suggest travel routes. The presence of the Schumann Cache near the divide between the Whitewater, Zumbro, and Root also suggests travel between regions along the drainage divides.

At least the Hruska site and probably the Schumann Cache would have been occupied prior to much of the post-glacial river valley evolution. Thus, modern environmental variables may not apply. The results of geomorphological testing at the Schumann Locality (see below) revealed an area of wet organic deposits in the small upland stream basin near the site that would have been an ancient wetland and could have served as a draw for Clovis peoples. The geomorphological analysis identified a series of histosol soils that might represent similar ancient wetlands that could be considered important site location variables for Paleoindian sites.

There is also potential in the county for buried Paleoindian landscapes. The results of geomorphological testing at the Schumann Locality (see below) suggest that archaeological deposits in small watersheds might be buried on the low terraces, in vertical accretion alluvium on the floodplains, and in organic sediments in wetlands.

**Archaic.** Nine sites have an Archaic component. One of these is probably Early Archaic, based on a fragment of a Kirk-like point (21OL1) recovered during 2010. It is on a terrace east of the North Branch of the Root River. This location matches that of the Paleoindian sites in that it is adjacent to a major waterway.

Three sites, including one discovered in 2010, are identified as Archaic, possibly Middle Archaic because of the presence of a grooved axe. Site 21OL19 is on a knoll adjacent to the South Fork Zumbro River and east of the Zumbro and another stream. The Axe site (21OL50) is on a terrace within a bend of the North Branch Root River. The Rossi site (21OLac) was found in a creek on the east side of a deep, wide valley that is tributary to the Zumbro River. All three of these sites lie within what would have been a fire-shadow, or an area that would likely not have experienced regular prairie fires because a body of water to the west would have blocked a prairie fire's passage. Since the wind in the region typically blows from west to east, this is the direction in which fires would have moved. Thus, areas east of a firebreak would have been less likely to experience fires. Areas such as these that are along waterways would be able to support trees, probably in larger numbers than in areas directly exposed to fires. Thus, these areas also would have attracted wild animals. Humans would have been drawn to areas of forest vegetation because of the availability of firewood, wood for tools and shelter, and animals and wild plant foods. Thus, these axes may mark areas where, during the Archaic period, there were trees. In counties that are largely wooded there may not have been much special attraction to any particular woods, but in a landscape dominated by broad stretches of prairie vegetation, wooded areas and all the resources they offer may have been sufficient incentive to attract people.

The axe recovered in 2010, and many of the axes seen in the Olmsted County History Center, have both a bit end for cutting wood and a blunt battering end. There are also a number of mauls (Figure 16) used for pounding and crushing rather than chopping. The maul or the crushing end

of an axe might have been used for pounding stakes into the ground or some such usage, but what is also likely is that they were used to crush bison bones to recover bone marrow, as suggested at bison kill sites on the Plains (Link 1999). Deer bones are relatively small and do not require great effort to break with a hand-held hammer, but bison bones are significantly larger and stronger and could have benefited from a heavy, hafted hammer, such as the axes or mauls. If this interpretation is correct, the axes at least might have been used at two very different habitats, the woods along streams and the prairies where bison were found. Archaic peoples are thought to have moved camp regularly, as did most people until late in prehistory. Thus, we may be seeing evidence of regular usage of two distinct habitats.

These types of sites might be expected in areas that are within fire shadows, or east of landforms or water bodies that could have served as fire breaks. Within those areas, sites are located on higher elevations near major rivers.



**Figure 16: Examples of mauls from the Peck collection, which came predominantly from Olmsted County (from collections in the Olmsted County History Center).**

Two other sites were identified as Middle Archaic based on projectile points, an Osceola point at 21OL20, and a Raddatz at Vermilya 1 (21OL46, discovered in 2010). Both sites were found on

low terraces on the side of a creek. Thus, if the above prediction about the location of sites with axes is correct, then sites without axes would not necessarily be associated with fire-breaks, and that is true here. In these cases, access to fresh water seems a priority. These sites may have been occupied at the end of the drier Altithermal, perhaps a time when the smaller streams once again had a reliable flow. It is possible that during the peak of the drought these smaller streams had dried up. Since much of the county is drained by what are mapped now as intermittent streams, during drier periods the spring-fed or more reliable water sources may have been the attraction.

To predict these types of sites, terraces of spring-fed streams would have a higher probability of sites than streams that collect rainfall. Site 21OL20 was not near any mapped springs, but it was near a larger creek that would have been a permanent water source.

Two of the final three Archaic sites can be attributed to the Late Archaic based on a Matanzas-like point from 21OL29, on a terrace over the Middle Fork Zumbro River, and a Durst Stemmed point from 21OL23, on a slope near a tributary of Willow Creek. The third point, from 21OL22, is only described as being obliquely side notched and may be either Archaic or Woodland, as there is a Woodland component at the site. This site lies on a terrace of the Root River. Thus, Late Archaic sites might be more common on a terrace near a river or large creek.

The Olmsted County History Center has two copper artifacts, a point and an axe, on display. The point was found near Carrollsville, and the copper celt was found in Kalmar township (Figure 17).



**Figure 17: Examples of copper artifacts found in Olmsted county. Copper celt found in Kalmar township. Copper point found near Carrollsville (Olmsted County History Center museum). No further provenience available**

**Woodland.** There are five Woodland tradition sites based on the presence of pottery, in good context at four of the sites. All are attributed to the Late Woodland period, more specifically for most, the Southeast Minnesota Late Woodland context. The absence of Early and Middle Woodland sites in this area is not surprising as there are few sites of those time periods anywhere in southern Minnesota (Arzigian 2008). Late Woodland site 21OL2 is within Oxbow Park along the Zumbro River. Site 21OL15 is on a terrace south and east of the South Fork Zumbro River, downstream from where a creek enters. Sites 21OL21 and 21OL22 are near the junction of Partridge Creek with the North Branch Root River. The fifth site, 21OL33, was found in a floodplain adjacent to the South Fork Zumbro River but was interpreted as representing secondary deposition.

Considering only the Woodland sites in context, each is near a major river at a junction with another stream or creek. The only recorded site in the county with two possible occupations, Archaic and Late Woodland, is the Muentner II (21OL22) site, and it too lies on a terrace by the Root River where Partridge Creek enters.

**Mounds:** There are no mounds in Olmsted County that have been verified by archaeologists. Winchell (1911) reports that none were known from the county. Since then, five sites have had mounds reported based on informants' reports, but they have never been field verified. None has specific site locational information. One site, Engel (21OL3), was reported as two mounds already plowed down by the time Oothoudt prepared a site form. The Trapp Mounds (21OLx) were sought by a number of archaeologists over the years but never located. The area has since been developed with houses. Three mounds reported from the Maple Valley Country Club golf course (21OLad) have not been verified. Other sites listed as possibly having mounds are in extensively disturbed areas, such as Oehlke (21Olaf), which had been identified only to a section that is now largely part of the Rochester airport. Muentner (21OLag) might still exist in woods within State Forest lands but could not be relocated in 2010 due to heavy undergrowth. In addition to these poorly documented sites, a sixth site (21OL9) with three ridges was examined in 1987 and argued to be related to historic construction.

**Site function and size.** The known sites in Olmsted County are all relatively small, and many are single-artifact sites. Although counts are not available for most assemblages, no site appears to have more than 200 artifacts, and most have less than 20. This is in sharp contrast to the sites in surrounding counties that have large villages. Olmsted County sites may be predominantly short-term encampments and extractive sites. One of the largest assemblages, the Schumann Cache, had 65 items stashed away but probably not at a habitation site. Most raw materials at Olmsted County sites are local, though there is use of Hixton silicified sandstone and other exotic materials (particularly with the oldest sites).

**Chronology.** The most significant finds in the county to date are the three sites with Paleoindian materials, with a unique cache of bifaces, a Clovis point, and a lanceolate point. These may reflect intermittent but repeated use of the area during Paleoindian times. The Schumann Cache in particular argues for an anticipated return to the vicinity to collect the cached materials. The

most intensive period of use is the Archaic, with three axes from known sites and more from museum collections, along with other Archaic point types such as Raddatz and Osceola. Woodland occupations based on diagnostic materials seem confined to the Late Woodland. Later occupations are not indicated by diagnostic artifacts, and large Oneota villages have not been found here. One chunky stone that might be from this county suggests some interaction with Mississippian cultures, but the artifact is too poorly provenienced to speculate more.

**Factors influencing site location:** Different types of archaeological sites will be associated with different landscape variables. Resource extraction sites such as those focused on lithic resources or specific faunal or floral resources (for example, bison hunting or fishing) will be placed in proximity to the resource; if the resource is mobile or fluctuates, the sites may be difficult to predict. Thus, if ancient habitats can be reconstructed, specialized extractive sites can be better predicted.

Based on previous predictive models, more generalized site occupations and habitations could be expected near shorelines; in areas such as Olmsted County that have no lakes, these would be along rivers. Where there is steep topography and rivers may be deeply incised, sites may be further away from water than in cases of lower relief. Areas where streams or springs enter river valleys are significant. In the Rochester Plateau, Mn/Model found its strongest correlation with swamplands, often those found within stream valleys, which fits well with the finding that sites tended to be further from major ridges or divides. In areas of higher relief, such as in the Blufflands, sites tended to be found lower in elevation and on more level ground. In areas of more level rolling landscape such as the Oak Savanna subsection, wetlands and areas of organic soils are also important, as are areas of vegetation diversity.

The 2010 survey examined many areas that would not have ranked high in site probability based on the previous predictive models. Many were “general upland” settings far from permanent water. Although only a few sites were found, the locations of these sites, together with the previously reported sites, suggest some refinements in the predictive models. These variables appear to be significant in the location of sites within Olmsted County:

- Proximity to major rivers, particularly terraces above a river.
  - Within this zone, proximity to the junction with another body of water.
- Interfluves between major drainage systems.
- Proximity to headwaters of spring-fed streams.
  - Particularly streams that lie on the headwaters of major drainage systems.
- Position within a fire shadow, such as on the east bank of rivers or within bends in the river that provide protection from fire.
- For older sites, particularly those that might date to drier periods, a possible preference for fire-break areas where both water and additional resources were available.
  - Such areas might be identifiable by histosols or wetland soils.

As discussed below with the geomorphological investigations, 3<sup>rd</sup> order and larger streams have responded to Holocene flood events by lateral channel adjustments rather than development of deep vertical stratigraphic sequences. Thus, older horizons might be found on the margins of valleys that might have escaped major flood erosion episodes.

# **STRATIGRAPHIC AND GEOMORPHOLOGICAL CONTEXTS WITH POTENTIAL FOR DEEPLY BURIED SITES IN OLMSTED COUNTY, MINNESOTA**

By Michael F. Kolb

(prepared as Strata Morph Geoexploration Report of Investigation No. 205)

## **INTRODUCTION**

The goal of the geomorphological investigation is to construct a preliminary model of the potential for deeply buried archaeological deposits in the small drainage basins of Olmsted County, Minnesota. Subsurface investigations are conducted in 4<sup>th</sup> order and smaller stream valleys at two localities: (1) the Schumann Locality, and (2) the Muentner Tract. Additionally, the effects of very large infrequent floods on floodplain stratigraphy and the archaeological record are examined using examples from the flood of 2007.

The model consists of a geographic dimension characterized by landforms and a vertical dimension characterized by a stratigraphic framework. Most of the depositional settings where archaeological sites may be buried are located in stream valleys. Streams can be ordered to form a hierarchical scheme where the smallest streams are the most numerous and are referred to as 1<sup>st</sup> order and the largest streams are the least numerous and have the highest order ranking. The magnitude of the stream order also describes the size of the valley (watershed). Hydrologic and morphologic attributes (Leopold et al. 1964) as well as volume and age of deposits (Bettis et al. 1992) among valleys of the same order are similar and predictable. Additionally, the interfluvial ridges between the valleys are generally proportional to the valleys and can also be assigned a ridge order that is a rough measure of the area of the ridge summit. This method organizes the geomorphic landscape based on natural morphologically defined units. Since the landscape is the substrate for the entire ecosystem, many other patterns, especially those related to human settlement and subsistence, can also be evaluated in this hierarchical framework with the goal of predicting the location of surface and buried archaeological sites.

### **Potential for Buried Archaeological Deposits**

Potential is a qualitative measure of the likelihood that a particular geologic environment will contain archaeological deposits in primary context. Three major geologic criteria are used when assigning a level of potential: (1) age of the deposits, (2) depositional environment, and (3) post-depositional modifications (Hudak and Hajic 2002). Human occupation within the project area occurred from the Late Pleistocene through the Holocene (<14,000 <sup>14</sup>C B.P.) Consequently, sediments deposited during this time span are considered as having chronological potential. The depositional environment most conducive to burying and preserving the primary context of the archaeological assemblage in this alluvial setting is vertical accretion alluvium on floodplains

and terraces, and dunes/sand sheets on terraces. Post-depositional modifications that may disturb the context of the archaeological deposits are pedogenic processes such as bioturbation and shrink-swell in clayey soils, and historic anthropogenic activities such as mining, agriculture, and various construction activities.

All of the vertical accretion facies of the De Forest Formation have geologic potential for buried archaeological deposits either contained within each member's stratigraphic sequence or where one member covers another. Archaeological deposits may occur in paleosols or in strata not marked by paleosols.

### **Field Study Localities**

Two localities were chosen for field investigations based on their geomorphic setting and access with the truck-mounted core rig. The Schumann Locality (Figure 18) was chosen because it contains 1<sup>st</sup> through 4<sup>th</sup> order streams high in the drainage net, and because of the presence of the Schumann Cache, a unique assemblage of early Paleoindian artifacts (Carr et al. 2008a). Subsurface investigations will examine the stratigraphy in these lower order stream valleys.

The Muentner Tract Locality (Figure 18) was chosen because of the presence of an access road that traverses the Partridge Creek valley near its confluence with the North Branch of the Root River where it is a large 4<sup>th</sup> order stream. Subsurface investigations will examine the valley bottom stratigraphy at this locality.

## **GEOMORPHIC SETTING AND PREVIOUS RESEARCH**

Three major rivers and their tributaries drain surface water from Olmsted County (Figure 18). The Zumbro River drains the western and north-central parts of the county. The Whitewater River drains the northeastern part of the county and the Root River drains the southeastern part of the county. All of these rivers are tributaries of the Mississippi River and drain pre-Illinoian glacial terrain (Hobbs 1988) with the exception of the Zumbro River. During Late-Wisconsin times when glacial ice was at the Bemis moraine ( $\pm 14,000$  B.P.) meltwater streams flowed east to the Mississippi River valley in the Zumbro River valley (Hobbs and Goebel 1982). Glacial topography has been almost completely modified by weathering during the Sangamon interglacial, Wisconsin glacial, and Holocene post-glacial periods (Hobbs 1988). Stream systems are well integrated and incised. The meltwater stream deposits are confined to the valley bottoms where they formed valley trains. Meltwater streams draining pre-Illinoian ice flowed in the Whitewater River valley and probably in the Root River valley. The resulting deposits, if present, occur in isolated terrace remnants.

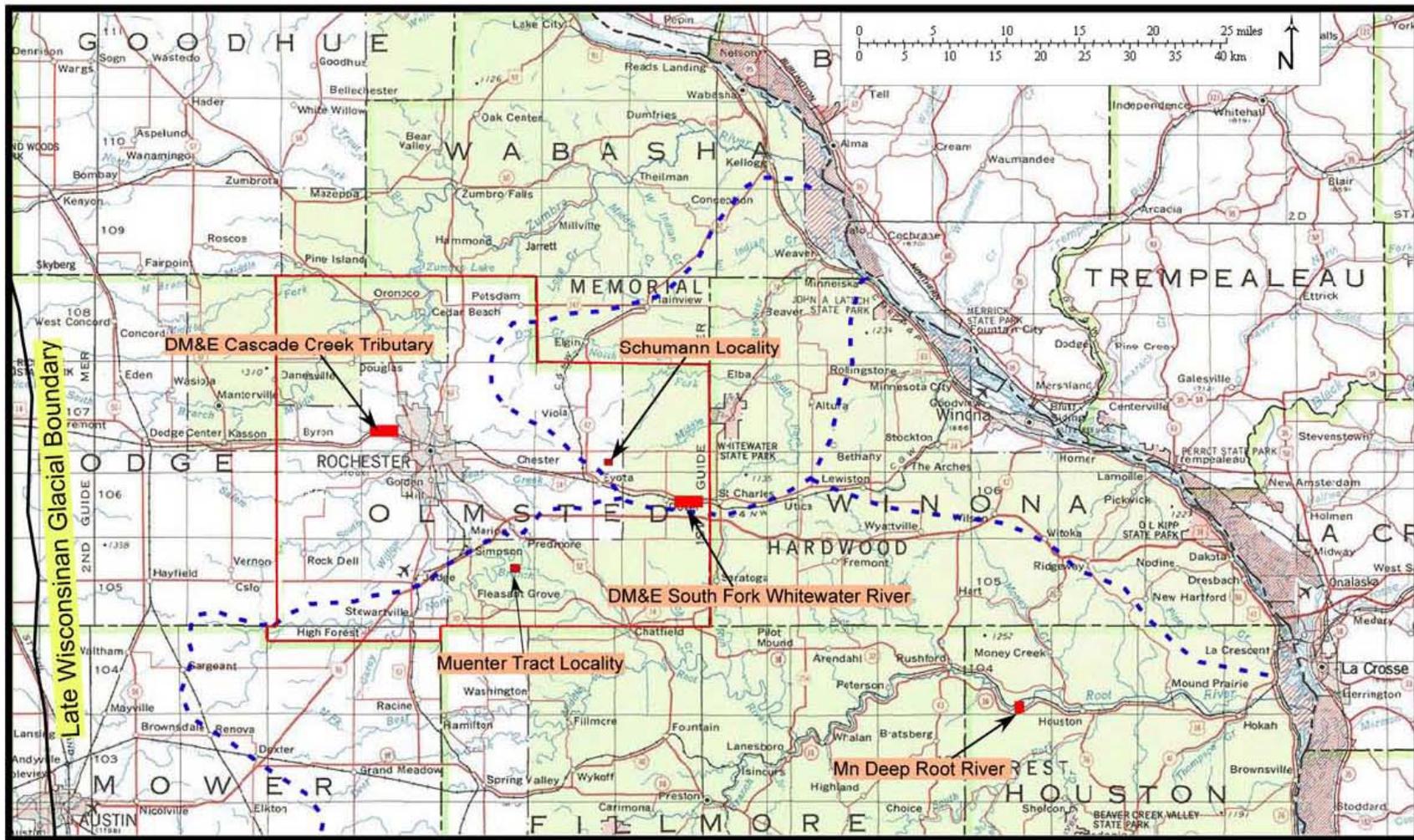


Figure 18. Location of major drainage divides, field localities and other places mentioned in the text.

Loess is the surface deposit in much of the uplands and on high terraces. Loess deposition occurred between about 25,000 B.P. and 12,000 B.P. (Forman 1990) and in Olmsted County the source was to the west along the margin of the retreating Des Moines lobe (Muhs and Bettis 2003). Its thickness varies depending on the locality's position on the landscape relative to paleowind direction, surrounding topography, and the distribution of vegetation when the loess was being deposited (Mason et al. 1994, 1999). It is thin in western Olmsted County (< 0.5 m) and becomes thicker and finer grained to the east (Mason et al. 1994). Major loess deposition ceased about 12,500 B.P. in the Illinois River valley (Grimley et al. 1998) and possibly earlier in southeastern Minnesota due to a cut off of the source to the west. Holocene loess is documented in the plains (Jacobs and Mason 2007) and could be present in southeastern Minnesota but would be thin. Post-depositional hillslope erosion has differentially removed and redistributed the loess. The loess on slopes and ridge tops is the source of sediment for the fluvial system; therefore, its thickness and distribution are important.

The stratigraphic framework consists of the spatial arrangement of the vertical sequences of four Holocene age lithostratigraphic units across the alluvial landscape. The framework has been defined and tested in parts of the Plains (Bettis and Mandel 2002) and Midwest (Bettis and Hoyer 1986; Bettis 1990; Bettis and Mandel 2002; Bettis et al. 1992; Thompson and Bettis 1980) including southeastern Minnesota (Baker et al. 2002) and is the only stratigraphic framework in the Midwest organized into formal units. The stratigraphic units are members (subunits) of the De Forest Formation and are listed in Table 11. Gunder Member deposits are the fills in 1<sup>st</sup> order valleys and are present as terraces in valleys 2<sup>nd</sup> order and larger. Roberts Creek Member deposits are inset into the Gunder Terraces in the 2<sup>nd</sup> order and larger valleys. Camp Creek Member deposits are inset into Roberts Creek deposits and also form a veneer over terraces underlain by Roberts Creek deposits. The De Forest Gap is a time transgressive erosional surface that began in the lower reaches (higher order streams) of the drainage net about 10,000 B.P. and ended in the upper reaches (low order streams) about 3500 B.P. Smaller watersheds also generally have steeper slopes and hence more stream power for a given flood (Knox 1999, Knox and Daniels 2002). The resulting stratigraphy and record of the flood events will vary in part depending on watershed size.

In southeastern Minnesota the alluvial sequence in Money Creek was examined as part of a broader study of the Holocene paleoenvironments (Baker et al. 2002). Three terrace levels and a channel belt were identified. The T3 terrace is underlain by early Gunder Member alluvium and formed between 11,450 and 8120 B.P. The T2 terrace is underlain by late Gunder Member alluvium that dates between 6060 and 5090 B.P. The T1 terrace is underlain by Roberts Creek Member alluvium that dates between 3850-1780 B.P. Camp Creek Member alluvium is in the channel belt and forms a veneer on the T1 and T2 terrace surfaces. The Early Holocene prairie-forest boundary is between Spring Valley Cave and Money Creek.

**Table 11: Members of the De Forest Formation**

<b>Member</b>	<b>Lithology*</b>	<b>Soils</b>	<b>Age Estimates</b>	<b>Riverscape Position</b>
Camp Creek	silt loam to loam	Weakly developed; A-C profiles	Very Late Holocene-Historic (400 BP – modern)	Channel belts and veneers on terraces and alluvial fans
Roberts Creek	silt loam, silty clay loam and loam	Moderately developed; mollisol, A-C or A-Bw profile: Dark-colored solum relative to Camp Creek and Gunder	Late Holocene (4000 BP – 500 BP)	Channel belt inset into Gunder terraces, floodplains
Gunder	silt loam, silty clay loam and loam	Well developed; with A-Bw, A-Bt or A-E-Bt profiles	Early - Middle Holocene (10,500 – 3000 BP)	Terraces in valleys
Corrington (alluvial fan facies)	loam and silty clay loam with sandy and gravelly interbeds	Variable but relatively well developed	Early to Late Holocene (9000 – 2500 BP)	Alluvial fans

\*vertical accretion lithology

### **DM&E Project: Geomorphology Localities in Olmsted County.**

Cascade Creek is west of Rochester and flows east into the Zumbro River (Figure 18). The Cascade Creek valley was investigated as a part of the DM&E Railroad geomorphology investigation (Kolb 2008). Subsurface investigations occurred in a 4<sup>th</sup> order tributary of Cascade Creek that flows parallel to State Highway 14 north of the main creek channel. It has a wide valley bottom with an underfit channel. Stratigraphy in cores and soil data from the USDA indicate the majority of the valley bottom is silty sediment, interpreted as tributary alluvium or slackwater alluvium deposited when the outwash in the Zumbro River blocked the mouths of the tributary valleys. No buried soils are present and the surface soil is relatively well-developed. The channel belt and channel belt margins consist of either a buried soil beneath historic alluvium or a cumulic surface soil with no distinct buried soil.

A second locality investigated in Olmsted County was along the South Fork of the Whitewater River between St. Charles and Dover (Kolb 2008) just southeast of the Schumann Locality (Figure 18). Subsurface investigations were conducted on a terrace and in the channel belt of the river. Stratigraphy beneath the terrace consists of silty deposits over sand and then either gravelly sand with an overall coarsening downward trend, or just sand. It is interpreted as outwash overlain by loess or eolian sand. The channel belt stratigraphy consists of clay alluvium to a depth of 1.3 meters.

## **Minnesota Deep Test Protocol and Mn/Model**

Geomorphology of a small area along the Root River in Houston County just southeast of Olmsted County revealed a detailed sequence of Late Holocene deposits (Monaghan et al. 2006). Stratigraphy and radiocarbon dates indicate that a channel formed and was abandoned before 1180 B.P. The abandoned channel filled with vertical accretion deposits that were also accumulating over the point bar platform sands by at least 850 B.P. Periods of low rates of sedimentation and/or short duration stability are marked by discontinuous paleosols. The Root River valley bottom is characterized by many abandoned meanders and traces of abandoned meanders indicating a very active lateral accretion alluvial regime possibly dating to the late Holocene and historic times.

The Root River valley was included in the geomorphological modeling for Mn/Model (Hudak and Hajic 2002). They defined valley terrace, floodplain, and valley margin landscapes in the valley proper. The three highest and oldest valley terraces are loess-mantled including the Savanna Terrace. Floodplain types include the modern channel belt, recently abandoned channel belts that are actively being covered by overbank sediment (the type described in the preceding paragraph) and a floodplain that has deeply buried channels (thick overbank deposits) or no channels. They also note down valley trends in the spatial distribution of landforms and stratigraphic sequences.

## **METHODS**

Project methodologically was divided into mapping and field investigations. Landforms were mapped in and around the localities where field investigations were planned using: (1) topographic maps, (2) soil maps, (3) aerial photographs, and (4) field observations. Valleys in areas of the county where subsurface data is available and/or where archaeological data is available were used as an additional source of data for characterizing landforms. Two lower terraces are Holocene in age.

### **Coring**

A truck-mounted Geoprobe® was used to extract 5 cm (2 inch) diameter cores. Core samples are described in the field using standard systems from soils (Soil Survey Staff 1975, Schoeneberger 1998) and geology (Collinson and Thompson 1982, Folk 1974), and discarded.

## **RESULTS: SCHUMANN LOCALITY**

The Schumann Locality is 2.4 km (1.5 mi) north of Eyota, Minnesota (Figure 18). It is in the middle reach of a 4<sup>th</sup> order drainage basin within the Whitewater River watershed just east of the divide between the Whitewater River basin and the Zumbro River basin. The locality contains 1<sup>st</sup> through 4<sup>th</sup> order streams (Figure 19). The Paleoindian artifacts cache is located on the shoulder of a ridge between a 2<sup>nd</sup> order and a small 3<sup>rd</sup> order valley. The surficial geology at the

Schumann Locality is mapped as loess over till and by definition the loess is >1.5 m (>5 feet) thick (Hobbs 1988).

The landscape at the Schumann Locality consists of upland ridges dissected by 1<sup>st</sup> and 2<sup>nd</sup> order streams on both the north and south sides of a 3<sup>rd</sup> order stream and then, further downstream, a 4<sup>th</sup> order stream (Figure 19). Downstream of the Schumann property the stream turns to the northeast and crosses a bedrock knick point formed about where the higher younger Prosser limestone and the limestone and shale of the Decorah Formation drop off to the older lower Saint Peter sandstone and Prairie du Chien Formation dolostone (Olson 1988). Downstream of the knick point the stream is more deeply incised. The 3<sup>rd</sup> order stream changes to a 4<sup>th</sup> order stream just east of the Schumann property. The 1<sup>st</sup> order streams have no floodplain, just slopes descending to a channel. The 2<sup>nd</sup> order streams are similar in their upper reaches except near the confluence with the 3<sup>rd</sup> order streams where they widen and form a fan/terrace. The 3<sup>rd</sup> order valley bottom consists of a well-developed floodplain with a meandering channel (Figure 20) and a seepage wetland.

Soils mapped on the Schumann landscape are the Port Byron, Mt. Carroll and Wuabeek series on the summits, shoulders, and backslopes of the interfluvial ridges, the Joy series along footslopes and low terraces at the mouths of the 2<sup>nd</sup> order valleys, the Garwin series in the 1<sup>st</sup> and 2<sup>nd</sup> order stream valleys and at the mouth of the small 3<sup>rd</sup> order drainage just east of the Schumann's property, and the Otter and Palms series on the floodplain and in the valley bottom wetland (Table 12).

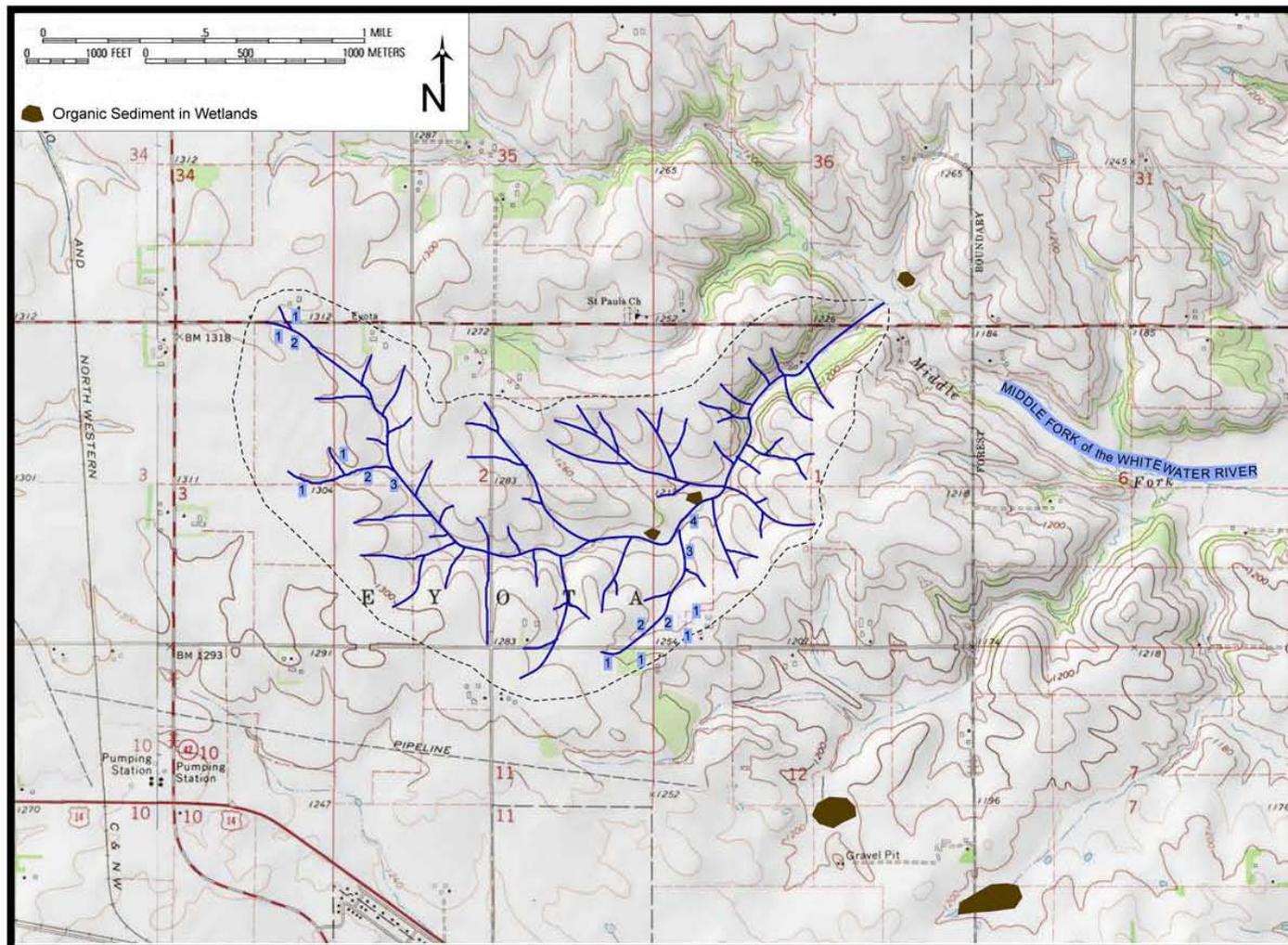


Figure 19. Topography and drainage net at the Schumann Locality and the locations of nearby peat producing wetlands.



Figure 20. The location of landforms and the Paleoindian cache at the Schumann Locality. Areas not delineated are upland ridges.

### Stratigraphy

Fourteen (14) Geoprobe cores and two (2) hand probes were extracted at the Schumann Locality (Figure 21). Cross-Section 1 traverses the summit, shoulder, backslope and footslope of the interfluvial ridge where the cache is located, ending on the low terrace/floodplain at the mouth of the 2<sup>nd</sup> order valley west of the cache (Figures 20 and 21). Stratigraphy consists of loess to at least 3 m depth on the summit, shoulder and backslope with sandier (very fine sand) loess over

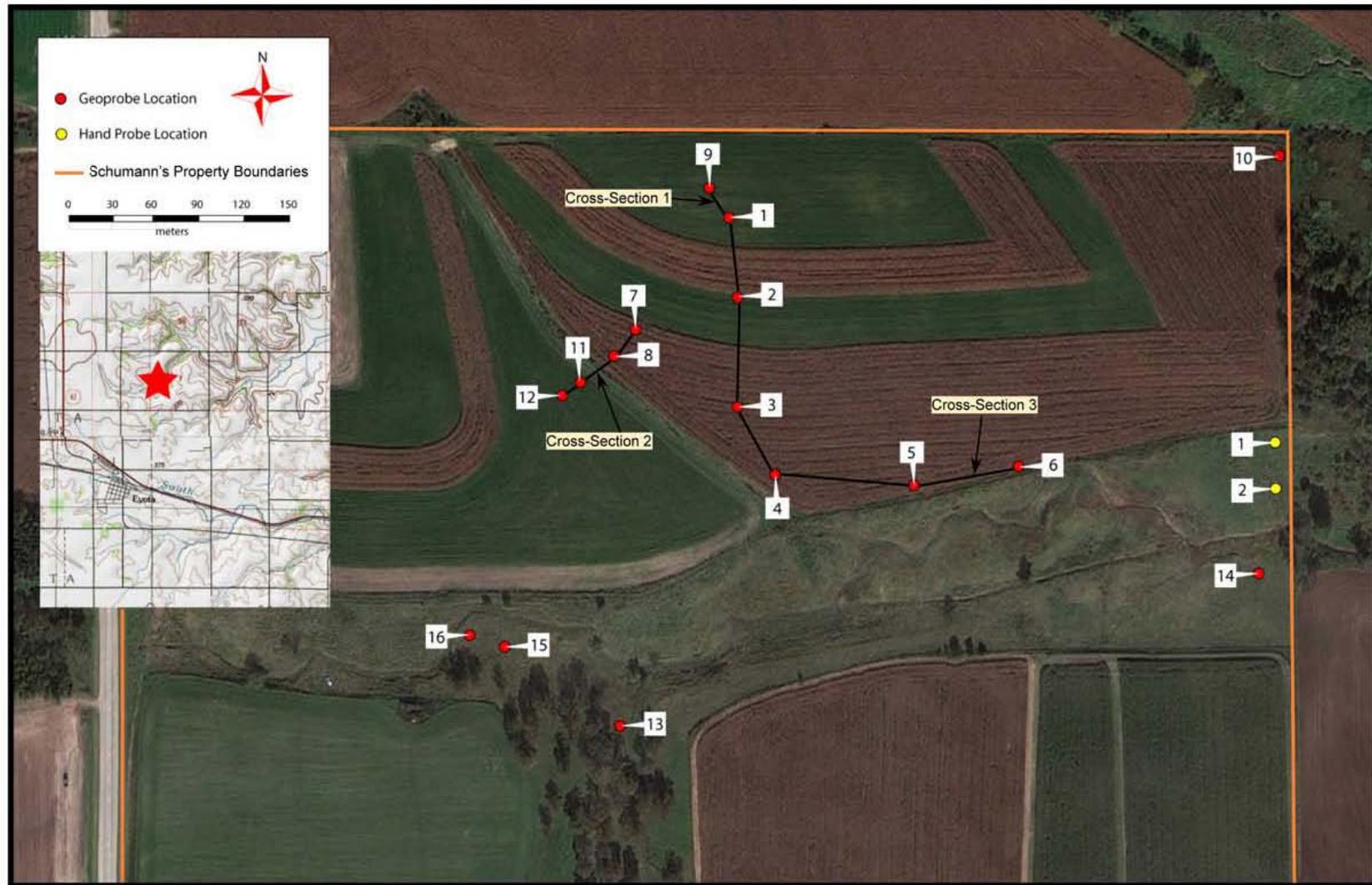


Figure 21. Geoprobe cores, hand probes, and cross-section locations at the Schumann Locality. Orange line is the boundary of the Schumann Property.

**Table 12. Soils mapped at the Schumann Locality (USDA-NRCS 2010)**

Series	Drainage Class	Parent Material	Texture	Taxonomic Class.	Landform
Port Byron	wd	loess	silt loam	hapudoll	ridge summits, shoulders and backslopes
Mt. Carroll	wd	loess	silt loam	hapludalf	ridge summits, shoulders and backslopes
Waubeek	mwd	loess/till	silt loam	hapludalf	ridge backslopes
Joy	spd	loess	silt loam	hapudoll	footslope/low terrace
Garwin	pd	loess	silty clay loam	endoaquoll	low terrace and low order drainages
Otter	pd & vpd	alluvium	silt loam	endoaquoll	floodplains
Palms	vpd	paludal	muck	haplosaprict	depressions on floodplain

alluvium or hillslope deposits (re-worked loess) at the footslope (Figure 22; Appendix A). Core 4 is at the base of the transect and is located on a low terrace at the mouth of the 2<sup>nd</sup> order basin just north of and above the floodplain. Stratigraphy consists of a cumulic A horizon formed in alluvium over an AB-Bt-Cg-2Cg soil horizon sequence formed in alluvium/loess over a silt loam and clay loam diamicton. The diamicton, or very poorly sorted sediment, is likely colluvium but could be *in situ* till.

Cross-Section 2 traverses the 2<sup>nd</sup> order valley just west of the cache (Figure 21). Cores 7 and 8 on the northeast side of the channel are located on a weakly stepped topography. Deposits consist of loess. In the upslope core the soil was truncated by erosion and then colluvium was deposited on the surface creating two plow zones. Core 8 is 8 m northeast of the channel. Stratigraphy consists of a cumulic A horizon formed in alluvium to a depth of 0.74 m over a BC-C horizon sequence formed in loess to a depth of 2.13 m (Figure 23).

Cross-Section 3 is parallel to and north of the trunk 3<sup>rd</sup> order stream (Figure 21). It traverses the low terrace at the mouth of 2<sup>nd</sup> order stream and the floodplain of the Schumann trunk stream. Core 4 is at the west end of the cross-section and is described above. Stratigraphy in the floodplain cores consists of a thick cumulic A horizon complex formed in alluvium over a series of C and Cg horizons formed in alluvium/colluvium over gravelly sandy loam and loam channel deposits (Figure 24).

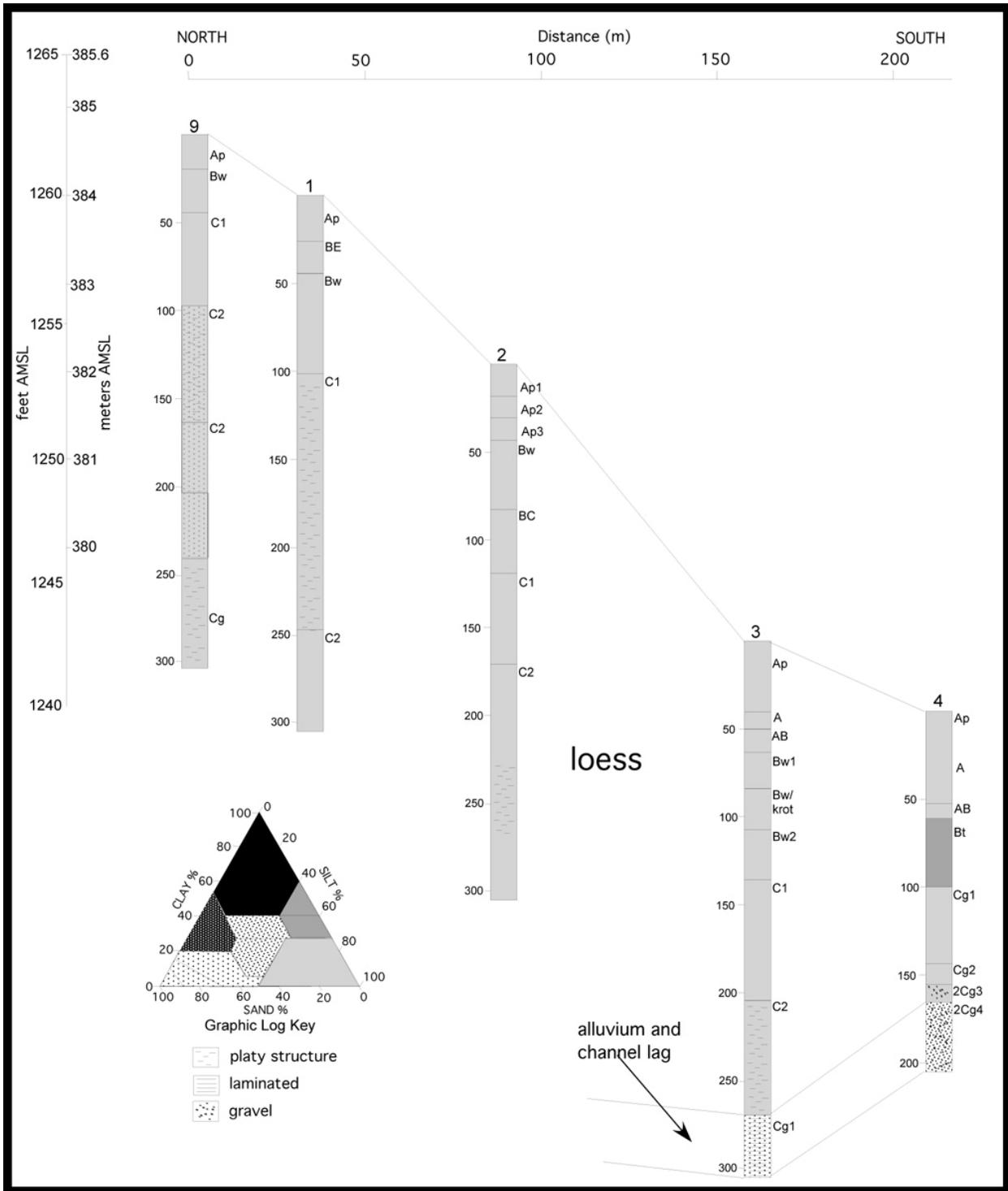


Figure 22. Stratigraphic cross-section 1 at the Schumann Locality. The Paleindian cache is near Core 1

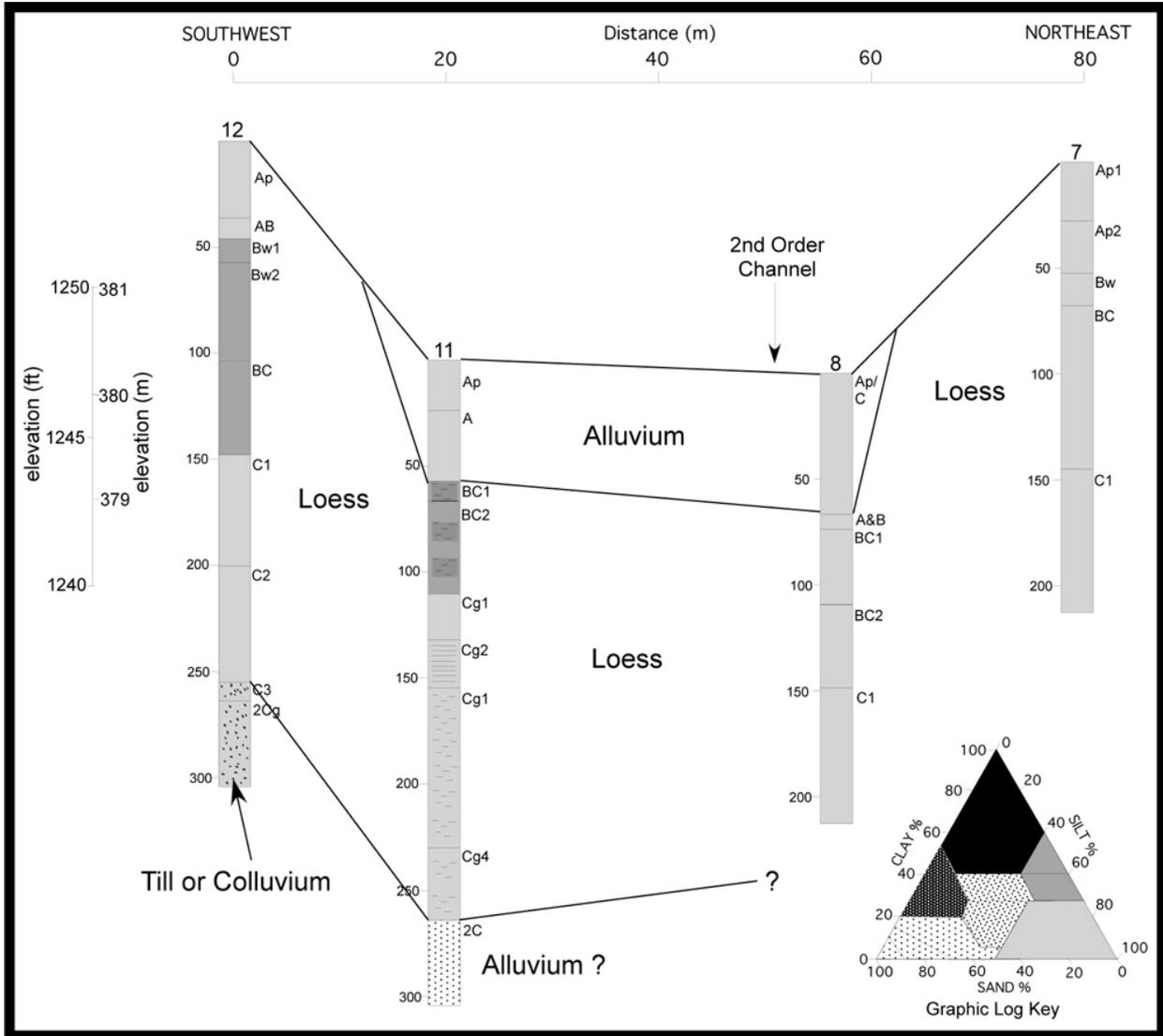


Figure 23. Stratigraphic Cross-Section 2 at the Schumann Locality.

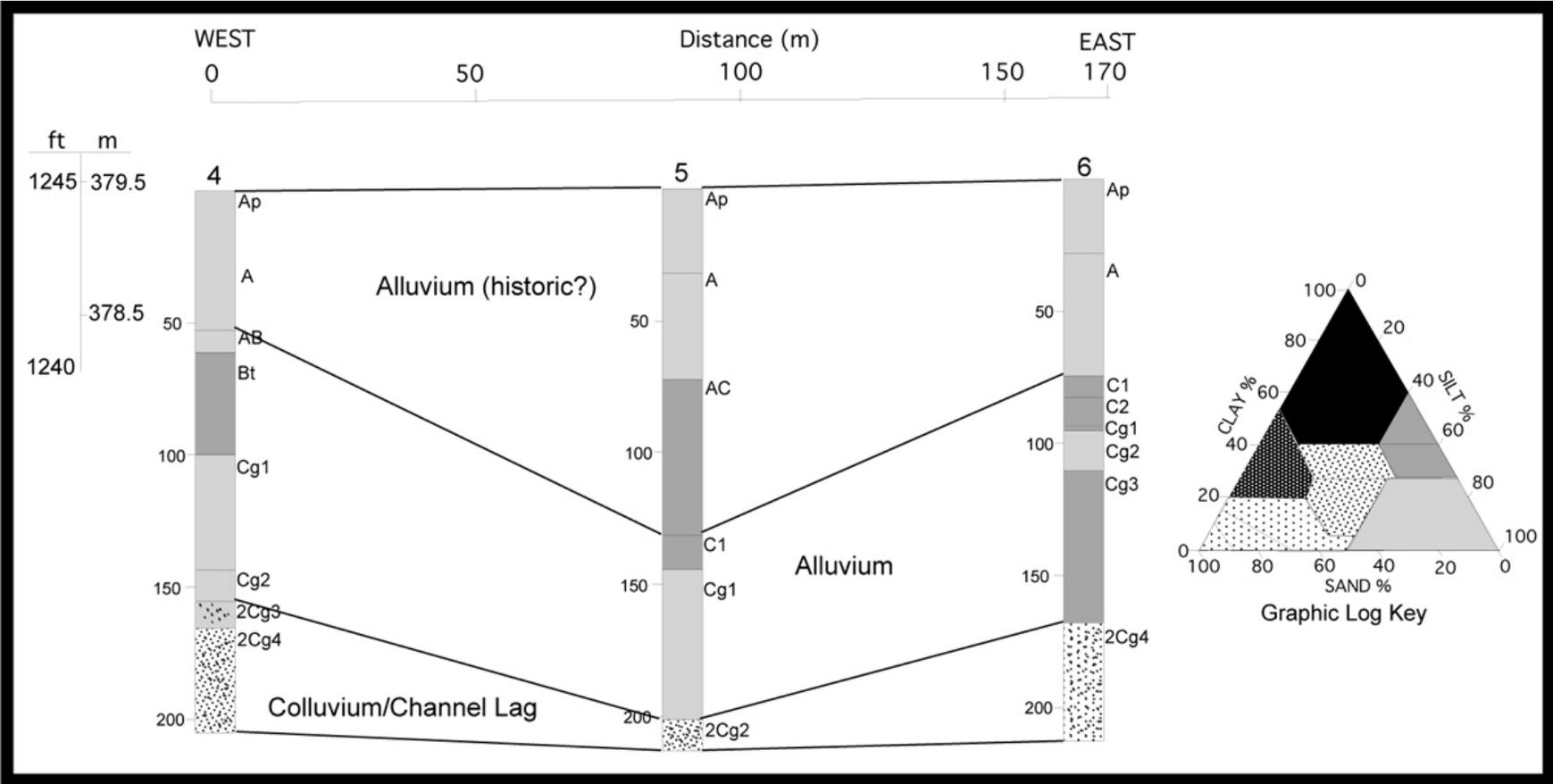


Figure 24. Stratigraphic Cross-Section 3 at the Schumann Locality.

Core 10 is located at the edge of a 3<sup>rd</sup> order valley in the northeast corner of the Schumann property (Figure 21). Stratigraphy consists of three units. The upper sequence consists of an Ap1-C-Ap2 horizon sequence formed in silt loam alluvium/colluvium to a depth of 0.76 m that is historic in age (Appendix A). The middle sequence consists of a cumulic Ab-AC-Cg1-Cg2-Cg3 horizon sequence formed in silty clay loam and silt loam to a depth of 2.38 m. This sequence is formed in alluvium over loess and is separated from the underlying sequence by a very abrupt boundary. The lower sequence is a loam diamicton colluvium or channel deposits to a depth of 3.04 m.

Core 13 is located in a 2<sup>nd</sup> order valley on the south side of the Schumann trunk stream (Figure 21). The valley sides are steep (11.5°) and short relative to the 2<sup>nd</sup> order valley on the opposite (north) side of the valley. Small areas of bedrock or bedrock-derived colluvium are exposed along the valley slopes. The flat valley bottom is an historic age alluvial fan surface that is only 17 m wide. The core is near the valley mouth. Stratigraphy consist of a C1-C2-AC soil horizon sequence formed in historic alluvium to a depth of 0.89 m, over a cumulic Ab-ABb-C horizon sequence formed in alluvium to a depth of 2.27 m, over a thin silty clay diamicton to 2.40 m, over a Cr horizon formed in weathered bedrock (Appendix A).

Core 14 is located on the south side of the trunk stream 1.86 m above the stream on a low terrace or step (Figure 21) that forms a relatively continuous unbroken slope segment with the low upland to the south. Stratigraphy consists of a cumulic Ap-A-BC horizon sequence formed in alluvium/colluvium to a depth of 1.10 m over laminated coarse silt to very fine sand grading up to silt loam down to 2.42 m (Appendix A). This very abruptly overlies gravelly loam.

Cores 15 and 16 are on a point bar in the floodplain (Figure 21). Both cores have a thick cumulic A horizon formed in silt loam alluvium over Cg horizons formed in silt loam and silty clay loam alluvium to a depth of 1.4 m in Core 15 and 1.0 m in Core 16 (Appendix A). The alluvium disconformably overlies weathered bedrock (Core 16) or it overlies channel gravel (Core 15).

Peat-forming wetlands, mapped as Palms muck, are present along the northern valley margin at the east end of the Schumann property and at the mouth of the 3<sup>rd</sup> order valley downstream of the Schumann property (Figure 20). Two hand probes were taken with a 4 cm (1.5 inch) diameter push probe in the wetland on the Schumann property (Figure 21). Probe 1 is located at the upslope end of the wetland at the base of the low terrace slope. Stratigraphy consists of historic colluvium to a depth of 0.58 m over an Ab horizon formed in silty clay loam to 0.82 m over unoxidized dark greenish gray laminated heavy silt loam and very fine sandy loam to a depth of 1.6 m. Probe 2 is 25 m south toward the stream channel (Figure 21). Stratigraphy consists of 2.10 m of organic sediment (muck) over a neutral black silty clay loam to silty clay Ab horizon.

The segment of the channel downstream of the Schumann property to the knick point, a distance of about 300 m ( $\pm$  1000 ft), was walked to examine the stream bank and bed. The bed of the stream consists of a stratum of gravel up to boulder-size over gleyed silty clay loam that changes to bedrock and/or tabular gravel in the knick point reach. Below the knick point the channel

flows on clay. Channel banks downstream to the knick point are uniformly dark silty clay loam that is similar to the deposits in Cores 15 and 16 on the point bar upstream. Below the knick point the banks are higher and expose a dark colored silty clay loam alluvium over dark colored clay slackwater alluvium.

## **Discussion: Schumann Locality**

### **Upland**

The ridge where the cache is located and the slope on the ridge are underlain by loess (Figure 20). It is silt loam and heavy silt loam in the upper 1.0 - 1.5 meters and lighter silt loam (coarser silt and very fine sand) lower in the cores to a depth of 3.04 m. The second order stream to the west of the cache is cut in loess with 0.5 – 0.6 m of alluvium at the surface. The loess overlies gravelly loam or silt loam diamicton textured colluvium in the 2<sup>nd</sup> order valley. The cache was found in the plow zone on the shoulder of the slope. Some soil erosion has certainly occurred but based on the preserved soil profile it does not appear to be severe, indicating the artifacts are not outcropping along a truncated buried surface. This indicates the artifacts were emplaced after the cessation of major loess deposition about 12,500 years ago.

### **Low Terrace**

A low terrace is present at the base of the slope where the cache was found and to the east in the broad mouth of a 3<sup>rd</sup> order valley (Figure 20). Stratigraphy consists of a thick cumelic surface soil indicating slow rates of deposition from the adjacent slope and/or the adjacent floodplain over silt loam and silty clay loam alluvium, over channel deposits consisting of clay loam, loam, and sandy loam, all with gravel. The channel gravels are 2 m or less below the surface. The gravels and diamictons could also be a lag associated with post mass-wasting incision. The low terrace northeast of the Schumann Property was only exposed in a single creek bank exposure where it consisted of 2.5 m of dark colored silt loam - silty clay loam alluvium over clay alluvium possibly deposited under slackwater conditions. This indicates the low terrace may be two or more landforms that could not be differentiated during this investigation. The knick point is near the downstream end of the low terrace.

On the south side of the trunk channel a low terrace or step occurs at a slightly lower elevation than the low terrace north of the creek (Figure 20). The upper 1.53 m is silt loam and silty clay loam capped with a thick cumelic Ap-A horizon sequence. Below 1.53 m to 2.42 m is graded and laminated down to platy silt loam that is predominately coarse silt and very fine sand. The base of the sequence is a gravelly loam. The sequence is colluvium that resulted from slopewash and mass wasting of the loess upslope. This same sequence occurs at the edge of the floodplain in Probe 1 slightly lower than a low terrace surface upslope to the north. It is possible there are two terrace levels.

### **Wetlands (organic deposits)**

The area of muck on the Schumann Property was probed (Figure 20). The probe at the upslope edge of the wetland did not reveal any organic sediment but has similar stratigraphy as Geoprobe 14 on a terrace/step directly across the valley and is considered a colluvial deposit that may have accumulated in standing water. A second probe downslope closer to the stream revealed 2.10 m of muck over a buried soil formed in silty clay loam to silty clay. The buried soil probably correlated with the buried soil in the bank cut downstream near the knick point.

The small wetlands where relatively thick sequences of organic sediment accumulates may provide the best Holocene paleoenvironmental record of these upland drainage basins and, if they are unique, may have been a draw for human settlement. Consequently, the distribution of this small wetland is of interest. The distribution of the wetland was determined by examining the distribution of histosols (Palms muck in this case) on the regional landscape. An unsystematic search of soil maps using search options available on Web Soil Survey indicates that small areas of histosols are present in a line trending southeast from the Schumann Locality for about 8 miles. All of the Palms muck soil bodies are in small upland basins. One of the soil bodies is located in a low order drainage in the uplands on the north side of the Middle Fork of the Whitewater River (0.75 mi) northeast of the Schumann Locality (see Figure 19). The trend parallels a buried bedrock escarpment where younger Paleozoic rocks (Galena Group, Decorah, Platteville, and Glenwood limestones and shaley limestones, and part of the St. Peter sandstone) are eroded and the older Paleozoic rocks (Prairie du Chien Group of limestone, dolostones and shaley limestones) form the surface bedrock (Olson 1988). The locations of these wetlands are likely tied to seeps or weak karstification where a low permeability strata underlies the unconsolidated deposits or where the same situation occurs within the bedrock sequence perhaps at the base of the St. Peter sandstone.

### **Floodplain**

The floodplain and channel belt consist of 1.0 – 1.4 m of alluvium over channel gravel or bedrock. Soils with A-C soil horizon sequences are formed in the alluvium. This sequence is probably young given the lack of soil development and shallow bedrock. Lateral migration is the likely response of the channel to any changes in the external controls on the system and larger floods may scour the valley floor removing much of the vertical accretion sediment. The floodplain narrows downstream of the Schumann property, possibly because the stream is downcutting into the low terrace.

### **Stream Order and Stratigraphic Sequence**

At the Schumann Locality, stratigraphic data is available in the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> order valleys. The first order valleys have v-shaped cross-sections with slopes descending to the channel with no flat valley bottom/floodplain. These valleys are cut into loess and do not contain alluvial fills. Alluvium in the 2<sup>nd</sup> order valleys is thin and consists an Ap-C or cumulic A horizon formed in 0.6 -0.7 m of dark colored silt loam (Roberts Creek and Camp Creek) over loess or para-

loess/Gunder alluvium on the north side of the valley. On the south side of the valley a C1-C2-AC soil horizon sequence is formed in 0.89 m of dark colored Camp Creek Member alluvium over an Ab-ABb-C horizon sequence formed in Roberts Creek Member alluvium to a depth of 2.27 m. Beneath the alluvium is a thin diamicton over weathered bedrock. The weathered bedrock occurs at 2.4 m below the surface. All the alluvium could well be historic.

The third order valley fill in the floodplain/channel belt consists of 1.0 – 1.4 m of alluvium (Roberts Creek) over gravel or bedrock. The channel has a meandering pattern but there are few oxbows indicating relative channel stability at least in the recent past. The floodplain/channel belt is inset into the low terrace or terraces that occur on both sides of the valley. The fill beneath the terrace surfaces does not resemble Gunder Member alluvium at depth and is likely colluvium.

Little stratigraphic data is available downstream of where the stream changes to 4<sup>th</sup> order but it appears the stratigraphy at least below the low terrace surface consists of fine grained alluvium over a buried soil also formed in fine grained sediment.

### **RESULTS: MUENTER TRACT LOCALITY**

The Muentner Tract Locality is 3.2 km (2 miles) south of Marion, Minnesota (Figure 18) in the Partridge Creek valley, just upstream of its confluence with the North Branch of the Root River (Figure 25). Core rig access was obtained along a track road that crosses the valley perpendicular to Partridge Creek.

The locality is across Partridge Creek where it flows in a rock-cut meander of the North Fork of the Root River. Partridge Creek is a large 4<sup>th</sup> order stream at its mouth. The south half of the locality is a terrace and is mapped as Joy series soils (Figure 26; Table 13; USDA-NRCS 2010). This is about 6 m (20 feet) lower than the nearby Wisconsinan or pre-Wisconsinan terraces mapped nearby by Hobbs (1988). Below the terrace to the north is the channel belt and floodplain (Figure 26). Soils mapped on the floodplain are the Root and Littleton series (Table 13; USDA-NRCS 2010). North of the floodplain is a colluvial apron that ascends up to the base of the bluffs (Figure 26). Soil mapped on the colluvial apron is the Mt. Carroll series (Table 13; USDA-NRCS 2010).

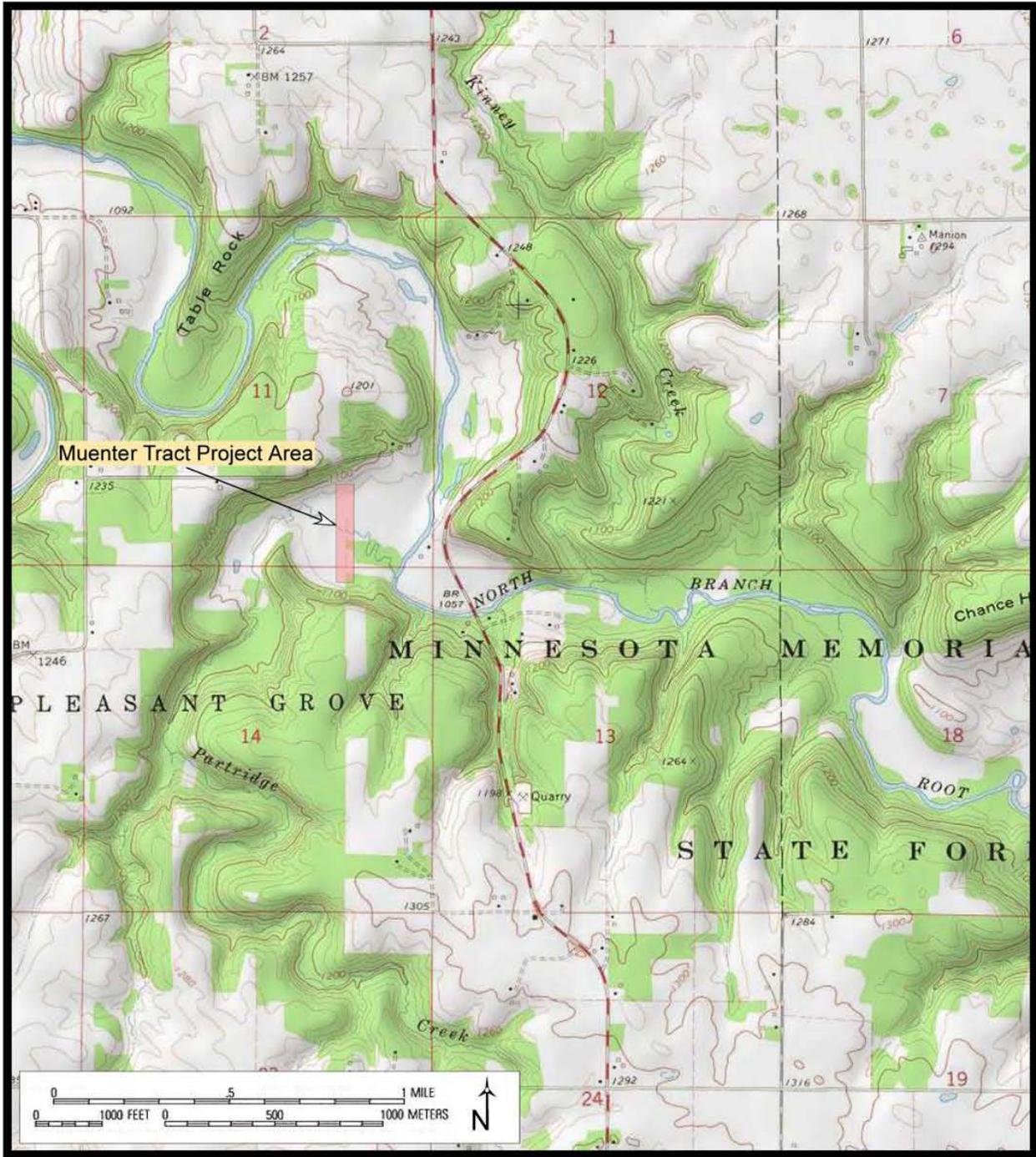


Figure 25. Muentner Tract Project Area location.

**Table 13: Soils mapped in the valley bottom and valley margins at the Muentner Tract Locality**

Series	Drainage Class	Parent Material	Texture	Taxonomic Class.	Landform
Mt. Carroll	wd	loess	silt loam	hapludalf	ridge summits, shoulders and backslopes
Joy	spd	loess	silt loam	hapudoll	footslope/low terrace
Littleton	spd	alluvium	silt loam	hapudoll	low terrace
Root	pd & vpd	coarse alluvium	loam/gravelly loam	fluvaquent	channel belt
Radford	spd	alluvium	silt loam	hapudoll	floodplains/footslopes

### Stratigraphy

The stratigraphic cross-section consists of six (6) cores along a track road in the Partridge Creek valley (Figure 26). Cores 1 and 2, at the south end of the corridor, are located on a terrace. Core 1 is near where the terrace meets the valley margin, possibly in an abandoned but in-filled paleochannel. Stratigraphy consists of an Ap-Bt-BC-C horizon sequence formed in silt loam and silty clay loam loess (or loess over slackwater) to 2.37 m below the surface (Figure 27; Appendix A). Below 2.37 m is a stratum of interlaminated silt and very fine sandy loam alluvium over gravel with a poorly sorted sand matrix. Core 2 is located on a ridge on the same terrace as Core 1 (Figure 26). The soil profile in Core 2 is truncated by the road and by other landscape modification to the west of the road. The ridge is wooded and intact to the east of the road but truck access is impossible without cutting trees. Given the circumstances the stratigraphic sequence beneath the ridge is pieced together from a Geoprobe core along the road and a soil pit excavated in the woods. Stratigraphy consists of a soil with an A-E-Bt-BC-C horizon sequence formed in silt loam and silty clay loam over silt loam to very fine sandy loam to a depth of 1.45 m in the soil pit. Approximately the upper 1.2 m is missing from the Geoprobe core. The sequence in the core consists of indistinctly laminated silt and very fine sandy loam over very fine sandy loam to 2.43 m (estimated 3.63 m below the original surface) over a silty clay loam diamicton colluvium to 3.04 m (4.24 m below the original surface).

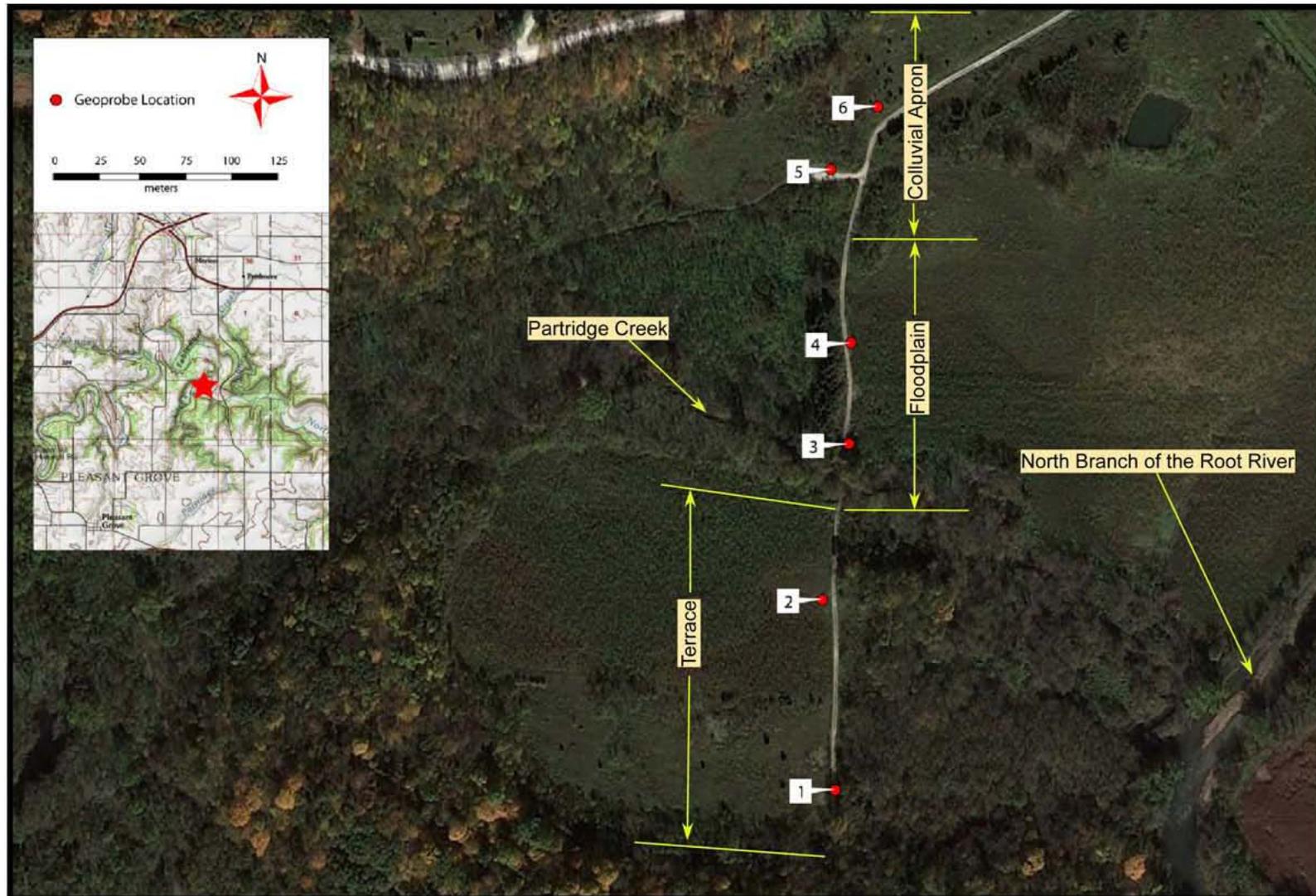


Figure 26. Geoprobe core locations and landforms along the core transect at the Muenter Tract.

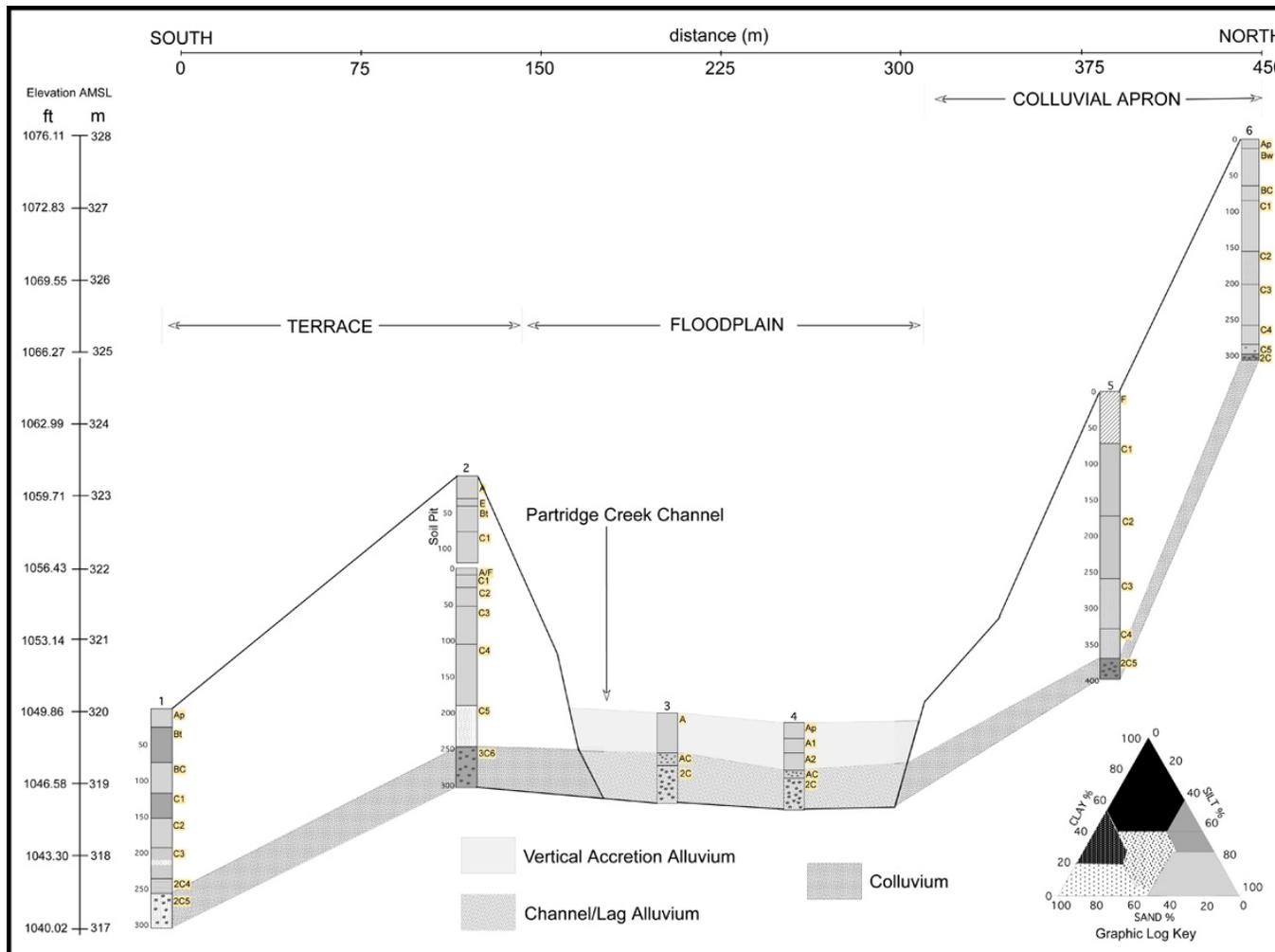


Figure 27. Stratigraphic Cross-Section at the Muentner Tract.

Cores 3 and 4 are located on the floodplain to the north of the Partridge Creek channel (Figure 26). Stratigraphy consists of A horizons formed in silt loam alluvium to a depth of 0.53 and 0.64 m respectively, over thin AC horizons formed in a silt loam diamicton to depths of 0.67 and 0.71 m, over gravel channel lag deposits to a depth of core refusal at 1.2 m (Appendix A; Figure 27).

Core 5 and 6 are located at the north edge of the valley on footslope/terrace (Figure 26). Core 5 consists of fill to a depth of 0.74 m over a series of C horizons formed in silt loam grading down to silt loam–very fine sandy loam to a depth of 3.63 m over a silty clay loam diamicton to a depth of 3.96 m (Appendix A). Core 6 is higher on the slope than Core 5 but has similar stratigraphy. It consists of an Ap-Bw-BC and a series of C horizons formed in silt loam and silt loam to very fine sandy loam to a depth of 2.82 m over silty clay loam diamicton colluvium to 3.04 m.

## **Discussion of the Muentner Tract Locality**

### **Terrace**

The terrace surface is high along the channel belt margin and slopes down toward the valley margin. Stratigraphy in the upper terrace deposits consists of a well-developed soil formed in silt loam and silty clay loam. Along the higher terrace margin the silt loam gets slightly coarser to a silt loam-very fine sandy loam over a discontinuity in a silty clay loam diamicton. Beneath the lower part of the terrace, possibly over an abandoned channel, the sequence below the silt loam consists of bedded and laminated silt loam and very fine sandy loams to silt loams disconformably over a gravelly loam. The sequence is interpreted as loess over channel lag. The soil in the wooded portion of the terrace near Core 2 appears to be intact, exhibiting no morphology related to plowing or other historic land-use activity.

### **Floodplain and Channel Belt**

The floodplain is a low flat surface underlain by a thin sequence (0.6-0.7 m) of vertical accretion silt loam over gravel lag. It is the same stratigraphy as at the Schumann Locality floodplain. The channel belt is narrow but likely changes positions on the floodplain during large floods.

### **Colluvial Apron/Terrace**

The colluvial apron slopes down from the footslope to the floodplain. It consists of silt loam over silty clay loam diamictons. Soils are only moderately developed, likely due to the sloping landscape surface. The sequence is interpreted as primary loess or colluviated loess deposited during or just after the last episode of loess deposition.

## FLOOD OF 2007

Data generated by a number of federal and state agencies that is compiled and analyzed by the Minnesota Climatology Working Group (MCWG 2008) combined with observations made by the author after the flood provide a basis for a qualitative assessment of the effects of this flood, and floods of similar magnitude in the past, on the evolution of the valley bottom and on the archaeological record in valley bottom settings. High magnitude flooding in southeastern Minnesota in August of 2007 caused extensive valley bottom erosion that permanently altered the valley morphology. Geomorphic effects of the storms that caused the flooding are exacerbated by the extensive agricultural land-use but the meteorological conditions that cause the storms could certainly have occurred in the past, although infrequently. A total of 14 inches of rain fell in Utica, MN on August 18 and 19, 2007 (MCWG 2008). Utica is located east of Olmsted County on the divide between Garvin Brook and the Whitewater River. For the same period a total of 11 inches fell in parts of Rochester in central Olmsted County. Just over 15 inches of rain fell at Hokah, MN in a 24 hour period. A 6 inch rainfall over 24 hour is about a 100 year storm event so the rainfall at Hokah and the surrounding area is probably greater than 2000 year rain event (MCWG 2008). The following is a discussion of some of changes in valley bottom morphology based on observations in the Garvin Brook valley along the DM&E railroad tracks.

Figure 28 illustrates geomorphic changes in the Garvin Brook valley in Farmers Community Park (located approximately 3 miles southwest of Stockton, MN) upstream of the campground looking east. Garvin Brook is a 4<sup>th</sup> order stream when it passes through Farmers Community Park and becomes a 5<sup>th</sup> order stream just downstream of the park at its confluence with Peterson Creek. The pre-flood single tread channel bank is just below the grass line in the middle of the picture. All of the vertical accretion alluvium is eroded away or trapped in pools and buried. The rock is channel deposit/lag moved downstream by the flood and debris flow moved onto the valley bottom out of small steep tributaries. White posts along the road in the upper left are about 32 inches high.

Figure 29 illustrates a bank exposure ( $\pm 1.5$  m high) created by the 2007 flood in Farmers Community Park. The picture is taken from a scoured gravel bar. Stratigraphy consists of historic alluvium over a buried soil formed in a thin unit of vertical accretion alluvium over channel gravel over the valley bottom armor. The length of the period of stability represented by the buried soils is not known. The flood of 2007 removed the entire sequence down to the valley bottom armor, creating a new geomorphic surface that dates to 2007.



Figure 28. Garvin Brook valley in Farmers Community Park.



Figure 29. Bank exposure ( $\pm$  1.5 m high) created by the 2007 flood in Farmers Community Park.

Figure 30 is a point bar on Garvin Brook after the flood. The point bar surface was scoured and then covered with channel bars consisting of cobble and pebble gravels. Also note the great amount of large woody debris.

Figure 31 illustrates the destruction of a railroad bridge and track segment along Garvin Brook just upstream of Stockton, MN. The track was damaged when the floodwater undermined the bridge support and washed away the sub-track ballast. Note how the flood channel cut across the distal (away from the channel) portion of the point bar, moving gravel and other heavy debris up onto the floodplain.

Figure 32 illustrates the erosion of a meltwater stream terrace just downstream of where Garvin Brook, now a 6<sup>th</sup> order stream, enters the Mississippi River valley at Minnesota City. A 25-30 foot flood crest widened the Garvin Brook channel by cutting into the meltwater stream terrace, causing the destruction of structures originally located  $\pm 75$  feet from the terrace edge. A house on a slackwater terrace in the lower Garvin Brook valley had flood debris in the second floor of the structure an estimated 28 feet above the bed of Garvin Brook.

The flood of 2007 resulted in the re-distribution of bedload down valley and the introduction of additional bedload from tributary valleys. In Farmers Community Park the channel went from a single thread to a braided pattern that would have persisted if the original channel hadn't been artificially restored. Fine-grained vertical accretion deposits were removed over much of the valley bottom except where protected by obstructions or along valley margins as illustrated in Farmers Community Park (see Figure 29). Where eroded a new geomorphic surface was created that will be buried by deposits associated with future smaller magnitude floods, building a new floodplain. Also of note is, with the exception of the channel in Farmers Community Park, there were few permanent channel position changes. After the flood the flow returned to the pre-flood channel. New channels were created that remain as flood chutes or flats along the original channel.

Archaeological deposits in the valley bottom would have been removed from their primary contexts except where portions of the floodplain, low terraces, or alluvial fans were preserved along the valley margin where archaeological deposits would be left in place and possibly buried. Floods of high magnitude, but not as extreme as the flood of 2007, would likely also spare a mosaic of landforms away from the valley margin randomly or due to obstructions such as bars or large woody debris dams. The resulting pattern over time is a temporal spatial mosaic of landforms and stratigraphic sequences in the valley bottoms.



Figure 30. Point bar on Garvin Brook after the flood.



Figure 31. Flood damaged railroad bridge and track segment along Garvin Brook near Stockton, MN.



Figure 32. Erosion of a meltwater stream terrace just downstream of where Garvin Brook enters the Mississippi River valley at Minnesota City.

## DISCUSSION

Three different alluvial settings were examined: (1) the Schumann Locality consisting of small low order stream valleys (1<sup>st</sup> through 4<sup>th</sup> order) in a relatively short tributary to the Middle Fork of the Whitewater River, (2) the Muentner Locality near the confluence of Partridge Creek, a large 4<sup>th</sup> order stream, and the North Branch of the Root River, and (3) Garvin Brook, a 4<sup>th</sup> through 6<sup>th</sup> order stream along the reaches where flood effects were observed. Streams 3<sup>rd</sup> order and larger appear to respond to Holocene flood events or regimes by lateral channel adjustments. This negates construction of thick vertical stratigraphic sequences. Instead the stratigraphic units should occur in lateral sequences inset beneath low terraces or as isolated abandoned channel belt sequences. Large floods tend to remove large areas of vertical accretions sediment from the valley bottom erasing much of the stratigraphic and archaeological record.

The geomorphic setting of the Schumann Locality is not representative of all small watersheds in Olmsted County. In fact, due to the different geomorphic/geologic histories of the watersheds in the county their valley bottom morphology and geomorphic response to flooding are different. At the Schumann Locality stream behavior is controlled by the near-surface bedrock topography. Archaeological sites may be buried: (1) at shallow depth in the cumulic soils on the low terrace, (2) in the low terrace deposits downstream of the Schumann property, (3) in the thin vertical accretion alluvium on the 3<sup>rd</sup> order stream floodplain, and (4) in the organic sediment sequence or buried soil in the wetland. The stratigraphic sequence in the wetland may provide a record of the Holocene environmental conditions in this small watershed.

At the Muentner Locality (mouth of Partridge Creek) and in the Garvin Brook stream response of floods is limited by the valley bottom gravel armor that can only be moved as bed load during large floods. Channels respond by lateral migration or avulsion. In these setting buried archaeological deposits will occur along valley margins where flood deposits accumulate over time and where erosive floods are less frequent and less effective. The flood on Garvin Brook was a high magnitude and low frequency event that scoured away the vertical accretion deposits over large areas of the valley bottom down to the gravel armor, even transporting the gravel up onto higher floodplain surfaces, yet leaving some areas of vertical accretion deposits intact. This type of river regime results in a mosaic of different stratigraphic sequences. Preserved area of the floodplain will remain as low terraces until flood vertical accretion sedimentation fill the lows and veneers the terrace, creating a composite landform with a singular morphological expression. Archaeological deposits can be buried in these contexts also.

## REFERENCES CITED

Allan, Stacy and Michael Magner

2007a *Report of Archaeological Reconnaissance Survey North Branch Root River Bank Stabilization Olmsted County, Minnesota*. Copy on file, Office of State Archaeologist, St. Paul, Minnesota.

2007b *Report of Archaeological Reconnaissance Survey: Mill Creek Habitat Improvements, Project F9144 Olmsted County, Minnesota*. Copy on file, Office of State Archaeologist, St. Paul, Minnesota.

Alex, Lynn M.

2000 *Iowa's Archaeological Past*. University of Iowa Press, Iowa City, Iowa.

Alexander, E. Calvin and Geri Maki

1988 Sinkholes and Sinkhole Probability. *Geological Atlas of Olmsted County, Minnesota*. University of Minnesota, County Atlas Series, Atlas C-3, Plate 7. Minnesota Geological Survey, St. Paul.

Anderson, Duane

1975 *Eastern Iowa Prehistory*. Iowa State University Press, Ames, Iowa.

Anfinson, Scott F.

1980 *1979 Annual Report: Minnesota Municipal and County Highway Archaeological Reconnaissance Study*. Copy on file, Office of State Archaeologist, St. Paul, Minnesota.

1984 *1983 Annual Report: Minnesota Municipal and County Highway Archaeological Reconnaissance Study*. Copy on file, Office of State Archaeologist, St. Paul, Minnesota.

1990 Archaeological Regions in Minnesota and the Woodland Period. In *The Woodland Tradition in the Western Great Lakes: Papers Presented to Elden Johnson*, edited by G. E. Gibbon, pp. 135–166. University of Minnesota Publications in Anthropology No. 4. University of Minnesota, Minneapolis.

1997 *Southwestern Minnesota Archaeology*. Minnesota Prehistoric Archaeology Series No. 14. Minnesota Historical Society, St. Paul.

2007 *The State of Archaeology in Minnesota: Annual Report of the State Archaeologist, Fiscal Year 2006*. Copy on file, Office of State Archaeologist, St. Paul, Minnesota.

Anfinson, Scott F. and Randy Peterson

- 1989 *1988 Annual Report: Minnesota Municipal and County Highway Archaeological Reconnaissance Study*. Copy on file, Office of State Archaeologist, St. Paul, Minnesota.

Arzigian, Constance

- 1993 *Phase I Archaeological Survey of Two Proposed Disposal Sites (Furlow Farm and Pinewood) in Rochester, Minnesota*. Report of Investigations Number 158. Mississippi Valley Archaeology Center at the University of Wisconsin-La Crosse. Copy on file, State Historic Preservation Office, St. Paul.

- 2008 *Woodland Tradition in Minnesota*. National Register of Historic Places Multiple Property Documentation Form. Available online at <http://www.dot.state.mn.us/culturalresources/studies/woolandtradition.html>

Arzigian, Constance and Katherine Stevenson

- 2003 *Minnesota's Indian Mounds and Burial Sites: A Synthesis of Prehistoric and Early Historic Archaeological Data*. Publication 1. Office of the State Archaeologist, St. Paul.

Baerreis, David A., Reid A. Bryson, and John E. Kutzbach

- 1976 Climate and Culture in the Western Great Lakes Region. *Midcontinental Journal of Archaeology* 1:39-57.

Baker, R. G., E. Arthur Bettis, III, R. F. Denniston, L. A. Gonzalez, L. E. Strickland and J. R. Krieg

- 2002 Holocene Paleoenvironments in Southeastern Minnesota-Chasing the Prairie-Forest Ecotone. *Paleogeography, Paleoclimatology, Paleoecology* 177:103-122.

Baker, R. G., L. A. Gonzalez, M. Raymo, E. A. Bettis, III, M. K. Reagan, and J. A. Dorale

- 1998 Comparison of Multiple Proxy Records of Holocene Environments in Midwestern USA. *Geology* 26:1131-1134.

Baker, R. G., J. A. Mason, and L. J. Maher,

- 1999 Petaloid organs preserved in an Arctic plant macro fossil assemblage from full-glacial sediments in southeastern Minnesota. *Quaternary Research* 52:388-392.

Baker, R. G., L. J. Maher, C. A. Chumbley, and K. L. Van Zant,

- 1992 Patterns of Holocene Environmental Change in the Midwestern United States. *Quaternary Research* 37:379-389.

Benchley, Elizabeth, Blane Nansel, and Clark A. Dobbs

- 1997 Historic Period. In *Archeology and Bioarcheology of the Northern Woodlands*, edited by Elizabeth Benchley, Blane Nansel, Clark Dobbs, Susan Thurston Myster, and Barbara O'Connell, pp.180-214. Arkansas Archeological Survey Research Series No. 52.

Benn, David W.

- 1977 *Cultural Resource Survey of the Proposed Byron Outfall Sewer Line, Olmsted County, Minnesota*. Copy on file, State Historic Preservation Office, St. Paul.

Bettis, E. Arthur

- 1990 Geologic Context of the Rainbow site. In *Woodland Cultures on the Western Prairies: The Rainbow Site Investigations*, edited by D. W. Benn, pp. 21-49. vol. Office of the State Archaeologist Report 18. The University of Iowa, Iowa City.

Bettis, E. Arthur, R. G. Baker, W. R. Green, M. K. Whelan, and D. W. Benn

- 1992 Late Wisconsinan and Holocene Alluvial Stratigraphy, Paleoecology, and Archaeological Geology of East-Central Iowa. *Iowa Department of Natural Resources, Guidebook Series 12*.

Bettis, E. Arthur, and B. E. Hoyer

- 1986 Late Wisconsinan and Holocene Landscape Evolution and Alluvial Stratigraphy in the Saylorville Lake Area, Central Des Moines River Valley, Iowa. *Iowa Geological Survey Open-File Report 86-1*.

Bettis, E. Arthur, and Rolfe D. Mandel

- 2002 The Effects of Temporal and Spatial Patterns of Holocene Erosion and Alluviation on the Archaeological Record of the Central and Eastern Great Plains *Geoarchaeology* 17:141-154.

Bourgerie, G., Craig Johnson, Daniel Pratt, Jeffry Oertel, Ed Hajic, and Gwen Bennet

- 1994 *TH14/52 Rochester Corridor Phase I Cultural Resources Survey Technical Report*. Report submitted to the Minnesota Department of Transportation. Copy on file, State Historic Preservation Office, St. Paul.

Boyd, Matthew

- 2002 Identification of Anthropogenic Burning in the Paleoecological Record of the Northern Prairies: A New Approach. *Annals of the Association of American Geographers* 92:471-487.

Breakey, Kim C. and Clark A. Dobbs

- 1995 *A Phase I Archaeological Survey of Selected Portions of the Northern Natural Gas Company Rochester Rehab Project Corridor, Dodge, Olmsted and Steele Counties, Minnesota*. Copy on file, State Historic Preservation Office, St. Paul.

Bryson, Reid. A.

- 1998 Climatic Episodes (Holocene). In *Archaeology of Prehistoric Native America: An Encyclopedia*, edited by G. Gibbon, pp. 158–161. Garland Press, New York.

Buckmaster, M. M. and J. R. Paquette

- 1988 The Gorto Site: Preliminary Report on a Late Paleo-Indian Site in Marquette County, Michigan. *The Wisconsin Archeologist* 69:101-124.

Caine, Christy A. H.

- 1978 *Archaeological Survey at Bear Creek Park, Rochester, Minnesota, Olmsted County*. Hamline University for Rochester Park and Recreation Department. Copy on file, State Historic Preservation Office, St. Paul.

Caine, Christy A. H. and M.A. Howard

- 1978 *Archaeological Survey at Stewartville, Olmsted County, Minnesota*. Copy on file, State Historic Preservation Office, St. Paul.

Carr, Dillon and Robert F. Boszhardt

- 2003 The Kriesel Cache: A Late Paleoindian Biface Cache from Western Wisconsin. *Plains Anthropologist* 48(187):225-235.

- n.d. *Silver Mound Archaeological District, Jackson County, Wisconsin*. National Historic Landmark nomination submitted to the National Park Service. Unpublished manuscript on file at the Mississippi Valley Archaeology Center, University of Wisconsin-La Crosse.

Carr, Dillon, Robert F. Boszhardt, Andrew Bloedorn, Dan Winkler, and Stephen Wagner

- 2008 A Preliminary Report on the Schumann Cache: An Early Paleoindian Find in Southeastern Minnesota. *Current Research in the Pleistocene* 25:66-68.

Carr, Dillon, Daniel Winkler, Andrew Bloedorn, and Robert Boszhardt

- 2008 *The Schumann Cache: A Silicified Sandstone Clovis Cache from Southeastern Minnesota*. Poster paper presented at the Midwest Archaeological Conference, Milwaukee, Wisconsin.

Cater, John D and Clark Dobbs

- 1995 *A Phase I Archaeological Survey of Selected Route Variations on Portions of the Northern Natural Gas Company Rochester Rehab Project Corridor, Dodge and Olmsted Counties, Minnesota*. Reports of Investigation Number 349, Institute for Minnesota Archaeology. Copy on file, State Historic Preservation Office, St. Paul.

Chumbley, C. A., R. G. Baker, and E. A. Bettis III.

- 1990 Midwestern Holocene Paleoenvironments Revealed by Floodplain Deposits in Northeastern Iowa. *Science* 249:272- 274.

City of Rochester

- 2011 Flood Preparedness. Available online at  
<http://www.rochestermn.gov/departments/administration/projects/flood/flood.asp>

Collinson, J. D. and D. B. Thompson

- 1982 *Sedimentary Structures*. George Allen & Unwin, London, 194 p.

Dobbs, Clark A.

- 1988 Outline of Historic Contexts for the Prehistoric Period (CA. 12,000 B.P.- A.D. 1700). *Institute for Minnesota Archaeology Reports of Investigations No.3 7*, Minneapolis, MN. Copy on file, State Historic Preservation Office, St. Paul.

Dowiasch, Jean

- 2006 *Phase I Archaeological Survey of the proposed Bear Creek Sewer Alignment, Rochester, MN*. Report of Investigations Number 638. Mississippi Valley Archaeology Center at the University of Wisconsin-La Crosse. Copy on file, State Historic Preservation Office, St. Paul.

Folk, R. F.

- 1974 *Petrology of Sedimentary Rocks*. Hemphill Publishing Company, Austin, Texas.

Forman, Steven L.

- 1990 Thermoluminescence and Radiocarbon Chronology of Loess Deposition at the Loveland Paratype, Iowa. In *Holocene Alluvial Stratigraphy and Selected Aspects of the Quaternary History of Western Iowa*, edited by E. Arthur Bettis III, pp. 165-172. Iowa Department of Natural Resources Geological Survey Bureau Guidebook Series No. 9.

Frison, George and Bruce Bradley

- 1999 *The Fenn Cache: Clovis Weapons and Tools*. One Horse Land and Cattle Company, Santa Fe, New Mexico.

Gibbon, Guy, Craig M. Johnson, and Elizabeth Hobbs

- 2005 Chapter 3: Minnesota's Environment and Native American Culture History. In *A Predictive Model of Precontact Archaeological Site Location for The State of Minnesota*, edited by G. Joseph Hudak, Elizabeth Hobbs, Allyson Brooks, Carol Ann Sersland, and Crystal Phillips. Electronic document, <http://www.mnmodel.dot.state.mn.us/chapters/chapter3.htm> , accessed 10/2010.

Grimley, David. A., Leon R. Folmer, and E. Donald McKay

- 1998 Magnetic Susceptibility and Mineral Zonations Controlled by Provenance in Loess along the Illinois and Central Mississippi River Valleys. *Quaternary Research* 49:24-36.

Grimm, E. C.

- 1981 *An Ecological and Paleoecological Study of the Vegetation in the Big Woods Region of Minnesota*. PhD. dissertation, University of Minnesota, Minneapolis.

Harrison, Christina

- 1980a *Report on the Cultural Resources Survey Carried Out in Zumbro and Essex Parks, Olmsted County, Minnesota on April 22-23, 1980*. Minnesota Historical Society (File J 723 and J 725) for Rochester Park and Recreation Department. Copy on file, State Historic Preservation Office, St. Paul.
- 1980b *Report on Cultural Resource Survey of a Proposed Wastewater Treatment Facility at Stewartville, Olmsted County, Minnesota: Additional Survey Work Carried Out along Proposed Interceptor Sewer Route (Addendum)*. Copy on file, State Historic Preservation Office, St. Paul.
- 2001 *Report on Cultural Resource Reconnaissance Survey Conducted along Route of Proposed Badger Run Trunk Sanitary Sewer, Olmsted County*. Copy on file, State Historic Preservation Office, St. Paul.
- 2009 *Report on Archaeological Reconnaissance Survey Conducted for a Proposed Water System Improvement Project City of Oronoco, Olmsted County, Minnesota*. Copy on file, State Historic Preservation Office, St. Paul.

Higginbottom, Daniel

- 1996 *Projectile Points of Minnesota*. Available online at <http://www.tcinternet.net/users/cbailey/lithic1.html>

- Hobbs, Elizabeth, Craig M. Johnson, Guy E. Gibbon, Carol Sersland, Mark Ellis, and Tatiana Nawrocki
- 2002 Model Results and Interpretations. In *Mn/Model Final Report Phases 1-3*, edited by G. Joseph Hudak, Elizabeth Hobbs, Allyson Brooks, Carol Ann Sersland, and Crystal Phillips. Chapter 8. Available online at <http://www.dot.state.mn.us/mnmodel/P3FinalReport/chapter8.html>
- Hobbs, Howard C
- 1988 Surficial Geology. *Geological Atlas of Olmsted County, Minnesota*. University of Minnesota, County Atlas Series, Atlas C-3, Plate 3. 1: 100,000 scale. Minnesota Geological Survey, St. Paul.
- Hobbs, Howard C. and Joseph E. Goebel
- 1982 Geological Map of Minnesota: Quaternary Geology. In *State Map Series S-1*. Minnesota Geological Survey, University of Minnesota, St. Paul.
- Holtz-Leith, Wendy K.
- 2005 *Letter Report: Site#: MREP-014, Oronoco-Stolp Property, Olmsted County, Minnesota*. Copy on file, Office of State Archaeologist, St. Paul, Minnesota.
- Hudak, G. Joseph
- 1974 *The South Zumbro Watershed Archaeological Survey*. Copy on file, Office of State Archaeologist, St. Paul, Minnesota.
- 1981 *Cultural Resource Inventory of Lands in and Adjacent to the City of Rochester, Minnesota, Flood Control Project on the South Fork Zumbro River*. Report submitted to the Army Corps of Engineers, St. Paul District, Contract # DACW37-80-D-0045. Archaeological Field Services, Inc. and Historical Research, Inc. Copy on file, State Historic Preservation Office, St. Paul.
- Hudak, Curtis. M., and E. R. Hajic
- 2002 Landscape Suitability Models for Geologically Buried Precontact Cultural Resources *In A Predictive Model of Precontact Archaeological Site Location in The State of Minnesota*, edited by G. J. Hudak, E. Hobbs, A. Brooks, A. Sersland, and C. Phillips (Minnesota Department of Transportation, St Paul):12-1–12-63.
- Hudak, G. Joseph, Elizabeth Hobbs, Allyson Brooks, Carol Ann Sersland, and Crystal Phillips, editors
- 2002 *Mn/Model Final Report Phases 1-3: A Predictive Model of Precontact Archaeological Site Location for the State of Minnesota*. Final report available <http://www.dot.state.mn.us/mnmodel/P3FinalReport/TOC.html>

Jacobs, Peter M., and Joseph A. Mason

- 2007 Late Quaternary Climate Change, Loess Sedimentation, and Soil Profile Development in the Central Great Plains. *Geological Society of America Bulletin* 119:462-475.

Johnson, Craig M.

- 1992a *A Phase I Cultural Resources Survey of the TH 63 Reconstruction Project, Rochester, Olmsted County, Minnesota*. Copy on file, State Historic Preservation Office, St. Paul.

- 1992b *A Phase I Cultural Resources Survey of Borrow and Disposal Areas, Stewartville, Olmsted County, Minnesota*. Copy on file, State Historic Preservation Office, St. Paul.

Johnson, Craig, and E. Abel

- 2002 *Phase I Archaeological Investigations of a Proposed Replacement of Bridge 89182 over the South Fork of the Zumbro River, Realignment of Co. Rd. 125*. Copy on file, State Historic Preservation Office, St. Paul.

Justin, Michael A. and Holly Halverson

- 2003 *Phase I Archaeological Survey of the Proposed Lake George Haul Road and Gravel Pit, Rochester, Olmsted County, Minnesota*. Copy on file, State Historic Preservation Office, St. Paul.

Kanivetsky, Roman

- 1988 Bedrock Hydrogeology. *Geological Atlas of Olmsted County, Minnesota*. University of Minnesota, County Atlas Series, Atlas C-3, Plate 5. Minnesota Geological Survey, St. Paul.

Kelley, Kyran and Thomas Madigan

- 2001a *Phase I Archaeological Survey of a Bridge Replacement and Associated Road Construction on CR 125 (MnDOT S.P. 55-598-42) in Olmsted County Minnesota*. Copy on file, State Historic Preservation Office, St. Paul.

- 2001 b *Phase I Archaeological Survey of a Bridge Replacement and Associated Road Construction on CR 105 (MNDOT S.P. 55-598-48) in Olmsted County, Minnesota*. HFS Reports of Investigation, No. 671. Copy on file, State Historic Preservation Office, St. Paul.

Kluth, David W. with contributions by Curtis M. Hudak

- 2002 *Phase I and II Archaeological and Geomorphic Investigations Along T.H. 52 Between Fine Island and Oronoco, Olmsted and Goodhue Counties, Minnesota (S.P. 5508-101)*. Copy on file, State Historic Preservation Office, St. Paul.

Knox, James C.

- 1983 Responses of Floods to Holocene Climatic Change in the Upper Mississippi Valley. *Quaternary Research* 23:287-300.
- 1996 Late Quaternary Upper Mississippi River Alluvial Episodes and their Significance to the Lower Mississippi River System. *Engineering Geology* 45:263-285.
- 1999 Long-term episodic changes in magnitudes and frequencies of floods in the Upper Mississippi River valley in A. G. Brown and T. A. Quine, eds., *Fluvial Processes and Environmental Change*, pp. 255-282. John Wiley & Sons Ltd.

Knox, James C. and J. M. Daniels

- 2002 Watershed scale and the stratigraphic record of large floods. In *Ancient Floods, Modern Hazards: Principles and Applications of Paleoflood Hydrology*, pp. 237-255. Water Science and Application Volume 5. American Geophysical Union.

Koenen, Bruce

- 2007 *Paleoindian in Southeast Minnesota*. Manuscript on file, Minnesota Office of State Archaeologist.

Kolb, Michael F.

- 2008 Geomorphic and Stratigraphic Investigations to Determine the Potential for Deeply Buried Archaeological Deposits in the Minnesota DM&E Railroad Corridor. *Strata Morph Geoexploration Report of Investigation No. 161*.

Kutzbach, John E.

- 1987 Model Simulations of the Climatic Patterns During the Deglaciation of North America. In *North America and Adjacent Oceans During the Last Deglaciation*, edited by W. F. Ruddiman and H. E. Wright Jr., pp. 425–446. Geological Society of America, Boulder, Colorado.

Leonard, Joseph A.

- 1910 *History of Olmsted County, Minnesota*. Goodspeed Publishing Co., Chicago.

Leopold, Luna B., M. G. Wolman, and J. P. Miller

- 1964 *Fluvial Processes in Geomorphology*. W. H. Freeman and Company, San Francisco.

Link, Jeannie

- 1999 Ground Stone Tools. In *Bison Hunters of the Western Prairies: Archaeological Investigations at the Dixon Site (13WD8), Woodbury County, Iowa* edited by Richard

- L. Fishel, p. 60. Report 21, Office of the State Archaeologist, University of Iowa, Iowa City.
- Lobel, T. J.  
2005 *The Organization of Early Paleoindian Economies in the Western Great Lakes*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Illinois-Chicago.
- Magner, Michael  
1997a *DNR Division of Forestry Heritage Resources Program Interim Project Review Report - Muentzer Road Realignment, Richard J. Dorer State Forest. June 2, 1997*. Copy on file, State Historic Preservation Office, St. Paul.  
  
1997b *Division of Forestry Heritage Resources Program Interim Project Review Report – Muentzer Unit Site Verification, Richard J. Dorer Memorial Hardwood State Forest. December 17, 1997*. Copy on file, State Historic Preservation Office, St. Paul.
- Marshner, Francis J.  
1974 *The Original Vegetation of Minnesota*. North Central Forest Experimental Station, U.S. Department of Agriculture, Forest Service, St. Paul. Copy on file, State Historic Preservation Office, St. Paul.
- Mason, Joseph A., Edward A. Nater, C. William Zanner, and James C. Bell  
1999 A New Model of Topographic Effects on the Distribution of Loess. *Geomorphology* 28:223-236.
- Mason, Joseph A., Edward A. Nater, and Howard C. Hobbs  
1994 Transport Direction of Wisconsinan Loess in Southeastern Minnesota. *Quaternary Research* 41:44-51.
- Mason, Ronald J.  
1997 The Paleo-Indian Tradition. *The Wisconsin Archeologist* 78: 78-110.
- Mason, Ronald J. and Carol Irwin  
1960 An Eden-Scottsbluff Burial in Northeastern Wisconsin. *American Antiquity* 26:43-57.
- Minnesota Climatology Working Group (MCWG)  
2008 Heavy Rains Fall on Southeastern Minnesota: August 18-20, 2007.  
([http://climate.umn.edu/doc/journal/flash\\_floods/f070820.html](http://climate.umn.edu/doc/journal/flash_floods/f070820.html) )

Minnesota Historical Society

- 1981 *Minnesota Statewide Archaeological Survey. Summary: 1977-1980*. Minnesota Historical Society, St. Paul. Copy on file, State Historic Preservation Office, St. Paul.
- 2007 *TrueNorth: Mapping Minnesota's History*. Accessed October 2011 online at <http://www.mngeo.state.mn.us/ghol/Maps.php>

Minnesota DNR-Division of Forestry

- 1999 Ecological Subsections of Minnesota. Minnesota Department of Natural Resources. Electronic document, <http://deli.dnr.state.mn.us/>, dataset downloaded 2010.

Minnesota Geospatial Information Office (MnGeo)

- 2011 Original Public Land Survey Plat Maps of Minnesota. <http://www.mngeo.state.mn.us/glo/Index.htm> accessed May 2010.

Monaghan, G. William, K. C. Egan-Bruhy, M. J. Hambacher, D. R. Hayes, M. F. Kolb, S. Peterson, J. A. Robertson, N. R. Shaffer

- 2006 The Minnesota Deep Test Protocol Project. Accessed online at <http://www.mnmodel.dot.state.mn.us/pages/DeepTestProtocol.html> )

Morse, Dan F.

- 1997 *Sloan: A Paleoindian Dalton Cemetery in Arkansas*. Smithsonian Institution Press, Washington, D.C.

Muhs, Daniel R., and E. Arthur Bettis III

- 2003 Quaternary loess-paleosol sequences as examples of climate driven sedimentary extremes. In *Extreme Depositional Environments: Mega End Members in Geologic Time*, edited by M. A. Chan and A. W. Archer, pp. 53-74. Geological Society of America Special Paper 370, Boulder.

Nienow, Jeremy L.

- 1997 *Public Archaeology at Whitewater: An Archaeological Survey of Portions of the Whitewater River Valley, Winona County, Minnesota*. Mississippi Valley Archaeology Center at the University of Wisconsin-La Crosse Report of Investigations No 277. Copy on file, University of Wisconsin-La Crosse.

Ojakangas, Richard W. and Charles L. Matsch

- 1982 *Minnesota's Geology*. University of Minnesota Press, Minneapolis.

Ollendorf, Amy L

- 2006a *Phase I Cultural Resources Investigation in the South Fork Zumbro River Floodplain for the Proposed Elford-Fullerton (ELF) Sewer Alignment, City of Rochester*,

*Olmsted County, Minnesota*. Prepared for EarthTech and the City of Rochester. Copy on file, State Historic Preservation Office, St. Paul.

- 2006b *Archaeological Monitoring in the Bear Creek Floodplain for the Proposed Bear Creek Sewer Alignment, City of Rochester, Olmsted County, Minnesota*. Copy on file, State Historic Preservation Office, St. Paul.

Olsen, Bruce M.

- 1988 *Bedrock Geology. Geological Atlas of Olmsted County, Minnesota*. University of Minnesota, County Atlas Series, Atlas C-3, Plate 2. 1: 100,000 scale. Minnesota Geological Survey, St. Paul.

O'Mack, Scott

- 1991a *A Phase I Cultural Resources Investigation: Archaeological Survey and Testing of Two Proposed Dredge Disposal Area for the Rochester Flood Control Project, Rochester, Olmsted County, Minnesota*. St. Paul District Corps of Engineers, Report of Investigations, No. CENCS-PD-ER 49. Copy on file, State Historic Preservation Office, St. Paul.

- 1991b *Phase I Cultural Resources Investigation: Archaeological Testing of Two Proposed Dredge Disposal Areas and a Proposed Equipment Storage Area for Stage 2B of the Rochester Flood Control Project Rochester, Olmsted County, Minnesota*. St. Paul District Corps of Engineers, Report of Investigation, No. CENCS-PD-ER 52. Copy on file, State Historic Preservation Office, St. Paul.

Oothoudt, J. W.

- 1976 *Preconstruction Cultural Resource Survey of the South Zumbro Watershed Project, Olmsted and Dodge Counties, Minnesota*. Copy on file, State Historic Preservation Office, St. Paul.

Perkl, Bradley E.

- 1998 *Cucurbita pepo* from King Coulee, Southeastern Minnesota. *American Antiquity* 63:279-288.
- 2009 *The Late Archaic-Early Woodland Transition in Southeastern Minnesota*. Ph.D. Dissertation, University of Minnesota.

Peterson, Leslie

- 1981 *The Minnesota Trunk Highway Archaeological Reconnaissance Survey. Annual Report 1980*. Copy on file, State Historic Preservation Office, St. Paul.

Peterson, Leslie, William Yourd

- 1984 *The Minnesota Trunk Highway Archaeological Reconnaissance Survey. Annual Report 1983.* Copy on file, State Historic Preservation Office, St. Paul.

Peterson, Randy J., Michael A. Magner, and Bruce A. Koenen

- 1991 *1990 Annual Report: Minnesota Municipal and County Highway Archaeological Reconnaissance Study.* Copy on file, State Historic Preservation Office, St. Paul.

- 1992 *1991 Annual Report: Minnesota Municipal and County Highway Archaeological Reconnaissance Study.* Copy on file, State Historic Preservation Office, St. Paul.

Peterson, Leslie D. David J. Mather and Wanda Watson Radford

- 1993 *1992 Annual Report: Minnesota Municipal and County Highway Archaeological Reconnaissance Study.* Copy on file, State Historic Preservation Office, St. Paul.

Peterson, Leslie D., Thor A. Olmanson, and Wanda Watson Radford, editors

- 1990 *The Municipal Trunk Highway Archaeological Reconnaissance Study Annual Report – 1989.* Copy on file, State Historic Preservation Office, St. Paul.

Peterson, Leslie D., Kent A. Skaar, and Wanda Watson Radford, editors

- 1994 *The Municipal Trunk Highway Archaeological Reconnaissance Study Annual Report – 1993.* Copy on file, State Historic Preservation Office, St. Paul.

Poch, George A

- 1980 *Soil Survey of Olmsted County. Soil Conservation Service, U.S. Department of Agriculture.* Copy on file, State Historic Preservation Office, St. Paul.

Pratt, Dan .R.

- 1989 *A Phase I Archaeological Survey of the 55th St. NE Corridor in Rochester (Olmsted County), Minnesota.* Copy on file, State Historic Preservation Office, St. Paul.

- 2007 *Olmsted County Department of Public Works, County State Aid Highway 1 Realignment, Pleasant Grove Township, Olmsted County, Minnesota. Phase I Archaeological Investigation of the Proposed CSAH 1 Realignment Corridor and Phase II Archaeological Investigation of Site 21OL0042.* Arch<sup>3</sup>, LLC. Copy on file, State Historic Preservation Office, St. Paul.

Ritzenthaler, Robert E.

- 1972 *The Pope Site, a Scottsbluff Cremation in Waupaca County? The Wisconsin Archeologist 53:15-19.*

Ryder, K. G

- 1982 *Cultural Resource Reconnaissance for Proposed Flood Control Levee on Bear Creek in Rochester, Olmsted County, Minnesota*. Copy on file, State Historic Preservation Office, St. Paul.

Schermer, Shirley I., William Green, and James Collins

- 1995 *A Brief Culture History of Iowa*. In *Guidelines for Archaeological Investigations in Iowa*, edited by Kira E. Kaufman. University of Iowa.

Schoeneberger, P. J., D. A. Wysocki, E. C. Benham and W. D. Broderson, compilers

- 1998 *Field Book for Describing and Sampling Soils*. Version 1.1. National Soil Survey Center, Natural Resource Conservation Service, USDA, Lincoln, Nebraska.

Schwartz, George M. and George A. Thiel

- 1976 *Minnesota's Rocks and Waters*. University of Minnesota Press, Minneapolis.

Sikkink, L.L.

- 1987 *Phase I and II Cultural Resource Investigation: Reassessment of Sites within the Rochester, Minnesota, Flood Control Project Area*. St. Paul District Corps of Engineers, Report of Investigations No. CENCS-PD-ER 27. Copy on file, State Historic Preservation Office, St. Paul.

Sims, P. K. and G. B. Morey

- 1972 *Geology of Minnesota: A Centennial Volume in Honor of George M. Schwartz*. Minnesota Geological Survey, St. Paul. Copy on file, State Historic Preservation Office, St. Paul.

Soil Survey Staff

- 1975 *Soil Taxonomy*. U. S. Department of Agriculture Handbook 436, U. S. Government Printing Office, Washington D. C.

Stevenson, Katherine P., Robert F. Boszhardt, Charles R. Moffat, Philip H. Salkin, Thomas C. Pleger, James L. Theler, and Constance M. Arzigian

- 1997 *The Woodland Tradition*. *The Wisconsin Archeologist* 78: 140-201.

Stewart, Patrick R.

- 1998 *Archaeological Investigation at the Proposed TH 63 South Corridor TH 52 to 48<sup>th</sup> Street SE, Olmsted County, Minnesota*. (S. P.) 5509-62 (TH63-Rochester). Report of Investigations Number 294. Mississippi Valley Archaeology Center at the University of Wisconsin-La Crosse. Copy on file, State Historic Preservation Office, St. Paul.

Stoltman, James B.

1979 Middle Woodland Stage Communities of Southwestern Wisconsin. In *Hopewell Archaeology*, pp.122-139. The Kent State University Press, Kent, Ohio.

1997 The Archaic Tradition. *The Wisconsin Archeologist* 78: 112-139.

Strachan, R.A.

1975 *Report on the Archaeological Survey of the Rochester-Zumbro River Flood Control Project*. Report submitted to the Army Corps of Engineers, St. Paul District, Contract # DACW37-76-C-0044. Museum of Anthropology, Mankato State University. Copy on file, State Historic Preservation Office, St. Paul.

Theler, James and Robert Boszhardt

2003 *Twelve Millennia: Archaeology of the Upper Mississippi River Valley*. University of Iowa Press, Iowa City.

Thompson, D. M. and E. A. Bettis,

1980 Archaeology and Holocene Landscape Evolution in the Missouri Drainage of Iowa. *Journal of the Iowa Archaeological Society*, 27:1-60.

Tumberg, Timothy

2009 *Water Recreation Program Annual Report 2006*. Prepared for MnDNR by Archaeology Department, Minnesota Historical Society. Copy on file, State Historic Preservation Office, St. Paul.

Twinde, Vicki L. and Barbara Kooiman

2001 *Supplementary Phase I Cultural Resource Investigations of the Proposed TH 63 South Corridor, TH 52 to 48th Street SW, Olmsted County, Minnesota*. Report of Investigations Number 431, Mississippi Valley Archaeology Center at the University of Wisconsin-La Crosse. Copy on file, State Historic Preservation Office, St. Paul.

USDA-NRCS (United States Department of Agriculture, Natural Resource Conservation Service)

2010 *Web Soil Survey*. Accessed online at <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>

Vermeer, Andrea

2005 *Phase I Archaeological Survey for the Silver Creek Sanitary Sewer Sub-Trunkline Project, Rochester, Olmsted County, Minnesota*. The 106 Group Ltd. St. Paul. Copy on file, State Historic Preservation Office, St. Paul.

- 2007 *Phase I Cultural Resources Survey for the MinnErgy Ethanol Plant Project, Eyota Township, Olmsted County, Minnesota. Addendum.* Copy on file, State Historic Preservation Office, St. Paul.

Walker, P. H.

- 1966 Postglacial Environments in Relation to Landscape and Soils on the Cary Drift, Iowa. Agriculture and Home Economics Experiment Station, Iowa State University, *Research Bulletin* 549:838-875.

Webb, T. III., and R. A. Bryson

- 1972 Late and Postglacial Change in the Northern Midwest, U.S.A., Quantitative Estimates Derived from Fossil Pollen Spectra by Multivariate Statistical Analysis. *Quaternary Research* 2:70–115.

Webb, T. III, E. J. Cushing, and H. E. Wright Jr.

- 1983 Holocene Changes in the Vegetation of the Midwest. In *Late Quaternary Environments of the United States, Volume 2: The Holocene*, edited by H. E. Wright Jr., pp. 142–165. University of Minnesota Press, Minneapolis.

Winchell, Newton H.

- 1911 *Aborigines of Minnesota.* Minnesota Historical Society, St. Paul.

Withrow, Randall M.

- 1990 *A Phase I Cultural Resource Investigation: Field Reconnaissance and testing of a Proposed Trail System in the Keller Wildlife Management Area, Olmsted County, Minnesota.* Report of Investigation #CENCS-PD-ER-43, St Paul District Corps of Engineers. Copy on file, State Historic Preservation Office, St. Paul.

Wright, Herbert E., Jr., T. C. Winter, and H. L. Patten

- 1963 Two Pollen Diagrams from Southeastern Minnesota: Problems in the Regional Late-Glacial and Postglacial Vegetational History. *Geological Society of America Bulletin* 74:1371-1396.