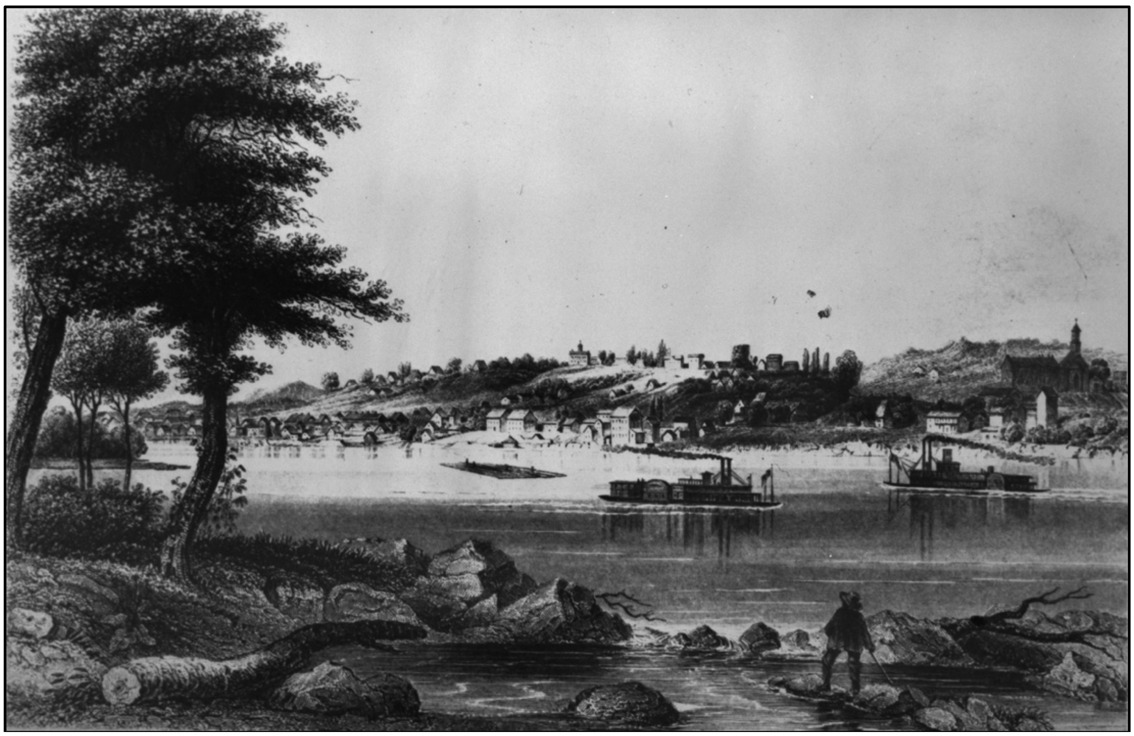
A SHIPWRECK MAGNETOMETER SURVEY ON BANGERT ISLAND, ST. CHARLES, MISSOURI

by
Dustin A. Thompson, Neal H. Lopinot, and Sarah J. Reid

Prepared for
The Kansas City District
U.S. Army Corp of Engineers
&
HDR Engineering



Research Report No. 1690

Center for Archaeological Research
Missouri State University
901 South National
Springfield, Missouri 65897

August 2020

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MoSHPO Tracking No.: 093-SC-20

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Cover figure: Drawing of riverfront at St. Charles, Missouri (University of Wisconsin-La Crosse, Murphy Library, Special Collections; Image Negative No. 28996, available at https://digital.library.wisc.edu/1711.dl/ QRBEXINCUZIEG8V).

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ABSTRACT

The Center for Archaeological Research, Missouri State University undertook background research and a magnetometer survey for the City of St. Charles and the Kansas City District, U.S. Army Corp of Engineers. The survey was undertaken under a contract with HDR Engineering with the purpose of determining if any buried steamboat wrecks would be disturbed as the result of the proposed re-excavation of a historic channel of the Missouri River. The channel once separated Bangert Island from the western shore of the Missouri River.

Based on a partial magnetometer survey, historic records about shipwrecks in the area, a large suite of historic maps and aerial photographs, and the geomorphological history of Bangert Island, it appears to be extremely unlikely that any buried steamboat wrecks dating to the nineteenth century are located within the project area. In fact, seven of the eight vessels of concern in this report were wrecked on or before 1879, or when an 1879 map and previous maps show the main river channel well to the east of the APE. Therefore, it seems impossible to expect the remains of any of these seven vessels to occur within or even near the Bangert Island APE. In addition, historical documentation indicates that the remaining vessel of concern, the *Ella Kimbrough*, was shipwrecked in 1884 downstream from the APE and appears to have been at least partially salvaged.

We believe that our report has sufficiently addressed the likelihood that buried steamboat wrecks are not located within the APE. Therefore, it is recommended that the proposed clearing of the former channel of the Missouri River on Bangert Island should be allowed to proceed as planned, provided that the following conditional stipulations are met. However, should a portion or portions of such vessel wreckage be encountered during the course of chute development, construction should cease immediately and the Kansas City District archaeologist and Missouri State Historic Preservation Office should be contacted.

ACKNOWLEDGMENTS

First and foremost, the authors of this report would like to express our deep gratitude to Dr. Gina Powell of the Kansas City District of USACE for overseeing our efforts throughout the course of this project. Charles Brown at the Herman T. Pott National Inland Waterways Library within the St. Louis Mercantile Library at the University of Missouri–St. Louis provided research assistance. We would also like to thank John Denlinger of HDR Engineering for his patience and assistance, along with that of Daniel Mann of the City of St. Charles. Jennifer Rideout assisted in the collection of historical information, as well as the conduct of the fieldwork. Dustin Thompson directed the magnetometer survey and was also assisted in the field by Brandon Ives, Alan O'Conner, and Grace Smith

Neal H. Lopinot
Principal Investigator

INTRODUCTION

The Center for Archaeological Research (CAR), as a consulting group working for HDR Engineering, undertook a steamboat wreck magnetometer survey for the Kansas City District, U.S. Army Corps of Engineers (USACE). The field survey was undertaken on November 18–21, 2019, supplemented by borings and test pits documented in early 2020 by Reitz & Jens, Inc. for HDR Engineering. CAR services were provided in accord with the tasks identified in the ACE Statement of Work titled *Bangert Island Flood Risk & Riverfront Transformation Project Section 22 of WRDA 1974 Planning Assistance to States*. The purpose of the survey was to determine if any buried steamboat wrecks would be disturbed as the result of the proposed re-excavation of the historic channel separating Bangert Island from the shoreline (Figure 1).

A Brief History of Steamboating on the Missouri River

River transportation opened the trans-Appalachian West to large-scale immigration and commercial development, particularly during the period of ca. 1820–1870 or prior to the development of an extensive network of railroads. During this period, the steamboat provided rapid transportation for products and people in a vast area that was characterized by a very poor, nascent road system. As Chittenden (1903:73) stated, "Then there were no railroads to speak of west of the Mississippi, nor, for that matter, any other roads worthy of mention. The river was the great, and almost the only, highway of travel and commerce." Steamboat construction and traffic during this period grew exponentially, creating great labor demands involving both the construction and operation of steamboats. These jobs ranged from those for shipwrights, joiners, and glass suppliers to iron ore miners and foundry workers to woodcutters and lumbermen to steamboat clerks, agents, operators, and merchants to insurance agents (e.g., Hunter 1949:382–383; Kane 2004:19–22).

The first steamboat to ply the Missouri River was the *Independence*, which travelled up the Missouri from St. Louis to Franklin and Chariton, Missouri in late May and early June of 1819 (McDonald 1927a:218). It left St. Louis on May 13, 1819 and arrived in St. Charles two days later (Brink 1875:11). It carried passengers as well as cargo that included flour, whiskey, sugar, nails, castings, and other merchandise for local merchants (Gould 1889:114: Lass 2008:48). Within a few months, a government-sponsored expedition consisting of a flotilla of four steamboats and nine keelboats headed up the Missouri River with the Yellowstone as its destination (Gould 1889:114). Although some steamboats began plying the Missouri River shortly thereafter, "the first regular service between St. Louis and Fort Leavenworth, by packet, is said to have been introduced in 1829" (Hunter 1949:47), and the "flush times of Missouri River steamboating fell within the twenty-five-year period from 1845 to 1870" (Hunter 1949:48).

The life span for a steamboat was relatively short. The average life spans differ for the various river systems and the period of study, but most lasted no more than five years and nearly one-fourth of steamboats were irreparably damaged as the result of some disaster (Hunter 1949:101). The Missouri River was particularly treacherous at times, which varied seasonally and whether a vessel was moving upriver or downriver. Approximately 400 vessels were sunk or disabled on the Missouri River during the steamboating period (Lass 2008:32). Hunter (1949:101) notes:

> On the Missouri River, where conditions were particularly difficult, it was reported in 1849 that a good boat would not last over three years . . . The longevity of western steamboats improved materially in later years as the result of technical advances, river improvements, and the operation of the steamboat inspection system.

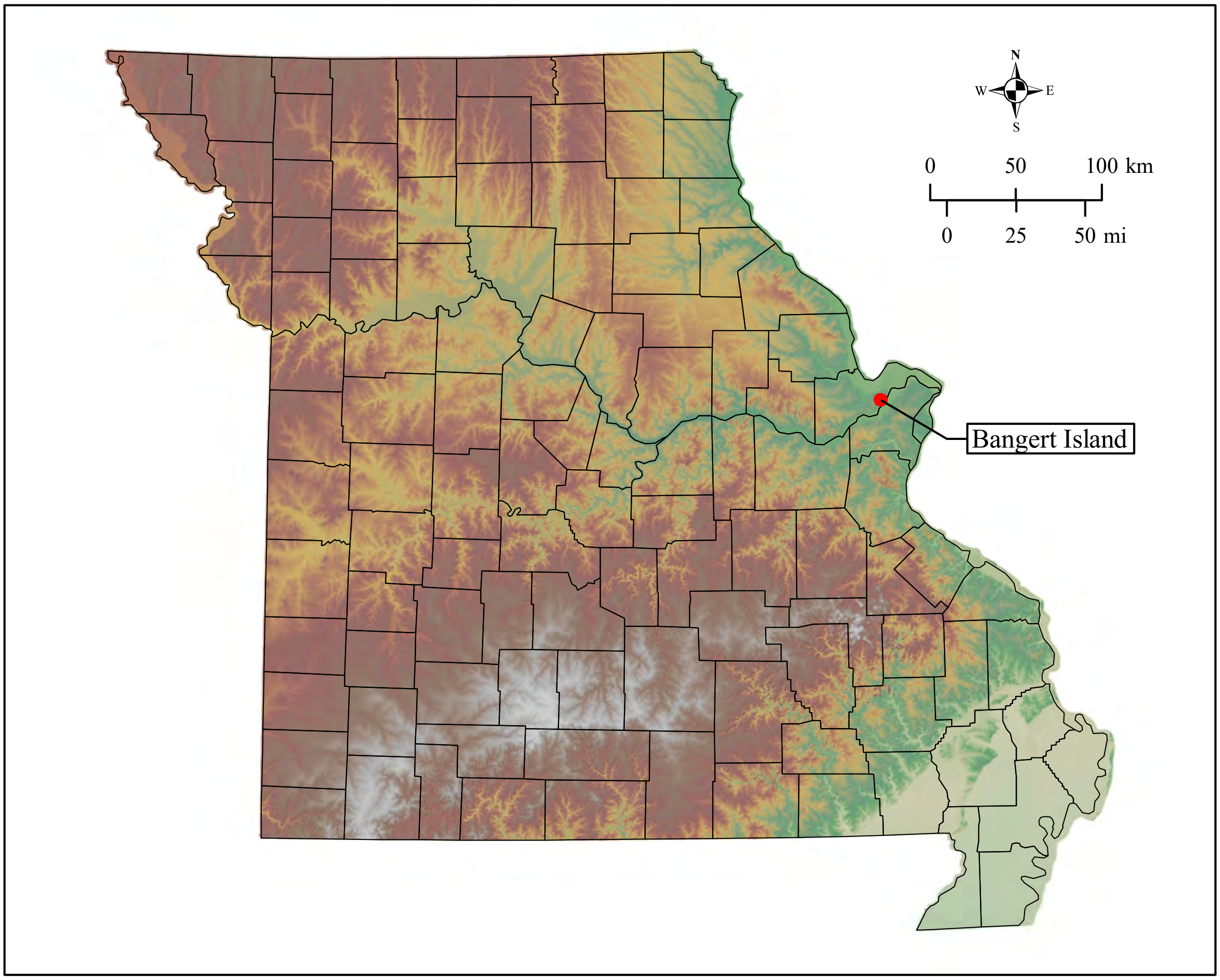

Figure 1. General location of Bangert Island in Missouri.

Hunter (1949:102) provides a good listing of the conditions that resulted in the short lifespan for western steamboats:

> Floating logs, driftwood and ice, raking snags, powerful engines operating at excessive pressures, direct landings at riverbanks, frequent groundings at low water, the strain of getting off and over bars, rot and deterioration from exposure to sun and air when stranded or beached during the low-water season—all these told heavily on lightly framed and planked hulls . . . Gross overloading, hard driving, carelessness in handling, and the widespread practice of undertaking and forcing through trips in disregard of low water and ice produced strain and distortion in hull members and intensified the wear of planking, engines, and machinery.

Snags were the most common reason for inland shipwrecks prior to the Civil War (Hunter 1949:272–289; Lass 2008:32). Of the 1,166 shipwrecks documented by Paskoff (2007) for the period of 1821–1860, snags were cited as the cause for 463 or nearly 40% (Table 1.1). Hunter (1949:Table 10) also noted that snags accounted for 576 or almost 58% of 995 steamboat accidents on the western waters during the period of 1811–1852. Paskoff (2007) presents additional shipwreck data to 1900. The data indicate a sharp decline in shipwrecks from 1871 to 1885. This is likely related to the increase in rail transportation and a concomitant decrease in steamboat transportation, although there was again a nearly fourfold increase in shipwrecks during 1886–1890. It is suspected that this coincides with a revival of river traffic involving a surge in the use of barges, principally for hauling grain and mining products (e.g., coal). By about 1890, gasoline power also began to replace steam power.

For the Missouri River itself, McDonald (1927c:607) documented 411 shipwrecks on the Missouri River, of which more than half (N=240) were caused by snags. The remaining causes consisted of ice (n=79), fire (n=49), bridges (n=17), explosion (n=10), and other (N=72). The Missouri River was notorious for snags.

> The conditions of the Missouri River bore many similarities to those of the lower Mississippi. Flowing through a bed of alluvial soils, it was prone to meander and became notorious for its many snags and obstructions. [Kane 2004:31]

Beginning in 1824, the federal government committed funding for snag removal along the Missouri and other rivers (Hunter 1949:192–193), but snags continued to be a major problem due to the meandering, erosive nature of the Missouri River. Steamboats were generally their own worst enemy since they burned immense amounts of wood fuel, obtained from wood sold by farmers periodically along the Missouri riverbanks. The clearance of the bottomland forests for agriculture in turn contributed to increased runoff and even greater erosion, particularly during the springtime when the Missouri River and its tributaries were fed by the most intense rainfall and melting snow and ice. As erosion occurred, large trees bordering the rivers were lost and new snags were created in addition sometimes to new channel segments.

Snags were of two types—*planters* and *sawyers*. Both involved large trees that lost most or all of their limbs and had become partially, if not entirely waterlogged. The massive rootwads of such trees would become embedded in the riverbed. A planter was regarded as a snag in a fixed position, whereas a sawyer would bob up and down. Since such snags would be pointed downriver, steamboats traveling upriver were more vulnerable than those traveling downriver. Lass (2008:21) provides an excellent description of snags:

> Sawyers—entire trees with soils still enclosing their roots—bobbed up and down near the bank. While aggravating to boats, they did not cause wrecks. But sometimes they blocked the most navigable channel and forced boats into shallow waters. Over time, water action and the annual ice-outs transformed some of the sawyers into [fixed] snags. Released from a collapsed bank and stripped of smaller branches, the base of a tree would become embedded in the streambed. All snags came from large trees, because only they had sufficient weight to cause their roots to become firmly fixed in the bottom. Snags stood alone or in clusters below timbered points. New snags often retained some large branches and, as the wood was bleached by sun and water, resembled an array of ghost trees.
>
> As they aged, snags became more dangerous. Everything above or slightly below the waterline was broken off, and the sharpened ends of the remnant trunks were often undetectable in the murky water. Pilots had to be constantly on the alert for small ripples, a telltale sign of snags just under the water.

The next most-common reason for steamboat wrecks during this period was simply burning as a result of boiler explosions, carelessness, or even arson. Of the 1,166 shipwrecks on the western waters documented by Paskoff (2007), 320 or 27.4% cases were due to burning. Given that steamboats were constructed largely of wood and given that torches and lamps (in addition to tobacco smoking) would have been common aboard such vessels, many steamboats were lost as the result of accidental fires. However, boiler explosions also were not uncommon. In addition, the burning of steamboats was enhanced by disasters. Of particular significance was the wind-driven 1849 St. Louis riverfront fire that destroyed 23 steamboats, three barges, a canal boat, and 500 buildings in a fifteen-square-block area (Lass 2001:7).

River transportation was the lifeblood of commerce and immigration during at least four to five decades of the nineteenth century, but this mode of transportation was rapidly eclipsed during the latter half of the nineteenth century by the growing network of relatively straight, overland railroads. According to Lass (2008:259), "From 1868 to 1873, rapidly advancing railroads drastically changed ... Missouri River steamboating and the scope of the St. Louis hinterland." Unlike the steamboat industry, the railroads benefitted greatly from free land grants and supplemental financing through the issuance of government bonds. Furthermore, railroad bridges provided major obstacles for steamboats, particularly when river levels were high and the water moved swiftly, making navigation more difficult. Hunter (1949:596) noted, "Hiram M. Chittenden, writing at the close of the [nineteenth] century, asserted that on the Missouri River bridges were more dreaded by pilots than all the other obstacles combined." Lass (2008:363) notes that the only "regular long-trade Packet" to ply the lower Missouri River in 1895 was the *Benton*.

BANGERT ISLAND HISTORICAL BACKGROUND

The Bangert Island project area is located in a silted-in channel separating Bangert Island from the shoreline along the west bank of the Missouri River in St. Charles, Missouri, just south of the Interstate 70 bridge. In fact, it will be shown that the entirety of Bangert Island is a relatively recent landform, created since the 1950s. As with much of the Missouri River, this stretch of the river has had a very active channel and a number of steamboat wrecks noted to occur within close proximity to Bangert Island. A series of maps and aerial photographs made between 1854 and 1955, after which the river settled into its current channel, illustrate just how much movement there has been.

The earliest historic maps dating to 1854, 1875, and 1879 clearly show the main channel of the Missouri River being situated well to the east of the Bangert Island APE (Figures 3–5). The earliest General Land Office (GLO) plat map dating to 1854 depicts the main channel of the river along the eastern side of the valley, not the western side of the valley where St. Charles is located (Figure 3). There is an island on the west side of the main channel with a slough on the west side of that island. The project area is located on land on the west bank of that slough. The 1875 and 1879 maps (Figures 4–5) also show the project area on land away from the river, although the slough or flood chute that created St. Charles Island occurred nearby. However, the island apparently was larger and extended further to the east than that depicted on the 1854 plat map. The 1879 map is a detailed river map that labels the island as St. Charles Island and the main channel to the east as St. Charles Bend, also called Penn's Bend after a landing on the east side of the river on Dr. Penn's land (Figure 6).

A major shift in the channel location is recorded on the 1894 Missouri River channel map (Figure 6). The channel apparently was deliberately shifted to the west side of the valley to protect the Wabash Railroad at the north end of St. Charles Bend. Structures were built in the river to force the channel to migrate west away from the east bank. This area subsequently silted in as the channel moved, leaving a large sand and silt flat behind. At the end of the nineteenth century, the river had not completely moved to the base of the bluff. A narrow strip of bottom land was still present. The north half of the APE would have been located on this strip of land, whereas the south half would have been mostly within the new river channel.

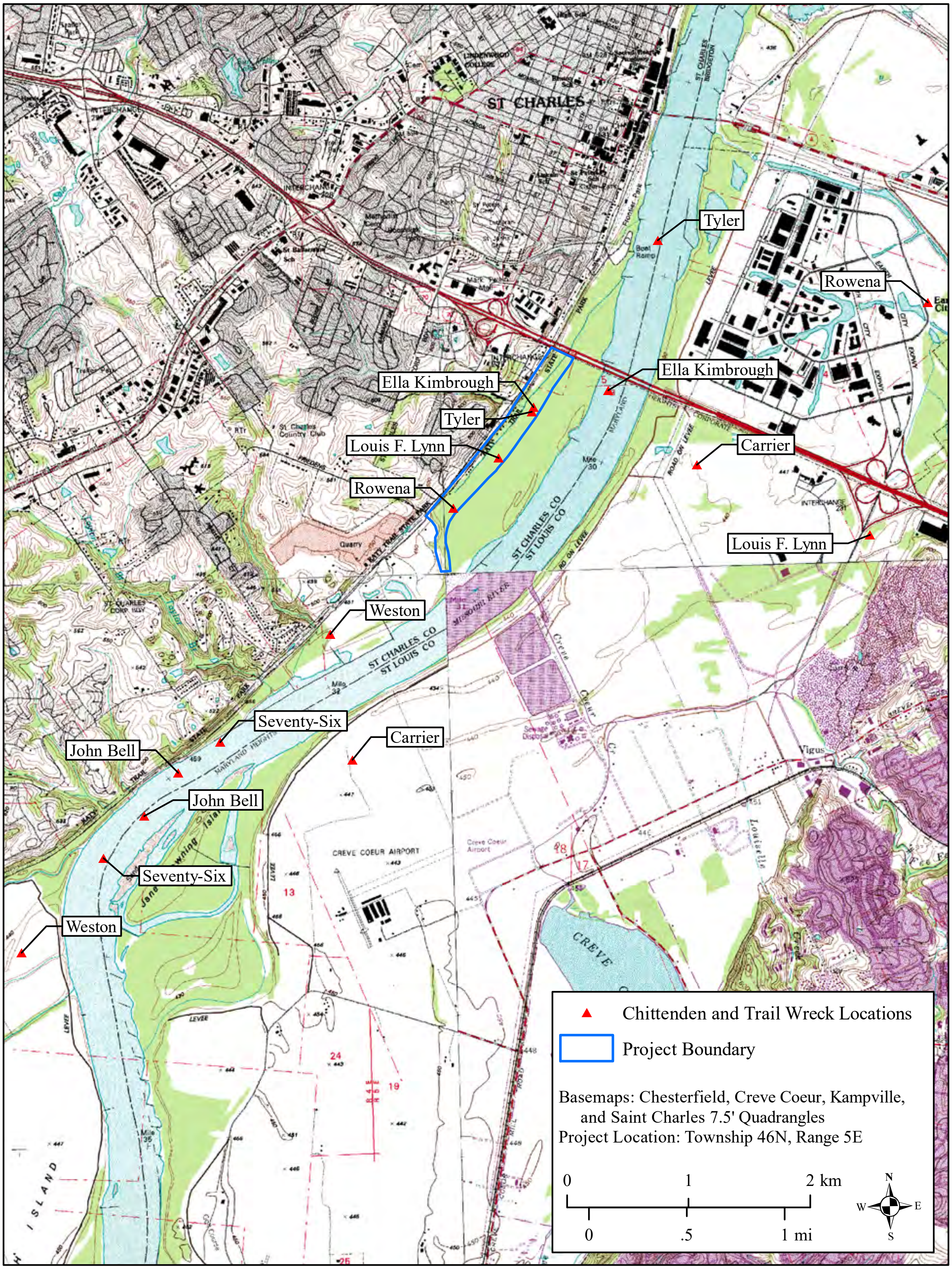

Figure 2. USGS map showing locations of shipwrecks plotted by Chittenden (1897) and Trail (n.d).

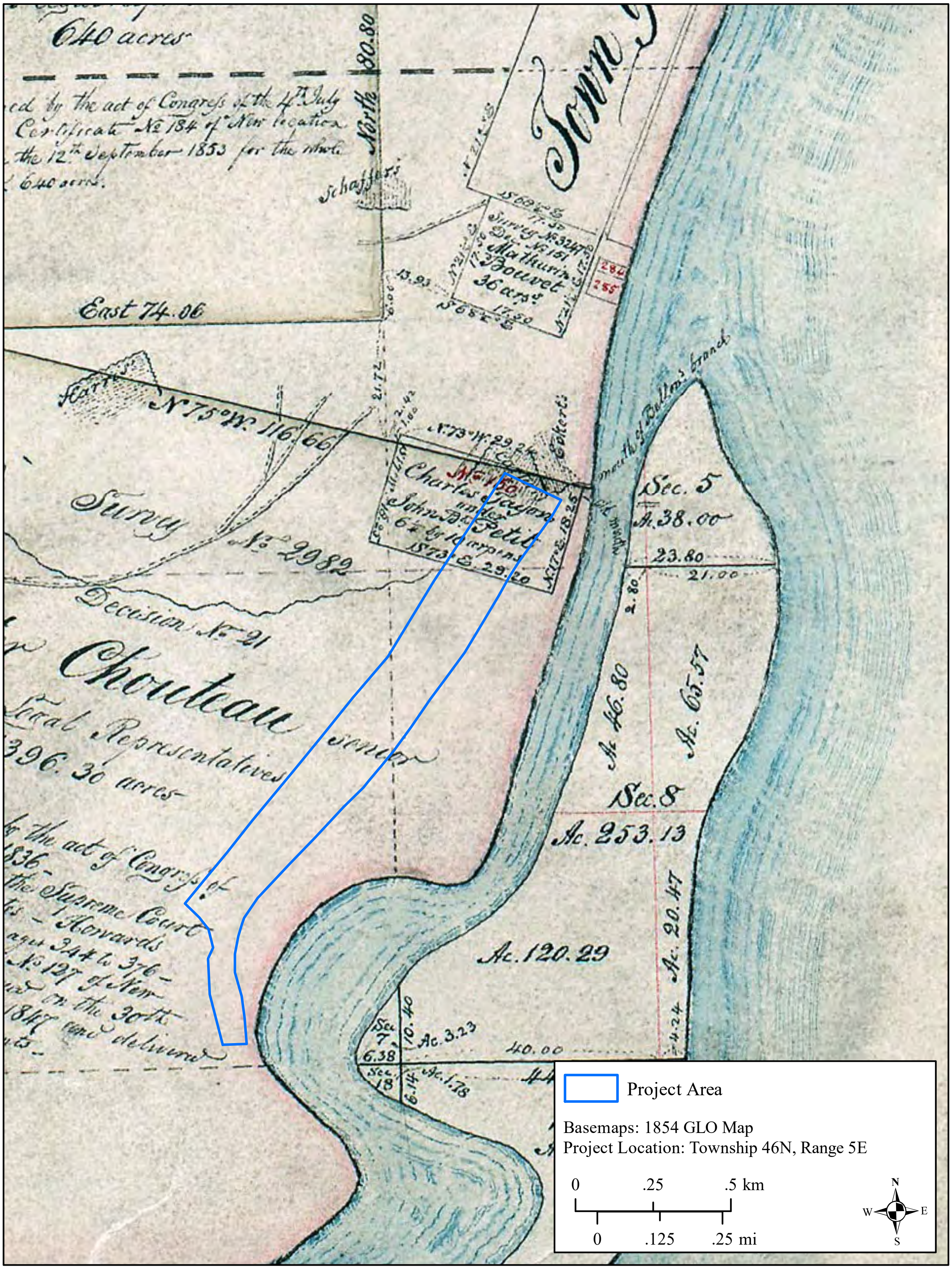

Figure 3. Excerpt from 1854 General Land Office (GLO) plat map showing APE and the Missouri River.

Figure 4. Excerpt from 1875 plat map showing APE relative to the Missouri River and St. Charles Island.

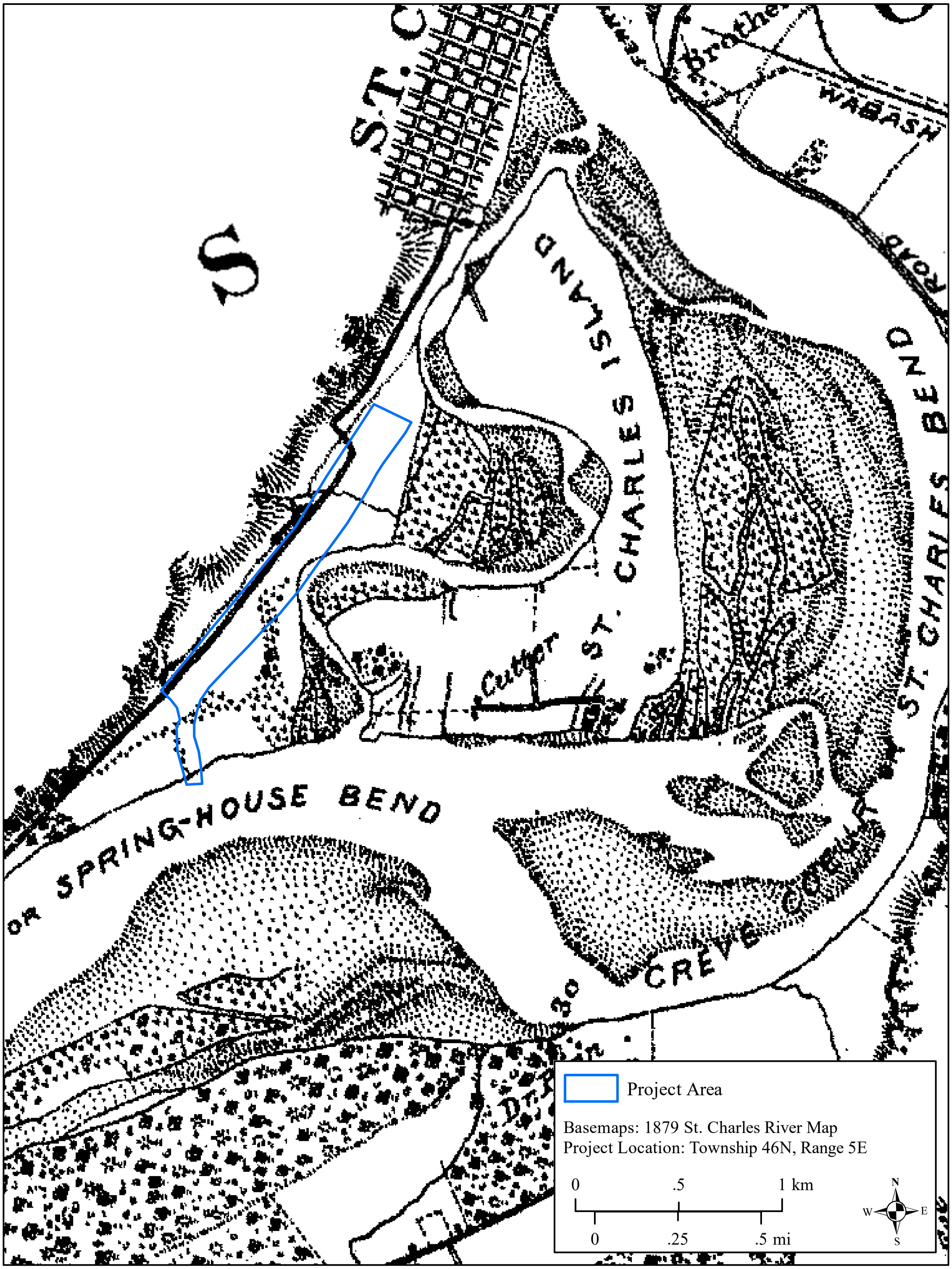

Figure 5. Location of APE in 1879 relative to the Missouri River and St. Charles Island.

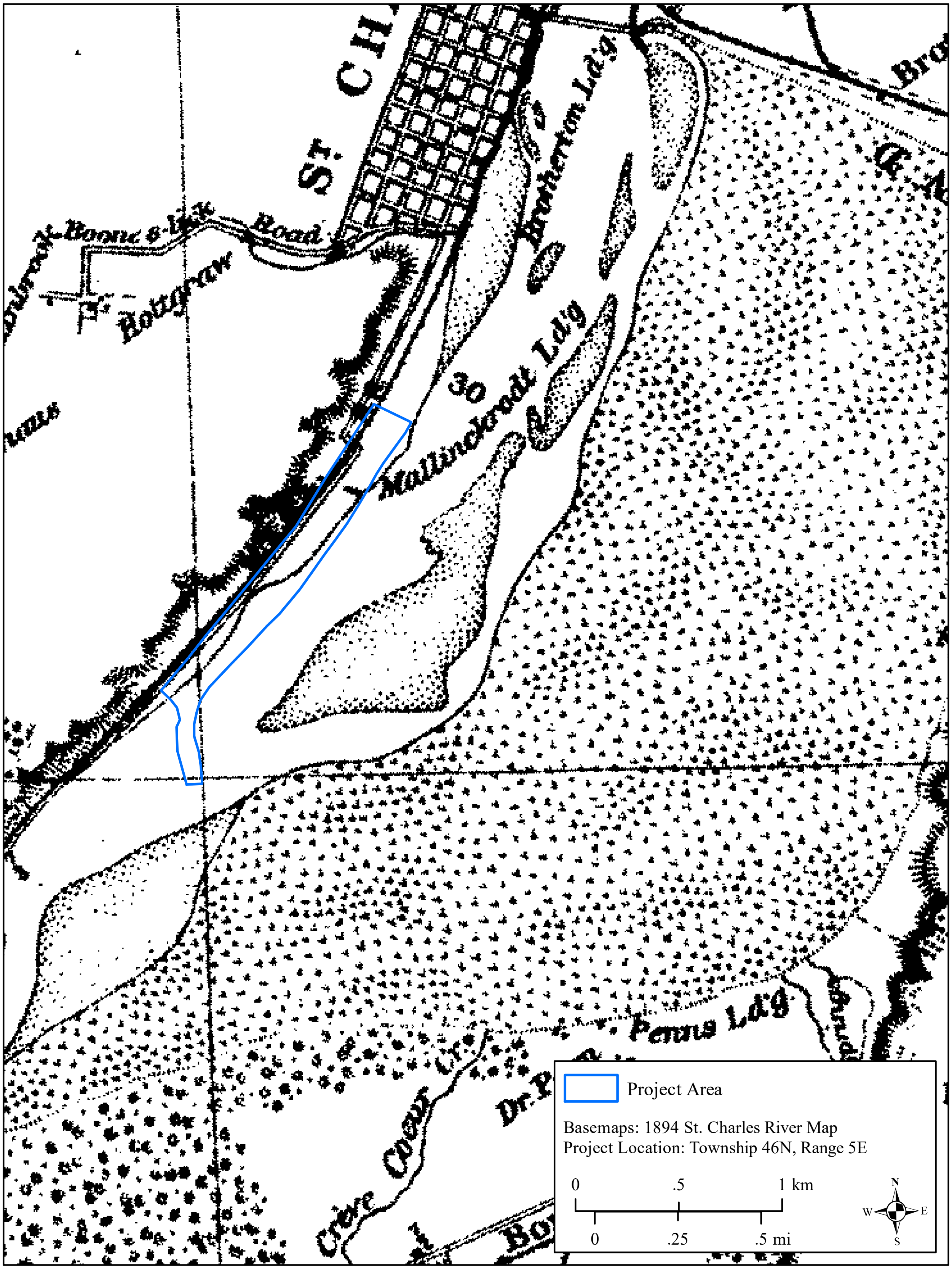

Figure 6. Location of APE in 1894 relative to the Missouri River and Mallinckrodt Landing.

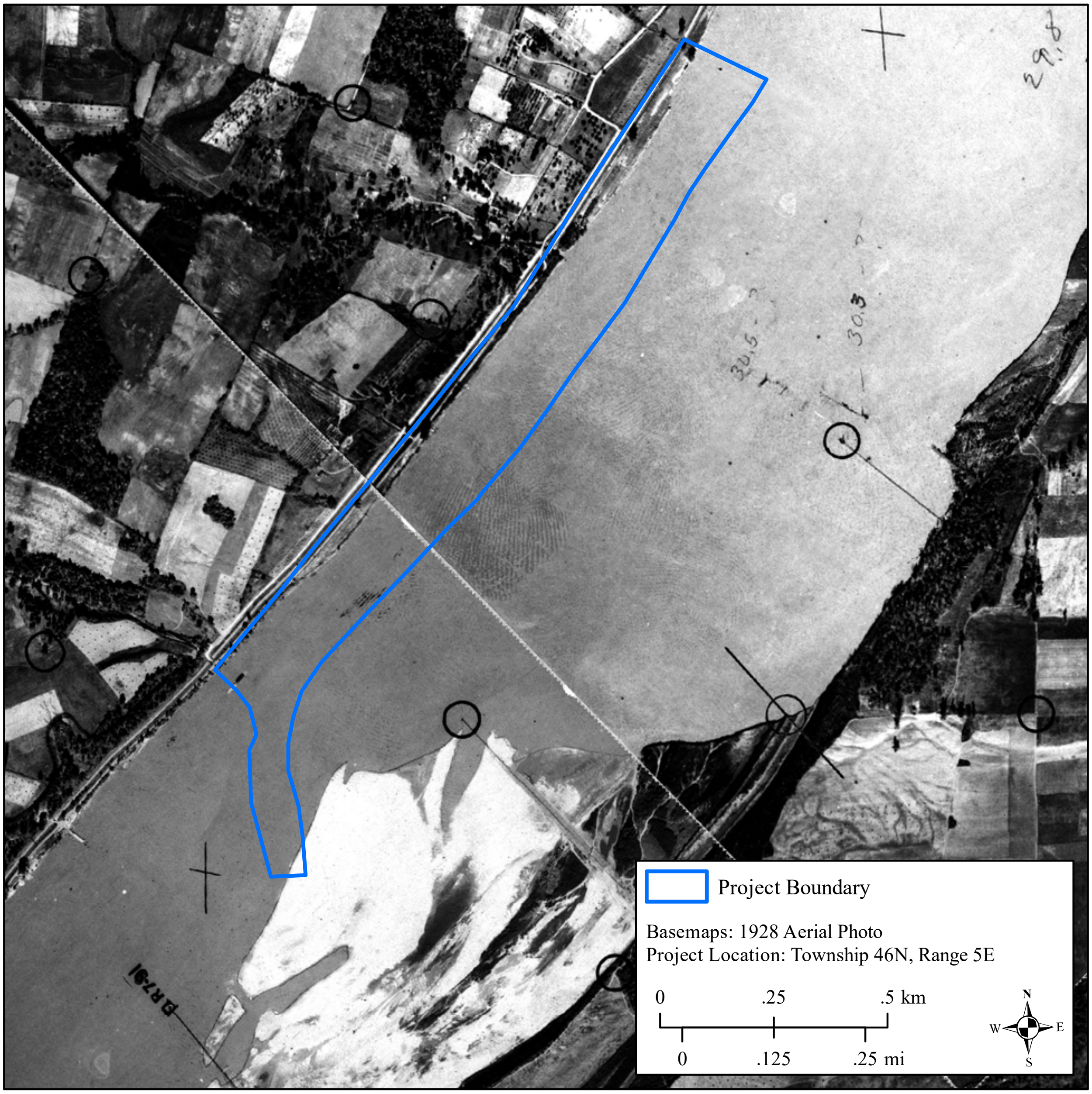

Figure 7. Location of APE in relation to the Missouri River in 1928.

Between 1894 and 1928, the river had migrated even further westward toward the bluff line. All but a portion of the APE located on the toe slope adjacent to where the railroad was located occurred within the river at the time. This is evident in a 1928 aerial photo of the area (Figure 7). This is the earliest aerial of the area and clearly shows that the main river channel was flowing through the great majority of the APE by then. Additional aerial photos and maps dating between 1937 and 1958 (Figures 8–11) illustrate the stability of the channel for another 20–25 years.

USGS 7.5' topographic maps dating to 1954 (Figure 9) show that the river had expanded to the east and nearly doubled in width since 1945. Two small islands were present by then in the middle of the channel east of the project area. These represent the beginning of Bangert Island's formation. It was shortly before this time that the U.S. Army Corps of Engineers began channelization projects

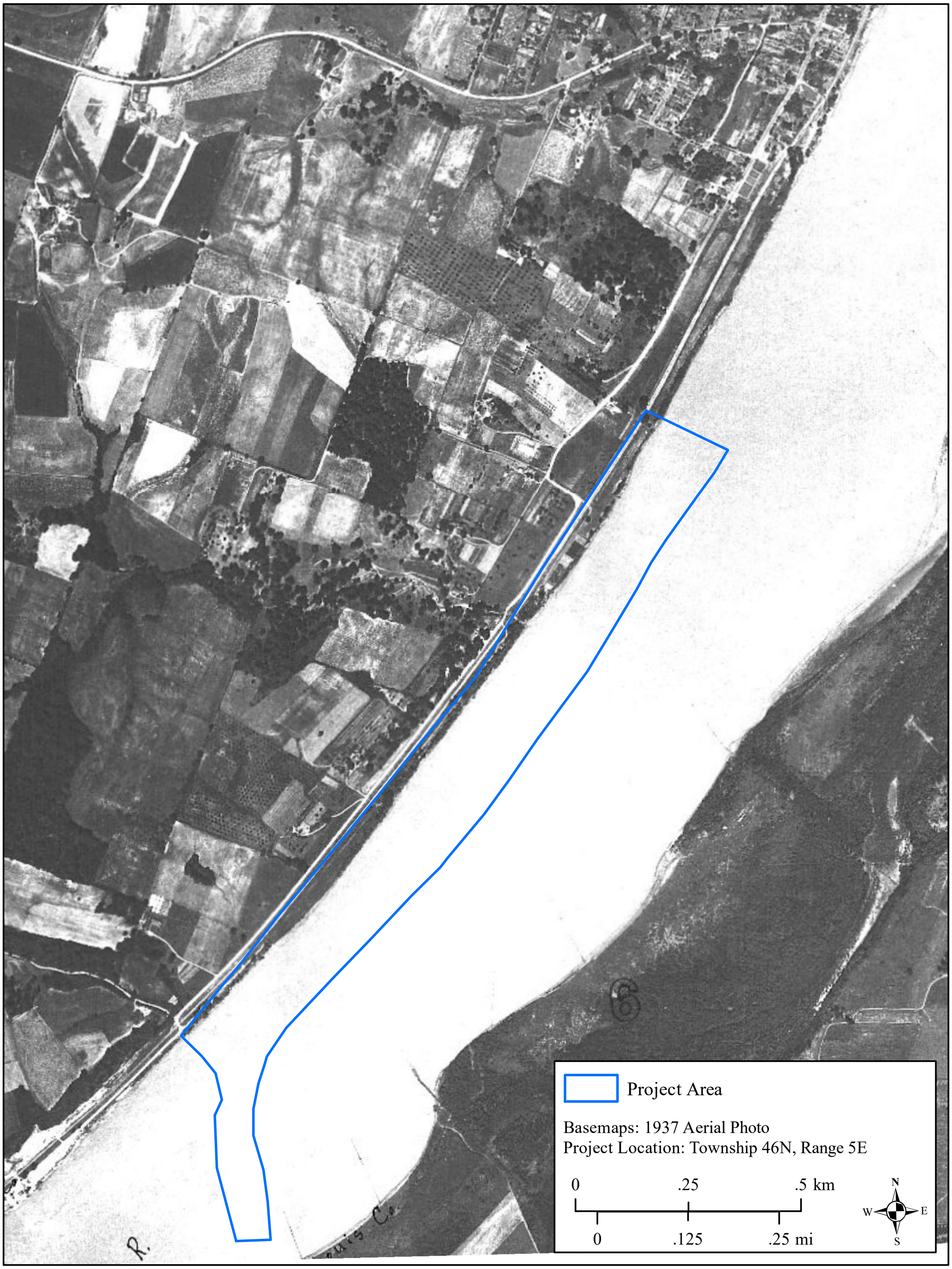

Figure 8. Location of APE relative to the Missouri River in 1937.

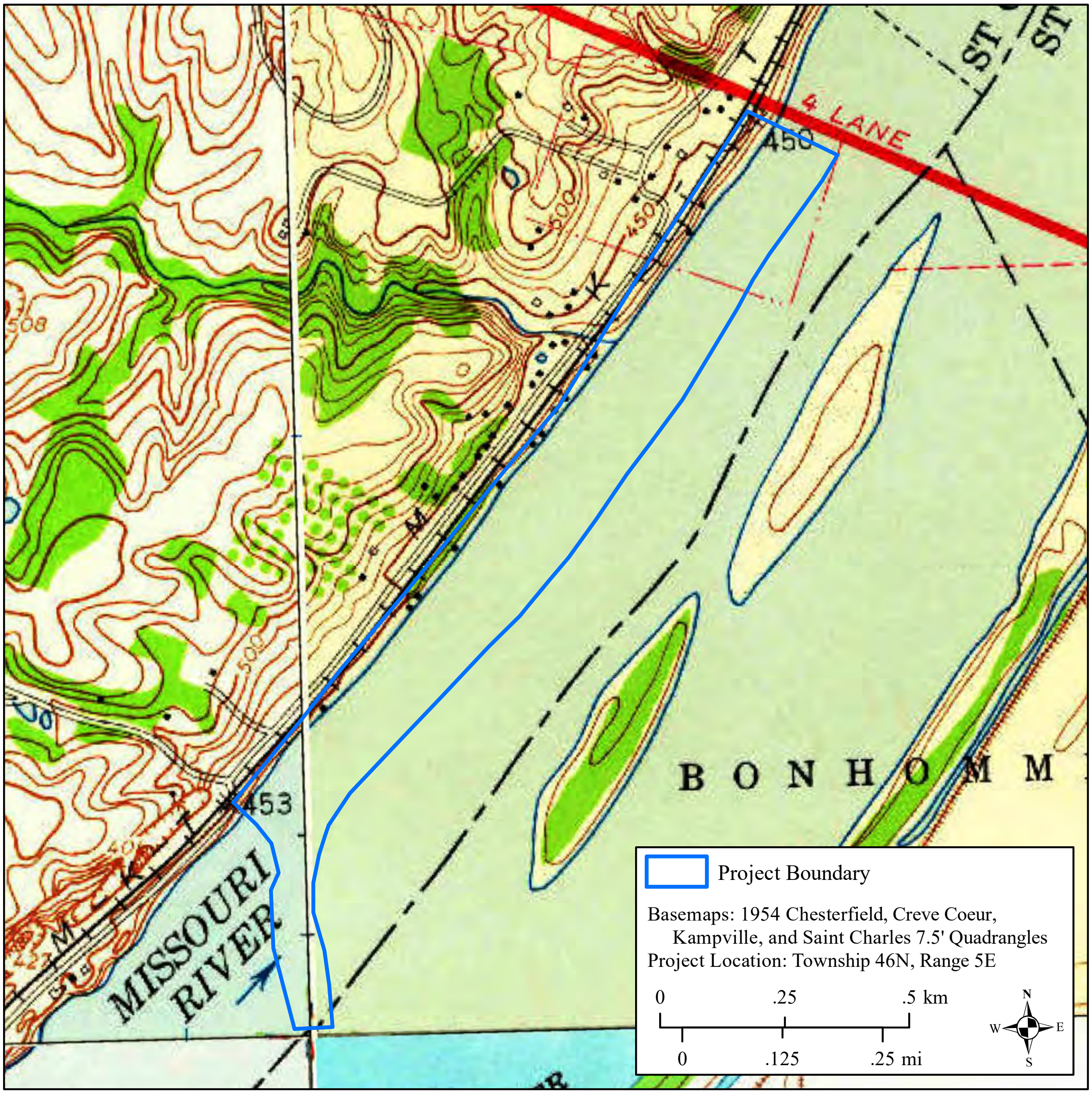

Figure 9. Location of APE relative to the Missouri River in 1954.

up and down the Missouri River to create a more narrow and deeper navigation channel. This was accomplished by the construction of dams, wing dikes, and bank stabilization projects.

An aerial photo from 1955 shows the continued siltation in the west half of the channel (Figure 10), leaving the east half to become the main channel. The two small islands had coalesced by then into one larger island, although there were still small sloughs running through it. The project area at this time was located in a backwater channel area away from the main channel. This backwater channel was still present in 1958, whereas the rest of the island became larger and more established (Figure 11).

A bridge for the newly constructed Mark Twain Expressway, later designated Interstate 70, is also evident on the 1958 aerial. The planning of this bridge likely influenced the relocation of the

Figure 10. Location of APE relative to the Missouri River in 1955.

Figure 11. Location of APE relative to the Missouri River in 1958 (white dashed line represents county boundary).

channel into its now, relatively permanent position. Construction of the bridge began in March of 1955 before Bangert Island had formed completely. However, the main truss span of the bridge, with its widely spaced piers, only crosses the east half of the river, whereas the western span uses a girder bridge with smaller more closely spaced piers. A photograph of the bridge during construction in 1957 shows the completed piers and continued accumulation of sediment at the north end of the island (Figure 12). It is unclear when the old channel west of Bangert Island completely silted in, but it was effectively no longer an island by 1994 (see Figure 2). A small permanent tributary of the Missouri River, which drains the uplands south of downtown St. Charles, adopted the old channel along the north end of Bangert Island and drained northward to the river.

Figure 12. I-70 bridge construction over the Missouri River at St. Charles in 1957, view to the west (photo by Reynold Ferguson, St. Louis Post Dispatch).

SHIPWRECKS OF CONCERN

Reported locations of shipwrecks within 1 mi of the project APE are based on maps prepared by Chittenden (1897) and Trail (n.d). The locations for the same vessels generally do not agree and should be regarded as approximate. Previous documentary research and magnetometer surveys by CAR on Jameson and Cora islands (Lopinot and Thompson 2013a) and Cranberry Bend (Lopinot and Thompson 2013b) on the lower Missouri River have revealed the imprecise nature of these

Table 1. Basic Information on Eight Shipwrecks of Concern.

Vessel Name	Date of Wreck	Cause of Wreck	Fate of Vessel
Weston	1843	Fire	Uncertain
Lewis (Louis) F. Lynn	1848/1849	Snag	Uncertain
Rowena	March 11, 1850	Snag	Loss; passengers saved
Carrier	October 15, 1858	Snag	Raised
John Bell	September 24, 1863	Snag	Loss
Seventy-Six	1876	Unknown	Unknown
Tyler	1878/1879	Unknown	Unknown
Ella Kimbrough	September 20, 1884	Snag	Loss; some cargo saved

historical maps of shipwrecks. In those studies, no steamboat wrecks were found at or in close proximity to any of the locations marked on both sets of maps. However, a deeply buried steamboat wreck was found where none was mapped. Previous research also has emphasized the importance of in-depth historical background research since some vessels marked on the Chittenden and Trail maps suffered from disasters (e.g., boiler explosions), but did not sink, while others were raised and/or salvaged.

Research was undertaken to locate historical information concerning six vessels mapped as having wrecked within 1 mi of the project area. The principle sources were McDonald (1927a, 1927b, and 1927c) and Way (1994), both of whom provide brief descriptions of vessels. In most cases, the two sources largely concur, but some vessels are only documented by one of the authors. Digitized nineteenth-century newspapers were also used when available to fill in details for some of the vessels and these sometimes provide contradicting reports. The mapped locations of six shipwrecks and historic river channels are shown in Figure 2. Two additional shipwrecks (*John Bell* and *Seventy-Si*x) are mapped upstream within a few miles of the APE and are also evaluated here. Table 1 contains basic information about each of these eight shipwrecks. Additional information for each is provided below.

Weston: Side-wheel packet, Captain William Littlejohn [Littleton]. Destroyed by fire in 1843. The hold caught fire and the crew battened down the hatches and intentionally ran aground at the head of St. Charles Island. None of the nearly 70 passengers were injured and the cabin furniture, vessel books, and all lives were saved. The cargo had been primarily hemp, tobacco, and wheat, and was insured for $8,000. [McDonald 1927c:605]

The *Boon's Lick Times* reported that the fire occurred four miles above St. Charles (Boon's Lick Times 1843:2). The same paper reported the *Weston* colliding with the *Alliquippa* the night of March 17, 1844 on the Mississippi River about 95 miles below St. Louis, with the *Weston* being a total loss (Boon's Lick Times 1844:2).

Lewis F. Linn (Louis F. Lynn): Side-wheel packet, wood hull, 163 tons, built in 1844 in Pittsburgh, Pennsylvania. Presumably, named for U.S. Senator Lewis F. Linn (1796–1843) from Missouri. Captain M. Kennett operated her on the upper Mississippi. Worked in tandem with *J.M White* for a record fast run from New Orleans to Galena, Illinois in April 1844, with the *Lewis F. Linn* taking the cargo and passengers from St. Louis to Galena. Captain W. C. Jewett snagged at the head of St. Charles Island in 1848 or 1849. [McDonald 1927b:476; Way 1994:284]

An ad dated April 10, 1847 for the *Lewis F. Linn* captained by M. Kennett runs in the *Boon's Lick Times* until October 2 (Boon's Lick Times 1847:4). Ads for the *Rowena* captained by W.

C. Jewett in the same paper begin in 1847 and continue until the last issue in September 1848, and then run in the succeeding paper the *Glasgow Weekly Times* throughout 1849 and 1950 until the wreck of the *Rowena* (see below).

Rowena: Side-wheel packet, wood hull, 230 tons, 200 feet long, built in 1847 in Elizabeth, Pennsylvania. Snagged and sunk up to the hurricane roof in Penn's Bend, just above St. Charles on either March 12 or 14, 1850 with a total loss of cargo. [McDonald 1927c:592; Way 1994:403]

The *Glasgow Weekly Times* reported Captain W. C. Jewett wrecking on March 11, 1850, noting: "a few miles above St. Charles, she ran on a rack heap at the head of an island, which so shattered her hull, that she went down in about three minutes." The wind then swung the vessel around and settled down on the larboard (left) side to the hurricane roof. The passengers were all rescued by the *Fayaway* and some had to escape by cutting holes in the roof. The papers and cabin furniture were saved, but all the cargo was lost. The boat was insured for $8,000 and Captain Jewett reportedly made arrangements for another boat. [Glasgow Weekly Times 1850:2]

Carrier: Side-wheel packet, wood hull, 250 tons, 215-x-33 feet, built in 1855 at Howard Yard in Jeffersonville, Indiana. It had a double stern with stern posts 10 feet apart. According to John Howard, of the Howard Yard, the *Carrier* was built for Captain Draffin and cost $34,000, and in a 32-day trip made $5,200. Captain Draffin made two runs to New Orleans and then sold the *Carrier* for $5,000 more than he had paid. She was running St. Louis to Glasgow, MO under Captain William C. Postal in April 1856. She snagged at the head of Penn's Bend on either October 12 or 15, 1858 under Captain McPherson. McDonald (1927a:232) gives this wreck as a total loss, but Way (1994:74) gives the *Carrier* as sinking again at Island 25 on the Mississippi on February 21, 1861 and finally being lost at St. Charles on September 12, 1861. [McDonald 1927a:232; Way 1994:74]

Contrary to McDonald and Way, the *Glasgow Weekly Times* reported on October 21, 1851 that the *Carrier* had snagged near Herman, Missouri (Glasgow Weekly Times 1958a:3). On November 4, 1858 she had been raised and taken to St. Louis for repairs (Glasgow Weekly Times 1958b:3). The *Glasgow Weekly Times* ran ads throughout 1860 stating the *Carrier* had been repaired and would run a weekly packet between St. Louis and Glasgow under Captain Henry McPherson (Glasgow Weekly Times 1860:2). The last issue published of the *Glasgow Weekly Times* reported the *Carrier* in port at Glasgow on August 17, 1861(Glasgow Weekly Times 1861:2).

John Bell: Stern-wheel packet, wood hull, 209 tons, built in Louisville, Kentucky in 1855. It was snagged and lost at St. Charles on September 24, 1863. [Way 1994:250]

Seventy-Six: Side-wheel packet, 181-x-25.5 feet; had two engines and was captained by John Gonsaullis. Sunk by rocks one-half mile above Spring House, Missouri in 1876. [McDonald 1927c:594]

Tyler: Stern-wheel packet, piloted by Captain Al Dodd. Sank just above St. Charles in 1878 or 1879 from unknown causes. [McDonald 1927c:600]

Ella Kimbrough: Stern-wheel packet, wood hull, 243 tons, 145-x-28-x-4 feet, built in 1877 at Barmore Yard in Jeffersonville, Indiana (Figure 13) for the U.S. as the *General Sherman*. She had two engines, 15½ inches x 4½ feet, and two boilers, 22 feet x 38 inches, allowing a working pressure of 145 pounds. The *General Sherman* was built for the Yellowstone River but the U.S.

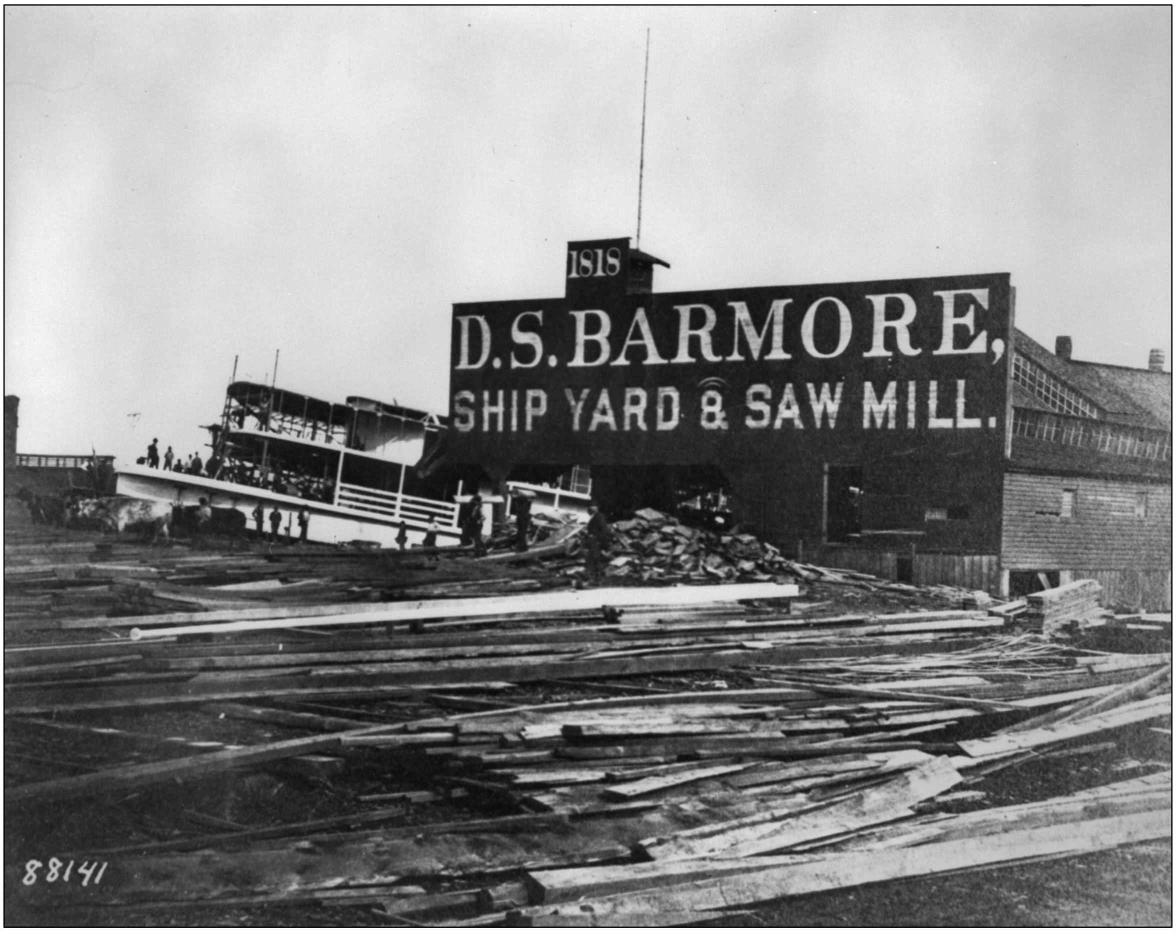

Figure 13. A steamboat on dry dock being built by D.S. Barmore Ship Yard & Saw Mill at Jeffersonville, Indiana, ca. 1861–1864 (from University of Wisconsin-La Crosse, Murphy Library, Special Collections; Image Negative No. 31510, available at https://digital.library.wisc.edu/ 1711.dl/GWWDJYYQALBFN8B).

U.S. sold her to Captain Peter M. Manion, who then sold her to Captain T. M. Kimbrough, who renamed her after his wife. The *Ella Kimbrough* snagged in the St. Charles Chute on September 20, 1884 while carrying a load 3,000 sacks of wheat insured for $8,000. The ferry *John L. Ferguson* (Figure 4) recovered the cargo but the *Ella Kimbrough* was lost. The loss was reported as $12,000. [McDonald 1927a:241; Way 1994:146]

Three days after hitting the snag the *St. Louis Globe-Democrat* reported "the wreckers are at work on her" (St. Louis Globe-Democrat 1884:10). Heckman (1914) reported that the *Ella Kimbrough* lay across from the waterworks. The 1905 plat map shows the waterworks north of the project area.

The earliest of the documented steamboat wrecks was that of the *Weston* (see Table 1). Despite being mapped in the vicinity upriver from the APE, there is good reason to assume that this vessel was damaged but not lost. The *Boon's Lick Times* reported that the fire occurred four miles above St. Charles (Boon's Lick Times 1843:2). The same newspaper reported that the *Weston* later collided with the *Alliquippa* the night of March 17, 1844 on the Mississippi River about 95 miles below St. Louis, with the *Weston* being a total loss (Boon's Lick Times 1844:2). So, it appears that the vessel was repaired and put back in service after the 1843 fire.

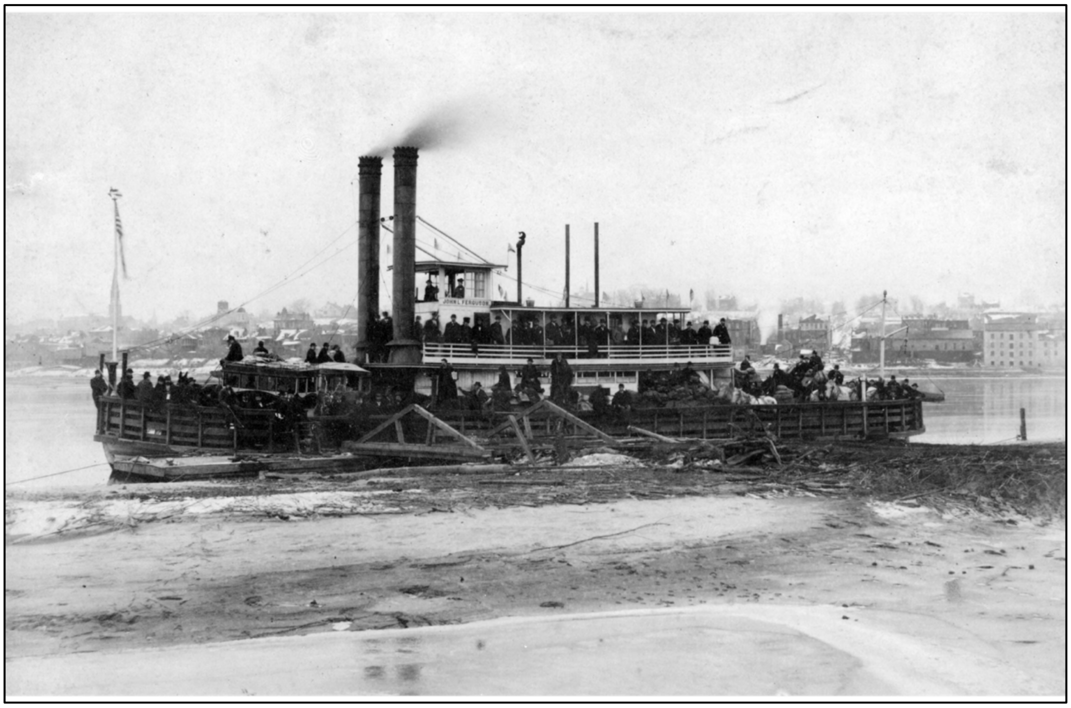

Figure 14. Steamboat ferry *John L. Ferguson* across river from St. Charles, ca. 1860–1900 (from the State Historical Society of Missouri, John J. Buse Collection, Image No. S1083_1729, available at https://digital.shsmo.org/digital/collection/imc/id/37849).

As for a few other vessels, the *Lewis F. Lynn* was documented as having been snagged at "the head of St. Charles Island" in 1848 or 1849 (Way 1994:284). The *Glasgow Weekly Times* noted that the 1850 wreck of the *Rowena* occurred: "… a few miles above St. Charles, [where] she ran on a rack heap at the head of an island, which so shattered her hull, that she went down in about three minutes." For the *Carrier*, there are conflicting stories about the actual location of the 1858 wreck, but it was raised and put back into service. In fact, the last issue published of the *Glasgow Weekly Times* reported the *Carrier* in port at Glasgow, Missouri upriver from St. Charles on August 17, 1861 (Glasgow Weekly Times 1861:2). We know very little about the *John Bell*, except that it was "snagged and lost at St. Charles" in 1863 (Way 1994:250). Information of the *Seventy-Six* is even more scant. Whereas both Chittenden and Trail depict the wreck of this vessel as occurring upstream from the Bangert Island APE, McDonald (1927c:594) indicates that it was "sunk by rocks one-half mile above Spring House, Mo. in 1876." This location is uncertain, although it likely refers to a location associated with "Spring-House Bend," as shown on the 1879 river map just upriver from St. Charles Island (see Figure 5). The only thing we know about the *Tyler* is that it sank above St. Charles in 1878 or 1879 from unknown causes (McDonald 1927c:600).

That only leaves the *Ella Kimbrough*, which sank five years after the 1879 river map (Figure 5) and 10 years before the subsequent river map of 1894 (Figure 6) was prepared. At some point during the interval of 1879–1894, the river indeed shifted westward to near the base of the St. Charles bluffline where the APE is located. It is recorded that the *Ella Kimbrough* snagged in the "St. Charles Chute" on September 20, 1884 while carrying a load 3,000 sacks of wheat insured for $8,000. The ferry *John L. Ferguson* (Figure 14) recovered the cargo, but the *Ella Kimbrough* was lost (McDonald 1927a:241; Way 1994:146). Three days after hitting the snag, however, the *St. Louis Globe-Democrat* reported "the wreckers are at work on her" (St. Louis

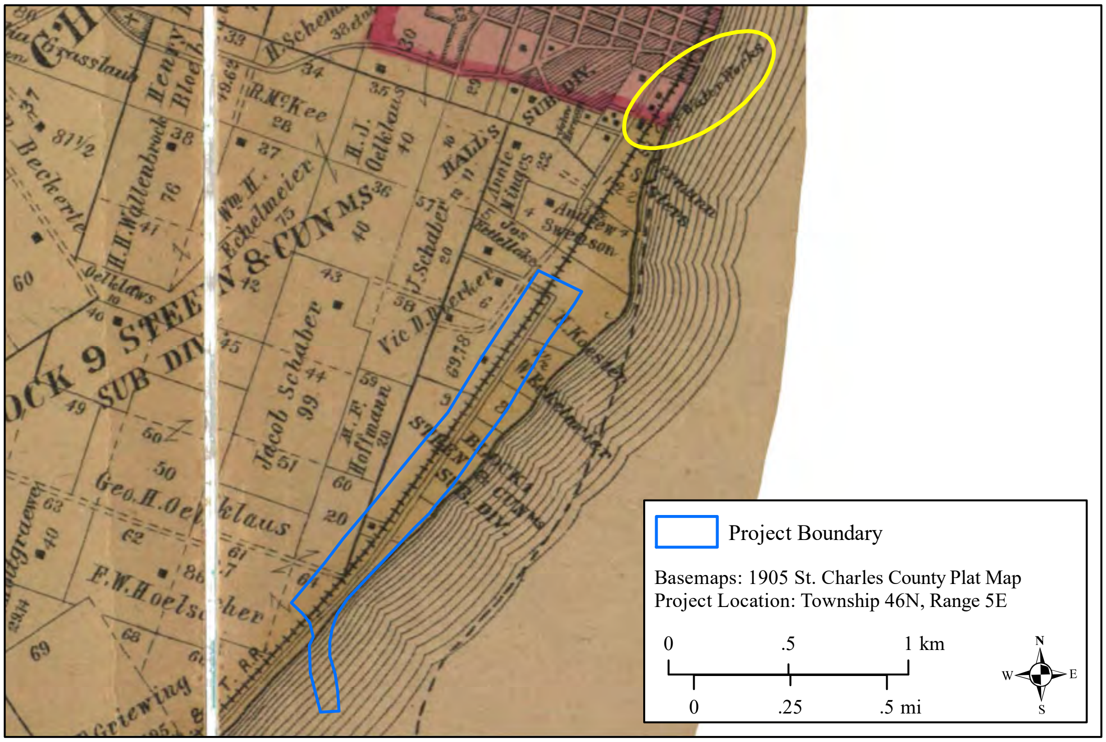

Figure 15. Plat map (1905) showing the location of the Water Works downriver from the APE.

Globe-Democrat 1884:10), which suggests that at least some salvage of machinery was likely undertaken. Heckman (1914) also later reported that the *Ella Kimbrough* lay across from the Water Works, which would place the wreck north of the project area or downriver according to the location of the waterworks on a 1905 plat of St. Charles (Figure 15).

Of the eight vessels of concern, seven of them wrecked on or before 1879, or when the 1879 river map was prepared (see Figure 5). Given the accuracy of the maps dating up to 1879, it seems impossible to expect the remains of any of these vessels to occur even near the Bangert Island APE, although parts could have been redeposited after the main channel of the river shifted westward sometime between 1879 and 1894. The *Weston* is clearly not in the APE and the *Ella Kimbrough* was downstream from the APE and appears to have been at least partially salvaged. The *Lewis F. Linn* and *Rowena* wrecked at the head of St. Charles Island, making them very unlikely to be in the project area. The *Carrier* clearly did not have a fatal wreck in 1858, although it may have done so in 1861. The actual locations for the *John Bell* and *Seventy-Six* are less certain, but they too were wrecked before the river had shifted to the left bank. One landing, Mallinckrodt Landing, is depicted within the project area on the 1894 river map (see Figure 6), though no further information on it could be located.

SURVEY METHODOLOGY

The Bangert Island survey involved the use of a (Geometrics) G-858 cesium vapor magnetometer strapped to the back and front of a surveyor (Figure 16). As with all magnetometers, the G-858 measures the intensity of the earth's magnetic field and anomalies often represent the presence of some ferromagnetic materials within that field. That is, the anomalies represent

Figure 16. Photo showing the G-858 cesium magnetometer.

deflections in the earth's magnetic field. The G-858 is highly sensitive and has an integrated submeter GPS system. It is designed for walking and its high data sample rates (up to 10 samples per second) allow one to walk at a relatively rapid pace. However, one magnetic reading per second (approximately one reading per meter) is more than adequate for a steamboat wreck survey. A handheld Trimble GeoXH submeter GPS instrument was used to locate waypoints for specific pre-programmed transects located over the proposed project area. The post-acquisition data processing was undertaken using MagMap2000, MagPick, Surfer, and ArcMap.

A base station was not used to correct for diurnal changes in the magnetic field. Such was not deemed necessary. The signature of the anomalies we expected should be between 50 and 100 gammas or more over a relatively small area (20–50 m). Diurnal variation of about 20 gammas over a 24-hour period would not affect the readings significantly.

Unfortunately, very little information has yet been found pertaining to the actual weight of engines, boilers, stacks, and other metallic machinery and piping present in steamboats. Instead, it

Table 2. Estimated Magnetic Signatures for Different Size Object(s) and Distances.[1]

Size (tons)	Distance (feet)	Anomaly (gammas)
1	30	40
	60	4.6
	90	1.4
2	30	74
	60	9
	90	2.7
4	30	148
	60	18
	90	5.5

[1]Based on formula: $T=M/r^3$, where T is in gammas, M is magnetization, and r is distance from magnetometer.

is common to find the overall tonnage, the length and diameter of the boilers, the number of boilers. and the diameter of the cylinder(s) and the length of the stroke (e.g., 20 in x 5 ft), whether the engines were low pressure or high pressure. Although we know the boilers were typically made of riveted ¼-inch cast-iron plates (Hunter 1949:155), we also have not found data pertaining to the weights of different sizes of boilers. Hunter (1949:129) indicates that the weight of machinery in the 403-ton *Washington*, considered the first great steamboat on western waters, was 4–5 tons. For the same vessel, Kane (2001:57) put the weight of the engine at a generally equivalent 9,921 lbs. This was a relatively large steamboat (403 tons) in comparison to most nineteenth-century steamboats. Not including the weight of nails, bolts, tackle, the hog chain, smokestacks, etc., it is suggested that a good approximation for the weight of the engine, boiler(s), and other operational machinery in the various unsalvaged shipwrecked vessels in this study would be 3–4 tons.

Larson (2008:2) provides a table of information pertaining to the magnetic signatures at different distances for items ranging from 1 to 4 tons in weight. The table is reproduced here (Table 2). A 15-m transect interval was used for the Bangert Island survey. The transect spacing of 15 m provides about 33 ft of coverage in all directions from the magnetometer.

The formulae provided by Larson (2008:2; footnote in Table 2) can be used to calculate the magnetic expectations for shipwrecks with 3–4 tons of metal. It is assumed that one ton of iron has the magnetization of 1×10^6. Given that and a distance of 33 feet, it is estimated that 3 tons should yield a minimum 83-gamma anomaly and 4 tons should yield a minimum 111-gamma anomaly. In general, steamboat wrecks at depths of 45 ft should yield an anomaly on the order of at least 80–110 gammas using transects of 15 m. If the objects are closer to the magnetometer, then they should yield more intense gamma spikes.

Field Conditions at Bangert Island

The magnetometer survey was undertaken on November 18–21 by Project Supervisors Dustin Thompson and Jennifer Rideout with assistance from U.S. Army Corps of Engineers, Kansas City District archaeologist Dr. Gina Powell and field technicians Brandon Ives, Alan O'Conner, and Grace Smith. Bangert Island is covered with a mix of bottomland forest, flooded and muddy remnant channel sloughs, a gravel parking lot, and masses of flood-deposited downed trees. Most of the project area is within Bangert Island, which is a relatively recent formation (post-1950s) consisting of ridge-and-swale deposits (Figure 17) in the old Missouri River Channel. The island

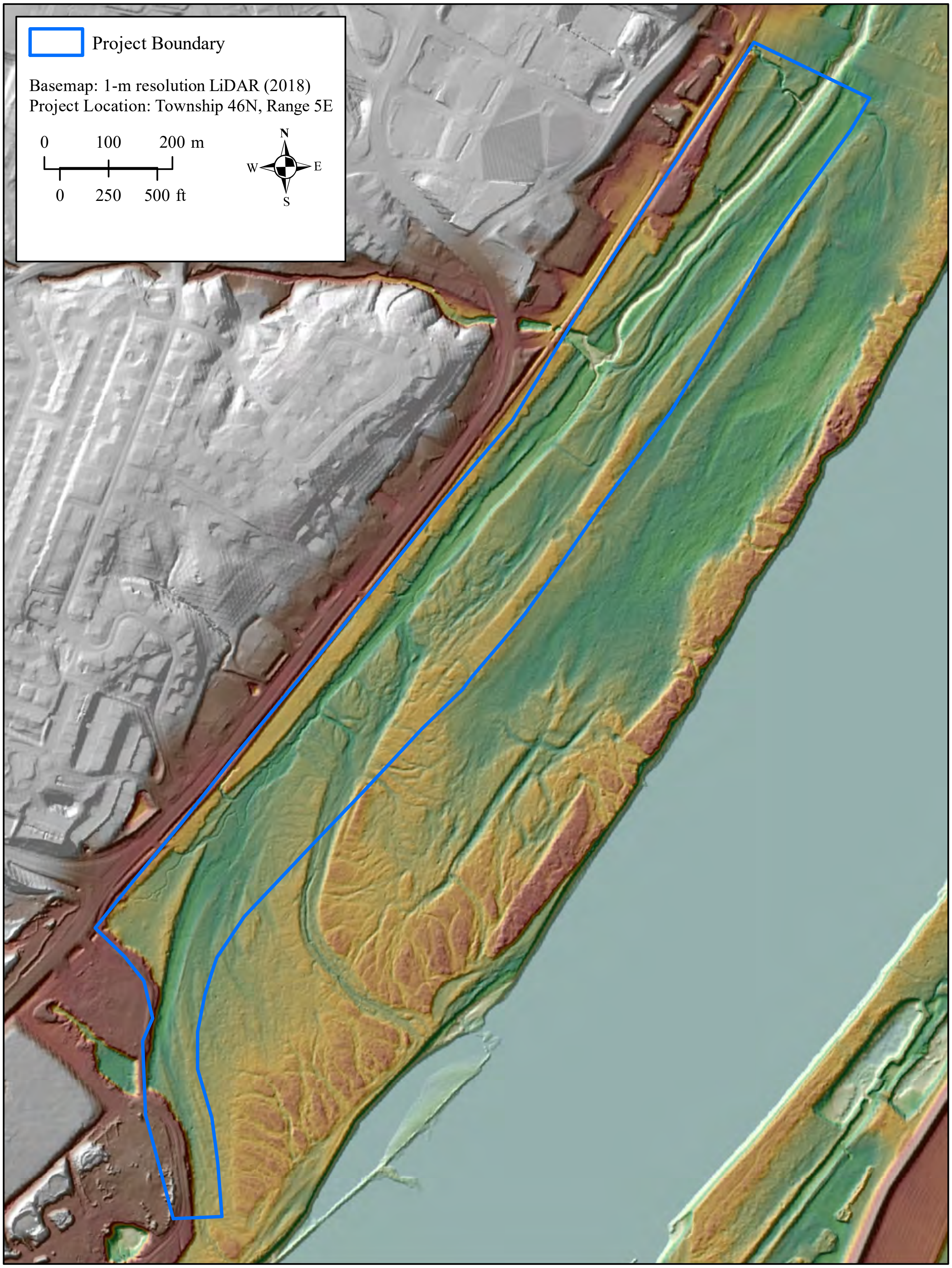

Figure 17. LiDAR map showing shaded relief within the project area.

is separated from a higher terrace (toeslope) remnant along the base of the upland ridge to the west by a slough (Figure 18), which was the last part of the old channel to silt in. The north half of this slough has since been captured by a permanent stream that drains the uplands south of I-70 and east of Highway 94 (see Figure 17). Nearly the entire project area is covered in bottomland forest vegetation (e.g., cottonwood, sycamore, and willow) and most of the project area has never been developed apart from a few park trails. However, there have been a few fishing cabins/houses built along the old terrace remnant along the base of the bluff.

The 1994 St. Charles 7.5' topographic quadrangle depicts 17 such structures along the west boundary of the project area (Figure 19). The location of the two northernmost structures, which are no longer extant, occur within the APE. One of these properties, purchased by the city and razed in 2019, offered a significant obstruction to the magnetometer survey. Aerial photos show and city employees confirmed (Daniel Mann, personal communication) that the area northwest of the previous house location was covered with old cars, boats, and miscellaneous trash. Most of the debris was removed or buried when the house was razed. However, there is still a significant amount of metal trash scattered across the project area west of the slough (Figures 20–21). This includes old tires with steel rims, metal buckets, boards with nails, metal fencing, etc. Compounding the problem in this area is the old railroad track along the west edge of the project area and a cell tower compound surrounded by a chain-link fence (Figure 22). The Interstate 70 bridge is also located at the northeast end of the project area. This continuous bridge has steel reinforced concrete piers and large steel girders supporting the deck (Figure 23).

The south end of the project area also was covered with masses of large downed trees (Figure 24) that apparently were knocked down by a tornado that passed through the APE in 2013. Unfortunately, this made it impossible to maintain evenly spaced transects in this area. Every effort was made to stay on the original transect spacing of 15 m, but it was not always possible. Alternate paths were made around the downed trees and returned to the original transects as quickly as possible. Data collection was continued on the alternate paths.

The U.S. Department of Agriculture soil map for Bangert Island characterized the soil as Haynie-Treloar-Blake complex, 0 to 2 percent slopes, frequently flooded with a typical profile having an Ap horizon of 0–18 cm of silt loam overlaying a C horizon, 18–60+ cm of stratified, very fine sandy loam to silt loam. This is consistent with a soil profile that was recorded on the terrace west of the slough. It consisted of an Ap horizon of silt loam (10YR 2/2) measuring 0–19 in thickness overlying; a stratified C horizon of sandy silt loam (10YR 4/2) at 19–46 cm; a sandy loam (10YR 5/2) at 46–84 cm; a sandy loam (10YR 4/4) at 84–98 cm; a sand (10YR 5/3) at 98–130 cm; a sandy clay loam (10YR 5/3) at 130–140 cm; and a sandy clay loam (10YR 4/6) at 140–190 cm.

Field Survey Methods

The survey of Bangert Island began with a shovel test survey of the high terrace along the northwest side of the project area. This was undertaken to identify any prehistoric or historic artifacts or features. Shovel tests were excavated at 20-m intervals along two transects spaced 20 m apart. These transects began south of the gravel parking lot in the northwest portion of the project area and extended 200 m to the southwest. Twenty shovel tests were excavated to a depth of at least 30 cm and the fills were screened through ¼-in hardware cloth. In addition, one shovel test on Transect B was continued to a depth of 1.9 m below surface using a bucket auger. All shovel tests were negative.

The magnetometer survey generally requires walking relatively straight parallel transects. Therefore, the collection of magnetometer data was obtained along transects that were created in ArcMap, loaded into the Trimble XH, and marked in the field. Guided by the Trimble GPS unit,

Figure 18. Slough in north half of the APE, a remnant of the former channel of the Missouri River.

survey transects were marked with a patch of orange surveyor's paint at intervals of 3–5 m after clearing brush and overhanging branches to a height of eight feet (Figure 24). In areas covered with brush and thickets, machetes and loppers were used to clear small trees, the lower limbs of saplings, and weedy undergrowth along each transect. There were also flooded and muddy areas that were impassable with the magnetometer. When these areas were reached, data collection on that transect was ended and was resumed once the transect was past the impediment.

The transects were roughly parallel to the western edge of the project area. They were spaced 15 m apart. Figure 25 is an aerial photograph illustrating a model of our planned investigations in the Bangert Island project area. Fifteen transects oriented northeast to southwest and spaced 15 m apart were planned for the 210-m wide and 1,750-m long main portion of the APE. An additional

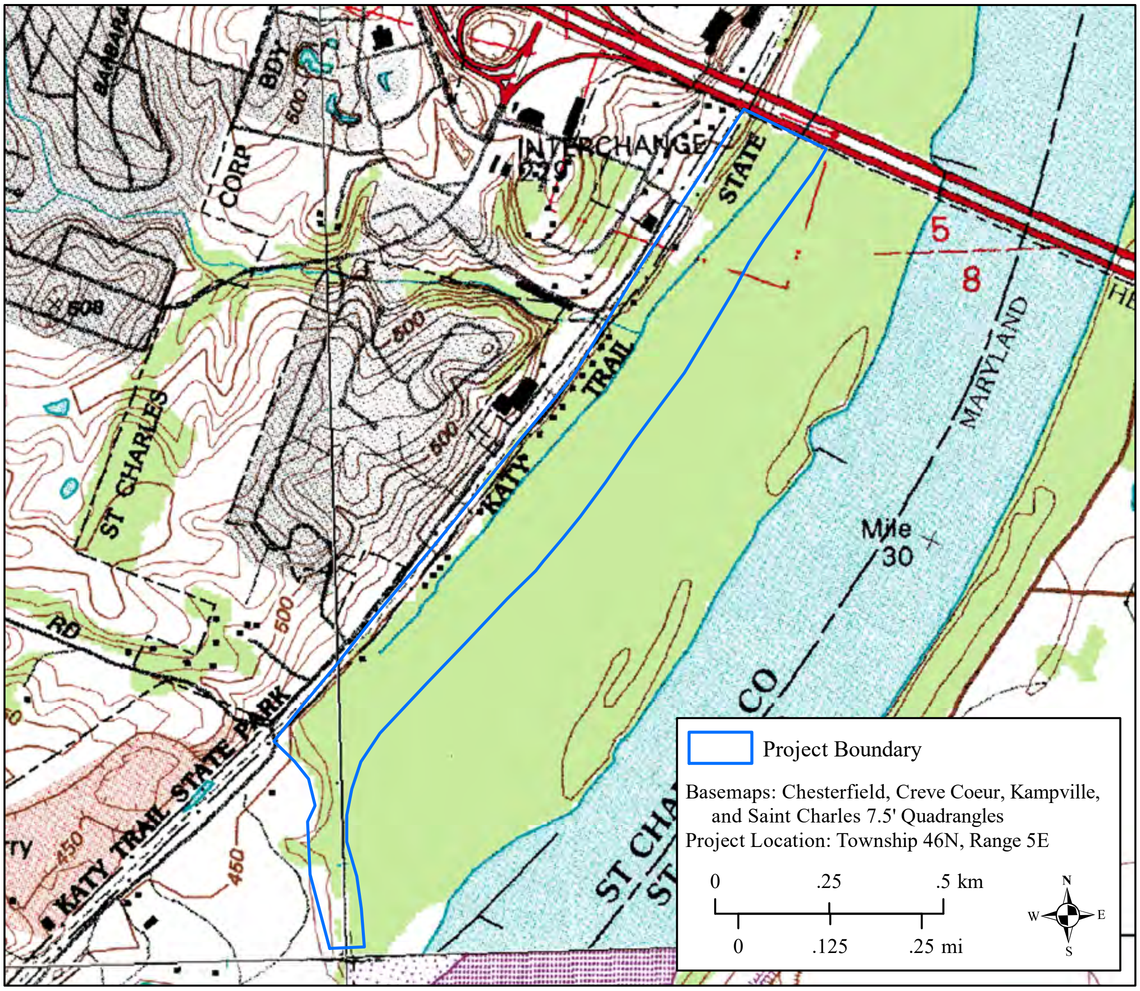

Figure 19. Excerpt of the 1994 St. Charles 7.5' topographic quadrangle depicting 17 structures along the west boundary of the APE.

five shorter transects oriented roughly north-south were planned for the shorter 90-m wide and 350-m long dogleg at the south end of the project area. However, only limited survey of the south half of the project area was completed owing to technical problems with the magnetometer.

Given technical issues with the magnetometer, nearly impenetrable mats of downed trees, the occurrence of some inundated areas, and also threats from local landowners, we had covered as much of the area as possible at the time. Additionally, it was concluded that there was a low probability of finding any historic shipwrecks within the project area after research into landform creation in the APE in relation to the timing of documented historic steamship wrecks. Therefore, the magnetometer survey portion of the project was halted before the survey of the south half of the project area was completed. Figures 26–27 illustrate what was completed and what was not completed.

DATA ANALYSIS

All collected data were downloaded from the magnetometer using Magmap 2000 software. The resulting .dat files were then opened in Microsoft Excel and all dropouts (data points with a zero reading) were subsequently removed. The resulting data were then formatted and imported

Figure 20. Scattered metal trash and wheels along northwest edge of APE.

into ArcMap 10.5 to search for anomalies. To find anomalies, individual point data were plotted and color-coded by magnetic strength. Due to the fact that some of the transects extended up to 1.7 km, the data were divided into smaller blocks that were easier to process. Due to the amount of modern debris that created large spikes in the data, this was the most efficient method to identify smaller anomalies. These smaller blocks of data were then imported into Surfer to create topographic and color relief maps using the gamma readings to better visualize potential anomalies.

Two minor issues in the data can be ignored with respect to the search for large, deeply buried objects such as steam engines, boilers, etc. First, the long staff holding the sensor for the G-858 is heavy and prone to bouncing during survey, adding minor noise to the data (Ernenwein and Hargrave 2009:72). This bouncing effect can create minor anomalies of less than about 4–5

Figure 21. Photo of additional scattered metal trash and wheels along west edge of APE.

gammas and are not an issue in distinguishing larger anomalies. Second, very small isolated pieces of ferrous metal near the floodplain surface, such as tin cans, nails in boards, and nuts or bolts from farm machinery, will yield magnetic data-point-specific spikes (i.e., cases where one point varied greatly from all the surrounding points) and therefore they can be excluded based on their magnetic extent.

A third problem that does require attention was the missplotting of data points. Although the survey was undertaken during the winter leaf-off season, dense tree cover still made it difficult for the internal GPS of the magnetometer to receive an accurate signal in places. Most of the data points follow the outlined transects. However, there are several data points clearly plotted incorrectly. This is most evident in the east central portion of the survey. If a point was incorrectly plotted into an adjoining transect that was surveyed during a different day or time of day, it would give the

Figure 22. Old railroad track (now the KATY Trail) and cell tower compound along west edge of APE.

false reading of an anomaly due to diurnal drift. An attempt was made to "clean up" such bad data by relocating obviously scattered points back into the correct location using the sequential number assigned to each point when generated.

Anomalies greater than 40 gammas, the minimum expected peak for a buried shipwreck, were further evaluated as to their depth and size. To calculate the depth of the anomalies, Peter's Half-Slope Method was used (see Burger et al. 2006:485–487). Contour maps for each of the analyzed magnetic anomalies were created using Surfer 18. The slope and half-slope of the anomaly was calculated using these maps. Using the half-slope distance, an approximation of the distance of the object from the sensor was calculated using the formula d=1.6h, where d is the half-slope distance, h is the distance to the anomaly, and 1.6 is an average value of a magnetic body. Once the distance

Figure 23. Continuous span I-70 girder bridge at the northeast end of the APE.

was calculated, an approximation of the anomaly size could be made in tons. This was undertaken using the formula provided by Larson ($M=T/r^3$), where M is magnetization (assumed that one ton of iron has the magnetization of 1 x 10^6), T is gammas, and r is distance from the magnetometer. Finally, the depth below ground surface was calculated by subtracting the height of the magnetometer sensor above ground (.75 m) from the distance to the anomaly.

BANGERT ISLAND SURVEY RESULTS

As expected, the area west of the slough yielded numerous peaks in the magnetometer data (Figure 28). Most of these peaks are clustered around the location of the house and lot where the

Figure 24. Downed trees at the south end of the APE showing an orange-painted survey transect.

old cars and boats were kept for many years. Some of the peaks along the western edge can be attributed to the old railroad tracks that extend along the western boundary of the project area. The cell tower complex is represented by an extreme low in the data (-7,970 gammas) and the bridge along the northeast end of the project area caused all the transects to dip as much as -1,900 gammas below the normal background level. There are other scattered anomalies outside the main cluster that represent metal trash that was noted on the surface during the survey (Figures 28–29). Because of the nature of these anomalies, they were not analyzed further. It should also be noted that if there was a buried shipwreck in this area, it's magnetic signature would be masked by the large amount of surface anomalies and would not be detectable.

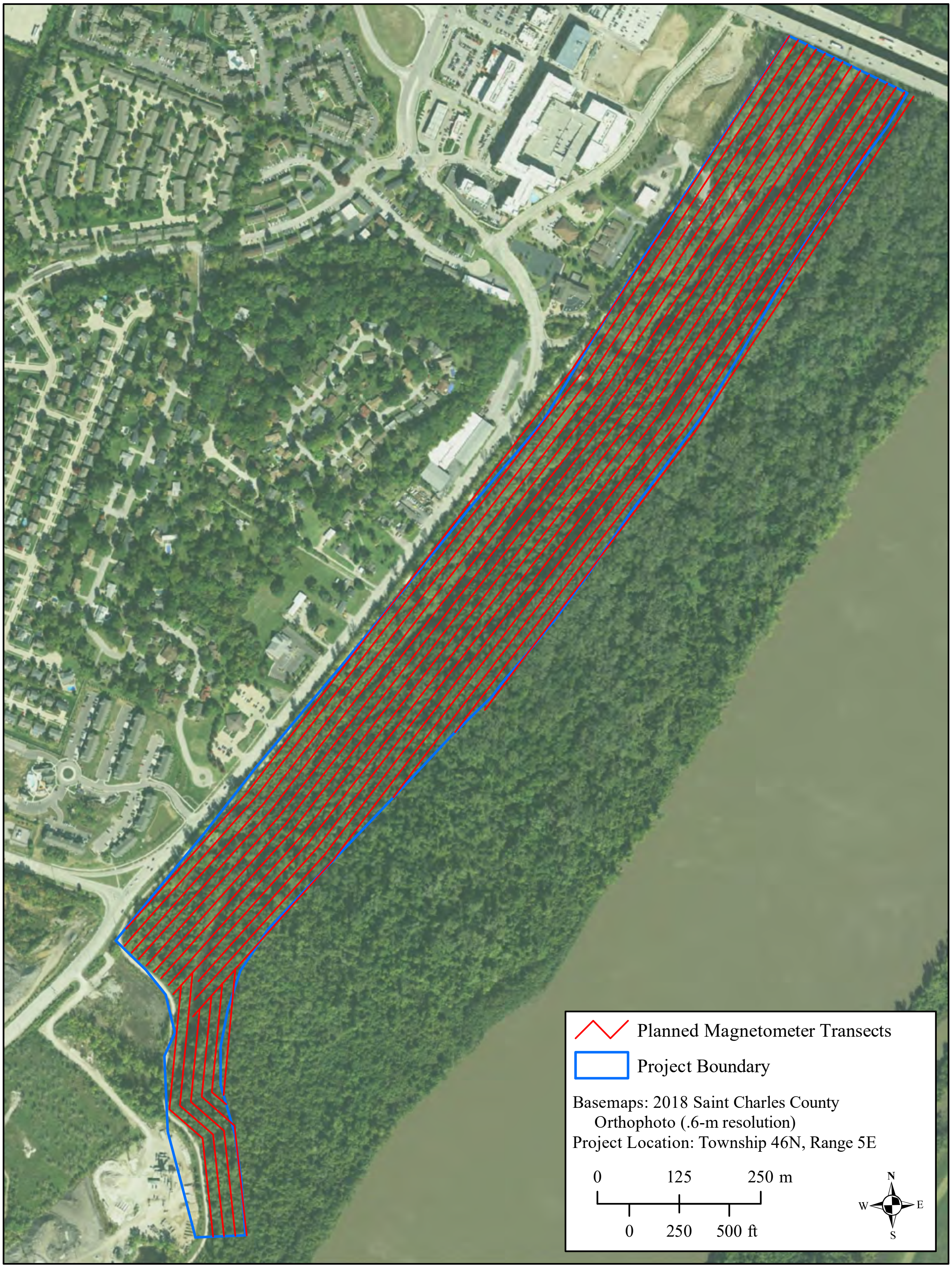

Figure 25. Aerial photo illustrating a model of our planned magnetometry investigations.

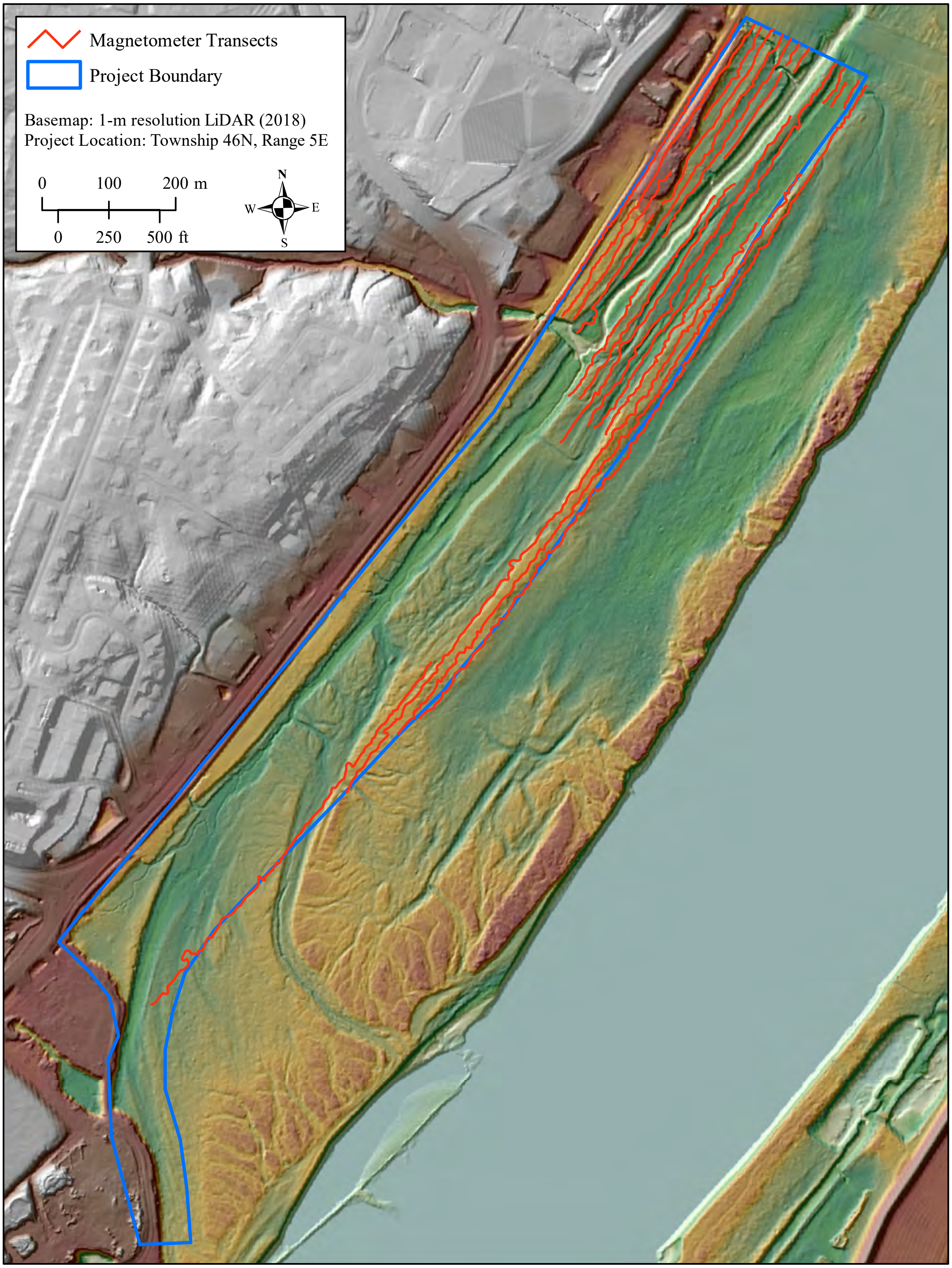

Figure 26. LiDAR map illustrating completed magnetometry transects.

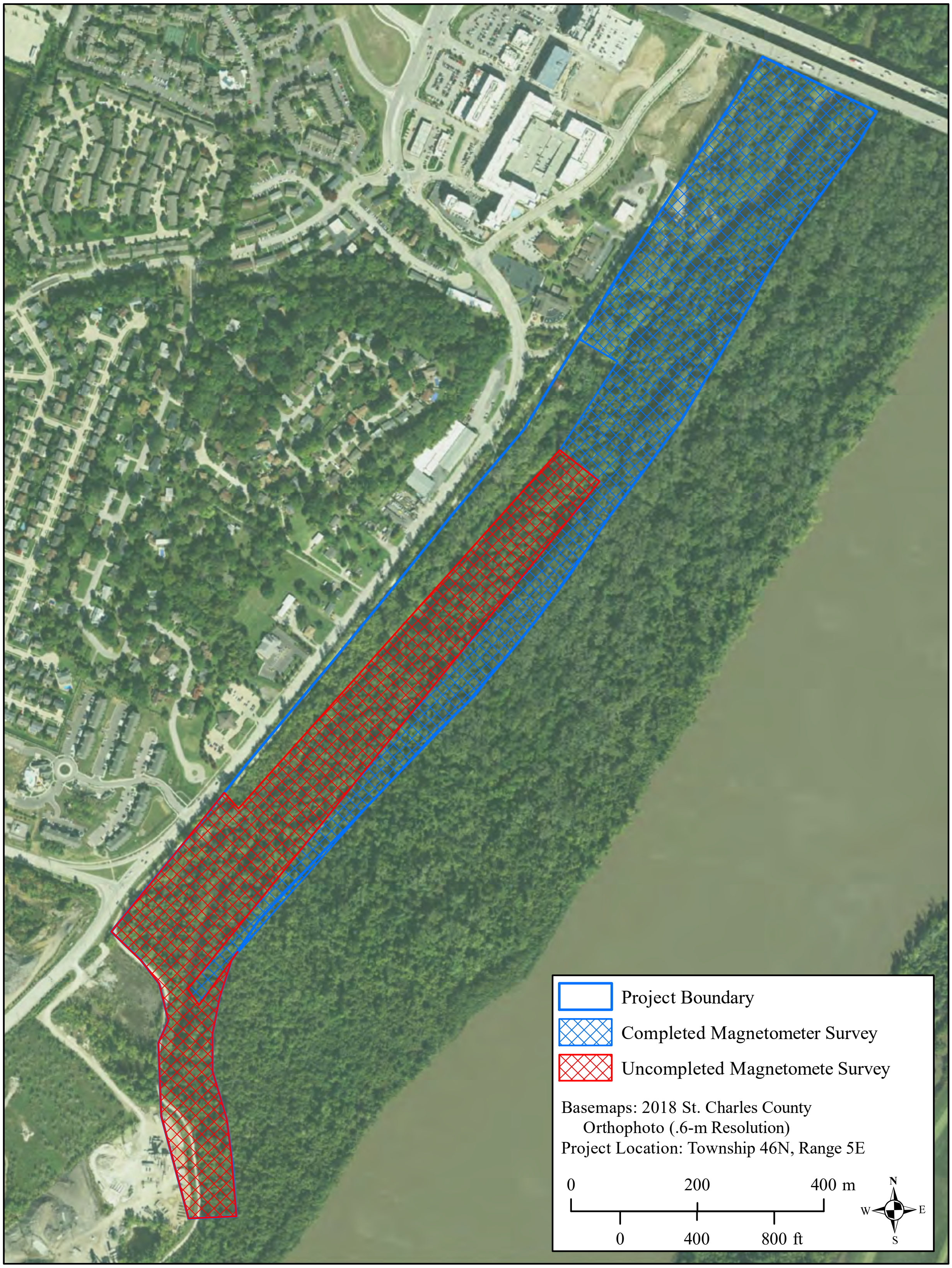

Figure 27. Aerial photo showing completed and uncompleted areas of the magnetometry survey.

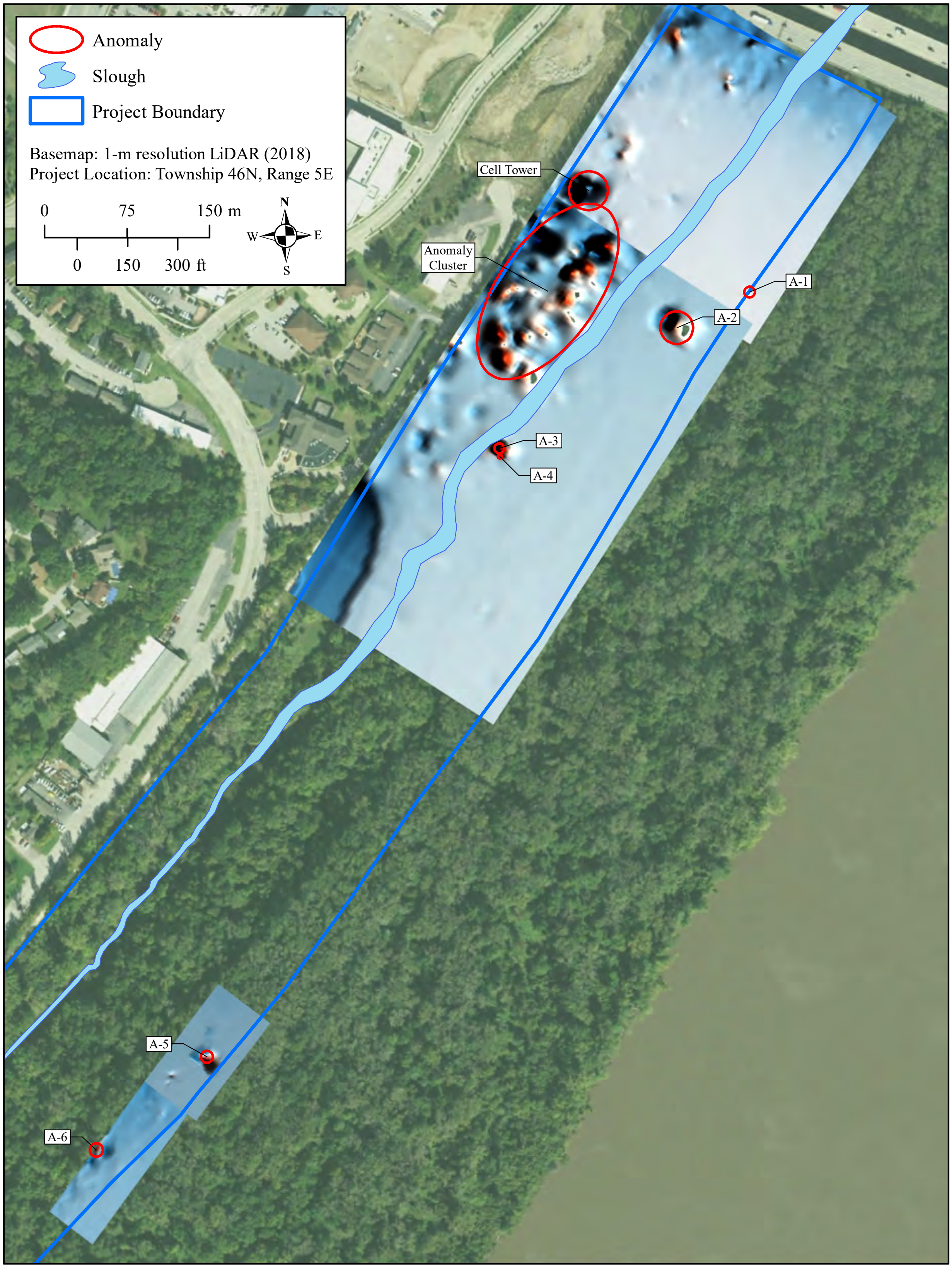

Figure 28. Aerial photo depicting magnetic anomalies detected during the survey of the APE.

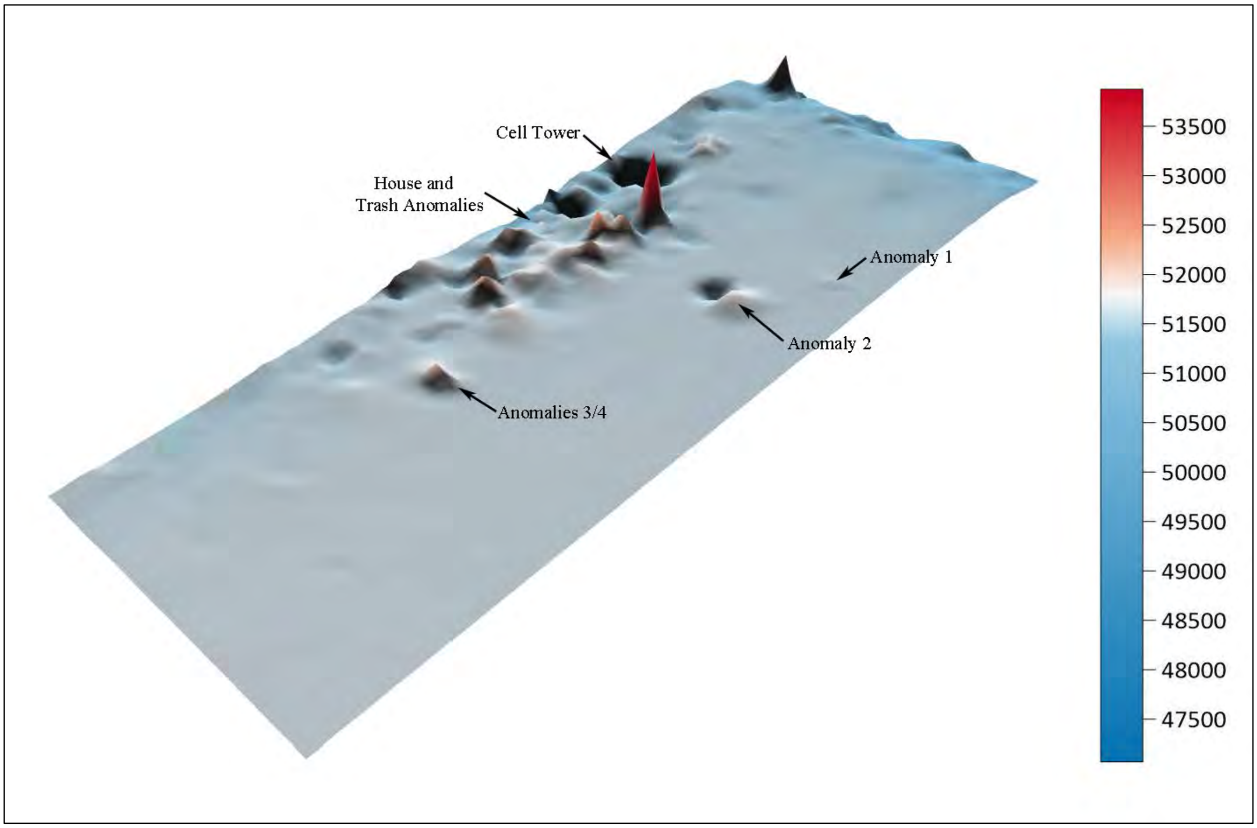

Figure 29. Three-dimensional depiction of anomalies at north end of the APE.

There are six remaining anomalies in the surveyed area east of the slough. Although, none of these anomalies appeared to have the expected attributes of a shipwreck, all six were analyzed so they could either be ruled out or be considered for further study. These anomalies are numbered 1–6 from north to south (see Figures 29–30).

Anomaly 1**:** Anomaly 1 is located along the eastern border of the project area approximately 200 m from the northeast end (Figure 28). It yielded a peak of 147 gammas (Figure 30), which does fall within the range expected for a buried shipwreck. However, the peak is only about 4 m in diameter. Using Peter's Half-Slope Method, the approximate depth of the anomaly is calculated to be 0.5 m below ground surface and the size of the anomaly is approximately 20 lbs.

Anomaly 2**:** Anomaly 2 is located in a swale in the north half of the project area (Figures 28–29). The anomaly has a peak of 2,900 gammas (Figure 31) with a diameter of 5 m. The distance to the anomaly is calculated to be approximately 1.25 m of the magnetometer or 0.5 m below ground surface with a weight of around 400 lbs.

Anomaly 3**:** This anomaly is located on the east bank of the slough in the north half of the project area (Figure 28–29). It consists of a peak of 2,860 gammas with a diameter of 4 m. It calculates to an object with a depth of approximately 0.25 m below ground surface and a weight of 138 lbs.

Anomaly 4**:** Anomaly 4 is located just a few meters south of Anomaly 3 near the slough (Figure 28). Like Anomaly 1, this anomaly is within the gamma range of a buried shipwreck with a peak of 125 gammas. However, the diameter of the anomaly is only 4.25 m and it is apparently about 0.5 m below ground surface with a weight of around 17 lbs.

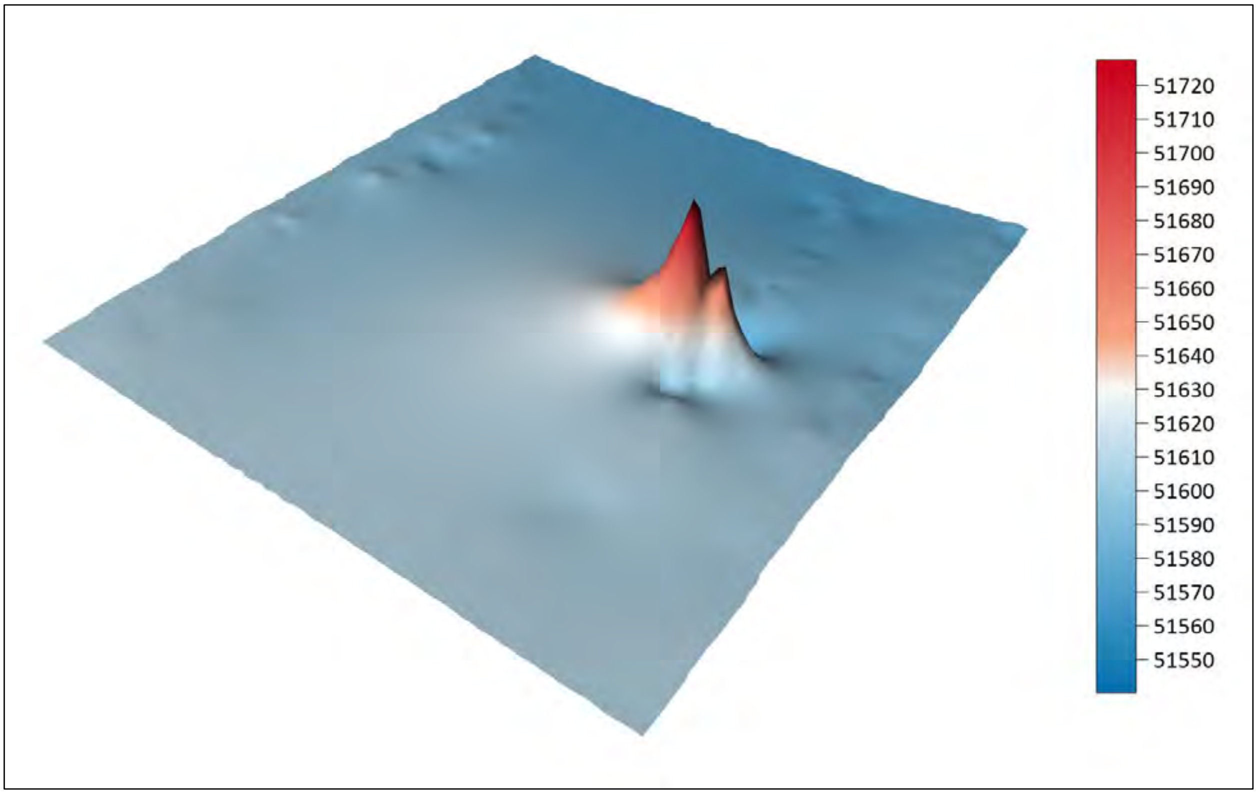

Figure 30. Three-dimensional surfer image of Anomaly 1.

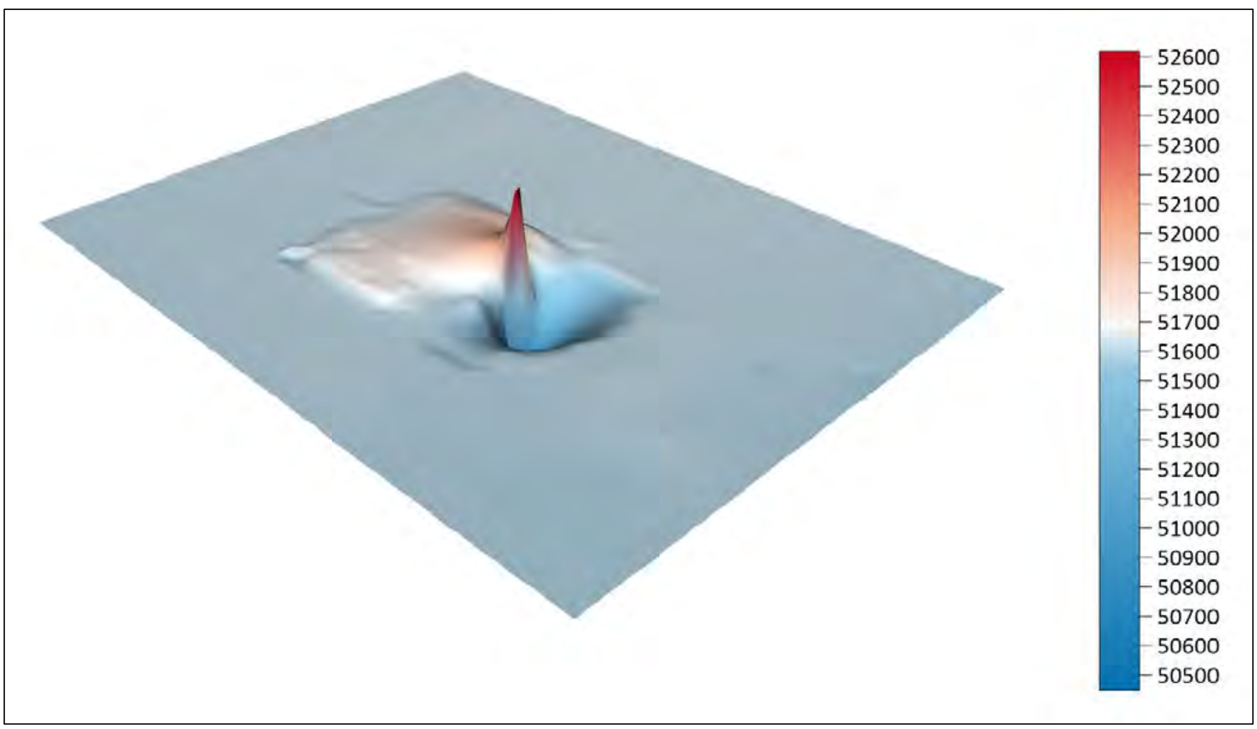

Figure 31. Three-dimensional surfer image of Anomaly 2.

***Anomaly 5*:** Anomaly 5 is located on a ridge in the south half of the project area (Figure 28). This is another large spike with a peak of 1,100 gammas with a diameter of 6 m. That makes the object around 325 lbs at a depth of 0.85 m below ground surface.

***Anomaly 6*:** The final anomaly is also located on a ridge in the south half of the project area, 120 m south-southwest of Anomaly 5 (Figure 28). It has a peak of 175 gammas, which is within the range expected for a buried shipwreck. However, the peak is only about 9 m in diameter. Using Peter's Half-Slope Method, the approximate depth of the anomaly is calculated to be 1.75 m below ground surface and the size of the anomaly is approximately 193 lbs.

Three of the six recorded anomalies had gamma spikes over 1,000. The spikes are indicative of relatively shallow iron objects. The remaining three anomalies were all within the gamma range (40–200) expected for a buried shipwreck. However, the diameter of an anomaly in this range needs to be between 20–40 m, which would indicate the buried object is at a sufficient depth to possibly represent a buried steamboat wreck. All of the detected anomalies were less than 10 m in diameter, meaning the magnetometer only began to detect the source within a few meters of passing over them. Although the calculated depths and weights of the anomalies are based on averages that can vary somewhat, it is clear that none of the anomalies represent large, deeply buried objects that could represent steamboat wrecks.

OTHER CONSIDERATIONS

Once the main channel of the Missouri River shifted to the left bank of the valley toward the end of the nineteenth century, the only remaining uneroded land within the project area would have been the linear apron of colluvial toeslope or terrace deposits bordering the western edge of the APE. The main channel remained in this location until at least 1954, based on a series of historic maps and aerials dating to 1921, 1928, 1937, 1940, 1946, and 1951, as well as its depicted location on the USGS St. Charles 7.5' Quadrangle (see Figure 9). By the time the photo-revised USGS quadrangle was prepared in 1968 and 1974, the Missouri River had moved eastward. This likely occurred during the late 1950s, but it had already begun by 1955 as an aerial photo from that year depicts (Figure 10).

In February, March, and early April of 2020, 20 borings and five test pits also were excavated in the APE. Figure 32 illustrates their location. Since the backhoe-excavated test pits only extended to 10 ft below surface (bs) and invariably ended in sands (n=3), sandy silt (n=1), and clayey silt, they are not very informative. However, it is notable that the profiles of those test pits illustrate relatively sharp boundaries with little or no welding between them, indicating very short-term and recent episodic deposition resulting from either ponding or swift current from floodwaters.

The depth of the borings ranged from 15.8 ft to 39 ft bs. Of the 20 borings, 14 were terminated upon encountering limestone bedrock or boulders. These consisted of B-1 (32 ft bs), B-4 (24.6 ft bs), B-5 (28 ft bs), B-6 (24.25 ft bs), B-8 (20.6 ft bs), B-9 (24 ft bs), B-11 (18.9 ft bs), B-12 (20.6 ft bs), B-13 (33.2 ft bs), C-1 (21 ft bs), C-2 (22.6 ft bs), C-3 (18.11 ft bs), C-4 (15.8 ft bs), and C-15 (17 ft bs). The two deepest borings (B-14 and B-15) extended to depths of 39 ft bs, but were terminated in sand. As is evident in Figure 32, both of the deepest borings were taken in the thalweg of the Missouri River by the early twentieth century, if not before. This would have been the deepest part of the river with the strongest current. If there ever was a shipwreck in the general vicinity, it would have surely washed away by the 1950s. Of the four other borings (B-2, B-3, B-7, and B-10) that did not encounter bedrock/boulders, all were stopped at 20 ft bs in fine to medium sand or silty sand, one of which had clay seams.

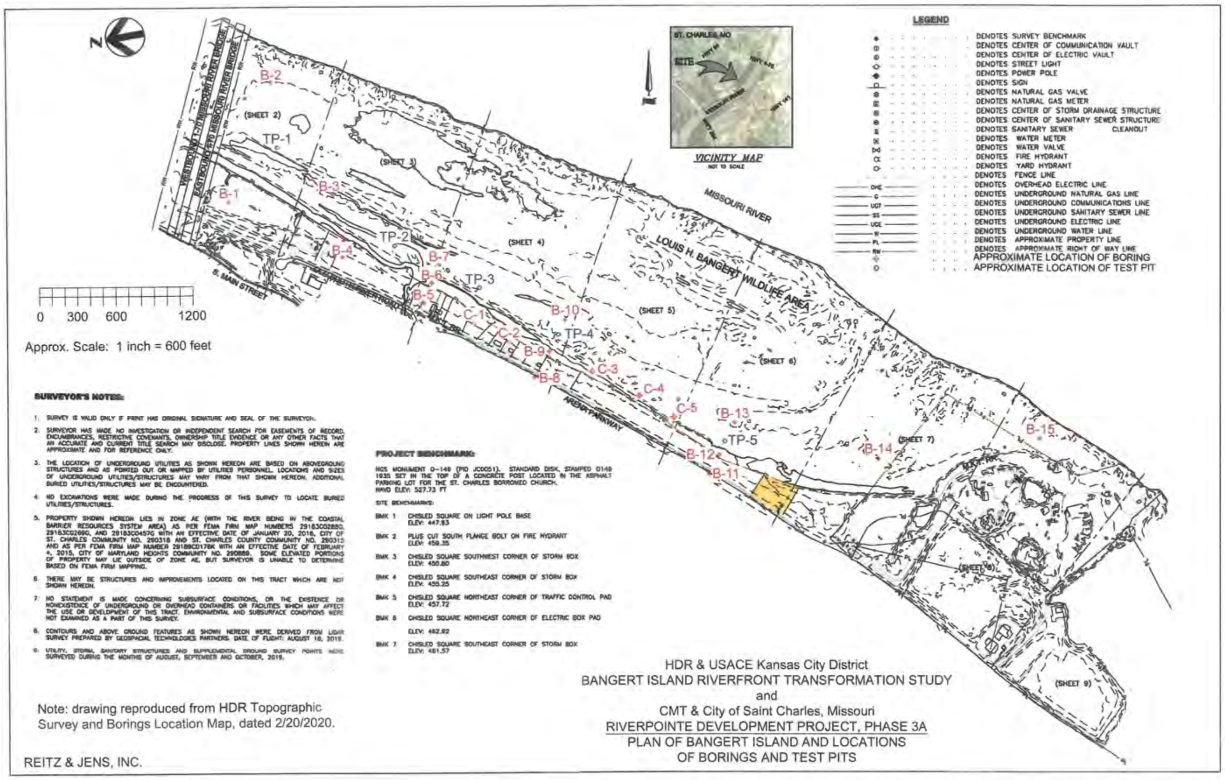

Figure 32. Plan map showing locations of borings (B- and C-) and test pits (TP-).

Due to the ridge-and-swale topography characterizing Bangert Island, it is noted that the depth-to-bedrock data found on the boring logs are not directly comparable. Table 3 was prepared to normalize the data somewhat and provide a better basis for evaluating conditions within and near the project area. The starting elevations of the 20 cores varied by 15 ft. To compensate for this, the depth of each core was subtracted from the core elevation to give the elevation of the bedrock at each core location. Cores in which bedrock was not reached provide a maximum elevation for bedrock. The buried bedrock surface appears to be very irregular, varying in elevation from 411.5 to 440.5 ft amsl, a difference of at least 29 ft. However, the bedrock is generally higher along the western edge of the island near the bluff line, and it becomes deeper closer to the current channel of the Missouri River.

It is evident that all of the strata in all 20 borings were deposited rapidly from floodwaters of variable mobility and/or force. That is, the major breaks in all of the strata illustrate rapid accretion and lack any stable soil development, except at the tops of the profiles or at/near the surface. The deeper borings—B-1, B-13, B-14, and B-15—contained 20–25 ft or more of silty sands and fine-to-coarse sands before encountering bedrock/boulders and being terminated in sand. This reflects deposition by still-rapidly moving water in the former channel of the Missouri River as it moved back eastward during the middle of the twentieth century.

CONCLUSIONS AND RECOMMENDATIONS

As for cultural resource management projects of this type, it is generally impossible to anticipate what may or may not be found in the absence of relatively intensive historical research.

Table 3. Summary of Boring Data from Bangert Island.

Bore No.	Date Drilled	Core Elevation	Total Depth (ft)	Termination Material	Elevation of Bedrock (ft amsl)
B-1	2/18/20	443.5	32	Bedrock/Boulder	411.5
B-2	3/17/20	445.0	20	Sand	below 425
B-3	3/17/20	440.5	20	Sand	below 440.5
B-4	2/18/20	446.5	20.5	Bedrock/Boulder	426
B-5	2/18/20	448.0	28	Bedrock/Boulder	420
B-6	4/1/20	440.0	24.25	Bedrock/Boulder	415.75
B-7	3/17/20	444.0	20	Sand	below 424
B-8	2/18/20	450.5	20.5	Bedrock/Boulder	430
B-9	3/17/20	439.0	24	Bedrock/Boulder	415
B-10	3/17/20	442.0	20	Sand	below 422
B-11	2/18/20	454.0	18.75	Bedrock/Boulder	435.25
B-12	4/2/20	443.0	20.5	Bedrock/Boulder	422.5
B-13	4/2/20	445.0	33.2	Bedrock/Boulder	411.8
B-14	4/2/20	445.0	39	Sand	below 406
B-15	4/2/20	451.0	39	Sand	below 412
C-1	2/18/20	445.0	21	Bedrock/Boulder	424
C-2	2/18/20	445.0	22.5	Bedrock/Boulder	422.5
C-3	4/1/20	439.0	18.9	Bedrock/Boulder	420.1
C-4	4/2/20	439.0	15.7	Bedrock/Boulder	423.3
C-5	4/2/20	439.0	17	Bedrock/Boulder	422

Such research generally cannot be undertaken prior to recommendations for Section 106 investigations. Furthermore, we are typically hampered by the reality that the reported locations of shipwrecks prepared by Chittenden (1897) and Trail (n.d) are only approximations, which requires remote sensing to determine if shipwrecks may be present in a particular project area. Chittenden in particular (but also Trail) did not have the kind of mapping and historical research tools, including access to a considerable volume of digital source material, that modern-day investigators have at our disposal. With this in mind, we have evaluated the likelihood that any shipwrecks may remain buried within the Bangert Island APE and might be subject to disturbance in the future.

Based on the partial magnetometer survey, the researched historic records of shipwrecks in the area, and the geomorphological history of Bangert Island, it appears to be extremely unlikely that any buried steamboat wrecks dating to the nineteenth century are located within the APE. It was our contention that additional magnetometer surveying within the APE would not be beneficial from a time and monetary standpoint, and that an interim report (Lopinot and Thompson 2020) and this report has sufficiently addressed the likelihood that buried steamboat wrecks are not located within the APE. However, a magnetometer survey cannot adequately detect the partial remains of shipwrecks that had salvaged engines and boilers, nor of flatboats and barges constructed with very little iron or other metals. Therefore, it is recommended that the proposed clearing of the former channel of the Missouri River on Bangert Island should be allowed to proceed as planned, provided that the following conditional stipulations are met.

1. If the current project boundaries change to include other previously unsurveyed areas that have a moderate to high probability for containing buried steamboat wrecks or other types of archaeological sites, additional archaeological investigations should be required.

2. If previously unrecorded buried cultural resources are encountered during project construction, the ground-disturbing activities must cease in the immediate area and the Kansas City USACE District Archaeologist and the Missouri SHPO must be notified immediately.

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