THE NATURAL HISTORY OF BELLEVUE STATE PARK, JACKSON COUNTY, IOWA

edited by
Raymond R. Anderson & Chad L. Fields

Geological Society of Iowa

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Cover Photograph

Silurian Marcas Formation dolomites form the bluffs along highway 52 at the entrance to the Nelson Unit of Bellevue State Park. These dolomites fill a paleo-valley incised into Ordovician Maquoketa Formation shale, seen as the slope-forming unit at the base of the bluff.

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INTRODUCTION TO THE NATURAL HISTORY OF BELLEVUE STATE PARK

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Figure 1. Photograph from Bellevue State Park of the world's largest steamboat, the American Queen heading south out of the Mississippi River locks at Bellevue.

Bellevue State Park, dedicated on August 24 1928, was the earliest of Iowa's State Parks. The park is perched on high bluffs of Silurian dolomite overlooking the Mississippi River (Fig. 1). These rocks were originally deposited in the warm, subtropical seas that covered the area about 435 million years ago. In more recent geologic history, Pleistocene glacial ice flowed over the region on multiple occasions, sculpting the landscape over the last 2 million years. Great floods of glacial melt-water surged down the Mississippi River, dumping sand, gravel, silt, and clay along the river valley, and constructing the great flood plane terraces that are the flat lands adjoining the river. We will have an opportunity to observe and discuss these great terraces and how they formed.

The presence of the Mississippi River, perhaps the most important historic route of transportation and commerce in the United States, guided the colorful history of the region from the early pre-history to the present. In this guidebook Mark Anderson, from the Iowa Office of the State Geologist, presents a fascinating review of much of the history of the area, with information on the park history added by Bellevue State Park Ranger Ron Jones. We will read about the plants and the animals in the park and see how nature and man have changed park vegetation in the area of the park through time.

Bellevue State Park offers a variety of recreational opportunities for visitors. Several hiking trails provide access to most areas of the park, camping sites are available in the southern unit of the park, picnic shelters are available, and a heated lodge with scenic view of the Mississippi River is also available. Bellevue residents maintain a series of butterfly gardens, and the park features an interesting and informative nature center (Fig. 2).

Figure 2. Photograph of one area of the South Bluff Nature Center at Bellevue State Park.

The Geological Society of Iowa field trip leaders and guidebook authors hope that everyone will enjoy the field trip and gain a little more knowledge about this beautiful and historic area. We hope that you will have an opportunity to return to Bellevue State Park in the future and perhaps encourage others to visit the region.

QUATERNARY MATERIALS IN THE VICINITY OF BELLEVUE STATE PARK, JACKSON COUNTY, IOWA

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INTRODUCTION

Bellevue State Park is located in Jackson County along the Mississippi River. It is positioned in the East-Central Iowa Drift Plain landform region (Prior and Kohrt, 2006) but is located very near the Paleozoic Plateau region to the north and is bordered by the Iowan Surface to the west and south (Fig. 1). The shallow rock and thin Quaternary cover are similar in characteristic to the Paleozoic Plateau region, although this area has less topographic relief and the valleys are much broader than those to the north making it part of the East-Central Iowa Drift Plain.

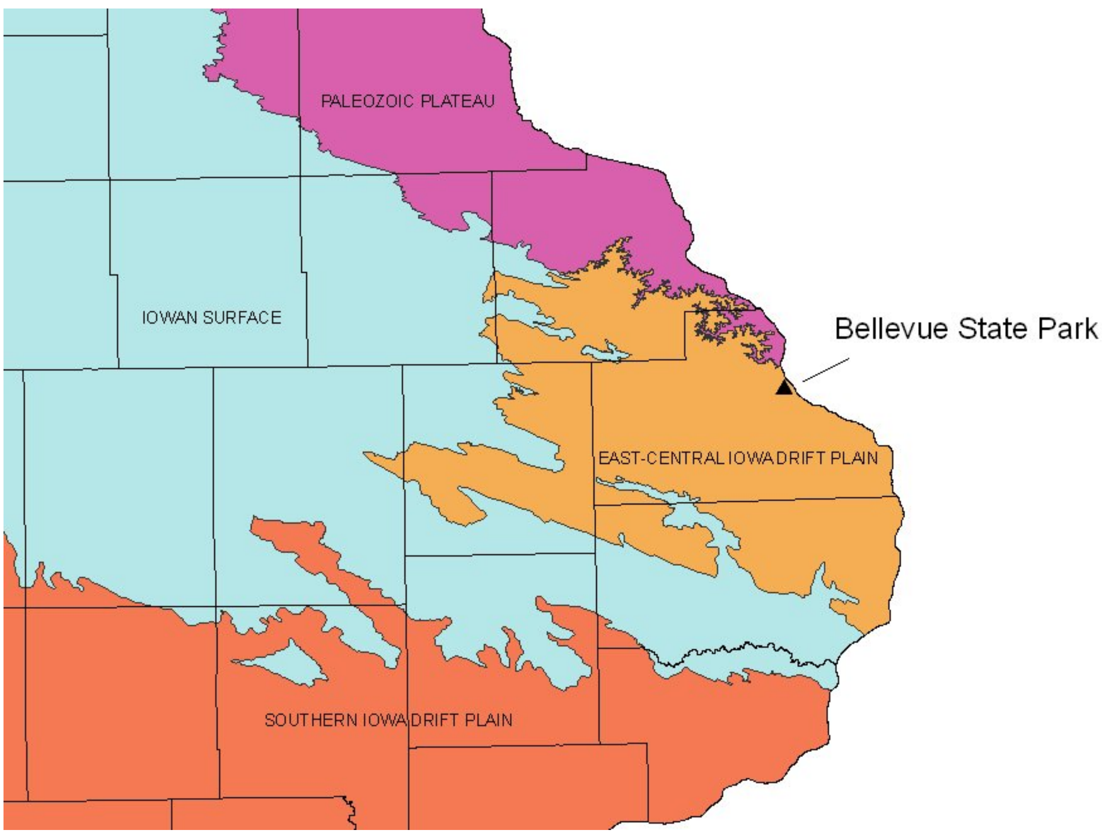

Figure 1. Landform regions of Iowa (Prior and Kohrt, 2006) showing the location of Bellevue State Park in the East-Central Iowa Drift Plan.

PALEOZOIC PLATEAU

The Paleozoic Plateau is a bedrock dominated landform region consisting of steep-sided valleys, limited Quaternary deposits and bedrock controlled surface topography. Steep slopes, bluffs, abundant rock outcrops, sinkholes, springs, and deeply entrenched stream valleys characterize this region. Northeast Iowa was originally termed the "Driftless Area" due to the lack of identified glacial deposits, but subsequent studies disproved this idea and the more appropriate term Paleozoic Plateau was introduced (Prior, 1976). The Paleozoic Plateau encompasses a larger area than the original Driftless Area to incorporate areas of similar geomorphology, topography, and ecology found in northeast Iowa. The Paleozoic Plateau was glaciated multiple times during the Pre-Illinoian (2.2 million to 500,000 years ago), but glacial deposits are generally limited to upland positions and are obscured by a loess mantle. The boundary between the Paleozoic Plateau and the East-Central Iowa Drift Plain to the south and the Iowan Surface to the west is marked by the transition from a rugged, dissected, rock-controlled landscape to that of the gently rolling, lower relief landscape.

EAST-CENTRAL IOWA DRIFT PLAIN

The East-Central Iowa Drift Plain is an extension of the Southern Iowa Drift Plain which comprises the southern portion of Iowa, although they are geographically separated by an area of Iowan Surface. The East-Central Iowa Drift Plain maintains the same characteristics as the Southern Iowa Drift Plain with the exception that there is more shallow bedrock in this landform region. Both the East-Central and Southern Iowa Drift plains are cut deeply into the Pre-Illinoian glacial till and are overlain by various thicknesses of Wisconsin loess. Iowa was glaciated as many as seven times during the Pre-Illinoian Episode, but differentiation of individual till units can be difficult. Based on work by Hallberg (1980), the Pre-Illinoian tills have been divided into the Wolf Creek Formation and the older Alburnett Formation. The Wolf Creek Formation is divided into three members (youngest to oldest): Hickory Hills, Aurora and Winthrop members. The Alburnett Formation is comprised of several undifferentiated members. The East-Central Iowa Drift Plain is characterized by a steeply rolling landscape that developed during alternating periods of erosion and landscape stability (during which time soil profiles form). Landscape development has removed the features typically associated with glacial landscapes (moraines, kames, kettle ponds, etc.). Subsequent glacial advances during the Illinoian and Wisconsin episodes did not reach this area.

Younger deposits consist of eolian materials associated with the Wisconsin Episode and alluvial deposits associated with melting of the Wisconsin glacier. Loess (wind-blown silt) deposits are dominated by Peoria Formation silt or sand facies materials. Loess deposition across the state was time-transgressive, but bracketing ages indicate deposition between 24,000 and 12,000 years BP throughout Iowa (Bettis et al., 2003). Loess is typically uniform, well-sorted, oxidized, light brown silt loam. Layers of fine sand may be present, especially near the base of the unit. The surface materials are usually leached, but in thicker profiles loess may be calcareous at depth and may contain snails. On the Southern Iowa Drift Plain the Peoria Formation loess commonly overlies an older Wisconsin loess (Pisgah Formation), but these materials are not believed to be present in the park. The Late Wisconsin and Early Holocene Mississippi River Valley history is discussed in a separate article in this guidebook.

QUATERNARY DEPOSITS OF BELLEVUE STATE PARK

Quaternary materials present in the park include loess (wind-blown silt), colluvium and alluvium. Loess typically lies directly on top of bedrock on relatively level upland surfaces, with colluvial materials present on slopes. Colluvium is generally loess-derived silt loam with pebbles and cobbles of local bedrock (carbonates and chert) incorporated. Bedrock is commonly exposed along bluff faces and steep slopes throughout the area. A parent materials map (Fig. 2) derived from NRCS soil series classifications shows the relationship between the upland loess mantle and bedrock exposures and colluvial materials on slopes.

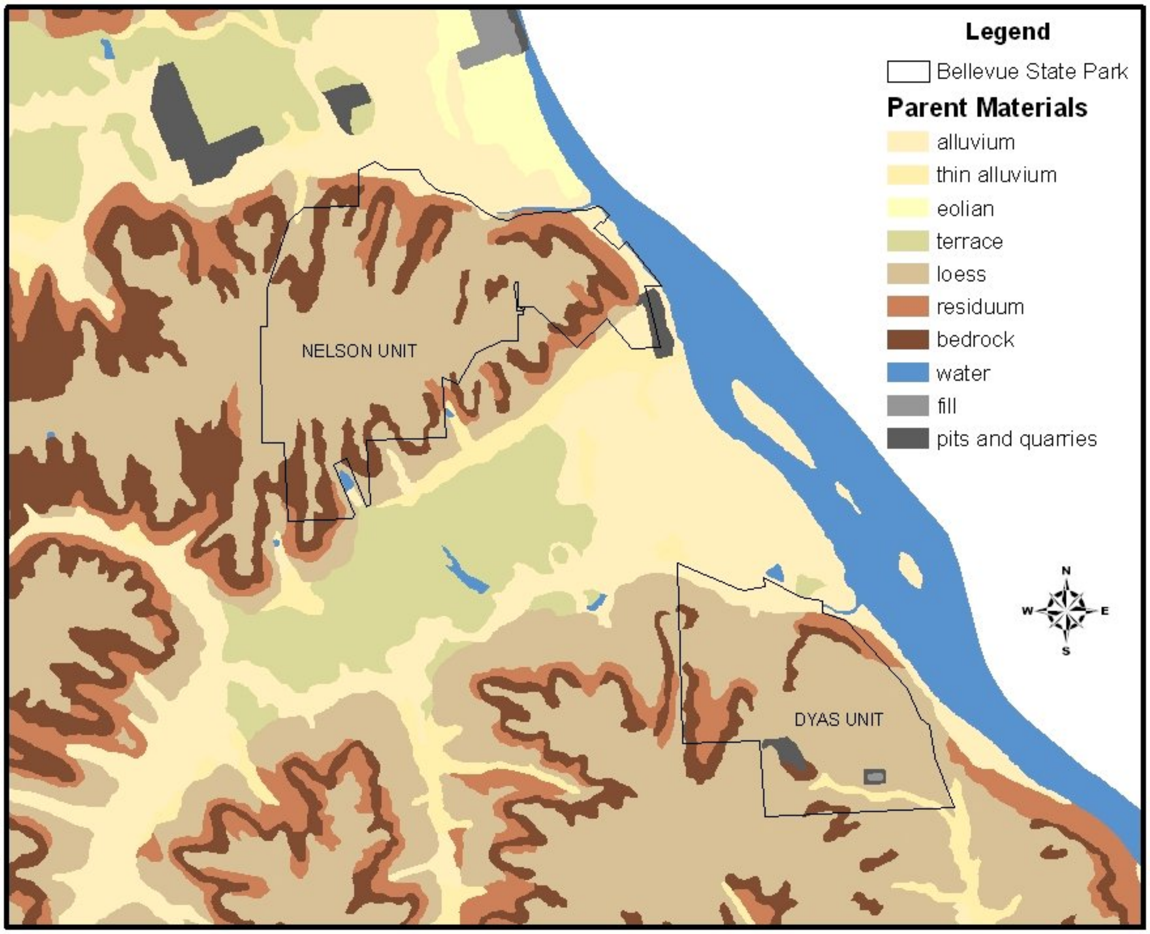

Figure 2. Parent materials map of Iowa derived from NRCS soil series classifications. Upland units are composed of loess, and slope positions are dominated by bedrock and colluvial materials.

Upland areas are mantled with varying thicknesses of Wisconsin age eolian silt (loess). Drilling records indicate that loess may be as thick as twenty feet in some locations, although ten feet is typical of most areas. Loess thickness and distribution may be highly variable on a local scale. No till exposures or other glacial materials have been identified in the park. Drillers logs confirm the absence of till deposits and indicate no till is present within several miles of the park.

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LATE WISCONSINAN AND EARLY HOLOCENE HISTORY OF THE MISSISSIPPI RIVER VALLEY IN THE BELLEVUE-SAVANNA ARMY DEPOT AREA

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The Wisconsinan and Early Holocene geomorphic and stratigraphic record of the Upper Mississippi River Valley (UMV) is related and shaped by both the advance and deglaciation of Wisconsinan-age glacial lobes in the Upper Midwest. Alluvial fills in the UMV record fundamental changes in seasonal meltwater and sediment discharge that mark the end of glacial meltwater into the valley about 12,400 years ago (Bettis, et al., 2008). On today's trip we will have an opportunity to view and traverse two of the major UMV terrace groups, the Savanna and Kingston Terraces along Mill Creek and Duck Creek valleys in the Bellevue and Savanna Army Depot (see article beginning on page 107 of this guidebook), area (Fig. 1).

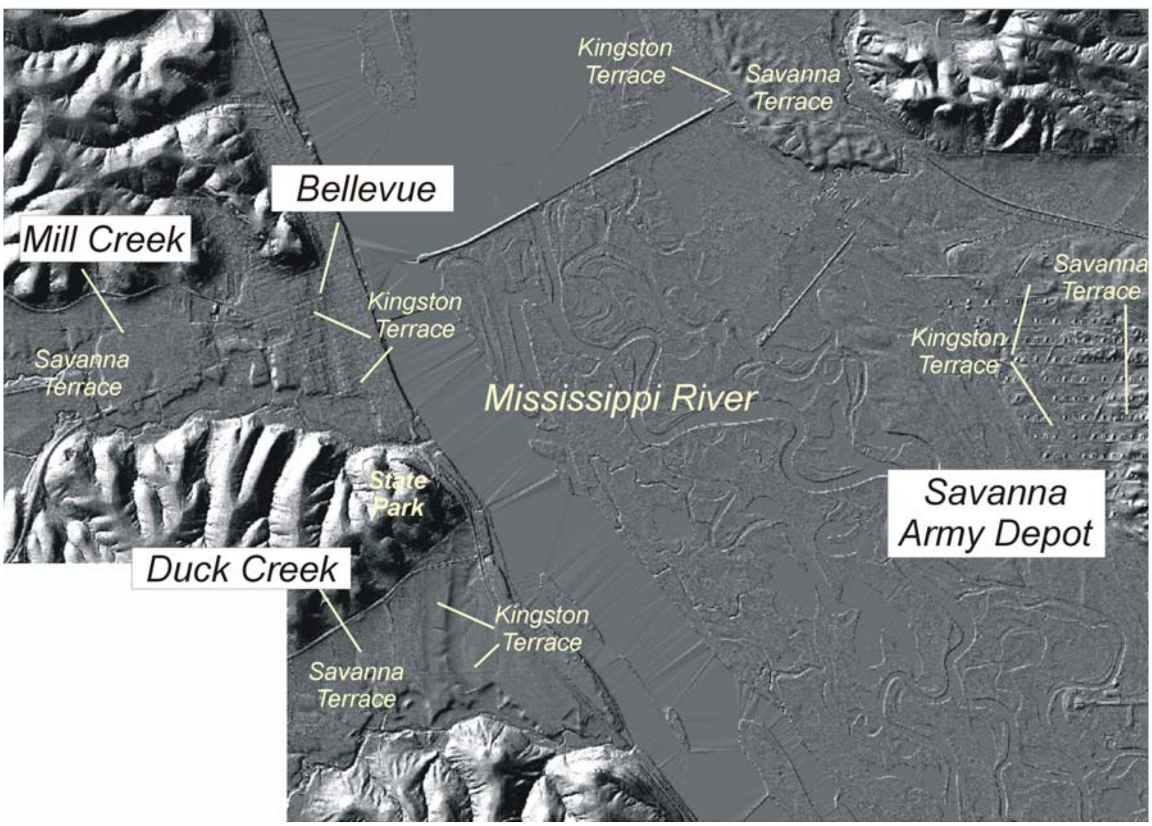

Figure 1. Shaded relief of the Bellevue, Iowa and Savanna Army Depot area, from the Statewide Iowa Lidar Project (provided by Jim Giglierano, IGWS-GIS section). Note locations of terraces along Duck Creek, Mill Creek and the Mississippi River valley.

FULL TO LATE GLACIAL ENVIRONMENT IN THE UPPER MISSISSIPPI RIVER VALLEY

The southward expansion of the Southern Laurentide Ice Sheet significantly affected sediment and water discharge into UMV drainage basin between 25,000 to 21,000 radiocarbon years before present (B.P.) , with maximum extent of ice along the western margin occurring until about 17,000-14,000 B.P. (Bettis et al., 1996). Pollen, macrofossils and faunal studies, by numerous authors indicate the presence of tundra conditions in northern Iowa and Illinois during that time as well as the presence of ice wedge casts and solifluction deposits that reflect the impact of full glacial conditions on upland landscapes in the drainage basin (Bettis and Kemmis, 1992). In the basin, regional loess accumulation began on stable landsurfaces about 26,000 to 24,000 B.P. and continued until 14,000 B.P.

By 21,000 B.P., the Mississippi River floodplain started to aggrade as massive amounts of sediment were delivered to the valley from the proto-Des Moines, Lake Michigan and Lake Erie Lobes (Hansel and Johnson, 1992, Michelson and Colgan, 2003). In addition, during full glacial time, adjacent tributaries draining the periglacial landscape of the UMV basin delivered sediment that was very similar in nature to the valley-train deposits associated with outwash from the glaciated areas in the Great Lakes Region. Bettis et al., 2008 have suggested that rainfall on the periglacial landscape supplied high sediment and flow discharges resulting in braided stream patterns in the tributary streams as well as in the Mississippi Valley. They suggest that the mid-latitude conditions of the UMV would have resulted in increased moisture regime than are typical of modern day tundra environments.

The accumulation of the coarse-grained sediment from tributary valleys in Iowa and the Missouri River Valley to the west significantly raised the UMV's base level, lower reaches of the tributary valleys filled with fine-grained alluvium from those basins, and silts and clays were backflooded into the tributary mouths by periodic Mississippi River flooding. The lower reaches of tributary valleys record a series of UMV flooding from 21,000 to 13,000 B.P (Flock, 1983; Hajic, 1991 and Bettis et al., 1992). After 12,500 B.P. the Laurentide ice sheet began a phase of retreat and deglaciation with glacial lakes forming at the ice margins as well as behind moraines (Mickelson et al., 1983, Teller, 1987: 1990). Catastrophic drainage of these proglacial lakes triggered downcutting in the UMV and left the full glacial floodplain as a terrace (Savanna Terrace) elevated above the late glacial floodplain (Kingston Terrace).

During the late glacial period the UMV continued to serve as a major conduit for meltwater and sediment from the Laurentide ice front, as well as the recipient of episodic large discharges from glacial lake drainage. The drainage of Glacial Lake Agassiz from 11,700 to 10,800 B.P. formed a series of late glacial terraces along the UMV. These terraces are collectively known as the Kingston Terraces and are inset several meters below the full glacial age Savanna Terrace (Hajic, 1991, Bettis et al., 2008).

The late glacial aggradation phase culminating in 12,000 B.P. was followed by erosive episodic glacial outburst floods, with a period of entrenchment from 10,900 to 10,500 B.P. that formed the lowest Kingston Terrace in the UMV (Bettis et al., 2008). By early Holocene time, the Mississippi's channel system had changed to an island-braided mixed load stream and net accumulation of fine-grained sediment on the floodplain ensued (Bettis et al., 2008).

Savanna Terrace

The Savanna Terrace is the highest and oldest terrace group without a loess mantle present in the Bellevue-Savanna Depot area. In eastern Iowa aggradation of the fill beneath this terrace began before 18,700 B.P. and continued until 13.000 B.P. The absence of loess cover (less than

25 cm) indicates that loess deposition had ceased by 12,500 B.P. before the terrace surface stabilized (Ludvigson et al., 1992, Bettis et al., 2008).

In the main valley, terrace fills consist of trough cross-bedded pebbly sands that grade to gravel and cobbles with depth. Dunes and sand sheets mantle the terrace in many areas. The nearby Savanna Depot terrace is a good example of a main valley terrace (Fig. 1). In the lower reaches of tributary valleys the Savanna Terrace is underlain by slackwater-flood lithofacies consisting of laminated reddish-brown silty clay, gray clay and silt deposit of variable thickness. In Duck Creek (Fig. 2), the Savanna Terrace level sits nearly 20 meters above the Mississippi River floodplain and occupies a broad area of the north side of the valley. These fine-grained deposits accumulated as sediment dams formed at the mouth of the valleys during aggradation of the Savanna Terrace in the Mississippi Valley. The fine-grained sediments accumulated from tributary sources as well as from backflooding during Mississippi River floods.

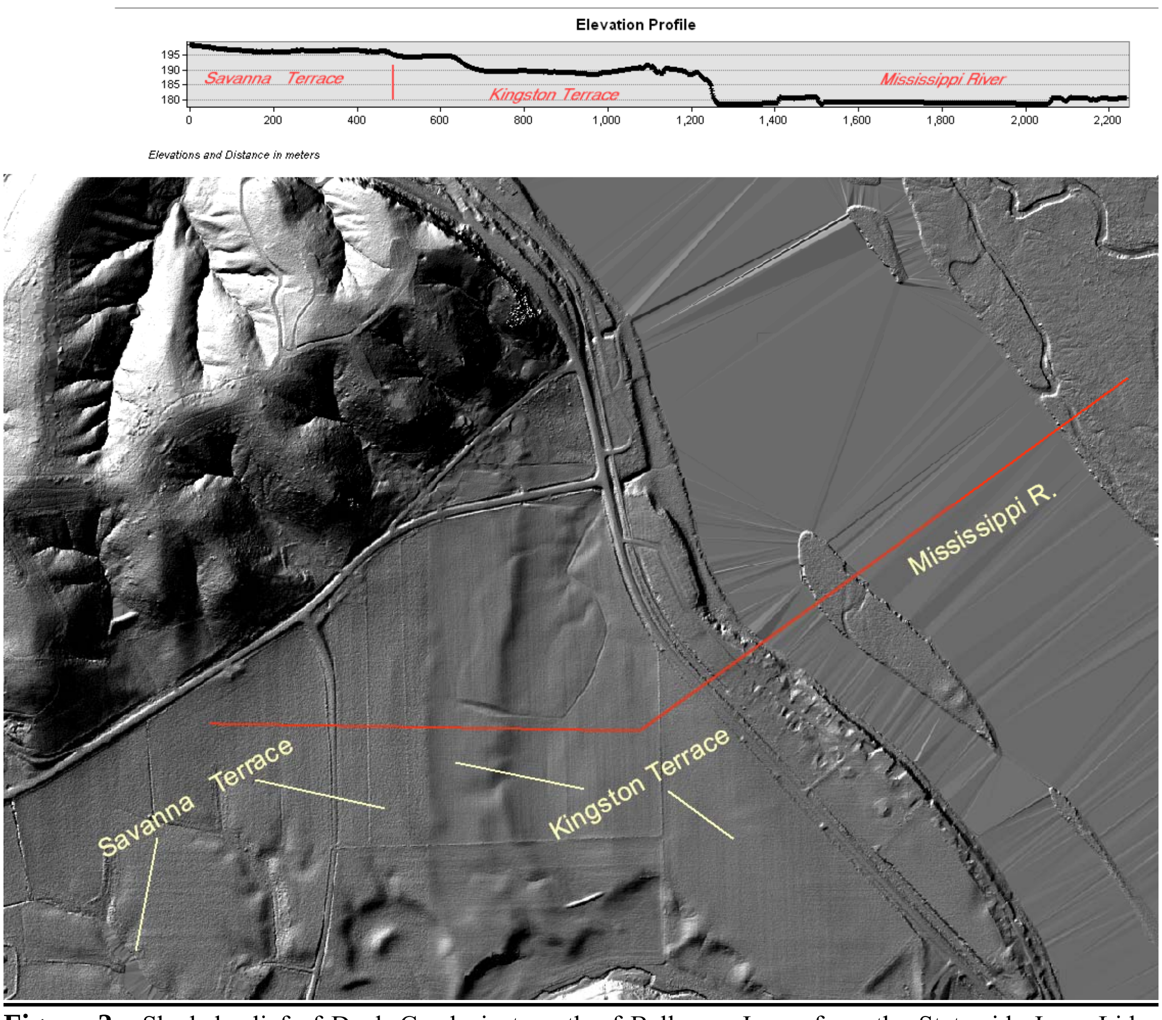

Figure 2. Shaded relief of Duck Creek, just south of Bellevue, Iowa, from the Statewide Iowa Lidar Project (provided by Jim Giglierano, IGWS-GIS section). Note the location of an expansive Savanna Terrace and several longitudinal type Kingston Terraces along the north valley wall of Duck Creek. An east-west Mississippi River Valley profile is inset above figure.

In tributary valleys such as Duck Creek and Mill Creek (Fig. 1), the underlying coarse-grained deposits are buried by a thick veneer of slackwater facies. Mark Anderson, of the Office of State Archaeology described a cutbank exposure along Duck Creek (Anderson, 2004) and reported 2.6 meters of laminated silty clay and no coarse-grained deposits exposed (Fig. 3).

The type area for the Savanna Terrace is along the Plum River near Savanna, Illinois (approximately 25 miles south of Bellevue). The terrace fill is the slackwater facies (Flock, 1983) which is characteristic of most of the terrace fills on the lower reaches of tributaries to the UMV. These terraces have a reverse gradient and can only be traced several kilometers upstream. The key distinguishing feature of these fills is thinly bedded to laminated reddish-brown silty clay of Lake Superior provenance along with the interbedded gray silts and silty clays. The slackwater facies in this terrace is recognized as the Late Wisconsinan age Equality Formation, Plum River Member sediments and the underlying pebbly sand fill is recognized as the Henry Formation, Sabula Member (Bettis, 1994).

Figure 3. Savanna Terrace cutbank along Duck Creek. Note thinly bedded slackwater deposits of Equality Formation, Plum River Member exposed (photo by Mark Anderson, OSA).

Savanna Terrace remnants are well documented and mapped in Iowa. Their distinctive sediment package is readily observed and mapped as the Zwingle soil series by the USDA Soil Conservation Service and Iowa Cooperative Soil Survey staff. Zwingle soils developed on forested high stream terraces along major tributaries that drain into the Mississippi River. Zwingle soils are poorly drained and exhibit an A-E-Bt-Btg-2Cg profile developed in dominantly reddish clayey lacustrine sediments 1 to 1.5 meters thick over stratified noncalcareous alluvial sediments that typically are loamy and sandy (USDA- Jackson County Soil Survey,1992)

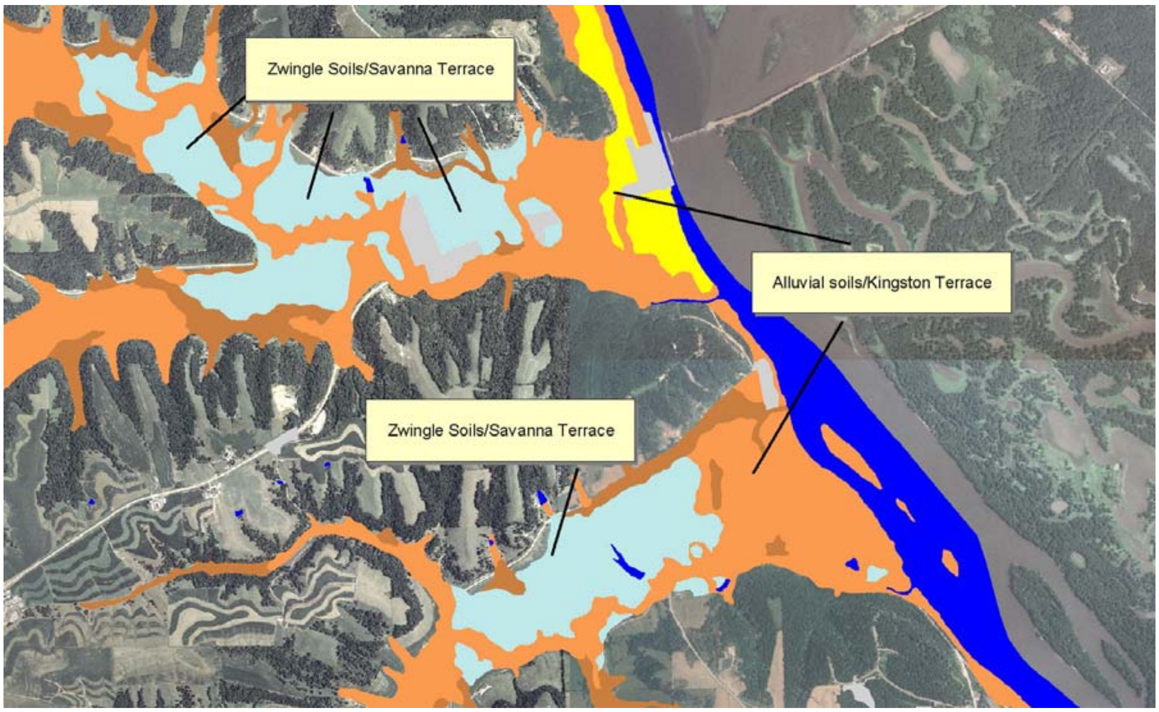

Figure 5. Soil survey map units for the Zwingle and numerous alluvial soil series overlain on the 2007 aerial photography mosaic for Jackson County. Zwingle soils are mapped in the lighter areas and Kingston Terraces in darker areas near the mouth of tributary streams. Note the Kingston Terrace at Bellevue is overlain with eolian sand.

Kingston Terrace

The town of Bellevue straddles two Kingston Terrace levels that are inset below a broad Savanna Terrace (Fig. 4). Kingston Terraces often are found as streamlined remnants in the main valley of the UMV. These terraces exhibit a similar longitudinal morphology to Late Wisconsinan age terraces associated with glacial outburst floods on the Des Moines Lobe in Iowa as well as a similar sand and gravel alluvial fill. These terraces are remnants of a former glacial sluiceway that drained meltwater and sediment from the Laurentide ice sheet as well as during high magnitude flood events. Entrenchment forming the Savanna Terrace surface occurred prior to 12,000 B.P. and was followed by aggradation of the Kingston Terrace level between 12,000 and 10,500 B.P. The pebbly sand dominated fill underlying the Kingston Terraces is indicative of sediments accumulating in a braided stream environment (Fig. 5) and braid patterns are preserved on terrace surfaces in many areas. In Illinois and Iowa, these terraces are recognized as Late Wisconsinan age Henry Formation, Muscatine Member (Bettis, 1994).

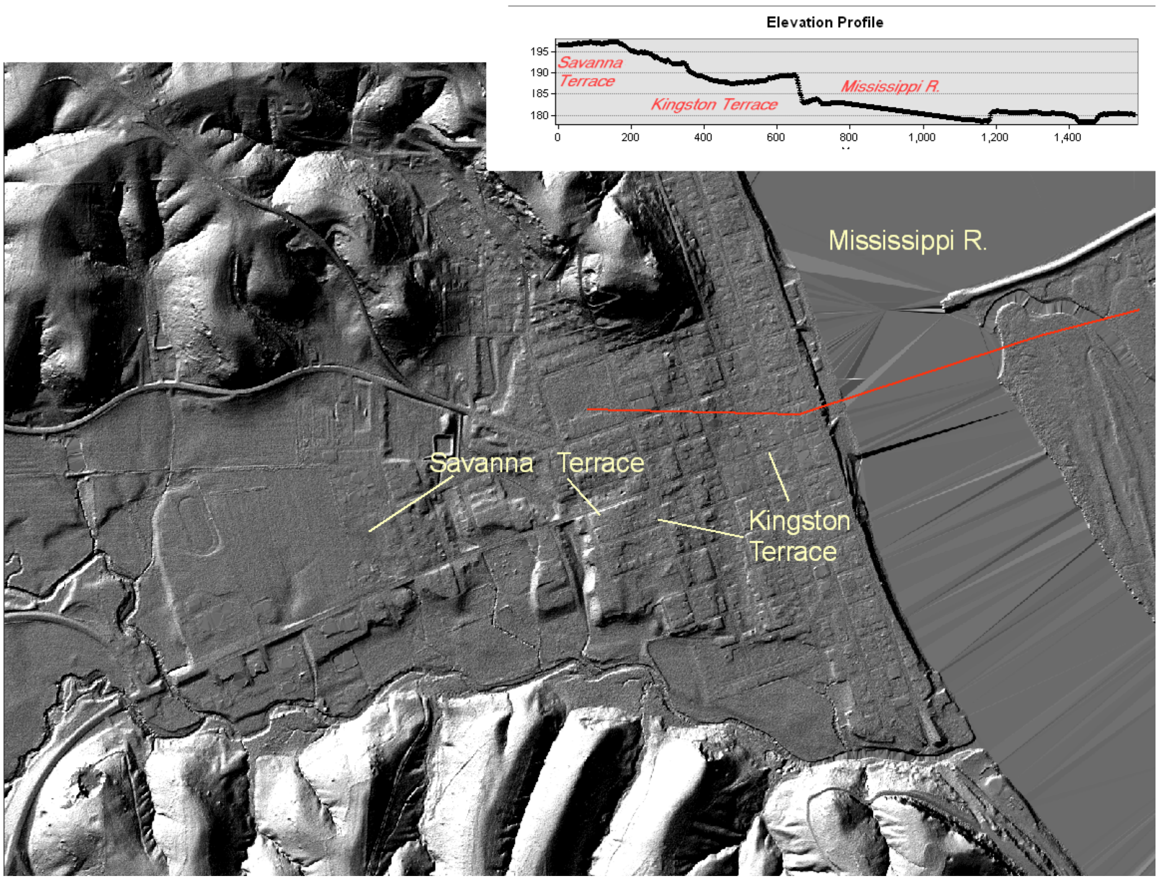

Figure 4. Shaded relief of Mill Creek, and Bellevue, Iowa, from the Statewide Iowa Lidar Project (provided by Jim Giglierano, IGWS-GIS section). Note locations of a broad Savanna Terrace and longitudinal shaped Kingston Terraces along Mill Creek, which is adjacent to the Mississippi River valley. An east-west Mississippi River Valley profile is inset in the upper right corner.

Figure 5. City of Bellevue water line trench through sandy Kingston Terrace fill. Beyond the Jeep in photo is the higher Kingston Terrace surface as well as the significantly higher Savanna Terrace level beyond trench (note the house on Savanna surface).

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BEDROCK GEOLOGY OF BELLEVUE STATE PARK AND THE BELLEVUE AREA

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INTRODUCTION

The picturesque bluffs that border the Mississippi River at Bellevue State Park provide an exceptional opportunity to examine Upper Ordovician and Lower Silurian bedrock strata, among the best available in the Upper Mississippi Valley area. These Ordovician and Silurian bedrock strata were originally deposited as sediments in shallow tropical seaways that covered portions of the North American continental interior between about 452 and 435 million years ago. The bedrock strata at Bellevue State Park can be subdivided into a series of intervals identified by their distinctive lithologies (rock types) and fossil content. These intervals are recognized across large areas of eastern Iowa and northwestern Illinois, and each interval has been given a regional name (formation or member) so that geologists can readily communicate and identify specific packages of rock strata. The succession of shale and dolomite strata seen in the park are like the pages in the book of earth history, each layer of rock recording information about the ancient environments and ancient life forms that once were found in this area when it occupied a position in the southern tropics. The following summary is arranged to reflect the succession of rock strata seen in the park and the general area around Bellevue, from oldest (bottom) to youngest (at the top). The general stratigraphy (the succession of rock layers) seen at Bellevue State Park is graphically displayed in Figure 1. The exposure of these strata in the Bellevue area resulted from more recent (Quaternary) erosion and down-cutting of the Mississippi River and its tributaries, exhuming bedrock strata now displayed in the bluffs and valley walls of the region. A brief summary of the geology at Bellevue State Park was previously presented by Ludvigson and Witzke (1988).

ORDOVICIAN – GALENA GROUP

The lowest bedrock strata seen in the Bellevue area, which belong to the uppermost part of the Galena Group, can be accessed in the low banks and streambed of Mill Creek adjacent to Potter's Mill in the northeastern corner of Bellevue State Park. These are the southernmost known exposures of Galena Group strata in all of Iowa, but Galena strata continue to dip southward beneath the level of the Mississippi River and are found in the subsurface across much of eastern Iowa. The upper strata of the Galena Group as seen at Bellevue are displayed as resistant ledges of evenly-bedded dolomite separated by thin shale partings and these beds comprise the upper part of the Dubuque Formation. The dolomite ledges contain molds and dolomitized grains of fossil crinoid debris. At low-water, only about 5 feet (1.5 m) of the Dubuque Formation are exposed. The Galena Group and Dubuque Formation derive their names from localities further north in the Mississippi Valley (at Galena, Illinois, and Dubuque, Iowa).

ORDOVICIAN – MAQUOKETA FORMATION

The Galena Group is overlain at Bellevue and elsewhere in the region by a shale-dominated succession of generally poorly exposed strata known as the Maquoketa Formation. The Maquoketa derives its name from the Little Maquoketa River Valley in Dubuque County, Iowa (see Witzke and Heathcote, 1997). The top of the Galena Group is marked by an irregular

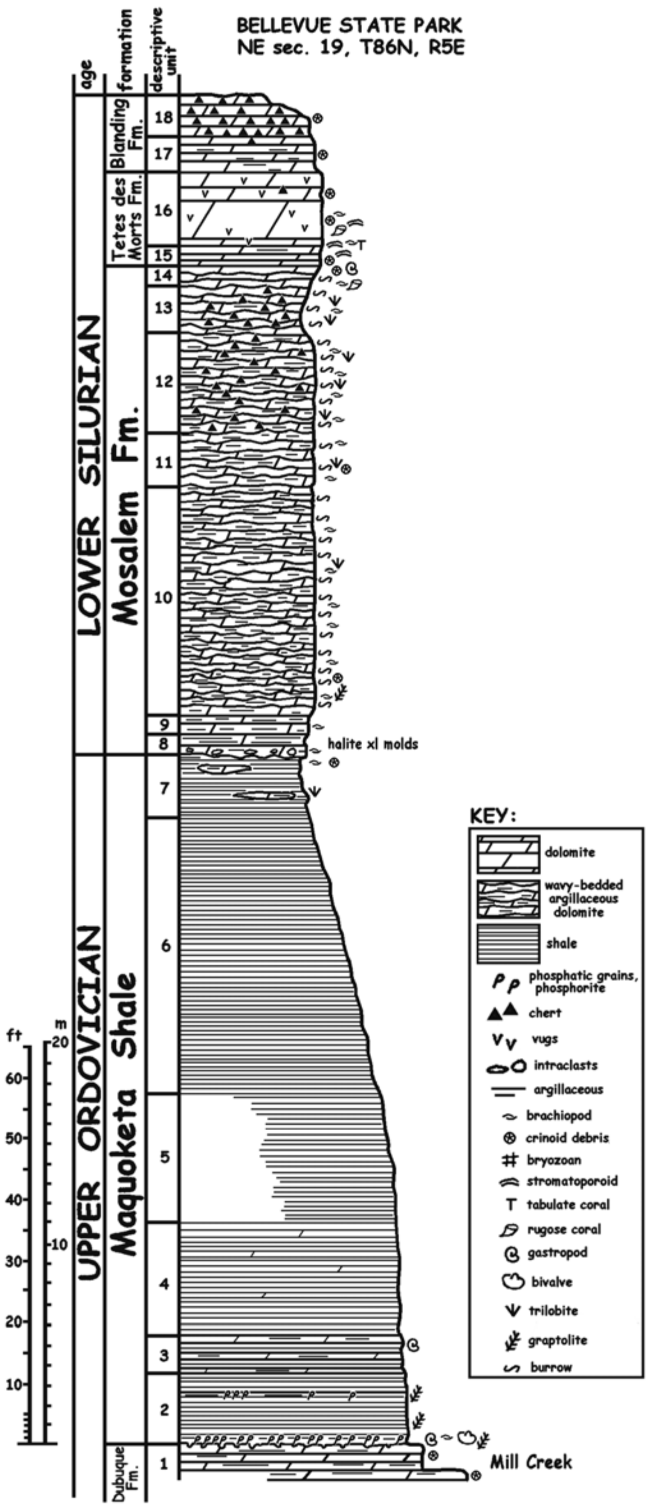

Figure 1. Graphic stratigraphic section of bedrock strata exposed along the east bluff face (Mississippi Valley) and Mill Creek valley, Nelson (North) Unit, Bellevue State Park, Jackson County, Iowa.

sculpted surface interpreted to have formed as a submarine hardground surface (a surface of nondeposition and carbonate dissolution). Unique phosphatic and organic-rich strata of the basal Maquoketa Formation are found immediately above this surface, but these are generally not well exposed in the valley of Mill Creek opposite Potter's Mill. Nevertheless, occasional cutbank slumps and geologic excavations have revealed that this interval along Mill Creek includes a basal phosphorite about 2 ½ inches (6 cm) thick. Phosphorite is a rock type composed primarily of apatite, a calcium phosphate mineral of similar composition to bones and teeth. Along Mill Creek this phosphorite is pyrite-cemented (iron sulfide mineral also known as "fool's gold") and is comprised of numerous small flaxseed-like grains of apatite, scattered larger apatite clasts, as well as an abundance of phosphatized molds of diminutive fossils less than 1 to 2 mm in size (especially small clams and snails). Above the basal phosphorite, about 10 feet (3.2 m) of medium to dark brown organic-rich shale are present. This organic shale is widespread in eastern Iowa and northern Illinois and has been termed the Argo Fay Bed (Kolata and Graese, 1983), which comprises the lower part of the "brown shaly unit" of Brown and Whitlow (1960). These shales contain scattered to common fossils of graptolites, compressed organic films of an extinct and enigmatic group of pelagic colonial animals. Brown shales continue higher for another 7 feet (2.2 m), but these become interbedded with green-gray shales, argillaceous dolomite, and thin phosphatic beds.

The remainder of the Maquoketa Formation at Bellevue is characterized by a poorly-exposed interval of shale, locally seen here and there along the lower slopes of the state park. These shales are dominantly green-gray in color and are slightly dolomitic; they are plastic and slick when wet. The upper part of this shale interval at Bellevue locally contains scattered interbeds of argillaceous dolomite, generally unfossiliferous but locally containing some brachiopod, bryozoan, or trilobite fossils in the uppermost beds. The brown and green-gray shales of the Maquoketa Formation contain few fossils, but there is indication of scattered burrowing in some beds. The general lack of fossils in these beds suggests bottom conditions during deposition that were inhospitable for most animals. Witzke and Heathcote (1997) proposed a depositional model in which the Maquoketa shales were deposited in a stratified seaway that displayed decreasing oxygenation with depth. They interpreted the organic-rich brown shales to have been deposited in the deepest anoxic (anaerobic) water mass.

The Maquoketa Formation is overlain by Silurian-aged strata in the park and across the region. However, the full thickness of the Maquoketa Formation at Bellevue State Park is the thinnest known in the entire Upper Mississippi Valley area. The Maquoketa Formation commonly reaches thicknesses of 200 to 240 feet (61-73 m) in nearby areas of Jackson, Dubuque, and Jones counties, but the full thickness at Bellevue is only about half that thickness (113 feet; 34 m). Of note, the uppermost part of the Maquoketa, the upper Brainard Member, is recognized only a short distance to the south of Bellevue State Park (about 3.5 miles south in SE SE sec. 5, T85N, R5E), indicating that the formation significantly thickens (to over 200 ft) over relatively short distances.

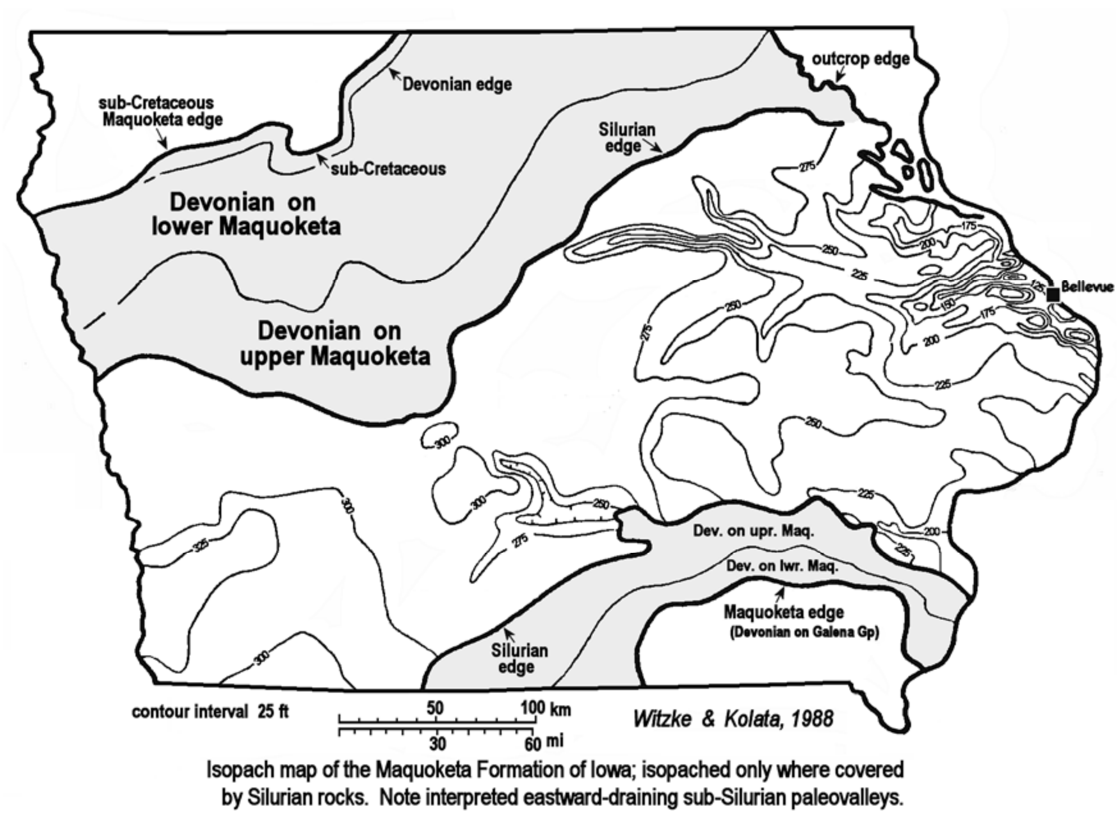

Figure 2. Isopach (thickness) map of the Maquoketa Formation in Iowa. Note that Bellevue occurs in an area of greatly thinned Maquoketa strata in the eastern part of a major eastward-draining sub-Silurian (sub-Mosalem-Tete des Morts) paleovalley system.

The dramatic thinning of the Maquoketa Formation at Bellevue is due to a major episode of erosion that preceded deposition of Silurian sediments in the region, an episode (likely of 1 or 2 million years duration) that ensued following the withdrawal of seas from the region near the close of the Ordovician period. The seaway's withdrawal left an exposed landscape of easily eroded Maquoketa Shale. It was on this landscape that river valleys developed across parts of region, significantly eroding and thinning the Maquoketa shale interval in some areas. The greatly thinned Maquoketa section at Bellevue indicates that this area was part of an eroded valley system that developed during the erosional episode that straddled the Ordovician-Silurian boundary. The thickness of the Maquoketa Formation in Iowa (where covered by Silurian rocks) graphically illustrates the development of significant sub-Silurian drainage networks in parts of central and eastern Iowa (Fig. 2). Bellevue occupies a position in the heart of an extensive west-to-east drainage system as portrayed on the Maquoketa thickness map (Fig. 2).

EARLIEST SILURIAN (and/or LATEST ORDOVICIAN?) – MOSALEM FORMATION

The prominent cliff face that towers above the Mississippi River in the Nelson (North) Unit of Bellevue State Park is dominated by strata of the Mosalem Formation. A large quarry above Mill Creek in the state park, now long abandoned, removed Mosalem beds for building stone and lime production (the quarry as well as remnants of an old lime kiln can be seen along the Quarry Trail in the park). The Mosalem was named by Brown and Whitlow (1960) as a member within the so-called "Edgewood" Formation, and Willman (1973) elevated the Mosalem to formational status. It is named for exposures in Mosalem Township in southeast Dubuque County. Willman (1973) designated the type locality in the roadcut along Highway 52 near the village of King, about 12 miles northwest of Bellevue (see Fig. 3). The Mosalem is identified in areas of east-central and northeast Iowa as well as parts of northwestern Illinois. Although it is primarily identified along the Silurian escarpment of the northeast Iowa, it is also recognized in the subsurface of several Iowa counties (e.g., Fig. 3, SS8 core; see also Fig. 4 where local sub-Blanding thicknesses exceed 35 feet).

The Mosalem overlies an erosional unconformity developed on the Maquoketa Formation, and the formation is entirely restricted to paleotopographic lows (paleovalleys) developed on the Maquoketa surface. The Mosalem is highly variable in thickness due to the irregular topography developed on the underlying Maquoketa surface, and it is known to range between 0 and 100 feet (0-30 m) in thickness in eastern Iowa and northwestern Illinois. The Mosalem is locally absent along the Silurian outcrop edge (where the Tete des Morts Formation directly overlies the Maquoketa), and significant variations in thickness are displayed over short distances. For example, the Mosalem at Bellevue State Park (Nelson Unit) is 80 feet (24 m) thick (on middle Maquoketa shales), but the Mosalem is thin to absent only 3.5 miles to the south (see earlier discussion of Maquoketa erosion). The Mosalem is not well displayed in the Dyas Unit (south) of the park, and it likely thins significantly to the south (across the present valley of Duck Creek, which separates the two units of the park). Although the Mosalem displays significant local variations in thickness, general patterns in the maximum local thicknesses of the sub-Blanding interval (Mosalem and Tete des Morts formations) are apparent (Fig. 4) that generally parallel the paleovalleys developed on the underlying Maquoketa shale surface (Fig. 2). Where the Maquoketa is thinnest, the Mosalem Formation is thickest.

The Mosalem is a wavy-bedded argillaceous dolomite separated by thin shaly partings. Individual dolomite beds commonly range from about 1 to 8 inches (2-20 cm) in thickness, and basal strata may weather into thin platy flags. Argillaceous (clay) content generally decreases upward through the Mosalem succession, but it remains argillaceous throughout. The

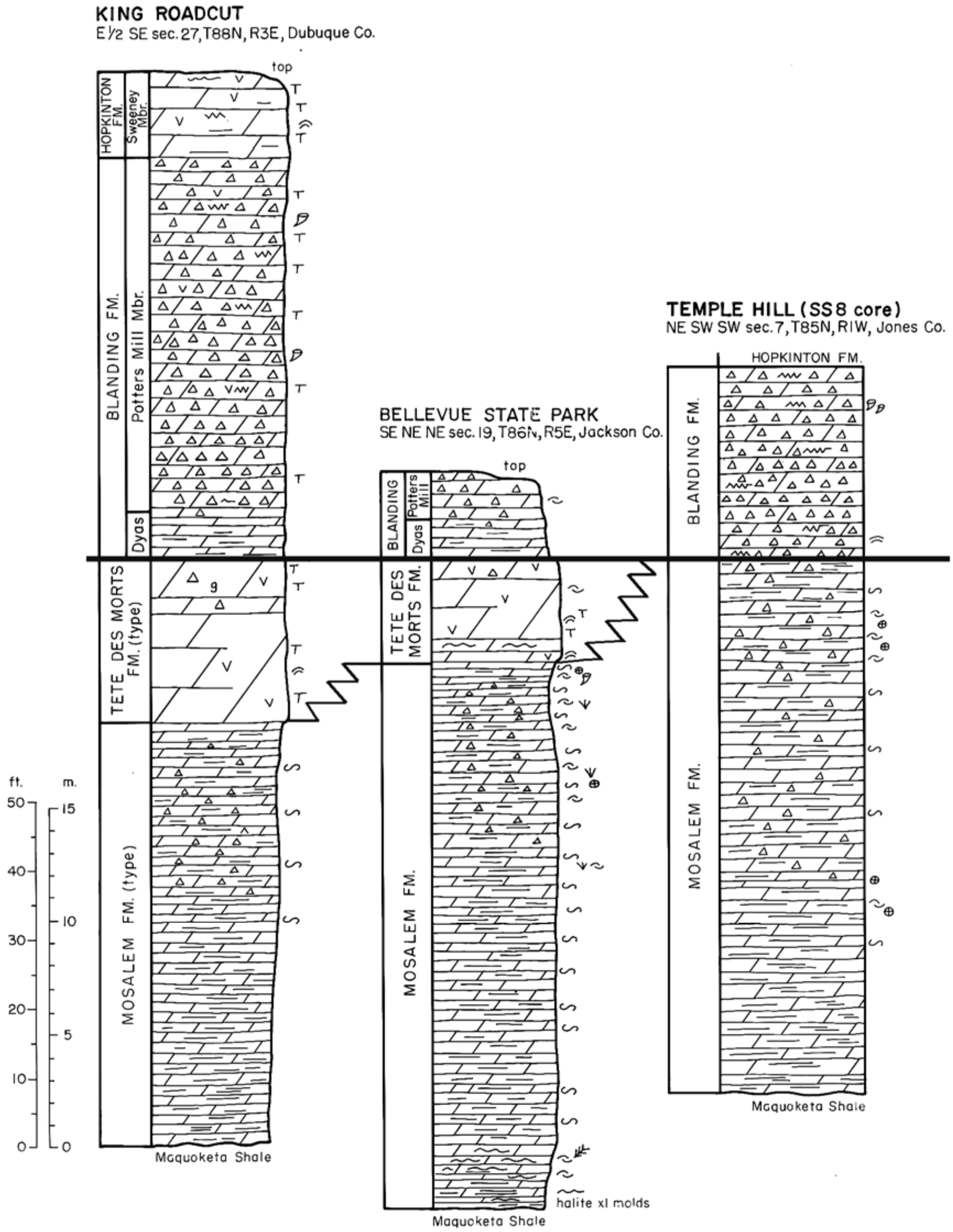

Figure 3. Graphic stratigraphic sections of Mosalem, Tete des Morts, and Blanding strata at Bellevue State Park and additional localities in southern Dubuque and northeastern Jones counties. The Tete des Morts Formation is portrayed as a facies equivalent of the upper Mosalem Formation. Symbols as in Figures 1 and 7. Locations shown on Figure 4.

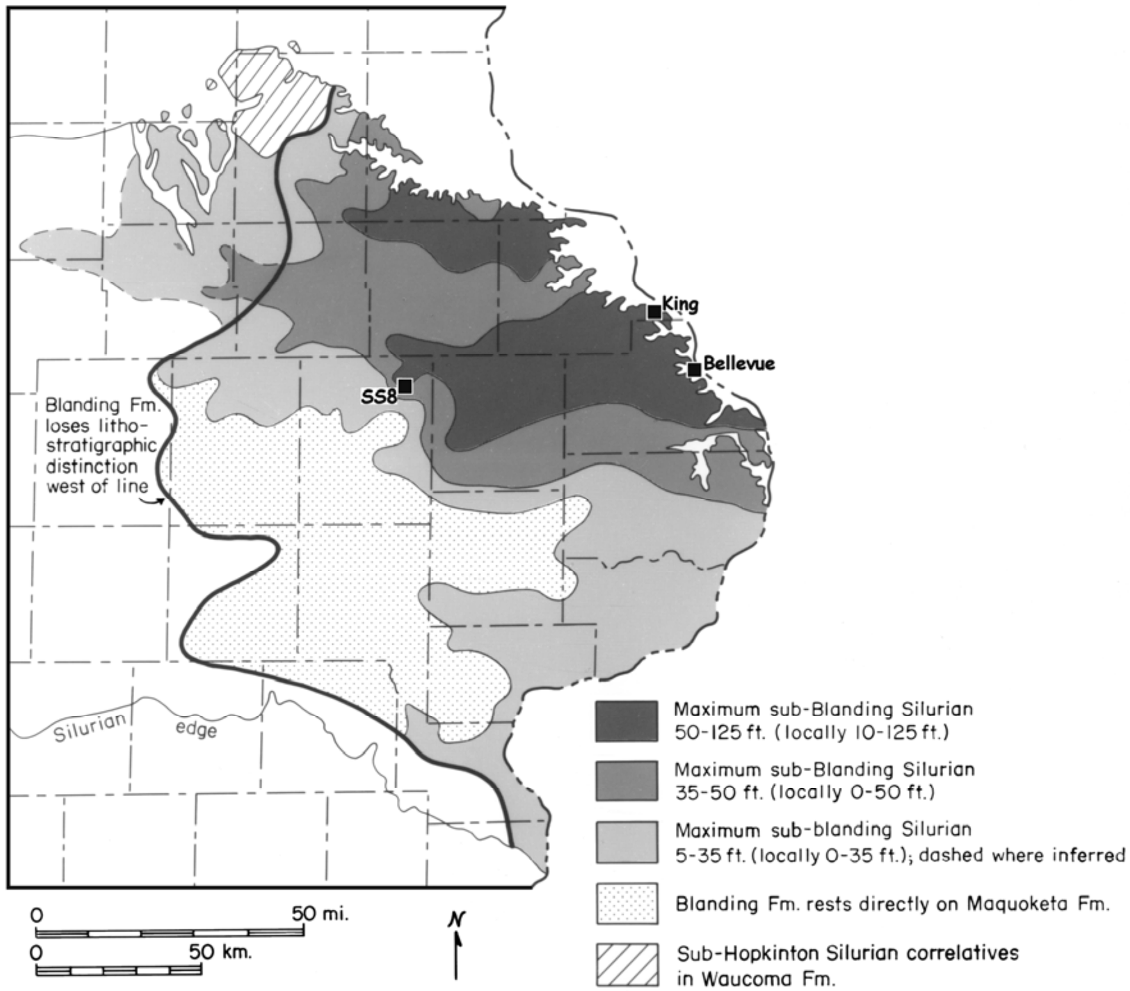

Figure 4. Generalized isopach (thickness) map of sub-Blanding Silurian (post-Maquoketa) strata in eastern Iowa; Mosalem and Tete des Morts formations. Because these thicknesses are highly variable over short distances, only locally maximum thicknesses are shown. Note the development of thick Mosalem-Tete des Morts strata in the areas of Bellevue and King (type locality).

argillaceous character of the Mosalem serves to distinguish the formation from all overlying Silurian formations, which are dominated by relatively pure dolomite strata. Much of the Mosalem is characterized by fine horizontal lamination, and low-angle ripple laminations are also noted. Wavy bedding is characteristic, and small-scale hummocky stratification and nodular bedding is locally noted in the upper part of the formation. Symmetrical ripples are seen in the basal part of the section at Bellevue State Park, locally preserving pseudomorphs of halite "hopper" crystals along the rippled surfaces. Horizontal burrow mottling is common in many dolomite beds, and Chondrites burrows are common. The argillaceous and shaly dolomites in the lower Mosalem are lithologically variable, and a "basal conglomeratic zone" is locally recognized (Whitlow and Brown, 1963). Clasts of dolomite, shale, phosphatic nodules, and ironstone ooids are apparently reworked by adjacent Ordovician strata of the Maquoketa Formation (Brown and Whitlow, 1960; Whitlow and Brown, 1963). Reworked Ordovician conodonts and other fossils are also recognized in basal Mosalem strata (Davis, 1965). Basal Mosalem strata locally contain abundant quartz silt (Brown and Whitlow, 1960), and quartz silt content decreases upward through the formation. Pyrite cements and nodules are best developed in the lower parts of the formation, locally oxidized to limonite. Where the Mosalem is thick, lower strata commonly contain carbonaceous or phosphatic debris, and glauconite is noted.

Except for the abundance of burrows, the Mosalem Formation is only sparsely fossiliferous in most beds. Nevertheless, several general associations of benthic fossils have been identified in the Mosalem, best seen in the Bellevue area. The lowest of these is identified 3 to 10 feet (1-3 m) above the base of the formation at Bellevue, and has been termed the "*Lingula*-Orbiculoid Community" by Witzke and Johnson (1999). This association is characterized by scattered specimens of small phosphatic-shelled inarticulate brachiopods including linguloids and orbiculoids, as well as dark organic specks of graptolite fragments. Indeterminate rugose corals also were identified from this interval at Bellevue by McAuley and Elias (1990). Graptolites are most noteworthy at Bellevue State Park in a thin layer 12 feet (3.6 m) above the base of the formation, where well-preserved specimens of *Normalograptus parvulus* are identified (Ross, 1964; Loydell et al., 2002). The linguloid-orbiculoid fossil association intergrades in the Bellevue area with a related fossil association termed the "*Lecthaylus gregarious*-*Sphenothallus* Community" by Frest, Brett, and Witzke (1999). This fossil association has been noted in roadside exposures of lower Mosalem stata along county road D57 immediately west of Bellevue, and it is a remarkable assemblage of fossils that includes soft-bodied preservation of organic tissues. Organic films of soft-bodied worms (*Lecthaylus*) are particularly noteworthy. A variety of additional fossils are also noted, including phosphatic-shelled brachiopods and conularids ("*Lingula*," *Sphenothallus*, *Protoscolex*, *Metaconularia*), bivalves, ceratiocarid phyllocarid crustaceans and other arthropod fragments, graptoloid graptolites (*Normalograptus*), and dendroid graptolites.

An association of marine shelly fossils is seen along some bedding surfaces in the upper half of the Mosalem Formation at Bellevue State Park, and has been termed the "*Dalmanella*-*Eospirigerina* Community" by Witzke and Johnson (1999). This fossil association is generally dominated by brachiopods (especially *Dalmanella* and the early atrypid *Eospirigerina*), but trilobites (calymenids, proetids, odontopleurids), echinoderms (crinoid, rhombiferan), cup corals, bryozoans, sponge spicules, conularids, gastropods, bivalves, and nautiloids have also been recognized. *Dalmanella* and *Eospirigerina* overwhelmingly dominate the association, but additional brachiopods are also present including strophomenids, *Leptaena*, *Platystrophia*, *Dolerorthis*, and *Whitfieldella*. Colonial tabulate corals and colonial and solitary rugose corals were identified in the upper Mosalem at localities in Iowa and Illinois (McAuley and Elias, 1990; Young and Elias, 1995).

Until recently, the Mosalem Formation has been considered to be the basal Silurian formation in eastern Iowa and northwestern Illinois. This age assignment was seemingly verified by Ross (1964) who identified the Early Silurian (Rhuddanian) graptolite *Diplograptus modestus* at Bellevue. However, McAuley and Elias (1990) andYoung and Elias (1995) raised the possibility that the lower Mosalem Formation may be of latest Ordovician age. "Channel-fill sediments of the Wilhelmi and Mosalem formations in northern Illinoios and eastern Iowa were likely deposited during the major latest Gamachian/Hirnantian-earliest Silurian transgression associated with deglaciation" (McAuley and Elias, 1990, p.27). Subsequently, Loydell et al. (2002) re-examined the Mosalem and Wilhelmi graptolites specimens initially reported by Ross (1964) and re-assigned them to *Normalograptus parvulus*, a graptolite known to range across the Ordovician-Silurian boundary (uppermost Ordovician through lowermost Silurian). As such, Loydell et al. (2002, p. 136) also raised the possibility that the Ordovician-Silurian boundary may occur *within* the Wilhelmi and Mosalem formations, rather than at the prominent unconformity below these formations as previously thought. These ideas were further promoted by Kleffner, Bergström, and Schmitz (2005), who identified a positive $\delta^{13}C$ positive carbon isotope excursion in the Mosalem and Wilhelmi formations of Iowa (Bellevue State Park) and Illinois which they provisionally correlated with the latest Ordovician Hirnantian global carbon isotope excursion. They suggested (ibid., p. 48) that the presence of this isotope excursion “provides strong evidence that . . . at least the lower part of the Mosalem Formation [is] of latest Ordovician (Hirnantian) rather than early Silurian age.” They correlated the Mosalem, Wilhelmi (Illinois), and Leemon (Missouri) formations and proposed a late Hirnantian age to these units (ibid., p. 46).

While the available graptolite correlations remain somewhat equivocal as to whether or not the Mosalem Formation is of latest Ordovician or earliest Silurian age (or both), I believe that other lines of evidence may still favor an earliest Silurian age for the entire formation. First, Mosalem faunas of the *Dalmanella-Eospirigerina* Community are reasonably correlated in the region (elsewhere in Illinois and Missouri) with the Lower Silurian (Rhuddanian), as these faunas lack any characteristic Hirnantian species. Although the Hirnantian and Rhuddanian faunas share a number of fossils in common, the upper Mosalem faunas lack characteristic Hirnantian species (see Amsden, 1974). Young and Elias (1995) also correlated the upper Mosalem coral faunas with the upper Rhuddanian (see their regional stratigraphic and biostratigraphic discussions). The Mosalem is overlain by the Tete des Morts-Blanding interval, and the basal Blanding Formation contains fossils correlated with the early Aeronian (the stage that follows the Rhuddanian; see Witzke and Johnson, 1999) – also consistent with a Rhuddanian age for the upper Mosalem. However, Kleffner et al. (2005) show the base of the Blanding at the Hirnantian-Rhuddanian boundary, a correlation seemingly inconsistent with the basal Blanding brachiopod faunas. Although the graptolites and other fossils recovered from the lower Mosalem are equivocal as to its age, they are certainly not inconsistent with a Silurian age.

Second, strata with confirmed Hirnantian (latest Ordovician) faunas in eastern Missouri (Noix, Leemon, Cyrene formations) are disconformably to unconformably overlain by Lower Silurian strata at all known localities (Amsden and Barrick, 1986; Thompson, 1993). It would be unusual if a similar unconformity would be absent in the Iowa Silurian succession if, in fact, the lower Mosalem is of Hirnantian age. However, the entire Mosalem-Tete des Morts-Blanding succession appears to form a continuous and conformable succession with no evidence of any unconformity or hiatus internally. This is of particular note, as the Ordovician-Silurian boundary at localities around the world is commonly marked by an unconformity (created at the end of the Ordovician by the fall of sea-level associated with the buildup of continental glaciers in the southern hemisphere). Kleffner et al. (2005) illustrated the Ordovician-Silurian unconformity occupying a position at the base of the Blanding Formation, but this correlation seems untenable. Hirnantian strata in nearby Missouri are characterized by a widespread but relatively thin interval of fossiliferous oolitic limestone strata (Amsden and Barrick, 1986; Thompson, 1993). This contrasts markedly with the thick succession of largely unfossiliferous argillaceous dolomite strata of the Mosalem Formation, which instead occupies erosional valleys incised into the Maquoketa shale. Finally, although the presence of a positive carbon isotope excursion in the Mosalem is certainly of note, it is not by itself sufficient to demonstrate a latest Ordovician age for the formation. Although the Hirnantian is known to display one or two global carbon isotope excursions (Bergström et al., 2006) and the Rhuddanian apparently does not, the nature of carbon cycling within the estuarine embayments of the interior sea (the interpreted depositional setting of the Mosalem; see below) is not known with certainty. In addition, the $\delta^{13}C$ data for the Mosalem at Bellevue illustrated by Kleffner et al (2005), which shows a jagged upward increase between about 1.4 and 3‰, do not provide a particularly good match for any of the upper Hirnantian carbon isotope curves shown by Bergström et al. (2006).

The Mosalem Formation has been interpreted by Brown and Whitlow (1960, p. 36) to be "…a shallow-water marine deposit formed in a sea that transgressed over the eroded surface of the Maquoketa shale… Much argillaceous material in the lower part of the Edgewood [Mosalem] probably was eroded from the hills or islands of Maquoketa shales…" Witzke and Johnson

(1999) interpreted lower Mosalem deposition to be within "restricted embayments along the margins of a transgressing epicontinental sea. . . . The preservation of organic carbon in these strata [lower Mosalem] suggests low-oxygen conditions during deposition. The Mosalem embayments apparently were marked by relatively quiet water deposition as evidenced by the abundance of mud and the preservation of fine laminations. . . pseudomorphs of halite hopper crystals suggest the development of hypersaline lagoons in [some shoreface settings]. As the transgression continued the embayments deepened, bottom oxygenation increased, and salinities stabilized . . . in the upper Mosalem environments" (see Fig. 5A). The Mosalem embayments can be considered estuaries, as they represent drowned river valleys that were flooded during earliest Silurian (or perhaps latest Ordovician) transgression. The fine-scale laminations within the Mosalem, as well as the rhythmic couplets of resistant and recessive beds, may represent tidally-modulated sedimentary patterns developed within these estuaries (as suggested by Ludvigson and Witzke, 1988).

Relatively quiet depositional conditions apparently marked most of upper Mosalem sedimentation. However, the presence of skeletal-rich horizons and rippled cross-laminations indicates episodic bottom current activity (ibid.), possibly storm current activity which disrupted the nearshore and embayed Mosalem settings. Normal wave currents may have been damped in a more offshore setting, permitting the development of low-energy nearshore and shoreline environments. "The absence or scarcity of skeletal debris [and the abundance of burrows] through much of the Mosalem sequence may indicate benthic stress, possibly low oxygen conditions at times" (ibid.). The shelly benthic faunas of the upper Mosalem are interpreted to record periodic colonization on the muddy substrate by normal-marine faunas. As the shoreline migrated westward, the nearshore and embayed Mosalem environments received terrigenous detritus (clay and silt) from the eroding Maquoketa shale surface, but purer carbonate deposition (of the Tete des Morts Formation) prevailed farther offshore in more open-marine environments (see Fig. 5B). Continuing transgression flooded the region, and widespread deposition of clean carbonate sediments of the Blanding Formation blanketed the area (Fig. 5C).

SILURIAN – TETE DES MORTS FORMATION

Prominent massive dolomite ledges are seen above the Mosalem Formation near the top of the bluff section at Bellevue State Park, and these beds belong to the Tete des Morts Formation. Brown and Whitlow (1960) originally defined the Tete des Morts as a member of the so-called "Edgewood" formation, and Willman (1973) subsequently elevated it to formational status. It is named for "the many cliffs formed . . . along the headwater drainage of the Tete des Morts River in Jackson and Dubuque Counties, Iowa" (Brown and Whitlow, 1960, p. 39). Willman (1973) designated the roadcut along Highway 52 south of King, Dubuque County, as the type locality, which also serves as the type locality for the underlying Mosalem Formation. The King roadcut lies within the valley of Lux Creek, a tributary of the Tete des Morts River. The Tete des Morts River (also known as Tete des Morts Creek) derived its name, which is French for "heads of the dead," from a story of an inter-tribal Indian battle in the 1700s. "A Frenchman, finding the scalped heads of the dead floating in the river –or the skulls and bones, according to another account—called the stream Tete des Morts"(Vogel, 1983, p. 89).

Brown and Whitlow (1960) described the Tete des Morts Formation as a bluff-forming massive-bedded, finely porous dolomite unit. Fine fossil debris molds or dolomitized grains are scattered, and vugs are commonly seen on outcrop. The massive beds are indistinctly mottled with networks of microporous dolomite (resembling burrow networks) in a denser matrix. Unlike the underlying Mosalem Formation, the Tete des Morts is a relatively pure dolomite, but rare argillaceous streaks or stylolites are noted, and occasional chert nodules are seen. The massive dolomites weather to produce rough uneven to pitted and vesicular surfaces. The formation is

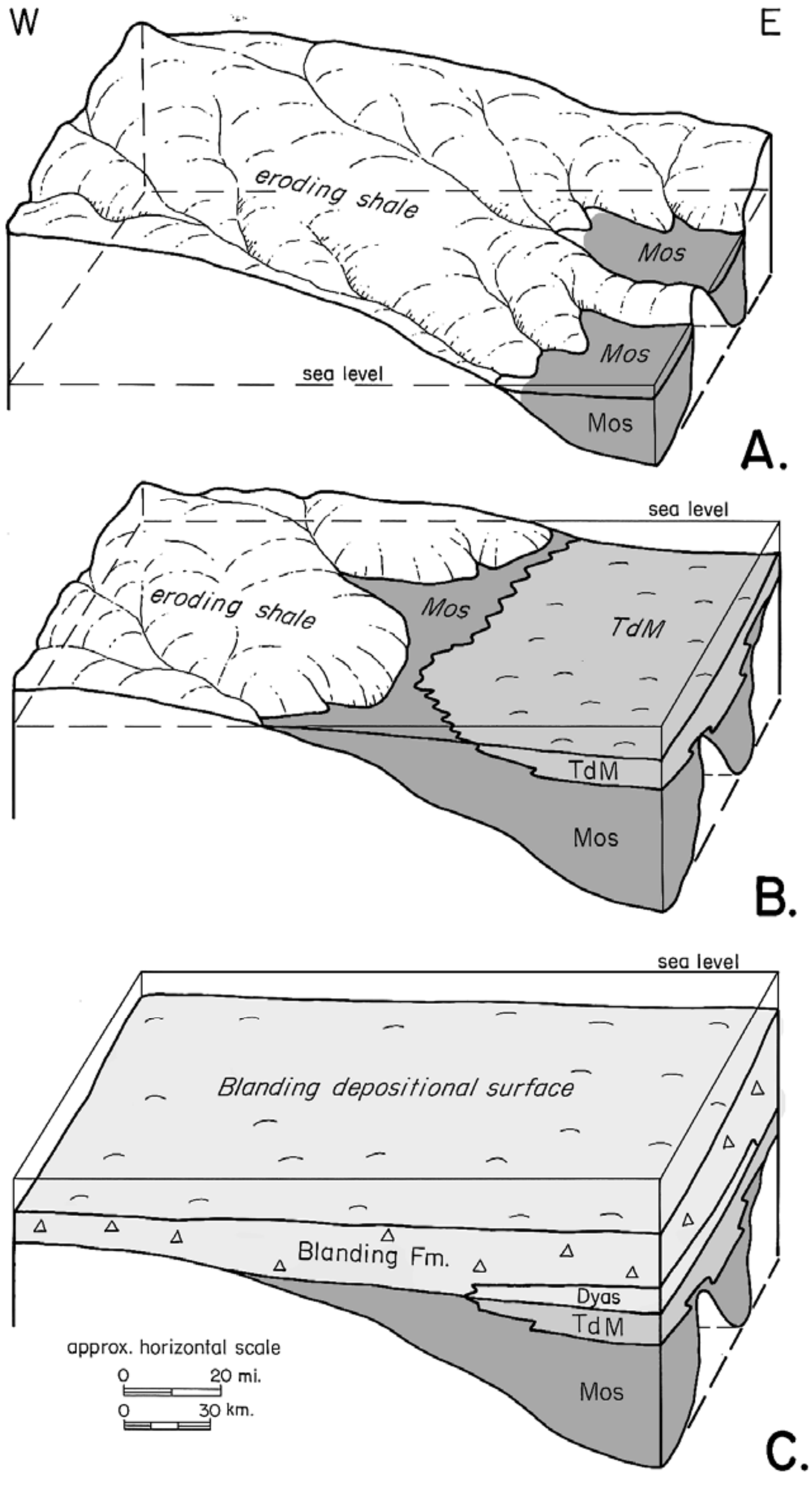

Figure 5. Block model portraying the regional deposition of lower Mosalem (A), upper Mosalem-Tete des Morts (B), and Blanding (C) strata in eastern Iowa. The depositional succession records the flooding and burial of an eroded Maquoketa shale landscape.

characteristically thick to massive bedded, and the interval is commonly exposed in bold to overhanging cliff faces above the recessive slopes of the underlying Mosalem and Maquoketa formations. The massive character of the Tete des Morts enables large car-sized to cottage-sized blocks to remain intact following dislodgement from the cliff faces, and large blocks (commonly rotated) are commonly identified on the colluviated Maquoketa shale slopes below the Silurian escarpment in northeast Iowa. Calvin and Bain (1900, p. 447) noted that "some of these masses, which may attain dimensions of 100 feet or more, settle[d] down [on the Maquoketa slopes] without disturbing their horizontal positon, [which] adds to the difficulties of the geologist in presenting the deceptive appearance of native ledges of rocks in place." Large blocks of Tete des Morts dolomite are commonly seen along the slopes in both units of Bellevue State Park.

The Tete des Morts is a relatively thin but distinctive formation, generally ranging between 5 and 30 feet (1.5-9 m) in thickness in the outcrop belt of eastern Iowa. The formation is identified in northeast Iowa, northwestern Illinois, and southwestern Wisconsin. It is 15 feet (4.6 m) thick at Bellevue State Park, and the old quarry in the park apparently provided building stone for some 19th century buildings in Bellevue. The Tete des Morts is largely restricted to the outcrop belt, and the formation generally loses its character in the subsurface south and west of the exposure belt, and is apparently replaced in that direction by argillaceous dolomite strata of the uppermost Mosalem Formation (see Fig. 3). The Tete des Morts likely shares lateral facies relationships with the upper Mosalem Formation in eastern Iowa (Fig. 3).

Fossils are recognized in the Tete des Morts Formation, and the fauna is similar to that seen in parts of the overlying Blanding and Hopkiniton formations. Lamellar stromatoporoids (an extinct group of coral-like sponges) and corals (primarily *Favosites*, *Halysites*, and solitary rugosans) are common, and fine crinoid debris occurs as dolomitized grains or external molds. Scattered brachiopods and nautiloids are also identified. Although the Tete des Morts has not yielded any fossils that permit a direct age assessment, its position above the upper Mosalem (with Rhuddanian fossils) and below the Blanding (Aeronian) suggests an Early Silurian mid-Llandovery (late Rhuddanian and/or early Aeronian) age. However, Kleffner et al. (2005) proposed a latest Ordovician age (Hirnantian) age for the formation (see earlier discussion for the age of the Mosalem Formation).

Brown and Whitlow (1960, p. 36) interpreted the Tete des Morts to be a "shallow-water marine deposit," and suggested that "the relative purity of the dolomite . . . is a result of the water's clearing after the summits of the Mauqoketa shale hills were covered by sediments." "Clean" carbonate sediments could be deposited in offshore settings following burial of local siliciclastic (clay and silt) sources of the eroding Maquoketa shale; the influx of clay would have waned across eastern Iowa as nearshore facies were displaced westward and southward during marine transgression (Fig. 5). Unlike the Mosalem, the faunas and sedimentary features of the Tete des Morts are consistent with oxygenated bottoms and stable marine salinities during deposition. Continued deepening of the seaway completely buried the Maquoketa shale hills, resulting in regional deposition of the Blanding Formation.

SILURIAN – BLANDING FORMATION

The highest bedrock exposed in the bluffs of Bellevue State Park is characterized by dolomite ledges containing a remarkable abundance of white chert (flint). These strata belong to the Blanding Formation (Fig. 1). The phenomenal abundance of chert in this formation is its characteristic feature, and the colluviated slopes below the Blanding ledges around Bellevue contain an abundance of broken chert. Willman (1973) named the Blanding Formation after exposures north of the village of Blanding, Jo Daviess County, Illinois, which lies immediately across the Mississippi River from Bellevue (near the east end of Lock and Dam no. 12). As such, the Blanding exposures in the Bellevue area form part of the type area of the formation. The Blanding Formation is subdivided in this report into two members, named after localities in the Bellevue area. The Blanding Formation was incorrectly labeled the "Kankakee" Formation in many previous studies (e.g. Brown and Whitlow, 1960). The formation is recognized across most of east-central and northeast Iowa (Fig. 6) and northwest Illinois, with outliers in southwestern Wisconsin. The Blanding beds are not as coherent as overlying and underlying Silurian strata in the outcrop belt, and the formation is commonly weathered to chert-rich scree along slope at many localities, including the upper slopes at Bellevue State Park.

The Blanding Formation overlies, apparently conformably, the Tete des Morts Formation throughout most of the Iowa Silurian outcrop belt, but the Blanding locally overlies the Mosalem Formation southward and westward in east-central Iowa (Fig. 3). The Blanding oversteps the Mosalem-Tete des Morts edge southwestward in eastern Iowa to directly and unconformably overlie upper Maquoketa strata (see Fig. 4). The Blanding loses its cherty character and lithologic distinction westward in the Iowa subsurface (Fig. 6). The thickness of the Blanding varies regionally, with the thickest sections (35-65 ft; 11-20 m) noted in the outcrop belt of northeast Iowa including Clayton, Delaware, Dubuque, and northern Jackson counties (Fig. 6). It thins southward into the Clinton County outcrop and in the subsurface across much of east-central Iowa (15 to 35 ft; 4-10 m; see Fig. 6). The Blanding Formation is herein divided into two members, the Dyas and Potters Mill, and their descriptions serve to characterize the formation in the Bellevue area and the northeast Iowa outcrop belt.

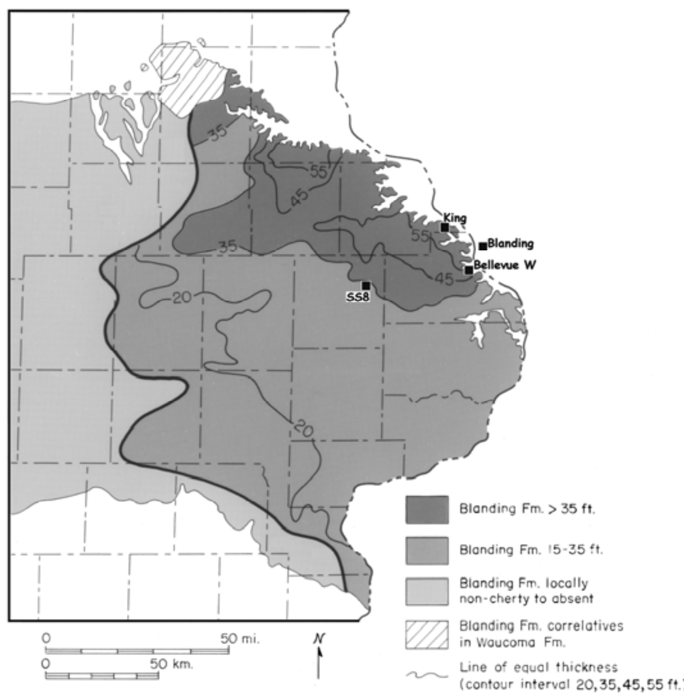

Figure 6. Isopach (thickness) map of the Blanding Formation in eastern Iowa.

The subdivision of the Blanding interval into two stratigraphic units (members) was first proposed by Calvin and Bain (1900), who recognized a lower unit, the "Lower quarry beds," and an upper unit, the "chert beds." Willman (1973, p. 34) also supported subdivision of the Blanding and suggested that the "lower quarry beds merit classification as a formation." However, Willman (1973) did not propose any formal subdivisions in his summary of Silurian stratigraphy in northwest Illinois.

Dyas Member (new)

The Dyas Member is proposed herein as the basal member of the Blanding Formation. The type locality is designated in the roadcut and quarry along Highway 62, 2 miles (3.2 km) southwest of Bellevue (Fig. 7), a section first described by Witzke and Ludvison (1988). This locality lies 1.5 miles (2.5 km) west of Dyas Cemetary (on the Springbrook Quadrangle) and 2.5 miles (4 km) northwest of the Dyas Unit (south unit) of Bellevue State Park. The Dyas Member was first identified as a distinctive stratigraphic unit, the "Lower quarry beds," by Calvin and

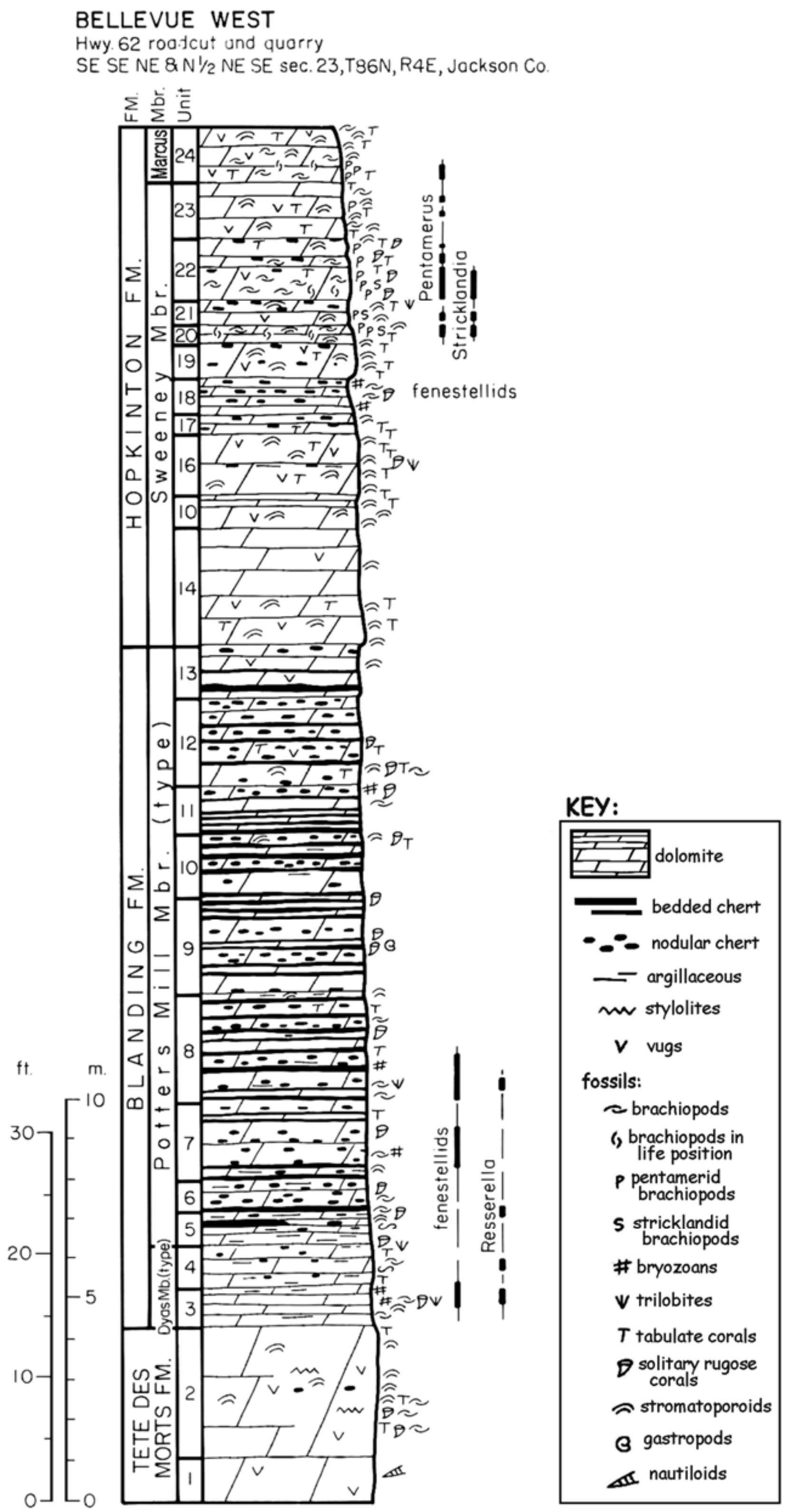

Figure 7. Graphic stratigraphic section of Silurian strata exposed in the roadcuts and quarry along Highway 62 southwest of Bellevue, Iowa.

Bain (1900, p. 451) who recognized its well-bedded and "easily worked" character, occurring in beds typically 4 inches to 2 feet thick (10-60 cm) and "separated by [thin] shaly partings." Strata of the Dyas Member were extensively quarried in Dubuque and Jackson counties for dimension stone in the mid to late 1800s and early 1900s. It was quarried near the bluff top in Bellevue State Park (old quarry area along the Quarry Trail), and blocks can be seen in some of the 19th century stone buildings in Bellevue (along with dimensioned blocks of Tete des Morts and Mosalem dolomite). As noted by Calvin and Bain (1900, p. 451), "the beds of the lower quarry zone weather easily, for which reason they are rarely exposed in natural cliffs."

The Dyas Member is 6.7 feet (2.05 m) thick at the type section, and it varies between 4.5 and 19 feet (1.4-5.8 m) in thickness in the northeast Iowa outcrop belt. The Dyas is characterized by well-bedded dense dolomite strata, argillaceous to slightly argillaceous in part, separated by thin shaly partings along some of the bedding surfaces. The bedding surfaces are commonly slightly wavy and irregular, but the bedding surfaces become more planar in the upper part of the member. Argillaceous streaks and stylolites also occur, and argillaceous burrow mottles and scattered fossil molds are seen in some beds. Most dolomite beds in the member are free of chert, but scattered chert nodules are commonly seen in the upper parts of the member. A hardground surface is recognized 22 inches (55 cm) above the base of the Dyas at the type locality, and the member locally overlies a "pitted corrosion surface" at the top of the underlying Tete des Morts Formation (Willman, 1973, p. 34).

Witzke and Johnson (1999) discussed the unique character of fossil faunas in the lower Blanding of Iowa and the type area. Although sparsely fossiliferous overall, occurrences of brachiopods (especially *Resserella*, *Coolinia*), fenestellid ("lacey") bryozoans, and trilobites (calymenids, illaenids) are noteworthy in the Dyas Member. Small corals, branching cryptostome bryozoans, and crinoid debris molds are also recognized. Frest et al. (1999, p. 671) identified a number of additional brachiopods from the Dyas Member in the Blanding-Bellevue area including *Leptaena*, *Plectatrypa*, *Dalejina*, *Flabellitesia*, *Platystrophia*, *Isorthis*, a rhynchonellid, a pholidostrophid, and a stricklandid. Although the specific identity of the stricklandid found near Blanding (ibid.) has not been determined, equivalent lower Blanding strata in the Iowa subsurface has produced identifiable specimens of *Stricklandia lens intermedia* (M. Johnson, pers. comm.) that indicate a mid-Llandovery (early to mid Aeronian) age for these strata.

Potters Mill Member (new)

The Potters Mill Member is proposed herein as the upper member of the Blanding Formation. It derives its name from historic Potter's Mill on Mill Creek along the northern edge of Bellevue State Park, a well-known landmark built by E.G. Potter in 1843 and presently on the National Register of Historic Places. The mill lies 1.8 miles (2.8 km) east-northeast of the type locality. The new member shares the same type locality as the Dyas Member (see Fig. 7). Strata presently referred to the Potters Mill Member were first recognized as a distinct stratigraphic unit, the "chert beds," by Calvin and Bain (1900). The member is characterized by the abundance of bedded to nodular chert. The cherty Potters Mill Member forms the uppermost bedrock unit exposed in Bellevue State Park. It conformably overlies the Dyas Member.

The Potters Mill Member can be recognized throughout most of the Blanding oucrop best of eastern Iowa and northwestern Illinois, and is also recognized through much of the subsurface of eastern Iowa. The member is 46 feet (14 m) thick at the type locality, and it is known to range between 23 and 50 feet in thickness across most of the Blanding outcrop belt of northeast Iowa and northwest Illinois. The Potters Mill Member is characterized by thin to medium bedded dolomite strata with abundant bedded chert and nodular chert bands. The dolomite beds are typically dense, dominated by dense very fine crystalline mudstone fabrics through most, but including fine to medium crystalline skeletal-moldic and skeletal-replaced wackestones and packstone fabrics especially in the upper part. The dolomites display a general upward trend toward more skeletal moldic and vuggy lithologies and decreasing argillaceous content. The lower part of the member is commonly slightly argillaceous and contains scattered wavy to wispy argillaceous streaks and partings.

The high chert content and stratigraphic position distinguishes the Potters Mill Member from other Silurian stratigraphic units in eastern Iowa. Chert commonly forms about 20-30% by volume of the member (Willman, 1973), with "as much as 50 percent bedded chert" at some localities (Brown and Whitlow, 1960, p. 42). The Potters Mill Member is differentiated only where the Blanding Formation incorporates very cherty facies. Chert is recognized both in nodular bands and discrete chert beds. Many chert beds are continuous at the scale of individual quarries and roadcuts, and some chert beds appear to correlate between sections at the scale of townships and counties. Chert beds reach thicknesses between 2 and 8 inches (5-20 cm) at most sections. Cherts range between white and light gray (locally dark brown) in color and vary between smooth (porcelanous) and chalky (dolomitic) in texture. Most cherts display sparse skeletal wackestones to mudstone fabrics, and represent silica replacement of original lime sediments.

A variety of fossils are recognized in the Potters Mill Member. Scattered small crinoid debris molds are observed through most of the member. Coralline faunas, assigned to the "Tabulate coral-lamellar stromatoporoid Community" of Witzke and Johnson (1999), are typically present and include scattered to common lamellar stromatoporoids, tabulate corals (especially Favosites, Halysites), and solitary rugose corals. These coralline faunas are observed as skeletal molds or silicified skeletons. Denser and more finely crystalline beds, especially in the lower part of the member, contain fossil fauns resembling that of the Dyas member and including brachiopods (*Resserella*, *Dolerorthis*, *Platystrophia*, *Cryptothyrella*), fenestellid bryozoans, and tryilbite material. The presence of *Cryptothyrella* is of special note, as its known range in North America supports a mid-Llandovery (early to mid Aeronian) age for the member.

Blanding Deposition

The Blanding Formation oversteps the Mosalem-Tete des Morts edge in eastern Iowa, indicating significant geographic expansion and deepening of the Silurian seaway during Blanding deposition (Fig. 5C). The fossil fauna supports the interpretation of oxygenated normal-marine environments in a shallow carbonate shelf setting. Johnson et al. (1985) and Witzke (1992) interpreted the lower Blanding (Dyas Member) to have been deposited in deeper-water environments and proposed a eustatic rise in sea-level during lower Blanding deposition. Witzke and Johnson (1999) further supported the idea that Dyas interval was deposited in slightly deeper and less agitated environments than preceding and succeeding strata, based on faunal differences and the more mud-rich (less winnowed) character of the carbonate lithologies. The upward increase in skeletal grains and winnowed sedimentary fabrics (packstones), as well as the upward shift toward incrasing abundance of lamellar stromatoporoids, are consistent with a general upward-shallowing depositional sequence for the Blanding. Upper Blanding environments are interpreted to have impinged, in part, at or near normal fair-weather wavebase. The great abundance of chert in the Blanding Formation is reasonably explained by diagenetic mobilization and precipitation of large volumes of biogenic silica originally deposited along with the Blanding carbonate sediments. The Blanding cherts display silicification of skeletal grains and carbonate fabrics, indicating that they are a replacement of original carbonate sediments and not a primary precipitate. The actual source of the silica remains largely unknown, but siliceous sponge spicules are identified in the Blanding. It is possible that siliceous sponges may have been the ultimate source of the abundant silica (chert) now seen in the Blanding Formation. Petrographic evidence indicates that the precipitation of chert preceded regional dolomitization of the carbonate sediments (see Witzke, 1992). This regional dolomitizaton pervasively replaced original lime sediments (calcium carbonate) with dolomite (calcium-magnesium carbonate).

SILURIAN – HOPKINTON FORMATION

The Blanding Formation is overlain by the Hopkinton Formation across eastern Iowa, although strata of the Hopkinton Formation have not been definitively identified in Bellevue State Park. However, it is possible that lower Hopkinton beds may be present in the highest parts of the park (especially in the southern Dyas Unit). Nevertheless, the Hopkinton Formation is certainly well exposed in the greater Bellevue area, and we will examine the lower part of the formation along Highway 62 about 1 mile (1.6 km) west of the state park boundary. The Hopkinton Formation was named after exposures along the Maquoketa River near the town of Hopkinton in Delaware County, Iowa, and has been subdivided into four widely recognized members (see summary by Witzke, 1992). The formation is dominated by fossiliferous dolomite throughout the outcrop belt of eastern Iowa and northwestern Illinois. Where capped by the Silurian Scotch Grove Formation, the Hopkinton Formation is about 105 feet (32 m) thick in the Bellevue area of eastern Jackson County.

The lower two members of the Hopkinton, the Sweeney and Marcus members, are exposed near Bellevue (Fig. 7). These strata are distinguished from the underlying Blanding Formation by its significantly lower chert content and generally thicker bedding. The basal 17 foot (5.2 m) interval of the Sweeney Member is largely devoid of chert, and is characterized by medium to thick beds of dolomite, porous and vuggy in part (units 14-16; Fig. 7). These beds contain common faunas of lamellar stromatoporoids and tabulate corals similar to that seen in the upper Blanding Formation. The middle part of the Sweeney Member units (units 17-21; Fig. 7) is denser, more finely crystalline, thinner bedded, and contains scattered to common chert nodules (but lacks the bedded cherts seen in the Blanding Formation). Additional fossil faunas occur in these beds, including fenestellid bryozoans and bands of large brachiopods (*Pentamerus* and *Stricklandia*). The upper 9.5 feet (2.9 m) of the Sweeney Member (units 22-23; Fig. 7) is thicker bedded and most porous, and includes fossil faunas of corals, stromatoporoids, and scattered large *Pentamerus*. The top of the exposure (unit 24, Fig. 7) is included in the Marcus Member, an interval characterized by abundant molds of the large brachiopod *Pentamerus oblongus*. Although *Pentamerus* first appears considerably lower in the middle part of the underlying Sweeney Member, the Marcus Member is distinguished by dense masses of packed *Pentamerus* shells in some beds.

The exposed portion of the Hopkinton Formation examined on this field trip records additional changes in deposition and sea-level within the Silurian seaway of eastern Iowa. Compared to the Blanding Formation, the signficant decrease in chert content in the lower Hopkinton may suggest that there was a decrease in siliceous organisms in the bottom environments. Lower Sweeney deposition has been interpreted to encompass a general upward-shallowing succession initiated in the underlying Blanding Formation (Witzke and Johnson, 1999). However, the lithologic and faunal shift (especially the appearance of stricklandid brachiopods) seen in the middle Sweeney Member has been interpreted to represent a deepening trend within the seaway (ibid.). The return to coral-stromatoporoid faunas in the upper Sweeney likely records a shallowing trend during deposition. The development of packed shell beds of *Pentamerus* in the Marcus Member apparently records the development of massive shell banks in the seaway across large portions of eastern Iowa, perhaps analogous in some sense to modern oyster banks. This shift from coral-stromatoporoid to *Pentamerus*-rich benthic faunas records yet another deepening phase of deposition within the seaway (ibid.). Of note, the interpreted changes in water depth and sea-level during deposition of the Blanding-Hopkinton interval are now known to global in scope and provide compelling evidence for global changes in sea level.

Eastern Iowa is a primary reference section for documenting these sea-level changes (Johnson et al., 1985).

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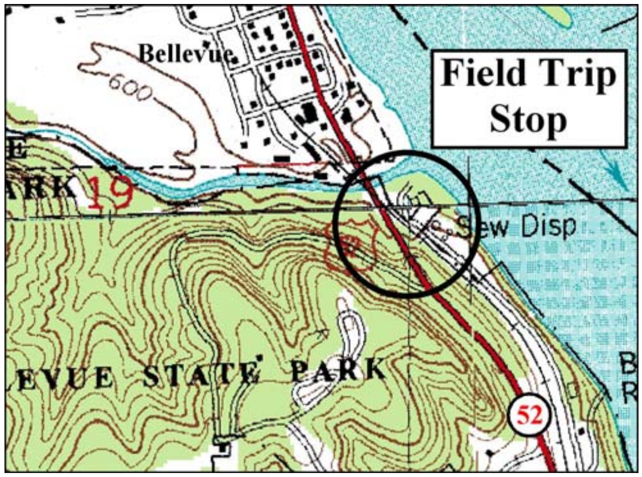
BEDROCK EXPOSURES ALONG HIGHWAY 52 AT THE TO THE NELSON UNIT, BELLEVUE STATE PARK

Brian J. Witzke



Silurian Mosalem, Tete des Morts, and Blanding formations overlie Ordovician Maquoketa Shale along Highway 52 near the entrance to Bellevue State Park.

Ordovician Maquoketa Shale exposures south of the entrance to Bellevue State Park on Highway 52.

BELLEVUE STATE PARK SECTION

bluff and roadcut section along Hwy 52 south of park entrance
SE SE NE NE and E 1/2 SE NE sec 19, T86N, R5E
basal section along Mill Creek NW NE sec 19, T86N, R5E
Jackson County, Iowa
description by B.J. Witzke and G.A. Ludvigson
(supplemental descriptions by R.A. Davis, 1965, M.S. thesis, Univ. Iowa)

LOWER SILURIAN

BLANDING FORMATION

UNIT 18

Dol., xf-f xlln, even-bedded 10-20 cm; very cherty, nodular chert bands and bedded cherts 5-10 cm thick, chert is chalky to smooth, bedded cherts are primarily smooth chert; echinoderm debris and indet. brachiopods noted in cherts; about 2.0 m thick.

UNIT 17

Dol., xf-vf xlln, dense ledges, slightly argillaceous, in beds 7 to 20 cm thick; scattered nodular chert in upper part; echinoderm debris noted; sharp contact at base; these are the "lower quarry beds" of Calvin; 1.8 m thick.

TETE DES MORTS FORMATION

UNIT 16

Dol., vf-f and vf-m xlln, vuggy to very vuggy, mottled with microporous networks (probably large thalassinoid-type burrows); in beds 30 cm to 1.2 m thick, prominent cliff-former, forms overhanging ledges in main cliff section; small fossil debris molds scattered, f-m xlln fabrics probably replaced crinoid debris; generally non-cherty but some silicified grains and chalcedony-linings present, rare small chert nodules in upper part; macrofossils are scattered, most noteworthy in the lower half, and include silicified laminar stromatoporoids (to 25 cm wide), tabulate corals (favositids), cup corals, and indet. brachiopods; 3.6 m thick.

UNIT 15

Dol., vf-m xlln, denser than above, in beds 7-28 cm thick, burrow networks are more coarsely xlln; slightly porous but vugs are rare; upper bed with prominent horizontal laminae; small crinoid debris represented by molds and replaced grains; silicified laminar stromatoporoid noted near middle; 98 cm thick.

MOSALEM FORMATION

UNIT 14

Dol., xf-vf and vf-m xlln, slightly argillaceous, in beds 5-20 cm thick, becomes generally thicker bedded upward, beds have undulose surfaces separated by thin shaley partings (1-10 mm thick), faintly laminated in part with some probable ripple laminae; Chondrites burrows scattered to common through (less common than underlying units); m xlln skeletal packstone bed near top, grains silicified in part; silicified skeletal debris scattered to common along some bedding surfaces and laminae; fossils include brachiopods (Dalmanella, orthids, atrypids, rhynchonellids), echinoderm debris, gastropods, corals (3 cm horn coral noted near base); 1.0 m thick.

UNIT 13

Dol., xf-vf xlln, slightly argillaceous to argillaceous, in beds 2-15 cm thick, undulose bedding surfaces separated by shaley partings 1 mm to 3 cm thick, argillaceous laminae and some probable ripple laminae present; unit becomes generally less argillaceous and shaley upward; Chondrites burrows scattered to abundant; small nodular cherts in irregular bands (1-5 cm thick), chert follows horizontal burrow networks in part, cherts are primarily chalky and argillaceous but some nodules are cored by smooth cherts in upper 1 m; skeletal debris scattered to common along some bedding surfaces and laminae, in part silicified; fauna includes common to abundant brachiopods (Dalmanella cf. edgewoodensis, Plectatrypa, Strophonella, etc.), common disarticulated trilobites (Calymene, proetid, odontopleurid), scattered echinoderm debris (columnals), scattered gastropods and bivalves (Pterinea), rare bryzoans (small cryptostomes), rare corals (small cup coral); 2.45 m thick.

UNIT 12

Dol., xf-vf xlln, argillaceous, in beds 2-15 cm thick, wavy bedding surfaces separated by shaley beds 1-4 cm thick; faint argillaceous laminae; common to abundant burrow mottles (primarily Chondrites); small chalky chert nodules scattered through unit; scattered silicified skeletal debris includes brachiopods (?Dalmanella, others) and trilobite fragments; 4.8 m thick.

UNIT 11

Dol., xf-vf xlln, argillaceous, thin to medium interbedded arg. dol. (2-15 cm) and shaley dol.(4-7 cm), wavy bedded, less argillaceous beds form resistant ledges along weathered cliff face; beds with faint argillaceous laminae in part, some display probable ripple laminae; interval with common to abundant burrow mottles (primarily Chondrites but including larger horizontal burrows); 50 cm below top is a thin f xlln dol (possibly fine skeletal packstone); scattered skeletal grains in unit (some silicified), including trilobite debris, sparse indet. brachiopods, rare echinoderm debris; 2.7 m thick.

UNIT 10

Dol., xf-vf xlln, argillaceous, silty in part, interbedded lighter-colored less argillaceous bands and darker-colored shaley units, wavy bedded 3-20 cm thick, lighter bands form more resistant ledges on weathered cliff face; faint argillaceous laminae through most of unit, may include some ripple laminae; common to abundant burrow mottles, primarily Chondrites but including larger horizontal (2 mm to 2 cm diameter) and subvertical burrows (in part weathering out as resistant dolomite in more argillaceous matrix), some burrows are dark gray to black with carbonaceous material; scattered bands of vf-f xlln dol 1-3 cm thick form thin resistant ledges in lower to middle part, in part pyrite-cemented (oxidized to ferric oxides); unfossiliferous to sparsely fossiliferous through much of unit, although some scattered articulate brachiopods (rhynchonellids) and other indet. skeletal debris (possible Cornulites-like tube noted) are present; basal portion of unit contains early Llandoverian graptolites (Diplograptus cf. modestus, see C.A. Ross, 1964, Jour. Paleon., v. 38, p. 1107) and other fauna (Lecthaylus soft-bodied worms, Sphenothallus tubes, Metaconularia, Lingula, bivalves, ceratiocarids; T.J. Frest, 1988, pers. comm.); unit forms prominent cliff face along Hwy 52, upper part of unit difficult to access; about 11.3 m thick.

UNIT 9

Dol., m. brown to brown-green, very argillaceous to shaley, slightly carbonaceous, less resistant than overlying unit but forms base of cliff-forming sequence, lower 35 cm is blockier and more dolomitic than upper 60 cm (shalier); entire interval is prominently and finely laminated (laminae < 1 mm), argillaceous laminae are flat and continuous on outcrop; top 15 cm has two lighter-colored dolomitic bands 4-6 cm thick; unit is generally unburrowed, although scattered burrow traces and indeterminate carbonaceous debris (probably including graptolite blebs) are seen along some laminae; macrofossils are scattered to common in a few thin horizons, primarily inarticulate brachiopods (Lingula cuneata, orbiculoids); 95 cm thick.

UNIT 8

Shale and dol.; upper 40 cm is dolomitic shale, green-gray to brown-gray, plastic when wet, chunky, contains thin platy flags of argillaceous dolomite, faint laminae, poorly exposed as recessive at base of cliff section; lower 60 cm is a reddish-brown argillaceous dolomite, silty to sandy in part, contains scattered clasts of phosphatic nodules and Maquoketa shale fragments, reworked phosphatic and dolomitic skeletal grains, basal portion with abundant iron oxides; ripple marks and halite hopper crystal molds present in interval, gradational with upper shaley beds; unit is poorly exposed, description of lower 60 cm largely derived from R.A. Davis (1965, M.S. thesis, Univ. Iowa); 1.0 m thick.

UPPER ORDOVICIAN

MAQUOKETA SHALE undifferentiated

(based on regional thickness patterns the upper Maquoketa Shale has been erosionally truncated at Bellevue; preserved section is probably equivalent to the Elgin-Clermont-Fort Atkinson sequence in northeast Iowa; Brainard Shale equivalents are apparently absent)

UNIT 7

Shale, green-gray, dolc, unit is poorly exposed at present, contains some interbeds (1-8 cm) of argillaceous dolomite, mostly unfossiliferous to sparsely fossiliferous (3 cm Isotelus cranidia noted); skeletal wackestone to packstone locally at top with echinoderm debris, bryozoans, and brachiopods (incl. Thaerodonta); about 3.2 m thick.

UNIT 6

Shale, green-gray, dolc, slumped and poorly exposed over much of section but most of unit is exposed at south end of roadcut, plastic when wet; no carbonate interbeds noted; unfossiliferous shale with pyrite (limonite) concretions (to 5 cm) in some horizons; 13.8 m thick.

UNIT 5

Shale, green-gray, dolc; completely covered in Bellevue section; shale-dominated sequence represented in nearby well sections; about 6.2 m thick.

UNIT 4

Shale, green-gray, dolc, with thin interbeds of unfossiliferous argillaceous dol.; mostly slumped and overgrown, but intermittently exposed in cut bank of Mill Creek (also units 2 & 3); about 5.4 m thick.

UNIT 3

Shale, brown-gray to green-gray, with interbeds of dense, argillaceous dol.; upper ledge contains phosphatized diminutive gastropods; 2.2 m thick.

UNIT 2

Shale, m. brown to brown-gray, dolc, blocky, organic-rich (especially in lower part), laminated in part, scattered graptolites (Orthograptus truncatus peosta); basal 6 cm is phosphorite, pyrite-cemented in part, composed of concentrically-laminated apatite pellets (< 1 mm), contains scattered irregular apatite clasts (to 5 cm), common phosphatized molds of mollusc-dominated diminutive fauna (gastropods, bivalves, Plagioglypta, Septemchiton, 3-D graptolite molds, etc.); thin phosphatic horizon near top; base overlies irregular phosphatized discontinuity surface (hardground) at top of Dubuque Fm.; this unit encompasses the lower part of the "brown shaly unit" of Brown & Whitlow (1960, USGS Bull. 1123A); 3.2 m thick.

GALENA GROUP

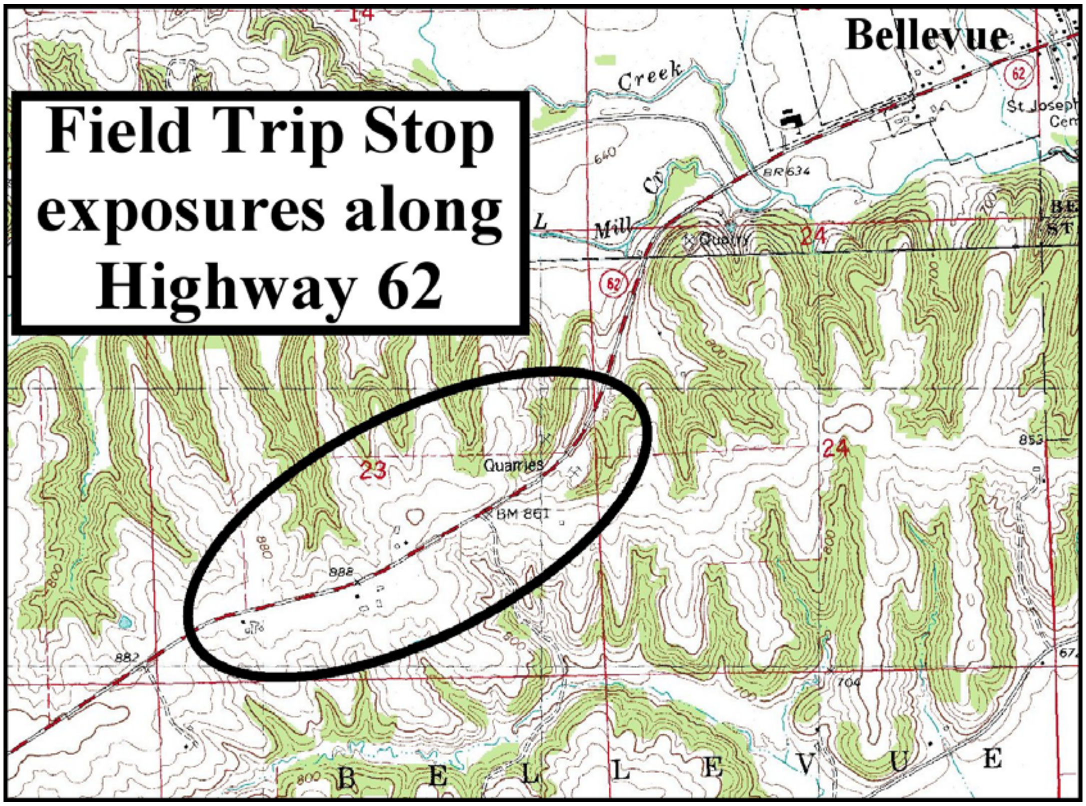
DUBUQUE FORMATION

UNIT 1

Dol., vf-m xlln, crinoidal, medium-bedded ledges separated by thin dolc shale partings (1-2 cm); exposed as ledges in lower banks and streambed of Mill Creek near Potter's Mill; about 1.5 m thick.

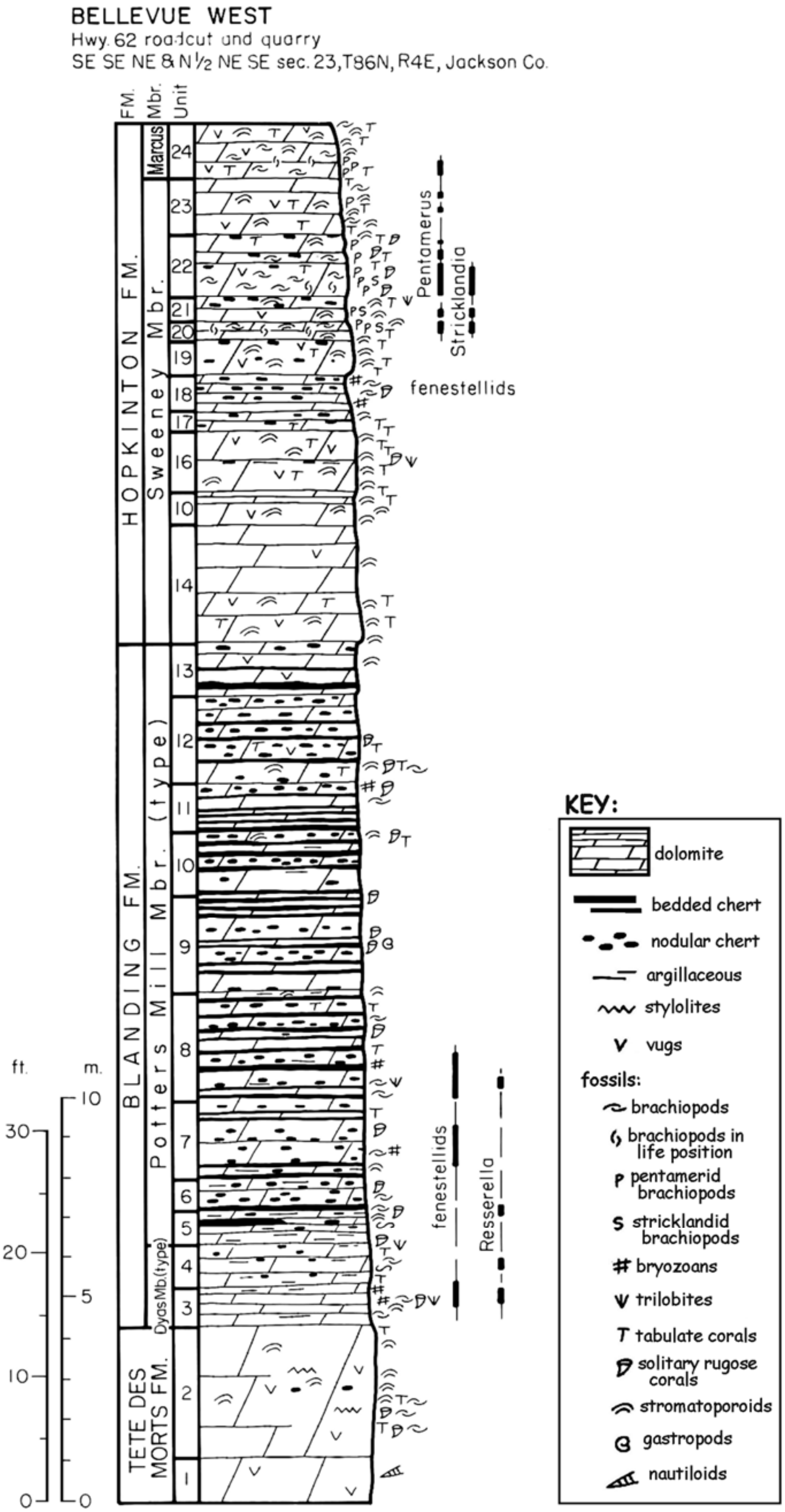
BEDROCK EXPOSURES ALONG HIGHWAY 52 AT THE TO THE NELSON UNIT, BELLEVUE STATE PARK

Brian J. Witzke



Exposures of Silurian Hopkinton Formation dolomites near the western end of the road cut on the north side of Highway 62 west of Bellevue.

Exposures of Blanding Formation cherty dolomites near the eastern end of the road cut on the north side of Highway 62 west of Bellevue. (insert shows close-up of beds)


BELLEVUE WEST
Hwy. 62 roadcut and quarry
SE SE NE & N 1/2 NE SE sec. 23, T86N, R4E, Jackson Co.
FM.
Mbr.
Unit
HOPKINTON FM.
Marcus
Sweeney Mbr.
BLANDING FM.
Potters Mill Mbr. (type)
Dyas Mb.(type)
TETE DES MORTS FM.
24
23
22
21
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15
14
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12
11
10
9
8
7
6
5
4
3
2
1
Pentamerus
Stricklandia
fenestellids
fenestellids
Resserella
ft.
m.
30
20
10
0
10
5
0
KEY:
dolomite
bedded chert
nodular chert
argillaceous
stylolites
vugs
fossils:
brachiopods
brachiopods in life position
pentamerid brachiopods
stricklandid brachiopods
bryozoans
trilobites
tabulate corals
solitary rugose corals
stromatoporoids
gastropods
nautiloids

BELLEVUE WEST SECTION

roadcuts and adjacent quarry along Hwy 62
about 2 miles southwest of Bellevue
SE SE NE sec 23 & N1/2 NE SE sec 23, T86N, R4E, Jackson Co., Iowa
measured by B.J. Witzke and G.A. Ludvigson

SILURIAN SYSTEM
HOPKINTON FORMATION
MARCUS MEMBER
UNIT 24

Dol., xf-f, xf-m xlln, fossil moldic, vuggy; crinoid debris; common Pentamerus in basal 45 cm, some in life position; scattered Pentamerus above; scattered silicified laminar stromatoporoids in middle to upper part; Favosites noted in lower to middle part; scattered Halysites (some silicified) in middle and upper parts; 1.4 m thick.

SWEENEY MEMBER
UNIT 23

Dol., xf-f, vf-m xlln (more finely xlln 45-100 cm up), part microporous mottled, fossil moldic; lower 45 cm recessive at top, silicified laminar stromatoporoids, Halysites, indet. brachiopod, crinoid debris, domal stromatoporoid overturned; 45-135 cm interval, crinoid debris, large horn corals in lower half, silicified laminar stromatoporoids, overturned Halysites near base, a few scattered Pentamerus valves; 1.35 m thick.

UNIT 22

Dol., xf-f, vf-m xlln, fossil moldic; divided into three intervals marked by thin recessive units at top of each containing scattered chert nodules; lower 85 cm with scattered vugs, massive single bed, scattered to common Pentamerus valves and shells along some horizons (1.5-4 cm shells) forming packstones along some horizons, some Pentamerus in life position 22-26 cm up, Stricklandia noted, silicified laminar stromatoporoids scattered (to 70 cm wide at 40 cm up), silicified Favosites in upper part (to 30 cm), silicified horn coral at 60 cm up; interval 85-112 cm up, silicified to moldic Halysites scattered, scattered Pentamerus valves (forms discontinuous packstone layer along one horizon), indet. silicified rhynchonellids; top 45 cm, includes some coarse xlln dol., few scattered Pentamerus valves in middle, includes laminar stromatoporoids, cup and horn corals, indet. small brachiopods, Halysites; 1.57 m thick.

UNIT 21

Dol., xf-vf xlln, scattered f-m xlln, small moldic to replaced crinoid debris, drusy quartz vug linings present, scattered to common chert nodules in top 30 cm (prominent nodular band 15-20 cm down), cherts are in part skeletal moldic, recessive at top; lower half has silicified fossils, laminar stromatoproids, Halysites, Syringopora, cup corals, a few scattered Pentamerus and ?Stricklandia valves; upper half with silicified laminar stromatoporoids (to 40 cm diam), Halysites (to 20 cm), trilobite (Stenopareia); 62 cm thick.

UNIT 20

Dol., xf-f xlln, replaced to moldic crinoid debris, scattered chalcedony and drusy megaquartz void linings, rubbly bedded unit; silicified laminar stromatoporoids, Halysites scattered through; silicified domal Heliolites near base; top 30 cm has three bands (laterally discontinuous) with large Pentamerus (to 8 cm long) and scattered Stricklandia lens progressa, some in life position, packed in part, part silicified; 45 cm thick.

UNIT 19

Dol., xf-f, vf-m xlln, common corals and stromatoporoids, replaced to moldic crinoid debris, forms overhanging ledge at base, scattered chert nodules 40 cm up and near top, chalcedony void fillings; common silicified laminar to domal stromatoporoids, moldic to silicified Halysites (to 8 x 25 cm) scattered (overturned noted 15 cm up), Favosites common (to 25 cm), Syringopora present in lower 15 cm (50 cm wide); 85 cm thick.

UNIT 18

Dol., xf-vf xlln, dense,, irregularly bedded with common to abundant nodular cherts (especially top 50 cm), unit is recessive; lithology contrasts with over and underlying units; scattered fossil molds include fenestellid bryozoans, cup corals, brachiopods (Hesperorthis); 90 cm thick.

UNIT 17

Dol., xf-vf xlln, similar to below but less coarsely xlln, thin bedded, scattered chert nodules (especially in middle); silicified laminar stromatoporoids, Halysites, Syringopora; 48 cm thick.

UNIT 16

Dol., xf-vf, f-m xlln, small vugs scattered, in 1 to 2 beds with rubbly recessive horizon containing scattered nodular cherts near midpoint, rubbly at top; moldic to replaced small crinoid debris; common to abundant silicified laminar stromatoporoids, Syringopora colony 65 cm up (15 x 50 cm), overturned domal stromatoporoids noted at 45 and 65 cm down, silicified Halysites noted at top and 45, 60, and 73 cm down, silicified horn coral at 65 cm down, trilobite (Stenopareia) in chert band; 1.5 m thick.

UNIT 15

Dol., xf-f xlln, small crinoid debris molds, massive in lower part, becomes irregularly bedded with scattered vugs in top 30 cm, scattered chert nodules, some chalcedony void fills; scattered silicified laminar stromatoporoids through, top 20 cm with Halysites, Favosites, Syringopora (to 25 cm diam), brachiopod (delthyridid aff. Howellella); 80 cm thick.

UNIT 14

Dol., xf-f, vf-m xlln, moldic to replaced small crinoid debris, microporous mottling, medium bedded, forms overhanging ledge above cherty Blanding; lower 1.2 m accessible in north quarry-roadcut section, remainder of unit accessible in south quarry area; scattered to common silicified laminar stromatoporoids and Favosites; about 2.9 m thick.

BLANDING FORMATION

POTTERS MILL MEMBER (type section); "chert beds"

UNIT 13

Dol., xf-vf, vf-m xlln, ledge-former at base, vuggy, 15 cm above base in a prominent 5-20 cm thick chert bed (thickest in Blanding section), 5 cm thick chert bed 60 cm up, nodular cherts in thinner bedded dol in upper 25 cm; fossil moldic, crinoid debris, silicified laminar stromatoporoids; 1.3 m thick.

UNIT 12

Dol., xf-f, vf-m xlln, more skeletal moldic than below, becomes more coarsely xlln upward; small crinoid debris, scattered small vugs; continuous beds of smooth to chalky chert (most are sparsely fossiliferous) noted 50 cm (5 cm thick, displays packstone fabrics), 80 cm (3 cm thick), 1.05 m (5-10 cm), 1.45 m (5-12 cm), 1.95 m (grades to nodular band) above base; nodular cherts noted in lower 20 cm and 65 cm, 90 cm, 1.3 m (to 15 cm thick), 1.65 m above base; silicified laminar stromatoporoid and tabulate coral at 45 cm up, 50 cm up with indet. brachiopods and cup corals, 80 cm up with moldic Favosites; 2.15 m thick.

UNIT 11

Dol., xf-vf xlln, includes f-m xlln top 50 cm (includes microporous mottlings), moldic to replaced small crinoid debris; prominent beds of smooth chert 5-14 cm thick at base, 18 cm, 35 cm, 53 cm (grades to nodular band), 86 cm, 1.05 cm (to band) above base, and top (to band); fossils include indet. brachiopods and bryozoans (20-30 cm down), small cup corals (top 50 cm); 1.2 m thick.

UNIT 10

Dol., xf-vf xlln, prominent argillaceous bedding surface at top, slightly argillaceous with scattered argillaceous partings, argillaceous content generally increases upward; bedded cherts at base, 95 cm up (8 cm thick), nodular cherts and nodular bands at 40 cm, 60 cm, 70 cm, 80 cm, 1.2 m, 1.3 m, and 1.4 m above base; cherts are smooth and sparsely fossiliferous; top 25 cm with silicified laminar stromatoporoids, horn corals, Favosites; 1.6 m thick.

UNIT 9

Dol., xf-vf xlln, scattered crinoid debris; nodular chert bands at base and 20 cm, 80 cm 90 cm, 1.45-1.55 m above base; bedded cherts at 45 cm, 65 cm (10 cm thick), 1.05 m, 1.15 m, 1.25 m (6 cm), 1.9 m (6 cm), 2.05 (7 cm), 2.2 m above base; fossils include gastropod 1.1 m up, cup corals 1.2 m up, packstone bed at 1.45 m up with cup and horn corals (to 2.5 cm diam), cup coral at top; 2.4 m thick.

UNIT 8

Dol., xf-vf xlln, scattered small crinoid debris molds; top 1.0 m has probable packstone interbeds with coarse xlln replaced crinoid debris; top 14 cm forms prominent argillaceous recessive bed, rubbly and burrowed; argillaceous streaks at 45 and 90 cm up; pyrite nodules 2-3 cm diam at 2.1 m above base; prominent chert beds at 14 cm, 28 cm (8 cm thick), 76-90 cm (8-14 cm thick), 1.25 m, 1.5 m (6 cm), 1.7 m (10 cm), 2.15 m (10 cm), 2.55 m (6 cm) above base; chert nodules and nodular bands at 38 cm, 50 cm, 95 cm, 1.06 m, 2.0 m above base; fossils include rhynchonellid at base, indet. trilobite at 40 cm up, Resserella at 45 cm up, fenestellid bryozoan at 90 cm up, silicified Favosites (3 x 25 cm) at 1.25 m up, strophomenid brachiopod at 2.0 m up, indet brachiopod and silicified Favosites (14 cm diam) at 2.3 m up; 2.75 m thick.

UNIT 7

Dol., xf-vf xlln, dol is slightly more coarsely xlln than below; slightly argillaceous, wispy argillaceous streaks at 15-30 cm above base, scattered pyritic blebs and nodules; chert beds at base and 30 cm, 75 cm, 1.45 m (7 cm thick), 1.6 m (5 cm) above base; nodular cherts and nodular bands (smooth chert with chalky to chalcedonic rims) at 20 cm, 40 cm, 45 cm, 60 cm, 90 cm, 1.0 m, 1.15 m, 1.75 m above base; fossils include scattered crinoid debris molds, fenestellid bryozoans, atrypid brachiopods, silicified laminar stromatoporoids in lower 50 cm; scattered cup corals and silicified Favosites in top 65 cm; 1.9 m thick.

UNIT 6

Dol., xf-vf xlln, slightly argillaceous, wavy argillaceous streaks in top 25 cm; prominent chert bed (5-12 cm thick) at base; scattered chert nodules throughout with nodular chert bands at

20, 25, 45, and 55 cm above base, cherts are smooth, light to dark brown, part with chalky rinds, may preferentially replace burrow networks; slightly fossiliferous with indet. brachiopod 20 cm up, rhynchonellid and crinoid debris near middle, small cup coral 50 cm up; 75 cm thick.

UNIT 5

Dol., xf-vf xlln, slightly argillaceous to argillaceous, lower 24 cm has thin beds of xf-m xlln dol with scattered small crinoid debris molds separated by wavy argillaceous partings; middle 33 cm is less argillaceous in 2 or 3 beds with scattered small fossils molds and pyrite blebs, contains subvertical burrows (1 x 7 cm); top 35 cm becomes more argillaceous with wavy argillaceous partings every 1 to 2 cm; interval contains 4 or more nodular chert bands, preferentially replacing burrow networks, top 18 cm laterally becomes single chert bed; silicified cup coral at base, scattered silicified fossils at top include small cup coral, Resserella, strophomenid; 82 cm thick.

DYAS MEMBER (type section); "lower quarry beds"

UNIT 4

Dol., xf-vf xlln at base, xf-f xlln above, relatively dense, scattered small fossil molds, argillaceous (especially at base), includes argillaceous streaks and stylolites above, argillaceous wavy-bedded aspect; dark colored burrow mottles scattered throughout, dispersed pyritic blebs; in 3 or more beds; irregular bands of nodular cherts at 25-30 cm and 80 cm above base, scattered cherts top 15 cm, incipient silicified zones or diffuse cherts scattered; prominent bedding surface at top; sparsely fossiliferous with scattered indet. brachiopod molds (orthids?), upper half with small Halysites, small cup coral, laminar alveolitid coral (30 cm diam), illaenid trilobite (smooth free cheek with large eye stalk); 1.05 m thick.

UNIT 3

Dol., xf-vf xlln, much denser than below, vf-m xlln at base, becomes more dense upward; in 10 to 15 beds, 3 to 13 cm thick, separated by thin argillaceous partings that become more abundant upwards; upper 17 cm beddings surfaces become more wavy and argillaceous; contrasts markedly from underlying lithologies; 55 cm above base is planar hardground surface (locally with 1 cm relief), pyritic to iron-oxide stained, scattered hardground clasts to 1.5 cm above surface; scattered iron-oxide stained horizontal burrows; scattered fossils include silicified laminar stromatoporoid 55 cm up, 65 cm up is a layer with common brachiopod molds (brachiopods include Fardenia, Resserella, indet. strophomenids, with fenestellid and stick bryozoans, cup and horn corals, Calymene trilobite fragments); scattered small crinoid molds throughout; top 10 cm with scattered fenestellid bryozoans; 1.0 m thick.

TETE DES MORTS FORMATION

UNIT 2

Dol., xf-vf, vf-m xlln, scattered vugs (1-10 cm diam, part with chalcedony linings); moldic to replaced small crinoid debris (in part forming thin dolomitized packstone beds), scattered silicified crinoid debris; argillaceous stylolitic streak at 1.1 m up, stylolite at 2.1 m up, thin argillaeous parting at top; one massive unit, laterally with one or two bedding splits; a few scattered chert nodules 1.6 m above base; scattered corals and stromatoporoids; silicified laminar stromatoporoids at 1.1 m, 1.3 m (to 35 cm diam), 1.6 m, 1.9 m, 2.7 m above base; overturned domal stromatoporoid (7 cm diam) overgrown by laminar stromatoporoid at 1.3 m above base; Favosites at 75 cm, 1.3 m, 1.4 m above base and at top (to 55 cm diam); rhynchonellid brachiopod and cup coral at 75 cm up, silicified horn corals at 1.1 m up, lissatrypid brachiopod at 1.3 m up; 3.2 m thick.

UNIT 1

Dol., vf-m xlln, single bed; some coarse xlln (replaced crinoid debris) along horizons (probable packstone lenses); scattered vugs, partly burrowed, zones of moldic porosity (small crinoid debris); nautiloid fragment in middle (3 cm diam); 1.1 m thick.

ARCHAEOLOGY OF BELLEVUE AND THE BELLEVUE STATE PARK VICINITY

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INTRODUCTION

The Bellevue area has seen a number of archaeological investigations spanning more than a century and a half. Local residents were well aware of the historic Native American groups in Bellevue and Jackson County. The prehistoric presence of these peoples was also noted. Burial mounds in particular were recognized for what they were, with relic hunters taking full advantage by digging in most every known location. As early the 1850s, a local resident named Dr. Lawrence Millar was digging primarily burial sites within Bellevue. Identified as an amateur archaeologist, Dr. Millar began prospecting about for graves below the Presbyterian Cemetery, opening three. He also recorded the presence of a shell midden further south along the bank of the Mississippi River as well as other mounds further south of Bellevue. Dr. Millar was also responsible for being the first to open several of the eight mounds located on the high ridge in the northwest corner of Bellevue (Western Historical 1879:534–535). During the 1870s, Clarence Lindley of the Davenport Academy of Natural Sciences was conducting the first “scientific” mound excavation in the county (Lindley 1877). Charles R. Keyes, often referred to as the father of Iowa Archaeology, recorded the existence of three conical burial mounds in the north unit of Bellevue State Park (13JK9) along with another mound group in the northwest part of Bellevue (13JK10) while recording additional sites in the vicinity during the late 1920-30s. Over the ensuing years, many of the most prominent names in the field have spent time in the Bellevue vicinity or Jackson County including the Reverend Jacob Gass, Frederick Starr, Theodore Lewis, Charles R. Keyes, and Ellison Orr. A through summary of these early and more recent investigations is recorded in Nagel et al. (2002). This research, both avocational and professional, continues today affording over 150 years of archaeological investigations in Jackson County.

As of this writing, Jackson County contains 279 recorded archaeological sites. These sites range from the Paleo-Indian through Late Prehistoric as well as Historic periods. Jackson County has only a single Paleo-Indian period site recorded during the 2003-2004 field season, but they undoubtedly do exist in greater abundance as evidenced by projectile points in amateur collections from the Bellevue vicinity. Thirty five of the 279 sites are located within Bellevue Township including 24 identified as prehistoric, nine identified as Historic period, and four identified as multicomponent composed of prehistoric, and historic period components. The number, occupation type, and cultural affiliation of recorded archaeological site results in large part from the opportunistic nature of cultural resource management, in other words, archaeological research is typically driven by where and how other projects impact the landscape. It is clear that many more sites exist in Jackson County than are actually recorded with the University of Iowa’s Office of the State Archaeologist. The work discussed in the remainder of this section are the result of a cultural resource survey for the US 52 bridge replacement project conducted by the U.I.’s Highway Archaeology Program (Anderson 2004).

HISTORICAL BACKGROUND OF BELLEVUE AND VICINITY

Early Exploration and Settlement in the Bellevue Vicinity, Jackson County

The area including Jackson County and the future site of Bellevue was originally part of the Louisiana Purchase, a deal made between France and the United States in 1803. As this huge parcel was divided and re-divided, the area to become Jackson County was included in the following: the Territory of Louisiana (1805), the Territory of Missouri (1812), the Territory of Michigan (1834), the Territory of Wisconsin (1836) and finally the Territory of Iowa on July 3, 1838 (Western Historical 1879).

In 1805 Lt. Zebulon Pike passed the project vicinity on his way up the Mississippi River. His journal entry for August 31 reads:

> *Saturday, embarked early. Passed one peroque [boat] of Indians; also, two encampments, one on the W. side of the river. This place had the appearance of an old town* [Jackson County, Iowa Historical and Genealogical Societies 1989:53].

Pike's recording corresponds with later settlers accounts of finding Native American villages in Bellevue, summarized as follows from local historian John Gibbs (Gibbs 1983). During the Fall of 1832, prior to the opening of lands west of the Mississippi River for Euro-American settlement, William and John Dyas made an exploratory mission to the Bellevue vicinity. David Alexander Dyas Sr. and his two sons from Galena, Illinois, were looking for new land to expand their farming operations. They were interested in the large valleys running back from the river along the west side. Upon landing, the sons hid their skiff and proceeded on foot. They noted the presence of two Indian council houses within the soon to be city limits, one just above the river bank and the other a bit further inland. With no sign of Indians they proceeded south until they encountered a stream with a good flow and decided that it would be a likely place for a mill, hence named the stream Mill Creek. They followed a plainly marked Indian trail south along the bluff until they came upon another extensive Indian camping ground as the next valley opened. They noted the presence of another council house with no other permanent structures and also noted that the valley was heavily forested with oaks, hickory, and cottonwood, with red oak being the most predominant. This is the location that the senior Dyas, a few weeks later, had a log cabin built and eventually build his home during the following year. Moving further south, William and John came upon another stream spooking a large flock of ducks into flight and hence the name Duck Creek. Continuing yet further south they came to another Indian village with council house that was later noted to be one of Keokuk's villages and ultimately to the area of Green Island. They then returned to their skiff, crossed the Mississippi River, and went home to Galena.

Once settlement commenced after 1833, local history notes that a Sac village was present in the area of what is now the Presbyterian cemetery with a burial ground located immediately below the cemetery (Western Historical 1879:534). There were also burial mounds along the river bank that the Sac said were built by people who had lived in the area long before them. Remnants of ancient fortifications likely built by these earlier peoples were also noted within Bellevue. Specifically, it is noted that a series of artificial earth mounds, "the remains of ancient fortifications about where Hyler's store now stands, regularly built breast-works, showing a great amount of skill," once existed in the southeast corner of Bellevue (Parker 1942:6, Western Historical 1879:535). However, their current disposition is unclear considering the town's early development and a lack of additional documentation. Both Gibbs (1983) and an early history of Jackson County (Western Historical 1879) state that a camp belonging to Chief Black Hawk and his people existed within Bellevue complete with a large council house. Western Historical indicates that it was well preserved until around 1834 (1879:542). Gibbs notes that embankments of the council house were very plain as late as 1879 and are likely still represented in the small mounds seen today near the entrance to Lock and Dam 12 within Riverview Park (Gibbs 1983). Although Black Hawk is noted as being associated with this location, no supporting documentation could be found in published documents specifically pertaining to Black Hawk. Yet another early account of a Native American presence in Bellevue notes that the very first settlers found “headquarters and council rooms of Bellevue’s Indian Village were in a perfect state of preservation and they counseled with the Indians in these chambers” (Jackson County, Iowa Historical and Genealogical Society 1989:53).

As noted earlier, the senior Dyas had his son John, James Armstrong, and a couple of other hired hands build a log cabin on the west side of the Mississippi River during the Fall of 1832. This was of course an illegal occupation since this portion of the Missouri Territory was not open to white settlement yet. The cabin was located in heavy timber at the base of the north valley wall of Duck Creek about a half mile from the river. The valley floor and walls were noted as timber covered at that time with the uplands being open due to the periodic prairie fires. Dyas Sr. had the cabin occupied during the winter of 1832–33 by his son William, and James Armstrong (Gibbs 1983). This time, no doubt, provided James with the opportunity to scout out his claim to be filed as soon as permanent settlement was possible.

The first legal and permanent white settlers in Jackson County were James Armstrong and Alexander Reed, the hired hand and son-in-law, respectively, of David Alexander Dyas Sr. Upon opening of the territory for settlement in June, 1833, Armstrong staked a claim that included the north unit of Bellevue State Park, located immediately south of town along the bluff. His claim extended south into the Duck Creek Valley. Reed settled several miles south in the Pleasant Creek valley. The senior Dyas followed shortly after and replaced the cabin with a house and referred to the Duck Creek valley for many years as the Christian Valley. All were occupied in farming. (Gibbs 1983, Jackson County, Iowa Historical and Genealogical Societies 1989:53). During the Fall of 1833 many others arrived in the Bellevue vicinity including William Jonas, David Segar, Thomas Nicholson, and William Dyas. All of these individuals settled in the area near Armstrong’s claim (Bellevue Herald-Leader 1983:14).

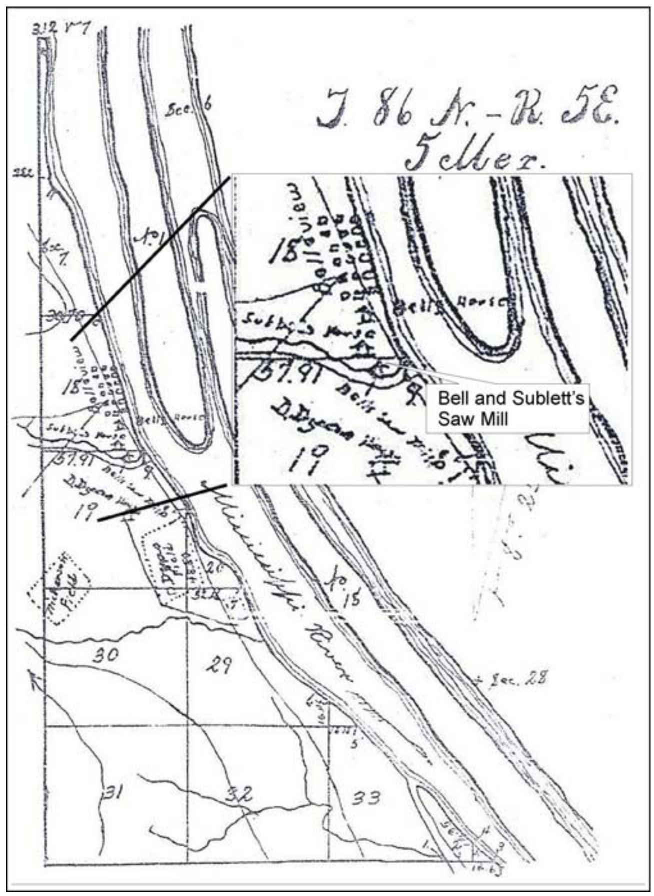

Figure 1. General Land Office map of 1838 showing Bellevue Township. Inset shows close-up of the Mill Creek vicinity showing the Bell and Sublett Mill location.

Early Bellevue, Settlers, and Industry

John Bell was the first settler in Bellevue arriving and building one of the first log cabins in 1835. He was responsible for platting and naming the city. He originally named the town after himself, referring to the area as Bell View. This was later changed to the French spelling of Belle Vue, meaning beautiful view, and later still joined into the one word name used today (Bellevue Herald-Leader 1983, Jackson County, Iowa Historical and Genealogical Societies 1989, Western Historical 1879). Bell and partner John D. Sublett built the first saw mill in the area in 1836. It was located approximately where the Jasper Flouring Mill was later built (Owen Publishing 1878, Western Historical 1879:533). It is noted on the 1838 General Land Office map (Fig. 1). It is not clear what happened to the saw mill after construction of the Jasper Flouring Mill (see below) but it is apparent that lumber milling continued in Bellevue. The next historical reference to lumbering is in 1855 when E. G. Potter and Hayes built a mill and equipped it with the capacity for sawing 30,000 board feet of lumber per day (Western Historical 1879:549). A. J. Dorchester arrived in Bellevue in 1853 and entered in business with E. G. Potter at the Dorchester & Company mill (Ellis 1910:481). Large rafts of logs from northern forests arrived via the Mississippi River to the mouth of Mill Creek where they were processed by the mill for local and regional use (Jackson County, Iowa Historical and Genealogical Society 1989). It is interesting that Potter's name apparently never appears associated with the saw mill and no mention of Hayes could be found. At some point during the 1850s, Dorchester joined with J. C. Hughey and his hardware business to form the Dorchester & Hughey lumber company. Hughey arrived in Bellevue in 1852 and immediately entered into the hardware business until 1876. In 1875, an H. G. Dorchester joined the lumber firm. It is not noted whether there is any relationship between the two Dorchesters other than through the saw mill. The undated photograph in Figure 2A shows the saw mill as it existed, likely dating to the mid 1800s.

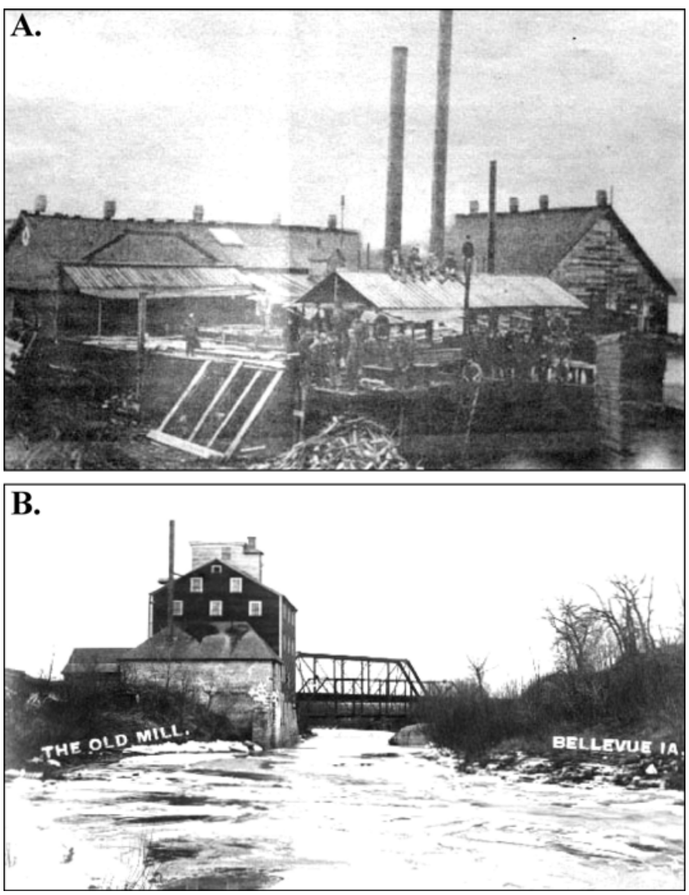

Figure 2. **A**.) Photograph of the Dorchester & Hughey Lumber Mill (Jackson County Historical Society, 2004). **B**.) Photograph of the flowering mill known as Potter's Mill (Jackson County Historical Society, 2004).

The Dorchester & Hughey Saw Mill dominated the southeast corner of Bellevue for more than 60 years reaching its greatest extent during the early 1900s. The 1902 Sanborn fire insurance map shows the lumber yard extending some 1,300 feet north of Mill Creek along the Mississippi River and some 750 feet south of Mill Creek between the Mississippi River and the railroad. Sometime between 1914 and 1928 the lumber yard changed ownership to become the H. O. Senffert Lumber Company. The mill also contracted to the yard area west of Water Street leaving only the Dorchester and Hughey warehouse on the east side of Water Street. Currently, Bellevue Building Supply, Inc., previously the H. O. Senffert yard, represents a continuation of the earliest lumber milling began in 1836 making for 172 years of continuous lumber production in

Bellevue.

Elbridge Gerry Potter came to Bellevue sometime around 1842 and settled four miles west of town along a small tributary to Big Mill Creek in what was at the time called Paradise Valley. Besides farming and having the first lending library in Iowa, Potter built the Jasper Flouring Mill in Bellevue in 1842–43. The mill is shown in Figure 2B, the view is from the west facing downstream towards the east and the Mississippi River.

Local and regional customers made up most of Potter's business. However, he also sold to locations as far away St. Louis, New Orleans, and New York. He purchased grain from local Iowa farmers as well as from Minnesota and Wisconsin. Originally the mill was water powered by an overshot wheel along the south side of the building. This was fed by a mill race that received water from a large impoundment just up stream. During the late 1860s, the limestone dam was raised and six water turbines were installed running six sets of milling stones. The mill produced 200 barrels of flour per day during these peak years (Eggers and Eggers 2004). Potter operated the mill until its sale to the Kilborn & Company in the Fall of 1871. Potter was also associated with the saw mill run by A. J. Dorcherster from 1855–1870. He was widely known and liked by the residents of the Bellevue vicinity. E. G. Potter died in May 1875.

On May 24, 1896, a disastrous flood destroyed the raceway, limestone dam, and drained the impounded water, but the mill survived. After this event it was converted to steam and later electric power. Up until 1903 the mill produced flour and other products whereas after that date it produced only livestock feed grain. In 1969 it ceased to operate as a grist mill (Bellevue Herald-Leader 1983, Ellis 1910, Western Historical 1879). The mill still stands and is a significant historic landmark being the oldest standing frame mill in Iowa. It is currently in use as the Potters Mill Bed and Breakfast, established in the early 1980s. The mill is listed on the National Register of Historic Places, and the Site's & Point of Interest list with the Silos & Smokestacks National Heritage Area (Eggers and Eggers 2004).

Mahlon G. Hyler arrived in Bellevue in 1842, setting himself up in farming and beginning one of the first general merchandising stores in 1844. He constructed a rock (limestone?) building for his store located north of Mill Creek along the east side of Water Street. Hyler's building was mentioned in the early histories as being built upon the remains of prehistoric fortifications or earthworks, as noted earlier in this section (Parker 1942:6, Western Historical 1879:535). Hyler continued farming for about a decade but in 1852 he turned his attention to his mercantile business full time. The location of his store eventually saw the expansion and/or reconstruction of the original structure that later included a lumber warehouse and a shell button factory. Mahlon Hyler was still alive and active in Bellevue society until his death in 1911 at the age of 88.

Figure 3. Plat map of 1893 showing the location of Hyler's lime kiln (Jackson County Historical Society, 2004).

At some point Mahlon Hyler appears to have entered the lime business. A local historian has noted that one of the first industries in Bellevue was the Hyler limestone kiln at the base of the south bluff (Wacker 2002). Lime mortar would have been very important in the early days of Bellevue and other cities and towns in eastern Iowa and western Illinois. Much of the construction utilized locally available limestone and dolomite which needs high quality lime mortar. Both materials were in abundance in Bellevue and by 1880 references are being made in the local paper to lime production:

> *The person who took the gads and sledge-hammer belonging to the lower lime kiln, on the Dyas Hill, had better return the same and save trouble* [Bellevue Leader 1880].

Another newspaper account indicates that it was Mahlon Hyler's son, Charles G. Hyler, who was behind the actual lime kiln operation. Charles is noted in one county history as being a foreman at the Dorchester & Hughey lumber yard (Chapman Brothers 1889). The Bellevue Leader of 19 April 1888 notes that "Charley Hyler has just finished burning a fresh kiln of lime." These kilns are included on the 1893 plat map of Bellevue Township (Fig. 3). The owner of this property is noted as Mahlon Hyler. There are 11 limestone quarries listed in 1906 for Jackson County with four located in Bellevue (Beyer and Williams 1907). Of these four, only C. G. Hyler is listed as producing lime. The largest lime producing kilns were located at Hurstville and Joinerville, near Maquoketa, and these two ultimately dominated the market. However, lime production was a burgeoning industry in the mid 1800s in Iowa and many of the smaller kilns such as the Hyler pair produced notable quantities for local and regional consumption over many years.

Early Transportation

The earliest form of mass transit in the Bellevue area was by water. River boats were noted passing the vicinity as early as the 1820s (Jackson County, Iowa Historical and Genealogical Society 1989). The mouth of Mill Creek has been a focal point of activities in Bellevue since its beginnings with some of the first vessels disembarking their passengers in this vicinity. River transportation had its limits however, and Bellevue was looking for overland routes to access the growing Midwestern markets. Early road development in any region often begins with trails. So is the case with north-south travel through Bellevue. During that first 1832 scouting mission into the Bellevue vicinity taken by the Dyas' brothers, it was noted that they used a Native American trail. The plainly marked Indian trail ran along the base of the bluffs and back from the Mississippi River providing easy foot traffic through the area. This early transportation route is included on the earliest map of Bellevue Township (Secretary of State 1979 [1838]). This plainly marked Indian trail was a precursor to the first historic road running north and south of Bellevue. Originally identified as a wagon road, this route appears on subsequent plat maps connecting Bellevue with Sabula, Clinton, and other towns to the south, and St. Donatis, Dubuque and other

Figure 4. Photograph of the Dorchester & Hughey Lumber Mill (left), the railroad bridge with a portion of the Great River Road to the right (center), and Potter's Mill (right). View facing south towards Mill Creek (from Explore Jackson County, 2004).

towns to the north. The route can be seen in a mid-1800s photograph just to the right of the railroad bridge (Fig. 4). The Dorchester & Hughey lumber mill can be seen on the left while the flouring mill is on the right. This route later became known as the Great River Road, multiple routes that run the length of the Mississippi River from Lake Itasca, Minnesota, to Venice, Louisiana. In the early 1900s communities along the Mississippi River organized to improve these routes and Bellevue was no different. The route can be seen in this mid- to late-1800s photograph facing south showing the road bridge and railroad bridge from the north bank of Mill Creek (Fig. 5).

Figure 5. Early Great River Road and railroad bridge spanning Mill Creek, facing south (Jackson County Historical Society, 2004)

In 1928, the Bellevue and Dubuque chambers of commerce began a movement to permanently surface the road between the two cities. The city of Clinton joined the movement and in 1929 the route was designated a county road. Less than two years later, contracts had been let for grading and paving. By 1938 paving had begun in the Bellevue vicinity and in 1942 the current bridge spanning Mill Creek was completed. Construction along the road was suspended after this date due to a World War II induced moratorium on new public works projects. A year after the war ended paving resumed from the north end of Bellevue to Dubuque and soon the route spanning the north–south length of Jackson County was complete (Jackson County, Iowa Historical and Genealogical Society 1989:51).

As Bellevue grew, additional overland methods of transportation were needed. With the great carrying capacity that railroads offered, this need became clear for the early citizens of Bellevue. In 1856 the U.S. Congress granted land to the Dubuque and Pacific Railroad with plans to build a line from Dubuque to Sioux City with a spur designed to head south to Bellevue. The road was started that year but the spur to Bellevue was abandoned just south of Dubuque. The Civil War intervened and no additional railroad activity is recorded for those years. In 1868 a new Dubuque railroad company was formed and granted 66 sections of land to build a line to the south, including Bellevue. This company failed also but another attempt was made beginning in 1870 that ultimately was successful. The Dubuque, Bellevue, and Mississippi River Company was incorporated in Dubuque with the avowed purposed to bring rail traffic to Bellevue and possibly further south with connections to other lines. Of the several initial investors, E. G. Potter is listed prominently. Later that year Bellevue Township voted in a five percent tax for railroad construction with the citizens of Bellevue subscribing to stocks to cover the rest, and construction was soon underway. Interestingly, the route followed the same one prescribed back in 1856. In 1871 the rail line was open from Dubuque to Bellevue and the name had been changed to the Dubuque, Clinton, and Chicago Railroad. The line was completed in 1872 to Clinton where it crossed the Mississippi River and linked with the east–west routes already extant. Figure 5 shows an early photograph of the railroad bridge spanning Mill Creek. Several more name changes occurred over the next couple of decades until it was eventually owned by the Chicago, Milwaukee, and St. Paul Railroad, eventually going bankrupt in the 1970s (Bellevue Herald-Leader 1983:17).

Other Individuals and Industries of Bellevue

Several other individuals and activities also figure in the early history at the U.S. 52 bridge replacement vicinity. Mill Creek had always been an important haven for small fishing boats. The Dorchester and Hughey lumber company received large rafts of logs from up stream for processing at their saw mill with the processed boards stacked in the area between Mill Creek, the Mississippi River, and Water Street. Ice harvest was an important early industry before and after the turn of the twentieth century. Ice was annually cut from the Mississippi River and stored in warehouses packed in saw dust. One such store house was located along the north bank of Mill Creek just east of the current bridge. By 1915 a new plant was constructed to produce ice through artificial means using distilled water. Ice manufacture continued in Bellevue as late as 1951 with three companies involved, all located in the north end of town (Jackson County, Iowa Historical and Genealogical Society 1989:55).

Along with the ice house, five other structures were once located along the north bank of Mill Creek and the adjacent east side of Water Street. These business included Doug's Dine and Dance, two tourist cabins, an office building, and a fish market. These existed until 1941 when the Iowa Department of Transportation purchased easement and right-of-way for the construction of the extant U.S. 52 bridge (Jackson County, Iowa Historical and Genealogical Societies 1989:54).

Throughout the late 1800s button manufacture was an important industry along the upper Mississippi River. Bellevue joined in this production by opening a button factory in 1909 under the direction of the Bellevue Commercial Club. The business was one of the first factories to operate in Bellevue and was located in the Dorchester and Hughey Warehouse/Mahlon Hyler's general store building. The factory seems to have followed an irregular production schedule but during peak times employed 20 to 30 cutters. By 1921 the operation had closed and the U.S. Button Company had set up a new factory in the northern part of town. This business continued until just prior to the beginning of World War II (Jackson County, Iowa Historical and Genealogical Society 1989:54-55).

The last major business considered here is the Bellevue Clay Products Company (Fig. 6). Formed in 1917 by a group of local businessmen, this company produced all sizes of clay flower pots for distribution nationwide. The factory took over the Hyler general store/Dorchester and Hughey warehouse and produced brick and drainage tile as well. The clays needed for production were excavated from along the south bank of Mill Creek where the north unit of Bellevue State Park exists. Three kilns operated between the factory and the Mississippi River which produced the three varieties of clay products for 24 years. The business charter expired in 1942 with the last kiln fired in July 1941 (Jackson County, Iowa Historical and Genealogical Societies 1989:54; Bellevue Herald-Leader 1983). The kilns were leveled and paved over for development of private residential space.

Figure 6. Bellevue Clay Products factory circa. 1917 (Jackson County Historical Society, 2004)

Finally, the land composing the

north unit of Bellevue State Park originally belonged to James Armstrong, one of the two original white settlers of Jackson County. The property changed hands several times after Armstrong departed, eventually ending up in the ownership of Mahlon Hyler. He strongly and vociferously resisted several purchase attempts during the early twentieth century. In 1924 the property became available and the Bellevue Commercial Club and the County Park Commissioners began planning for the park. The State Conservation Commission soon became interested and accepted the local plan for development. Convict labor from the Men's Reformatory at Anamosa was used to construct access roads and other park facilities. Limestone from the south bluff was used for both road and building construction. Four years later, in 1928, Bellevue State Park was formally included within the State Parks system (Bellevue Herald-Leader 1983:63).

ARCHAEOLOGICAL BACKGROUND OF BELLEVUE AND VICINITY

As previously noted, Charles R. Keyes recorded the location of three conical burial mounds in the north unit of Bellevue State Park. This site, known as 13JK9, probably date to the Woodland period and was the only recorded archaeological site within the park until a 2003-2004 cultural resource survey recorded four historic era sites, which will be discussed later in this report. The south unit of the park contains no recorded archaeological sites as of this writing (Fig. 7).

Several recent archaeological investigations have been conducted in the immediate vicinity of Bellevue and the state park. During the late 1980s a cultural resource survey was conducted within the Mississippi River valley resulting in the identification of multiple sites (Benn 1989). In 1995 a Phase I archaeological investigation of rip-rap placement sites within Mississippi River pools 12 and 13 resulting in recording three new and one previously identified sites (Kullen 1995). In 1996 a Phase I archaeological survey was conducted for the proposed Riverfront Park Enhancement Project in the city of Bellevue resulting in the recording of a single site, 13JK218 (Rogers 1996). In 1998, a Phase I survey for the proposed municipal water and sewer system improvement work in the southern portion of Bellevue, "along previously disturbed topography, including city streets and the respective ROWs of U.S. Highway 52 and the Burlington Northern Railway grade" (Molseed 1998:1). No archaeological resources were recorded as a result of this survey. In 2001 a Phase II archaeological investigation was conducted on sites 13JK77, located at the north end of the city of Bellevue, and 13JK137, located near the mouth of Duck Creek across from the entrance to the south unit of Bellevue State Park. Neither site yielded information on cultural affiliation but did indicate intensive prehistoric use of riverine site locations (Snyder and Anderson 2002).

During the 2003-2004 field season, a cultural resource survey was conducted prior to the replacement of the U.S. 52 bridge in Bellevue. This project recorded 12 new archaeological sites, eight of which exist within the proposed borrow areas located along Duck Creek. Three of these archaeological sites, 13JK266, 13JK267, and 13JK271, exist within the bridge replacement area while 13JK264 exists just west of the bridge replacement location. Three of these sites exist within the boundaries of the north unit of Bellevue State Park. These four sites all relate to the early history and commercial development of Bellevue focusing on the Mill Creek area. The following section on the bridge replacement location establishes the context of the four archaeological sites, whose discussions follow next.

Historic research on the US 52-bridge replacement location

Available historical plat maps provided good details on early landscape modifications in the U.S. 52 bridge replacement vicinity. The 1838 and 1867 plat maps contained limited physiographic information. The vegetation map of Jackson County provided no useful data on land use during the very early historic period of the bridge replacement vicinity. The 1875, 1893 and 1913 plat maps offered no physiographic information but do identify land owners and in some cases, building locations. The available Sanborn fire insurance maps were invaluable in identifying the early industrial development in the bridge replacement vicinity as well as providing information on land owners. They provide a relatively detailed visual and written accounting of residents and business interests during the late nineteenth and early twentieth century.

Figure 7. Archaeological sites cataloged by the Office of the State Geologist.

This map contains confidential site location information. Neither the map nor the associated data may be reproduced or distributed apart from this guidebook.

The earliest available map is the 1838 General Land Office survey conducted by the United States Government (Fig. 1). This early map shows the small town of Bellevue referred to as Bell View as named by its founder, John Bell. His house is noted immediately south of the platted town lots. Also noted in this map is the house of John Sublett, another early settler and business partner of John Bell. They began the first saw mill that is also noted on this 1838 map in the approximate location of the present day Potters Mill, along the north bank of Mill Creek just up stream from the banks of the Mississippi River. This saw mill is noted in county histories as dating to 1836. Although John Armstrong is acknowledged as the first European settler of the Bellevue area, his residence is not identified on this early map. A trail which became a wagon road, and later U.S. 52, is clearly noted running both south and north of Bellevue. This trail was originally noted as an Indian trail by Armstrong and Dyas in 1832.

The 1867 plat map shows only limited details. The map indicates the presence of the Jasper Flouring Mill (today known as Potters Mill) located along the north bank of Mill Creek. The wagon road (U.S. 52) is clearly defined as a road rather than a trail. The saw mill is not identified on this map. The area south of the bridge location is timber covered and the owner is identified as Mahlon G. Hyler. No other details are available from this map.

The 1875 plat map shows the same location of flouring mill and identifies the owners as Kilborn & Company. The wagon road (U.S. 52) is shown along with the addition of the railroad tracks, completed in 1871. Lastly, the area south of Mill Creek is still shown under forest cover. Because this map is at a small scale, fine details of the Bellevue area are not discernible.

The 1893 plat map is interesting in that it has both a township map and a city of Bellevue map. The township map shows the location of a pair of lime kilns immediately south of Mill Creek between the railroad and U.S. 52. The property was still owned by Mahlon G. Hyler and the presence of these lime kilns concurs with early historical accounts of lime production by this family. The pair of kilns are clearly marked on this map but appear on no other plats. Also shown on this map is the presence of two mill ponds along Mill Creek. The lower pond was catastrophically drained when the dam failed during heavy rains in May of 1896. The city map shows the flouring mill, now owned by Reiling & Company, and the Dorchester & Hughey lumber yard. The saw mill is shown along the east side of Water Street with the lumber yard occupying the remainder of the land between Water Street and the Mississippi River extending south to the north bank of Mill Creek (Fig.3).

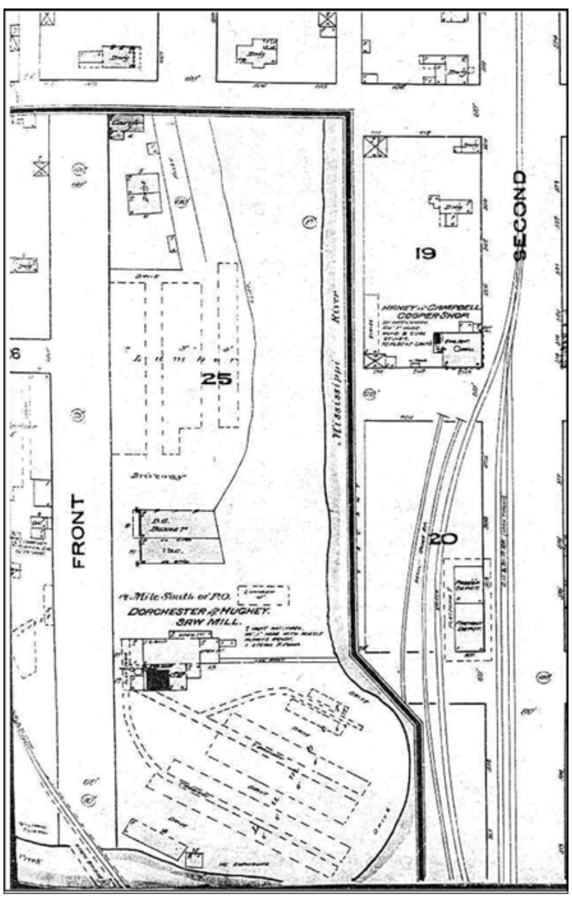

Figure 8. Sanborn fire insurance of 1885 showing the location of Dochester & Hughey lumber yard in relation to Mill Creek and the Mississippi River.

The 1913 plat also has a township and city map. The township map does not show any information regarding timber cover or structures but does indicate that the property containing the lime kilns, previously owned by Hyler, now belonged to R.W. Dyas. The city map indicates that the flouring mill still belonged to Reiling & Company. The Dorchester & Hughey lumber yard vacated the property east of Water Street between the Mississippi River and the north bank of Mill Creek and contracted to occupy property only along the west side of Water Street. This area represents the location of the currently extant Bellevue Building Supply. The fresh water mussel shell button factory is now shown along the east side of Water Street where it shared a building with the Hyler grocery store and a Dorchester & Hughey warehouse.

The Sanborn fire insurance maps provided a wealth of information regarding the early historical development in the vicinity of the U.S. 52 bridge replacement project. The earliest available insurance map from 1885 (Fig.8) shows the Reiling & Company flouring mill on the west side of Front (Water) Street and the railroad tracks. The structure that houses Mahlon G. Hyler's grocery store is identified existing north of the saw mill with lumber piles surrounding it to the north, however Hyler is not identified by name. The Dorchester & Hughey lumber yard occupies property both east and west of Front (Water) Street although the western portion is not completely shown in the figure. The area west of Front (Water) Street forms a triangle between the street, the railroad tracks to the west, and Elm Street to the north. This portion of the yard contains the main offices, a planning mill for finishing work, dimension lumber piles and shingles. The area east of Front (Water) Street extends from the street east to the Mississippi River and 750 ft (228.6 m) along the river from the north bank of Mill Creek. The saw mill (Fig. 2A) is shown along the east side of Front (Water) Street with a log way leading from the Mississippi River to the mill for bringing timber in for processing. Timber was also brought into the yard up the street and from Mill Creek as is mentioned in the early histories. The northern yard has three piles stacked parallel to the street from 5–7 ft (1.–2.1 m) high. A single 4 ft (1.2 m) pile exists just east of the mill and the building to the north. The southern yard contains six rows of lumber, accompanying tramways and drives, and a lumber shed located near the bridge spanning Mill Creek. The southern pair of stacks are 8 ft (2.4 m) high while the remaining four are 6 ft (1.8 m) high.

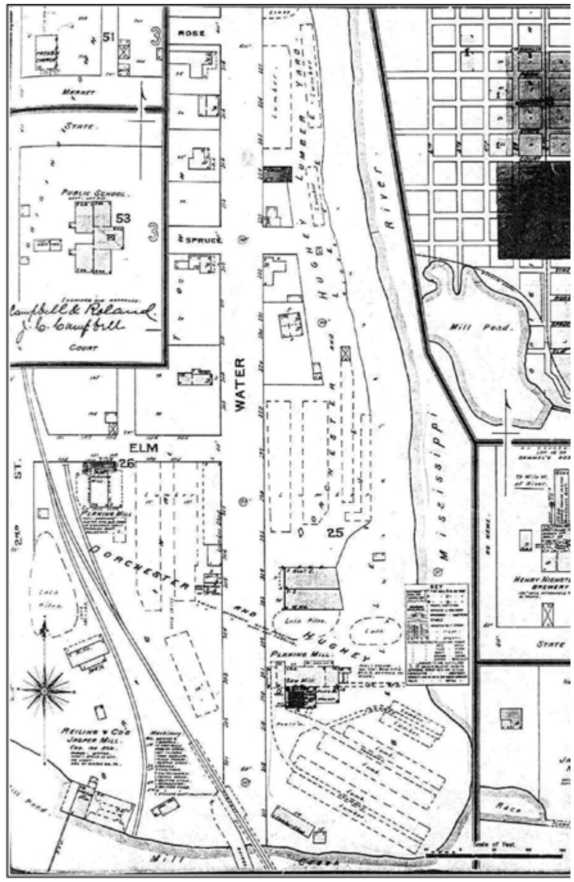

Figure 9. Sanborn fire insurance of 1894 showing the location of Dochester &Hughey lumber yard in relation to Mill Creek and the Mississippi River.

The 1894 fire insurance map contains additional written details along with structure locations (Fig. 9). The map shows the same configuration of flouring mill and lumber yard however Front Street has been changed to Water Street. The mill pond is still extant in 1894 and the plat map shows not only the pond but also the location of the dam which failed in 1896. The building containing Hyler's grocery store is still present with the north half being identified as a general store while the southern half is noted as a warehouse, likely belonging to Dorchester & Hughey. The triangular portion of the lumber yard appears to be the same as the 1885 with the exception of pile height being noted at 10–12 ft (3–3.7 m). Two large piles of lath are noted as existing along the south side of this building and to the southeast between the building and the Mississippi River. Greater detail about the lumber operation indicates that the yard between the Mississippi River and Water Street has expanded to over 1,300 ft (396.2 m) north of Mill Creek. Three lumber piles have been added to the other three along this northern extension to match the six already extant in the southern yard. No lumber pile height information is noted for either the north or south yards. This map also includes a key of specific physical information about the saw mill building itself.

The 1902 fire insurance map also contains additional written details along with structure locations (Fig. 10). The map shows the flouring mill still belonging to Reiling & Company and notes that it is now steam powered since the 1896 flood removed its source of water power.

Hyler's general store is in the same location with the southern half of the building being noted as a lumber warehouse. The most notable element of 1902 is the large expansion of the Dorcherster & Hughey lumber operation. The triangular yard is now identified as the office yard with its configuration little changed from 1894. The lumber yard east of Water Street still extends the same 1,300 ft (396.2 m) along the Mississippi River bank north of Mill Creek. The northern yard is noted as having lumber piles stacked up to 16 ft (4.8 m) over the natural sandy soils. The saw mill remains unchanged as does the southern yard area. The southern yard is noted as being filled up with mill waste with the average height of the lumber piles being 12 ft (3.7 m). The saw mill is noted as being able to produce 60,000 board feet of lumber per day. Two areas of significant expansion have occurred to the west of the office yard and to the south of Mill Creek. The Mill Pond Yard, west of the office, exists for 400 ft (121.9 m) along the west side of the railroad tracks, 300 ft (91.4 m) along the north edge and 925 ft (281.9 m) along the east edges of the drained

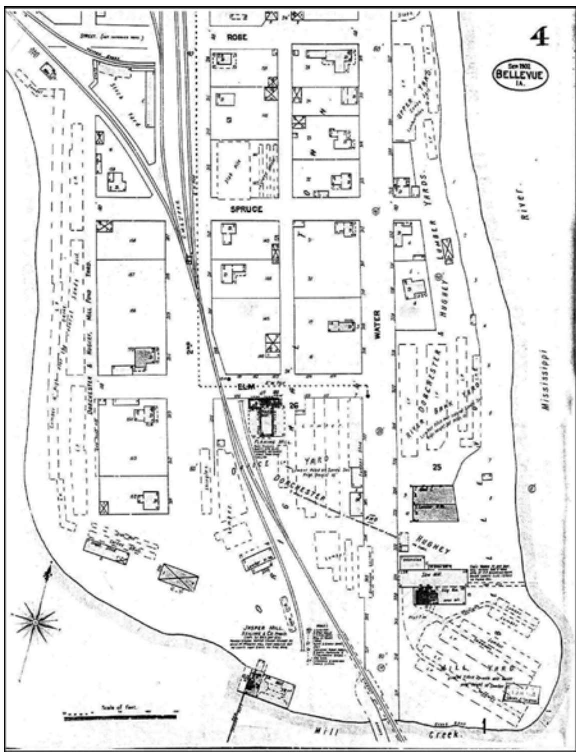

Figure 10. Sanborn fire insurance of 1902 showing the expanded location of Dochester &Hughey lumber yard in relation to Mill Creek and the Mississippi River.

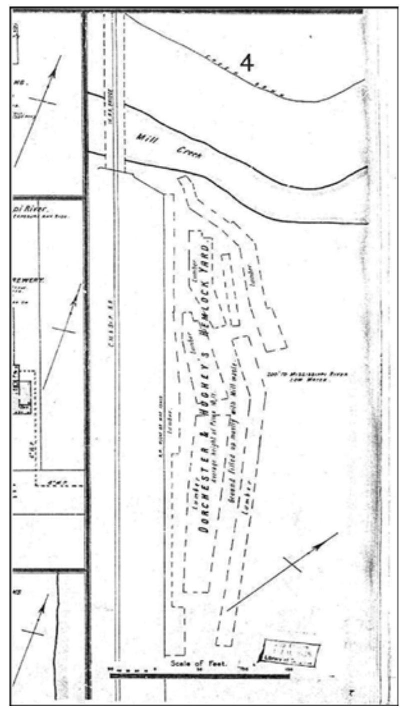

Figure 11. Sanborn fire insurance of 1902 showing the location of Dochester &Hughey lumber yard to the south of Mill Creek (the Mississippi River is just off the right side of the map.

flouring mill pond. This yard contains nine piles of lumber stacked an average of 16 ft (4.9 m) on the natural sandy soils, a slab pile, a corded pile, a shingle pile, a lumber warehouse, an implement shed, and an unidentified house-like structure. The Hemlock Yard, south of Mill Creek, extends from the south bank for 375 ft (114.3 m) south along the Mississippi River (Fig. 11). It contains seven long lumber piles stacked an average of 16 ft (4.9 m) on ground filled up mostly with mill waste. A note regarding the number of watchmen on duty day or night indicates that this mill often ran around the clock processing the vast amounts of timber harvested locally as well as floated down the Mississippi River from northern forests. It is not clear why the area south of Mill Creek was named the "Hemlock Yard" but it is conceivable that it came from the Canadian Hemlock (Tsuga canadensis), a common and desirable lumber species found throughout western Wisconsin and eastern Minnesota.

The 1914 fire insurance map shows a considerable contraction in the lumber yard areas (Fig. 12). While the office yard remains the same, the Mill Pond Yard and the Hemlock Yard no longer exist. The area of the Mill Pond yard is now platted to individual lots. The Hemlock yard is not shown nor is any area south of Mill Creek. The saw mill along the east side of Water Street is still extant, however this yard has contracted to extend only 350 ft (106.7 m) north from Mill Creek. The ground is noted as being low and filled with mill waste. There are four large lumber piles averaging 4–6 ft (1.2–1.8 m) south of the saw mill and two shingle piles averaging 10 ft (3 m) east of the mill. There is no longer a log way leading to the mill from the Mississippi River indicating that large log rafts were no longer arriving from points up stream. Contraction of the Dorchester & Hughey lumber production is consistent with the contraction of the lumbering industry occurring throughout the upper Midwest during the early decades of the twentieth century. The lumber industry fell rapidly once depletion of the northern pine forests dried up cheap supplies. This coupled with a leveling off of population growth in Iowa and the opening of rail links to the developing northern mills meant a change in the traditional processing patterns. Lastly, the viability of local mills was further complicated by the economic depression of 1893–1896 (Svendsen et al. 1982:4-4– 4-5). Hyler's general store is no longer noted as the building has been taken over by the shell button factory. The flouring mill is still owned by Reiling & Company but is now powered by electricity.

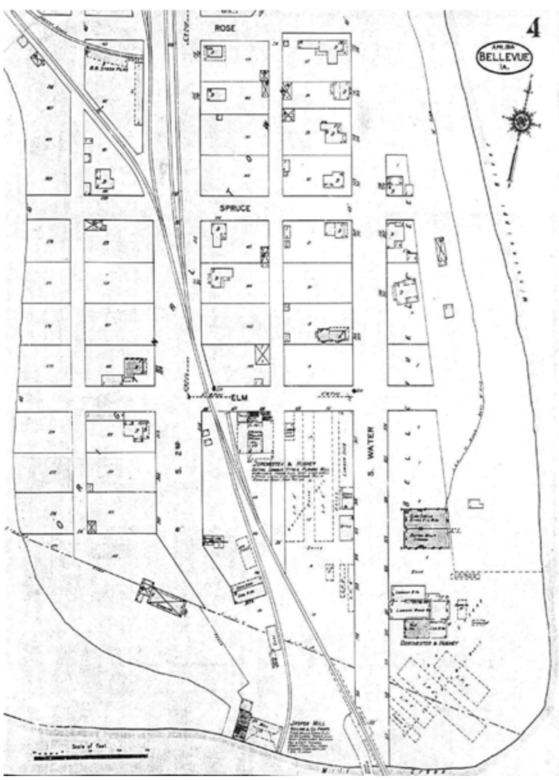

Figure 12. Sanborn fire insurance of 1914 showing the location of Dochester &Hughey lumber yard in relation to Mill Creek and the Mississippi River.

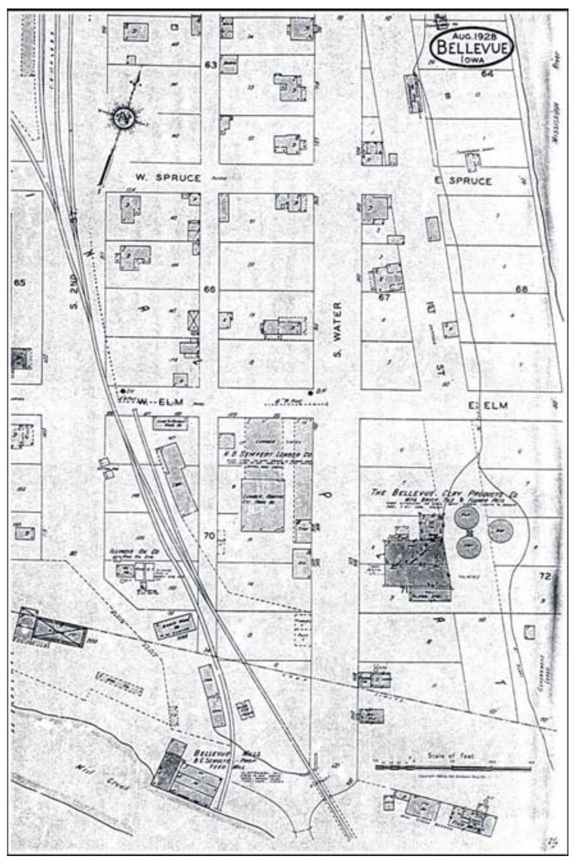

Figure 13. Sanborn fire insurance of 1928 showing the location of the Senffert Lumber Company and the Bellevue Clay Products Company in relation to Mill Creek and the Mississippi River.

The 1928 fire insurance map shows significant change throughout the southeast corner of Bellevue (Fig. 13). The lumber operation of Dorcherster & Hughey is now the H. O. Senffert Lumber Company and has contracted to be contained within the original triangular office yard between Water Street, the railroad tracks and Elm Street. The saw mill along the east side of Water Street has been completely removed along with all of the lumber piles in the south yard. This area has been platted into lots taken over by several new establishments. An automobile filling station and another unidentified building are now located along Water Street. Four structures are located along the north bank of Mill Creek. The eastern most structure is identified as a fish market but no owner is listed. The center building is identified as an ice house. The westernmost pair of buildings are not identified as to function but may be associated with the ice house since they appear to be connected. The flouring mill is now owned by B. G. Schultz and has become a feed mill. The biggest change in this area is the conversion of the Hyler general store/Dorchester & Hughey warehouse building into the Bellevue Clay Products Company. The original building has two small additions to the north and a slightly larger addition to the south. The south addition is noted as a tile packing stage. It is not clear what the two northern additions were used for. The most significant change is the three large pottery kilns constructed between the original building and the Mississippi River. Flower pots, brick, and tile were produced at this facility until 1942 with shipments traveling across the country during the height of production. Several other businesses were located between the pottery factory and Mill Creek. They operated up until the currently extant bridge was constructed during 1941–42 at which time they were razed.

The Mill Creek vicinity has been the focus of settlement in Bellevue since James Armstrong and John Bell arrived in the early 1830s. Lumber milling has the longest history in this area starting with the Bell and Sublett saw mill built in 1836. This lumber industry grew continuously from that time to dominate the southeast portion of Bellevue during the late nineteenth and early twentieth centuries. The available plat maps and fire insurance maps indicate that the areas east of the current U.S. 52 bridge has been disturbed due to lumber milling activities. This area of disturbance includes portions of the currently proposed bridge replacement project both north and south of Mill Creek. Movement of unprocessed timber, stacking of processed lumber, and a significant amount of mill waste fill are noted in both of the areas, the north being much more heavily utilized than the south. Once lumber production waned in the early twentieth century the yard south Mill Creek was abandoned and the yard north was used by other business interest until the current bridge was constructed. Disturbance to this area was severe during the 1941–42 bridge construction (see site 13JK267), significantly limiting the potential for intact archaeological remains existing from lumbering activities. Since that time the area once known as the Hemlock Yard has been redeveloped including the City of Bellevue sewage treatment plant, a fish farm pond and building, and recreational Mississippi River access. The area north of Mill Creek has been converted to a mobile home park. This long term commercial development of the U.S. 52 bridge replacement vicinity indicates that the archaeological resources in this area have been adversely affected for at least 153 years and perhaps as long as 172 years.

ARCHAEOLOGICAL ANALYSIS OF SITES 13JK264, 13JK266, 13JK267, AND 13JK271.

13JK264

Site 13JK264 represents a lime kiln likely dating to the mid-nineteenth century. The site was identified as a result of interviews with Ron Jones, Department of Natural Resources Park Ranger for Bellevue State Park. Several early discussions with Ron Jones during Fall 2003 field work focused on potential archaeological resources within the area of the U.S. 52 Bridge replacement location. The southwest portion of the survey area falls within the north unit of Bellevue State

Park. Additional discussions during the Spring 2004 field work led to information regarding a potential structure that stood in the park and the possibility of it being a lime kiln. Shannon Petersen, park manager, later contacted the author for an evaluation and an on site visit was arranged. Two site visits were conducted during the Spring 2004 field work. The first visit served as an identification and assessment visit conducted during the late afternoon on a rain day. During this visit the hypothesis of the structure being a lime kiln was confirmed. The second visit was again scheduled during a late afternoon session including a pedestrian survey, photographic documentation, and mapping all conducted near the end of project fieldwork.

The site exists west from the existing U.S. 52 Bridge, upstream along Mill Creek, and south from Mill Creek up a first order tributary. The site was examined by a crew of four using pedestrian survey transects walked at 2 m intervals in a checker-board pattern over an area roughly 3 times the area of the lime kiln. A GPS unit was used to record the location of a point on the top of the east wall. The only artifact noted during the pedestrian survey was a piece of rusted, corrugated sheet metal. It was located approximately 4 m (13.3 ft) northeast of the kiln front along the edge of the intermittent tributary. This artifact was not collected.

Figure 14. Photograph of site 13JK604. **A.**) Looking down on the lime kiln showing crew member for scale facing south, **B.**) View looking up at kiln showing crew members for scale, the partial north wall collapse, and the stoking door facing west south-west.

The lime kiln forms a slightly irregular circle and is constructed out of sizeable local limestone blocks. Figure 14A shows the kiln from above facing south with crew member Dan Horgen inside the structure for scale. The kiln's inside diameter measures 4.6 m north-south by 4.7 m east-west while the outside diameter measures 5.45 m north-south by 6.65 m east-west. The front width of the kiln measures 4.7 m at the base and 3.7 m at the top; it is 2.7 m high along the left or south wall and 2.5 m along the right or east wall. Average thickness of the limestone wall forming the chimney-like structure is 85 cm (2.8 ft) derived from a half dozen informally located measurements. Figure 14B shows the kiln from the front, facing northwest, and includes two crew members providing a visual scale for the building block size. The kiln was apparently built either immediately against or partially into the foot slope considering the current ground surface on the upslope side abuts against the kiln. There has been some deformation of the entire structure, likely due to down-ward pressure from the up-slope side. A partial collapse of the north wall can also be seen in both Figures 14A and B. Crew member Michelle Wienhold (right) is standing in the top center of the collapse in Figure 14B. Some blocky debris from this collapse is evident outside of the kiln. It is likely that additional blocks from the upper portion of the kiln, particularly from the hill slope or west side, have toppled into the interior based on the uneven and incomplete profile. Figure 14B shows the kiln from the hill slope above or facing east-southeast. Side slope colluvial materials have added to the fill, and along with the limestone block collapse, may have possibly sealed any interior contents remaining from the period of active use. This colluvium masks the limestone blocks of the kiln's wall which does form a complete circular structure. The stoking door is located at the base of the wall and measures 56 x 33 cm and extends into the kiln for 1.36 m. The view inside the stoking door shows a large limestone slab likely a result of upper wall collapse. Overall, the kiln appears to be in stable condition with no loose or deteriorating limestone blocks present. There are two main separations of limestone block noted along the right and left sides but again, no loose blocks were noted. Colluvial materials were still accumulating into the interior and along the exterior; however vegetation appears to be keeping any significant soil creep in check. This colluvium has likely added to the sediment in front of the kiln as well and may be capping the original activity surface

Neither the General Land Office plat map of 1838 nor the 1875 plat map indicates the existence of any structures or other features near the site location (Office of Secretary of State 1979[1838]; Andreas 1970, 100). No structures are indicated on the 1867, 1893, or 1913 plat maps (Thomas and Everts 1867, Northwest Publishing Company 1893, Excelsior Publishing 1913). The property owner in 1867 is identified as D. Potter, son of E. G. Potter, owner of the Jasper Flouring Mill. The owner in 1893 has changed hands to a J. McCarthy and is still listed as belonging to a Jerry McCarthy as of 1913. Since the kiln is located outside of the city limits it is not noted on any of the Sanborn fire insurance maps of Bellevue (Sanborn Map Company 1885, 1902, 1914, 1928, Sanborn–Perris Map company 1894). The 1952, 1957, 1964, and 1970 aerial photographs were all taken during the summer months when leaf canopy was at its height. Visibility of any kiln-sized ground features or structures was not possible. The 1940 aerial photo showed much less tree canopy however resolution was inadequate for defining a kiln-sized structure (USDA, ASCS 1940, 1952, 1957, 1964, 1970). Neither Shannon Petersen nor Ron Jones could provide any additional information regarding the structure.

Lime kilns are a common feature of the early settlement period through the Midwest. They were crucial in places where lime was used in stone masonry as well as for chinking of log homes. Lime was also used for plaster over lath to create a smooth interior wall surface of early frame-built homes. The kiln within the north unit of Bellevue State Park represents an early, small commercial operation used before the intensification of industrial lime production typified by the Hurstville or Joiner lime kilns near Maquoketa (Reesink 1979, Naumann 1990). The kiln at 13JK264 represents an early type, similar to the simplest type known as a draw kiln. Quarried limestone and cut timber would be dumped into the top of the kiln in alternating layers and stoked through a small opening above the kiln mouth located at the bottom of the kiln. The kiln mouth afforded air flow to create a draft adequate for proper combustion of both wood and limestone. The burnt lime would settle to the bottom and be removed through the kiln mouth. Kilns were typically constructed with a roof or shed covering the front, including the mouth, keeping lime and workers dry. Since the survey time spent during this project was limited and no subsurface testing was conducted, the specific construction details of this kiln remain unknown. The absence of archival information, past the plat map and aerial photograph reviews noted above, means that specific details of construction date, length of use, and possible owner association also await future study.

Site 13JK264 represents a lime kiln likely dating to the mid-nineteenth century. The site is composed of a structure build for the burning of limestone to produce calcium carbonate lime mortar used in a variety of nineteenth century building techniques. There is no indication of the kiln on any of the available plat maps nor is there indication on any of the aerial photographs due to heavy tree canopy. The only artifact noted during this investigation was a piece of corrugated sheet metal providing no reliable date range. Lime kilns are well known in Jackson County with an excellent example of late nineteenth century kilns at Hurstville, just north of Maquoketa. Intact kilns are not currently known from anywhere in the Bellevue vicinity even thought three were identified as operational as late as 1906 (Beyer and Williams 1907). It is not known whether this kiln was included in the 1906 report. The potential for intact, significant archaeological remains existing at 13JK264 is unknown since no subsurface testing was conducted during this survey. Further archival and archaeological research would likely yield information on this lime kiln and would be necessary in order to determine the sites eligibility for inclusion to the National Register of Historic Places. The sites existence within the north unit of Bellevue State Park offers an excellent situation for long-term preservation of this potentially unique archaeological site.

13JK266

Site 13JK266 represents an historic limestone quarry. The pedestrian survey noted that the general site area is characterized by three broad, roughly step-like levels extending from Mill Creek south to the state park entrance road and from site 13JK267 to the west site boundary of site 13JK266. Most of the east site boundary forms an almost vertical, 2–3 m (6.6–9.8 ft) high wall extending from the west boundary of 13JK267 to the first step-like level of the quarry. Unfortunately, the USGS 7.5’ series topographic map contour interval is too coarse to show this attribute on the site map. The surface inspection also recovered the three artifacts, three additional artifacts recorded but not collected, and identified three surface features including two road beds and a circular pit. The three artifacts were recovered from the surface of the site, two from the vicinity of a pit feature and one from the northeast corner of the site. A single earthenware plate or platter fragment was recovered from the northeast corner of the site, where the north quarry access road meets site 13JK267. It is not clear whether this artifact is related to the site or if it represents early road side trash disposal. A wagon axle clip was recovered from along the northeast edge of the pit feature and represents a type associated with heavy load wagons of the late nineteenth through early twentieth centuries (Steve Hanken, personal communication 2004). The third artifact recovered from the site surface is an automobile license plate. Only the left half of the rusty plate remains containing the numbers … 238 and below it the letters “WA” and the date “1941” embossed in its surface. Iowa plates issued in 1941 contained a six number code with two numbers, a dash, and the remaining four numbers then the word “IOWA” beneath followed by the year (Scheel 2002).

Two of the three additional artifacts not collected were located in the pit feature vicinity are probably site related. These artifacts include two lengths of braided steel cable. The larger diameter cable measured roughly 5 m (16.4 ft) by 5 cm (2 inches) and was located 11 m (36 ft) east of the pit feature. The smaller diameter cable measured roughly 3.5 m (11.5 ft) by 2.5 cm (1 inch) and was located roughly 8 m (26.3 ft) southeast of the pit just below the surface of the abandoned road. Braided steel cables are common equipment in heavy construction and mining and are most likely related to the quarrying operation. Due to their unwieldy size and limited research potential they were recorded but not collected. The third artifact was attached to the bedrock base of the pit feature and is discussed below.

A variety of other historic material was observed within the southeastern site area concentrated along the site boundaries. This material represent relatively modern road side trash disposal items ranging from days old fast food bags to soda and beer cans from the 1970s. None of this material was collected.

The three surface features encountered during this survey include two access roads, one each along the south and north site boundaries, and a pit feature. The south access road runs west and up slope along the southern edge of the site. The road travels roughly 150 m (492 ft) from the southeast corner of the site, where it connects with the site 13JK267, to its disappearance just below the current entrance road to the north unit of Bellevue State Park. A side spur runs off the road towards the north and the pit feature (Fig. 15A). A Test Trench was located at a point where excavation could provide construction details and yet not destabilize the feature once backfilled. After removing a roughly 10 cm veneer of very dark gray sandy silt overburden, a 20 cm pavement of very dark gray to dark grayish brown silty clay loam and crushed limestone matrix was encountered. The limestone gravel dominated the matrix, was of local origin, and relatively uniform in size. A very thin zone of large irregular gravel transitioning to bedrock was encountered beneath the crushed limestone pavement suggesting that the road was laid upon quarry exposed bedrock. The crushed limestone pavement tapered out about 35 cm from the southern, or up slope end of the trench. A faint boundary was noted from the end of the limestone sloping towards the south profile wall, below which the matrix increased in gravel content before stopping on bedrock. This deposit continues a short distance beneath the crushed limestone pavement indicating that the pavement was laid on top of this surface. The slope of both surrounding matrix and crushed limestone pavement in this end of the trench is indicative of a drainage ditch along the outside edge of the road. The road continued to the north for about another 50 cm where it abutted with a well defined edge that slopes away toward the rest of the site area. Tile probing of this portion of the road yielded a 10–20 cm penetration depth before the crushed limestone pavement stopped further progress of the probe. It was felt that excavating completely across the road would destabilize the feature and potentially lead to destructive erosion once backfilled. Consequently, excavation stopped short of trenching the entire road width. However, this additional 50 cm suggests that the road would have provided an approximate 2.5 m (8.2 ft) wide driving surface

Figure 15. Photograph of site 13JK266. **A.**) Photo of south quarry road with the Test Trench in the foreground, facing west. **B.**) Photo showing the north quarry road from the junction with 13JK627, facing west.

when it was in use. Significant effort had been expended on this portion of the road in order to facilitate heavy loads, good drainage and firm traction. This road appears to have served as an internal quarry access as well as facilitating access to the main north-south wagon road out of Bellevue, identified as site 13JK267, and to the access road to the north unit of Bellevue State Park.

The north access road runs west and up slope near the northern edge of the site (Fig. 15B). The road travels roughly 105 m (345 ft) from the northeast corner of the site, where it connects with 13JK267, to a point where it terminates near the west site boundary. No subsurface testing was conducted on the north access road considering the probable limited amount of duplicate information available. The north access road also appears to have served as an internal quarry access as well as facilitating access to the main north-south wagon road out of Bellevue identified as site 13JK267.

The pit feature is located in the southeast portion of the site and represents a remnant of the once active quarry operation (Fig. 16A). The pit feature measures 4.8 m north-south by 4 m east west, is roughly 1 m deep, and has a short side spur extending toward it from the south access road. Small to medium sized limestone blocks and slabs are scattered on the surface about the pit and a tree is growing from the west pit wall. The third non-collected artifact was identified at the base of the pit but was fastened to the bedrock and could not be removed. This artifact is composed of a rigid, semi-circular metal rod that is square in cross-section, with a welded "T" strap handle bolted to one end of another steel strap that is also bolted into the bedrock at the opposite end (Fig. 16B). The rigid semi-circular piece may form a complete circle, roughly 1 m in diameter, but excavation of the entire device was determined impractical. Figure 17 provides a close-up view of this artifact. The "T" handle has a carriage bolt opposite the nut and bolt assembly where a wooden handle likely once existed. The nut and bolt attachment through the handle and strap can be clearly seen. The opposite end appears to be modified to form a square box-end through which the semi-circular metal rod passes. As previously mentioned, the opposite end of the steel strap is then bolted to an anchor inside the semi-circle. This arrangement of T-handle and box-end suggests that the handle would allow the steel

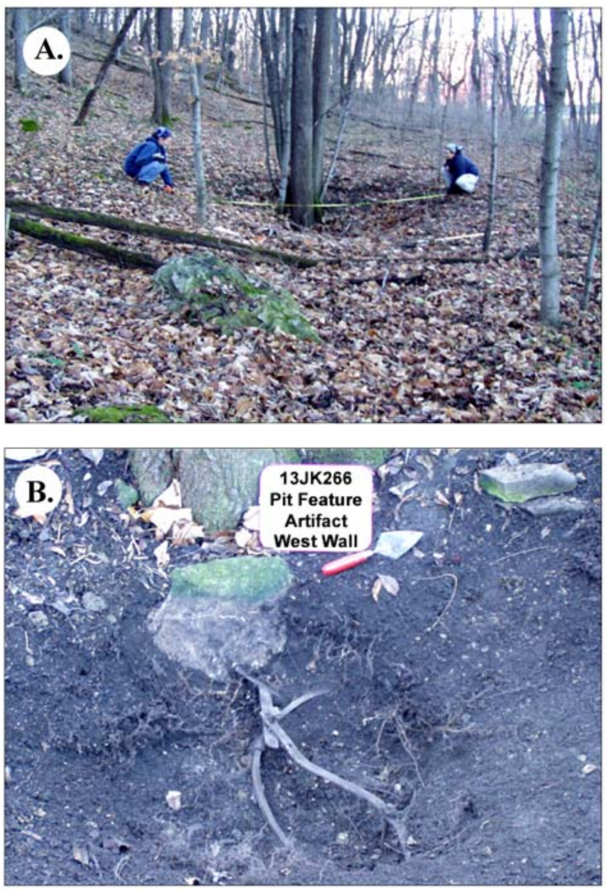

Figure 16. Photograph of site 13JK266. **A.**) Photo showing the pit feature with crew members for scale, facing west. **B.**) Photo showing close-up of artifact bolted to the bottom of the pit feature, facing west.

strap to be moved along the semi-circle, perhaps functioning more or less as a pivot. The entire device is consistent with heavy steel machined parts in use during the early decades of the twentieth century (Marlin Ingalls, personal communications 2004). Several additional sources on mining operations and technology were contacted for information regarding this artifact. None could provide a specific identification for the artifact. However, consensus opinion has the artifact associated with the lifting and moving, and possibly cutting, of limestone blocks. The mechanism may have been a part of a windlass or other lifting device commonly used in quarrying and mining allowing workers to load the limestone onto heavy wagons (indicated by the axel clip) and taken down the road to either road site 13JK267 or on to the railroad.

Figure 17. Close-up photograph of pit feature artifact.

First archival indication of quarrying at the south end of Bellevue is an 1880 newspaper reference indirectly associating Mahlon Hyler's lime kilns to the quarry. This quote (see Historical Background section) indicates that tools had been removed from the lower lime kiln area of the Dyas Hill or the south bluff of Bellevue. The gads and sledge hammer that are mentioned refer to quarrying tools. Webster defines a 'gad' as a chisel or pointed or wedge-shaped bar of iron or steel for breaking or loosing ore or rock in mining (Webster 1981:927). The continued production of lime at the Hyler kilns would have required an immediately available source of raw materials, both limestone and timber. The area of 13JK266 would have adequately furnished the limestone with timber harvesting expanding out along the bluffs. Two newspaper references to lime production indirectly suggesting quarrying activities include:

Charley Hyler has just finished burning a fresh kiln of lime. [Bellevue Leader 1888].

C. G. Hyler has just burned a kiln of lime. Call at saw mill office. [Bellevue Leader 1893].

The first specific mention of a quarry in this vicinity is also from the Bellevue Leader of 1897:

A man employed by Contractor Nagle at the south quarry was quite severely injured yesterday afternoon. He was at the top of the cliff engaged in prying loose a large section of boulder when he slipped and fell to the rocks below, a distance of fifteen or more feet, sustaining a number of cuts and bruises about the head and face, which required several stitches by Dr. Hunter.

The first professional notation of quarrying activities at 13JK266 comes from the 1905 Geological Survey of Iowa. Lime was noted as an important Jackson County product with the kilns of Charles Hyler, just south of Bellevue, recognized as producing 1500 to 1700 barrels annually. The raw material is identified as coming from the upper transition beds of the Maquoketa Formation and from the overlying Niagara Formation (Savage 1906:616). Lime production is also noted in the 1906 Geological Survey of Iowa. An inventory of Iowa Limestone quarries was conducted and included in this volume listing four active quarries in the Bellevue vicinity. Second on the list is the Charles G. Hyler quarry, mining impure limestone and yellow dolomite, quarry equipment is listed as hand work, and the product is noted as lime (Beyer and Williams 1907:572). The last encountered reference regarding 13JK266 again came from the Bellevue Leader of 1913:

> *Mr. Cossoon, the government contractor who is opening a stone quarry in the south bluff, fired his first shot Friday, and the result was a stone the size of a man's head took a skyrocket bound in the air and came down plump in the wagon bridge at the foot of Front Street, going through the floor. What would have happened if someone had been passing that spot at that time? The shot was fired with high explosives but a less powerful agency will be used hereafter which will eliminate future danger.*

Neither the General Land Office plat map of 1838 nor the 1875 plat map indicates the existence of any structures or other features near the site location (Office of Secretary of State 1979[1838]; Andreas 1970, 100). The association of this quarry with the Hyler lime kilns is based on the 1867 and 1893 plat maps that indicates Hyler owned the area containing both (Thomas and Everts 1867, Northwest Publishing Company 1893. The 1913 plat indicates that this property belonged to R.W. Dyas (Excelsior Publishing 1913). This may coincide with the change in a locally operated quarry to the government contracted operator noted in the quote above. Since the quarry is located outside of the city limits it is not noted on any of the Sanborn fire insurance maps of Bellevue (Sanborn Map Company 1885, 1902, 1914, 1928, Sanborn–Perris Map company 1894). The 1941 plan sheets for the currently existing U.S. 52 bridge shows nothing in the vicinity of 13JK266 but does show an active quarry roughly 335 m (1,100 ft) south between the bluff face and roadway (Iowa State Highway Commission 1941). None of the available aerial photographs show any indication of quarrying activities in this vicinity. They were all taken during the summer months when leaf canopy was at its height making visibility of any ground disturbance features impossible (USDA, ASCS 1940, 1952, 1957, 1964, 1970).

Site 13JK266 represents an historic limestone quarry. This operation may originally be associated with the lime kilns of Mahlon and Charles Hyler dating from the late 1800s to early 1900s. Building stone production may also have been an early function of 13JK266. The site continued to be used as a building stone and gravel quarry into the mid-1900s. The site is composed of three roughly step-like levels and three surface features. The three surface features include north and south access roads and a pit feature. All three are associated with quarrying activities. The quarry is first noted through an indirect reference to lime kiln production in 1880 and is later identified as a quarry primarily through print sources. A pair of professional geologic sources records the production of lime in the site vicinity. Newspaper references continue into the early 1900s. The recovery of a 1941 Iowa license plate coupled with the bridge replacement work conducted in that year suggests that the quarry was abandoned at or slightly before that time. The site appears to have suffered little from historic impacts following its abandonment as a quarry, with both roads being intact. The presence of two lengths of braided steel cable associated with quarrying activities lying near the pit feature supports the idea of the site having been little changed since its abandonment. However, this is not the only quarry in Bellevue with north and west quarries noted in the historic literature (Wacker 2002). The western quarry provided rock during the 1930s construction of Lock and Dam No. 12 and is better documented than 13JK266.

Intensive pedestrian survey yielded no other artifacts associated with the active period of quarrying. The three recovered artifacts date from the late nineteenth through the mid twentieth century. The two lengths of braided steel cable and pit feature artifact are consistent with early twentieth century quarrying equipment. However, revised project plans indicate that the originally proposed bridge replacement impacts will occur to the east side of the existing U.S. 52 bridge and will not affect 13JK266.

13JK267

Site 13JK267 represents a portion of the original north-south wagon road out of Bellevue, which later became known as U.S. Highway 52. The presence of cement-filled, cast-iron bridge footings were noted along the south bank of Mill Creek representing supports for the previous high truss bridge spanning Mill Creek (Figs. 18A and B). A Test Trench, a 50 cm by 4 m unit, was located well south of the creek at a point along the road broad enough to excavate the majority of the bed including the eastern edge. Total average width of the road bed in the trench vicinity was roughly 4.5 m (14.8 ft). Figure 19A shows the road leading towards the non-extant bridge and Bellevue while Figure 19B shows the road leading south with the Test Trench and crew member Dan Horgen for scale in the foreground. After removing a roughly 10 cm veneer of very dark gray silty loam overburden, an intentionally laid series of limestone slabs were encountered within a very dark gray silty clay quickly transitioning to a yellowish brown gravel and silty clay matrix. These slabs were varying sized pieces of locally derived limestone, possibly from quarry activities at 13JK266. The western half of the bed was composed of limestone slabs laid horizontally within a gravel and silty clay matrix. The slabs covered the approximate 3.3 m (10.8 ft) center portion of the road with smaller irregular cobbles and gravel filling the 0.6 m (2 ft) ditch-like east edge. This center portion was slight convex so that water would be shed towards the edges. The trench did not extend far enough to expose the west ditch but it could be clearly seen as an approximate 0.6 m (2 ft) wide swale extending from the end of the trench toward the bedrock wall. Orientation of the slabs begins to deform at the midpoint of the roadbed and trench toward the east, tipping slightly on edge and at a diagonal slant to the surface. The west edge is confined by bedrock while the eastern edge is not only open but slopes gently down and away from the roadbed. This leaves no retaining structure to prevent alteration of the original slab alignment. This deformation appears to have been caused by heavy loads traversing the area of the trench and could have occurred either during active use of 13JK267 or after abandonment, possibly during construction of the 1941–42 bridge. Substantial effort had been expended on this portion of the roadbed in order to facilitate heavy loads, better drainage, and firmer traction. The approximate 3.3 m or 11 ft center pavement would be typical of early roads, and the total approximate width of 4 m or 13 ft is consistent with the 15.88 ft bridge that spanned the creek (Marlin Ingalls, personal communication 2004).

Figure 18. Photographs of the cast-iron bridge footings located at the north end of site 13JK267. **A.**) Photo showing bridge footings from the north Mill Creek bank, facing south. **B.**) Photo a showing close-up of the cement-filled, riveted, cast-iron bridge footings along the south bank of Mill Creek.

Early road development in any region often begins with trails and so is the case with 13JK267. The early history of a Native American trail being the precursor to the current U.S. 52 was outlined in the Early Transportation section of this report. The General Land Office plat map of 1838 shows the earliest representation of the road as a single line running parallel to the Mississippi River both south and north of Bellevue (Fig. 1). There is no indication on either the GLO map or in the notes as to how Mill Creek was crossed. The 1867 plat shows the wagon road as a well defined route closely approximating the 1838 course (Thomas and Everts 1867). This map is the first to indicate that a bridge spanning Mill Creek exists along the route. The railroad, built in 1871, is shown on the 1875 map running along side of the wagon road while the 1893 plat maps shows increasing development throughout the area (Northwest Publishing 1893; Andreas 1970:100). The 1893 map is the last to show any structures. By the 1913 plat the route is identified as having an "improved road surface" placing it amongst the best roads in the county (Excelsior Printing 1913). The road is never identified by name on any of these early plat maps. The early histories have no consistent reference either, calling it part of the "river road" or the road between Bellevue and points north or south of town. As automobiles became more commonplace on Iowa roads during the early 1900s, maps with road names became more important and the 1923 Rand McNally map identified this road as part of Route 1 running the length of eastern Iowa along the Mississippi River (Rand McNally 1923). During the early 1930s as the Primary Roads system developed, Route 1 was changed to U.S. 52/67 (American Lithographing and Printing 1938:49). As interstate construction began to develop out of late 1940s, primary and secondary roads also received improvements including pavement completion of U.S. 52/67 for the entire north-south length of Jackson County. By 1967 the U.S. 67 reference was dropped and this route became known solely as U.S. 52 (Wordiq.com, 2004).

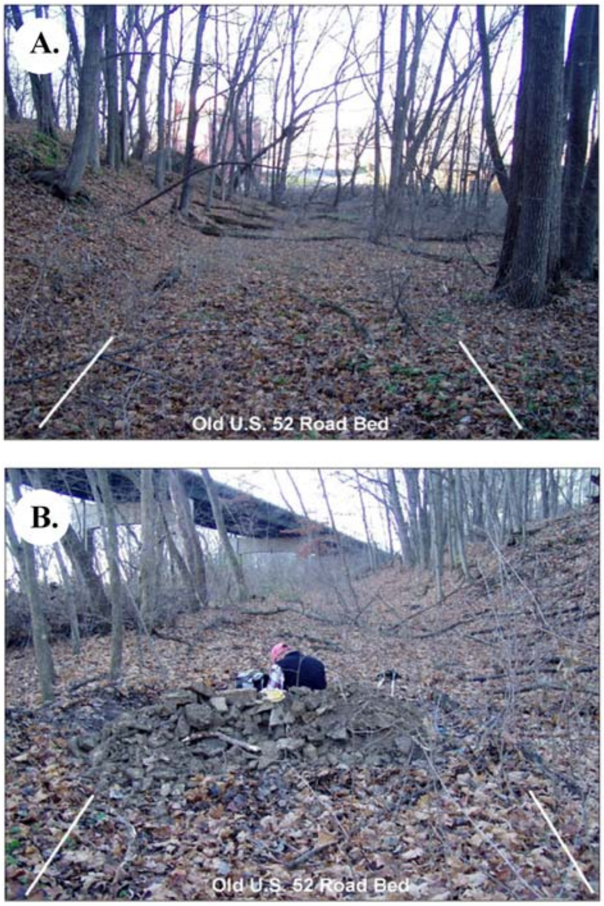

Figure 19. Photographs of site 13JK267. **A.**) Photo of Old U.S. 52 road bed from the Test Trench, facing north towards Bellevue. **B.**) Photo of Old U.S. 52 road bed showing Trench 1 and crew member for scale in foreground, facing south.

The earliest reference to the road bridge spanning Mill Creek suggests that a toll bridge once existed at this location, built prior to the 1871 railroad construction (Wacker 2002). The presence of a road bridge is consistent with the 1867 plat map (Jackson County Historical and Genealogical Society 1989:54). This bridge was destroyed during the Mississippi River flood of 1880. Both bridges shown in Figure 4 may be the pre-1880 bridge. The southern portion of Bellevue is noted as being inundated with heavy damage to the Dorchester & Hughey Lumber Yard. An historic account notes that bridges over both Mill and Duck Creeks were wiped out (Parker 1942:90–91). This replacement road bridge was again destroyed, along with the railroad bridge, during the Mill Creek flooding of 1896 when heavy rains washed out the mill dams on Mill Creek, scouring out the lower reaches of the creek (Bellevue Herald-Leader 1983:53). The Dorchester & Hughey Lumber Company was again hard hit while the Jasper Flouring Mill survived intact. The bridges spanning Mill Creek were rebuilt and are likely the one pictured in the historic photograph featured earlier in Figure 5. A single limestone footing of the original railroad bridge still stands as a testament to the power of this flood (Fig. 20). The current railroad bridge represents this post-1896 reconstruction. The extant cement-filled cast-iron formed footings shown in Figure 18 likely date to this third (?) reconstruction and would have supported the steel high truss bridge that was subsequently replaced by the 1941-42 concrete I-beam bridge. Cement-filled cast-iron footings were a typical late nineteenth and early twentieth century bridge construction element (Marlin Ingalls, personal communication 2004).

Available aerial photographs provided some detail on landscape modification in the U.S. 52 bridge replacement vicinity. The 1940 aerial shows the presence of U.S. 52 as a gravel road. The Mill Creek crossing can be seen at the same location as the previously noted bridge in the Historical Background section. The railroad tracks and bridge can also be seen. Resolution in the 1940 aerial is inadequate to see the actual bridge structure for either U.S. 52 or the railroad. Photographs on file at the Jackson County Historical Society yielded information on the Mill Creek bridge replacement. From 1941–1942, U.S. 52 was realigned and the existing high truss bridge was removed and replaced with the currently extant structure. Figures 21A and B show the construction facing south and north respectively. The roadway and bridge realignment required removal of several buildings located north of Mill Creek and east of the current alignment. The 1952 aerial shows a completed U.S. 52 bridge and hard surface pavement along the current

Figure 20. Photographs railroad bridge footings left from the 1896 flood beneath extant bridge.

alignment. The previous bridge spanning Mill Creek has been removed. The current alignment cut into the west bluff in the north unit of Bellevue State Park. Site 13JK267 running east of the new alignment is still visible but tree cover has obscured the portion crossing under and to the west of the new bridge. There appear to be several structures located north of Mill Creek and east of the new bridge alignment but resolution is inadequate for further detail. The 1957 aerial shows the entire length of site 13JK267. Again, resolution is inadequate for detailing the activity north of Mill Creek and east of the new bridge. The 1964 aerial shows site 13JK267 running east of the current alignment. Tree canopy obscures any view of the portion west of the current bridge. U.S. 52 appears as a poorly defined light swath south of the bridge suggesting that some type of road work, perhaps resurfacing, was underway during 1964. The aerial also shows that development of the Bellevue sewage treatment plant was underway in the area south of Mill Creek and east of the current alignment. The 1970 aerial shows the entire length of site 13JK267. The roadwork shown in 1964 has been completed leaving a wide shoulder and pull-off along the east side of the highway south of the current bridge. The Bellevue sewage treatment plant is clearly visible south of Mill Creek and east of the current bridge. The 1999 aerial shows only a short portion of the southern end and terminus of 13JK267. This visible portion is actually a shadow indicating the vegetation gap made by the site. The only visible portion of the actual site is where 13JK267 meets the right-of-way of the current U.S. 52 alignment.

Site 13JK267 represents a cut-off portion of the original wagon road traveling south from Bellevue. The site is composed of a road bed constructed of locally derived limestone slabs and gravel. The road originally existed as a trail noted by the earliest Euro-American explorers in the Bellevue vicinity. The route appears on the 1838 GLO plat as a trail and on every available plat map after as a continually improving road. The earliest appearance of the bridge along the route spanning Mill Creek appears on the 1867 plat and was originally noted in county histories as a toll bridge. It was washed out twice by flooding of the Mississippi River and Mill Creek, in 1880 and 1896 respectively, and replaced both times. The last bridge was removed in 1941 and replaced with the existing structure. It was also at this time that 13JK267 was abandoned as U.S. 52 was realigned to its present course. As a short, cut-off abandoned segment, the road retains little historic integrity.

13JK271

This multicomponent site is located on a relatively level flood plain surface west of the railroad tracks south of Mill Creek immediately north of the Bellevue Sewage Treatment Plant. The site was identified as a result of subsurface testing with recovered materials including both prehistoric and historic artifacts.

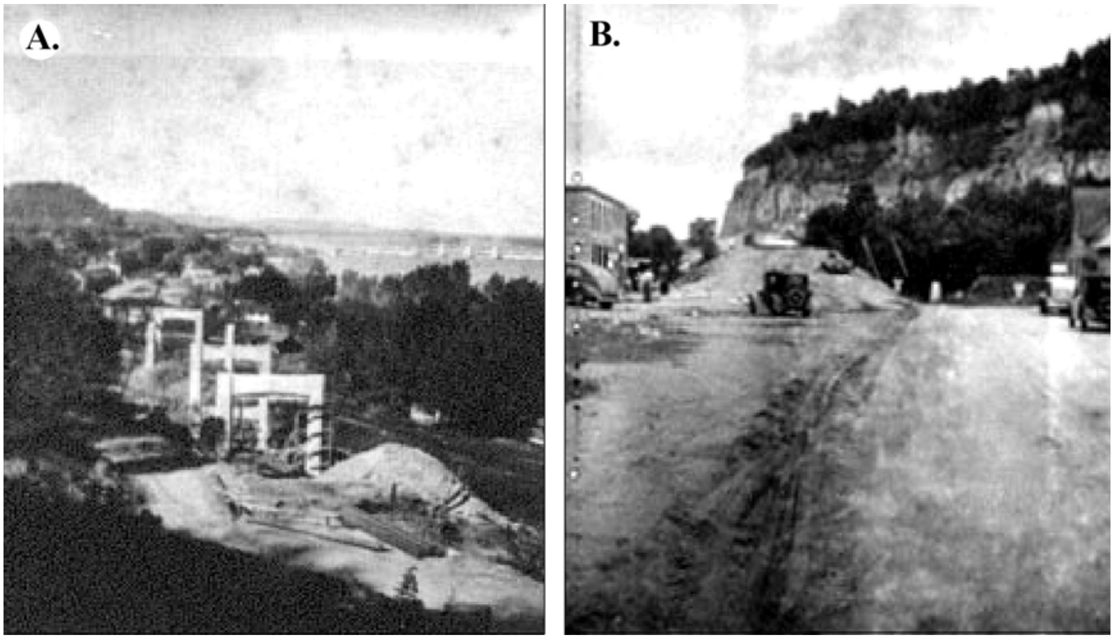

Figure 21. Historic photographs of the 1941-1942 U.S. bridge replacement (Jackson County Historical Society, 2004). **A.**) Photo facing north showing concrete bridge footings. **B.**) Photo facing south showing creation of the elevated roadway surface.

The prehistoric artifacts represents 59 percent (n=13) of the total recovered artifact assemblage. Five waste flakes, four pieces of shatter, one core fragment and one piece of fire cracked rock were recovered. Site activities, based on the artifact assemblage, can be inferred to include but are not limited to lithic tool manufacture and/or maintenance and the use of fire. No cultural affiliation can be assigned to the site due to the absence of culturally diagnostic materials. The site possibly represents a very short term or single episode lithic reduction station. The historic artifact assemblage represents 41 percent (N=9) of the total recovered artifact assemblage. All of the artifacts, excluding the modern plastic bead, represent typical historic occupation refuse dating from the mid-nineteenth through mid-twentieth centuries.

The beginning of Euro-American settlement in the Bellevue vicinity began at the mouth of Mill Creek. William and John Dyas, the first recorded white explorers, literally identify the fact that they passed through the immediate site vicinity. However, neither the General Land Office plat map of 1838 nor the 1875 plat map indicates the existence of any structures or other features near the site location (Office of Secretary of State 1979 [1838]; Andreas 1970, 100). No structures are indicated on the 1867, 1893, or 1913 plat maps (Thomas and Everts 1867, Northwest Publishing Company 1893, Excelsior Publishing 1913). The property owner in 1867 and 1893 is identified as Mahlon G. Hyler. By 1913 ownership had changed to R. W. Dyas. Since the site area is located outside of the city limits it is not noted on any of the Sanborn fire insurance maps of Bellevue with the exception of the 1902 map (Sanborn Map Company 1885, 1902, 1914, 1928, Sanborn-Perris Map company 1894). This map shows the expansion of the Dorchester & Hughey lumber operation by the creation of the Hemlock yard. This expansion took place sometime after 1894 and was abandoned sometime before the 1914 Sanborn map. The 1940 bridge construction plans indicate the presence of a fish hatchery building and another smaller structure located just northwest of the hatchery. Although the smaller structure's association is not identified it may likely be related to the hatchery. These plans also show the presence of an access road that leaves U.S. 52 at the bridge and heads east, paralleling Mill Creek and crossing over the railroad tracks to the hatchery. This road is visible in the historic Mill Creek bridge photograph featured in Figure 5.

The 1940 aerial photo indicates the presence of the fish hatchery and the smaller structure to the northwest. The access road paralleling Mill Creek from U.S. 52 is clearly visible. The 1940 aerial was taken one year prior to the construction of the existing U.S. 52 bridge. The 1952 aerial shows the completed existing U.S. 52 bridge and a considerable amount of vegetation clearing in the site vicinity. The fish hatchery and smaller structure, fish pond, old U.S. 52 access road, and the gravel road and boat landing are clearly visible. The 1957 aerial shows the same features as in the two previous aerials with the addition of an access road immediately along the north side of the fish hatchery running toward the Mississippi River. The 1964 aerial shows the first developments of the sewage treatment facility to the southeast of the fish hatchery and pond. The smaller structure northwest of the hatchery appears to have been removed. The access road does not appear on the east side of the railroad track suggesting that it too has been covered or removed. The gravel road and boat landing is the same but the access road immediately along the north side of the hatchery is gone. The 1970 aerial clearly shows the hatchery, pond, gravel road and boat landing, and sewage treatment facility. The treatment facility is more developed than eight years earlier. The smaller structure is gone and in its place is a gravel turn around. The access road no longer exists. The 1999 aerial shows the same features as previously noted with the addition of more development at the sewage treatment plant (USDA, ASCS 1940, 1952, 1957, 1964, 1970; USDI, USGS 1999c).

Site 13JK271 represents a multicomponent site composed of prehistoric and historic materials recovered from the subsurface of three shovel tests. The prehistoric component includes 13 artifacts and possibly represents a very short term or single episode lithic reduction station of unknown cultural affiliation. The historic component is composed of 9 artifacts that are related to the historic activities occurring in the site vicinity beginning in the mid 1800s and continuing up to the present day. The site’s physical integrity has been severely compromised by at least 168 years of historic activities.

SUMMARY

The southeast portion of Bellevue has experienced a long and rather complex history of development. The Mill Creek vicinity has served as a focal point for this deep record of human activities over the millennium. The archaeology of Bellevue and vicinity spans the entire 14,000 year expanse of recognized human occupation of North America dating from Paleo-Indian hunters and gathers, to historically known Native American groups, to the earliest historic Euro-American settlers in the state of Iowa. The sites located to date in the Mill Creek vicinity include a very early form of lime kiln likely used to serve the building need of the earliest historic inhabitants of Bellevue, an historic limestone quarry, and a portion of the early wagon road running south from Bellevue. Although historic activities have compromised the prehistoric landscape, there remains considerable potential for future research as suggested by the prehistoric remains at 13JK271. Bellevue is a rich local for investigating both prehistoric and historic human activities. With little archaeological research focusing on either units of Bellevue State Park, there remains a great potential for recovering significant data on both historic and prehistoric periods within the two units. This potential source of future research coupled with ongoing cultural resource management work will afford a framework for the continued exploration of the depth and breadth of human activities and settlements in the Bellevue vicinity.

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VEGETATION OF BELLEVUE STATE PARK

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INTRODUCTION

Bellevue State Park is located along bluffs and uplands bordering the Mississippi River on the eastern edge of the Southern Iowa Drift Plain. Nearly 800 acres in size, the park is divided into two separate parcels located a mile apart: the northern Nelson Unit and the southern Dyas Unit. High cliffs of dolomite overlooking the Mississippi River and the town of Bellevue are prominent along the eastern part of the Nelson Unit, but most of the park consists of broad, level, loess-capped ridges flanked by steep ravines. The park is extensively wooded except for mowed lawns maintained as picnic areas and campgrounds, prairie plantings and cropfields managed for wildlife habitat on ridges in the far western part of the Nelson Unit, and a few small openings along bluffs and streams. Dramatic changes in vegetation of the park have occurred over the past 170 years, revealed by comparison of General Land Office (GLO) plat maps from 1837, early aerial photographs from ~1938, and modern aerial photographs (2007). Field observations in the summer of 2008 provide descriptions of vegetation that presently occupies areas with contrasting histories of clearing, cropping, grazing, and regrowth.

VEGETATION IN 1837

In 1837, land surveyors for the General Land Office (GLO) prepared coarse-scale maps of the vegetation of the civil townships now aggregated as Jackson County, identifying three prevalent types: grassland (“prairie”), forest (“timber” and “grove”), and savanna (“scattering trees”, “barrens”, and a complex of “timber and scattering trees”) (Fig. 1). Small areas of the county were mapped as various kinds of wetland (“slough”, “marsh”, “bayou”, etc.) and as cropland (“fields”). Bellevue State Park straddles two townships that were mapped by different surveyors, one classifying the dominant vegetation as “timber”, the other as “scattering trees” (Fig. 2); the abrupt line between these two types extending through the western part of the Nelson Unit is undoubtedly an artifact of differences in terminology between the surveyors in describing a continuous vegetation of open forest. The Nelson Unit includes some areas that were mapped as fields in 1837; the Dyas Unit was entirely timber. Prairie was not mapped in either unit.

VEGETATION CIRCA 1938

The first aerial photographs of the park were taken circa 1938, approximately 100 years after the GLO maps were drawn (Fig. 3). In both the Nelson and Dyas units, forests were mainly confined to ravines and bluffs. Although trees obviously dominated the canopy of the forests, the crowns of individual trees are distinguishable in the photographs, indicating a discontinuous canopy typical of recently grazed woodlands. In addition to the forests, areas of widely scattered trees occurred on some ridgetops and on some slopes, likely representing sparsely wooded pastures. Open fields predominated on high ridges, probably indicating open pasture or even cropfields.

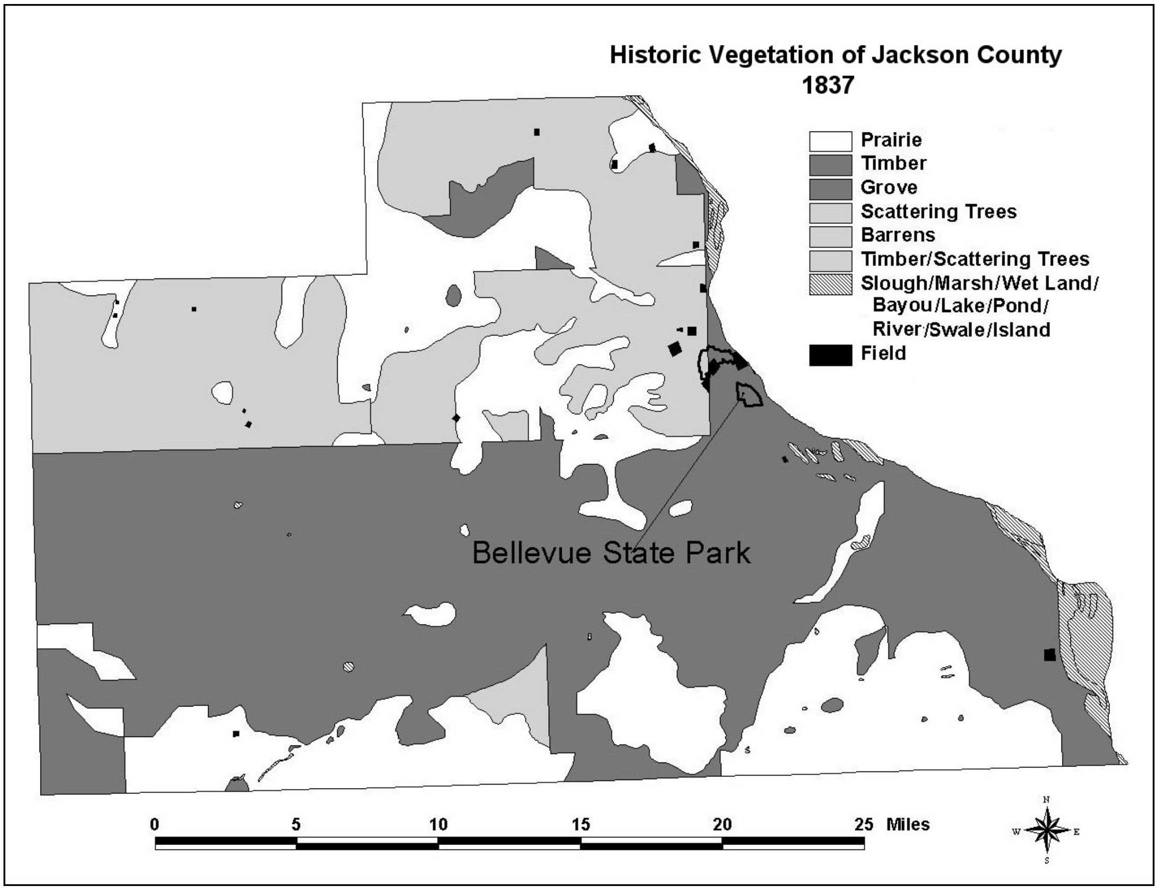

Figure 1. Vegetation of Jackson County in 1837 based on General Land Office (GLO) survey plats (Anderson 1996).

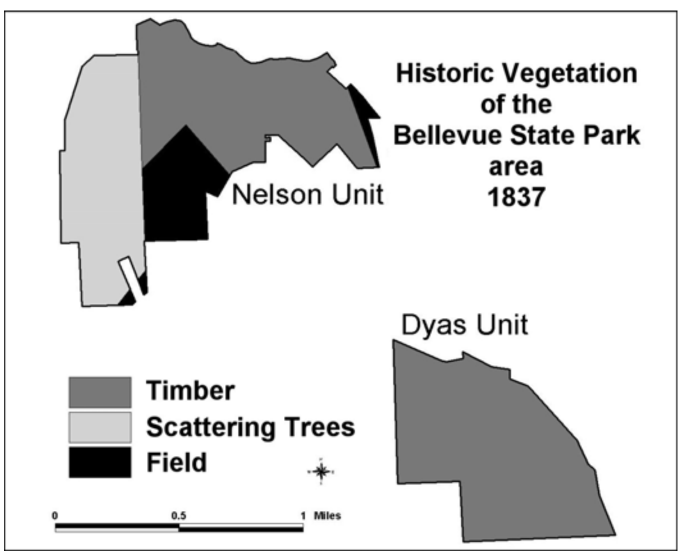

Figure 2. Vegetation of Bellevue State Park (Nelson and Dyas units) based on General Land Office (GLO) survey plats (Anderson 1996).

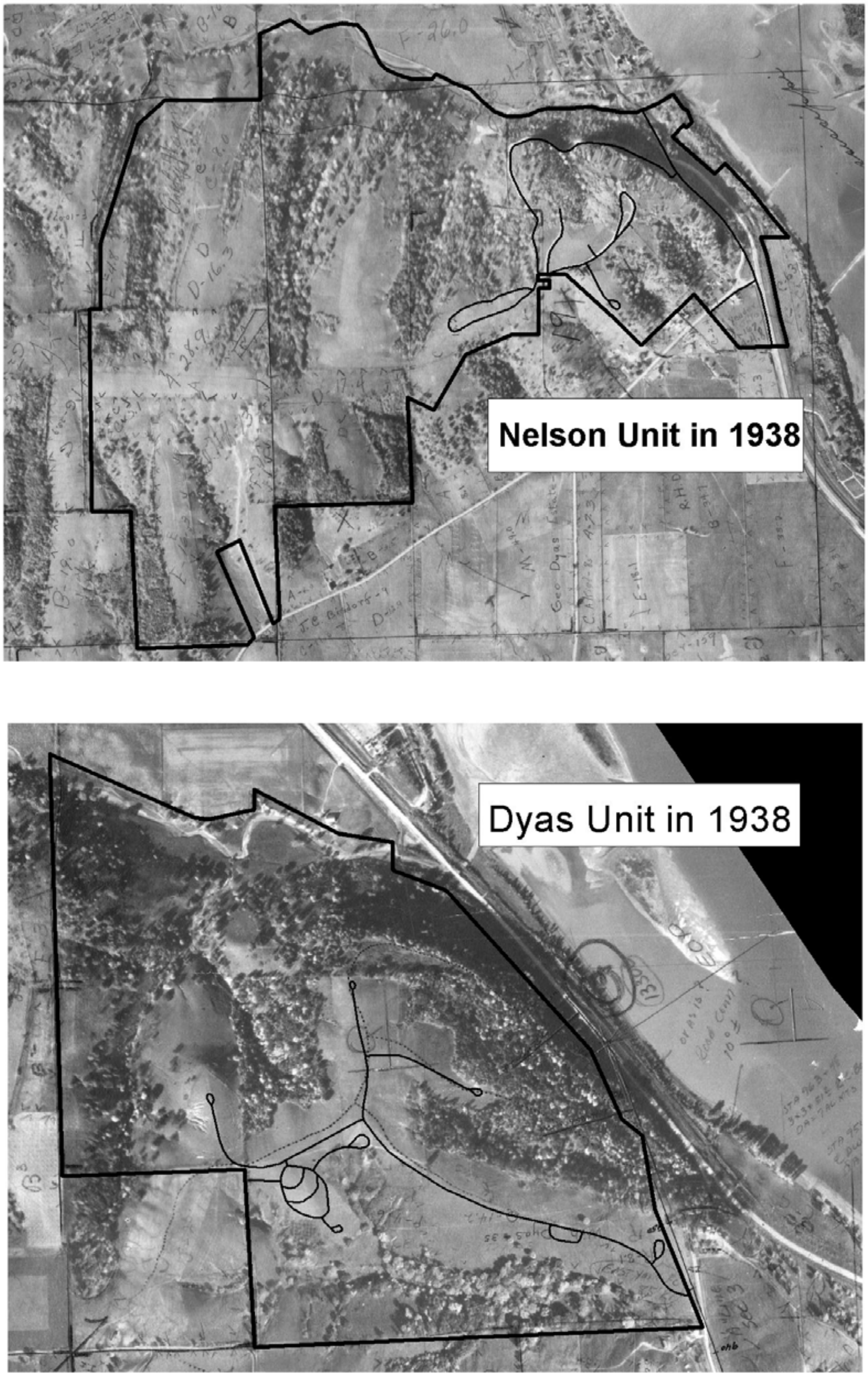

Figure 3. 1938 aerial photographs of a) Nelson Unit and b) Dyas Unit.

VEGETATION IN 2007

Land parcels now comprising Bellevue State Park were acquired between 1925 and 1975. The eastern part of the Nelson Unit containing the cliffs, Mississippi River overlooks, and picnic areas was acquired by 1929; the entire Dyas Unit was acquired in 1966. As parcels were acquired for the park, grazing was discontinued. Cropping was also discontinued except for portions of the wildlife management area in the far western part of the Nelson Unit (whose parcels were acquired in 1996 and 1999 as a buffer to the park open to hunting). By 2007, grazing and cropping had been terminated from most of the park for up to 82 years. Without suppression from grazing or tillage, trees invaded and multiplied, creating dense forests on land previously occupied by woodland, scattered trees, or open fields. To illustrate the expansion of forest in the park between 1938 and 2007, forests and areas of scattered trees evident on the 1938 aerial photographs were digitized and highlighted with transparent cross-hatching (Figs. 4a and 5a). Overlaying these digitized templates onto aerial photographs from 2007 (Figs. 4b and 5b) shows a tremendous increase in forested cover over a 70-year time period. In addition to expanding in area, trees also increased in density to form a continuous canopy (regardless of their initial density), eliminating the visual distinction on the 2007 aerial photograph between stands of forest and of scattered trees so evident in 1938.

Areas of land that were open fields in 1938 but forested in 2007 are classified as “new forest” (originating on open fields since 1938 and thus up to 70 years old) while areas that consisted of open forest or of scattered trees in 1938 that thickened in density are termed “old forest” (developing from pre-existing stands that consisted of mature trees in 1938 and thus now well over 70 years old) (Fig. 6). Forest now covers 80% of the park; nearly 70% of the forest is “old” with the remainder being “new”. Once widespread during the agricultural era preceding establishment of the park, open fields have disappeared from the Nelson Unit except in the wildlife management area (in which ridgetops are maintained in a treeless condition with prescribed burning of prairie plantings and cultivation of cropfields as wildlife food plots); only a single small open field remains in a bottomland in the northwest corner of the Dyas Unit.

The species composition of old forests and new forests was determined with field visits to the park in August 2008. In old forests, the dominant tree species are large individuals (up to 2.5’ diameter) of white oak (Quercus alba), red oak (Q. borealis), sugar maple (Acer saccharum), and basswood (Tilia americana). In contrast, the canopy of new forests is a diverse, variable mixture of several pioneer tree species, including elm (Ulmus americana and U. rubra), walnut (Juglans nigra), bitternut hickory (Carya cordiformis), and eastern red cedar (Juniperus virginiana), often accompanied by other species of lesser abundance: black locust (Robinia pseudoacacia), honeylocust (Gleditsia triacanthos), bigtooth aspen (Populus grandidendata), mulberry (Morus rubra), green ash (Fraxinus pennsylvanica), and northern pin oak (Quercus ellipsoidalis).

Shrubs are common in the understory of new forests, often forming thickets, but are relatively uncommon in the old forests, which typically have open understories (except in old forests developing from scattered trees, in which shrubs are still prevalent). Dominant shrub species in the new forests include prickly ash (Xanthoxylem americanum), blackberry (Rubus occidentalis), Amur honeysuckle (Lonicera maackii), multiflora rose (Rosa multiflora), Japanese barberry (Berberis thunbergii), and Missouri gooseberry (Ribes missouriensis). Several of these species also occur in the old forests (particularly honeysuckle, barberry, and gooseberry), but at a much reduced level of abundance.

Despite strong differences in the species composition of their tree canopies and shrub understories, old and new forests do not differ greatly in the composition of their dominant herbaceous undergrowth. In both types, the most frequent species are honewort (Cryptotaenia canadensis), lopseed (Phryma leptostachya), hog peanut (Amphicarpa bracteata), clearweed (Pilea

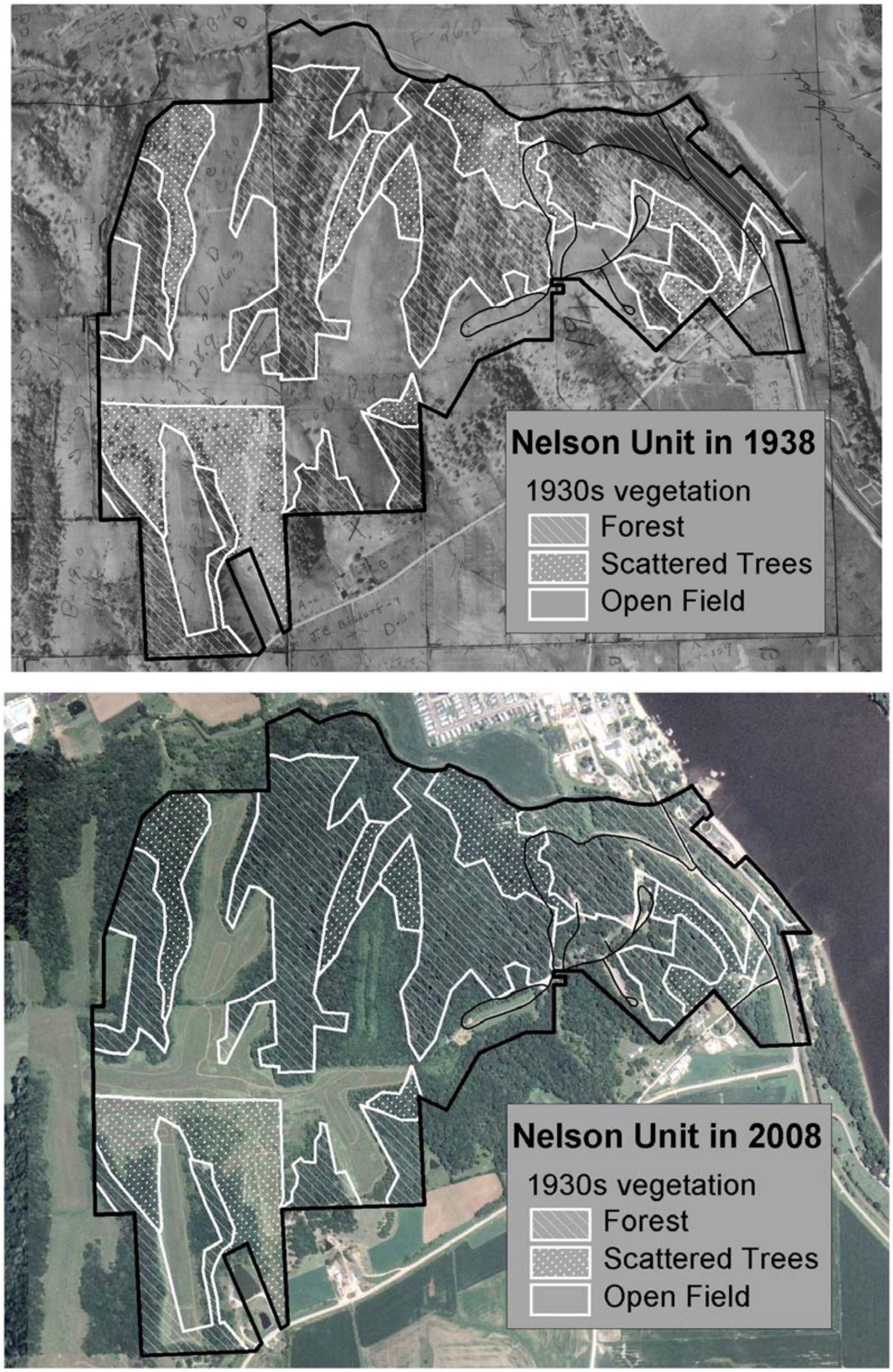

Figure 4. Vegetation of Nelson Unit: a) 1938 aerial photograph with areas of forest and scattered trees highlighted with cross-hatching, b) 2007 aerial photograph overlaid with cross-hatched areas of 1938 forest and scattered trees.

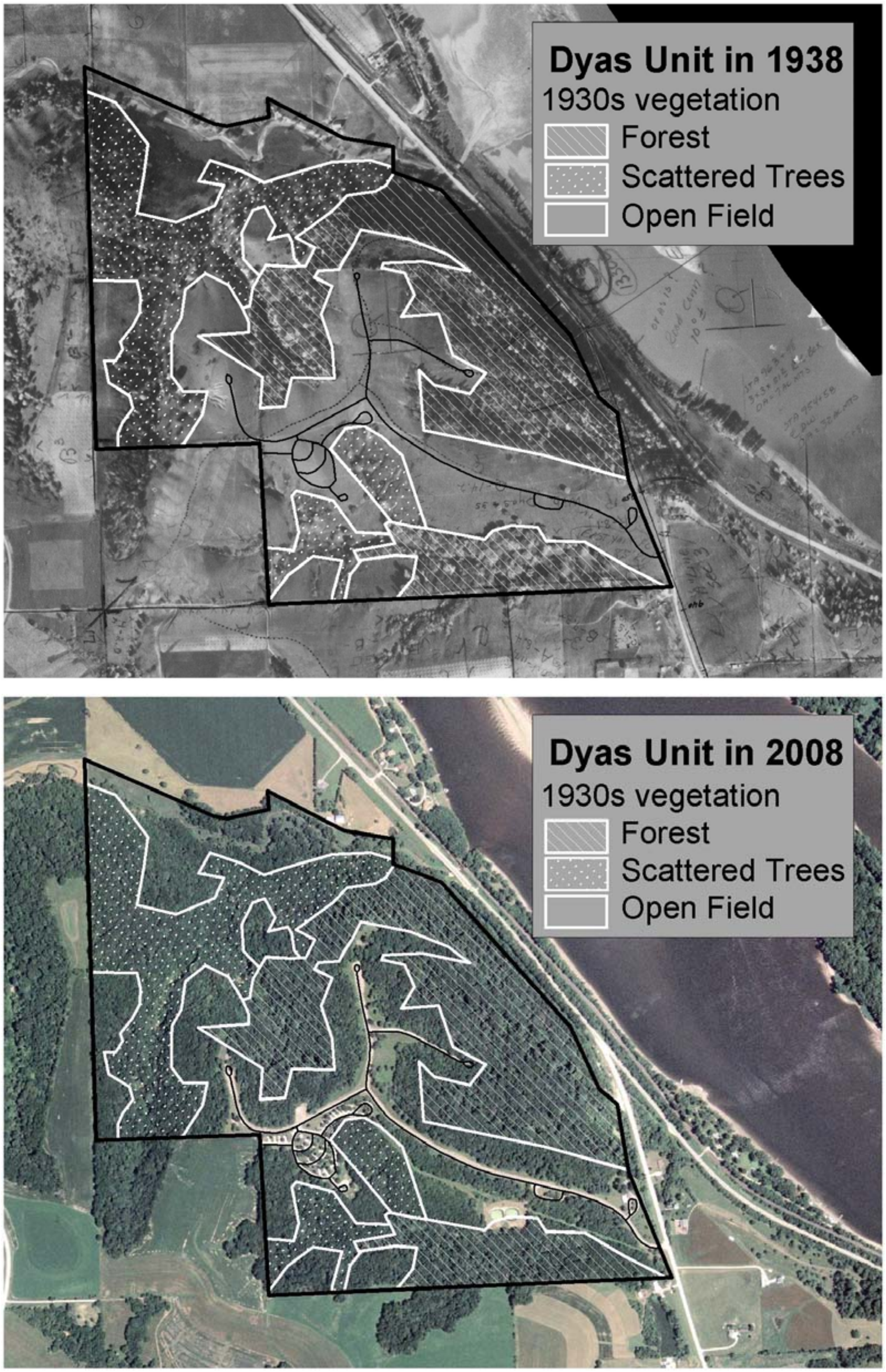

Figure 5. Vegetation of Dyas Unit: a) 1938 aerial photograph with areas of forest and scattered trees highlighted with cross-hatching, b) 2007 aerial photograph overlaid with cross-hatched areas of 1938 forest and scattered trees.

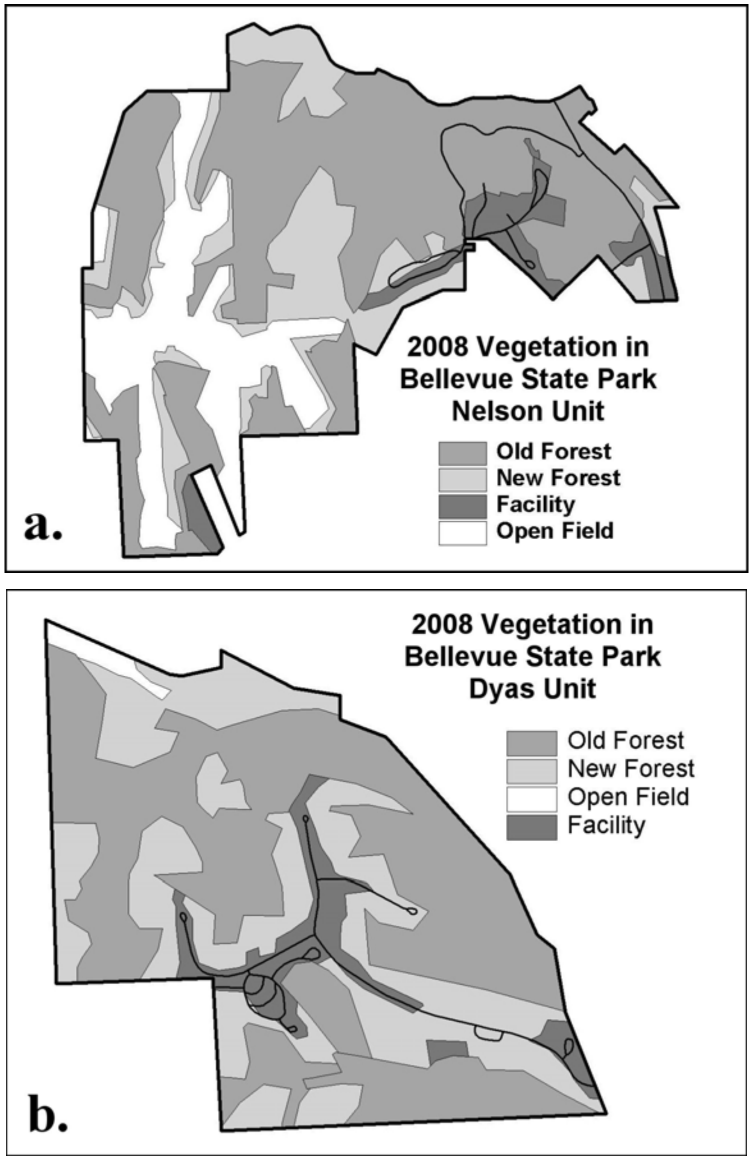

Figure 6. Maps of vegetation of Bellevue State Park in 2008: **a.**) Nelson Unit, **b.**) Dyas Unit.

pumila), Jack-in-the-pulpit (Arisaema triphyllum), jumpseed (Tovara virginianum), white snakeroot (Eupatorium rugosum), black snakeroot (Sanicula spp.), and garlic mustard (Alliaria petiolata). All of these except garlic mustard are native forest-dwelling species, but are especially abundant in forests recovering from past heavy grazing. Their high abundance in both the old and new forests indicates that both types in Bellevue State Park were heavily grazed prior to acquisition for the park. Steep, rocky ravines and shaded rock outcrops in the park support additional, more "conservative" species characteristic of undisturbed natural habitats such as wild ginger (Asarum canadense), bulblet bladder fern (Cystopteris bulbifera), mitrewort (Mitella diphylla), and columbine (Aquilegia canadensis).

Most of Bellevue State Park is covered by the upland forest communities described above, but small areas of other vegetation types are also present:

Bottomland forest – Narrow strips of bottomland forest occur in the bottom of ravines throughout the park, but in general do not form stands large enough for mapping at the scale (~1:9000) used this paper. Two exceptions occur along the extreme northern and southeastern edges of the Dyas Unit (Fig. 6b). The southeastern stand is an old forest that was present in 1938 while the northeastern stand is a new forest that has developed on an open field since 1938. Walnut, elm, honeylocust, green ash, and hackberry (Celtis occidentalis) are frequent in both locations, but walnut is especially abundant in the old field site, where it is the most frequent and dominant tree species in an open canopy over a tall, grassy undergrowth of canarygrass (Phalaris arundinacea), cutleaf coneflower (Rudbeckia laciniata), and wood nettle (Laportea canadensis). Walnut is codominant with other tree species in the old forest, which displays a typical forest groundflora of honewort, lopseed, hog peanut, clearweed, jumpseed, white snakeroot, and black snakeroot but also includes a lowland grass species, woodreed (Cinna arundinacea).

Prairie opening – Along a roadside on the east border of the Dyas Unit, a small area (< 1 acre) of native prairie occurs on an outcropping of yellowish shale at the base of a wooded bluff. The droughty substrate of the shale has created a dry habitat supporting prairie vegetation in a very unusual situation. Big bluestem (Andropogon gerardii), Indiangrass (Sorghastrum nutans), little bluestem (Schizachyrium scoparium), and sideoats grama (Bouteloua curtipendula) are prairie grasses found here along with leadplant (Amorpha canescens), flowering spurge (Euphorbia corallata), purple prairie-clover (Dalea purpurea), partridge-pea (Cassia fasciculata), prairie blazingstar (Liatris pycnostachya), and others.

Exposed rock outcrops – Sheer cliffs of dolomite along the eastern edge of the Nelson Unit represent the most severe environment for plant growth in the park. Lichens are conspicuous here, forming a thin, often colorful crust over rock faces. Several species inhabit this area, including mealy firedot lichen (Caloplaca citrina, forming large yellow patches on vertical bluffs above the park entry road), sidewalk firedot lichen (Caloplaca feracissima, a species that occurs on calcareous, artificial substrates such as mortar and sidewalks, but occurs here in its natural habitat), brown cobblestone lichen (Acarospora cf. fuscata), and many others.

SUMMARY

The vegetation of Bellevue State Park has changed dramatically several times over the last 170 years. Up to 1837, it was primarily a landscape of open woodland. Agricultural clearing for fields had progressed by 1938 to the point where forest was confined to steep bluffs and ravines. Following acquisition by the state park, the forest expanded and by 2007 had nearly filled all lands used as fields except in the wildlife management area. Despite appearing visually similar on 2006 aerial photographs, old forests and forests newly developed on former fields can be distinguished on the ground by differences in their dominant tree species and understory shrub communities. Old forests are presently dominated by white oak, red oak, sugar maple, and basswood with an open understory while new forests are dominated by pioneer tree species such as elm, walnut, and bitternut hickory (among several others) with a shrubby understory of prickly ash, blackberry, honeysuckle, multiflora rose, barberry, and gooseberry. The flora of the park has never been comprehensively inventoried, so study of all groups (vascular plants, bryophytes, and lichens) remains an open opportunity.

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FAUNA OF BELLEVUE STATE PARK

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INTRODUCTION

Bellevue State Park provides striking views of the Mississippi River at Bellevue, Iowa. The park is divided into the Nelson Unit, located on the south edge of the town of Bellevue, and the Dyas Unit, two miles south. These units are about 500 acres and 300 acres, respectively. Both units are dominated by second growth forest on the ridge tops and gentler slopes and small pockets of older forest in the steepest ravines. The majority of both units are on the bluffs overlooking the Mississippi River. A small portion of the Nelson Unit includes bottomland forest in the Mississippi floodplain.

BIRDS

Fifty-one species of birds were listed as probable or confirmed breeders (Table 1) in the 9 section breeding bird atlas block that included both units of Bellevue State Park (Jackson et al. 1996). Bellevue State Park and Mill Creek Park were the only two areas listed as being surveyed in the 9 section atlas block. The number of birds listed is somewhat lower than other forested parks like Lacey-Keosauqua and Dolliver, which list 69 and 68 species respectively.

Table 1. List of confirmed and probable breeding birds for the Bellevue State Park Breeding Bird Atlas Block (Jackson et al. 1996).

Double-crested Cormorant	Canada Goose	Wood Duck
Mallard	Turkey Vulture	Cooper's Hawk
Red-tailed Hawk	American Kestrel	Ring-necked Pheasant
Killdeer	Rock Dove	Mourning Dove
Chimney Swift	Ruby-throated Hummingbird	Red-bellied Woodpecker
Downy Woodpecker	Hairy Woodpecker	Northern Flicker
Great-crested Flycatcher	Purple Martin	Tree Swallow
Northern Rough-winged Swallow	American Crow	Black-capped Chickadee
Tufted Titmouse	White-breasted Nuthatch	House Wren
Eastern Bluebird	American Robin	Gray Catbird
Brown Thrasher	European Starling	Red-eyed Vireo
American Redstart	Prothonotary Warbler	Common Yellowthroat
Scarlet Tanager	Northern Cardinal	Rose-breasted Grosbeak
Indigo Bunting	Dickcissel	Eastern Towhee
Field Sparrow	Song Sparrow	Bobolink
Red-winged Blackbird	Common Grackle	Brown-headed Blackbird
Baltimore Oriole	American Goldfinch	House Sparrow

Figure 1. Cooper's hawk.
Photograph by James Durbin.

The diversity of breeding bird species for Bellevue is lower because second growth forest dominates the park, with only scattered areas of mature forest. Lacey-Keosauqua and Dolliver both have larger areas of mature forest with a well developed understory. Many forest-interior birds require high quality understory to provide food, cover and nest sites. Past heavy grazing and current browsing by white-tailed deer have prevented the development of a diverse understory in much of the park.A Cooper's hawk (Fig. 1) nest was found in the Nelson Unit in 1990. This species was previously listed as threatened in Iowa. Comprehensive surveys in the 1990's found the Cooper's hawk to be more common than previously thought and it was subsequently taken off the state list of threatened and endangered species. The banning of DDT and other related persistent insecticides and improved protection of raptors may have helped the species recover from low populations in the 1960's.

During late September and early October the overlook at the park is a good location to observe raptor migration. The Mississippi River is a major migration route for not only raptors but many bird species, most notably waterfowl. In the spring the park is also an excellent place to observe warblers and other neotropical migrants.

Bald eagles congregate along the river below the lock and dam at Bellevue after freeze-up. Ice conditions determine the distribution of wintering eagles. During very cold weather only the area below the dam has open water, forcing bald eagles to congregate or move farther south where the river is more open.

The 2007-2008 Christmas Bird Count for the Green Island Route, which includes the park, listed 4,920 birds of 73 species. Eight species of raptors, 228 bald eagles, 1 northern harrier, 1 sharp-shinned hawk, 5 Cooper's hawks, 94 red-tailed hawks, 26 rough-legged hawks, 9 American kestrels, and 1 peregrine falcon were seen. Because the route includes a much larger area and the Mississippi River the number of species is much greater than is found in the upland portion of the park.

MAMMALS

Mammals that are commonly seen in the park are white-tailed deer, raccoon, opossum, wood chuck, gray squirrel, eastern chipmunk, and cottontail rabbit. Bobcats have occasionally been seen in the upland areas of the park. Muskrat, beaver and mink can be observed in the Mississippi River. Small mammals that are rarely seen but occur or are likely to occur in the park are eastern mole, short-tailed shrew, masked shrew, white-footed mouse, meadow vole, meadow jumping mouse, and southern flying squirrel (Table 2).

Figure 2. Eastern chipmunk
DNR image.

The eastern chipmunk (Fig. 2) is a handsome, small striped ground squirrel with rounded ears and flattened hairy tail. Total length, including the 2-4 inch tail, is 8 inches to 12 inches. There are five dark stripes and two white or buffy stripes on the back and the rump is brown or rusty in color. They have two large internal cheek pouches that are used for carrying food. When the pouches are full a chipmunk's cheeks look huge. They will make multiple trips to a feeder or an ear of corn and stuff their pouches before returning to a den. Nuts and seeds are stored for the winter because not all individuals hibernate. Some become torpid only during severe cold weather.

Chipmunks can live from 2-5 years in the wild and often occupy the same den for most of their lifetime. As would be expected males and juveniles, are more likely to move than adult females. An area of about 50 feet around the den is actively defended. The den or burrow system may extend 20 to 30 feet and have several chambers. The nest chamber is often 1 foot wide by 6 inches high and is used as a storage area for food and as a nest. It may be 2-3 feet below the ground surface.

Population density varies depending on the quality of habitat. In good habitat home ranges may be as small as 0.4 acres, and in poorer habitat 2 or 3 acres. They prefer forest edge to deep forest but can also be found in cities and towns.

Two to seven young are born in late spring. The young begin to explore outside the burrow at about five weeks and disperse after another week or two. While some chipmunks move long distances, most establish home ranges near the natal area.

Table 2. List of Mammals Observed or Potentially Occurring in Bellevue State Park.

Virginia Opossum	Masked Shrew	Short-tailed Shrew
Eastern Mole	Northern Myotis	Little Brown Bat
Eastern Pipistrelle	Big Brown Bat	Red Bat
Hoary Bat	Eastern Cottontail	Eastern Chipmunk
Woodchuck	Fox Squirrel	Gray Squirrel
Southern Flying Squirrel	Beaver	Western Harvest Mouse
White-footed Mouse	Deer Mouse	Meadow Vole
Woodland Vole	Meadow Jumping Mouse	Muskrat
Coyote	Red Fox	Raccoon
Mink	Spotted Skunk	Long-tailed Weasel
River Otter	Bobcat	White-tailed Deer

AMPHIBIANS AND REPTILES

No survey of the park has been completed for amphibians and reptiles. Eleven species of amphibians and 18 reptile species potentially occur in the park and the adjacent Mississippi River (Table 3).

Table 3. List of Amphibians and Reptiles Observed or Potentially Occurring in Bellevue State Park.

Mudpuppy	Tiger Salamander	Northern Leopard Frog
Green Frog	Bullfrog	Gray Treefrog
Cope's Gray Treefrog	Spring Peeper	Western Chorus Frog
Cricket Frog	American Toad	Five-lined Skink
Painted Turtle	Map Turtle	False Map Turtle
Snapping Turtle	Spiny Softshell Turtle	Smooth Softshell Turtle
Northern Water Snake	Brown Snake	Eastern Garter Snake
Plains Garter Snake	Western Ribbon Snake	Prairie Ringneck Snake
Blue Racer	Milk Snake	Bullsnake
Fox Snake	Black Rat Snake	Eastern Hognose Snake

Species like the mudpuppy, bullfrog, green frog, northern water snake and the turtles are restricted to the small area of the park adjacent to the Mississippi River and in the river itself.

BUTTERFLIES

Fifty-eight species of butterflies have been reported for the park (Table 4). The list is based on recent verified and photographed specimens from within park boundaries. However most of the records are from or near the butterfly garden. A comprehensive survey of the entire park has not been completed.

No threatened or endangered butterflies have been found in the park but one special concern species, the wild indigo duskywing has been found in the park. The southern or oak hairstreak and the clouded skipper are species not previously reported for Iowa. These records may require further verification.

The butterfly garden at the park was designed to attract butterflies by providing nectar sources for adults and host plants for the caterpillars. The garden plots are cared for by volunteers, who are responsible for planting, weeding and watering the plots. In September park staff tag migrating monarch butterflies and send them on their way to Mexico.

Table 4. List of Butterflies Observed in Bellevue State Park Compiled by Volunteers and Park Staff.

Black Swallowtail (Fig. 3)	Eastern Tiger Swallowtail	Giant Swallowtail
Checkered White	Cabbage White	Clouded Sulphur
Orange Sulphur	Dainty Sulphur	American Copper
Gray Copper	Gray Hairstreak	Banded Hairstreak
Coral Hairstreak	Southern Hairstreak	Eastern Tailed-blue
Reakirt’s Blue	Spring Azure	Summer Azure
Harvester	American Snout	Monarch (Fig. 4)
Variegated Fritillary	Great Spangled Fritillary	Aphrodite Fritillary
Meadow Fritillary	Pearl Crescent	Gorgone Checkerspot
Common Buckeye	Question Mark	Eastern Comma
Gray Comma	Milbert’s Tortoiseshell	Mourning Cloak
Red Admiral	Painted Lady	American Lady
Red-spotted Purple (Fig. 5)	Viceroy	Hackberry Emperor
Tawny Emperor	Northern Pearly- Eye	Little Wood Satyr
Common Wood Nymph	Silver-spotted Skipper	Northern Cloudywing
Wild Indigo Duskywing	Common Checkered-skipper	Clouded Skipper
Least Skipper	Fiery Skipper	Sachem
Peck’s Skipper	Tawny-edged Skipper	Long Dash
Little Glassywing	Delaware Skipper	Hobomok Skipper
Dun Skipper		

Figure 3. Black swallowtail butterfly.
Photograph by Aaron Brees.

Figure 4. Monarch butterfly.
DNR image

Figure 5. Red-spotted purple butterflies.
Photograph by Aaron Brees.

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HISTORY OF BELLEVUE STATE PARK

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INTRODUCTION

The area of eastern Jackson County that includes Bellevue State Park (map on back cover) has enjoyed a colorful and interesting history. From the original Native American inhabitants to the European pioneers who settled the area, the high bluffs that overlooked the Mississippi River were sacred and inspiring. The early residents of Bellevue recognized the importance of preserving the bluffs south of town and worked with the State to acquire the land and get it into the State Park System as Bellevue State Park. Recently the DNR has been working on a plan to increase the accessibility of Bellevue State Park to visitors and to develop programs to better explain its features. Working with consultants, they have produced the Bellevue State Park Interpretive Plan. It puts forth a plan for revealing the story of the park's unique natural, historical, and cultural resources. It makes recommendations in the area of interpretation with specific suggestions for interpretive products and services, including guided tours, self-guided tours, workshops, programs, special events, exhibits, signage, media, web learning, and retail items. The Plan can be viewed or downloaded from the DNR's Bellevue State Park web site at www.iowadnr.gov/parks/files/bellevue_interp_plan.pdf. Much of the material included in this discussion of park history was derived from the Interpretive Plan.

**BELLEVUE STATE PARK INTERPRETIVE PLAN
2008**

The year 2008 is a very important year for Bellevue State Park with regards to interpreting its resources. The Iowa DNR has employed a private consulting firm to design an Interpretive Plan for the park. Interpreting the resources at Bellevue State Park has always been an important element of the park's operation. A huge step forward has now been taken to enhance the efforts of many. The formal interpretive plan was written by The 106 Group Ltd. located in St. Paul Minnesota. The 106 Group enlisted the help of local Bellevue citizens, DNR park employees, and other professionals to develop the plan. Excerpts of the 106 Plan are included in this historical perspective of Bellevue State Park:

Interpretive theme:

"Bellevue State Park's vantage point overlooking the Mississippi River has attracted and inspired generations of people to understand, harness and care for the area's significant natural resources.

NATIVE AMERICAN INHABITANTS OF THE AREA

Bellevue State Park: has been a place of inspiration across time. Human history in Iowa extends back more than 10,000 years, and people have been drawn to the limestone bluffs of Bellevue State Park across much of that time. An observer standing at one of Bellevue State Park's overlooks would have witnessed many changes in the landscape. The forests in the area transformed from a conifer-hardwood to an elm– and oak– dominated woodland. The Mississippi River transformed from a meandering, natural river to a deep and wide river of commerce. And, a small Native American settlement along the Mississippi transformed into the bustling river town of Bellevue.

Native American history in the area of Bellevue State Park prior to the arrival of European settlers in 1833 has not been well documented. The many Native American artifacts have been found in and around the park is a testament to their presence in the area. Indian groups that are known to have resided in or used portions of Iowa seasonally include the Iowa, Oto, Omaha, perhaps the Missouri, and Middle and Eastern Dakota tribes. In Iowa the tribes mentioned above gave way to the Great Lakes group including the Sauk, Mesquakie (Fox), Winnebago, and Potawatomi. Though there has been little research and documentation on the mounds in Bellevue State Park, it is likely that they predate the groups mentioned above and likely belong to the Late Archaic (2500 B.C. -500 B.C.) or Woodland (500B.C. – A.D. 1000) traditions. For additional information on the Indian Americans in this area see the article on Archeology beginning on page 41 of this guidebook.

EARLY EURO-AMERICAN SETTLERS

Even before white settlers arrived in the Bellevue area, explorers, fur traders, hunters and trappers, and miners passed through the area. Among the first white men to enter the area now known as Jackson County were French explorers who, in 1673, explored the Mississippi River valley. In 1833, John Reynolds of Illinois and Major General Winfield Scott met with Chief Black Hawk (see Fig. 1) and other Native Americans of the Sac, Fox, and Winnebago tribes, all of whom had villages along the Maquoketa and Mississippi rivers. As part of this meeting a treaty was made, the Black Hawk Purchase, for the land that is now Bellevue State Park and the city of Bellevue. This marked the beginning of white settlement of the region.

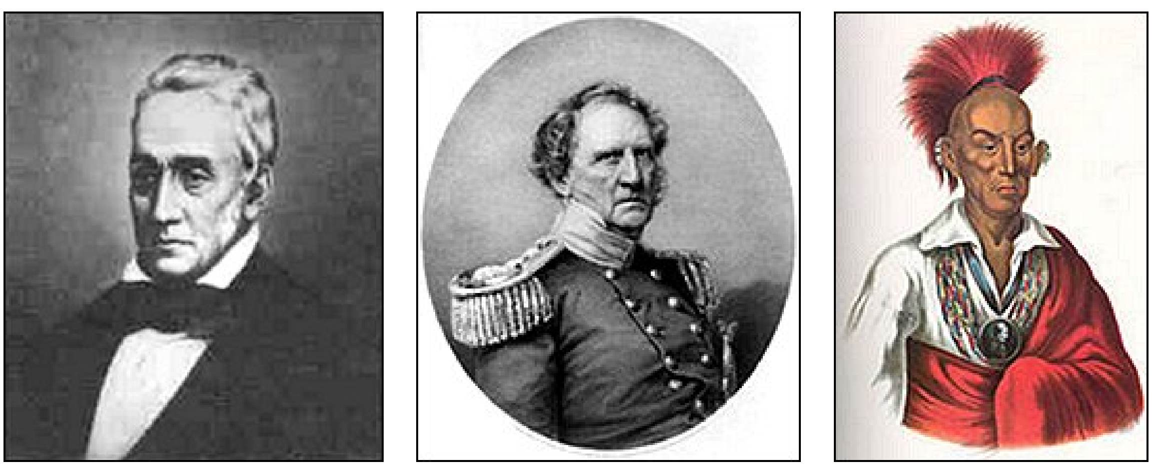

Figure 1. (Left to right) John Reynolds, Major General Winfield Scott and Chief Black Hawk.

Most of the Native Americans moved out of Jackson County in 1833, prior to the arrival of white settlers. This left what is now the town of Bellevue as an abandoned Sac Indian settlement. The next year the first documented white settler to enter the area, James Armstrong, arrived and built a cabin south of the present town. Armstrong had the original claim on what eventually became Bellevue State Park. Early Bellevue settlers coined the term "Paradise Bluff"for this area. In 1835 John Bell, the town's namesake, arrived and platted the city of Bellevue. He subsequently built and operated the town's first sawmill.

CREATION OF BELLEVUE STATE PARK

In 1908, the citizens of Bellevue created a park commission that started planning the creation of a park to make the "city beautiful." At this time the newly minted park commission started planning for what at the time was called "South Bluff Park;" however, it was not until 1917 that the Iowa Legislature enacted the State Park Act that authorized the establishment of public parks in Iowa. It took another 8 years, until 1925, for the citizens of Bellevue to purchase the land immediate south of their town in an effort to preserve the natural beauty of the bluffs. Through the efforts of their active park board, Bellevue's citizenry purchased 36 acres of land for the park, (Figs. 2 and 3) which is located within the boundaries of the Nelson Unit. The park commission transferred the South Bluff Park and several adjacent tracts of land into the Iowa State Park system thereby establishing Bellevue State Park. Through the next 80 years, the park continued to expand in size (see Figure 9 for the history of park parcel acquisition) most recently adding 224 acres that is now a public hunting area. Today, the park totals 788 acres, including 473 acres in the Nelson Unit and 315 acres in the Dyas Unit.

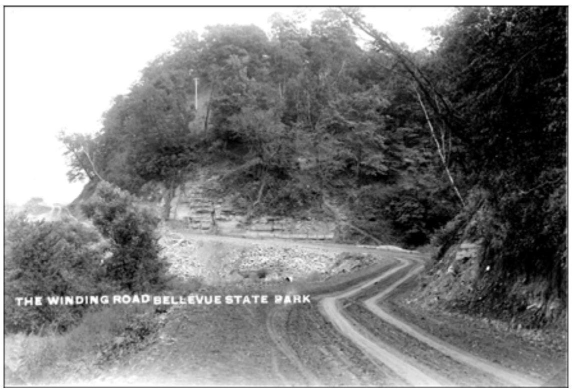

Figure 2. This winding dirt road was the initial access to Bellevue State Park.

Figure 3. Inspiration Point overlooking Bellevue near the Lodge at Bellevue State Park.

The early construction projects in Bellevue Sate Park was not the work of the Civilian Conservation Corp or Works Progress Administration like many state and national parks of the time, but were built primarily through the use of prison laborers from the nearby Anamosa Reformatory. The prisoners who started construction activities in late 1926 were mostly African American who lived on site at the park while constructing the parks roadways. The construction activities and the workers themselves were a source of intrigue for local Bellevue residents. The local newspaper reported that up to 100 cars a day would drive the newly constructed road to watch the progress. The road (Fig. 4) was completed in August of 1927; however, the inmates stayed on through 1928 to build a limestone retaining wall along the road; a nine-hole golf course, as well as the Oak Lodge, the clubhouse for the Bellevue Country Club that was founded in 1927.

Figure 4. Crews paving roads in Bellevue State Park in the 1960s.

The outstanding level of community support for Bellevue State Park from the time of its establishment is remarkable. On the park's dedication day in August of 1928, 4,000 – 5,000

Figure 5. Crowds gather near the old lodge for the Dedication of Bellevue State Park on August 24, 1928.

people came to see the park (Fig. 5), the town held a parade down the main streets of Bellevue (Figs. 6 and 7), and several local bands played. The sense of community spirit that created Bellevue State Park continued with the creation of the butterfly garden in 1985. Local resident Judy Pooler approached the park with her butterfly garden proposal, which was modest at the time. She hoped to create a small sanctuary garden. Volunteers continue to plant and maintain the park's butterfly garden."

Figure 6. Dignitaries parading in downtown Bellevue prior to the dedication of Bellevue State Park.

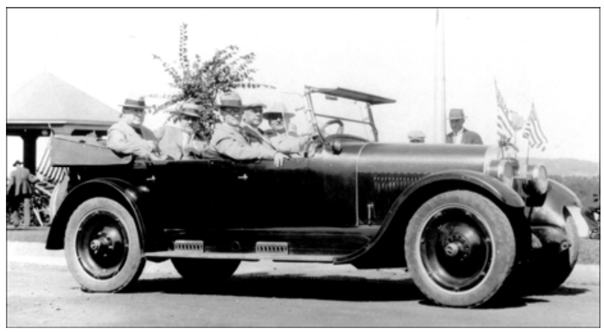

Figure 7. Dignitaries (lert to right) Bill Schirmer, Governor John Hammill, Clarence Pinnell, Joe Young, and Orion DeGear parading in Bellevue prior to the dedication of Bellevue State Park.

FOCAL POINTS OF BELLEVUE STATE PARK'S NELSON UNIT

Figure 8. Sign at entrance of Bellevue State Park Nelson Unit.

The Nelson Unit of Bellevue State Park (Fig. 8) is located immediately south of the town of Bellevue, off state highway 52. Reverend Lawrence Nelson came to Bellevue as a Presbyterian minister in 1939. Reverend Nelson was a great orator and was dedicated to conserving our human and natural resources for the good of all. A member of the Iowa Conservation Commission, Reverend Nelson worked hard to secure land for the park's southern Dyas Unit. At his death in 1970, it was suggested that the unit next to Bellevue be named in his honor, and it became the Nelson Unit.

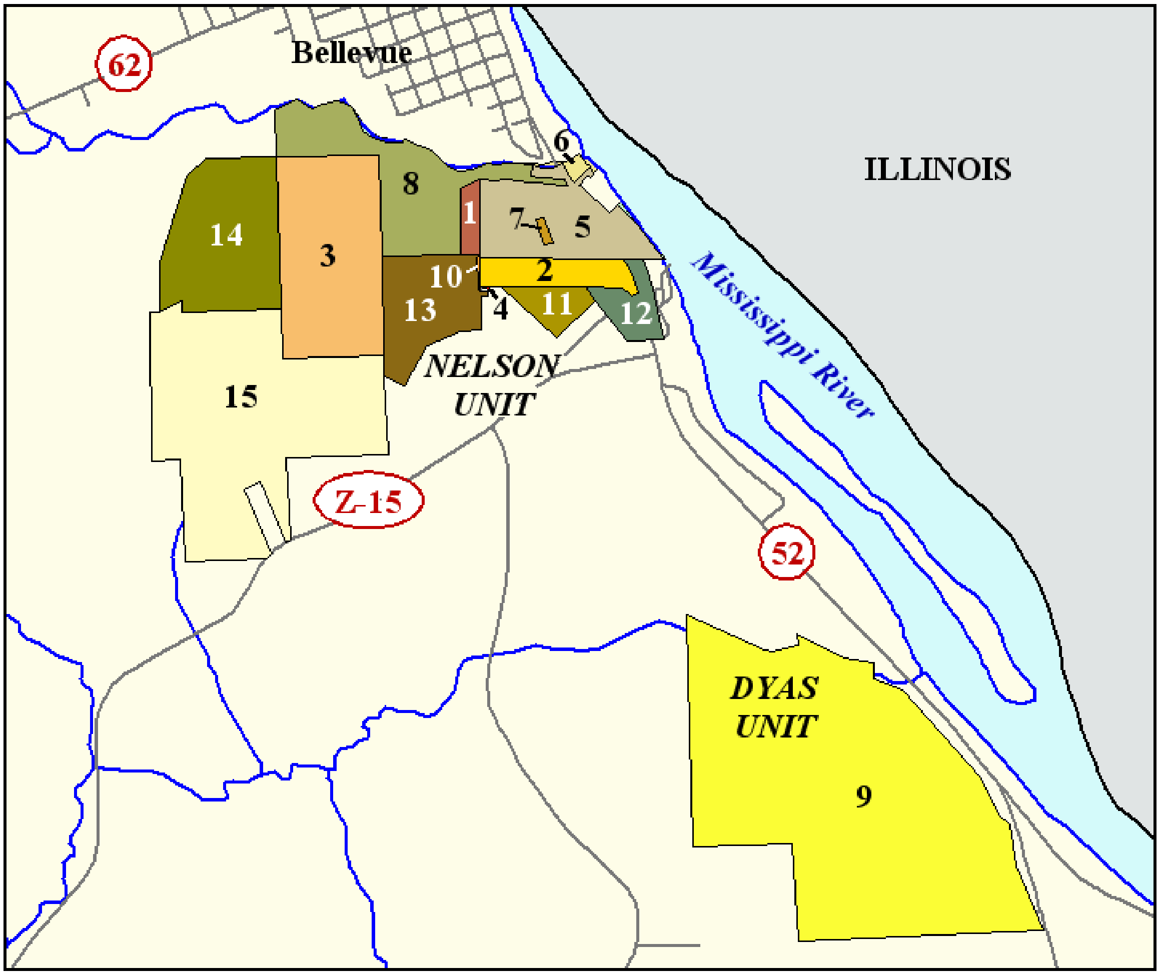

Figure 9. Parcels that comprise Bellevue State Park. Numbers indicate order in which the parcels were acquired. The table below shows the date that the parcel was acquired, the total acreage of the parcel, and the former owner.

Map Number	Date Acquired	Acres	Former owner
1	06/22/1925	5.66	Reiling, Benjamin A. & L
2	08/13/1925	17.80	Yeager, Xavier & Caroline
3	06/22/1928	81.97	Bausch, T.W. & Clara M.
4	08/25/1958	0.07	Dyas, R.H.
5	09/25/1928	45.79	Bellevue Park Assoc.
6	02/01/1929	1.60	U.S. Government
7	06/29/1929	0.98	Bellevue Park Assoc.
8	08/18/1964	58.28	Nau, Theodore Etux.
9	04/08/1966	292.13	Dyas, Wilber J. Etux
10	11/31/1966	0.38	Bellevue Park Assoc.
11	05/27/1969	10.46	Dyas, Wilber J. Etux
12	06/25/1969	12.5	Weinschank, Alvina S.
13	03/25/1975	37.74	Bellevue Golf Club
14	04/11/1996	66.00	Mootz, Marita M.
15	10/14/1999	157.34	McAbbee, Lee Kerry & Barbara

Scenic overlooks

The Nelson Unit of Bellevue State Park affords fantastic views of the Mississippi River valley from its limestone bluffs 300 feet above the floodplain. The town of Bellevue (Figs. 10 and 11) and Lock and Dam 12 (Fig. 11) can be seen to the north, and the former Savanna Army Depot can be seen on the east side of the Mississippi River. The Savanna Army Depot covered a 13,062 acre area, including about 7,000 acres of uplands and 5,500 acres of bottomlands. The depot was officially closed on March 18, 2000. The depot land was divided between the Upper Mississippi River National Wildlife and Fish Refuge and the Illinois Department of Natural Resources.

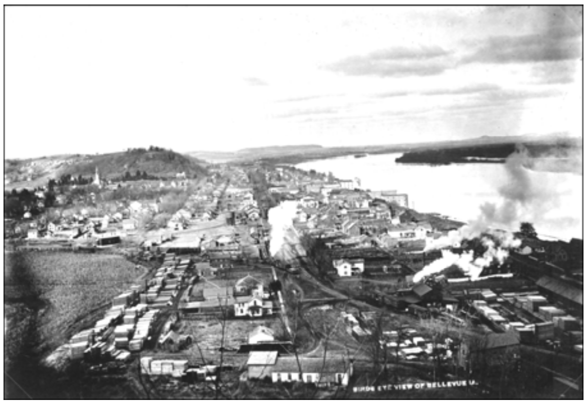

Figure 10. View of Bellevue from Bellevue State Park in about 1928.

Figure 11. View of Bellevue from Bellevue State Park in 2008.

Earthen Mounds

Professor Charles R. Keyes of the State Historical Society of Iowa identified 3 conical mounds in the park in the 1930s. These mounds, located in the Nelson Unit, are at the edge of the bluffs overlooking the Mississippi River (Fig. 12). To learn more about these mounds see the discussion by Mark Anderson (Office of the State Archaeologist) on page 41 of this guidebook.

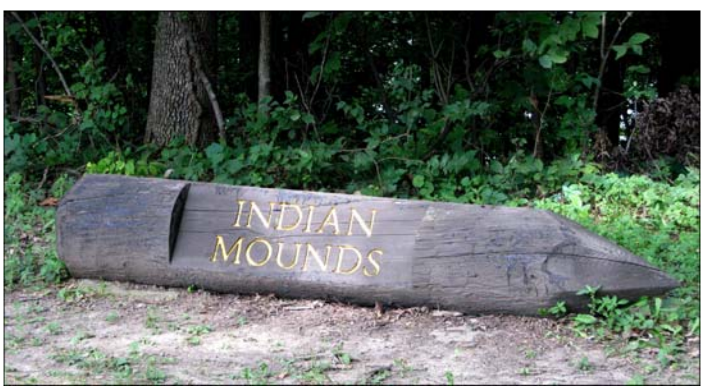

Figure 12. Marker pointing to trail leading to Indian Mounds (above) and the three mounds behind a security fence (right).

Lodge

The old Oak Lodge (Fig. 13) that was originally located near the main scenic overlook burned to the ground in 1973 (Fig. 14). Arson was suspected, but sufficient evidence to file charges was never obtained. A new lodge of western red cedar was built (Fig. 15) in 1972. The enclosed lodge is popular for weddings, family reunions, graduation parties and other various meetings, and it will host the 2008 Geological Society of Iowa Annual Meeting and Banquet.

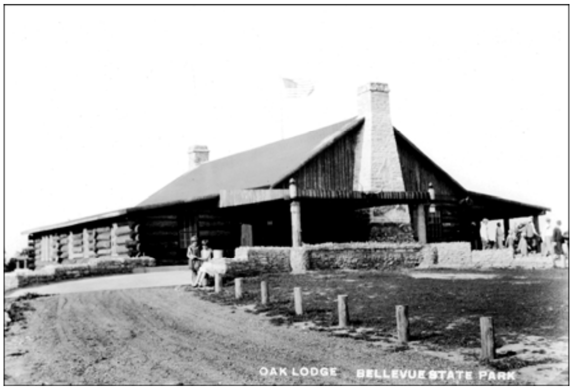

Figure 13. Image of the old Bellevue Park lodge that burned in 1973.

Figure 14. Image on the new Bellevue Park lodge with Chad Fields and current Park Ranger and Ron Jones.

Figure 15.

Photo of the new Bellevue Park lodge with Chad Fields (IGWS) and current Park Ranger and Ron Jones.

South Bluff Nature Center

Bellevue State Park at one time was the destination of area golfers. The park had a nine hole, sand green course with a clubhouse. Eventually the town of Bellevue developed a new golf course north of town and the old park clubhouse was abandoned. The old clubhouse was subsequently converted into the South Bluff Nature Center (Fig. 16) in 1984.

Figure 16. The South Bluff Nature Center was the former Club House for the park's golf course.

Butterfly Garden

In 1984 local resident Judy Pooler approached Park Ranger Don Carrier with the idea of constructing a Butterfly Garden in the park (Fig. 17). Judy had received a book from a friend about butterfly gardening, and the seed of the project was planted. When finished the following year the garden occupied nearly an acre of ground in a swale of the old golf course. Each year volunteers come to plant and care for individual garden plots, which continued to grow in number to include 148 individual garden plots and a central water feature. Over 60 species of butterflies

Figure 17. One of the outstanding features of Bellevue State Park is the community-maintained butterfly garden.

have been identified in the garden. In September park staff tag migrating monarch butterflies and send them on their way to Mexico. License plates from nearly every state, including Hawaii have been seen in the parking area.

Public Hunting Area

The State of Iowa purchased 224 acres of land in the late 1990's. The area is utilized as a public hunting area. Major species include deer and turkey.

Trails

There are six trails in the Nelson Unit. The trails traverse through woodlands, reconstructed prairie, past a rock quarry, and pass near an old lime kiln remnant. Early to mid October are popular times of the year for hikes in the park. At that time of year the hard maples turn a brilliant yellow and the scenery is fantastic.

DYAS UNIT OF PARK

In 1966 a three hundred-acre tract of land, owned by Wilbur J. Dyas, became available for purchase. In April of 1966 two hundred and ninety-two acres of the Dyas property were purchased for $37,000. In 1969 a second purchase, the other ten acres of the land was acquired for $1,000. These tracts of land, located 2 miles south of the town of Bellevue, were named the Dyas Unit (Fig. 18). Development of the unit would not be completed for several years.

Figure 18. Sign at entrance of Bellevue State Park Nelson Unit

Modern Campground

The Dyas Unit is the only place where camping is allowed in the park. Thirty of the campgrounds 46 sites have electrical outlets. Fifteen sites are available for tent camping, and one site is reserved for organized youth groups. At the entrance to the camp area is a modern shower restroom facility. Half of the camp areas sites can be self-registered on a first-come first-served basis. The remaining sites can be reserved in advance over the internet or through a call center. The internet site is www.reserveiaparks.com. The phone center number is 1-877-427-2757. The parks enclosed lodge and open shelters can also be reserved through the internet site or call center. Naturalist often give interpretive programs in the camp area.

Scenic overlooks

The Dyas Unit offers spectacular long distance scenic views of the Mississippi River. Open shelters are located at each overlook site.

Playgrounds

Both units of Bellevue State Park have modern playgrounds.

Trails

The Dyas Unit offers 4 scenic nature trails.

REFERENCES

Iowa Department of Natural Resources, 2008, Bellevue State Park Interpretive Plan, 67p. plus Appendices.

THE TOWN OF BELLEVUE, IOWA

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Figure 1. One of many native stone buildings in Bellevue..

INTRODUCTION

"Bellevue is situated on the Mississippi River, twenty-two miles below the City of Dubuque, and twelve miles from Galena, Illinois. The town site is upon a beautiful plateau of land whose general height is about fifteen feet above high water mark, and is surrounded by an amphitheater of hills which break off the severe cold of winter. Few places on the river present more picturesque or beautiful scenery than that witnessed from the top of the big bluffs, either on the north or south of the town, including the river with its islands, the shores of Illinois beyond, the farms and farm houses up the valley, which runs to a point westward at the distance of about six miles, and the village nestling in the ample area at the foot of the bluffs, with is business streets, its levee and its tasty dwellings. A steam ferry boat makes constant trips between Bellevue and the opposite shore, whence a considerable portion of the country trade is received, and steamboats are almost constantly in sight, either at the landing, in the regular up or down river trips, or going to, or coming from Galena. The railroad trains of the Chicago, Dubuque and Minnesota road pass directly through the village to the station, which is just north of the corporate limits."

from A.T. Andreas Illustrated Historical Atlas of the State of Iowa, 1875

Nestled between towering wooded bluffs and bordered by the mighty Mississippi, Bellevue offers an assortment of venues to relax with nature, enjoy shopping and dining experiences, and participate in festivities throughout the year.

HISTORY

Beginning on page 41 of this guidebook, Mark Anderson (Office of the State Geologist) presents a fascinating and informative account of the pre-history and early history of the town of Bellevue and the area of Bellevue State Park. This narrative provides a little additional information and some historic facts to add a bit more color to this beautiful town on a lovely fall day.

The first county seat of Jackson County, Bellevue, early records used the spelling "Belleview" or "Bellview", since the town was named in honor of John D. Bell, an early resident who built the first cabin in the area in 1835 and became the town's first postmaster. However, at some time the spelling was changed to Bellevue, meaning "beautiful view", a name that is very appropriate for its spectacular panoramic views up and down the Mississippi River (Jackson County History, 2008).

The town of Bellevue was first laid out by John D. Bell, in 1835, the surveying being done by Phillip McLean. It was again laid out by Commissioners appointed by the United States, among who were General George Cabbage and William W. Cahill. At that time lots were valued at $7.50 for front lots and $5.00 for back lots, the proceeds after paying the commissioners and the cost of surveying, being appropriated to the town. The first hotel was built by Peter Dutell, in 1836, and was called the Bellevue House. The first Wisconsin Territorial Court was held at Bellevue in June, 1837, by Judge Dunn. The first County Court of Jackson County under Wisconsin Territory was held by J. K. Moss, County Judge, at Bellevue on the 12th of March, 1838. Judge Moss also held the first County Court of Jackson County under Iowa proper, October 27, 1838. The first meeting of the Jackson County Commissioners was held on April 2, 1838, at Bellevue, which was then the only town of consequence in the county and therefore a natural choice for the county seat. The first term of court was held two months later. A one mill tax was levied by the commissioners for the county fund and a one-half mill tax for the court fund. Since money was scarce, payments in commodities, such as coonskins and maple sugar, were accepted for tax payments.

The Bellevue War

In Bellevue's early days, desperadoes settled in the woods along the Maquoketa River and occupied themselves with horse stealing, counterfeiting, and murder. Their activities frequently included raucous and destructive revelry in Bellevue. In 1840, a posse of outraged citizens confronted these outlaws, called the Brown gang, in what came to be known as the "Bellevue War." Several people were killed, including Brown, and others wounded during the fighting which ended in the arrest of 13 gang members. A jury of 80 men then voted on the penalty. Those who wanted the outlaws hanged dropped a white bean into the "ballot" box passed around, while those who wanted them whipped dropped a colored bean. The judge totaled the result. By a margin of only 3 colored beans, the jury decided on whipping and exile, and each prisoner was lashed on his bare back, and then sent by boat down the Mississippi with a warning never to return. This punishment did not keep some members of the old Brown gang from continuing their lives of crime. On July 4, 1845, seven of them were involved in the robbery and murder of Colonel George Davenport in his home at Rock Island; they were apprehended and convicted.

The Battle for the County Seat

Iowa officially became a Territory on July 4, 1838 and the Territorial Assembly set up procedures for the location and survey of a new seat of county government at a point centrally located. Andrew was chosen by the three locating commissioners, who met on April 15, 1841. An election between Bellevue and Andrew was then held in May. Andrew was the winner, receiving 208 votes against 111 for Bellevue. The first courthouse at Andrew was a log structure, about 30' x 40', built by local citizens just north of the public square. It was used until 1848. About that time, a brick courthouse was erected at Bellevue, and the county seat moved back to that town, with the Andrew courthouse becoming a stable. When the county seat was once again removed from Bellevue, this building was used as a public school.

After 1849 there followed a long period during which the location of the county seat continued to change. It was moved back and forth between Bellevue and Andrew, while the towns of Centreville (within one mile of Andrew) and Fulton were unsuccessful contenders for the honor. Jackson County voters became more and more agitated over the constant attempts to relocate the county seat, and the chronic ballot box stuffing that was a common occurrence during the heated elections of the day. Before the 1861 election, it was finally required that no one could vote who was not a citizen, prompting many residents to receive their naturalization papers with full citizenship status in time to vote in that year's county seat election. Andrew won the election and yet another courthouse was built there in 1861. It was not until 1873 that the long drawn-out county seat contest in Jackson County ended when Maquoketa won in an election over Andrew by a majority of 179 votes, and the county seat has remained there since.

Bellevue in 1875

In 1875, the Andreas Atlas (see map on Fig. 2) noted that Bellevue had a population of about 2,000, and it is a large shipping point, both by river and railroad. The business of the present year (1875) will not fall short of $500,000. The principal business of Bellevue were eleven dry goods and general mercantile houses, three hardware stores, two grocery stores, two drug stores, four millinery establishments, two harness shops, five blacksmith shops, five shoemaker shops, one large boot and shoe store and manufactory, one carpenter shop and planning mill, three furniture and cabinet shops, thee grain and produce warehouses – two on the river and one on the railroad, two private banks, two large flouring mills, one saw mill, one foundry, two agricultural warehouses, one cigar manufactory, and two hotels. There were six churches, Congregational, Presbyterian, Methodist, Lutheran, Episcopalian and Catholic, and one graded public school.

BELLEVUE TODAY

Today Bellevue is Jackson County's second largest community with the 2000 Census noting a population of approximately 2,350 residents, 942 households, and 629 families residing in the city. The population density was 2,410.7 people per square mile (935.4/km^2). There were 1,012 housing units at an average density of 1,038.1/sq mi (402.8/km^2). The racial makeup of the city was 99.79% White, 0.04% Asian, and 0.17% from two or more races. Hispanic or Latino of any race represented 0.47% of the population (Wikipedia, 2008).

Of the 942 households, 32.2% had children under the age of 18 living with them, 56.6% were married couples living together, 7.7% had a female householder with no husband present, and 33.2% were non-families. 29.7% of all households were made up of individuals and 17.8% had someone living alone who was 65 years of age or older. The average household size was 2.41 and the average family size was 3.01.

In the town of Bellevue the population was spread out with 25.4% under the age of 18, 6.4% from 18 to 24, 25.1% from 25 to 44, 20.7% from 45 to 64, and 22.3% who were 65 years of age or older. The median age was 40 years. For every 100 females there were 91.7 males. For every 100 females age 18 and over, there were 86.9 males.

The median income for a household in Bellevue was $35,293, and the median income for a family was $44,438. Males had a median income of $35,507 versus $20,791 for females. The per capita income for the city was $15,928. About 5.0% of families and 7.3% of the population were below the poverty line, including 5.3% of those under age 18 and 13.1% of those age 65 or over.

Figure 2. Map of Jackson County from the 1875 A.T. Andreas Illustrated Atlas of the State of Iowa.

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LOCK AND DAM 12 AT BELLEVUE

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INTRODUCTION

The town of Bellevue hosts one of the 37 Corps of Engineers Locks and Dams (Fig. 1) on the Mississippi River system. These structures, largely constructed in the 1930s, are a critical to the maintenance of a 9-foot navigation channel extending down the Upper Mississippi River from Minneapolis-St. Paul to its confluence with the Ohio River and up the Illinois Waterway to the Thomas J. O'Brien Lock in Chicago. This system provides approximately 1,200 miles of navigable waterway in Illinois, Iowa, Minnesota, Missouri, and Wisconsin. Lock and Dam 12 at Bellevue stretches across the river at a point where the bluffs on the Iowa side are very close to the river. From the Illinois side a complex of islands and sloughs extends nearly three-quarters of the way across the river. These islands and associated water bodies constitute the Lost Mound Unit of Upper Mississippi River National Wildlife and Fish Refuge.

Figure 1. Oblique aerial photograph of Lock and Dam 12 looking north (up river). Barges can be seen moving through the lock and a portion of the town of Bellevue can be seen on the left.

LOCK AND DAM CONSTRUCTION

The lock and dam at Bellevue was constructed between 1934 and 1938. The general contractors were the James Stewart Corporation (lock contractor) and the Warner Construction Company (the dam contractor), both from Chicago Illinois. During the peak of construction, a maximum of 1,217 men were employed at one time. The lock and dam elements of the complex were completed at a cost of $5,581,000. The lock was completed and opened in 1938.

The movable dam consists of seven submersible Tainter gates (20-feet high and 64-feet long), see Figure 2, and three submersible roller gates (20-feet high and 100-feet long), see Figure 3. The dam system also includes two, non-overflow, earth and sand-filled dikes; two transitional dikes; and a concrete-covered, ogee spillway, submersible earth and sand-filled dike. The foundation is set in sand, gravel, and silt.

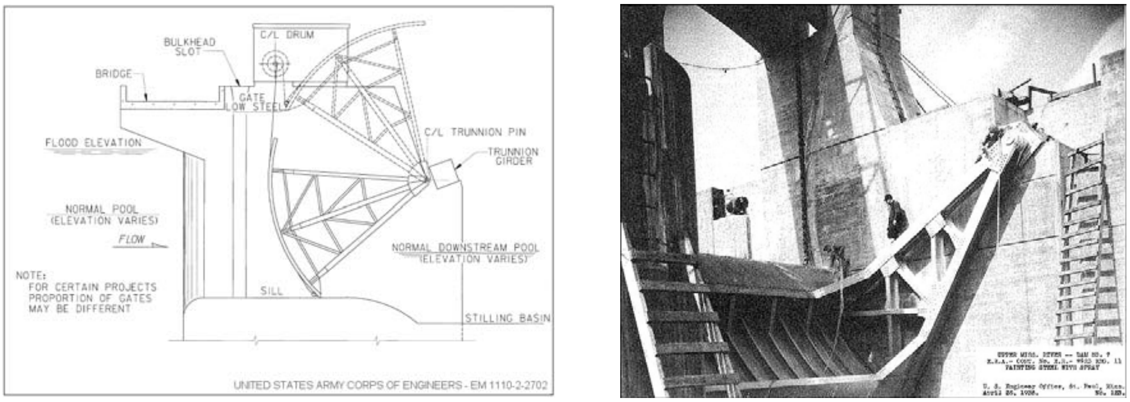

Figure 2. Illustrations of the Tainter gates used at Dam 12. A Corps of Engineers Tainter gate design sketch on the left and an archive photograph of a gate at Dam 7 on the right.

The Bellevue lock's dimensions are 110-feet wide by 600-feet long with additional provisions for an auxiliary lock. The elevation of the normal upper pool above the dam is 592 feet, approximately 15 feet above the tail waters below the dam at low water. The maximum lift provided by the lock is 9 feet with an average lift of 6 feet. It takes approximately 10 minutes to fill or empty the lock chamber. Under normal flow conditions the waters of the Mississippi River take about 8 hours to travel the 26.3 miles from Lock and Dam 11, in Dubuque, Iowa, to Lock and Dam 12. Over that distance the river drops about 11 feet in elevation.

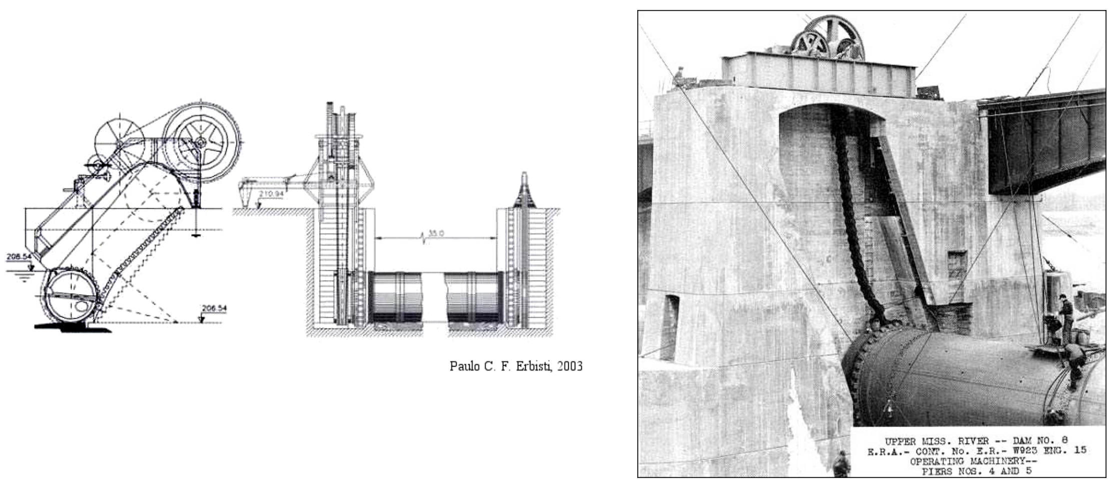

Figure 3. Illustrations of the roller gates used at Dam 12. A sketch of a roller dam design by Erbisti (2003) on the left and an archive photograph of a gate at Dam 8 on the right.

The locks at Bellevue are only 600-feet in length and do not accommodate today's modern tows without splitting and passing through the lock in two operations. This procedure requires uncoupling barges at midpoint which triples lockage times and exposes deckhands to increased accident rates.

COMMERCIAL CARGO USING THE LOCK AT BELLEVUE

More than 580 manufacturing facilities, terminals, and docks ship and receive cargo that is shipped on the Upper Mississippi River system. In 2005 barges moved more than 160 million tons of commercial cargo worth roughly $28.5 billion. Grains (corn and soybeans) constitute the dominate traffic on the system, with cement and concrete products comprising the second largest group. A modern 15-barge tow transports the equivalent of 870 large semi-trucks (22,500 cargo tons, 787,500 bushels, or 6,804,000 gallons). Annually, the project generates an estimated $1 billion of transportation cost savings compared with the operation and maintenance costs of approximately $115 million. Tables 1 and 2 (below) display the tonnages and product that moved through the lock at Bellevue.

Year	Tons	Year	Tons
1998	21,596,296	2003	19,622,041
1999	24,426,919	2004	17,350,487
2000	22,280,448	2005	17,672,950
2001	19,098,873	2006	18,655,930
2002	23,031,159	2007	17,681,771

Table 1. Tons of freight passing through the lock at Bellevue over the last 10 years *.

Coal	3,996,770	**Subtotals**:	
Petroleum	401,956		
Chemicals	2,089,998	Grain	7,863,070
Crude Materials	1,980,406	Steel	176,400
Manufactured Goods	650,106		
Farm Products	8,531,987	**Lockages**:	
Manufactured Machinery	24,354		
Containers & Pallets	1,624	Boats:	4,679
Unknown	4,570	Cuts:	4,088

Table 2. Commodities and tonnages of freight passing through the lock at Bellevue in 2007. values presented in tons *.

(* information from United States Army Corps of Engineers, Rock Island District, 2008)

MAINTENANCE ISSUES

According to the U.S. Army Corps of Engineers, Rock Island District, in constant dollar terms, operations and maintenance funding for the system has been largely flat or declining for decades, while maintenance needs of the aging infrastructure increase. This is adversely affecting reliability of the system. Long-established programs for preventative maintenance of major lock components have essentially given way to a fix-as-fail strategy, with repairs sometimes requiring weeks or months to complete. Depending on the nature of a lock malfunction, extended repairs can have major consequences for shippers, manufacturers, consumers, and commodities investors. The cost of remediating the current list of maintenance issues at Lock and Dam 12 is estimated by the Corps of Engineers at approximately $27,000,000.

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POTTER'S MILL, BELLEVUE, IOWA

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Figure 1. Potter's Mill, as it appears in 2008, serves as a bed and breakfast.

The south edge of the town of Bellevue is separated from Bellevue State Park by Mill Creek, and as the observant traveler crosses Mill Creek on Highway 52 a glance to the right (west) will reveal a large red building with white trim. This is Potter's Mill, one of the earliest grist mills in Iowa. It was constructed in 1834 on Big Mill Creek by Captain Elbridge Gerry Potter, who had traveled to the area in search of an ideal location for his new merchant flour mill. Potter formed a partnership with local millwright John Gammel to construct the building. The foundation of the building and an eleven-foot thick dam were constructed from lime rock quarried from the bluffs to the south (now Bellevue State Park). In addition to the local lumber that was cut and milled for the construction, the men purchased 73,000 board feet of lumber for use in the building. Hand-hewn walnut and oak beams, up to 45 feet long and 15 inches across framed the building, and construction costs totaled about $40,000.

Potter's Mill began operations in 1845, milling wheat purchased from local farmers as well as wheat shipped in from Minnesota and Wisconsin. The flour that was produced was marketed to customers as far away as St. Louis, New Orleans, Cincinnati, and New York.

The power for the mill during this early period came from an overshot waterwheel located on the south side of the structure. In the late 1860's, the limestone dam was raised to its current height to accommodate the installation of six turbines which turned six sets of milling stones (Fig. 2). At this time, the mill reached its peak flour production of about 200 barrels per day.

Figure 2. A Potter's Mill grist stone.

In 1871 Captain Potter sold the mill to Kilborn and Company. Ten years later, in 1881, the Kilborns sold Potter's mill to Arnold Reiling, whose family owned it for 38 years. The mill then went through several different owners until the Dyas family bought the mill in 1931.

On May 24, 1896, 14 inches of rain falling in 12 hours created a flash flood on Big Mill Creek which destroyed another dam upstream from Potter's Mill. The torrent of water released tore out the spillway (Fig. 3) and a frame office at Potter's Mill. The Reiling family who owned the mill at that time decided not to rebuild the spillway, choosing to install a 35 horsepower Atlas steam engine which was connected to the repaired millstone shaftworks. This modification caused production capability to fall to 50 barrels per day. Later, electricity replaced the steam engine, and then in 1969, after 126 years of production, the milling operations were discontinued.

Figure 3. Damage to the mill caused by 1896 flood

In 1980, Daryll and Carolyn Eggers bought the building at an auction and began reconstruction on the creek-side foundation and other restoration work. Local craftsmen preserved as much of the original structure and interior as possible. The mill was added to the National Register of Historic Places in 1984 (Building - #84001257), one of what is now 21 buildings in Bellevue that are listed on the register.

The Eggers originally opened Potter's Mill as a restaurant, then later moved the restaurant to the second floor of the building, and then converted the third and fourth floors into a bed and breakfast. After an extensive Certified Historic Rehabilitation that preserved the original fabric and feel of the old mill four beautiful Bed and Breakfast rooms were added in 2002. The restaurant was recently closed, but the building still hosts a bed and breakfast.

Additional information and descriptions of the history of Potter's Mill and archaeological discoveries relating to the mill and historical events during its construction and early history are described by Mark Anderson of the Office of the State Geologist beginning on page 33 of this guidebook.

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THE SAVANNA ARMY DEPOT, ILLINOIS

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Figure 1. Google Virtual Earth composite image of the Savanna Army Depot Activity.

INTRODUCTION

Savanna Army Depot Activity (SVADA) is located in Illinois across the Mississippi River from Bellevue State Park. SVDA was the oldest depot in the Industrial Operations Command and the Army wholesale logistics structure. It covers just over 13,000 acres in Jo Daviess and Carroll counties in Illinois and lies on a long, narrow Pleistocene terrace lying between the Mississippi River and a line of hills and bluffs. Savanna Army Depot Activity's mission was the storage, issue, and demilitarization of conventional munitions, storage, and issue of general supplies, and was one of only two manufacturers and maintainers of ammunition peculiar equipment and repair parts for DOD worldwide. Savanna was home to the Defense Ammunition Center and School and the United States Army Technical Center for Explosive Safety, which is responsible for the training, testing, safety, and quality assurance of all conventional ammunition items. Over time, the Savanna installation became a super-secret development and testing lab where the US Army went when it wanted to be alone, much like the Air Force's Area 51 (Weeks, 2008). The Savanna Army Depot was identified for closure by Congress in July 1995 under the Base Realignment and Closure Act, and it officially closed on March 18, 2000.

HISTORY

Savanna Army Depot Activity was established in 1918 as the Savanna Proving Ground, a proof and test facility for artillery weapons and ammunition. In 1919 and 1920, many new buildings were constructed at the site and in 1921 its name was changed to Savanna Ordnance Depot. A shell-loading facility was built in 1931 to load and renovate 155-millimeter shells and 300-pound bombs. During World War II, additional facilities were constructed and Savanna Ordnance Depot was given the task of studying and developing methods to stabilize ammunition for shipping (Fig. 1). From 1947 to 1962, various types of mustard-filled projectiles were shipped to Savanna for renovation; the fuses were removed and reused and the mustard-filled projectiles were either shipped to Rocky Mountain Arsenal or destroyed (by burning) at Savanna (Dames and Moore, 1994c).

Figure 2. A complex of the older metal warehouses, one appears to be partially dismantled. A large pile of contaminated soil in the foreground likely came from that building (Photo from Weeks, 2008)

The U.S. Army Ordnance Ammunition, Surveillance, and Maintenance School (currently known as the Defense Ammunition Center and School) was activated at the post in 1950. The installation was designated as a U.S. Army Ordnance Depot in 1959 and was assigned a special weapons storage and maintenance mission from 1961 to 1974. In 1962, the installation's name changed to Savanna Army Depot when it was placed under the jurisdiction of the U.S. Army Supply and Maintenance Command (Dames and Moore, 1994). The installation finally became known as the Savanna Army Depot Activity in 1976 and was put under the command of

Letterkenny Army Depot in Pennsylvania. From that time on, SVADA's mission was the receipt, storage, issue, and demilitarization of conventional ammunition and general supplies, as well as the manufacture, procurement, and maintenance of ammunition-peculiar equipment and repair parts for worldwide Department of Defense support. In 1995, SVADA was placed on the Base Realignment and Closure list.

The SVADA property included 923 buildings, many of which were ammunition storage igloos (Fig. 3) or other storage facilities. The four major plant areas (designated by letters) at SVADA were the CN Plant (originally developed as an ammonium nitrate plant, but never used for that purpose), the CL Plant (first used to load bombs with explosives, and later used to demilitarize, renovate, and modify equipment), the CF Plant (first used to load fixed round ammunition with explosives, and later used for various other purposes), and the Ammunition Washout Facility (constructed to wash explosives from bombs), SAIC, 1996.

Figure 3. Ammunition storage igloo at SVADA. Photo by Jim Frazier, Flickr.com

As a result of these past operations and waste disposal practices, hazardous materials have been released to the environment. Principal site contaminants are munitions-related compounds (trinitrotoluene [TNT], dinitrotoluene [DNT], trinitrobenzene [TNB], Royal Demolition Explosive [RDX], and metals), polycyclic aromatic hydrocarbons (PAHs), solvents, and unexploded ordnance (UXO). Past operations that may have contributed to environmental contamination at SVADA include munitions manufacture and renovation, munitions testing, munitions disposal (including burning), (Dames and Moore, 1994; ATSDR, 1991), fire-fighting training, landfilling, and use and disposal of solvents, fuels, and pesticides.

In 1990, a remedial action began at the TNT washout lagoons to remove contaminated sediments; a major source of TNT contamination. In 1992, a Record of Decision was signed approving the incineration of TNT-contaminated soil and sediment from the site. In 1993, the installation completed a trial burn and began full-scale sediment removal, incineration, and ash processing operations. That same year cleanup began for VOC-contaminated soil at the fire training area. The cleanup operations used high-temperature thermal treatment. In 1994, the installation completed incineration of TNT-contaminated. To promote the use of innovative technologies, the Army hosted a demonstration of an ultraviolet and oxidation (UV/OX) groundwater treatment technology. During the demonstration, four UV/OX commercial vendors operated their treatment systems.

A three-party Inter-Agency/Federal Facility Agreement between the Department of the Army, Illinois Environmental Protection Agency, and the U.S. Environmental Protection Agency was signed in late 1989 (Global Security.Org, 2008). In September, 1995, the facility was included in the Department of Defense Base Closure List. Up to 75 areas of the site were identified and evaluated in a facility wide Remedial Investigation. During subsequent reviews for the base closure process, approximately three hundred additional areas of potential concern were identified for further evaluation prior to transferring facility property. The facility has worked with the Local Reuse Authority (LRA) to develope a plan to transfer the facility property to U.S. Fish & Wildlife, U.S. Corps of Engineers, and the LRA for redevelopment.

The traditional Superfund progress at Savanna has was hampered due to the shift in focus to Base Realignment and Closure land transfer goals. In 1997, the LRA successfully competed in a statewide competition for the siting of a correctional facility on the Depot property. However, during 1998, environmental issues and concerns forced the Governor to relocate the proposed prison to privately held land, 15 miles south of the Depot near Thomson, Illinois.

The current proposal is to transfer land to four agencies: 9,113 acres to the Service; 3,223 acres to the Local Redevelopment Authority; 456 acres to the U.S. Army Corps of Engineers; and 270 acres to the Illinois Department of Natural Resources.

The U.S. Fish & Wildlife Service has accepted certain management rights and some land at the former Savanna Army Depot. On September 26, 2003, the Department of Defense agreed to transfer 9,404 acres of land to become the Lost Mound Unit of the Upper Mississippi River National Wildlife and Fish Refuge (Division of Conservation Planning, 2008). A total of 3,022 acres was actually transferred in fee at the time of the signing of the Memorandum of Agreement. The remaining acreage will be transferred in the future as parcels are certified clean from environmental contaminants. In the meantime, the Service will manage wildlife and habitat on all 9,404 acres.

The Lost Mound Unit was included in a comprehensive conservation plan (CCP) completed by the Upper Mississippi River National Wildlife and Fish Refuge in 2006 (www.fws.gov/midwest/Planning/LostMound/EA_november03.pdf). The CCP is intended to outline how the Refuge will fulfill its legal purpose and contribute to the National Wildlife Refuge System's wildlife, habitat and public use goals. The plan articulates management goals for the next 15 years and specifies the objectives and strategies needed to accomplish these goals. While the planned future condition is long-term, we anticipate that the plan will be updated every 5 to 10 years based on information gained through monitoring habitat and wildlife, as well as recreational usage.

The name "Lost Mound" refers to local folklore of a nearby post-glacial hill, or mound, that provides a backdrop for the sand prairie uplands of the Savanna Depot. The mound did not appear on early maps of the region; however the "lost" mound has since been found and is featured on recent topographical maps.

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Photograph of lime kiln near the west end of the Nelson Unit of Bellevue State park in the area of field trip stop 5 (back cover). This is archaeological site 13JK264 and is described in detail by Mark Anderson beginning on page 55 of this guidebook. Photo by Brian Witzke.

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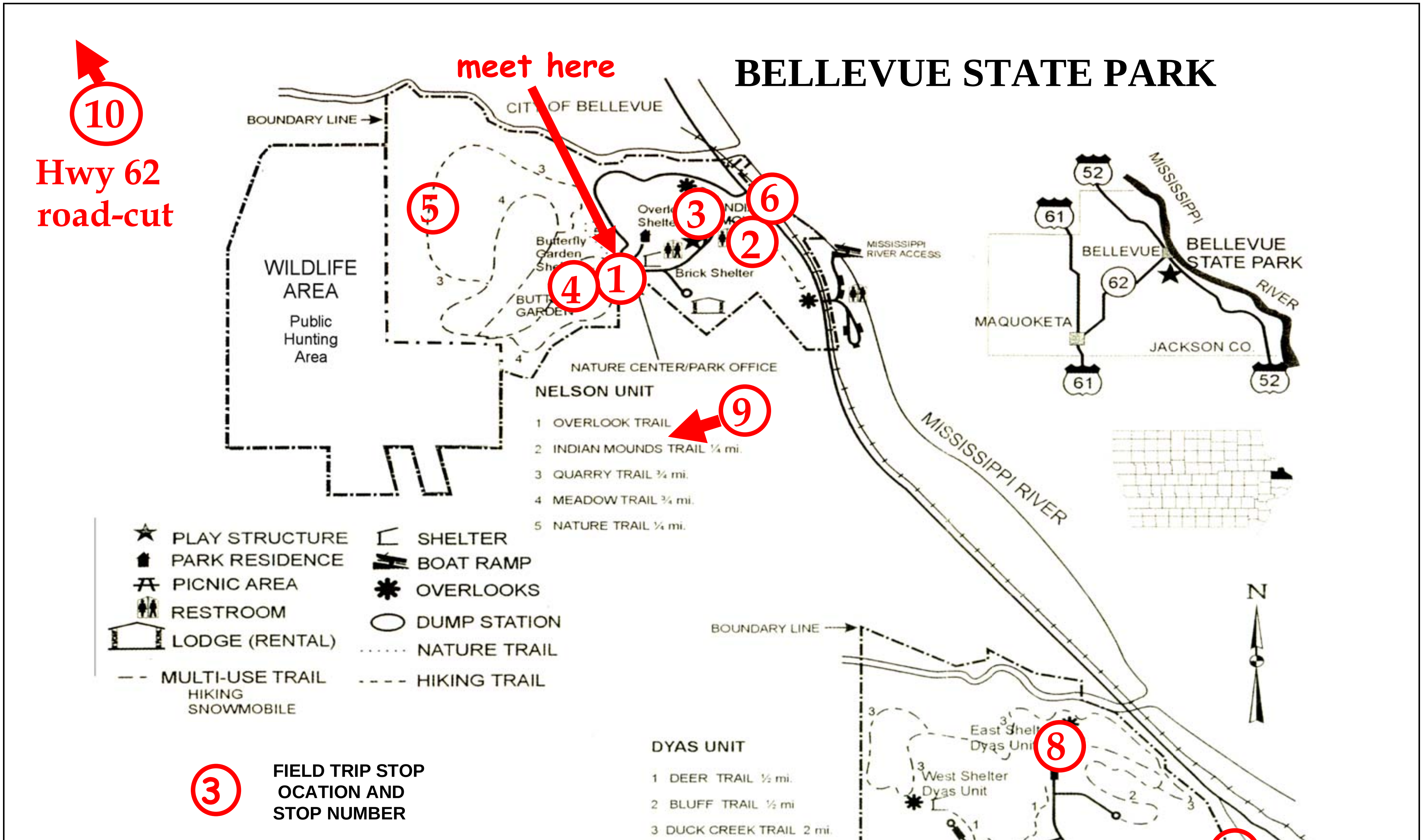

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