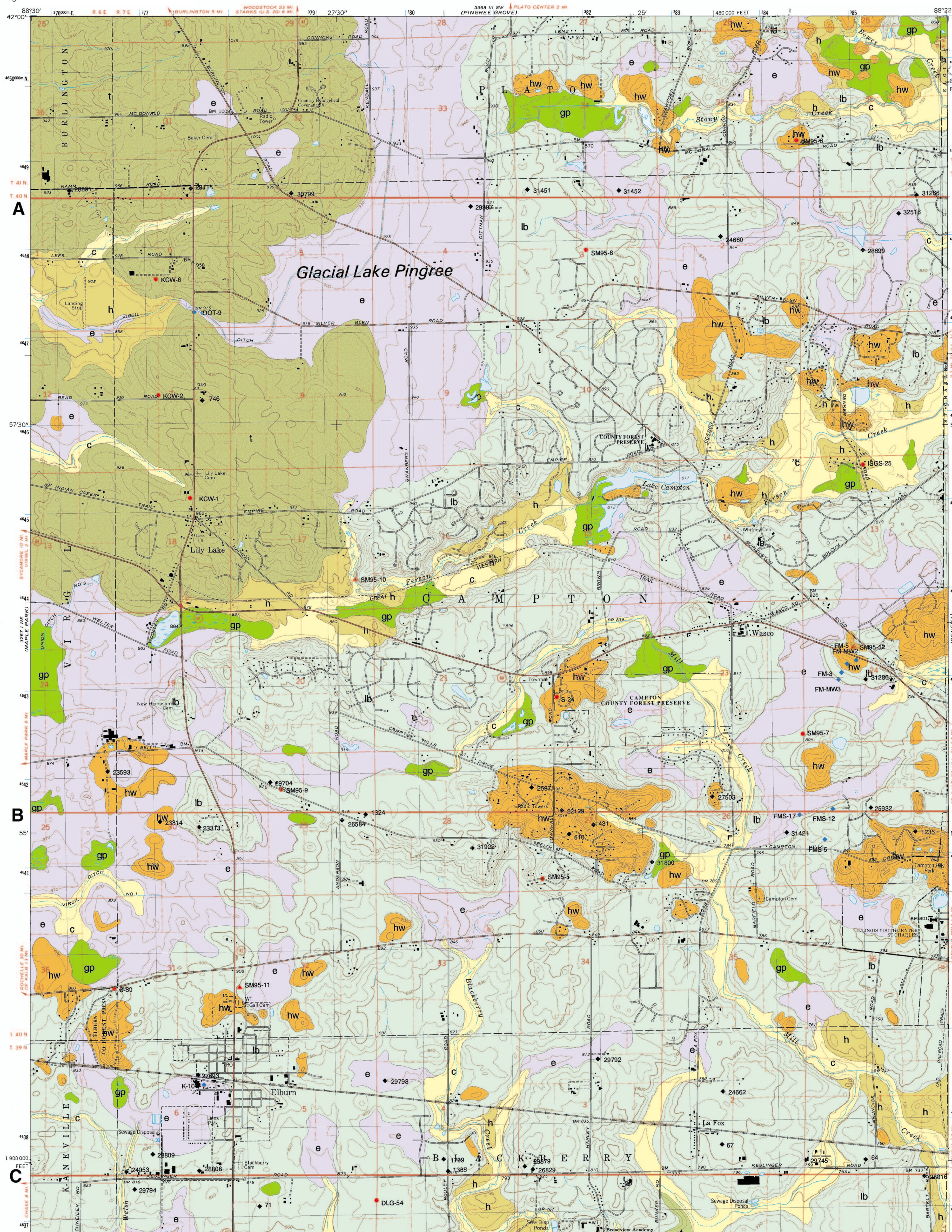
George H. Ryan, Governor

Department of Natural Resources
Brent Manning, Director
ILLINOIS STATE GEOLOGICAL SURVEY
Illinois Geologic Quadrangle Map: IGQ Elburn-SG
William W. Shilts, Chief
2001

SURFICIAL GEOLOGY MAP

Elburn Quadrangle, Kane County, Illinois

David A. Grimley and B. Brandon Curry



DISCLAIMER: The above map and associated cross sections are based on data from different sources that are of varying quality. The accuracy of map unit boundaries is nonuniform, reflecting differences in the quality and quantity of data point locations and material descriptions. Some map unit boundaries, particularly those in the subsurface, are difficult to delineate due to the transitional and unpredictable nature of material characteristics inherent in most glacial and nonglacial deposits. This map does not replace the need for more detailed site-specific studies of geologic materials and is not meant to be used at an enlarged scale. Rather, this study provides a geologic framework and model for future work in the area.

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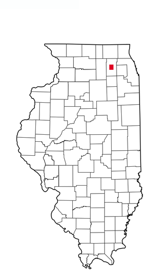
Scale 1:24,000
0 — 2 miles
0 — 2 kilometers
0 — 2000 feet

BASE MAP CONTOUR INTERVAL 10 FEET

Base map compiled at the Illinois State Geological Survey (ISGS)
from 1993 digital data provided by the U.S. Geological Survey and the ISGS
1927 North American Datum
Universal Transverse Mercator grid, zone 16



1	2	3
4		5
6	7	8

1 Hampshire
2 Pingree Grove
3 Elgin
4 Maple Park
5 Geneva
6 Big Rock
7 Sugar Grove
8 Aurora North

ADJOINING 7.5-MINUTE QUADRANGLES

DIGITAL CARTOGRAPHY: B.J. Stiff and S.K. Beaverson

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QUATERNARY GEOLOGY

The Elburn Quadrangle in northeastern Illinois, about 45 miles west of downtown Chicago (fig. A), is a glaciated area on the edge of rapid urbanization in Kane County. The present-day landscape and most surficial deposits in the Elburn Quadrangle resulted primarily from the action of continental glaciers during the last glaciation (Wisconsin Episode). Deposits of the next to last glaciation (Illinois Episode) are preserved in buried bedrock valleys and lowlands (see cross sections) where they were protected from erosion by subsequent glacial advances. Pre-Illinois episode glacial advances probably occurred in the region (Willman and Frye 1970), but their deposits have not been recognized in Kane County, because they were either eroded or are not distinguishable from Illinois Episode deposits. As a result of the many glacial pulses during the Wisconsin and Illinois Episodes, bedrock is buried by up to 225 feet of unsorted glacial debris (till), sorted sand and gravel (glaciofluvial deposits), sorted silt and clay (glacial and postglacial lake sediment), and peat (marsh deposits). Windblown silt (loess), peat, and modern river sediment thinly cover the glacial deposits with 2 to 15 feet of loose sediment. Bedrock does not crop out in the Elburn Quadrangle, but is within 50 feet of ground surface in some areas, as shown along cross section C–C′.

During early glaciations, ice advanced generally to the southwest from Canada via the Lake Michigan basin (fig. A; Willman and Frye 1970). During the most recent glaciation (the Wisconsin Episode), two sublobes of the Lake Michigan glacial lobe (the Harvard and Princeton Sublobes) merged and overlapped in Kane County (fig. A; Hansel and Johnson 1996). The flow of these sublobes, generally to the west, was impeded by bedrock highs (fig. B) or preexisting moraines in northwestern and central Kane County. As a consequence, several moraines, well separated to the south, are less separated or overlap in Kane County (fig. A; McGarry 2000). Thus, stacking of various types of glacial deposits of contrasting age and lithology occurs in the Elburn Quadrangle (see cross sections).

Deposits of the Illinois Episode glaciation include yellow-brown to pinkish brown loam to sandy loam till (Glasford Formation) as much as 70 feet thick. Significant sand and gravel bodies (also in Glasford Formation), deposited by glacial meltwaters, are up to 45 feet thick and occur within and beneath the till (all cross sections). The Glasford Formation is preserved below Wisconsin Episode deposits, primarily in bedrock lowlands or in buried valley segments below about 750 feet elevation (see cross sections). Illinois Episode deposits are not exposed in outcrop in this quadrangle. The upper 5 to 10 feet of Glasford Formation tills were weathered during the Sangamon interglacial episode (from about 135,000 to 55,000 years before present). This weathered zone is often described as a green clay in water-well drillers' logs. In some ancient depressions, the till deposits are overlain by as much as 10 feet of peat and organic silt (Robein Member of Roxana Silt), deposited in cool to cold climate bogs, between about 50,000 and 24,000 years before present in northern Illinois (Meyers and King 1985, Curry 1989).

The first major deposit of the Wisconsin Episode is a pinkish brown loam to clay loam diamicton with minor sand and gravel bodies (Tiskilwa Formation). This unit overlies the Robein Silt, Illinois Episode deposits, or bedrock in the Elburn Quadrangle. The typically dense and uniform Tiskilwa Formation is interpreted to be primarily subglacial till, but also may consist of debris flows. This unit may be up to 220 feet thick in the Marengo Moraine (cross section A–A′), the oldest moraine of the Wisconsin Episode in Illinois (fig. A; Hansel and Johnson 1996). Tiskilwa till occurs at the surface only in the northwest quarter of the Elburn Quadrangle and generally thins to the southeast beneath younger units. A buried portion of the Marengo Moraine occurs in the western half of cross section B–B′ (also, Wickham et al. 1988). The Tiskilwa till has a distinctive pinkish color and also has diagnostic physical properties in northeastern Illinois, averaging 35 ± 10% sand (0.063–2.0 mm), 39 ± 5% silt (0.004–0.063 mm), and 26 ± 6% clay (<0.004 mm) and 66 ± 3% illite in the clay mineral fraction, based on hundreds of samples (Wickham et al. 1988).

The Tiskilwa till in the Elburn Quadrangle was deposited by two sublobes of the Lake Michigan Lobe. Initially, the Harvard Sublobe advanced and formed the Marengo Moraine (fig. A) between about 25,500 and 22,500 years before present. A change in the configuration of the ice margin occurred afterwards when the Princeton Sublobe advanced and formed the Bloomington Morainic System (fig. A) between about 22,500 and 19,000 years before present. The Princeton Sublobe is thought to have overtopped the Marengo Moraine in much of Kane County (Wickham et al. 1988), including the Elburn Quadrangle. Fabric analyses from the Fox River Stone Quarry, a few miles east of this quadrangle, indicate a westerly direction of ice advance (for the Harvard Sublobe) during deposition of the lower part of Tiskilwa Formation, which changed to a northwesterly advance (for the Princeton Sublobe) during deposition of the upper Tiskilwa Formation (Curry et al. 1999).

Throughout most of the Elburn Quadrangle, in a hilly, morainic area known as the Elburn Complex (east and south of the Marengo Moraine), a yellow-brown to gray, silt loam to loam diamicton (Batestown Member, Lemont Formation) overlies the Tiskilwa Formation. Batestown diamicton, 5 to 35 feet thick, is generally softer, less uniform, and less pink than the Tiskilwa Formation. It can sometimes have a pale pinkish hue due to incorporation of Tiskilwa till. When uniform, Batestown till (previously called Malden Till Member; Willman and Frye 1970) is fairly silty, averaging 32 ± 6% sand, 46 ± 5% silt, and 22 ± 5% clay in northeastern Illinois (Wickham et al. 1988). Illite content in the clay mineral fraction (76 ± 2%) is greater than the Tiskilwa till, which reflects a larger proportion of shale eroded from the Lake Michigan basin (Wickham et al. 1988).

Batestown diamicton in this quadrangle is commonly associated with sand and gravel deposits (Henry Formation). The Elburn Complex (Willman and Frye 1970) also contains numerous hills, many of which are kames, that contain sand and gravel in their cores. Therefore, this geomorphic region is interpreted to be a stagnation (kamic) moraine. The kames formed where sand and gravel was deposited by meltwater flowing into holes or low areas in the ice, or along the margin of stagnant ice. Sand and gravel intermixed with silt and diamicton bodies (Wasco facies of the Henry Formation) can be up to 150 feet thick in the largest kames (cross section B–B′). The flanks of these kames are overlain by 5 to 25 feet of Batestown diamicton, deposited as debris-rich stagnant ice melted out on top of the sand and gravel. Sand and gravel (Henry Formation), deposited between glacial advances, is also found underneath many areas mapped as Batestown Member diamicton (cross sections A–A′ and C–C′).

The extensive kamic landscape in central Kane County was probably a result of the convergence of the Harvard and Princeton Sublobes and their inability to advance upgradient over the prominent Marengo Moraine (fig. A). These conditions, and the obstruction of drainage to the northwest, are consistent with ice stagnation in the deteriorating Harvard Sublobe and the interlobate area, as the Princeton Sublobe regionally advanced to the southwest and cut off the Harvard Sublobe after Tiskilwa till deposition. Deposition of Batestown diamicton and Wasco sand and gravel most likely occurred between about 19,000 and 18,000 years before present (Hansel and Johnson 1996).

After deposition of Batestown Member diamicton, glacial ice receded toward Lake Michigan before readvancing to the St. Charles Moraine and Minooka Moraine, just east of the Elburn Quadrangle (fig. A). Fossil seeds, small freshwater clams, and ostracodes (sand-sized aquatic crustaceans) from lacustrine deposits on the St. Charles Moraine in eastern Kane County suggest a climatic condition at about 17,500 years before present similar to modern-day tundra conditions in northern Canada (Curry et al. 1999).

A relatively thin covering (< 20 feet) of stratified fine sand, silt, and clay (Equality Formation) was deposited in many low lying areas, where glacial lakes formed during the last glacial episode. Larger lakes, such as Glacial Lake Pingree (Sec. 4 and Sec. 9, T40N, R7E), formed when water was trapped between advancing ice and the Marengo Moraine. After ice receded to the east, Glacial Lake Pingree probably drained southward and westward into another lake basin (Sec. 24 and Sec. 25, T40N, R6E) and, eventually, farther westward to the South Branch Kishwaukee River and the Rock River valleys. Other lakes formed on top of glacial ice or in valleys tributary to larger creeks and rivers during periods of high flow. Outwash sand and gravel (Henry Formation), from 5 to 40 feet thick, occurs along valley terraces of Ferson, Mill, and Blackberry Creeks. These coarse-grained river deposits were periodically deposited by glacial meltwater streams as ice downwasted in the Elburn Complex.

After ice of the Wisconsin Episode receded, 2 to 4 feet of loess (Peoria Silt) was deposited by episodic dust storms, which deflated silt from outwash in the Rock River and Mississippi River Valleys. During postglacial times, Grayslake Peat was deposited in current and former marshy depressions where high water tables and lack of oxygen prevented organic materials from decomposing. Modern stream sediment (primarily sand and silt deposits) occurs above outwash, lake deposits, and till along the many creeks and rivers in the area. Thin colluvial deposits on some steep hillsides were not mapped.

MATERIAL RESOURCES AND ENVIRONMENTAL HAZARDS

Sand and Gravel

Significant sand and gravel deposits in the Elburn Quadrangle include the Henry Formation, as well as sorted sediment within till units. Sources of economically minable sand and gravel are mostly limited to the Henry Formation (including the Wasco facies) because sand and gravel bodies within till units are more limited in thickness and are unpredictable in their dimensions. Sand and gravel within the Glasford Formation is significant, but appears to be buried too deeply for any practical use (cross sections and fig. B).

Sand and gravel deposits in central Kane County have been a source of construction materials for many years (Leighton et al. 1928–1930, Block 1960, Masters 1978). Many small pits once operated in outwash deposits in terraces and deltas (undifferentiated Henry Formation) and in ice-contact deposits in kamic hills (Wasco facies, Henry Formation). Few, if any, pits remain in the Elburn 7.5' Quadrangle because of the rapid suburban growth of the area and because of the trend towards fewer, but larger, sand and gravel operations. Several large operations exist immediately south of this quadrangle (about 3–4 miles south of Elburn) in the delta of the Kaneville Esker, where thick deposits of Henry Formation and Pearl Formation occur. Today, sand and gravel are commonly used by the construction industry for concrete, asphalt, fill, and roadbase (Goldman 1994).

Groundwater and Its Potential for Contamination

Groundwater, pumped from sand and gravel aquifers, is extensively used by households, municipalities, and industries in Kane County (Curry and Seaber 1990). Aquifers, in former valleys that are buried by later glacier advances (such as the sand and gravel in the base of the Glasford Formation), provide a high-quality water supply because they are overlain and protected by silty or clayey till deposits (cross sections B–B′ and C–C′). In the many upland areas, the most common Quaternary aquifers are Wasco facies of the Henry Formation as well as sand and gravel bodies within and between till units (stippled in all cross sections). In some valleys and lowlands (such as Ferson Creek, Blackberry Creek, and Mill Creek), bodies or tongues of Henry Formation sand and gravel compose the most significant Quaternary aquifer. Many wells also obtain water from fractured dolomite bedrock or deep sandstone aquifers. Curry and Seaber (1990) provide an overview of bedrock and Quaternary sediment aquifers and groundwater resources in Kane County.

Agricultural or industrial contaminants are a potential threat to groundwater quality in near-surface aquifers that are not overlain by a clayey, unfractured confining unit (such as clayey till or lake sediment). Shallow sand and gravel aquifers, such as the Henry Formation exposed at the surface or buried by a thin loess cap (< 4 feet), are most vulnerable to contamination. Tiskilwa Formation till, typically ranging from 25% to 30% clay, is a good aquitard where it is uniform and does not contain sand bodies. Batestown Member till (typically 15% to 20% clay in the quadrangle) is a fair to poor aquitard because it is less clayey than Tiskilwa Formation till and is more heterogeneous, containing numerous sand bodies and lenses, particularly where associated with or near areas of kamic topography (see cross sections). Sand and gravel occurring below Glasford tills are probably well protected, but may have limited yields. A summary of the factors in determining the potential for contamination in shallow aquifers in Illinois is provided by Berg et al. (1984).

MAPPING TECHNIQUES AND DATA SOURCES

This surficial geologic map is based in part on soil parent materials compiled from the *Soil Survey of Kane County* (Goddard 1979, scale 1:15,840) and early unpublished data and geologic maps at the 1:62,500 scale (Leighton et al. 1928–1930). The map was considerably modified based on field observations and new drill cores taken in 1995 (e.g., SM95-6 on map). Additional data sources for the surficial geology map include Leverett (1899), Gross (1969), Curry et al. (1988), and unpublished field notes on file at the Illinois State Geological Survey (ISGS). Well-log descriptions, Illinois Department of Transportation records, and other logs of engineering data, on file at the ISGS, were also used to aid in mapping, and especially in drafting the three cross sections. The most important data used for constructing this surficial geologic map are located on the map and are described in detail in an accompanying report of the Key Outcrop and Boring Descriptions of the Surficial Geology Map of the Elburn 7.5' Quadrangle (Grimley 2000).

CROSS SECTIONS

Sand and gravel bodies are stippled on cross sections. Their extents are estimated from available data. Additional sand and gravel lenses undoubtedly occur within till of the Glasford Formation, Tiskilwa Formation, and Batestown Member of Lemont Formation, but are not shown except where water wells, test holes, or outcrops indicate their presence. Sand and gravel lenses, deposited in former glacial meltwater channels, are difficult to predict in the absence of detailed data. A 2- to 4-foot-thick cover of loess at the ground surface is not shown, nor are most other geologic units that are less than 5 feet thick.

Water wells and test holes used for the three cross sections are transposed from no more than 2000 feet to the north or south of the cross section lines (see data points on map.) Data points were transposed to positions on the cross section with similar geomorphology and with surface elevations similar to the original borings. Many water wells extend deep into bedrock and so their full extent is not always shown. Details of the stratigraphic information yielded from these wells and test holes are provided in Grimley (2000). Well-log descriptions are available from the Geologic Record Unit at the ISGS.

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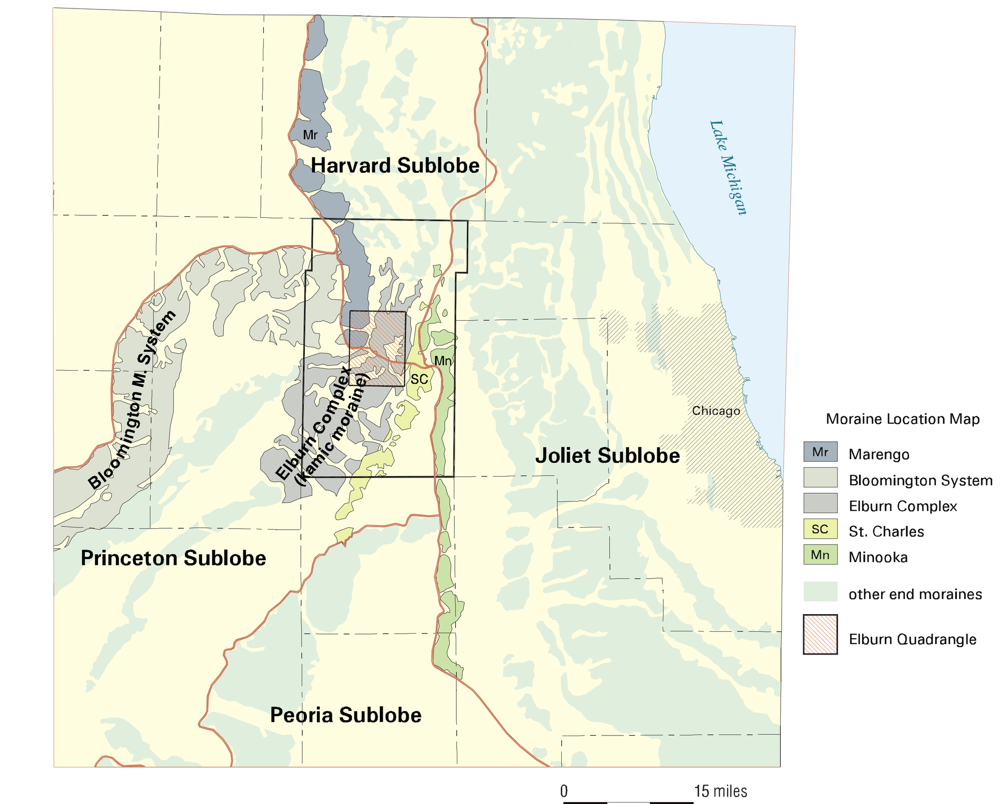


Figure A Wisconsin Episode moraines in northeastern Illinois.
Moraines, shown in blue and green, were formed near the terminus of glacial ice during various positions of the Lake Michigan Lobe. Glacial ice advanced in a westerly and southwesterly direction into Illinois from the Lake Michigan basin. Thus, the older moraines of this figure occur generally to the west and the younger moraines to the east. On this map, adapted from Willman and Frye (1970), Kane Cc hatchured in red.

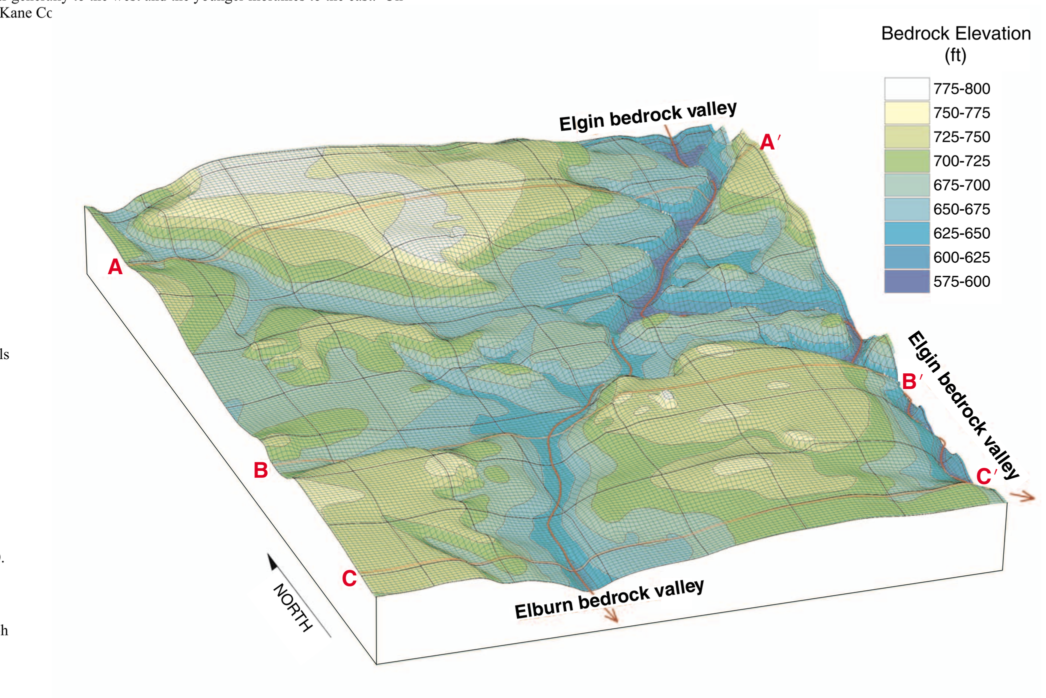
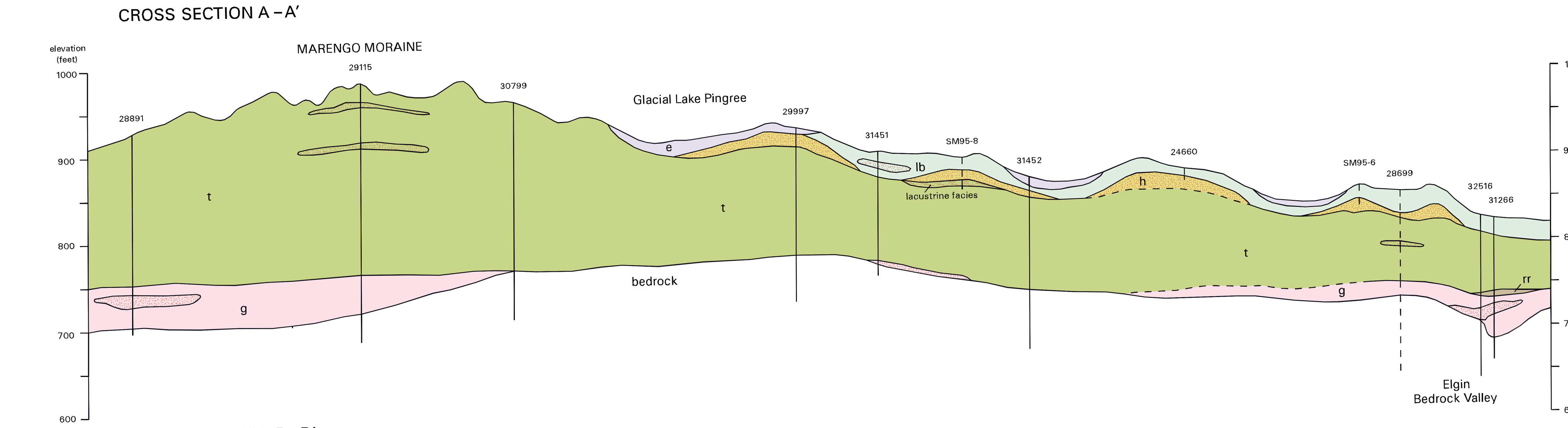
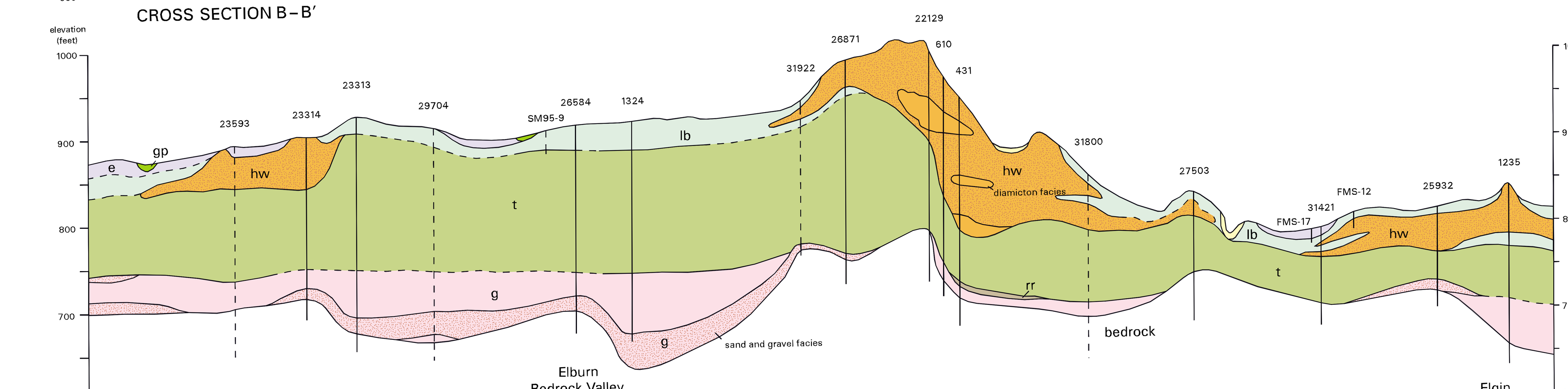


Figure B Bedrock topography of the Elburn Quadrangle.
This map portrays the elevation of the bedrock surface below glacial deposits (see cross sections). Lighter shades indicate higher elevations. Major valleys on the bedrock surface (such as the Elburn Bedrock Valley) reflect the preglacial topography. Most preglacial geomorphic features were reshaped by successive glacial advances or filled in with glacial deposits during the Quaternary Period. On this map, the black line grid indicates land survey section lines for reference with the surficial geologic map, with each square on the grid being one mile on a side. Cross section lines are shown in red for additional reference to the map and cross sections.

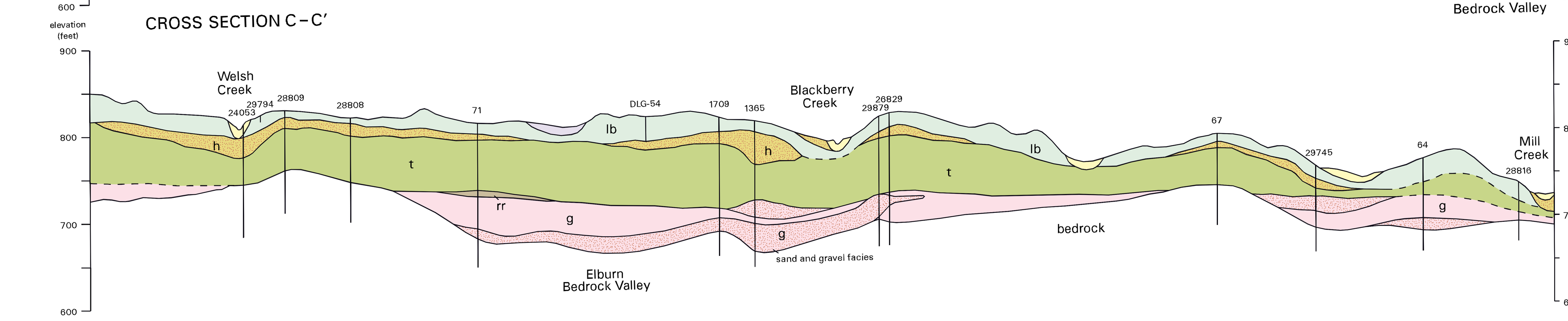
CROSS SECTION A – A′



CROSS SECTION B – B′



CROSS SECTION C – C′



Materials		Lithostratigraphic Units and Interpretations
		QUATERNARY DEPOSITS
		Hudson Episode (postglacial)
fibrous peat, muck, and organic silt and clay; sometimes interbedded with sand, silt, and clay; 5 to 10 feet thick	gp	Grayslake Peat [gp] Intertongues with the Equality and Cahokia Formations.
stratified sand, silt, and clay, locally containing beds of sandy gravel; 5 to 20 feet thick	c	Cahokia Formation [c] Alluvium; occurs in floodplains and channels of streams such as Ferson, Bowes, Blackberry, and Mill Creeks.
		Wisconsin Episode
laminated to massive clay and silt, containing some beds of fine to medium sand; 5 to 20 feet thick; overlain by 0 to 4 feet of silt (loess)	e	Equality Formation [e] Lacustrine sediment; intertongues with other units in the Mason and Wedron Groups; occurs in proglacial, supraglacial, slackwater, and some postglacial lake basins; overlain by 0 to 4 feet of Peoria Silt.
stratified to massive sand and gravel containing beds of silt, clay, and diamicton; generally well-sorted; can be cross-bedded or plane-bedded; generally 5 to 30 feet thick; overlain by 0 to 4 feet of silt (loess)	h	Henry Formation (except Wasco facies) [h] Outwash; intertongues with Equality Formation and Wedron Group units; occurs in glacial meltwater channels along Ferson, Bowes, Blackberry, and Mill Creek valleys; overlain by 0 to 4 feet of Peoria Silt.
irregularly bedded and moderately sorted sand and gravel, containing lenses of silt, clay, and diamicton; 5 to 150 feet thick; overlain by 0 to 4 feet of silt (loess)	hw	Wasco facies, Henry Formation [hw] Ice contact sediment; commonly interstratified and associated with the Batestown Member, Lemont Formation; occurs in kames and kamic moraines; overlain by 0 to 4 feet of Peoria Silt.
stratified organic silt, peat, silt, and clay; brown, black, gray, and blue gray; leached; 0 to 10 feet thick	rr	Robein Member, Roxana Silt. [rr] (in cross-sections only) Underlies Henry Formation or Wedron Group.
silt loam to loam diamicton, gray to gray-brown, oxidizing to yellow-brown, orange-brown, or pale pinkish brown; 5 to 35 feet thick; lower portion is massive; upper portion is often stratified and interbedded with silt and sand; massive zones are less common in northern part of quadrangle; overlain by 0 to 4 feet of silt (loess)	lb	Batestown Member of Lemont Formation [lb] Till and ice marginel sediment; often intertongues with Wasco facies, Henry Formation in kamic topography; overlain by 0 to 4 feet of Peoria Silt.
loam to clay loam diamicton; gray to pinkish brown; locally contains beds or small channels of sand and gravel; occurs at the surface in the Marengo Moraine where it is as thick as 220 feet; thins considerably to south and east; overlain by 0 to 4 feet of silt (loess)	t	Tiskilwa Formation [t] Till and ice marginel sediment; overlain by 0 to 4 feet Peoria Silt.
		Illinois Episode
loam to sandy loam diamicton; 0 to 70 feet thick; pinkish brown to brown; some thick beds and channels of sand and gravel (up to 45 feet thick)	g	Glasford Formation [g] (in cross-sections only) Till, ice marginel sediment, and proglacial outwash; sorted sediment channels are particularly thick in bedrock valleys underneath diamicton bodies in cross sections B-B′ and C-C′.
		SILURIAN AND ORDOVICIAN BEDROCK
limestone, shale, and dolomite bedrock which dip gently to the east		bedrock (in cross-sections only) Silurian carbonates and Ordovician shale and dolomite (Maquoketa Group); Silurian rock is preserved mainly on bedrock highs, but has been eroded to the underlying Maquoketa Group in most bedrock valleys (fig. B and Curry et al. 1988)

DATA POINTS

- Water Wells
- IDOT Borings
- Engineering Borings
- ISGS Outcrops
- ISGS Borings
- Water
- Marengo Moraine (map only)

CROSS SECTIONS

- More reliable contact (based on higher quality data)
- Less reliable contact (based on lower quality or limited data)
- Data point less than 1000 feet from cross section line
- Data point more than 1000 feet from cross section line
- Sand and gravel (cross section only)

Horizontal scale: 1 inch = 2000 feet

Vertical scale: 1 inch = 100 feet

Vertical exaggeration: 20x