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SAND AND GRAVEL RESOURCES OF McHENRY COUNTY, ILLINOIS

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ABSTRACT

The sand and gravel deposits in McHenry County are the result of glacial processes which were in operation during the recent geologic past. Three general types of gravel deposits are recognized: outwash plains (sheet deposits), valley trains (elongate deposits), and ice-contact stratified drift (kames and related forms).

Outwash plains support the bulk of the present sand and gravel industry and probably offer the most favorable prospects for further industrial expansion. Valley-train deposits are limited in occurrence but could be developed to a much greater degree than they are at present. Ice-contact deposits offer good possibilities for production of sand and gravel, but because of their extreme textural variability they must be thoroughly tested and evaluated before their development is undertaken.

INTRODUCTION

Purpose of Study

The sand and gravel industry of McHenry County (fig. 1) has been well established for many years, particularly in the area between Algonquin and Crystal Lake. In recent years the demand for sand and gravel has increased sharply, and as the Chicago metropolitan area continues to expand, the sand and gravel deposits of McHenry and adjacent counties will assume an increasingly important role in the pattern of metropolitan growth.

This report is one of a series prepared by the Illinois State Geological Survey to delineate and evaluate the sand and gravel resources of the state. For the northern Illinois area, reports on Kane (Block, 1960), Lake (Ekblaw and Schaefer, 1960), Cook (Bretz, 1955) Counties and a major part of Will County (Fisher, 1925) have been published.

Fig. 1. Index map

Previous Investigations

The glacial geology of McHenry County was first described by Leverett (1899) in his monograph on the Illinois Glacial Lobe. Similar studies in adjoining parts of Wisconsin were carried on later by Alden (1904, 1918). During the decade 1920 to 1930, a preliminary map of the sand and gravel resources of northeastern Illinois was prepared by George E. Ekblaw, and the Barrington, Elgin, and Geneva quadrangles were mapped in detail by Paul MacClintock (1921) and by M. M. Leighton, Paul MacClintock, L. E. Workman and W. E. Powers (1931). Their unpublished reports are on open-file at the offices of the State Geological Survey. The glacial geology of the Grays Lake quadrangle, part of which is in McHenry County has been briefly described by Powers and Ekblaw (1940). A review of the textures of soil parent materials in northeastern Illinois, including McHenry County, has recently been made by Wascher and others (1960).

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TYPES OF DEPOSITS

General Statement

The earth-materials at the surface of McHenry County are, with minor exceptions, the product of glacial activity. So recent has been the retreat of the glaciers from the area that the present day weathering and stream erosion have but slightly modified the original landscape.

The sand and gravel deposits of the county are intimately related to the advance and retreat of the glacial ice and to the sorting action of the accompanying glacial meltwaters. Therefore, an understanding of the major features and events of the glacial history of the county is necessary in order to evaluate the sand and gravel resources. The present study has utilized topographic maps,

TABLES 1 - LOCATION OF SAMPLES

Sample no.	Location 1/4	1/4	Sec.	T.	R.	Thickness sampled (feet)	Source	Kind of deposit
1	NE	NE	11	44N.	6E.	10	Gravel pit	Outwash (sheet deposit)
2	SE	SE	14	43N.	5E.	8	Gravel pit	Outwash (sheet deposit)
3	SE	SW	35	45N.	5E.	Pit run	Gravel pit	Outwash (sheet deposit)
4	SW	NW	1	45N.	5E.	15	Gravel pit	Outwash (sheet deposit)
5	NE	NW	8	46N.	7E.	17	Gravel pit	Kame
6	NE	NE	6	45N.	8E.	5	Gravel pit	Kame
7	SW	NW	22	46N.	8E.	10	Gravel pit	Outwash (elongate deposit)
8	NW	NE	14	45N.	8E.	6	Sand pit	Outwash (elongate deposit)
9	SE	NE	31	45N.	9E.	8	Gravel pit	Kame
10	NW	SW	15	44N.	7E.	7	Gravel pit	Outwash (sheet deposit)
11	NW	SE	28	43N.	7E.	5	Gravel pit	Outwash (sheet deposit)
12	NE	NE	9	43N.	8E.	Pit run	Gravel pit	Outwash (sheet deposit)

field examination of the materials in natural and man-made exposures and in hand auger borings, and a study of the logs of wells, both to understand the glacial history and to map potential sand and gravel bearing areas.

McHenry County contains four major types of materials occurring at the ground surface, the first three of which are of glacial origin. They are till, outwash, ice-contact stratified drift, and peat and muck.

Glacial Till

Glacial till, a mixture of earth materials deposited directly by a glacier, has the following characteristics: it is not layered or bedded, it is composed of a mixture of materials ranging in size from clay to boulders, it usually displays a platy or blocky structure, and when crumbled between the fingers it forms rough blocks or plates.

When the front of a glacier remained stationary, or fluctuated within a narrow zone, the rock debris within the ice was liberated as the ice melted, and it accumulated as a series of marginal ridges, composed mainly of till, known as an end moraine. The surfaces of the end moraines in McHenry County are hummocky and have many sharp knolls and undrained depressions. There are several end moraines in the county, some of which contain hills of gravel.

Outwash

The melting of the ice of the glaciers produced large quantities of meltwater, especially during the summer, that flowed upon, within, and beneath the ice and also away from the front of the glacier. The meltwater carried a load of rock debris freed from the ice, and, because of loss of velocity, dropped much of this material as a sheet-like deposit in front of the glacier. Such deposits are called outwash plains.

Some of the meltwater flowing away from the glacier followed pre-existing stream valleys, and, because of loss of velocity, built up large deposits of sand and gravel along the old channels. These deposits, called valley trains, are another type of outwash. Later erosion removed portions of such valley trains, leaving only remnants of them as terraces along the valley walls.

In some places outwash deposits occupy linear depressions cutting back into, or even through, an end moraine. They were made by meltwater that flowed through channels beneath a glacier. Such features are well developed along the Marengo moraine in western McHenry County (pl. 1).

When the material in outwash deposits was being transported and deposited by water, it was subjected to a sorting action that removed most of the clay and resulted in stratified deposits consisting of sand and/or gravel. Areas of outwash, therefore, are favorable areas in which to search for commercial deposits of gravel or sand. The deposits are usually in layers. The size of the materials in the different layers is likely to vary and may change abruptly from place to place. Some outwash deposits are mainly sand; in others pebbles predominate.

Ice-Contact Stratified Drift

When a glacier became immobile or stagnant, outwash was deposited upon or adjacent to melting masses. The result was layered deposits that are called ice-contact stratified drift, and such deposits constitute all or a part of an end moraine. Many areas of ice-contact stratified drift are characterized by closed depressions that mark the former site of huge blocks of ice that broke loose from the glacier. Rounded hills and knobs of sand and gravel, formed where water plunged into crevasses in the glacial ice, also are common at some places. The depressions are called "kettles" and the hills "kames." Where kames constitute a major portion of an end moraine, it is referred to as a kame moraine. Kames and kettles are especially abundant and well developed in the vicinity of Wonder Lake.

At some places ice-contact deposits are good sources of gravel or sand, but many such deposits are relatively small. Generally, the material in the ice-contact deposits is less well sorted than that in the outwash deposits, it ranges in size from silt to coarse gravel, and it is irregularly bedded. Kames have been the source of sand and gravel at many places.

Peat and Muck

Peat and muck deposits occur in numerous depressions in McHenry County, and, although they are not related to sand and gravel resources, they were mapped in order to complete the picture. Peat is defined (Soper and Osbon, 1922, p. 4) as "the partly carbonized organic residuum produced by an arrest in the decomposition of . . . vegetation covered or saturated with water," whereas muck is considered to be "soil that contains a high percentage of uncarbonized organic matter."

Both the peat and muck of McHenry County accumulated in poorly drained areas during post-glacial times. No distinction was made between the two materials in mapping, but the quantity of true peat in the county probably is limited. Proper preparation of the material from some deposits may yield a product that is commercially valuable for horticultural purposes.

DISTRIBUTION OF SAND AND GRAVEL

General Statement

For convenience, and to facilitate describing them, the sand and gravel deposits of the county have been grouped according to their association with end moraines. Because it is not always possible to link outwash deposits with specific moraines, this subdivision is at many places purely arbitrary.

Sand and Gravel Associated with the Shelbyville End Moraine

The Shelbyville end moraine trends north-south along the western boundary of the county. The glacial till which makes up the end moraine is silty and clayey, compact and impervious. Because only the back slope of the end moraine lies within McHenry County, no Shelbyville outwash occurs within the county. Limited areas of ice-contact deposits occur at four places as distinct knobs or kames. In secs. 8 and 18, T. 46 N., R. 5 E., the kames each have a "tail" which has been worked as a local source of gravel. The material ranges from pebbly sand to coarse gravel with generally less than 5 feet of silt overburden. Similar conditions are found in a group of small kames near the center of sec. 29 of the same township, although exposures in an abandoned pit show mostly pebbly sand. Another prominent kame is located in the NE$\frac{1}{4}$ sec. 7, T. 44 N., R. 5 E. where road-cuts show sand and coarse gravel.

Sand and Gravel Associated with the Marengo End Moraine

Outwash

Because of its pink color, silty texture, and platy structure, till of the Marengo end moraine is distinctive. The end moraine trends north-south from the Wisconsin state line to Marengo where it swings sharply to the southeast, reaching the southern boundary of the county near the village of Harmony. Throughout this distance it is bordered on the outer, western margin by an extensive outwash plain and is bisected in several places by subglacial channels. This outwash plain and its associated subglacial channels are composed almost entirely of gravel. Pits have been opened at a number of places in it but the most successful operations are located at the outer ends of subglacial channels, particularly those at Big Foot Prairie (SW$\frac{1}{4}$ sec. 1, T. 46 N., R. 5 E.), south of Harvard (NW$\frac{1}{4}$ sec. 1, NE$\frac{1}{4}$ and SE$\frac{1}{4}$, sec. 2, T. 45 N., R. 5 E.), in the SW$\frac{1}{4}$ sec. 35, T. 45 N., R. 5 E., and northeast of Riley (SE$\frac{1}{4}$ sec. 14, T. 43 N., R. 5 E.) (pl. 1). The gravel pits south of Harvard are operating, at least in part, in outwash from the West Chicago end moraine. Likewise the bisecting channels to the south, including the large channel now occupied by the Kishwaukee River, contain admixtures of later outwash.

In general, the thickness of outwash decreases with distance west of the Marengo end moraine. Inasmuch as the outwash overlaps the back slope of the Shelbyville end moraine on the west and becomes restricted to definite channels as it crosses the moraine, "islands" of Shelbyville till remain above the level of the outwash plain at a number of places (pl. 1). Bedrock lies close to the surface along Piscasaw Creek southwest of Chemung and crops out just beyond the county line in the NE$\frac{1}{4}$ sec. 24, T. 45 N., R. 4 E. Bedrock also lies close to the surface east of Garden Prairie in Boone County and is quarried in the NW$\frac{1}{4}$ sec. 31, T. 44 N., R. 5 E., in McHenry County. In these areas the bedrock is overlain

by Shelbyville till. Apparently these masses of till were "defended" from later meltwater erosion by resistant bedrock at shallow depth. Thus around these "islands," outwash from the Marengo moraine becomes thin and may at places lie directly upon bedrock rather than upon Shelbyville till.

Ditch excavations and small gravel pits along Rush Creek as far downstream as the NE$\frac{1}{4}$ sec. 19, T. 44 N., R. 5 E., show gravel which is probably more than 10 feet thick throughout this distance. The maximum reported thickness in gravel pits along the front of the Marengo moraine is 50 feet, and it is likely that within and adjacent to the subglacial channels the thickness is not less than 20 feet.

The gravelly portions of the outwash plain range from fine to coarse sandy gravel (tables 1 and 2, samples 2, 3, 4) with from 2 to 5 feet of pebbly silt overburden. Sample 4 may contain outwash associated with the West Chicago moraine. A large area of medium-grained, well sorted sand occurs along the Kishwaukee River and the lower portions of Coon Creek within the county. It is continuous with an extensive sandy outwash plain along the West Chicago end moraine to the east. West of Marengo this sand may be underlain by gravel similar to that which occurs elsewhere along the Marengo end moraine. Between Harvard and Chemung and extending northward toward Lawrence the outwash appears to be mostly silt (pl. 1). This was probably a backwater area during the period of outwash deposition.

About 85 percent of the pebble fraction consists of dolomite (table 3, samples 2, 3, 4). The remainder is mostly limestone and igneous rocks. Soft shale pebbles are rare.

Ice-Contact Stratified Drift

Small masses of ice-contact stratified drift occur in secs. 29, 31, and 32, T. 45 N., R. 6 E. (pl. 1). Here, on the north side of the up-stream end of a subglacial channel, is a complex of small kames which has supplied local gravel needs from several small pits. The material is fine- to medium-grained sandy gravel with as much as 5 feet of clayey silt overburden.

Sand and Gravel Associated with Gilberts, Huntley, and Marseilles End Moraines

Outwash

Inasmuch as the Gilberts, Huntley, and Marseilles end moraines are rather closely related, and because they are limited to the south-central part of the county, they are considered as a unit. These end moraines trend northwesterly from the southern boundary of the county, at approximately the latitude of Union they change to a northeasterly trend, and two to three miles west and southwest of Woodstock they are covered and obscured by the West Chicago end moraine (pl. 1). Portions of these moraines have been covered or eroded away by later meltwater, and hence they tend to be patchy and discontinuous, particularly the Gilberts end moraine, the oldest of the three. Gilberts till is buff-brown and somewhat more sandy than Marengo till. By contrast, Huntley and Marseilles till is lighter in color and contains significantly more clay, making it compact and tough.

Coarse-grained outwash associated with these end moraines is restricted primarily to the area adjacent to the Kishwaukee River and its South

TABLE 2 - SCREEN ANALYSES
(Percent retained)

Sieve	Sample number 1	2	3	4	5	6*	7	8	9	10	11	12
2½ inch	-	-	-	-	-	-	-	-	-	-	-	-
2 inch	3.3	5.0	2.0	-	15.2	9.9	8.7	-	6.4	1.3	-	0.8
1½ inch	3.1	8.8	3.5	7.0	2.9	11.2	6.7	-	-	3.3	1.7	6.3
1 inch	5.6	7.7	2.4	9.1	5.1	6.8	4.8	-	4.1	7.3	2.0	7.3
3/4 inch	6.6	7.0	7.7	9.0	5.1	7.6	4.0	-	1.9	7.0	4.4	7.7
½ inch	4.9	5.1	7.9	7.2	5.9	4.9	4.2	-	2.4	4.9	4.0	6.8
3/8 inch	6.1	5.3	11.4	8.0	6.7	5.1	6.1	-	3.1	6.3	7.8	8.9
4 mesh	9.9	8.2	17.6	11.5	10.9	7.2	13.5	-	11.8	8.6	11.4	16.5
6 mesh	8.8	5.5	6.2	4.7	8.9	5.6	5.4	-	5.0	13.9	6.0	7.4
8 mesh	9.1	6.4	7.2	9.7	7.9	3.5	7.8	-	7.4	14.1	8.2	6.3
10 mesh	7.1	6.0	5.6	7.4	6.2	2.1	6.7	-	8.6	11.2	6.7	7.9
14 mesh	5.7	5.5	4.5	5.6	4.3	1.6	5.9	-	9.9	7.7	5.9	6.0
20 mesh	4.5	5.1	3.6	4.1	3.1	1.5	5.6	-	9.5	5.0	4.3	4.4
28 mesh	6.1	6.7	4.2	5.3	3.4	2.4	8.6	-	9.9	4.0	5.1	3.7
35 mesh	6.2	5.9	3.7	3.2	3.1	3.1	6.0	0.2	6.7	2.5	4.2	2.3
48 mesh	6.7	6.0	4.5	2.4	3.6	5.1	3.5	1.9	5.2	1.4	5.1	1.5
65 mesh	3.0	2.8	3.7	0.8	2.3	4.8	0.8	24.3	2.6	0.5	3.5	0.8
100 mesh	1.4	1.2	2.2	0.2	1.8	4.2	0.3	53.4	1.3	0.2	2.6	0.6
150 mesh	0.4	0.4	0.7	0.1	0.8	2.4	0.1	16.3	0.5	0.1	1.2	0.4
200 mesh	0.2	0.2	0.3	Tr	0.5	1.9	0.1	3.0	0.3	Tr	1.0	0.2
270 mesh	Tr	0.1	Tr	Tr	0.2	0.9	0.1	0.1	0.1	Tr	0.5	Tr
Pan	1.2	1.2	1.0	5.0	1.9	8.2	1.0	0.7	3.1	0.5	14.2	3.9
Total	99.9	100.1	99.9	100.3	99.8	100.0	99.9	99.9	99.8	99.8	99.8	99.7
+1 inch	12.0	21.5	7.9	16.1	23.2	27.9	20.2		10.5	11.9	3.7	14.4
+4 mesh	39.5	47.1	52.5	51.8	51.8	52.7	48.0		29.7	38.7	31.3	54.3
-4 mesh	60.4	53.0	47.4	48.5	48.0	47.3	51.9	99.9	70.1	61.1	68.5	45.4

*Sample contained balls of sandy clay and loosely cemented sand. Sample analyzed was washed to disaggregate these balls.

TABLE 3 - PEBBLE COUNTS OF GRAVEL DEPOSITS IN McHENRY COUNTY
(Percent by number of pebbles)

Sample No:	1		2		3		4		5		6		7		9		10		11		12	
Size inches:	1/2 × 3/8	3/4 × 1/2	1/2 × 3/8	3/4 × 1/2	1/2 × 3/8	3/4 × 1/2	1/2 × 3/8	3/4 × 1/2	1/2 × 3/8	3/4 × 1/2	1/2 × 3/8	3/4 × 1/2	1/2 × 3/8	3/4 × 1/2	1/2 × 3/8	3/4 × 1/2	1/2 × 3/8	3/4 × 1/2	1/2 × 3/8	3/4 × 1/2	1/2 × 3/8	3/4 × 1/2
Dolomite	89.8	80.2	88.2	84.5	85.6	88.1	80.8	84.0	80.0	74.3	84.4	88.7	63.3	79.8	85.2	80.4	79.5	86.5	81.2	82.2	84.3	87.8
Limestone	0.4	3.2	1.5	7.3	3.2	2.6	3.5	1.9	3.1	9.7	2.3	3.5	9.2	0.8	4.0	2.2	2.8	3.0	0.9	1.4	3.1	2.9
Chert	1.5	2.4	1.1	0.9	1.9	0.9	1.7	3.8	8.7	2.7	2.0	1.7	7.1	5.6	----	----	5.4	0.7	3.3	2.7	2.3	0.4
Shale	0.4	----	0.7	0.9	0.3	----	----	----	----	----	1.1	----	4.6	0.8	1.7	----	----	----	10.9	12.3	0.5	----
Siltstone & sandstone	0.7	1.6	0.4	----	1.6	1.7	0.7	0.9	----	0.9	1.7	----	1.0	0.8	1.1	----	1.4	----	0.3	----	0.3	----
Ironstone Concretion	0.4	0.8	___	___	___	___	___	___	___	___	___	___	___	___	___	___	___	___	___	___	0.2	0.4
Dark colored Igneous	2.9	4.0	3.7	1.8	2.3	2.6	7.7	5.7	2.0	4.4	4.5	4.3	5.6	5.6	6.9	10.9	5.4	3.0	1.2	1.4	5.0	4.6
Granitic	1.8	1.6	1.1	0.9	2.3	1.7	1.7	2.8	2.0	5.3	1.7	----	5.1	2.4	----	----	2.3	3.7	1.5	----	2.3	1.8
Rhyolite	----	----	0.7	----	----	----	----	----	1.2	----	0.3	----	----	0.8	0.6	----	----	----	0.3	----	0.3	----
Quartz	----	----	----	----	0.3	----	----	0.9	1.2	----	----	0.9	----	----	----	----	0.3	----	----	----	----	----
Quartzite	0.7	3.2	0.4	1.8	----	2.6	1.7	----	0.8	----	0.3	0.9	1.0	0.8	----	----	----	0.7	----	----	0.2	1.4
Gneiss	----	0.8	1.1	----	0.3	----	----	----	0.8	0.9	0.3	----	0.6	0.8	0.6	2.2	1.1	0.7	----	----	----	0.7
Schist	1.1	0.8	----	1.8	0.6	----	----	----	----	----	0.3	----	----	----	----	2.2	0.6	----	----	----	0.9	----
Graywacke	0.4	1.6	1.1	----	1.6	----	2.1	----	0.4	1.8	1.1	----	2.5	1.6	----	2.2	0.9	1.5	0.3	----	0.8	----
Greenstone	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	0.3	----	----	----	----	----
Total	100.1	100.2	100.0	99.9	100.0	100.2	99.9	100.0	100.2	100.0	100.0	100.0	100.0	99.8	100.1	100.1	100.0	99.8	99.9	100.0	100.2	100.0
Number of pebbles counted	275	126	272	110	311	117	287	106	254	113	353	115	196	124	175	46	352	134	330	73	656	280

Branch (pl. 1). Most of this outwash appears to have come from the Marseilles end moraine. Small areas of sand and gravel occur in subglacial channels in the Gilberts end moraine east of Coral (secs. 9, 10, 15, 16, T. 43 N., R. 6 E.) and in sec. 36, T. 43 N., R. 6 E. Both of these areas are connected to channels that bisect the Marengo end moraine and that probably contributed sand and gravel to them. A small area of sandy Gilberts outwash is found southwest of Huntley in secs. 28, 29, 32, and 33, T. 43 N., R. 7 E. This deposit and the material in sec. 36, T. 43 N., R. 6 E. were deposited in part against stagnant ice blocks, but they are mapped as outwash rather than ice-contact stratified drift because they retain the essential characteristics of outwash deposits. A small mass of Gilberts outwash also occurs in the NE$\frac{1}{4}$ sec. 19, T. 44 N., R. 6 E. Coarse-grained outwash from the Huntley end moraine is found only along the margin of the moraine east and southeastward from the village of Huntley (secs. 28, 33, 34, T. 43 N., R. 7 E.) Sandy outwash from the Marseilles end moraine occurs in secs. 25, 26, 35, and 36, T. 43 N., R. 7 E.

With the exception of the materials along the Kishwaukee River and the lower portion of its South Branch, where thicknesses of sand and gravel are known to approach 50 feet, these deposits probably do not average more than 10 feet in thickness with a maximum probably not greater than 20 feet.

Where it can be observed, particularly in the pits in the SE$\frac{1}{4}$ sec. 4 and the NW$\frac{1}{4}$ sec. 10, T. 43 N., R. 7 E., the gravel along the Kishwaukee River in this area is fine- to medium-grained and sandy, having generally less than 5 feet of silty overburden. The peat and muck deposits in this area are underlain by similar materials. Elsewhere the coarser-grained outwash consists of fine- to medium-grained sand, except for small areas of sandy, silty gravel in sec. 19, T. 44 N., R. 6 E., and sec. 28, T. 43 N., R. 7 E. (tables 1, 2, sample 11). Predominantly fine-grained outwash occurs along the Huntley and Gilberts moraines between Huntley and Union.

Sample 11 (table 3) consists of about 81 percent dolomite and about 11 percent soft shale. The latter represents local erosion of the underlying bedrock.

Ice-Contact Stratified Drift

Ice-contact materials are found in scattered, small deposits on the Gilberts, Huntley, and Marseilles moraines, but because of their small size and because of the availability of other deposits, they have not been exploited as sources of sand and gravel. Limited exposures indicate that the kames in the southwestern corner of T. 43 N., R. 8 E. and the southeastern corner of T. 43 N., R. 7 E., consist of pebbly, silty sand and silty, fine gravel.

Sand and Gravel Associated with the West Chicago End Moraine

Outwash

The West Chicago end moraine extends in a broad, double curve across the county from the southeastern corner, through the center of the county, reaching the northern boundary about 2$\frac{1}{2}$ miles east of Big Foot Prairie (pl. 1). Till of the West Chicago end moraine in McHenry County is extremely coarse textured as compared to other tills in the state. It contains but little clay, has a large percentage of silt and sand, and pebbles and cobbles are abundant. The ice which deposited the West Chicago moraine overrode the Gilberts, Huntley, and Marseilles moraines and moved up the back slope of the Marengo end moraine almost

to its crest. Hence the West Chicago moraine marks an important change in the pattern of glaciation in McHenry County.

Outwash deposits occur along the front of the West Chicago end moraine except where it lies against older, overridden moraines, such as south of Woodstock and northeast and southeast of Harvard. Northwest of Woodstock the outwash is clearly related to subglacial channels that now are occupied by the headwaters of Mokeler Creek and the North Branch of the Kishwaukee River. The persistence of the channel east of Harvard through both the Marengo and West Chicago end moraines is probably related to a prominent valley in the underlying bedrock. The bedrock valley caused sags in the moraines, thus leaving drainageways along which subglacial meltwaters were channelled.

South of Woodstock an outwash plain of irregular dimensions extends along the front of the moraine to the southeastern corner of the county (pl. 1). This segment of the moraine lacks well defined subglacial channels. In fact, in this area it is difficult to distinguish the moraine from the outwash plain. Both have prominent ice-contact features, and the moraine appears to be almost completely buried by its associated outwash. This is particularly true for the area between Woodstock and Ridgefield. The boundary line shown on plate 1 is drawn primarily on the basis of topography and observed occurrences of West Chicago till.

This outwash plain, north of Algonquin, for years has been an important source of sand and gravel. At least one, perhaps two, older outwash deposits lie buried beneath the West Chicago outwash and probably extend eastward beneath the West Chicago moraine. The narrow strip of outwash which occurs beneath West Chicago till along the west wall of Spring Creek valley in the southeastern corner of the county (pl. 1) is considered to be an eastward continuation of this older gravel (Leighton et al., unpub., p. 99). It has been suggested that the sandy, stony character of the West Chicago till is the result of having overridden these older gravels.

The thickness of gravel along the West Chicago end moraine ranges from less than 5 feet to more than 60 feet. Thicknesses greater than 20 feet can be observed at several places along the subglacial channel east of Harvard. Little is known regarding the thickness of sand and gravel in the outwash plain lying east of the North Branch of the Kishwaukee River, but it undoubtedly averages more than 15 feet throughout this area. A pit in the NW$\frac{1}{4}$ sec. 11, T. 44 N., R. 6 E. has an exposed thickness of 20 feet of gravel, but this may not be representative of the outwash plain to the west.

South of Woodstock the thickness of the outwash is variable, decreasing toward its southwestern margin. In sec. 16, T. 44 N., R. 7 E., the gravel is more than 30 feet thick; in sec. 15 of the same township it is more than 20 feet thick. Gravel pits and road-cuts between Algonquin and Crystal Lake show gravel ranging from 10 to more than 60 feet in thickness.

Samples 1, 4, 10, and 12 (tables 1, 2) are from West Chicago outwash, although samples 4 and 12 may contain some older material. These samples probably represent the coarsest materials of the outwash, ranging in texture from fine to coarse, sandy gravel. In addition, an extensive area of medium-grained sand is found east of the North Branch of the Kishwaukee River, a sand plain co-extensive with that found along the South Branch and the Kishwaukee River proper. Local masses of silt with observed thicknesses ranging up to 10 feet are found at a number of places on the outwash plain between Woodstock and Algonquin

The pitted plain in the moraine re-entrant northwest of Ridgefield contains large amounts of silt. North of Algonquin the silt is from 5 to 10 feet thick and constitutes the overburden at the gravel pits in this area. Inasmuch as the silt is believed to be underlain by gravel throughout the outwash plain, no attempt was made to map it separately.

The pebble fraction of samples 1, 4, 10, and 12 averages more than 80 percent dolomite (table 3). Most of the remainder are igneous and metamorphic types. Soft shale pebbles are rare.

Ice-Contact Stratified Drift

The West Chicago end moraine in McHenry County contains large quantities of ice-contact stratified drift; it is a kame moraine (pl. 1). Ice-contact silt, sand, and gravel are so complexly and intimately associated with till that it was not practical to map them separately. In places these deposits have served as commercial sources of sand and gravel, and in secs. 2, 3, and 11, T. 43 N., R. 8 E., they supported large-scale operations for a number of years. It is significant, however, that the West Chicago end moraine no longer produces gravel in any quantity. This is because the extreme variability of the material does not readily lend itself to the efficient and relatively inexpensive methods of mass production currently employed in the sand and gravel industry. This is true not only of the West Chicago end moraine but almost all other ice-contact deposits in the county as well. Nevertheless the West Chicago end moraine contains a large number of gravel deposits which may serve local needs.

Sand and Gravel Associated with the Till Plains and Uplands Northeast of the West Chicago Moraine

The glacial geology of the area northeast of the West Chicago moraine is extremely complex. Several moraines can be recognized in this area, but their inter-relationships are obscure, and for the purposes of this report the region is considered as a single unit.

Outwash

Much of the broad lowland lying west of the till upland that extends from Woodstock to Richmond is underlain by outwash silt (pl. 1). The low areas mapped as till south of Hebron also have a cover of silt 6 to 8 feet thick. Likewise the lowland at the head of Nippersink Creek (northeast quarter of T. 46 N., R. 6 E.), an extension of the subglacial channel ending at Harvard, is believed to be underlain by a considerable thickness of silt. Throughout this area no coarse-grained outwash is known to occur.

East of the till upland, however, coarse-grained outwash is abundant, most of it occurring as elongate, valley-train deposits (pl. 1). On the west side of the valley of Nippersink Creek from a point two miles west of Richmond to the south end of Wonder Lake there occurs a gravel terrace whose surface, though irregular, lies at an elevation of approximately 850 feet. The largest pit in this deposit ($NE\frac{1}{4}$ sec. 30, T. 46 N., R. 8 E.) shows 20 feet of medium to coarse sandy gravel. Observations at numerous smaller pits show essentially the same material. Similar gravel terraces farther south along Boone Creek (secs. 1, 2, and 12, T. 44 N., R. 7 E.) and the abandoned channel trending southeast from sec. 18, T.

44 N., R. 8 E., to sec. 28 of the same township are part of this valley train. Probably the peat and muck in the abandoned channel (secs. 19, 20, and 29, T. 44 N., R. 8 E.) is underlain by gravel. It seems quite likely that the broad area of gravel lying to the north and, to a lesser extent, to the south of Silver Lake (secs. 1, 2, T. 43 N., R. 8 E.) is also a part of this valley train system. If this is correct, the large mass of medium-grained, well-sorted sand at Cary represents the deposits at the lower end of the valley train, perhaps a delta formed as meltwater discharged into a temporary body of standing water impounded behind the constriction of the Fox River Valley where it crosses the West Chicago moraine. Regardless of how they are interpreted, these elongate deposits, extending from Richmond to Cary, constitute a virtually undeveloped potential source of sand and gravel.

The valleys of Nippersink and Boone Creeks, the small channels at Ringwood and northwest of Johnsburg, and the large, abandoned channel trending southwestward from McHenry and extending in a wide arc to Barreville, as well as the lowlands along the Fox River, all appear to be underlain by sand (pl. 1). At places the sand is covered by peat and muck deposits or silty alluvium, as along Nippersink Creek, upstream from Spring Grove. Gravel occurs at a number of places within these valleys (for example, NW$\frac{1}{4}$ sec. 22, T. 46 N., R. 8 E.; center sec. 8, T. 44 N., R. 8 E., SE$\frac{1}{4}$, sec. 35, T. 45 N., R. 8 E.), but, with the exception of the low terrace at Richmond and the small terrace remnant a mile southeast of Richmond, the quantities of gravel are too small to map separately. It is possible that gravel underlies the sand throughout most of its extent, as suggested by well records at Spring Grove, ditch excavations along Nippersink Creek downstream from Wonder Lake, and test borings at McHenry Dam State Park (NW$\frac{1}{4}$ sec. 12, T. 44 N., R. 8 E.). Where the gravel is present, it lies below the water table.

Samples 7 and 8 (tables 2, 3) show the range in texture and composition of these deposits. Sample 7 contains significantly less dolomite and more igneous and metamorphic rocks than do the other samples (table 3). This suggests that it was deposited by meltwater derived from farther north along the valleys of Nippersink Creek and Twin Lakes.

Elongate (terrace) deposits occur along Spring Creek in the southeastern corner of the county and are particularly well developed in the area around Fox River Grove. The sand at Fox River Grove is similar in type and origin to that which occurs across the river at Cary. The gravel in this area is medium to coarse in texture and represents outwash from moraines which lie farther to the east and south in Lake and Cook counties.

Two outwash plains are found in the eastern part of the county, one north of Spring Grove and the other east of the Fox River at McHenry. Significant differences in elevation suggest that these deposits were not formed at the same time, nevertheless they exhibit certain features in common. Both consist predominantly of fine to coarse, sandy gravel with up to 6 feet of silt overburden. Both have a pitted surface indicating deposition around and upon ice blocks which subsequently melted, producing the pits. The plain east of McHenry is so thoroughly pitted that little "plain" remains. Thus these deposits can be expected to show some of the characteristics of ice-contact stratified drift. They are, in fact, closely associated with extensive deposits of ice-contact stratified drift.

TABLE 4 - SAND AND GRAVEL PRODUCERS HAVING PERMANENT EQUIPMENT

Company name	Near	Location ¼	¼	Sec.	T.	R.	Type of deposit worked
Algonquin Ready-Mix, Incorporated	Algonquin	NW	SW	22	43N.	8E.	Outwash plain
Consumers Co. Division of Vulcan Materials Company	Crystal Lake		N½	9	43N.	8E.	Outwash plain
Consumers Co. Division of Vulcan Materials Company	Algonquin		NW	21			
			SE	21	43N.	8E.	Outwash plain
			NE	28			
Crystal Lake Trucking and Excavating Company	Algonquin		SW	27	43N.	8E.	Outwash plain
Cowhey Materials and Fuel Company	Algonquin	SW	NW	22			
		NW	SW	22	43N.	8E.	Outwash plain
Fox Valley Sand and Gravel Company	Cary	S½	NW	18	43N.	9E.	Valley train
Griebel Sand and Gravel Company	Riley		SE	14	43N.	5E.	Outwash plain
Material Service Division of General Dynamics Corporation	Algonquin		NW	27	43N.	8E.	Outwash plain
McHenry Sand and Gravel Company	McHenry	SE	NE	31	45N.	9E.	Kame
		SE	NW	28	45N.	8E.	Kame
O'Leary Construction Company	Woodstock		NW	16	44N.	7E.	Outwash plain
			SW	15	44N.	7E.	Outwash plain
Peters Sand and Gravel Company	Harvard		NW	1	45N.	5E.	Outwash plain
Tonyan Brothers	Johnsburg		NW	20	45N.	9E.	Kame

Ice-Contact Stratified Drift

Northeast of the West Chicago end moraine ice-contact stratified drift is abundant, in marked contrast to the area outside (southwest) of the West Chicago end moraine. The largest and most important deposits are located: 1) around Hebron; 2) on the bluffs overlooking Wonder Lake and extending southward into the drainage of Boone Creek; 3) along the west wall of the valley of Boone Creek west of McHenry; 4) along the south bluffs of Nippersink Valley from sec. 34, T. 46 N., R. 8 E., to Pistakee Lake; 5) along the eastern border of the county from the northeastern corner to Griswold Lake (sec. 17 and 18, T. 44 N., R. 9 E.); and 6) west of the Fox River from 2 to 6 miles north of Cary. In addition, a number of smaller kame areas, many of which have yielded sand and gravel, are indicated on plate 1.

Although these deposits have great variations in texture and, in general are inferior to outwash plains as sources of sand and gravel, there are places where meltwater has removed the fine materials and produced high quality gravel deposits such as those in the NW$\frac{1}{4}$ sec. 28, T. 45 N., R. 8 E.; the NE$\frac{1}{4}$ sec. 31, T. 45 N., R. 9 E.; the NW$\frac{1}{4}$ sec. 20, T. 45 N., R. 9 E.; and the NE$\frac{1}{4}$ sec. 25, T. 44 N., R. 8 E. Undoubtedly others exist. The overburden on these deposits is generally less than 5 feet and in many areas does not exceed 2 feet.

Samples 5, 6, and 9 (tables 1, 2, and 3) represent ice-contact deposits in this area.

SAND AND GRAVEL INDUSTRY

Many of the smaller gravel pits in McHenry County are worked periodically by portable equipment. No attempt is made to enumerate these pits althougl most of them are indicated on plate 1. Gravel pits operating fixed equipment during the summers of 1960 and 1961 are listed in table 4.

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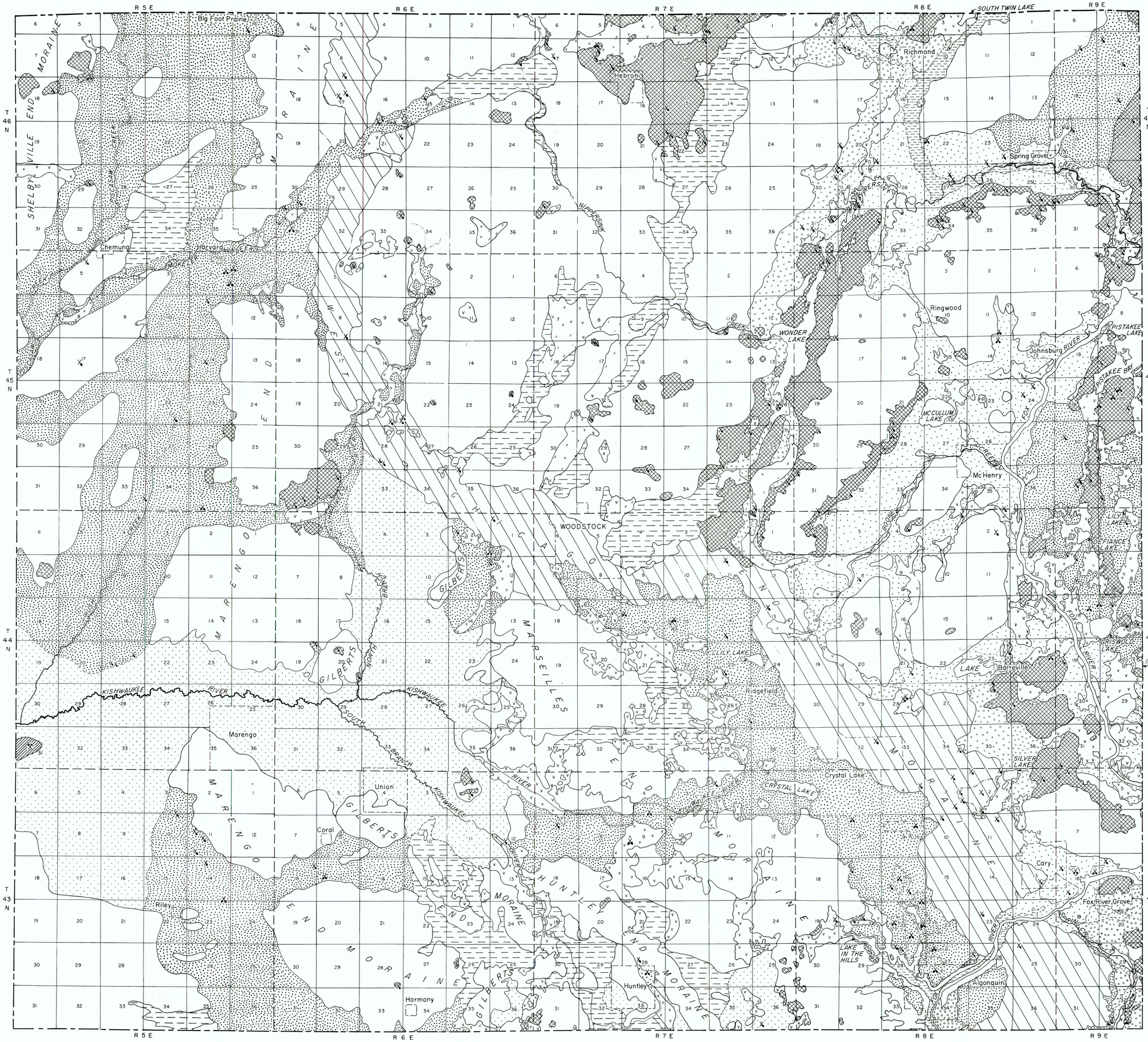

KEY

SHEET-LIKE DEPOSITS
(OUTWASH PLAINS, DELTAS, AND SLACK-WATER DEPOSITS)

Areas generally underlain by gravel and sand deposits commonly more than 10 feet thick. The deposits generally are thickest and coarsest in the eastern parts of the areas mapped.

Areas generally underlain by sand deposits commonly more than 10 feet thick.

Areas of silt that may overlie sand and gravel deposits in some places.

ELONGATE DEPOSITS
(VALLEY TRAIN AND CHANNEL DEPOSITS)

Areas generally underlain by sand and gravel deposits commonly more than 10 feet thick.

Areas generally underlain by sand deposits commonly more than 10 feet thick.

Areas of silt that may overlie sand and gravel deposits in some places.

HILLS AND RIDGES
(KAMES, ESKERS, OR OTHER ICE-CONTACT DEPOSITS)

Areas of hills and ridges containing sand and gravel that occur mostly in upland areas either as isolated mounds or closely associated groups of hills and ridges constituting complex deposits. The gravel content, texture, and thickness of these deposits vary greatly, both horizontally and vertically.

Areas mainly of clay or clayey sand but with hills and ridges of sand and gravel in some places. These areas compose the West Chicago end moraine. The gravel content, texture, and thickness of the hill and ridge deposits vary greatly both horizontally and vertically.

OTHER

Low lying, poorly drained areas containing peat and muck.

Areas believed to be devoid of sand and gravel, although small deposits may be present in some places; generally glacial till.

Area where dolomite bedrock crops out.

Active gravel pit

Idle or abandoned gravel pit

Stone quarry

Approximate limits of sand and gravel pit

Indefinite gradational boundary

Scale of Miles

0 1 2 3 4

CIRCULAR 336

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