

# Potential Sand and Gravel Resources of the Mansfield 30 x 60 minute quadrangle

Erk R. Venteris, Douglas L. Shrake, Glenn E. Larsen, Richard R. Pavey, and Gregory A. Schumacher  
GIS Administration by Donovan M. Powers  
GIS Database Administration by Joseph G. Wells  
GIS Cartography by Dean R. Martin

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DRAFT

**INTRODUCTION AND PURPOSE**  
The Ohio Department of Natural Resources (ODNR), Division of Geological Survey has completed a reconnaissance map showing areas of mineable sand and gravel resources in the Mansfield, Ohio, 30 x 60 minute (scale 1:100,000) quadrangle. The main purpose of this map was to create a reconnaissance-level map that would show the potential for mineable sand and gravel in this quadrangle. We sought to create this map from as many existing ODNR Division of Geological Survey maps and GIS datasets as possible. The map shows areas of surficial materials in increments of 10 feet (ft) and then differentiates sand, sand and gravel, and ice-contact deposits from fine-grained materials, such as silt, clay, lacustrine clay and silt, and alluvial materials. The sand and sand-and-gravel units includes both surficial and buried outwash and valley train deposits and ice-contact deposits, such as kames, kame terraces, and eskers. To determine if a sand-and-gravel deposit was economically viable, this map shows the total thickness or accumulation of sand and gravel in the Mansfield 30 x 60 minute quadrangle.

This map is a derivative map based directly from the ODNR Division of Geological Survey SG-2 series map, *Surficial Geology of the Mansfield 30 x 60 Minute Quadrangle* (Venteris and others, 2008). The SG-2 series features maps based upon polygons that represent a "stack" of mapped units and lithologies and thicknesses. A set of queries were run in ESRI ArcGIS® to illustrate the range of thicknesses of the surficial materials overlying the topmost bedrock units. The main purpose of the map is to indicate areas where sand and gravel mining would be economically viable. For the mine to be viable, an adequate thickness of sand and gravel typically must be 30 ft or greater with a minimum amount typically no more than 20 feet of fine-grained material such as silt or clay overlying the sand and gravel. This map reflects the overall goal purpose of the mapping which is to use the SG-2 series of surficial geology "stack maps" as the basis for creating a number of easy-to-understand, reconnaissance-scale derivative maps that allow the user to quickly determine the thickness and nature of the drift and the underlying bedrock for a variety of uses, including the potential for mineral bedrock, sand-and-gravel aggregate resources, and solid-waste disposal sites. The "Mapping Conventions" section below describes surficial mapping units and bedrock units and includes a brief discussion of the potential mineable resources of the bedrock units. A more detailed discussion of the data sources and techniques used for creating the original SG-2 map, *Surficial Geology of the Mansfield 30 x 60 Minute Quadrangle*, can be found in Venteris and others (2008).

In addition to the main "stack map"-based derivative map, this publication includes three useful, smaller-scale "inset" maps. The first inset map (Fig. 1) shows the location of both bedrock quarries and sand-and-gravel pits located in the Mansfield 30 x 60 minute quadrangle (Wade, 2009). The second inset map (Fig. 2) shows where the thickness of sand and gravel as opposed to fine-grained materials (essentially waste for the aggregate industry) exceeds a ratio of 4:1. The higher the ratio, the greater the proportion of sand and gravel to fine-grained materials exists in the particular mapped polygon. In some of the deeper, sand-and-gravel filled buried valleys, ratios may exceed 25:1. This also assures that the sand and gravel at the surface will be covered by no more than 40 ft of fine-grained overburden. The third inset map (Fig. 3) depicts the drift thickness of the Mansfield 30 x 60 minute quadrangle, based upon the *Shaded Drift Thickness Map of Ohio* (Powers and Saitford, 2004).

**MAPPING CONVENTIONS**  
This map provides a three-dimensional framework of the area's surficial geology and depicts four important aspects of surficial geology:  
1. Geologic deposits, indicated by letters that represent the major lithologies.  
2. Thicknesses of the individual deposits, indicated by numbers and modifiers.  
3. Lateral extent of the deposits, indicated by map-unit area boundaries.  
4. Vertical sequence of deposits, shown by the stack of symbols within each map-unit area.

Figure 4 illustrates mapping conventions. Letters, numbers, and modifiers are arranged in stacks that depict the vertical sequence of lithologic units for a given map-unit area. A single stack of symbols occurs in each map-unit area and applies only to the volume of sediments within that particular map-unit area.

**Letters** represent geologic deposits (lithologic units) and are described in detail below. Lithologic units may be a single lithology, such as sand (S) or clay (C), or a combination of related lithologies that are found in specific depositional environments, such as sand and gravel (SG) or ice-contact deposits (IC). The bottom symbol in each stack indicates the bedrock lithologies that underlie the surficial deposits. The detailed lithologic unit descriptions below summarize:

1. Geologic characteristics, such as range of textures, bedding, and age.
2. Engineering properties or concerns attributed to the unit.
3. Depositional environment.
4. Geomorphology or geomorphic location.
5. Geographic location within the map area, if pertinent.

**Numbers** (without modifiers) that follow the lithology designator represent the average thickness of a lithologic unit in tens of feet (for example, 3 represents 30 ft). If no number is present, the average thickness is implied as 1 (10 ft). These unmodified numbers correspond to a thickness range centered on the specified value but may vary up to 50 percent. For example, T4 indicates the average thickness of till in a map-unit area is 40 ft, but thickness may vary from 20 to 60 ft.

**Modifiers** provide additional thickness and distribution information:

1. Parentheses indicate that a unit has a patchy or discontinuous distribution and is missing in portions of that map-unit area. For example, (T2) indicates that till with an average thickness of 20 ft is present in only part of that map-unit area.
2. A minus sign following a number indicates the maximum thickness for that unit in areas such as a buried valley or ridge. Thickness decreases from the specified value, commonly near the center of the map-unit area, to the thickness of the same lithologic unit and vertical position specified in an adjacent map-unit area. For example, a SG9 map-unit area adjacent to a SG2 area indicates a sand-and-gravel unit having a maximum thickness of 90 ft that thins to an average of 30 ft at the edge of the map-unit area. If the material is not present in an adjacent area, it decreases to zero at that boundary.

The small scale of this reconnaissance map generalizes the great local variability within surficial deposits. That variability is explained in the lithologic unit descriptions and by the use of thickness ranges. Some areas and lithologies are too small to delineate at a 1:100,000 scale and have been included in adjacent areas. This map should serve only as a regional predictive guide to the area's surficial geology and not as a replacement for subsurface borings and geophysical studies required for site-specific characterizations.

- SURFICIAL UNITS**
- W **Water.** Lakes generally larger than 20 acres and not appearing on base map.
  - M **Made land.** Large areas of cut and fill, such as dams, landfills, and urban areas; may include reclaimed strip mine areas. Underlain by bedrock or other lithologic units.
  - A **Alluvium (Holocene).** Includes a wide variety of textures from silt and clay to boulders; commonly includes organic material; generally not compact; rarely greater than 20 ft thick. Present in floodplains of modern streams throughout entire map area. Mapped only where areal extent and thickness are significant.
  - O **Organic deposits (Holocene).** Muck and peat, may contain clay at depth. Generally less than 20 ft thick. Formed in undrained depressions. Organic deposits too small to map at 100K-scale indicated by an asterisk (\*) and underlain by material shown in surrounding map-unit area. Present also on outwash trains, ice-contact areas, and hummocky moraines throughout the map area.
  - Ac **Alluvium and alluvial terraces (combined).** Shown in areas where insufficient space is available to delineate separate units.
  - A **Alluvial terraces (Wisconsinan).** Old floodplain remnants along streams that flowed into high, proglacial lakes. Highly variable textures, commonly present tens of feet above modern floodplains.
  - C **Clay (Wisconsinan).** Massive to laminated; may contain interbedded silt and fine sand; clay content can exceed 50 percent; laminated clay commonly contains thin silt or sand partings. Carbonate-cemented concretions occur in some areas. Commonly contains fractures 6 to 12 inches apart. Distributed throughout map area as lowland surface deposits, terraces, and as deep-water deposits of proglacial lakes.
  - Co **Complexly interbedded deposits of clay, silt, sand, gravel, and till in deeper parts of buried valleys (unspecified).** Unit identified from well logs, data insufficient for more detailed differentiation or age assignment. Present in deeper buried valleys throughout the area.
  - IC **Ice-contact deposits (Wisconsinan).** Highly variable deposits of poorly sorted gravel and sand, silt, clay, and till lenses common; may be partially covered or surrounded by till. Deposited directly from stagnant ice as kame or esker landforms. Commonly associated with deep buried valleys.
  - L **Silt (Wisconsinan).** Massive or laminated, commonly contains thin sand partings. Carbonate-cemented concretions occur in some areas. May contain localized clay, sand, or gravel lenses. Clay content commonly increases with depth. Present throughout the map area as lowland surface deposits; terraces; and thick, deltaic deposits of proglacial lakes.
  - U **Backwater lake deposits (Wisconsinan).** Mostly lacustrine silt and clay in tributary valleys south of the glacial border. Commonly interbedded with alluvium, alluvial fans, and debris flows from surrounding steep-walled tributary and main valleys.
  - LC **Silt and clay (Wisconsinan).** Laminated to interbedded; may contain thin, fine sand or gravel layers. Occurs as thick, lacustrine valley fill deposits of high, proglacial predecessors of lakes. Also may occur as thick, regional, deltaic deposits or as thick, deltaic, outwash deposits in upland depressions. Present as terraces along streams in the eastern half of the map area.
  - S **Sand (Wisconsinan).** Contains minor amounts of disseminated gravel or thin lenses of silt or gravel; grains well to moderately sorted, moderately to well rounded; finely stratified to massive; may be cross bedded; locally may contain concretion; in deep buried valleys, may be older than Wisconsinan age. Present in terraces and buried valleys throughout the map area, and in association with deltaic deposits or outwash.
  - SG **Sand and gravel (generally Wisconsinan).** Intermixed and interbedded sand and gravel commonly containing thin, discontinuous layers of silt, clay, and till. Grains well to moderately sorted, moderately to well rounded; finely stratified to massive; may be cross bedded; locally may contain concretion. In deep buried valleys, may be older than Wisconsinan age. Present as terraces along valley walls and in buried valleys throughout the map area.
  - SS **Sand and gravel (Illinoian).** Properties similar to unit SG; shows, except upper part of unit is deeply weathered and leached where near surface. Present in high-level terraces and in deep buried valleys in the south-central-southern map area.
  - GA **Basal gravel.** Highly variable, poorly sorted gravel and sand, with significant amounts of silt and clay. Present in the northwest part of the map area, deposited at or near the front of the ice sheet directly on bedrock. Presumably of Wisconsinan age, but may be older.

**1. Unsorted mix of silt, clay, sand, gravel, and boulders, fractures/joints common (Wisconsinan age when at surface).** May contain silt, sand, and gravel lenses. Deposited directly from several successive advances. Undifferentiated and nonspecific age in buried valleys or where separated by intervening non-till units from an overlying designated till. Most common surficial material in the map area.

**2. Loam till (Illinoian).** May be overlain by up to 3 ft of loess. Till contains silt, sand, and gravel lenses; unit deeply weathered and leached to 6 ft; fractures/joints common. Deposited by direct lodgment or outwash from glacial ice. Widespread in the eastern map area as a surface and buried unit.

**3. Vertically and horizontally variable sequences of sandstone, shale, siltstone, claystone, limestone, and coal bedrock, including associated colluvium of the Middle and Lower Pennsylvanian age (Allegheny and Pottsville groups undivided).** Sandstone interbedded to massive; may be conglomeratic in basal portions of shale, sandstone, siltstone, clay, and limestone common in upper portion of unit. The basal portion of the Pottsville Group is predominantly a light-gray, medium to coarse grained, crossbedded to massive sandstone with abundant, rounded quartz pebbles and quartz pebble conglomerate until known as the Sharon Sandstone, and conglomeratic tuffaceous forms resistant hills and cliffs.

**4. Shale.** Designation **Sh** used in western quarter of map area primarily to denote areas underlain by black shale. Key stratigraphic units are broken out in descending stratigraphic order: Sunbury Shale (Lower Mississippian age; present as brownish black, carbonaceous, pyritic, in a north-to-south belt from Perryton to Mount Gilead, Ohio Shale, including associated colluvium; Devonian age); present as black to brown, silty, organic-rich, carbonaceous, fissile parting shale, which contains beds of gray to greenish-gray, silty, clay shale. Dominant basal stack unit within a north- to south belt along the western edge of map area. Olentangy Shale (Upper and Middle Devonian age); present as upper portion greenish gray, lower portion gray, clayey; disseminated pyrite, locally contains lenses and nodules of limestone. Contains thin, brownish-black shale beds in upper portion; Unit mapped only in very northwestern corner of map area; may also be included with the Ohio Shale.

**5. Limestone (Devonian).** Devonian-age Delaware and Columbus Limestones, present as a basal bedrock deposition only in the extreme southwest corner of map area. Delaware Limestone is medium brown, fine to medium crystalline, fossiliferous, cherty limestone containing shale laminae. Columbus Limestone is light to medium gray limestone, fine to coarse crystalline, fossiliferous, and cherty in the upper portion.

**6. Shale and limestone (Devonian).** Devonian-age Sunbury Shale and Delaware Limestone, present as an undifferentiated basal stack unit in the northwestern corner of map.

**7. Sandstone and shale (Devonian).** Devonian-age Logan and Coshocton Formations, present as a basal stack unit over the eastern three-quarters of the map area. The includes following stratigraphic units may be mapped as (SSB): Mississippian Logan and Coshocton Formations (undivided) and Sunbury Shale and Devonian Bedrock and Lower Sandstone undivided, Logan and Coshocton Formations (Upper and Lower Mississippian undivided), sandstone, conglomerate, shale, and siltstone; Logan Formation: sandstone and siltstone, shades of gray, yellow, and brown; Coshocton Formation: mainly shades of gray, olive, brown, and yellow sandstone, siltstone, and shale; Sandstone, silty to conglomeratic, occurs in thin to massive beds. SSB may also be used in map areas comprised of the colluvium derived from sandstone and shale beds associated with the Mississippian age Logan and Coshocton Formations; Sunbury and Bedford Shales undivided; Sunbury Shale (Upper Devonian to Lower Mississippian age); Sunbury Shale present in north- to south band in the western quarter of the map area; is brownish black to greenish black, carbonaceous, pyritic; Bedford Shale, shades of gray to olive green; silty to clayey, soft with some siltstone. Beres Sandstone, a resistant unit that forms a north- to south escarpment of silt and clays in the western quarter of map area; is light gray to shades of brown, medium to fine grained to silty, and thin to massive bedded.

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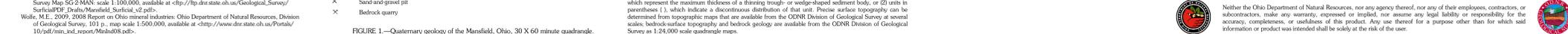
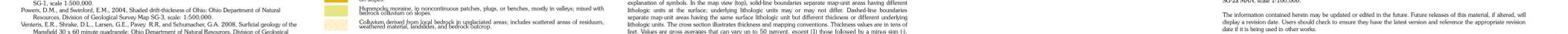
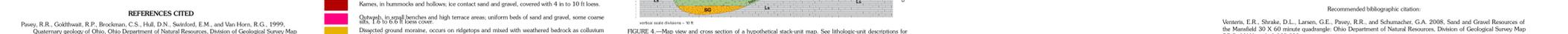
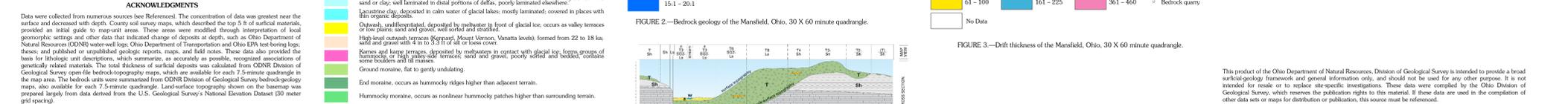
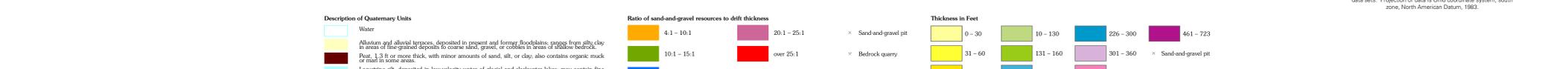
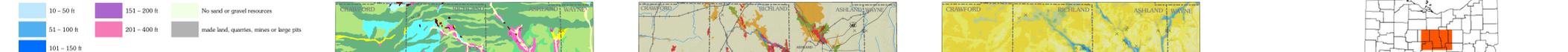
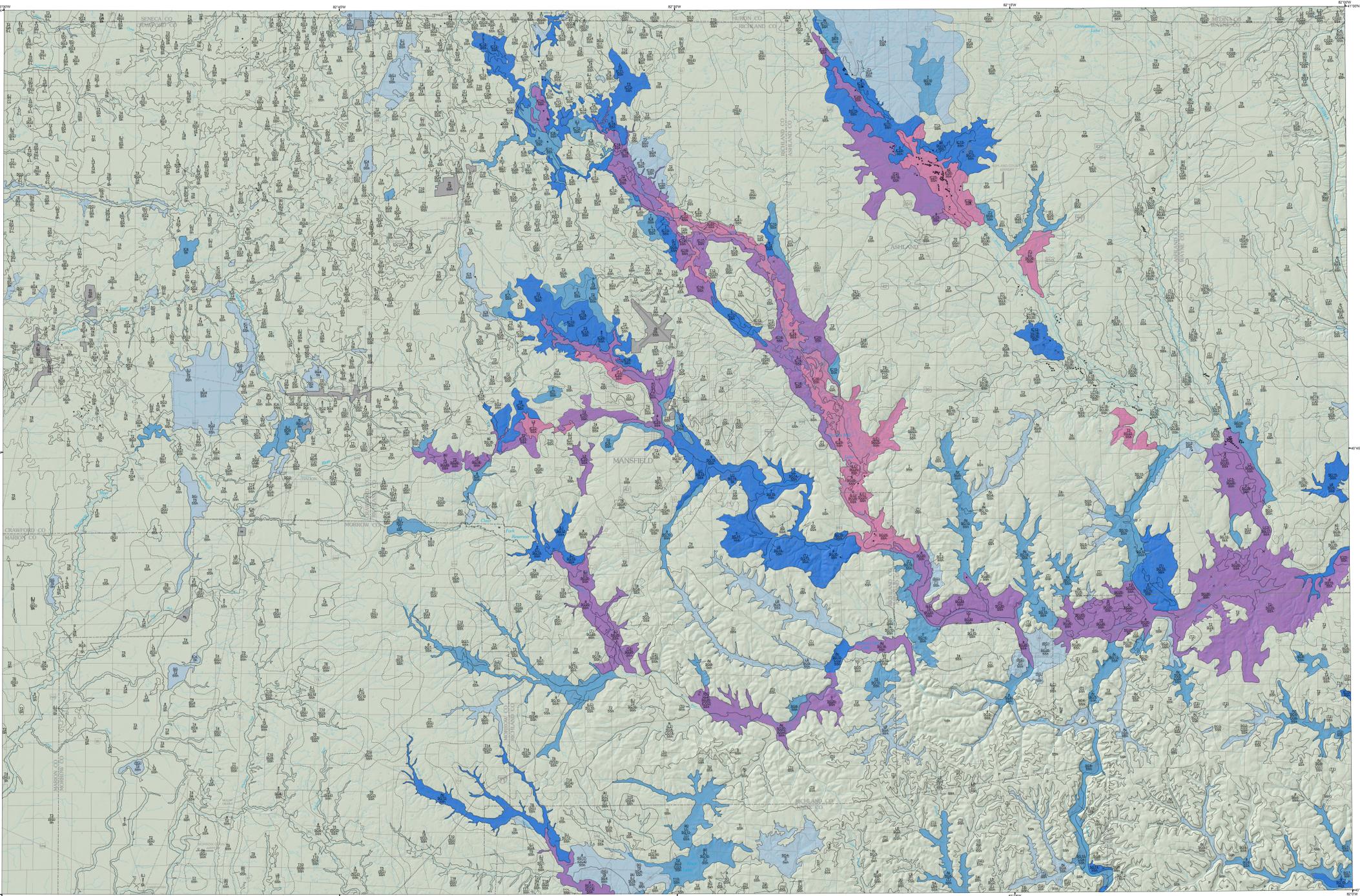
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**GLACIAL GEOLOGY AND SAND-AND-GRAVEL MINING POTENTIAL**  
The uppermost surficial deposits found in the Mansfield quadrangle are predominantly Wisconsinan in age (Venteris and others, 2008; Pavey and others, 1999). Bedrock units comprise the uppermost surficial units in portions of the southeastern corner of the quadrangle. The northeastern corner of the quadrangle also contains some unglaciated areas in the uplands which appear as dark gray on the map. In 2008 sand-and-gravel production from pits located in the Mansfield quadrangle was more than 1.7 million tons, which is approximately 5 percent of the state's total annual sand-and-gravel production (Wade, 2009).

The Mansfield map is intended as a general guide to be explored for potential sand-and-gravel resources. The map also may be used for land-use planning in the Mansfield map is based on reconnaissance-level surficial geology and bedrock-topography maps; it should not be used for resource leasing purposes. A more detailed geologic and engineering investigation, including detailed mapping, additional laboratory work, drilling, and laboratory testing of chemical and physical properties would be needed to delineate and evaluate the economic viability of the carbonate resources.



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