UNIVERSITY OF MINNESOTA
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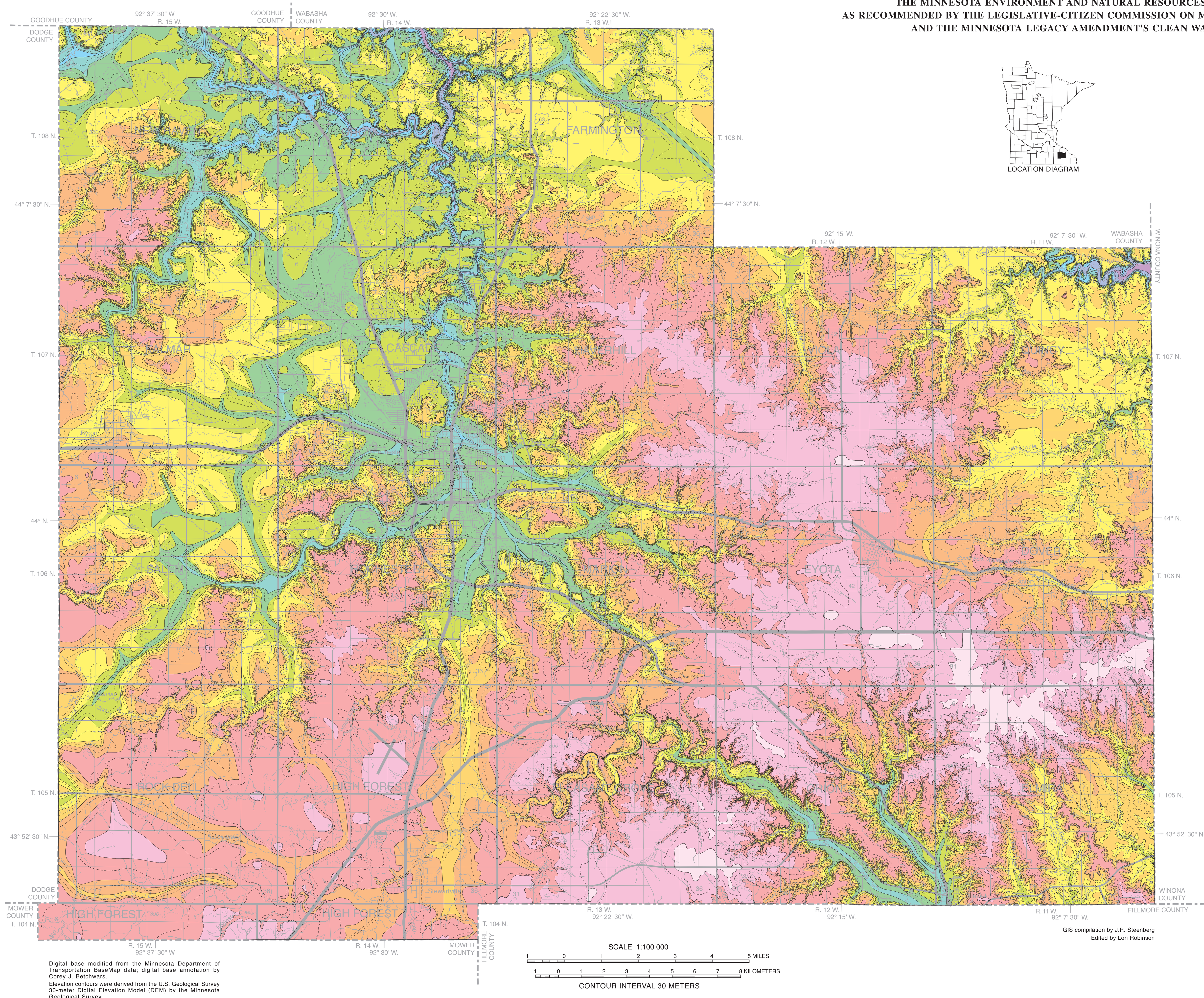


Digital base modified from the Minnesota Department of Transportation BaseMap data; digital base annotation by Corey J. Betchwars.
Elevation contours were derived from the U.S. Geological Survey 30-meter Digital Elevation Model (DEM) by the Minnesota Geological Survey.
Universal Transverse Mercator Projection, grid zone 15
1983 North American Datum

GIS compilation by J.R. Steenberg
Edited by Lori Robinson

LOCATION DIAGRAM

Elevation of the bedrock surface in feet above mean sea level

- 1,301–1,350
- 1,251–1,300
- 1,201–1,250
- 1,151–1,200
- 1,101–1,150
- 1,051–1,100
- 1,001–1,050
- 951–1,000
- 901–950
- 851–900
- 801–850
- 751–800

BEDROCK TOPOGRAPHY

By

Julia R. Steenberg and V.W. Chandler

2020

EXPLANATION

The elevation of the bedrock surface in Olmsted County is represented by colors assigned to 50-foot (15-meter) contour intervals (example: 951 to 1,000 feet [290 to 305 meters] above sea level) on the Bedrock Topography map. Additional 25-foot (8-meter) contour lines (dashed) are shown in most areas to further constrain the bedrock surface. Several 25-foot (8-meter) contours are omitted along steep slopes and within narrow valleys in places where individual lines cannot be discerned from one another when printed at the 1:100,000 scale. The bedrock surface in Olmsted County ranges in elevation from 1,330 feet (405 meters) above sea level on the plateaus in the eastern part of the county, to 785 feet (239 meters) above sea level within narrow bedrock channels underlying Lake Zumbro and the North Fork of the Whitewater River. The average bedrock elevation throughout the county is about 1,135 feet (346 meters) above sea level. A Digital Elevation Model (DEM) of the elevation of the bedrock surface and all contour lines are available in the supplementary digital and GIS files (https://www.mngs.umn.edu).

The position of contours was determined from water-well construction records from the County Well Index, engineering test borings, and bedrock outcrop mapping. Passive seismic soundings were used to further constrain the bedrock surface in some areas. The distribution of data can be seen on Plate 1, *Database Map*, and should be considered when assessing the reliability of the map at specific locations. These data points can also be viewed as shapefiles within GIS and are included in the supplementary digital and GIS files. Geomorphic features visible on lidar imagery and indicative of near-surface bedrock conditions (less than 50 feet [15 meters] of overburden) were also taken into consideration and include prominent steep rocky bluffs, rock-cored mesas, and areas of karst terrain (marked predominantly by field-located sinkholes and springs). The most updated data bases of karst features and springs can be accessed through the Minnesota Geospatial Commons (https://gisdata.mn.gov). Copies of these data bases that were available at the time this atlas was completed are included in the supplementary digital and GIS files as shapefiles. In addition, Part B of the Olmsted County Geologic Atlas, to be published by the Minnesota Department of Natural Resources, will highlight karst hydrogeology and inventory the karst features and springs of Olmsted County.

Areas with a high density of bedrock control points are more likely to have an accurate interpretation of the bedrock elevation, whereas those areas with widely spaced control points may be less reliable. Records of drill holes that intersect bedrock are fairly evenly distributed across Olmsted County. The highest density of data points is in the center of the county within the city of Rochester.

The majority of the bedrock valleys in the county coincide with valleys at today's land surface, including the South and Middle Forks of the Zumbro River, the North Branch of the Root River, and their tributaries. There are several bedrock valleys that are not visible on the land surface where they are buried with unconsolidated Quaternary deposits. These valleys are primarily in the western half of the county, where the deposits are thickest. Most major bedrock valleys follow the surface-water valleys and are located entirely within the major watershed boundaries, including those for the Mississippi River–Winona, Root River, and Zumbro River watersheds. However, there are several exceptions where buried bedrock valleys cut across surface watershed boundaries (Fig. 1). This occurs in the southwest part of the county, near Stewartville, and in the north-central part of the county. All bedrock valleys are part of a network that drains to the Mississippi River.

Bedrock valleys can be an important control on groundwater flow. Buried valleys can focus discharge towards nearby rivers. Where they cross surface watershed boundaries they may direct flow across those boundaries. Bedrock valleys also can provide direct hydrogeologic connection to deeper aquifers where they incise into underlying regional bedrock aquitards. Depending on hydraulic gradient, these connections can lead to enhanced recharge into the aquifers, or discharge from the aquifers into the valleys.

The variable resistance of the bedrock to weathering and erosion, as well as the presence of fractures and joints, can greatly affect the shape of the bedrock topography. As a result, the bedrock topography exhibits some correlation with rock units. Limestone and dolostone are resistant to physical erosion and form extensive, relatively flat plateaus. For example, the bedrock uplands in eastern Olmsted County are underlain by resistant limestone of the Galena Group. However, these units are prone to chemical weathering and therefore are susceptible to dissolution and karst development, as indicated by the increased presence of sinkholes and springs. In contrast, weakly cemented sandstone and shale are easily eroded by flowing water. Once resistant layers are breached, erosion of underlying sandy units creates narrow, steep-sided valleys.

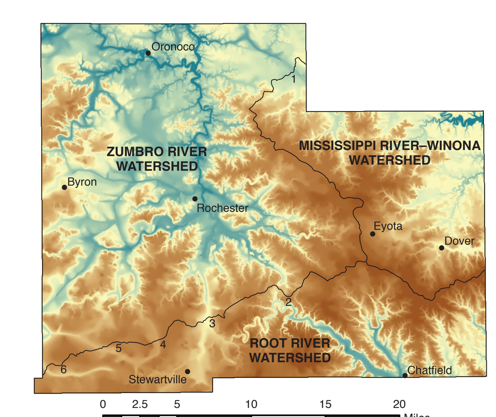


Figure 1. A comparison between the boundaries of the three main surface watersheds in Olmsted County and the underlying bedrock topography. Six numbered areas show examples of where the bedrock valley drainages cross the surface watershed drainage divides.

DEPTH TO BEDROCK

By

Julia R. Steenberg and V.W. Chandler

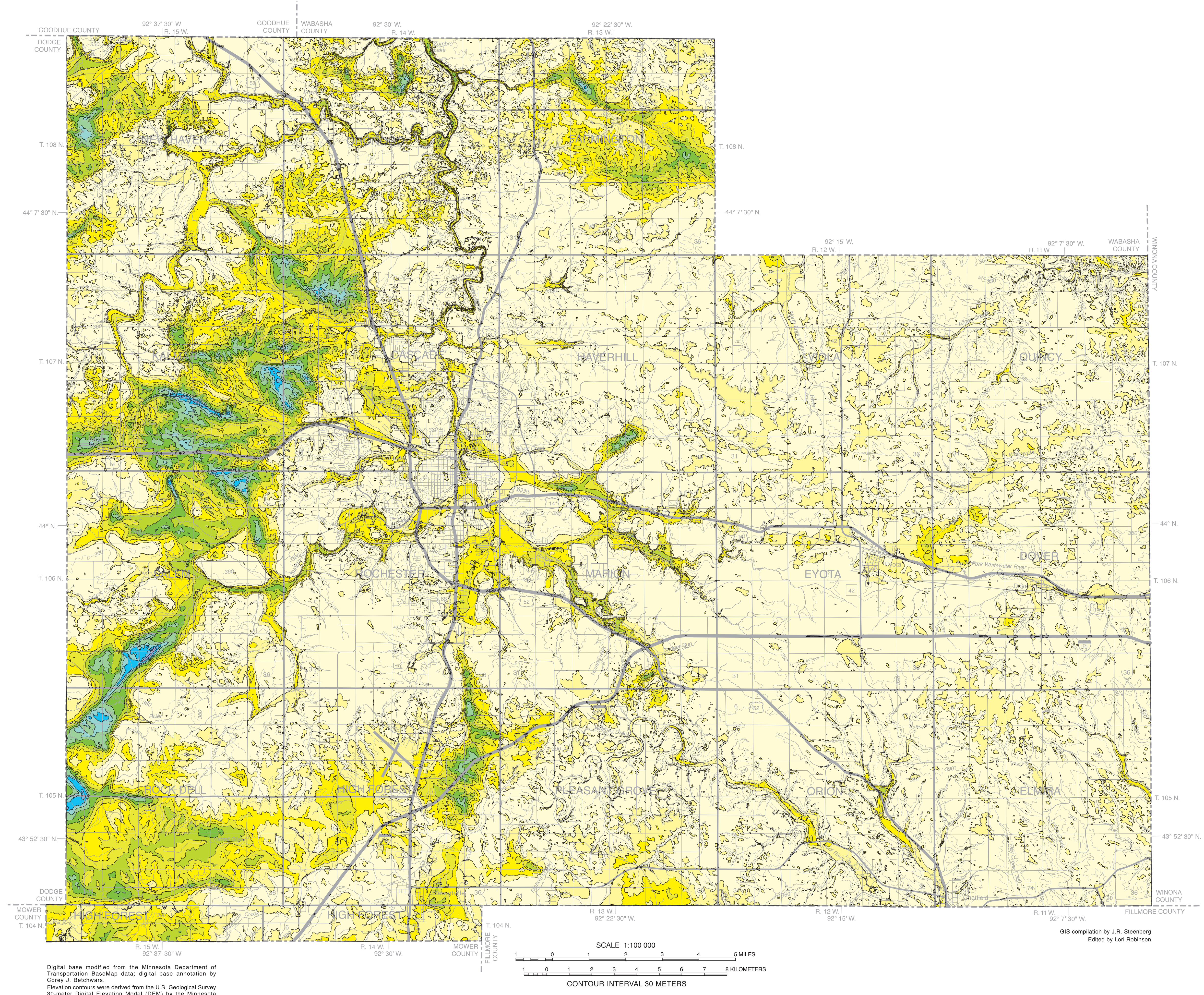
2020

EXPLANATION

The depth to bedrock map portrays the thickness of unconsolidated material overlying the bedrock surface. To calculate this thickness, a digital grid of bedrock-surface elevations was subtracted from a corresponding digital grid of land-surface elevations. The surface-elevation grid was resampled from a 3-foot (1-meter) digital elevation model derived from lidar by the Minnesota Department of Natural Resources, whereas the bedrock-elevation grid was derived from the Bedrock Topography map, which was inferred from outcrop mapping and interpretation of water-well records, engineering test borings, passive seismic data, and geomorphic features. The residual grid was then classified at 25-foot (8-meter) intervals to produce the color-coded Depth to Bedrock map. Thickness of the Quaternary sediments can vary greatly over short distances, and mapping at this scale (1:100,000) may not properly resolve prominent variations. For this reason, it is best to consult site-specific data (such as water-well records, engineering test borings, and passive seismic soundings) wherever available. The thickest Quaternary sediments in Olmsted County are within buried bedrock valleys in Salem, Kalmar, and Rock Dell Townships, where the depth to bedrock is as much as 276 feet (84 meters). Bedrock is at or within 25 feet (8 meters) of the land surface over the majority of the county.

Depth in feet from the land surface to the bedrock surface

- 0–25
- 26–50
- 51–75
- 76–100
- 101–125
- 126–150
- 151–175
- 176–200
- 201–225
- 226–250
- 251–275
- 276–300



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