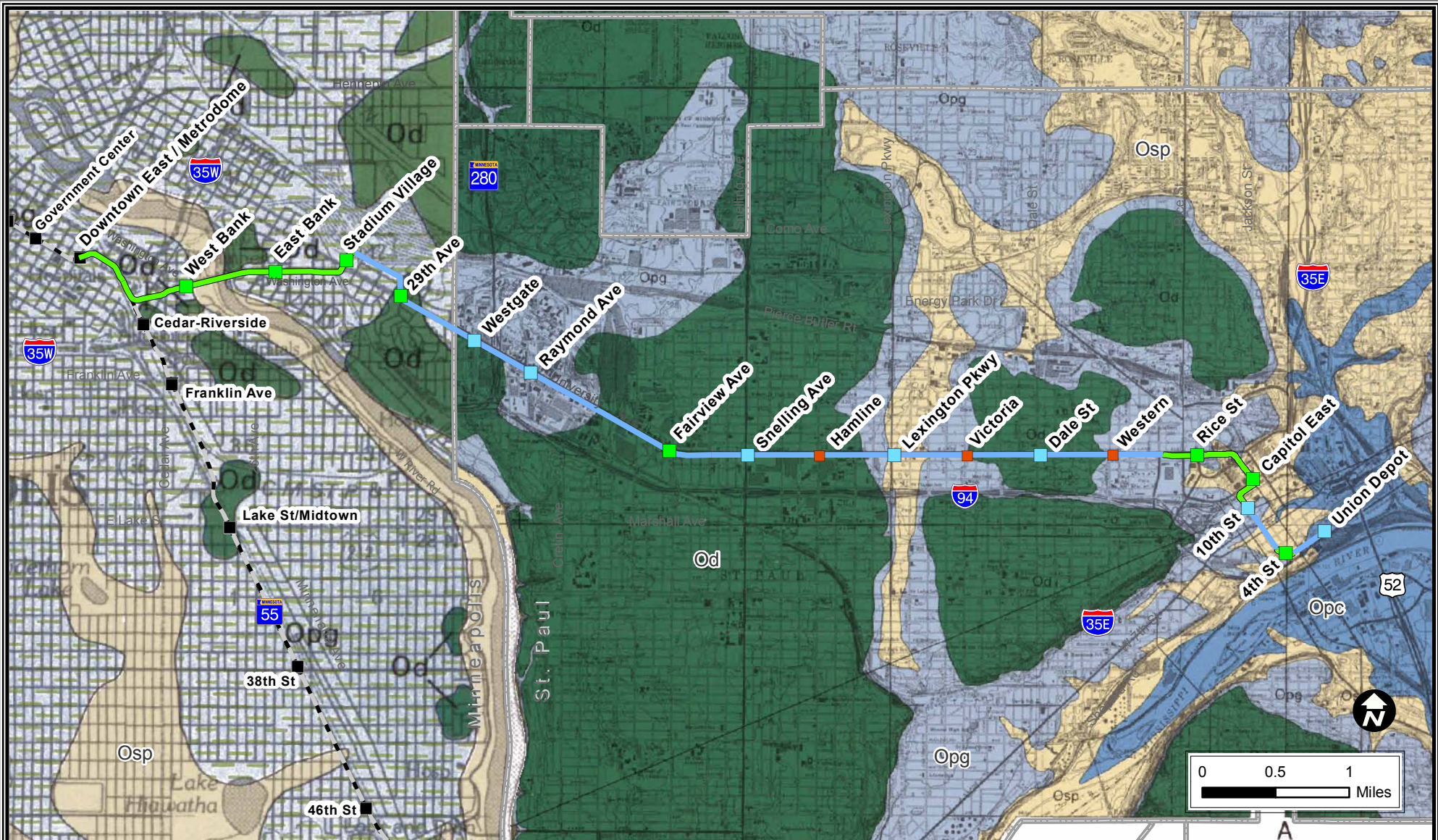


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CCLRT Station		Bedrock Legend*	
■	Identical to DEIS	Od	Decorah Shale (Od)
■	Changed from DEIS	Opg	Platteville and Glenwood Formations (Opg)
■	Future infill station	Osp	St. Peter Sandstone (Osp)
CCLRT Alignment Status		Opc	Prairie Du Chien (Opc)
—	Identical to DEIS		
—	Changed from DEIS		
■	HLRT station		
	Hiawatha Light Rail		

*Hennepin and Ramsey County Bedrock Geology has been mapped according to different standards.

Figure 4.1-2
Bedrock Geology

4.1.2.3 Groundwater Resources

The water table is the boundary between geologic materials completely saturated with water and the unsaturated zone above. The depth to the water table (i.e., groundwater) depends on a variety of factors, including the elevation of nearby surface water features, the permeability of the geologic materials and surface topography. The depth of the water table varies across the Study Area from less than 20 feet to greater than 100 feet below-grade.

The regional groundwater flow direction in the Study Area varies with location. West of the Mississippi River, the groundwater flows easterly toward that river. The groundwater in the central portion of the Study Area generally flows east or west from a groundwater divide approximately located at Snelling Avenue. West of that street, the groundwater generally flows west, then southwest, as it approaches the Mississippi River. East of Snelling Avenue, the groundwater generally flows east until it nears the intersection of Rice Street. Near the proposed Rice Street Station site and throughout the extreme eastern portion of the Study Area, the groundwater generally flows southeast toward the Mississippi River.

In the vicinity of the Mississippi River, particularly near the Washington Avenue Bridge, groundwater seeps and springs are observable along the river bluff face. These seeps and springs vary in elevation and occurrence depending on the time of year. The seeps and springs typically occur immediately above a layer of low permeability geologic materials or where fractures are present. Seeps and springs are most likely found near such elevations as the Decorah-Platteville contact or Platteville-Glenwood contact. Contacts of varying members of the Platteville may also produce seeps and springs.

In areas where the Mississippi River may cut deep into the Prairie Du Chien unit, perched groundwater systems have been known to exist where the Platteville and/or Glenwood formations act as a confining unit and parts of the St. Peter Sandstone may be unsaturated.

4.1.2.4 Potable Water Supply

Shallow groundwater in the unconsolidated geologic materials is not used as a major source of potable groundwater within the Issue Area. Groundwater resources found in the deeper bedrock aquifers beneath the unconsolidated sediments may be used as a source of potable water in the Issue Area. These aquifers include:

- St. Peter aquifer
- Prairie Du Chien-Jordan aquifer
- Franconia-Ironton-Galesville aquifer
- Mt. Simon-Hinckley aquifer

These four aquifers describe the bedrock aquifers beneath the Study Area and are described in Table 4-2 from upper to lower aquifer (shallower to deeper).

Table 4-2 Bedrock Aquifers

Aquifer	Use	Description	Yield
St. Peter Formation	Least used in Issue Area	Fine to medium grained sandstone; the base of the St. Peter is less permeable and is considered a confining unit.	250 gallons per minute (gpm) when the aquifer is not confined, such as near the Mississippi River in the eastern portion of the Issue Area, and greater than 250 gpm where the aquifer is confined.
Prairie Du Chien-Jordan	Most heavily used in Issue Area	Consists of approximately 120 feet of Prairie Du Chien dolostone and 100 feet of Jordan sandstone. No regional confining unit separates the two geologic units; therefore they are considered a single aquifer.	Potential yield of the aquifer is generally greater than 2,000 gpm. Seasonal fluctuations of the potentiometric surface can occur depending on the amount of pumping in the western and eastern portions of the Issue Area. Water level declines can be as much as 30 feet during heavy pumping periods.
Franconia-Ironton-Galesville	Not highly used in Issue Area	The upper part is Franconia Formation sandstone, which is approximately 1,140 feet thick. The lower portions of the Franconia are less permeable and are considered a confining unit. The middle part consists of Ironton sandstone, which is approximately 20 feet thick. The bottom part consists of Galesville sandstone that is approximately 40 feet thick.	Potential yields are generally less than 1,000 gpm
Mt. Simon-Hinckley	Highly used in Issue Area	The aquifer is comprised of Mt. Simon and Hinckley sandstone. These units total approximately 125 to 250 feet of thickness.	Potential yields are generally between 1,000 and 2,000 gpm.

Source: Minnesota Geologic Survey: Geologic Atlas of Hennepin County (1989)
Minnesota Geologic Survey: Geologic Atlas of Ramsey County (1992)

Municipal potable water is supplied to the entire Study Area, although numerous groundwater wells are located within the Study Area and are used for non-potable purposes. Suppliers of potable water are the City of Minneapolis Water Works and St. Paul Regional Water Services. These suppliers derive the majority of their water supplies from surface water sources, although the St. Paul Regional Water Services does operate some groundwater wells.

4.1.2.5 Groundwater Pollution Sensitivity

The susceptibility of an aquifer to surface pollutants is based on the degree of protection provided by geologic materials overlying it. This is dependent on the vertical travel time required for a waterborne contaminant release at or near the land surface to enter the groundwater. Vertical travel time is primarily controlled by the permeability of the sediments and their thickness. Several areas along the Central Corridor LRT Study Area lie within zones of very high sensitivity of pollution to the water table system (MGS, 1989 and 1992). This specific rating occurs where the unsaturated zone is less than 20 feet thick and underlying geology consists of sandstone bedrock, carbonate bedrock (limestone or dolostone), sand and gravel, or organic deposits. Estimated travel times for surface water to travel vertically to the water table in very high sensitivity areas range from a few months to hours. A Groundwater Pollution Sensitivity Map of the proposed project corridor is shown in Figure 4.1-3.

Three areas of very high sensitivity were identified along the Central Corridor LRT Study Area. These areas include:

- Downtown St. Paul (from the Mississippi River to the Capitol Commons)
- Midway East (along University Avenue between Avon Street and Lexington Avenue)
- Midway West (along University Avenue between Snelling Avenue and Raymond Avenue)

The majority of the remaining Central Corridor LRT Study Area lies within the high sensitivity classification. These are areas where the unsaturated zone is more than 20 feet thick and where there is no presence of confining units of moderate or low permeability. The travel times estimated for these areas range from weeks to years. Areas of high sensitivity were determined at a gross regional level. If factors such as the geology and thickness of the unsaturated zone differ at a local level than that determined in the county atlas, the pollution sensitivity rating may increase or decrease in areas of the Key Project Elements. The sensitivity ratings discussed relates to the water table system only, the point at which there is a continuous saturation of soil and bedrock. By definition, this does not include local perched systems that have been known to exist along the Study Area.