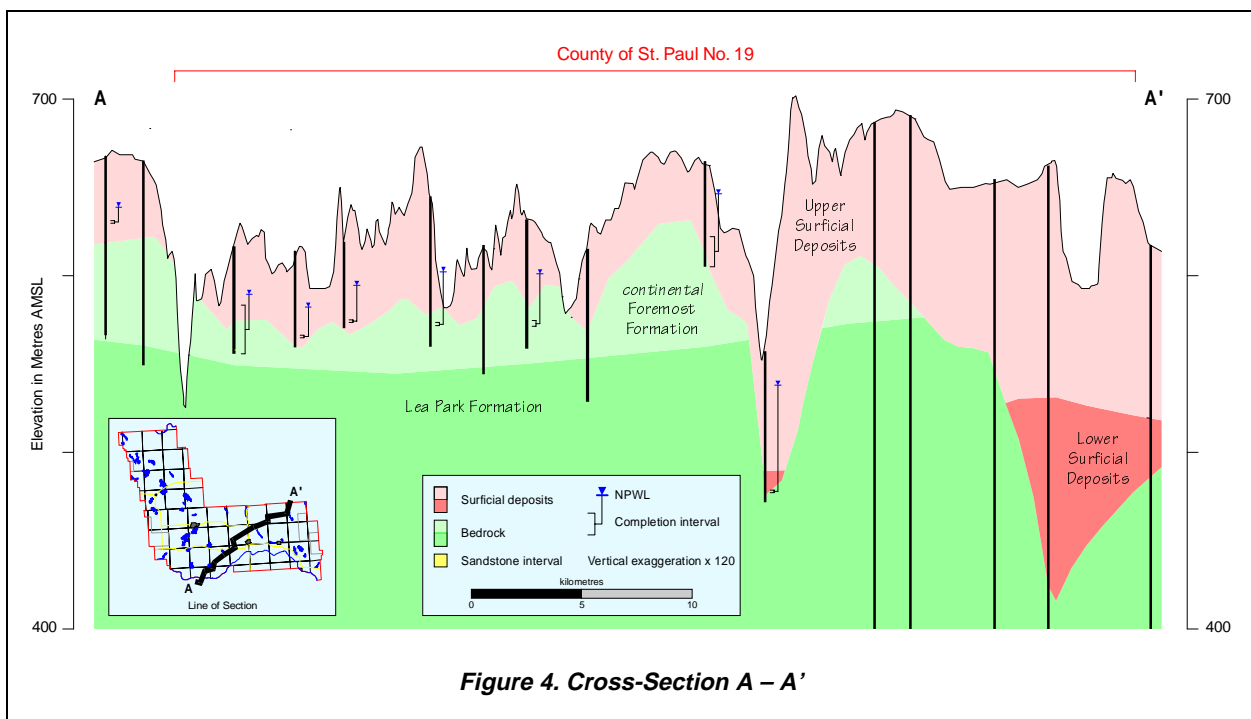


### 5.1.2 Bedrock Aquifers

The upper bedrock includes rocks that are less than 200 metres below the bedrock surface. Some of this bedrock contains porous, permeable and saturated rocks that have a structure that is permeable enough for the rock to be an aquifer. Water wells completed in bedrock aquifers usually do not require water well screens and the groundwater is usually chemically soft. The majority of the water wells completed in bedrock aquifers within the County have casing diameters of less than 200 millimetres.

The upper bedrock includes part of the Belly River Group and the Lea Park Formation. The Belly River Group has a maximum thickness of 150 metres and includes both the *continental* and *marine* facies<sup>9</sup> of the Foremost Formation.

The Lea Park Formation is the upper bedrock over approximately 50% of the County. The Lea Park Formation is mainly composed of shale, which is a fine-grained deposit that without fracturing has a very low permeability and cannot transmit significant quantities of groundwater to water wells. Hydrogeologists refer to the very low permeability rocks as aquitards<sup>10</sup>; they are unsuitable for the development of groundwater supplies, even for single-family needs.



<sup>9</sup> See glossary  
<sup>10</sup> See glossary

## 5.2 Aquifers in Surficial Deposits

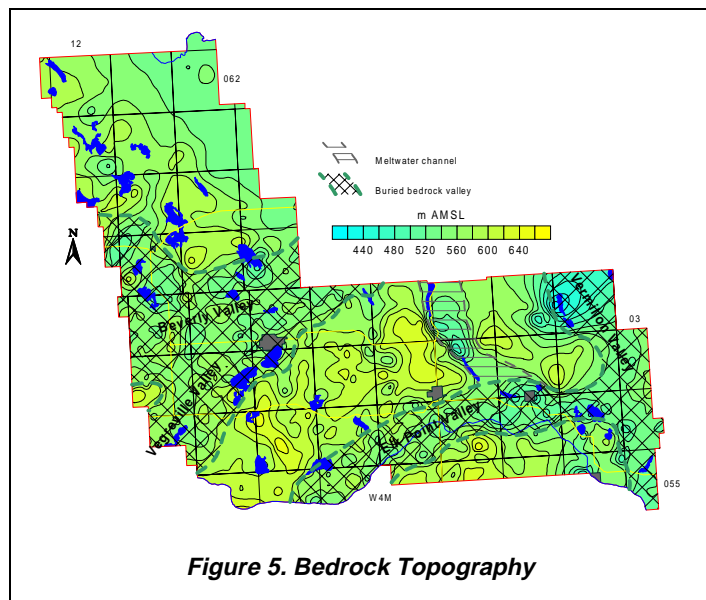
The surficial deposits are the sediments above the bedrock surface. This includes pre-glacial materials, which were deposited before glaciation, and drift, materials deposited directly by or indirectly during glaciation. The lower surficial deposits include the pre-glacial and some transitional sediments deposited as the glaciers advanced. The upper surficial deposits include the more traditional glacial deposits of till and meltwater deposits.

### 5.2.1 Geological Characteristics of Surficial Deposits

While the surficial deposits can be treated as one hydrogeological unit, they consist of two hydraulic parts. One hydraulic part includes sand and gravel aquifers associated with major linear lows in the bedrock surface and are part of the lower surficial deposits. The second hydraulic unit includes sand and gravel deposits that are not necessarily associated with major linear lows in the bedrock surface and are in the upper part of the surficial deposits. The sand and gravel deposits in the upper part of the surficial deposits can extend above the upper limit of the saturation zone and because they are not saturated, they are not an aquifer. However, these sand and gravel deposits are significant since they provide a mechanism for liquid contaminants to move downward into the groundwater. Because of the significance of the shallow sand and gravel deposits, they have been mapped where they are present within one metre of the ground surface and are referred to as the “first sand and gravel”.

The total thickness of the surficial deposits ranges from less than 20 to more than 140 metres. The maximum thickness occurs in association with the Buried Beverly Valley, which is north of the Town of St. Paul. Over the majority of the County, the surficial deposits are less than 100 metres thick.

The lower surficial deposits are composed mostly of fluvial<sup>11</sup> and lacustrine<sup>12</sup> deposits. The total thickness of the lower surficial deposits can be up to 100 metres. If the elevation of the top of the lower surficial deposits is approximately 540 metres AMSL, an elevation that corresponds closely to the top of the Muriel Lake Formation (Andriashek, 1985), the lower surficial deposits can be expected under approximately 20% of the County. The lowest part of the lower surficial deposits includes pre-glacial sand and gravel deposits. These deposits can directly overlie the bedrock surface in the buried bedrock valleys referred to as the Buried Beverly Valley and the Buried Vermilion Valley. The lowest sand and gravel deposits are of fluvial origin and are usually no more than a few metres thick.



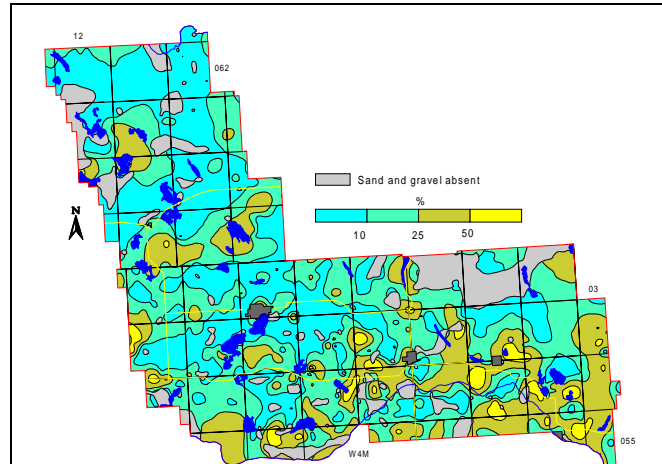
**Figure 5. Bedrock Topography**

<sup>11</sup> See glossary

<sup>12</sup> See glossary

The upper surficial deposits are either directly or indirectly a result of glacial activity. The deposits include till, with minor sand and gravel deposits of meltwater origin, which occur as isolated pockets. The thickness of the upper surficial deposits can be up to 120 metres. The greatest thickness of upper surficial deposits occurs in the areas of the buried bedrock valleys. These valleys include the Buried Beverly, Vegreville, Elk Point, and Vermilion Valleys, plus the deeply incised meltwater channel northeast of Elk Point.

Sand and gravel deposits can occur throughout the entire unconsolidated section. The combined thickness of all sand and gravel deposits as a function of the total thickness of the surficial deposits has been determined. Over approximately 5% of the County, the sand and gravel deposits are more than 50% of the total thickness of the surficial deposits. The areas where the sand and gravel thickness is more than 50% of the total thickness of the surficial deposits are all in the southern part of the County, with most of the areas associated with buried bedrock lows.

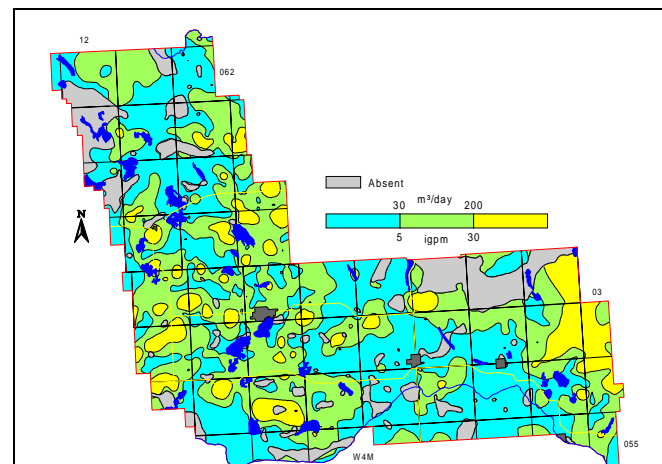


**Figure 6. Amount of Sand and Gravel in Surficial Deposits**

### 5.2.2 Sand and Gravel Aquifer(s)

The main source of groundwater in the County is aquifers in the surficial deposits. The particular aquifer used is in a large part dictated by the aquifers present. Some water wells are completed in aquifers in the lower surficial deposits and some are completed in aquifers in the upper surficial deposits.

The adjacent map shows the water well yields that are expected in the County based on the surficial aquifers that have been developed. Based on these data, water well yields of more than 200 m<sup>3</sup>/day can be expected in parts of the County, most notably in the eastern part. Over a significant part of the County, water well yields can be less than 30 m<sup>3</sup>/day. One of the noteworthy points of the adjacent map is the “patchy” nature of the expected yields. The patchy appearance of the yield map indicates the lack of continuity of the individual aquifers. The higher values for water well yields are more frequently located in the middle part of the County, where the general trend of the Buried Beverly and Vermilion Valleys can be seen.



**Figure 7. Apparent Yield from Water Wells completed through Sand and Gravel Aquifer(s)**