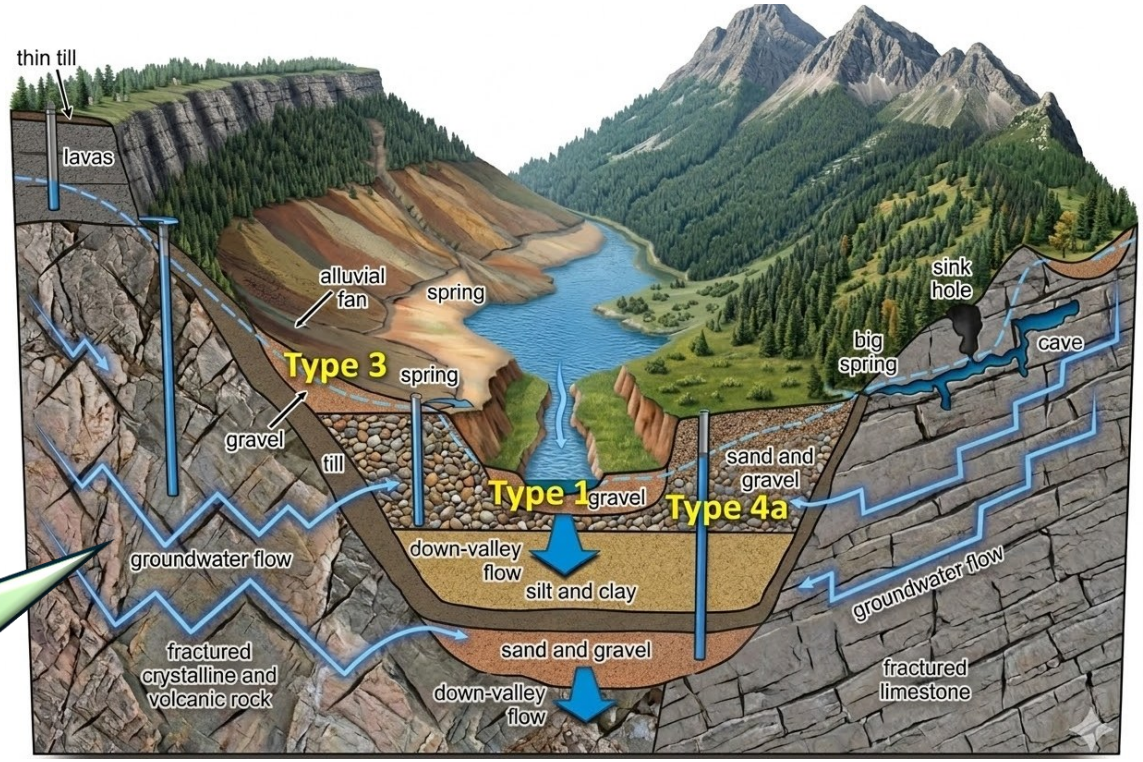
Shallow groundwater in the Peel River basin: Where is it and where might it be at risk?

Groundwater is a key part of the water cycle. It is also an important natural resource for humans, plants and animals. Rainfall and snowmelt that soak into the ground flow as groundwater through soil and rock. The groundwater is naturally stored underground in "aquifers" before eventually making its way to springs or larger waterbodies such as lakes or rivers.

The Government of the Northwest Territories and the Government of Yukon want to ensure groundwater in the Peel River basin and Western Mackenzie Delta is understood and managed properly. Groundwater helps keep streams and rivers flowing during the long winter months when surface water is frozen. Many animals and their habitats depend on this water and how it interacts with the land.

Shallow surficial aquifers are particularly important because they are right below the ground surface. Many community members rely on groundwater for drinking, cooking and bathing, as well as for commercial and industrial uses. Sometimes, the groundwater in shallow surficial aquifers can be too short in supply for use or can become unsafe if it becomes contaminated by dirty material from leaks or spills at the surface.



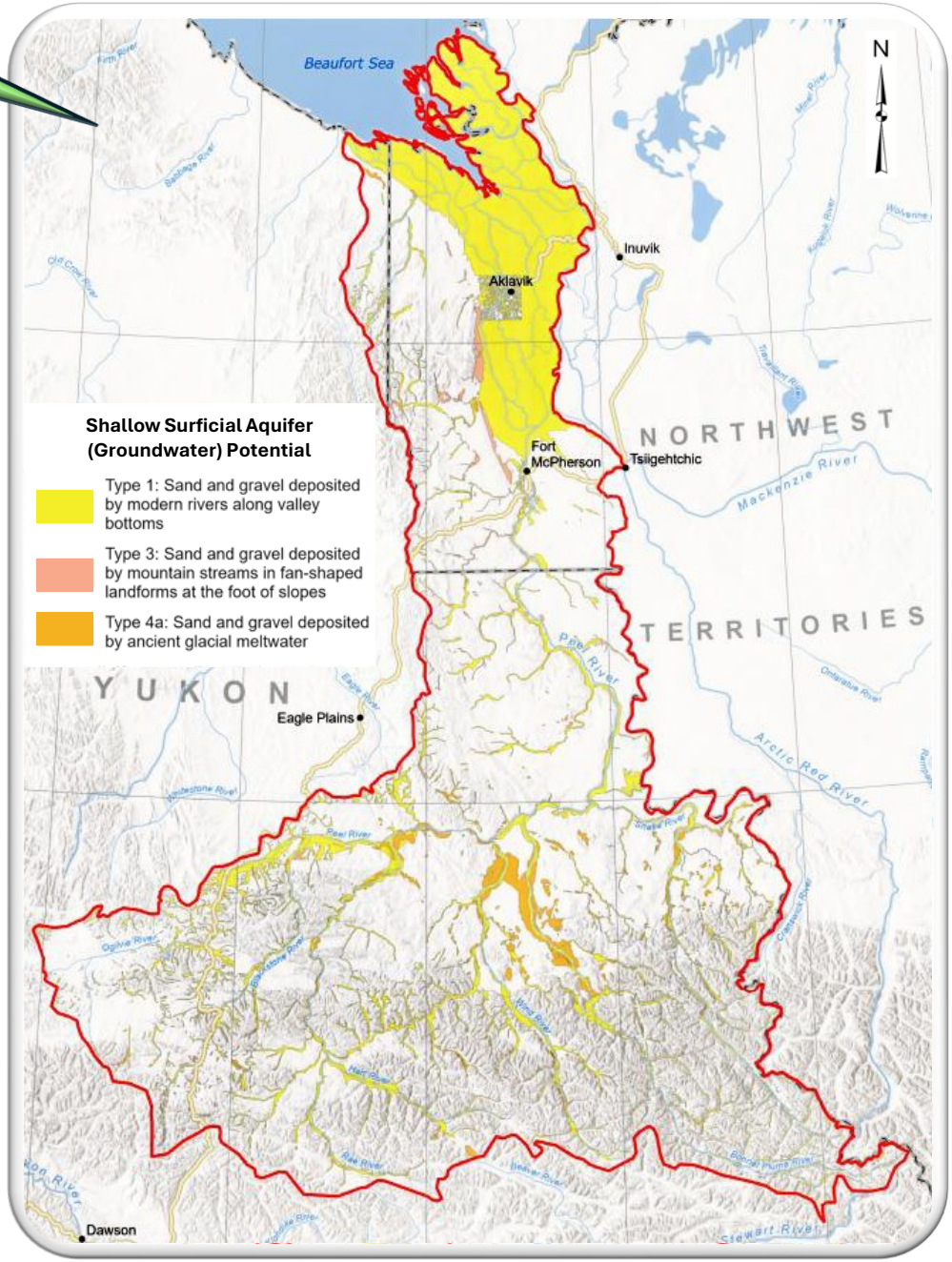
A slice through the ground helps show where the three main types of shallow surficial aquifers are in valleys like those of the Peel River basin. Modified from Wei et al. (2009).

Shallow groundwater is most likely to be found in one of three main types of surficial aquifer along the valleys of the Peel River basin.

The study of shallow surficial aquifers was mostly based on information and maps about landforms, different types of soil and rock, vegetation, and frozen ground called "permafrost." This information provides valuable clues about where water can move underground. Permafrost is widespread in the Peel River basin. It stops rainfall and snowmelt from soaking deeply into the ground and, instead, forces slow seepage of shallow groundwater toward waterbodies.

Information from water wells is very limited in this remote region. To fill in the gaps, the study used records from oil and gas exploration (seismic shotholes) and looked at river flow records to estimate how much water is coming from underground.

The study determined that rainfall and snowmelt soak into the ground mostly in the mountainous regions to the south (the Upper and Central Peel areas). Although the flat plains of the Western Mackenzie Delta have soil that can hold water, less water actually soaks in there because there is less rainfall and snowmelt overall compared to in the mountains. On average, only about 88 millimetres of water (less than the height of a coffee mug) soaks into the ground each year to replenish aquifers within the Peel River basin. However, this groundwater is vital, providing roughly 12% to 14% of the water that flows through the basin's rivers.

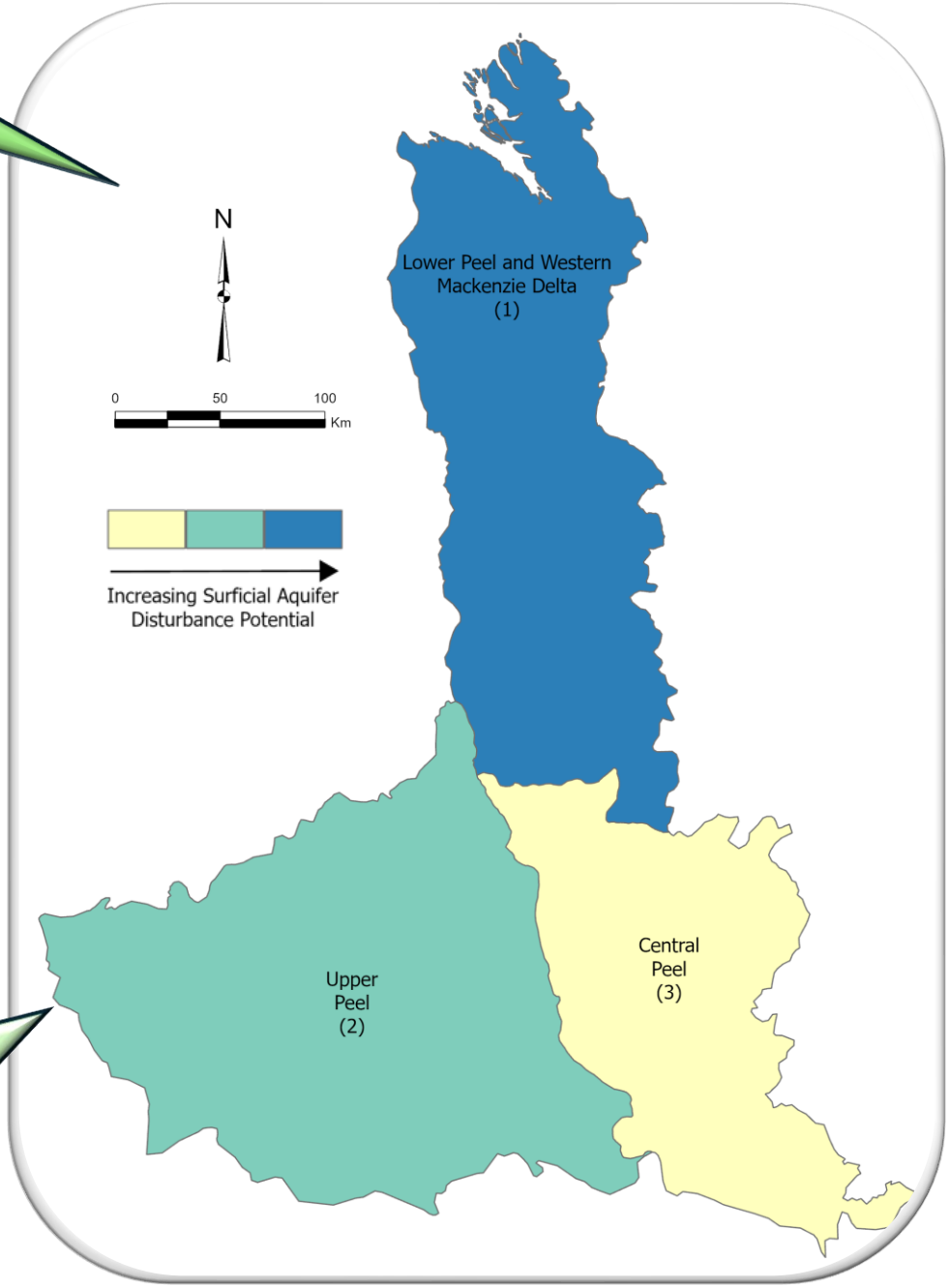


The mountains and valleys of the Peel River basin were divided into three subbasins for the purposes of studying shallow groundwater.

The study also found that groundwater in the Lower Peel and Western Mackenzie Delta is most vulnerable to surface disturbance because there is more human activity there. The Upper Peel area is most vulnerable in specific places where surficial aquifers and recharge areas overlap with what few water-supply wells exist. Groundwater is least at risk in the Central Peel area, which is rugged and has very little human disturbance.

One thing that became clear through this study is that additional research and Traditional Knowledge are needed to better understand these surficial aquifers. As the climate warms and permafrost thaws, the way water moves underground will change. Better information will allow the governments and communities to protect water resources for the future.

By considering where human activities overlap with areas of shallow surficial aquifers, it is possible to rank the three subbasins of the Peel River basin from lowest (light yellow) to highest (dark blue) groundwater disturbance potential.



Questions? Or observations or experience to share? Please contact Anna Coles (anna_coles@gov.nt.ca)