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NWT Environmental Research Bulletin (NERB)

NWT Cumulative Impact Monitoring Program (NWT CIMP)

A source of environmental monitoring and research in the NWT. The program coordinates, conducts and funds the collection, analysis and reporting of information related to environmental conditions in the NWT.

NWT Environmental Research Bulletin (NERB)

A series of brief plain language summaries of various environmental research findings in the Northwest Territories. If you're conducting environmental research in the NWT, consider sharing your information with northern residents in a bulletin. These research summaries are also of use to northern resource decision-makers.

Thaw slumps, landscape change and critical infrastructure

In the NWT, permafrost thaw is causing slumps which can impact land, water and infrastructure. In 2017, increased thaw caused large amounts of mud to flow towards the Dempster Highway, exposing a large cavity of ice-rich permafrost.

Why is this research important?

The Dempster Highway is a critical link between Beaufort Delta communities and southern Canada. Northerners are concerned with permafrost related risks to infrastructure and public safety. Monitoring thaw slumps is important because they can impact infrastructure such as the Dempster Highway.

What did we do?

Since 2011, drone surveys were used to track the growth of thaw slumps in the Gwich'in, Sahtú and Inuvialuit Settlement regions and to calculate the amount of materials carried downslope (Figure 2). Field monitoring guided the launch of a real-time surveillance system by the Department of Infrastructure (INF) to manage risks posed by thawing permafrost.

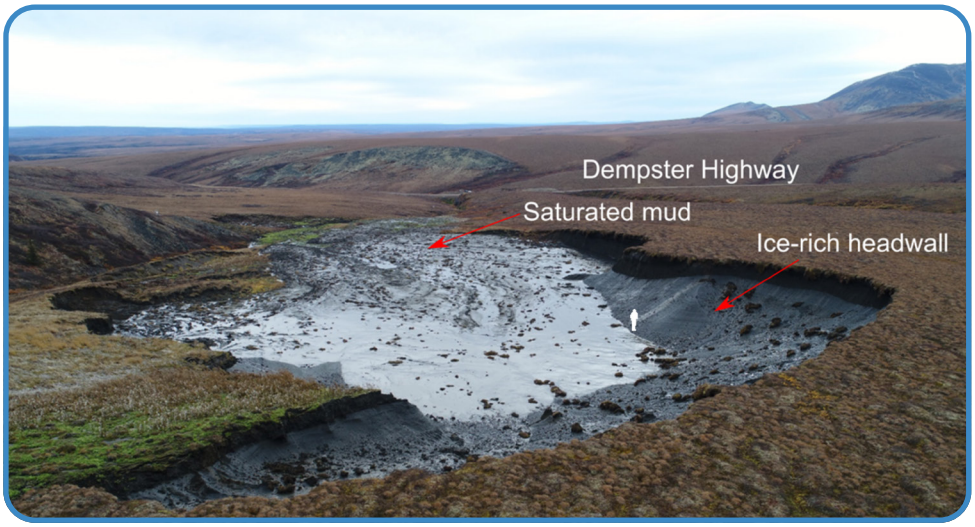

Figure 1 Looking downslope towards the Dempster Highway (~500 m away at km 28.5), from the top of the thaw slump. Note the white silhouette of person for scale.

What did we find?

- In summer of 2017, previously stable materials rapidly slid away in a 20,000 m^3 mud flow that stopped only 200m from the Dempster Highway.
- A headwall of ice-rich permafrost, 20 m in height, was exposed. This accelerated the growth of the slump and increased the volume of thawed material.

What does this mean?

Over two decades, climate warming and rainfall have caused the size of thaw slumps to grow rapidly. The continued thaw of ice-rich permafrost will pose a risk to the stability of the Dempster Highway and infrastructure in this region. This work is linked to a larger project that is mapping sensitive permafrost terrain across the NWT and transboundary watersheds *(CIMP186 NWT Permafrost Collective)*.

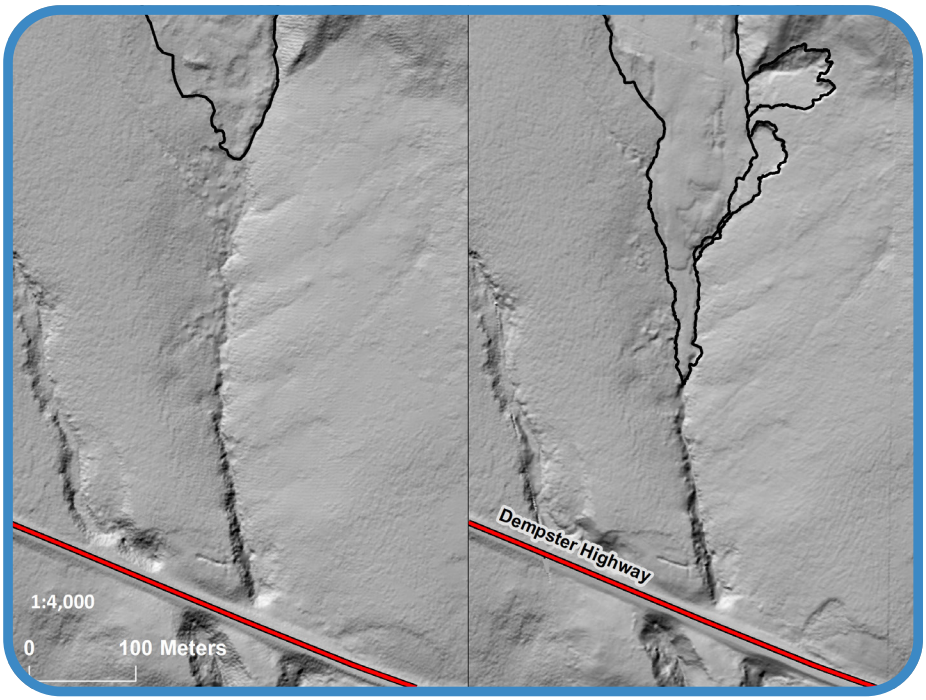

Figure 2 Left panel - Slump 2011. Right panel – Slump 2019. The two smaller slumps on the eastern side of the main slump were formed when the 2017 mudflows pushed the stream into the opposite bank.

What's next?

The Project team continues to work with the Tetl'it Renewable Resources Council and Gwich'in land users to monitor slumps in the region and report findings to communities and INF.

What is a thaw slump?

Thaw slumps are a type of landslide occurring in large permafrost regions. A slump is formed when ice-rich permafrost is exposed by natural or human disturbance. These can grow into mega slumps, (some exceeding 20 ha in area) when they occur in ice-rich permafrost, which is common in parts of the NWT.

Recommended Reading

Kokelj, S. V., Kokoszka, J., van der Sluijs, J., Rudy, A. C. A., Tunnicliffe, J., Shakil, S., Tank, S., and Zolkos, S. *Permafrost thaw couples slopes with downstream systems and effects propagate through Arctic drainage networks, The Cryosphere*. **2021**, 15, 3059-3081. https://doi.org/10.5194/tc-15-3059-2021.

van der Sluijs, J.; Kokelj, S.V.; Fraser, R.H.; Tunnicliffe, J.; Lacelle, D. *Permafrost Terrain Dynamics and Infrastructure Impacts Revealed by UAV Photogrammetry and Thermal Imaging. Remote Sens.* **2018**, 10, 1734.

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