

Managing Yukon's Transportation Infrastructure in a Changing Climate

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VIRTUAL | VIRTUEL

XVI WORLD WINTER SERVICE AND ROAD RESILIENCE CONGRESS
XVI^e CONGRÈS MONDIAL DE LA VIABILITÉ HIVERNALE ET DE LA RÉSILIENCE ROUTIÈRE
XVI CONGRESO MUNDIAL DE VIALIDAD INVERNAL Y RESILIENCIA DE LA CARRETERA





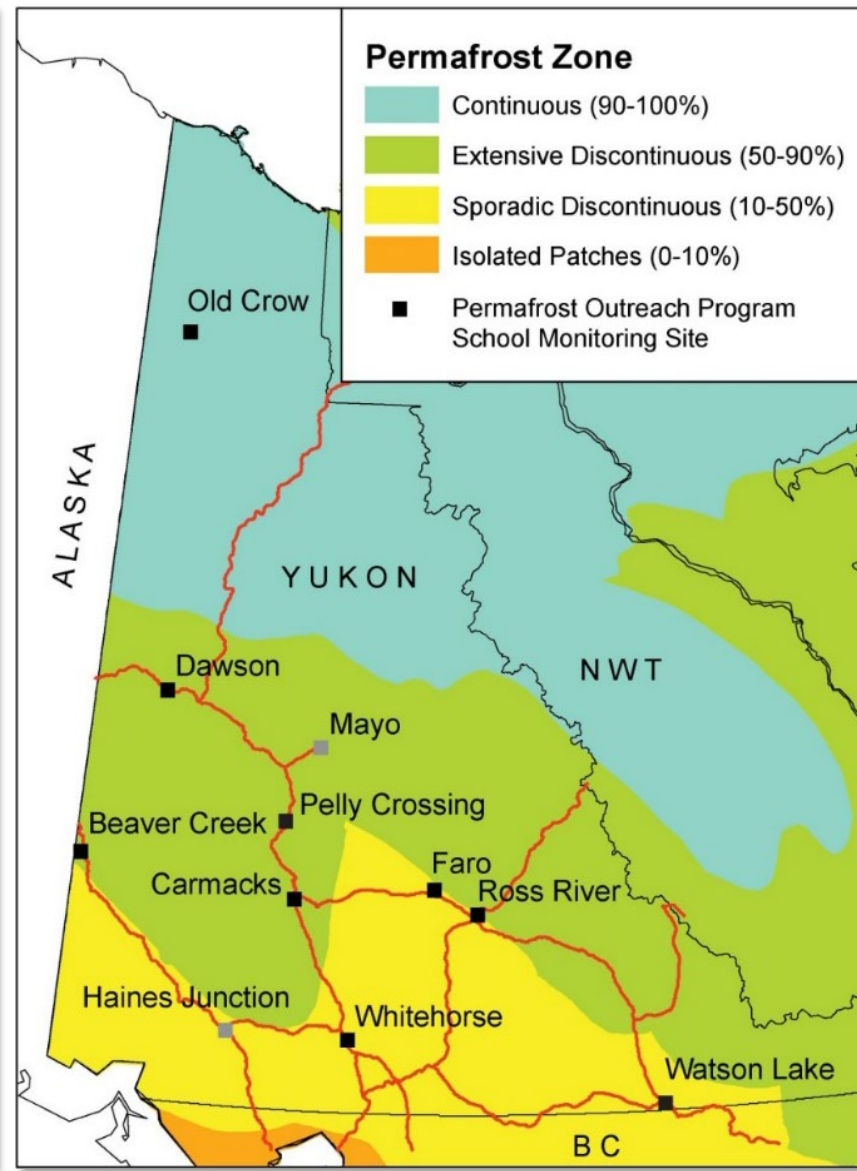
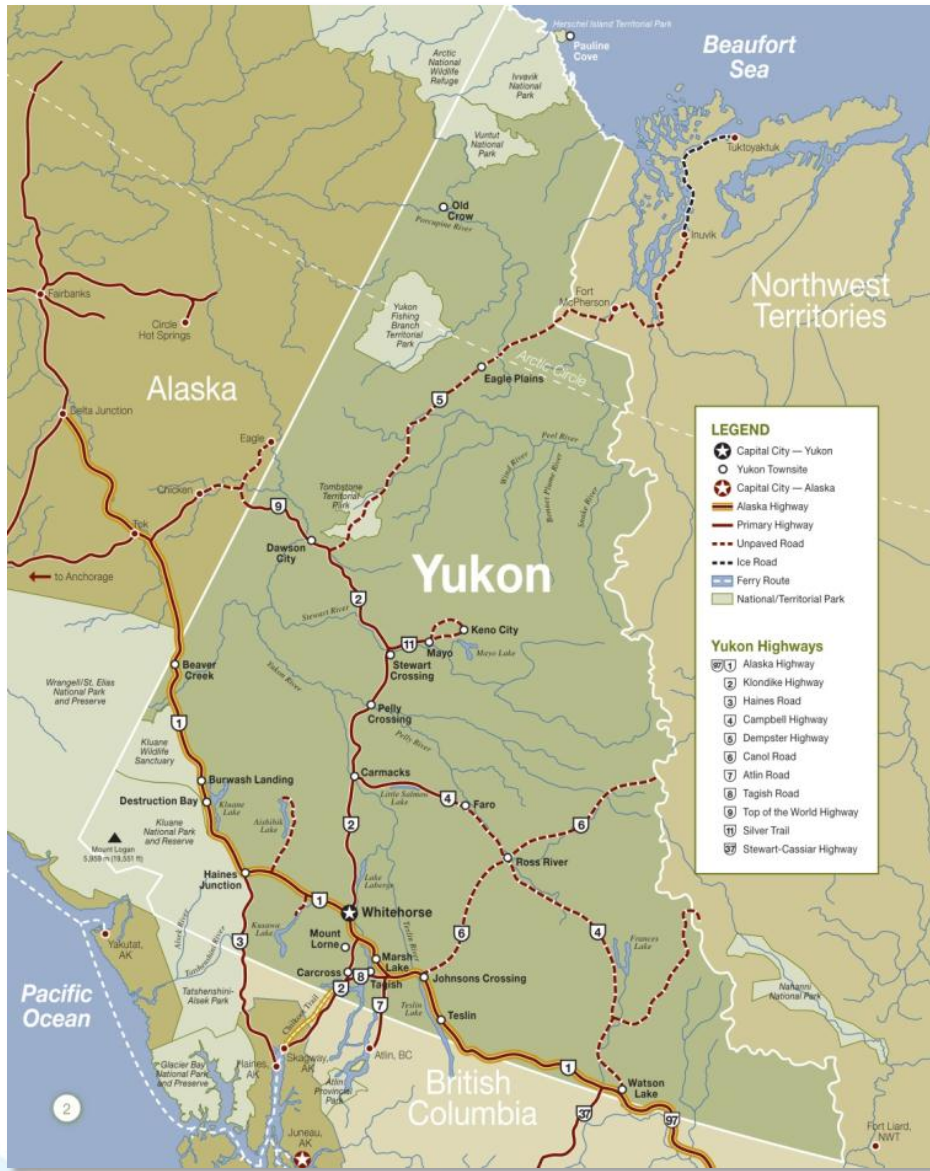
Whitehorse



Yukon's Highway Infrastructure

- Area: 483,450 square kilometers
- Population: 42,000
- 4,800 km of maintained highway
- >25 percent of highway network on permafrost





Objectives

- Improve our understanding of the physical and financial impacts of climate change on northern transportation infrastructure
- Support the advancement of research to address these challenges
- Adapt transportation engineering practices to develop infrastructure that is resilient to climate change





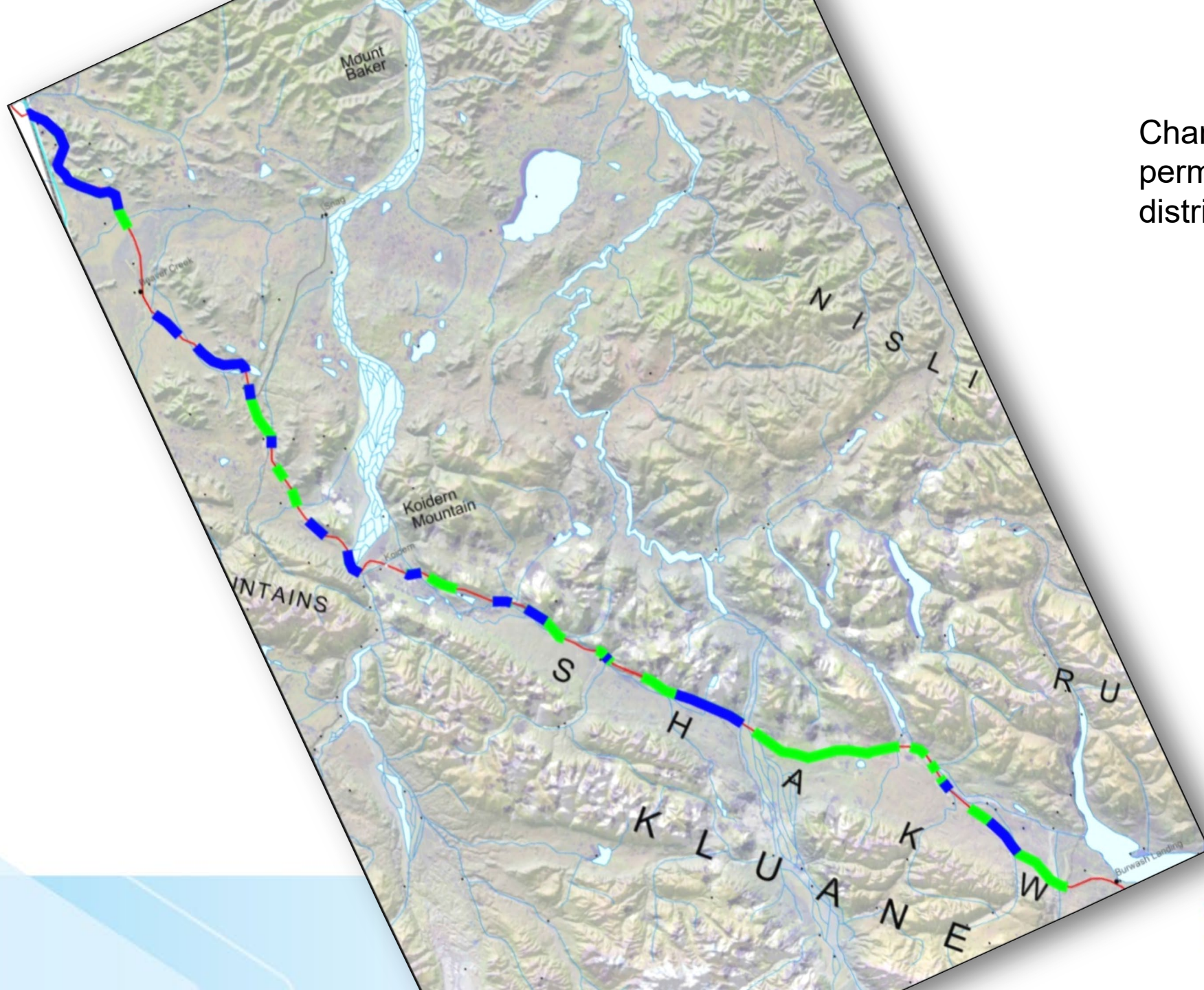
Permafrost
distribution based
on boreholes
completed
between 1990 and
2001

Topographic map of the Kluane region, showing the Kluane River and surrounding mountains. The map is tilted at an angle. Key features include:

- Mount Baker** (top left)
- Koidern Mountain** (center left)
- Kluane River** (center, flowing from the top left towards the bottom right)
- NTAINS** (left side, part of a larger label)
- SH** (center, part of a larger label)
- KLUANE** (bottom center, part of a larger label)
- RU** (right side, part of a larger label)
- W** (bottom right, part of a larger label)
- Burwash Landing** (bottom right corner)

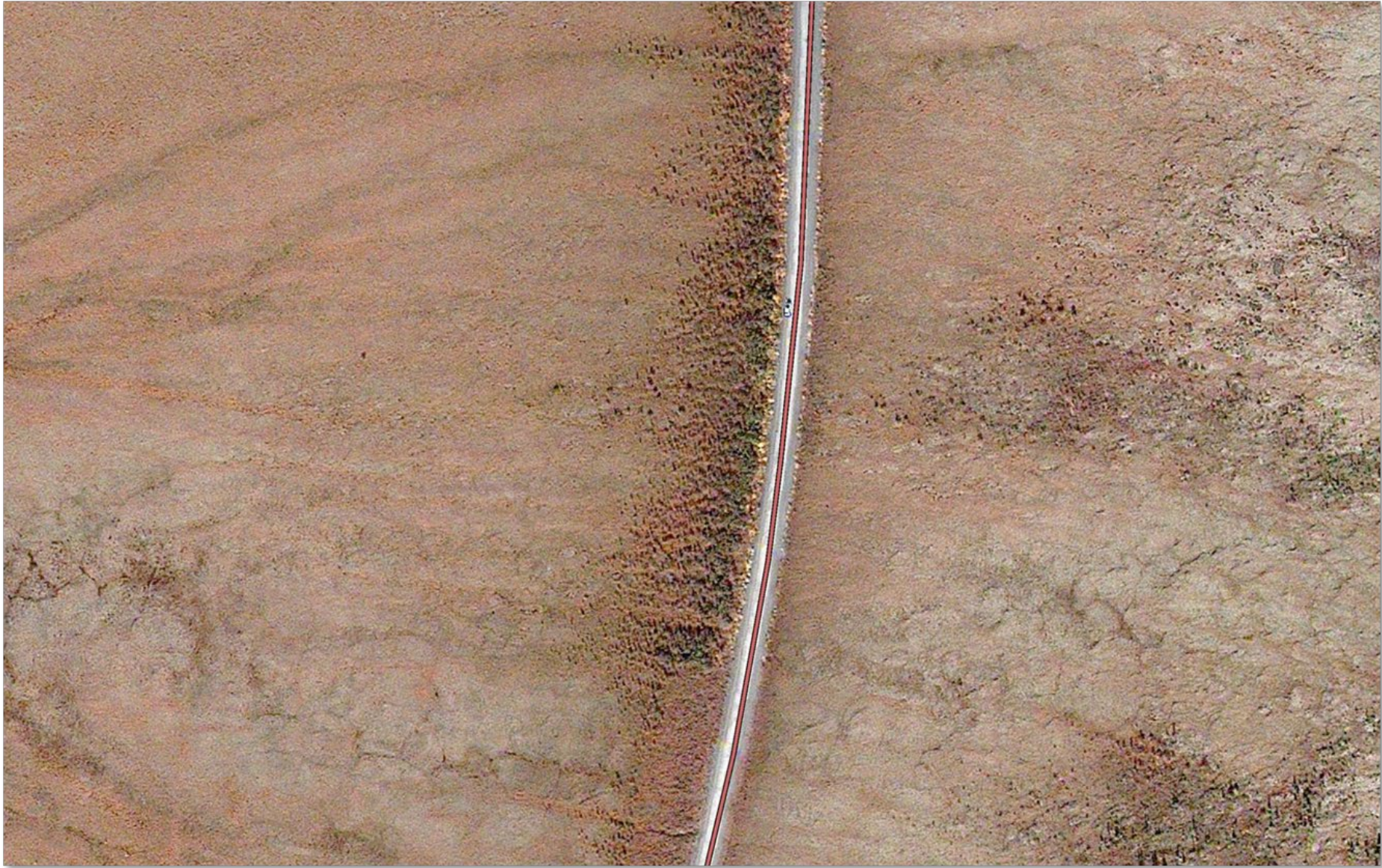
The map shows a network of rivers and lakes, with the Kluane River being the most prominent. The terrain is rugged and mountainous.

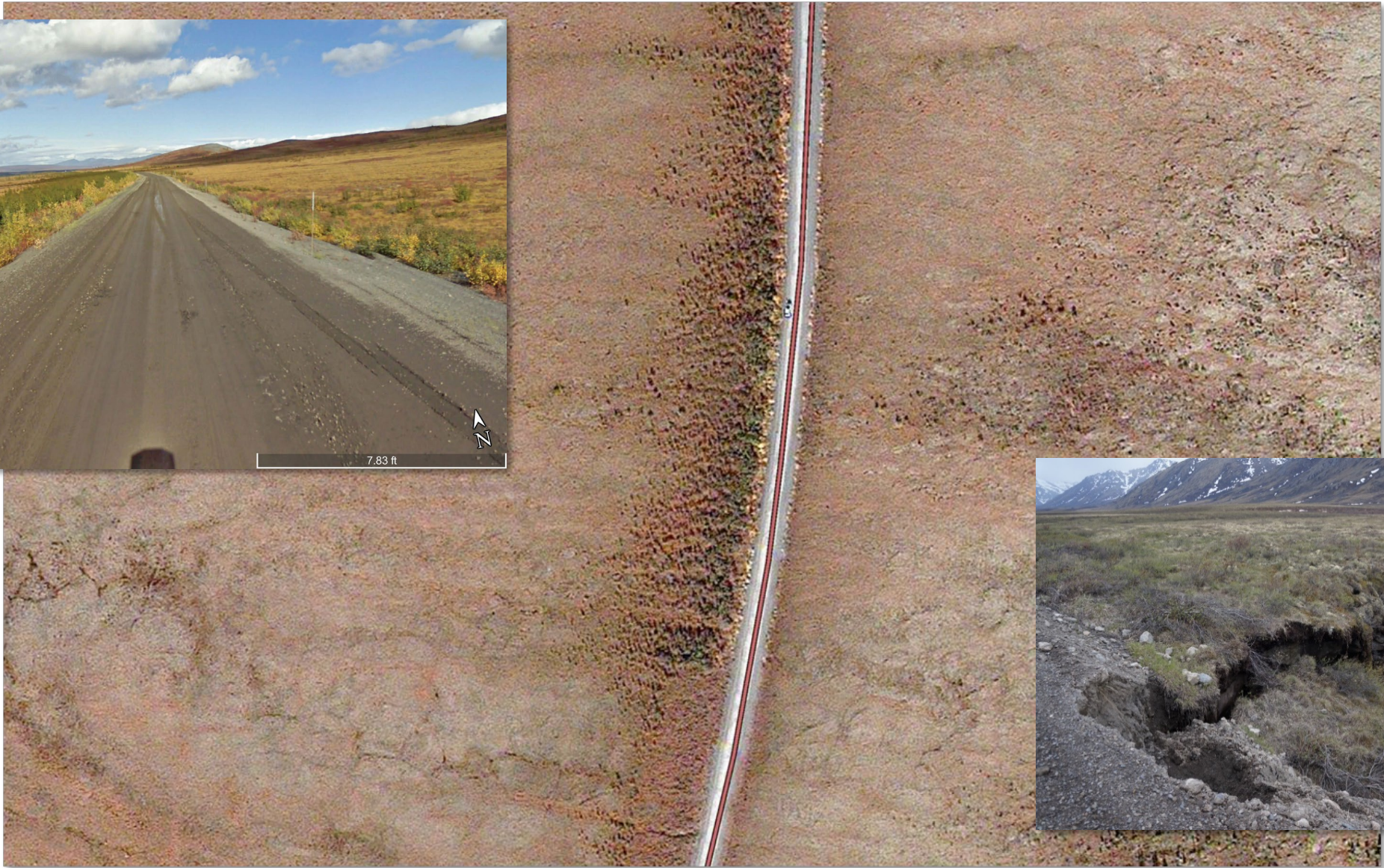
Change in
permafrost
distribution











Engineering Adaptations and Technologies

- Design and installation of thermosyphons and Air Convection Embankments
- Sun/Snow Sheds
- High Albedo Surfacing
- Heat Drains
- Bioengineering techniques on disturbed permafrost rich slopes
- Frost Depth Monitoring and modelling
- Borehole and Electrical Resistivity Tomography surveys
- Subsurface and meteorological data collection and warehousing
- Snow compaction to stabilize thermal properties of highway embankments
- Snow fencing and control

High Albedo Surfaces

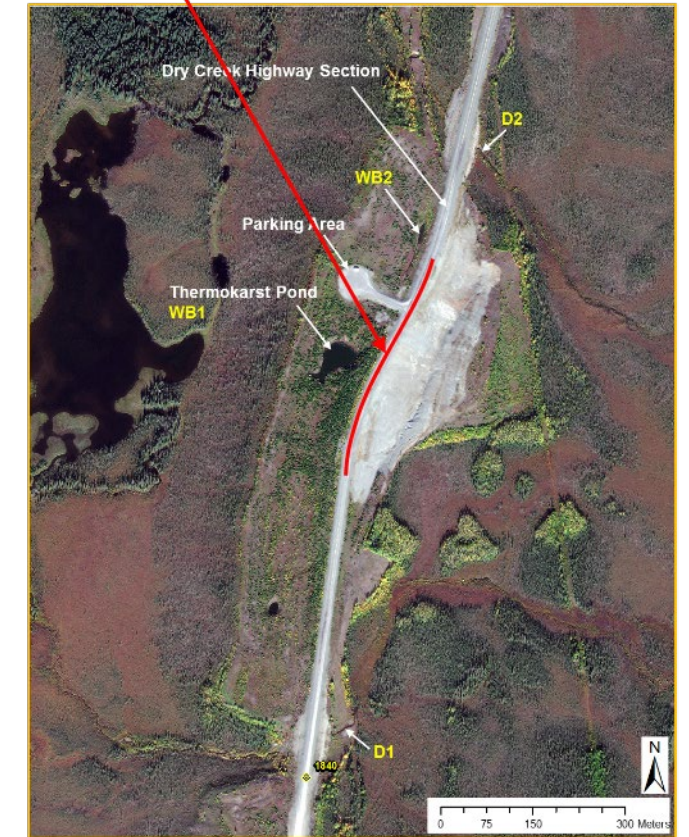
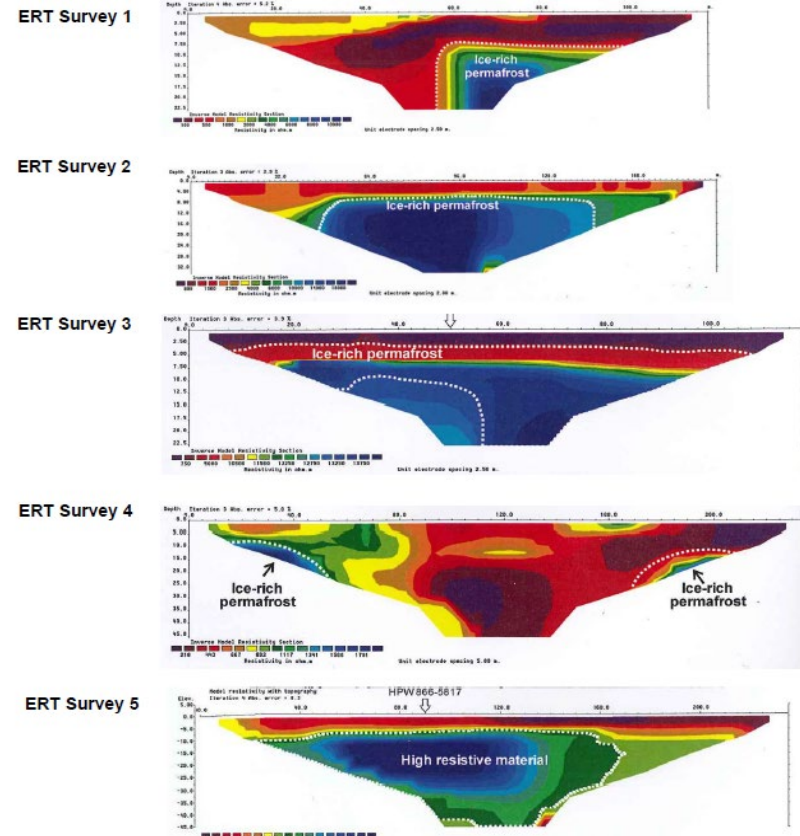
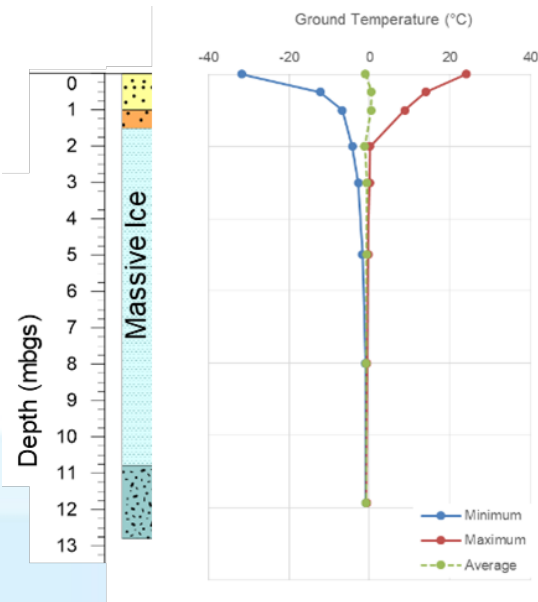


Front Street, Dawson c. 1898

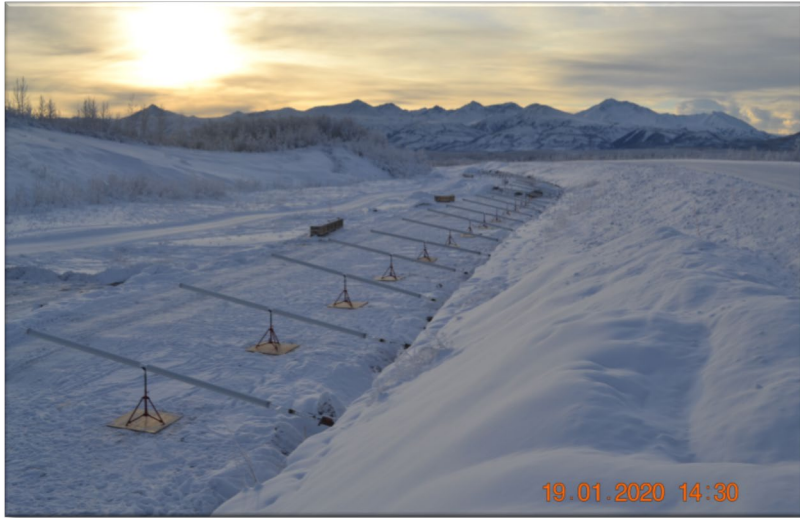


Thermosyphons

Approximate extent of test section



Thermosyphons

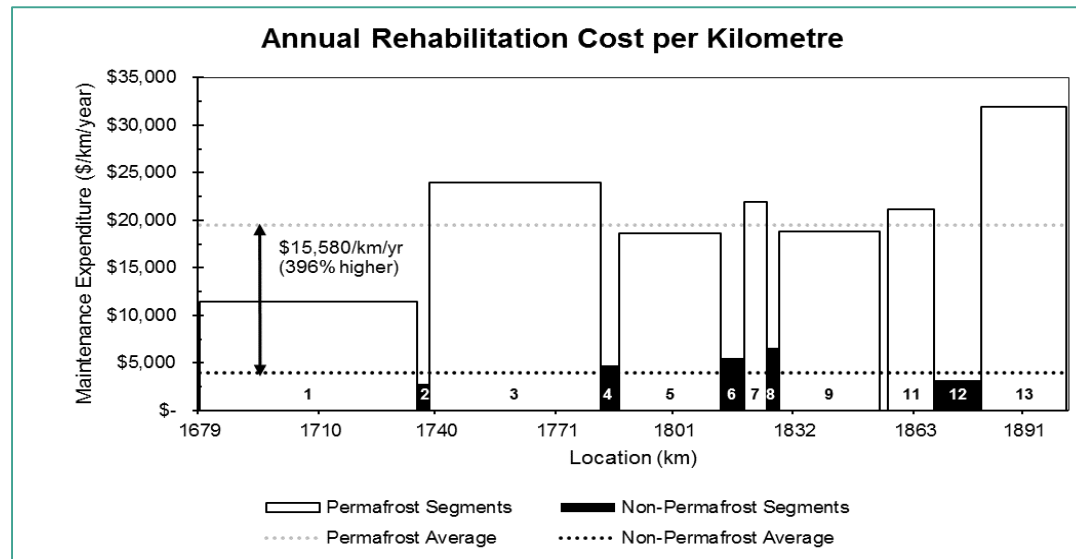


Bioengineering – Peat Moss and Revegetation



Chapman Lake – Dempster Highway, km 116

Cost of Constructing and Maintaining Highways on Permafrost



	Permafrost	Non-Permafrost	Factor Difference
Overall	\$1.44M	\$963K	1.49
Reconstruction	\$1.01M	\$882K	1.25
Rehabilitation	\$337K	\$81K	4.17
Annual Rehabilitation	\$20K	\$3.9K	4.96

Gracias/Merici/Thank you