Aboriginal Affairs and Northern Development Canada

Affaires autochtones et Développement du Nord Canada

Mapping landscape hazards in Yukon for community climate change adaptation planning

Bronwyn Benkert
Research Project Coordinator
6 Nov 2013

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NCE has provided a range of climate change services to Yukon since 2000, related to:

- **Adaptation** (community climate change adaptation plans, vulnerability assessments, hazard mapping, and mainstreaming…)
- **Education and outreach** (Climate Change for Decision Makers, regular online newsletter distributed across Canada, lecture series…)
- **Mitigation** (Whitehorse Green Guide, Advisor for YG Climate Change Action Plan and emission targets…)
- **Climate Change Information and Mainstreaming Program**

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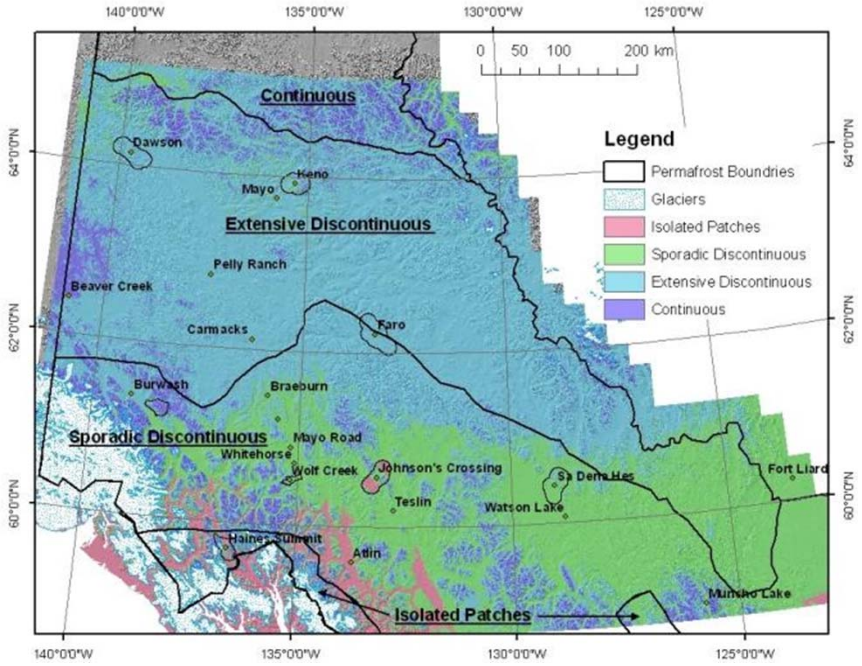
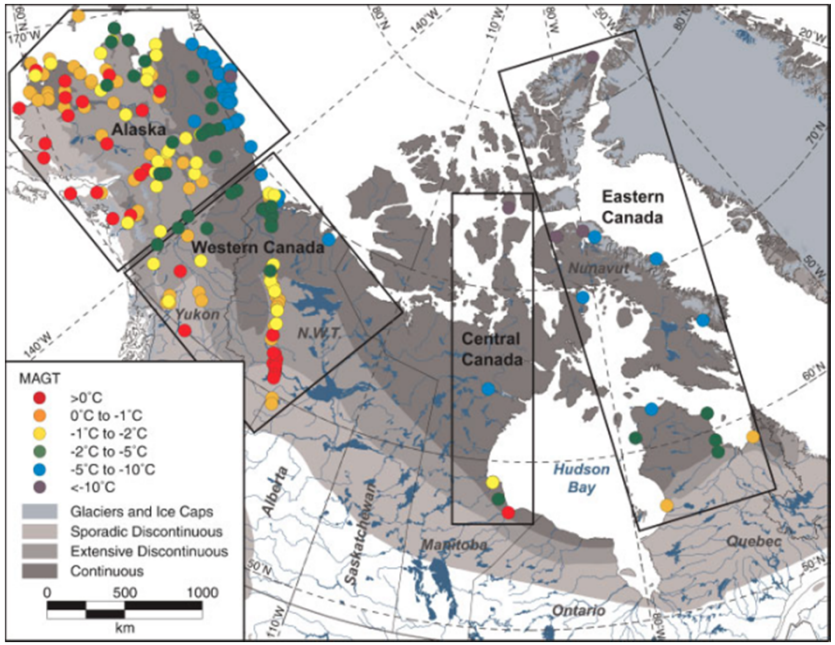
Yukon permafrost distribution



Source: Bonnaventure et al., 2012



Source: Smith et al., 2010

Careful planning required to adapt to permafrost change in Yukon

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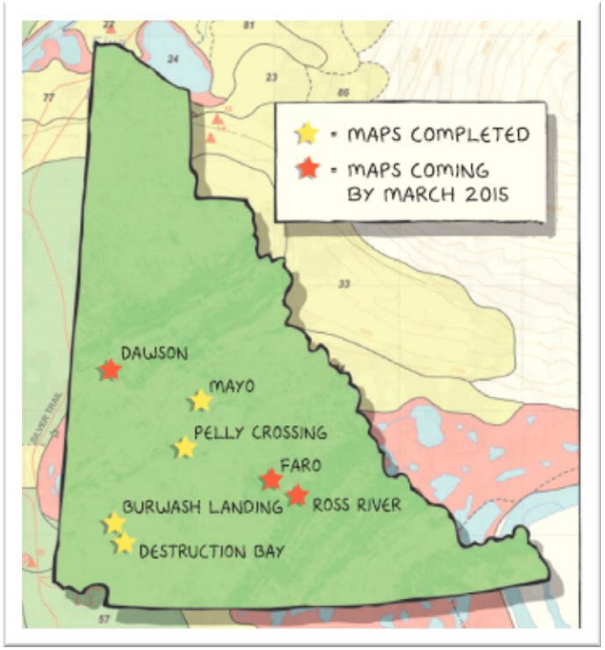
Hazards mapping for adaptation planning



Ensuring relevancy through meaningful community engagement

- Support of initial proposals
- Local community coordinators
- Field site selection – invitational meetings, open houses
- Opportunities for school involvement, fieldsite tours
- End-of-project celebration
- Targeted communication products

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What are hazards?

SURFICIAL GEOLOGY

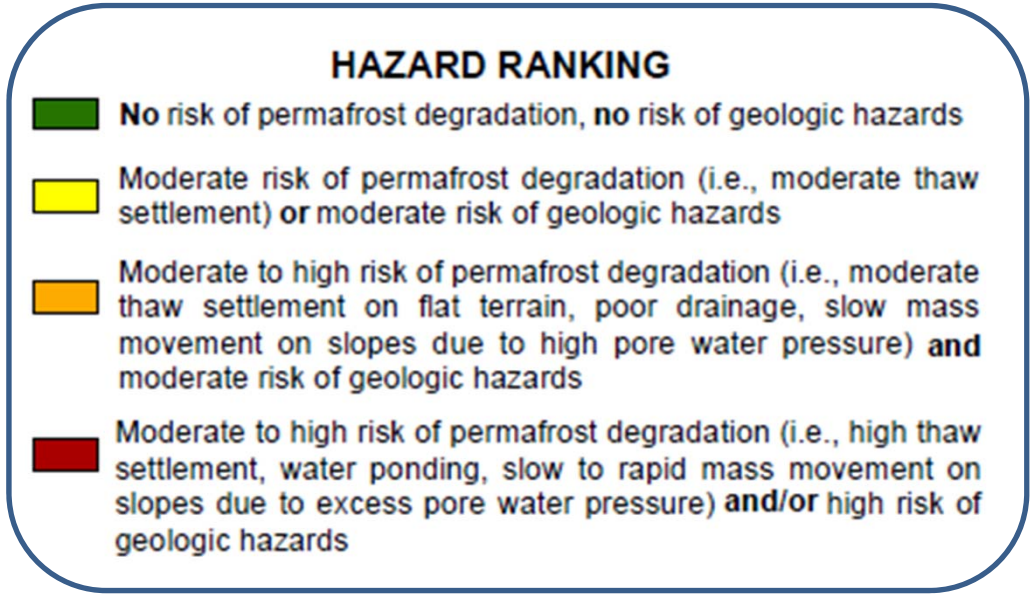
- Landslides/mass movements
- Slumps
- Cracking

PERMAFROST

- Thaw
- Settlement, subsidence
- Ponding

HYDROLOGY

- River flooding
- Groundwater
- Water availability



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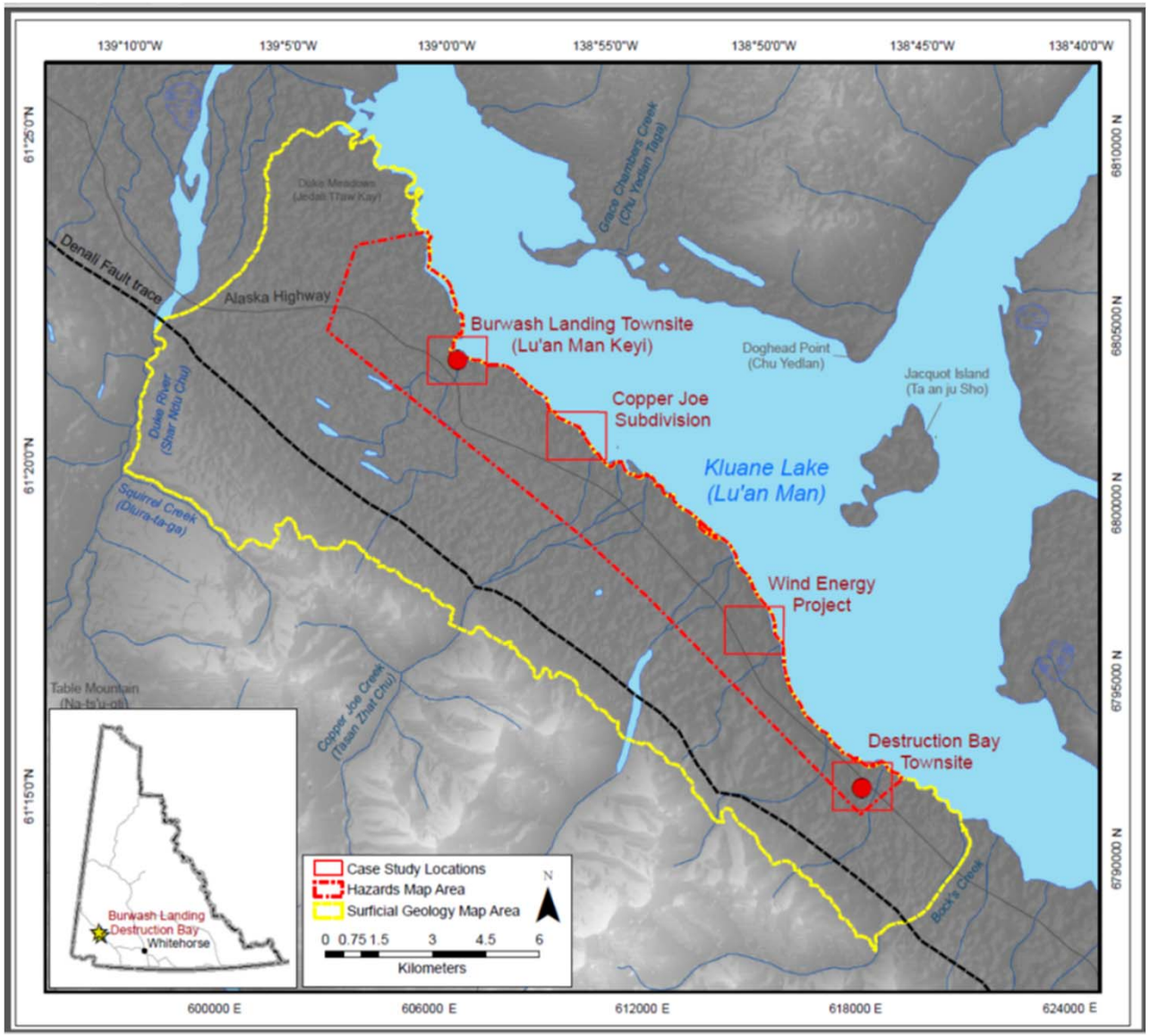
Hazards mapping in Burwash Landing and Destruction Bay



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Approach

DESK-BASED

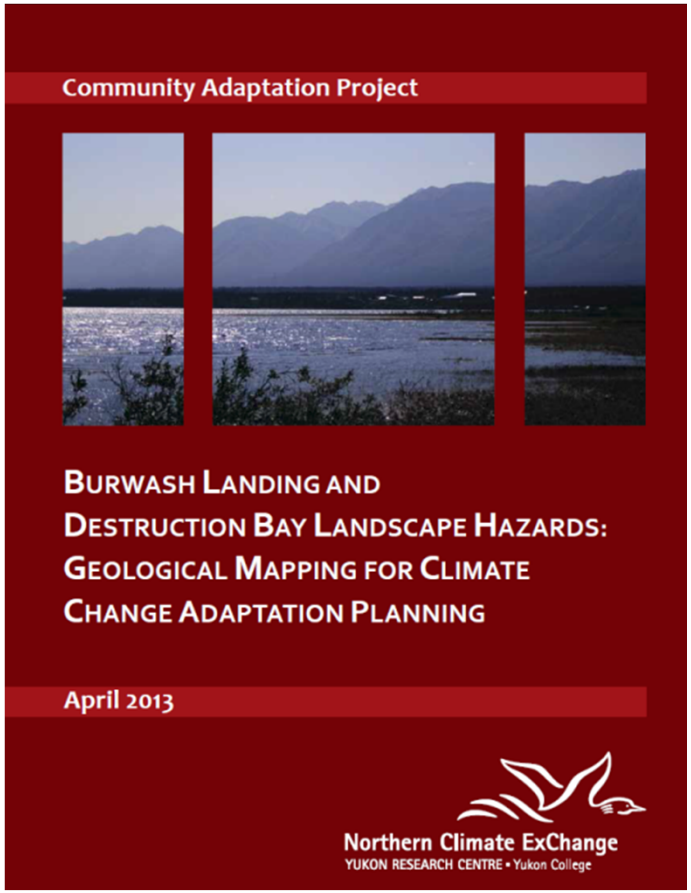
- Existing mapping, airphotos
- Existing geophysics, reports
- Community consultation

FIELD-BASED

- Surficial geology mapping
- Ground penetrating radar
- Electrical resistivity tomography
- Permafrost coring, borehole drilling

ANALYSIS

- Grain size distribution
- Ice and water contents, permafrost properties, settlement potential…



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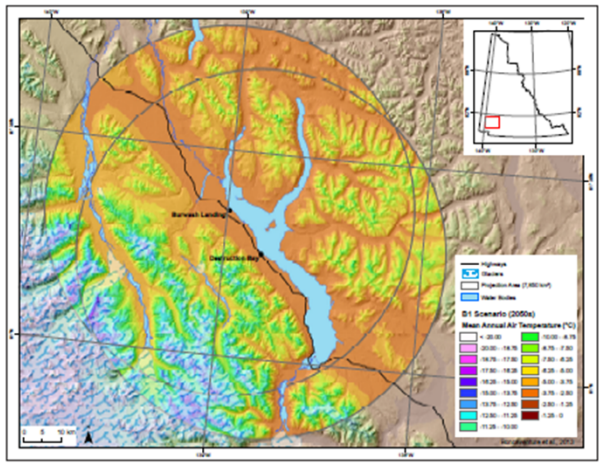
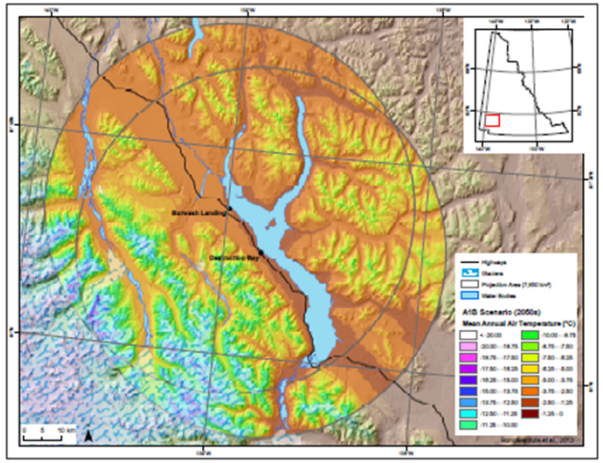
Future environmental change

Climate projections



Appendix D5 – Mean annual air temperature for the Burwash Landing area for 2050, projected using the B1 scenario.



Appendix D6 – Mean annual air temperature for the Burwash Landing area for 2050, projected using the A1B scenario.

Permafrost probability models

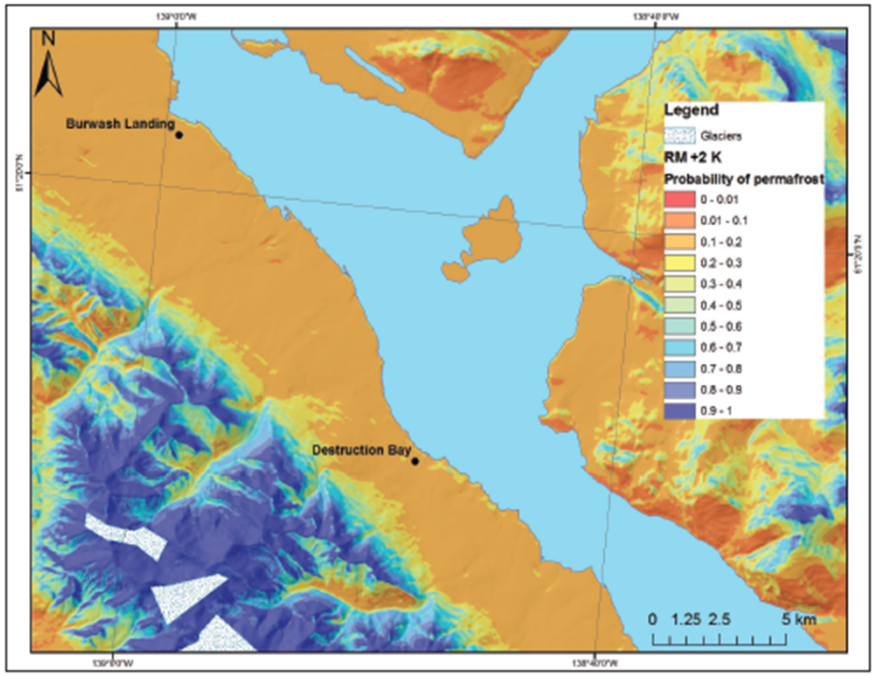


Figure 57. Permafrost probability for the area around Burwash Landing and Destruction Bay depicting an increase in MAAT of +2 K. Note that glacier extent is highly generalized.

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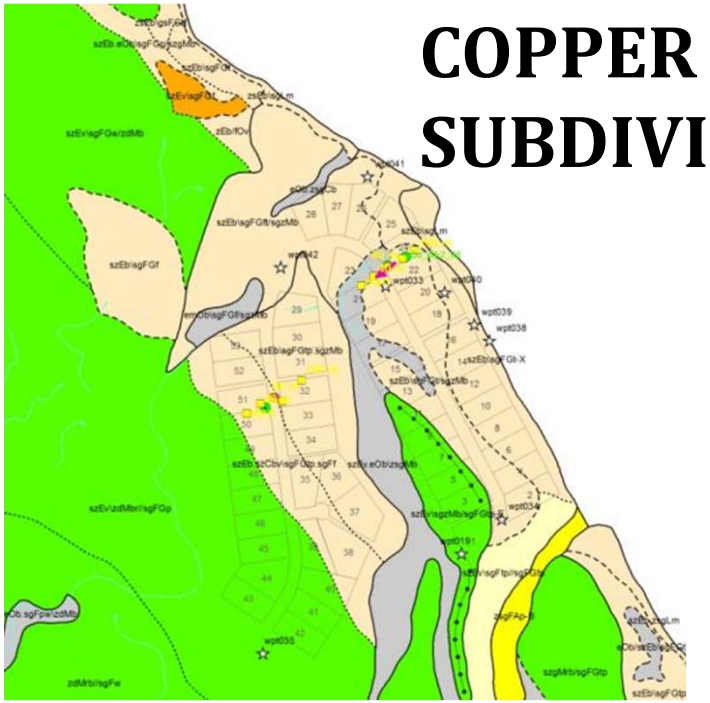
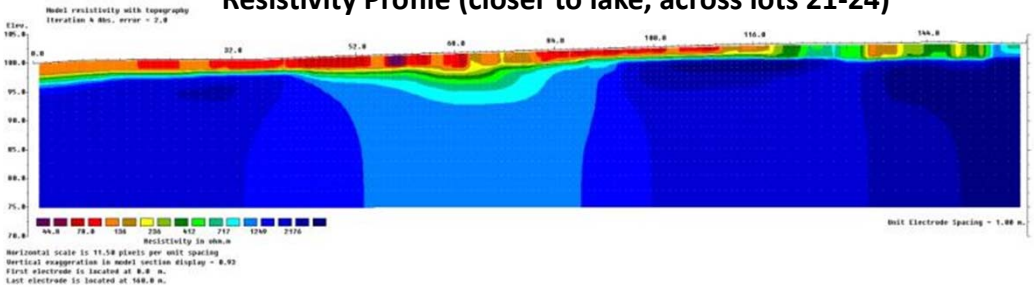
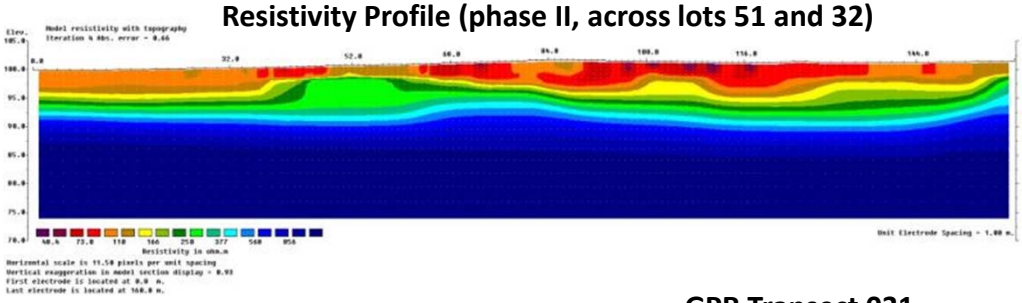
COPPER JOE SUBDIVISION



Resistivity Profile (closer to lake, across lots 21-24)



Resistivity Profile (phase II, across lots 51 and 32)

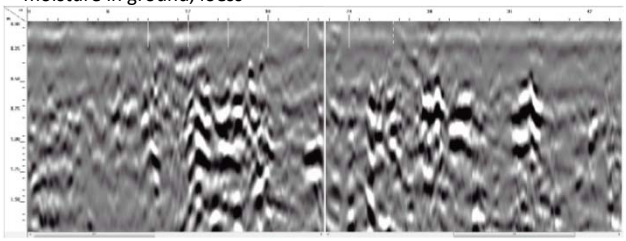


Copper Joe 1

1 m beside quad path, deforested stripe, thin organic layer, shrubs and spruce

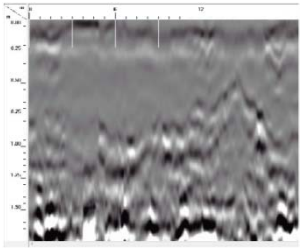
GPR Transect 030

red line for power pole, had to go over willow and shrubs, moisture in ground, loess



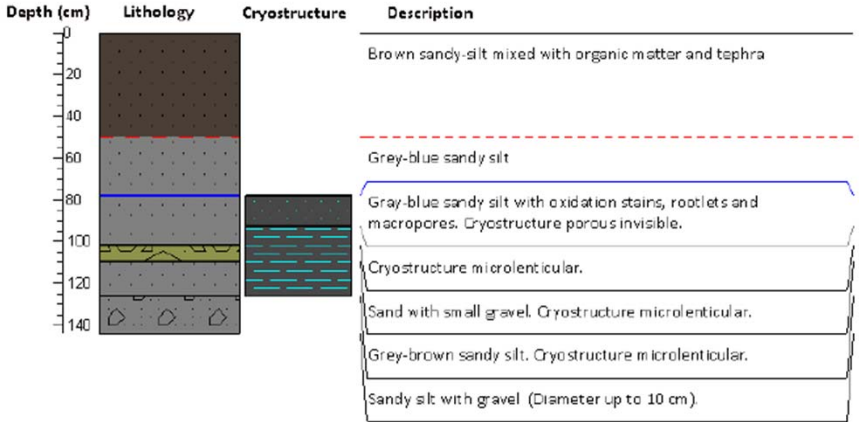
GPR Transect 031

power line near lot 50, too many shrubs to pull GPR any further



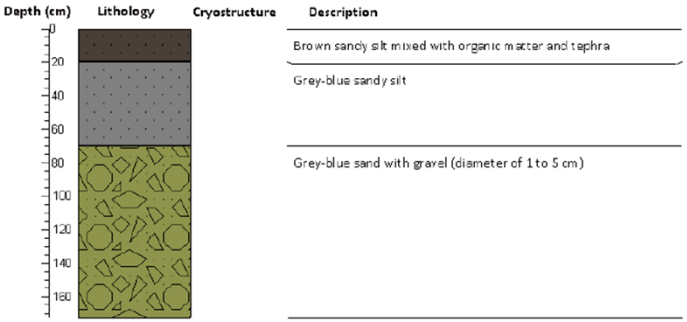
Copper Joe 2

Forest, 30 m from BH1, 5 cm moss cover, spruce and shrubs

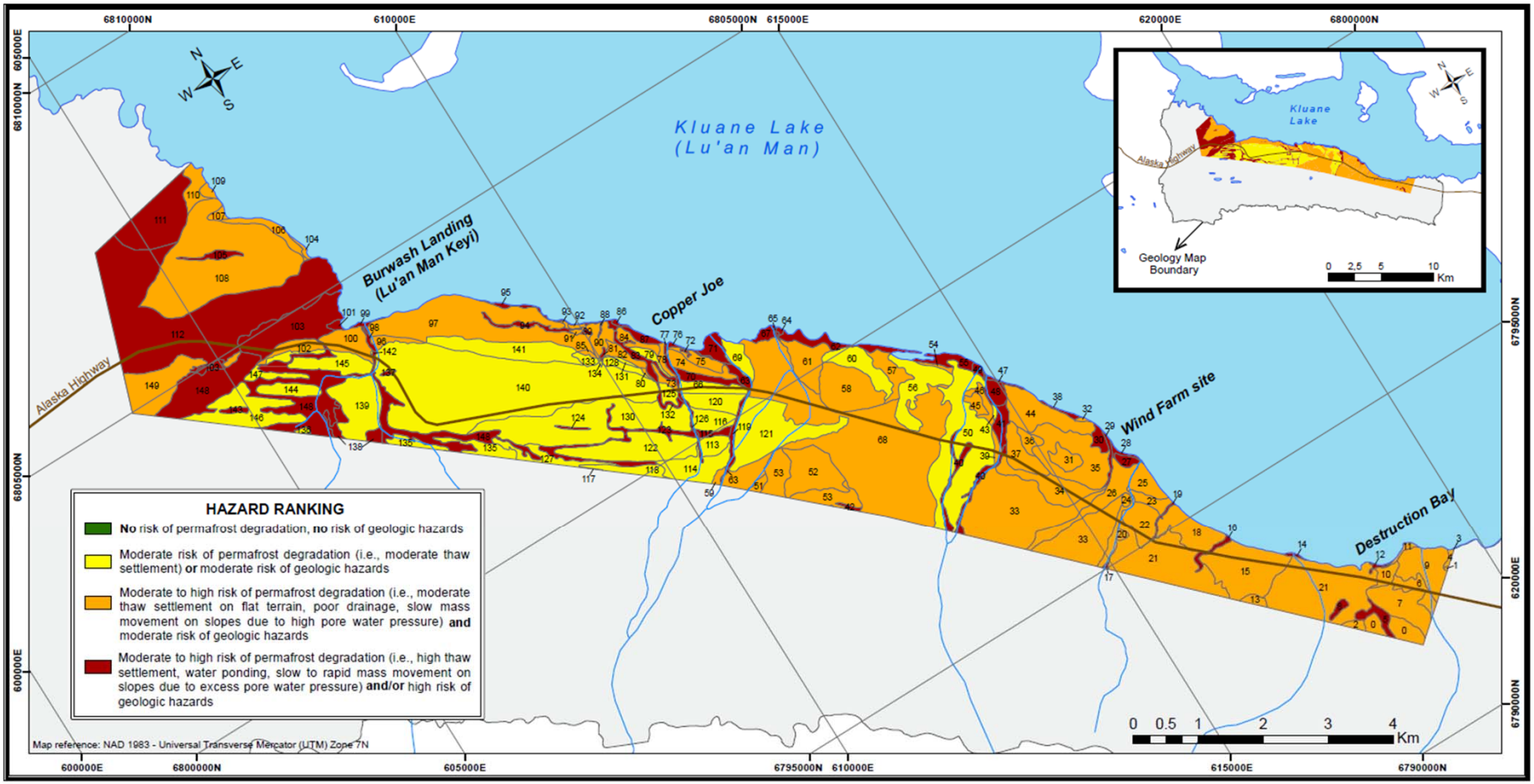


Copper Joe 3

Forest fire zone, clear w/ some burned wood, shrubs, <1 cm organic cover



Burwash Landing and Destruction Bay landscape hazards map



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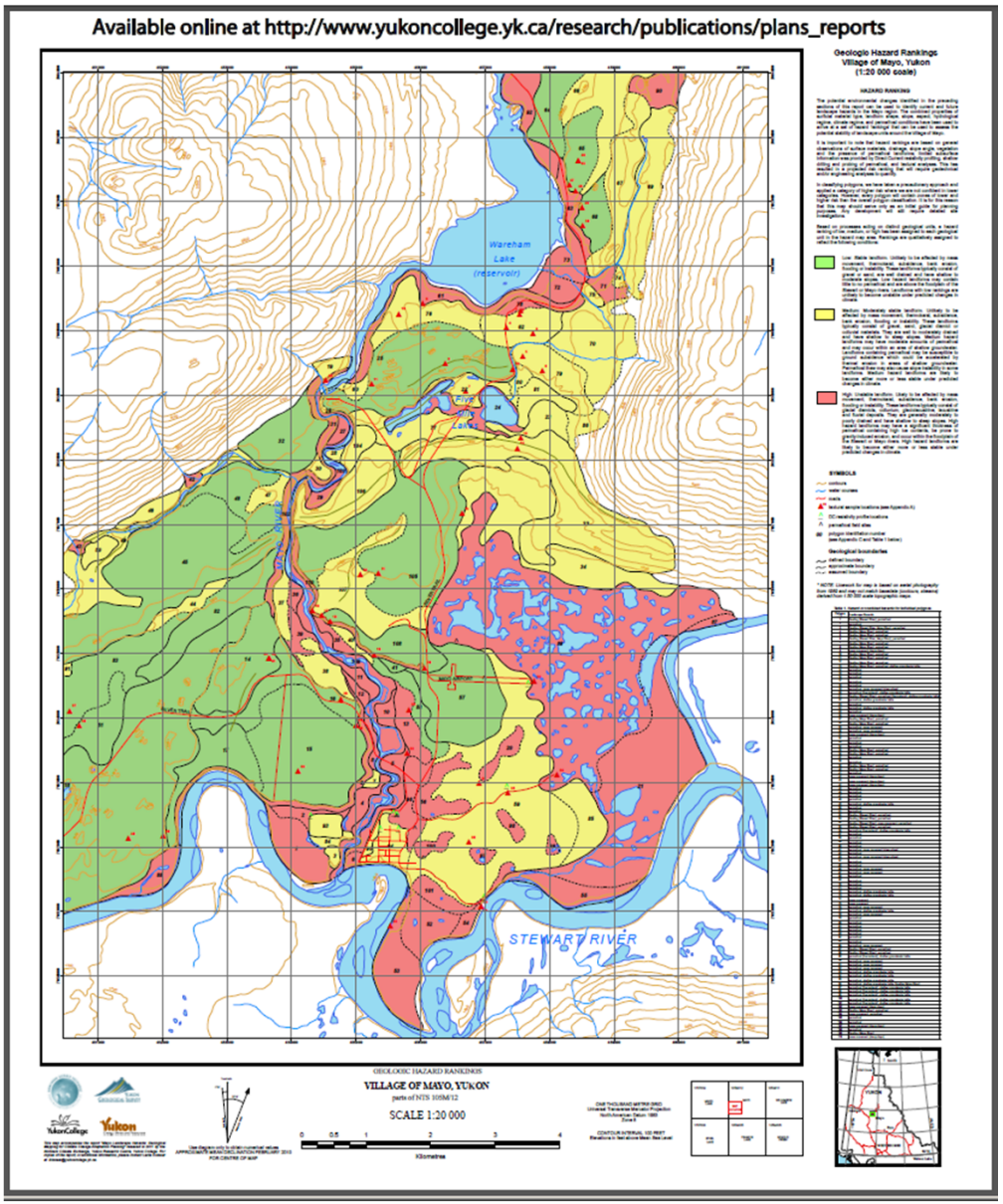
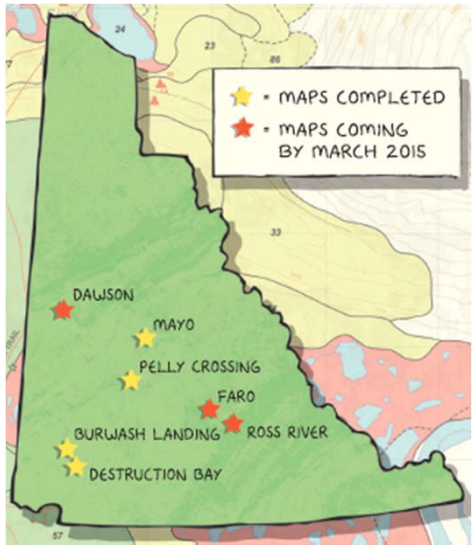
Mayo landscape hazards map



- Classification reflects local conditions
- Tailored to each community



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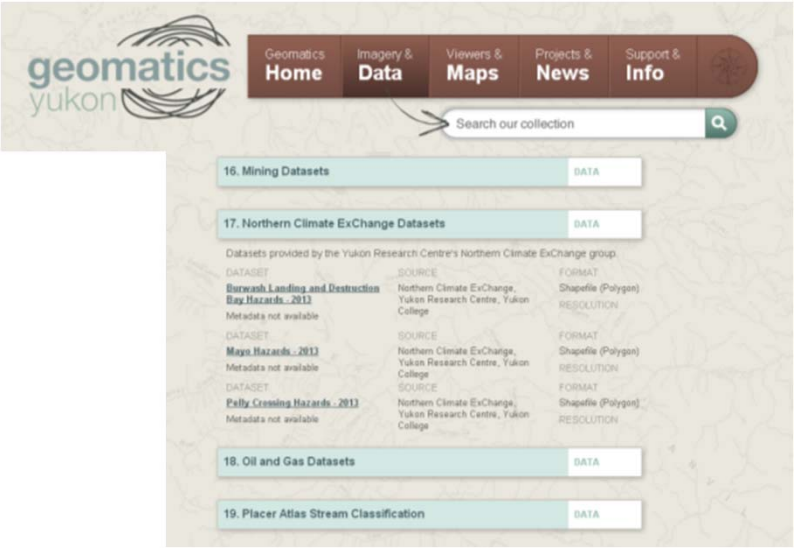
Bringing results to communities



- Bingo!
- Invitational meetings
- Maps in public places
- Formal ‘thank you’
- Posting on community Facebook pages, websites
- GIS layers on Geomatics Yukon
- End-user workshop
- CBC & local radio coverage
- Lay report/hazards 101
- Hazards comic

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HAZARDS
MAPPING THE RISKS OF CLIMATE CHANGE
LIFE IN THE NORTH IS CHANGING...
YUKON, CANADA
THAWING PERMAFROST IS AFFECTING ROADS...
AND BUILDINGS
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OUR TEAM GATHERS DATA TO CREATE A MAP OF LANDSCAPE HAZARDS...
DETECTING PERMAFROST USING GROUND PENETRATING RADAR...
... AND ELECTRICAL RESISTIVITY
DRILLING PERMAFROST CORE SAMPLES
DOING SURFICIAL GEOLOGY FIELDWORK
PROBING PERMAFROST
THIS RESEARCH HELPS US TO UNDERSTAND PERMAFROST.


COMMUNITIES USE THESE MAPS TO PLAN FOR A CHANGING CLIMATE
THE COLOURS SHOW HAZARDS RISK. GREEN IS GOOD TO GO, YELLOW IS CAUTION AND RED IS STOP TO EVALUATE.
THANKS TO OUR MAPS, THE KLUANE FIRST NATION WIND ENERGY PROJECT HAS BEEN ADAPTED FOR CONSTRUCTION ON PERMAFROST.
OUR QUICK RESULTS YIELD INSTANT BENEFITS TO THE COMMUNITIES!
HAZARDS RESEARCH MATTERS TO:
FIRST NATIONS
CONSULTANTS
ENGINEERS
PLANNERS
DECISION-MAKERS
RESIDENTS


CLIMATE CHANGE RESEARCH
TEAMING UP FOR CHANGE
= MAPS COMPLETED
= MAPS COMING BY MARCH 2015
DAWSON
MAYO
PELLY CROSSING
FARO
BURIAN LANDING
ROSS RIVER
DESTRUCTION BAY
BRONWYN BENKERT, RESEARCH COORDINATOR NORTHERN CLIMATE EXCHANGE
ANTONI LEWKOWICZ, PERMAFROST SCIENTIST UNIVERSITY OF OTTAWA
DANIEL FORTIER, PERMAFROST SCIENTIST UNIVERSITY OF MONTREAL
COLIN WRIGHT, ENVIRONMENT OFFICER KLUANE FIRST NATION
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YUKON GEOLOGICAL SURVEY
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