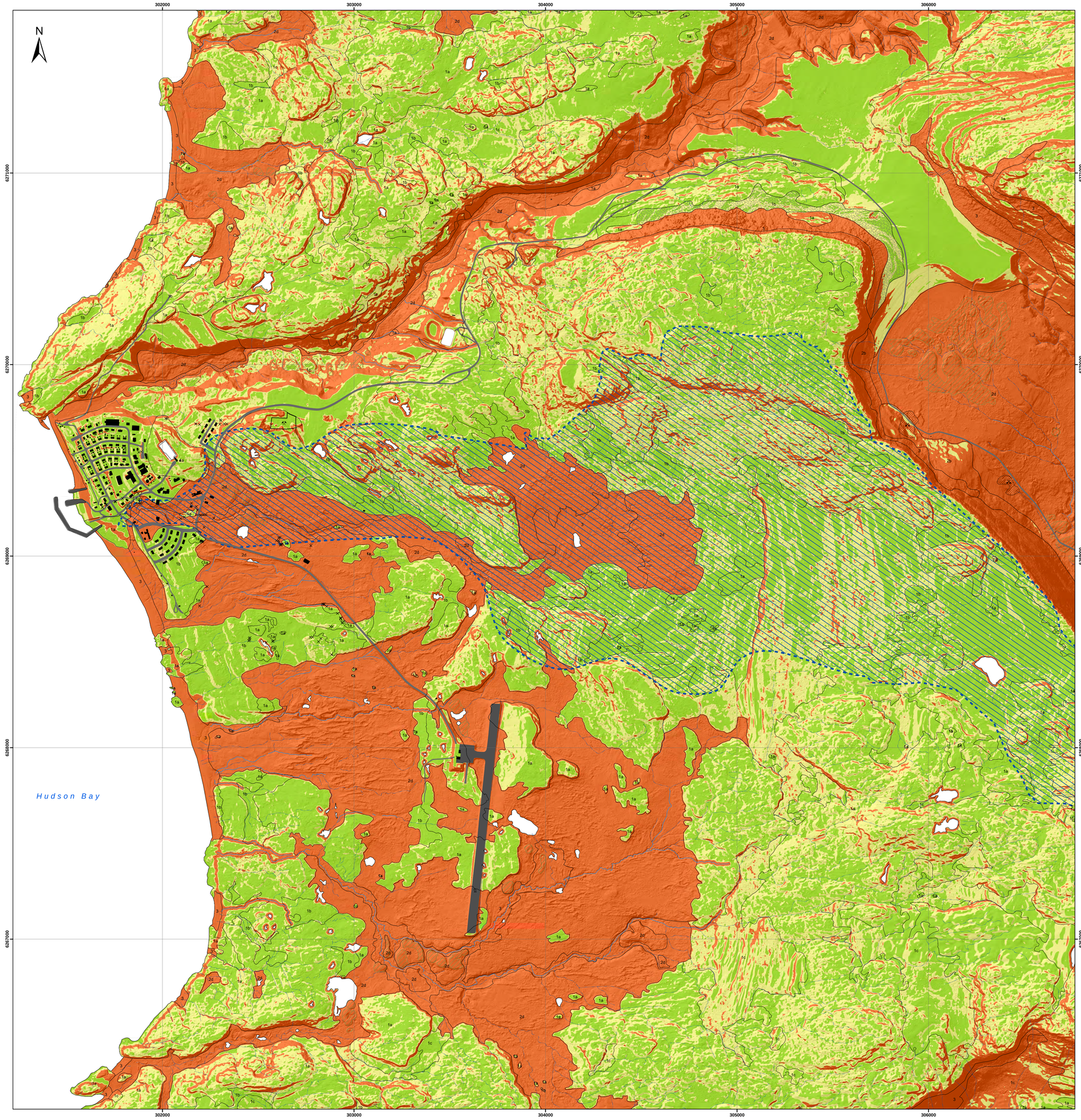

Résumé

Cette carte présente le potentiel de construction et les types de fondations selon les conditions de pergélisol et les pentes de la région d'Umiujaq. Ce village se situe au Nunavik, à 15 km à l'ouest du lac Tasisijaq, sur la côte est de la baie d'Hudson (56°33' N ; 76°31' O).

Abstract

This map shows the construction potential and foundation design options based on permafrost conditions and slopes of the Umiujaq region. This Nunavik village is located 15 km to the west of the Tasisijaq Lake, on the eastern coast of the Hudson Bay (56°33' N ; 76°.31' W).

Note

Cette carte a été compilée principalement par photo-interprétation et validée avec un nombre limité d'observations de terrain, de sondages et de forages dans le pergélisol. Toute information pouvant en améliorer la précision et éventuellement conduire à la production d'une mise à jour sera appréciée.

Note

This map was compiled mainly by air photo interpretation and validated by a limited number of terrain observations, probing and drill holes in the permafrost. Any information leading to an improvement of precision and, eventually, an update of the map will be received with thanks.

The National Topographic System of Canada

Vector indexes of the National Topographic System of Canada. Government of Canada, Natural Resources Canada, Earth Sciences Sector, Mapping Information Branch, Centre for Topographic Information (2008).

Cover illustration:
Umiujaq, Nunavik, Québec.
Photocredits: Emmanuel L'Hérault.

Centre d'études nordiques, Québec, 2018

Construction potential and foundation design options based on permafrost conditions and slopes

UMIUJAQ

Québec, Nunavik

1 : 8 000

THAW-STABLE GROUND: BEDROCK AND SUPERFICIAL DEPOSITS WITH NO OR LITTLE ICE CONTENT

1a

- Bedrock consisting of volcano-sedimentary rocks in the Churchill Tectonic Province forming a cuesta landscape. These rocky hills slant toward Hudson Bay and their tops, overlooking Tasisijaq Lake, rise to an altitude of up to 320 m. The active layer reaches a thickness of approximately 4 m. Only the part of its structure made up of joints and fractures is likely to contain a small amount of ice.

- Various types of Northern home foundations. The rugged topography often requires adaptation.

Terrain manageable for construction (slope < 7.5°).

Terrain manageable for construction but may require significant earthwork (slope between 7.5 and 15°).

Terrain unsuitable for construction (slope > 15°).

1b

- Thin cover of sand and gravel over bedrock. The thickness of the deposit is generally less than 2 m and the topography is controlled by bedrock. Presence of scattered rock outcrops. The active layer thickness is generally ranging from 1.5 to 2.5 m. Contains pore ice whose volume is generally less than 10%.

- Deep northern foundations on the underlying bedrock applicable (ex.: pile foundations). Adjustable post and pad foundations also feasible. Buildings with slab-on-grade foundations need elaborated techniques of terrain preparation (ex.: removal or pre-thaw of frozen sediments and consolidation).

Terrain manageable for construction (slope < 7.5°).

Terrain manageable for construction but may require significant earthwork (slope between 7.5 and 15°).

Terrain unsuitable for construction (slope > 15°).

1c

- Stratified thick sand and gravel deposit. The thickness of the deposit generally exceeds 2 m. Nearshore sand and gravel (Mn) form raised beaches or marine terraces. The thickness of the active layer ranges between 1.5 and 2.5 m. It contains interstitial ice and possibly ice lenses in the layers of fine-grained material.

- Slab-on-grade with adjustable jacks and pile foundation systems in Northern homes. Homes with slab-on-grade foundations may require the use of elaborate techniques to protect them against the melting of the permafrost (e.g. thermosyphons).

Terrain manageable for construction (slope < 5°).

Terrain manageable for construction but may require significant earthwork (slope between 5 and 10°).

Terrain unsuitable for construction (slope > 10°).

THAW-UNSTABLE GROUND: ICE-RICH PERMAFROST IN SUPERFICIAL DEPOSITS

2a

- Thin cover of heterogeneous deposit (till) over bedrock. Composed mainly of sand and silt with some gravel and boulders. The thickness of the deposit is generally less than 2 m and the topography is controlled by bedrock. Presence of scattered rock outcrops. The active layer thickness is generally ranging from 2.5 to 3 m. Contains pore ice and ice lenses in fine-grained material layers. The volumetric ice content is generally less than 30%. Occurrence of mudboils and gelifluction lobes on slopes. Creep and differential settlements may occur upon thawing, but are limited due to the shallow thickness of the deposit.

- Deep northern foundations on the underlying bedrock applicable (ex.: pile foundations). Adjustable post and pad foundations also feasible. Buildings with slab-on-grade foundations need elaborated techniques of terrain preparation (ex.: removal or pre-thaw of frozen sediments and consolidation).

Terrain manageable for construction (slope < 4°).

Terrain manageable for construction but may require significant earthwork (slope between 4 and 8°).

Terrain unsuitable for construction (slope > 8°).

2b

- Thick cover of heterogeneous deposit (till) over bedrock. Composed mainly of sand and silt with some gravel and boulders. The thickness of the deposit is generally more than 2 m with occasional bedrock outcrop and can reach more than 25 m thick in places. The active layer thickness is generally ranging from 2.5 to 3 m. Contains pore ice and ice lenses in fine-grained material layers. The volumetric ice content is generally less than 30%. Occurrence of mudboils and gelifluction lobes on slopes. Creep and differential settlements may occur upon thawing.

- Pile foundations feasible but require deeper drill-holes for pile driving. Adjustable post and pad foundations also feasible. Buildings with slab-on-grade foundations need elaborated techniques to retain permafrost in its frozen state (ex.: thermosyphons). Excavation shall be avoided.

Terrain manageable for construction, but caution is needed (slope < 8°).

Terrain unsuitable for construction (slope > 8°).

2c

- Thin cover of fine-grained (fine sand, silt and clay) deposit of marine or lacustrine origin over bedrock or thick layered sand and gravel deposit. The thickness of the deposit is generally less than 2 m and the topography is controlled by bedrock. Presence of scattered rock outcrops. The active layer thickness is ranging from 0.5 to 1.5 m. Contains ice lenses. The volumetric ice content regularly exceeds 30% and may reach almost 100%. Possibility of mudboils occurrence. Differential settlements may occur upon thawing, but are limited due to the shallow thickness of the deposit. Subject to failure on slopes.

- Deep northern foundations on the underlying bedrock applicable (ex.: pile foundations). Adjustable post and pad foundations also feasible. Buildings with slab-on-grade foundations need elaborated techniques of terrain preparation (ex.: removal or pre-thaw of frozen sediments and consolidation).

Terrain manageable for construction, but caution is needed (slope < 2°).

Terrain unsuitable for construction (slope > 2°).

2d

- Fine-grained deposit of marine origin (sand, silt and clay) sometimes covered with a thin layer of organic, alluvial or coastal sediments. Poorly drained. The active layer thickness is ranging from 0.5 to 1.5 m. Contains ice lenses. The volumetric ice content regularly exceeds 30% and may reach almost 100%. Possibility of ice wedges occurrence. Material subject to significant differential settlements and failure on slopes upon thawing.

- Adjustable post and pad foundations. Buildings with slab-on-grade foundations need elaborated techniques to retain permafrost in its frozen state (ex.: thermosyphons). Excavation shall be avoided.

Terrain unsuitable for construction.

SEVERE LIMITATIONS: DYNAMIC ACTIVE PERIGLACIAL AND SLOPE PROCESSES, LITTORAL ZONE OR FLOODPLAINS

3

- Contemporary deposit affected by current and dynamic geomorphological processes. Subjects to erosion, flooding and slope movements.

- Problematic terrains to be avoided.

Terrain unsuitable for construction.

ICE-CORED PERMAFROST MOUNDS (LITHALSA)

BLOCK CORDON: High concentrations of pebbles and blocks deposited by ice floes on the coast of the postglacial Tyrrell Sea; thickness between 0.5 and 3 m; resting on rock or marine sediments of sandy texture.

SAND OR GRAVEL PIT (active or inactive)

QUARRY (active or inactive)

WATERSHED: watershed for the village's potable water

BUILDING

TRANSPORT INFRASTRUCTURE

GEOLOGICAL UNIT BOUNDARY

WATERCOURSE - creek or stream running throughout all arctic summer

WATERCOURSE - creek or stream running occasionally during spring melt

× ISOLATED ROCK OUTCROP

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Hillshade created by L'Hérault, E. from LIDAR data (MRNF 2010, gouvernement du Québec). Illumination: azimuth 315°, altitude 45°, vertical exaggeration 1x

Projection: MTM zone 9, NAD83

Construction potential and foundation design options based on permafrost conditions and slopes

UMIUJAQ

Québec, Nunavik

1 : 8 000

0 125 250 500 750 1 000 1 250 1 500 Meters

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