

DESCRIPTION OF INTERPRETIVE PERMAFROST MAP UNITS

INTRODUCTION

Permafrost, or perennially frozen ground, is rock or soil that remains continuously colder than 0°C for 2 years or longer (Muller, 1947; Ferrians and others, 1969; Péwé, 1966, 1982). On the basis of the interpretation of ~1:65,000-scale false-color infrared aerial photographs, this map illustrates the inferred extent and estimated ice content of permafrost between the ground surface and a depth of 6 m in the proposed corridor straddling the Alaska Highway between Delta Junction and the Canada border from July 1978 to July 1983, the dates of the aerial photographs. The presence or former presence of permafrost and the ground-ice content are inferred from several indicators, including vegetation, slope and aspect, landform, soil type, local drainage, and terrain features, such as open-system pingos, polygonal ground, and thermokarst pits, gullies, and ponds (Kreig and Reger, 1982). After initial permafrost maps were completed, airborne-resistivity data, collected in 2005 and 2006, became available in a series of sennepel resistivity sections with a maximum depth of 100 m (Burns and others, 2006). We were able to compare our initial interpretations with those data, producing considerable map changes, especially in the extensive riverine lowlands where subsurface circulation of ground water is pervasive and evidence indicates that permafrost is thinning and becoming less continuous.

Because of the paucity of confirming subsurface data in the proposed corridor, we consider our interpretation to be tentative until validated by multi-year ground-temperature measurements that verify the presence of frozen ground. Permafrost classifications in areas that were burned just prior to August 1980 are less reliable than in unburned areas because the surface vegetation was destroyed or significantly altered and, in those areas interpretation of permafrost is based primarily on landform and setting, which are less diagnostic than vegetation. The user is cautioned that this map has not been verified by field observations, except very locally, although we have considerable field experience in the Tanana River valley and during our interpretation referred to available published and unpublished maps. Physical properties of map units are extrapolated from similar deposits in the region and from previously published reports and data. Detailed subsurface investigations should be

PERMAFROST MAP UNITS

Symbols indicate the inferred continuity of permafrost in uppercase letters and the estimated ice content in lowercase letters. For example, "Dm" indicates that discontinuous permafrost with low to moderate ice content is inferred between the ground surface and a depth of ~6 m. Classes of permafrost continuity are consistent with classes used in previous mapping in Alaska (Ferrians, 1965; Kreig and Reger, 1982; Brown and others, 1997; Jorgenson and others, 2008).

- F CONTINUOUSLY FROZEN—More than 90 percent of the area is inferred to be underlain by permafrost; can include local areas of polygonal ground. Ground temperature at level of no seasonal variation is -5°C to -11°C.
- D DISCONTINUOUSLY FROZEN—Between 50 and 90 percent of the area is inferred to be underlain by permafrost; can include local areas of polygonal ground and scattered thaw lakes. Ground temperature at level of no seasonal variation is -1°C to -5°C.
- S SPORADICALLY FROZEN—Between 10 and 50 percent of the area is inferred to be underlain by permafrost; can include local areas of polygonal ground and concentrations of thaw lakes. Ground temperature at level of no seasonal variation is 0°C to +1°C.
- G GENERALLY UNFROZEN (ISOLATED MASSES)—Between 0 and 10 percent of the area is inferred to be underlain by permafrost; ground temperature at depth of no seasonal variation is 0°C to +1°C.
- U NO KNOWN PERMAFROST—Seasonally frozen but the ground is inferred to be warmed to a temperature above 0°C at least once during any 2-year period
- r MODERATE TO HIGH ICE CONTENT—Estimated to typically contain 50 to >1,000 percent gravimetric soil moisture relative to dry weight
- m LOW TO MODERATE ICE CONTENT—Estimated to typically contain 25 to 50 percent gravimetric soil moisture relative to dry weight
- l LOW ICE CONTENT—Estimated to typically contain 5 to 25 percent gravimetric soil moisture relative to dry weight

EXPLANATION OF MAP UNITS

- Fr CONTINUOUSLY FROZEN, MODERATE TO HIGH ICE CONTENT
- Fm CONTINUOUSLY FROZEN, LOW TO MODERATE ICE CONTENT
- Dr DISCONTINUOUSLY FROZEN, MODERATE TO HIGH ICE CONTENT
- Dm DISCONTINUOUSLY FROZEN, LOW TO MODERATE ICE CONTENT
- Di DISCONTINUOUSLY FROZEN, LOW ICE CONTENT
- Sr SPORADICALLY FROZEN, MODERATE TO HIGH ICE CONTENT
- Sm SPORADICALLY FROZEN, LOW TO MODERATE ICE CONTENT
- Sl SPORADICALLY FROZEN, LOW ICE CONTENT
- G GENERALLY UNFROZEN (ISOLATED PERMAFROST MASSES)
- U NO KNOWN PERMAFROST
- Water, ASSUMED UNDERLAIN BY TALIKS

MAP SYMBOLS

NOTE: Map symbols below might not all appear on this sheet

- PHOTOINTERPRETED BOUNDARY—All boundaries are inferred or approximately located
- ▲ SOIL MOISTURE LOCALITIES (Table 5, this report)
- TEMPERATURE LOCALITY—A temperature of -2.1° C was recorded at the level of zero amplitude (7.6 m deep) on 3/15/2009
- * INTACT OR BREACHED OPEN-SYSTEM PINGO
- ★ LITHALSA
- ◇ FOSSIL LOCALITY
- ◆ PERMAFROST EXPERIMENTAL SITE
- × MAP LOCALITY DISCUSSED IN TEXT

REFERENCES

Brown, J., Ferrians, O.J., Jr., Heginbottom, J.A., and Melnikov, E.S., 1997. Circum-arctic map of permafrost and ground-ice conditions: U.S. Geological Survey Circum-Pacific Map CP-45, 1 sheet, scale 1:10,000,000.

Burns, L.E., Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2006. Line, grid, and vector data and plot files for the airborne geophysical survey of the Alaska Highway corridor, east-central Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2006-6, 1 DVD.<http://doi.org/10.14509/14864>

Ferrians, O.J., Jr., 1965. Permafrost map of Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-445, 1 sheet, scale 1:2,500,000.

Ferrians, O.J., Jr., Kachadorian, Reuben, and Green, G.W., 1969. Permafrost and related engineering problems in Alaska: U.S. Geological Survey Professional Paper 678, 37 p.

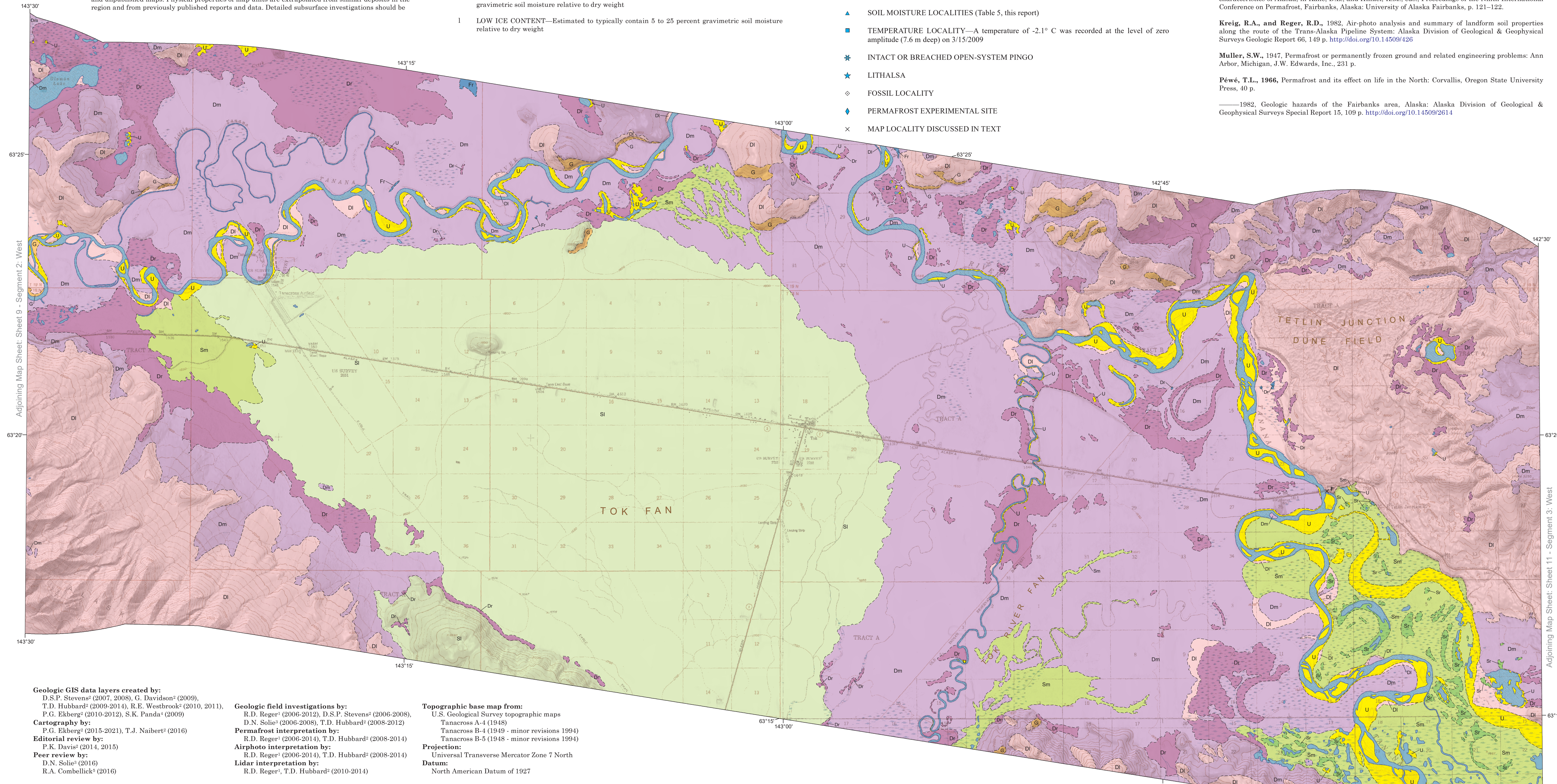
Jorgenson, Torre, Yoshikawa, Kenji, Kanevskiy, Mikhail, Shur, Yuri, Romanovsky, Vladimir, Marchenko, Sergei, Grosse, Guido, Brown, Jerry, and Jones, Ben, 2008. Permafrost characteristics of Alaska, in Kane, D.L., and Hinkel, K.M., eds., Proceedings of the Ninth International Conference on Permafrost, Fairbanks, Alaska: University of Alaska Fairbanks, p. 121–122.

Kreig, R.A., and Reger, R.D., 1982. Air-photo analysis and summary of landform soil properties along the route of the Trans-Alaska Pipeline System: Alaska Division of Geological & Geophysical Surveys Geologic Report 66, 149 p. <http://doi.org/10.14509/426>

Muller, S.W., 1947. Permafrost or permanently frozen ground and related engineering problems: Ann Arbor, Michigan, J.W. Edwards, Inc., 231 p.

Péwé, T.L., 1966. Permafrost and its effect on life in the North: Corvallis, Oregon State University Press, 40 p.

—1982. Geologic hazards of the Fairbanks area, Alaska: Alaska Division of Geological & Geophysical Surveys Special Report 15, 109 p. <http://doi.org/10.14509/2614>



Geologic GIS data layers created by:
D.S.P. Stevens² (2007, 2008), G. Davidson² (2009),
T.D. Hubbard² (2009-2014), R.E. Westbrooke² (2010, 2011),
P.G. Ekberg² (2010-2012), S.K. Panda² (2009)

Cartography by:
P.G. Ekberg² (2015-2021), T.J. Naibert² (2016)

Editorial review by:
P.K. Davis² (2014, 2015)

Peer review by:
D.N. Solie² (2016)
R.A. Combellic² (2016)

Geologic field investigations by:
R.D. Reger¹ (2006-2012), D.S.P. Stevens² (2006-2008),
D.N. Solie² (2006-2008), T.D. Hubbard² (2008-2012)

Permafrost interpretation by:
R.D. Reger¹ (2006-2014), T.D. Hubbard² (2008-2014)

Airphoto interpretation by:
R.D. Reger¹ (2006-2014), T.D. Hubbard² (2008-2014)

Lidar interpretation by:
R.D. Reger¹, T.D. Hubbard² (2010-2014)

Topographic base map from:
U.S. Geological Survey topographic maps
Tanacross A-4 (1948)
Tanacross B-4 (1948 - minor revisions 1994)
Tanacross B-5 (1948 - minor revisions 1994)

Projection:
Universal Transverse Mercator Zone 7 North

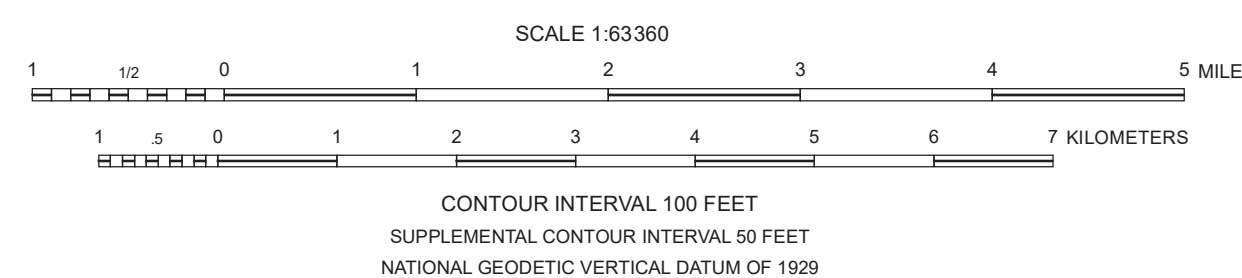
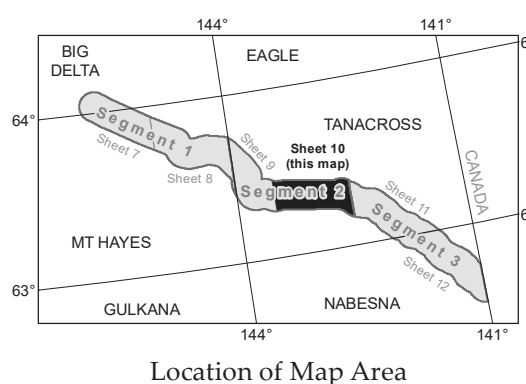
Datum:
North American Datum of 1927

List of Map Sheets

- Surficial Geologic Maps**
Sheet 1 - Segment 1: West
Sheet 2 - Segment 1: East
Sheet 3 - Segment 2: West
Sheet 4 - Segment 2: East
Sheet 5 - Segment 3: West
Sheet 6 - Segment 3: East
- Permafrost Maps**
Sheet 7 - Segment 1: West
Sheet 8 - Segment 1: East
Sheet 9 - Segment 2: West
Sheet 10 - Segment 2: East (this map)
Sheet 11 - Segment 3: West
Sheet 12 - Segment 3: East
- Engineering Geologic Maps**
Sheet 13 - Segment 1: West
Sheet 14 - Segment 1: East
Sheet 15 - Segment 2: West
Sheet 16 - Segment 2: East
Sheet 17 - Segment 3: West
Sheet 18 - Segment 3: East

INTERPRETIVE PERMAFROST MAP, ALASKA HIGHWAY CORRIDOR, DELTA JUNCTION, ALASKA, TO THE CANADA BORDER: SEGMENT 2 EAST

by
R.D. Reger¹ and T.D. Hubbard²
2021



Affiliations:

- ¹ Reger's Geologic Consulting, P.O. Box 3326, Soldotna, Alaska 99669
- ² Alaska Division of Geological & Geophysical Surveys, 3354 College Road, Fairbanks, Alaska 99709-3707
- ³ Baseline Geoconsulting, LLC, P.O. Box 82293, Fairbanks, Alaska 99708-2293
- ⁴ University of Alaska Fairbanks, Geophysical Institute, 903 Koyukuk Drive, Fairbanks, Alaska, 99775
- ⁵ Alaska Division of Geological & Geophysical Surveys, 3354 College Road, Fairbanks, Alaska 99709-3707; Retired

The State of Alaska makes no expressed or implied warranties (including warranties for merchantability and fitness) with respect to the character, functions, or capabilities of the electronic data or products or their appropriateness for any user's purposes. In no event will the State of Alaska be liable for any incidental, indirect, special, consequential, or other damages suffered by the user or any other person or entity whether from the use of the electronic services or products or any failure thereof or otherwise. In no event will the State of Alaska's liability to the Requestor or anyone else exceed the fee paid for the electronic service or product.

Publications produced by the Division of Geological & Geophysical Surveys (DGGS) are available for download from the DGGS website (dgggs.alaska.gov). Publications on paper or digital media can be examined or purchased in the Fairbanks office.

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
3354 College Road • Fairbanks, Alaska 99709-3707
Phone 907-451-5010 • Fax 907-451-5050
email: dgggs@alaska.gov • website: dgggs.alaska.gov

