

PLATE 16. COMPOSITION AND TRANSIENT CONDITIONS OF SURFICIAL GEOLOGIC UNITS (CONTINUATION OF PLATE 15).

ENGINEERING GEOLOGIC UNIT	STRATIGRAPHY	GRAIN SIZE DISTRIBUTION	ICE CONTENT AND TYPE	MOISTURE CONTENT OF ACTIVE LAYER	ORGANIC CONTENT	VEGETATION AND SOIL CHARACTERISTICS	DRAINAGE/SURFACE WATER	DEPTH OF ACTIVE LAYER	BOUNDARY CONDITIONS	SLOPE AND SLOPE STABILITY	BEARING STRENGTH, THAWED
Silts and gravels associated with partially drained lakes-lp	Stratified sand and gravel, interbedded with lenses of sand and silt, much in excess of 100 m thickness; overlain by continuous silt and fine sand of variable thickness, from less than 2 m to greater than 5 m.	Same as unit ml.	Unpredictable, although ice wedge polygons should be expected, even beneath extensive surface water areas; permafrost table shallow; pore ice and segregated ice lenses present in active layer during winter and spring. * pingo occasional.	Same as unit ml.	Organic tundra mat often continuous across unit; sandy silt unit organic-rich, particularly in regressive stage of lake development (see text).	Same as unit ml.	Much of surface continuously submerged or marshy; positive areas such as raised polygon rims may be emergent; water currents very localized due to shallow water and topography; total freeze-down of surface water from fall to spring; drainage very poor.	Generally 1.5 to 3.0 m; perennially thawed zones may locally exist between active layer and permafrost table.	Boundary area often defined by active or inactive raised-rim ice wedge polygons (<10-m diameter), by gradational embankment slopes, or by low broken-tundra scarps; boundary conditions dependent upon stage in lake cycle (see text).	Same as unit ml.	Extremely poor due to marshy to shallow-submerged conditions; unit should be avoided, or if necessary both drained and insulated with thick (>2 m) gravel pad.
Silts and gravels associated with drained lake basins-lb	Same as unit lp.	Same as unit ml.	Variable, dependent on time interval since being drained, and character of previous lake (size, depth, etc.). Commonly contains ice wedge polygons from incipient to massive; pore ice and ice lenses common in active layer, lenses as much as 25 cm thick. * pingo present, often adjacent to existing lakes.	Sandy silt near saturation to super-saturated dependent on segregated ice, moisture content up to 40%, to >200% where ice lenses occur; 5-30% in underlying sandy gravels.	Organic tundra mat absent in some recently drained areas; broken to continuous elsewhere; sandy silts commonly organic rich.	Variable, chiefly wet edge meadow and tussock-dwarf heath tundra, may be absent in recently drained areas. Tundra soil less than 10 cm thick.	Moderate to poorly drained, poorer where low center polygons have developed; usually some surface water present during spring and early summer; marshy conditions typical but sporadic.	Less than 2 m; frost heaving considerable. Perennial thaw zones between active layer and permafrost table due to earlier thaw cycle.	Generally gradational to upper tundra unit, or to submerged lake areas. Remnant scarps may occur along former lake strandlines and along outlet channels.	Generally nearly horizontal, except along boundary areas where scarps and slopes up to 5° may occur. Surface may be disrupted by raised-rim polygons; slopes stable except for seasonal frost action; excavated slopes susceptible to permafrost thaw, resultant flow and subsidence.	Moderate to poor, dependent on local drainage; vegetation a good indicator; tussock-dwarf heath tundra being most favorable; best conditions July-August.
Silts and gravels associated with abandoned lacustrine strandlines-ls	Same as unit lp.	Same as unit ml.	Same as unit ml, but with polygons oriented along old strandlines.	Same as unit ml.	Same as unit ml.	Tussock-dwarf heath tundra, variable in assemblage along slopes of strandlines. Tundra soil less than 10 cm thick.	Moderate, slightly poor where low center polygons have developed, but generally better than unit ml.	Less than 2 m; frost heaving considerable. Perennial thaw zones may occur between active layer and permafrost table, beneath most recently abandoned strandlines and adjacent to present lakes.	This unit is transition zone between present lacustrine units and drained tundra units; shallow thaw zone may occur adjacent to present lakes.	Subtle transitions from horizontal to up to 5°; generally no scarps. Moderate to good stability when undisturbed; poor in excavated slopes due to thaw of massive ice lenses and wedges.	Moderate to poor; better where drained; relatively good for dynamic loading from midsummer to late summer.
Silt, sand, gravel associated with marine shorelines-sm	Weakly stratified to moderately well stratified sand and gravel along coastal beaches; locally at spits and bars, poorly stratified silty sand interbedded with lenses of sandy gravel.	Dominantly sand and gravel, some cobble size gravel, but generally less than 20 mm in diameter. Bars and spits dominantly sand (0.15 to 0.5 mm) with lesser amounts of silt and minor gravel; some offshore bars comprised chiefly of gravel with some sand.	Seasonally thawed to considerable depth, winter pore ice only.	Saturated to the surface or a few cm below surface; usually less than 15% moisture content, except sand bars up to 30%.	Generally organic free, except for occasional fragments mixed with sediment and for dislodged pieces of organic tundra mat from adjacent units.	Vegetation sparse to absent; aquatic waterways community with <i>Saxifraga</i> dominant. No soil.	Generally well-drained of surface water; saline groundwater table near the surface.	Not known.	Gradational to submarine surface; beaches bounded landward by scarps 1.0-3.0 m high which are being cut by thermal, marine hydraulic, and sea-ice-shore erosion.	Beaches horizontal to 1.5 m/m; bars and spits have steeper side slopes (up to 15°) down to marine surface. Beach surface stable but sediment being washed; bar and spit slope moderately stable; all surfaces unstable in steep cuts (>20°); backscarp to beaches unstable and undergoing slow mass movement as permafrost thaws. Entire unit subject to winter-spring ice shove from sea ice.	Moderate to good, particularly if well drained.
Silt and sand of subaerial segments of active deflation-ad	Moderate to well stratified silt and very fine sand of undetermined thickness, with occasional lenses of coarser sand and fine gravel.	Greater than 95% very fine sand and silt <0.15 mm; particle size rarely larger than 1.0 mm (see pl. 17).	Seasonal pore ice only, no massive ice. Depth to permafrost unknown, but presumed to be several meters.	Saturated to or near surface, moisture content up to 40%.	Small amounts of organic material incorporated in silt.	Vegetation very sparse, aquatic waterways community, saline to brackish water tolerance favored. No soil.	Frequently inundated by river and/or tidal waters, particularly in spring.	Not known, although total thawed zone presumed to be several meters thick.	Adjacent to active river channels, causing perennial thaw zone in deltaic deposits; erosion and deposition active along stream boundaries; other boundaries range from gradational slopes to abrupt scarps up to 3 m relief.	Less than 0.75° (2 m/m); poor stability along active channel boundaries; minor thermal erosion and mass movement along scarps; frost heaving along gradational boundaries with associated creep; artificial cuts in silt unstable due to slow flowage and slump.	Moderate under low stress, diminishes to poor under increasing dynamic stress (e.g., heavy vehicles), or under long-term static loading (e.g., piling, fabricated structures).
Inactive deltaic sands and silts-id	Same as unit ad.	Same as unit ad.	Same as unit ad.	Saturated to within 1.5 m of surface, sometimes to shallower depths. Moisture content 10-40%.	Same as unit ad.	Sparse aquatic waterways community, more common than on unit ad; particularly occurs toward center of interfluvium; saline to brackish water tolerance favored. No soil.	Moderately well-drained, although potential of flooding during periods of high river discharge, ice damming, or unusual sea-level fluctuations.	Not known; perennially thawed subsurface zone may occur in proximity to unit ad, to river, and to ocean.	Same as unit ad.	Same as unit ad.	Slightly better than unit ad due to lower moisture content in upper 1.5 m.
Active aeolian silt and sand dunes-as	1.0 to 5.0 m of moderately well stratified, cross-bedded fine sand, overlying stratified sand and gravel containing lenses of silty sand.	Greater than 90% medium to fine sand, 0.07 to 0.3 mm, with minor amounts of silt and occasional pebbles; underlying sediment is sand and gravel similar to unit ut.	Seasonal pore ice only, permafrost table depth unknown, in excavated exposures voids only partially filled with ice but visible.	Not determined but below saturation.	Very minor amounts of fine organic debris incorporated in sand.	Dwarf shrub-heath tundra association, sparse distribution. No soil.	Moderate to well-drained, surface water unlikely; good permeability above permafrost table.	Not determined but believed to be >3 m; perennial thawed zone may occur above permafrost table where dunes have accumulated. Talk may also exist beneath dunes.	Fluctuating boundaries as dunes advance over, or are removed from older underlying units; fluctuations annual.	Highly variable, up to 27° measured on lee side of dunes. Natural slopes unstable during thaw or when subjected to dynamic stress. Artificial cut slopes >25° unstable except when frozen.	Fair to moderate when frozen, poor when thawed; slightly better under static loading than under dynamic loading.
Inactive aeolian silt and sand dunes-is	Same as unit as.	Same as unit as.	No evidence of massive ice within dunes, although probable that permafrost table may extend into dune interiors. Pore ice only, pore only partially filled in upper part of active layer.	Not determined. Water table presumed to be several meters below surface except where unit occurs in active delta or floodplain.	Same as unit as.	Dwarf shrub-heath tundra association, extensive but broken. No soil.	Same as unit as.	Same as unit as.	Stabilized boundaries, although localized deflation and stream erosion may be acting on unit.	Same as unit as, although primary scarp forms more subdued as that most slopes are less than 20°.	Slightly better than unit as due to more extensive vegetation.
Deflation basins of sand and silt-db	Generally less than 3 m of moderately well stratified, cross-bedded fine sand, underlain by stratified sand and gravel containing lenses of silty sand.	Same as unit as.	Seasonal pore ice in sand, permafrost table presumed shallow (<2 m) and evidence suggests inactive ice wedges may be present below 2 m.	Near saturation to saturated; may be partially submerged by static surface water <1.0 m deep.	Same as unit as.	Same as unit as.	Depressions with centripetal drainage, often contain static bodies of water; probably due to seasonal desiccation of surrounding dunes as well as surface encrustment; impermeable at shallow depth due to perennially frozen sediments.	Not determined, generally believed to be shallow (<2 m, see text).	Fluctuate annually; boundaries extended due to thaw, desiccation, and deflation; boundaries retreat due to active dune transgression and to erosion by streams.	Generally very low angle in basins; gradational slopes at margins into adjacent units. Partially frozen remnant of dunes, often with high angle slopes occur within basins. Stability varies from good (frozen basin floors), to moderate (partially thawed low-angle slopes), to poor (locally thawed moderate to steep slopes). Artificial cuts unstable when thawed due to high moisture content.	Fair to moderate when frozen, poor when thawed and/or saturated.
Pingo-p	A superpermafrost feature associated with various map units, as indicated by "u" under "ice content and type." Because of their size and potential hazards, pingos are indicated on the surficial geologic maps.		Massive ice lenses, formed within saturated sediments above the permafrost zone. Ice accumulates due to groundwater flow to a freezing interface (see text). Resultant ice mass circular or elliptical in plan view, with a convex upper surface.	Not applicable.	Not applicable.	Surface tundra mat and soil fragmented due to ground heave; resultant mounds 10-20 cm in diameter.	Rills forming radial pattern develop from crest of pingos, rills follow fragmented tundra cracks; crest often possesses small crater, which may contain a small pond; if pingo is thawing, springs may emanate from crest or flanks; small alluvial fans sometimes occur at toe of slopes due to rill wash of silts and sands.	Not applicable.	Not applicable.	Slopes uniformly steep, up to 20° inclination, crests small and rounded, or cratered; toe of slope gradational for several tens of meters until map unit slope attained. Surface of slopes somewhat unstable due to cracking, high angle, and sporadic surface runoff.	Very poor due to release of very large volume of meltwater. Static conditions of pingos should not be disturbed by excavation or surface compaction.

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