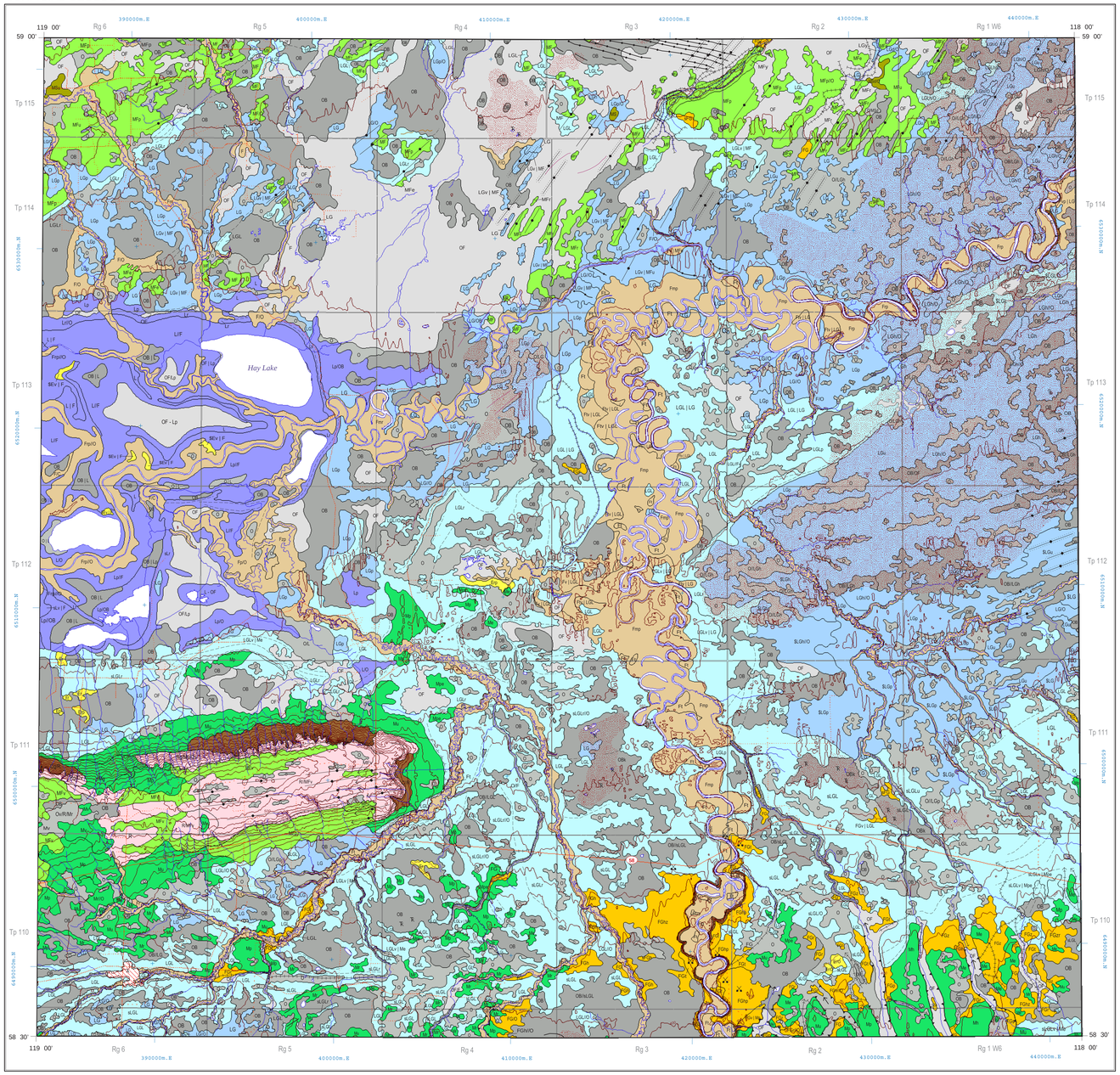
NTS 84L/NE
SURFICIAL GEOLOGY



This is a common map legend for the surficial geology of northern Alberta. Coloured legend blocks indicate map units that appear on this map. Not all map symbols shown in the legend necessarily appear on this map.

UNIT	UNIT NAME	DESCRIPTION AND GENESIS
QUATERNARY		
	HOLOCENE	
A		**ANTHROPOGENIC MATERIALS:** Culturally-made or modified geological materials such that their physical properties (e.g., structure, cohesion, compaction) have been drastically altered.
O		**ORGANIC DEPOSITS:** Undifferentiated peat (woody to fibrous muck) occurring in undifferentiated wetlands; commonly underlain by fine-grained, poorly-drained glaciolacustrine deposits; includes marshes, swamps, bogs and fens.
OB		**Bog peat:** Occurs in a peatland with a fluctuating water table and commonly a raised surface; peatland surface is dominated by sphagnum mosses, heath shrubs and short, stunted trees.
OF		**Fen peat:** Occurs in a peatland with water table at surface and slow internal drainage; peatland surface is dominated by sedges, with grasses and reeds near local pools, and is sparsely treed.
C		**COLLUVIAL DEPOSITS:** Materials that have reached their present position as a result of direct, gravity-induced movement; commonly occurs as slope and slump deposits confined to valley slopes and floors; includes pre-existing bedrock, till, glaciolacustrine, glaciofluvial and eolian sediments; generally poorly sorted.
F		**FLUVIAL DEPOSITS:** Sediments transported and deposited by streams and rivers; synonymous with alluvial. Includes well-sorted stratified sand, gravel, silt, clay and organic sediments occurring in channel and overbank deposits (e.g., postglacial floodplains, terraces, fans and deltas).
L		**LACUSTRINE DEPOSITS:** Sediments deposited in and adjacent to recent and modern lakes; offshore sand, silt and clay, minor organic deposits; littoral (nearshore) beaches and bars; sand, silt and minor gravel.
E		**EOLIAN DEPOSITS:** Wind-deposited sediments; well-sorted, medium- to fine-grained sand and minor silt (loess); generally massive to locally cross-bedded or ripple laminated; includes both active and vegetated deposits.
	PLEISTOCENE	
LG		**GLACIOLACUSTRINE DEPOSITS:** Primarily fine-grained distal sediments deposited in or along the margins of glacial lakes, including sediments that were released by the melting of floating ice. Includes laminated (rhythmically bedded) to massive fine sand, silt and clay, and may contain ice-rafted stones.
LGL		**Littoral and nearshore sediments:** Massive to stratified well-sorted silty sand, pebbly sand and minor gravel; occurs as beaches, bars, spits and foreset deltaic deposits deposited during regression and lowering of glacial lakes.
FG		**GLACIOFLUVIAL DEPOSITS:** Sediments deposited by glacial meltwater streams as subaerial or subaqueous outwash. Includes sand and gravel, often stratified, minor silt, and may show evidence of ice melting (slumped structures). Features include meltwater channels, kettle holes, terraces and minor ice-contact sediments.
FGI		**Ice-contact sediments:** Sediments deposited by glacial meltwater streams in direct contact with glacial ice, either in front of (kame terraces) or within (eskers, crevasse ridges) glacial ice. Includes massive to stratified, poorly to moderately sorted coarse sediments (predominantly pebble gravel and coarse sand, locally till) and may show evidence of ice melting (slumped structures).
M		**MORAINE:** Material deposited directly by glacial ice without modification by any other agent of transportation. Includes nonsorted diamicton deposited as lodgement till (a mixture of clay, silt, sand and minor pebbles, cobbles and boulders) at the ice margin or beneath a glacier. Locally, it may contain blocks of bedrock, pre-existing stratified drift and till. Beds and lenses of glaciolacustrine and/or glaciofluvial sediments may occur.
MS		**Stagnant ice moraine:** Terrain resulting from the collapse and lateral movement of englacial and supraglacial sediment in response to melting of buried stagnant ice at the ice margin; sediment is mainly diamicton (till), but locally includes stratified sediments of glaciolacustrine or glaciofluvial origin. Characterized by low- to high-relief hummocky topography.
MT		**Ice-thrust moraine:** Terrain resulting from glacio-tectonic transport of originally subglacial sediment and deposited by the glacier more or less intact; deposits may include syngenetic till as well as masses of deposited pre-existing till, stratified drift and/or bedrock. Characterized by high to moderate relief and features include hill-hole pairs and glacio-tectonic moraine ridges.
MF		**Fluted moraine:** Glacially streamlined terrain; varies from alternating furrows and ridges to nearly equidimensional smoothed hills; all landforms parallel the local ice flow direction; includes flutes, drumlins and drumlinoids.
FP		**PREGLACIAL FLUVIAL DEPOSITS:** Sediments transported and deposited by streams and rivers prior to glaciation. Includes sand and gravel deposits occurring in paleovalleys (i.e. preglacial floodplains, terraces, fans and deltas); ranging in age from middle Wisconsin to late Tertiary.
PRE-QUATERNARY		
RT		**UNCONSOLIDATED FLUVIAL GRAVELS:** Predominately well-sorted, quartzite and chert gravel and cobbles; Cordilleran source, Paleogene (Tertiary) to early Quaternary age.
R		**BEDROCK:** Undifferentiated; may include clastic sedimentary rock, shale, coal, carbonate and crystalline (Shield), kimberlite and/or coal.

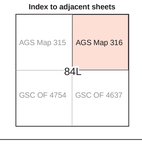
SYMBOL LEGEND

- Permafrost; relict and/or active
- Thermokarst depression
- Landslide and active layer failure scar (small)
- Landslide and active layer failure scar (large)
- Eolian forms; dune ridges
- Beach or strandline
- Wave cut bench
- Escarpment
- Meltwater channel (minor)
- Meltwater channel (minor, flow indicated)
- Meltwater channel (major)
- Meltwater channel (major, flow indicated)
- Crevasse filling
- Ice contact slope
- Kettle
- Esker, direction of paleoflow unknown
- Esker, direction of paleoflow indicated
- Drumlinoid or streamlined landform
- Drumlinoid, down-ice flow indicated
- Buried drumlinoid or streamlined landform
- Minor moraine ridge
- Major moraine ridge
- Iceberg scour
- Ice thrust ridge
- Striation (direction unknown)
- Striation (direction known)
- Bedrock outcrop
- Gravel and/or sand pit
- Section of stratigraphic interest

BASEMAP LEGEND

- Paved highway
- Gravel road - all season
- Unimproved road
- Trail
- River
- Lake
- UTM grid, Zone 11 (430000m.E)
- Contour, 10 metre interval

Index to adjacent sheets



UNIT NOTATION
Example: GLACIOLACUSTRINE plain

s GL p
Textural modifier — Genetic class — Geomorphic modifier

Textural Modifier
Textural characteristics may be applied to the terrain classification as a prefix based on field observations or by inference from distinctive genesis and/or morphology. When two modifiers are given, the second letter is the dominant texture, with the first letter indicating the secondary texture; i.e., sc for sandy clay
p = pebble
g = gravel
s = sand
$ = silt
c = clay
a = sand-silt-clay

GENETIC & GEOMORPHIC MODIFIERS

c	**crevasse fill**	ice-contact ridges; ice squeeze deposits; linear forms deposited by meltwater in stagnant ice
d	**doughnut rings and ridges**	circular hummocks with a central depression, plateau mounds and brain-like pattern ridges, low to moderate relief
e	**eroded**	planar surface eroded by glacial meltwater, often capped by a boulder lag deposit and/or thin deposit of sand and gravel
f	**fan**	gently sloping fan-shaped mass of detrital debris
g	**gullied**	slopes dissected by modern ravines created by intermittent runoff
h	**hummock**	assemblage of approximately equidimensional hills and hollows; moderate to high relief (commonly greater than 2 m)
k	**collapse**	depression, including kettles, pitted morphology, thermokarst depressions, karst sinkholes
m	**meander**	sinuous curves, loops and ox-bows produced as meltwater and modern streams shift their channel over time
p	**plain**	deposit greater than 2 m thick; commonly masks geomorphic pattern of underlying deposits; flat to gently rolling topography (commonly less than 2 m relief)
r	**ridged**	one or more parallel or subparallel, convex, linear morphological elements with a length-to-width ratio greater than 2; low to high relief
s	**slumped**	landslide blocks, slope failure debris
t	**terrace**	terrace bench cut by either meltwater or wave action; antiplanation terrace, kame terrace
u	**undulating**	low-relief rolling terrain; swell and swale topography
v	**veneer**	thin mantle of unconsolidated material too thin to mask the minor irregularities of the surface of the underlying material; it ranges in thickness from 10 cm to 1 metre and may be discontinuous
w	**washboard**	low relief transverse moraine ridges, usually formed from basal ice shearing
y	**dissected**	channelled or dissected by glacial meltwater flow; dissected terrain by Holocene fluvial activity
z	**delta**	lake delta; ice-contact delta

Complex
Where two or more classes of terrain are interspersed in a mosaic or repeating pattern on a scale too small to warrant meaningful differentiation, the proportion of each component in the combination is given in a two or three position designation set off by slashes denoting arbitrary percentage limits. For example,

'MgVLGv' means that the area is underlain by approximately 60% morainal plain and up to 40% glaciolacustrine veneer.

'MvILGvIFGp' means that at least 60% of the area is underlain by morainal veneer, with up to 40% glaciolacustrine veneer and less than 15% glaciofluvial plain.

'LGpI/M' means that more than 60% of the area is underlain by a glaciolacustrine plain, with less than 15% moraine.

Stratigraphic Sequence
Where materials of different origin or texture are known to be superimposed or can be confidently inferred, the sequence is indicated in conventional order using vertical separators, such as:

'sLGv | Mp' Thin sandy glaciolacustrine sediment deposited on morainal plain

Transitional Association
Locally, two or more terrain units are juxtaposed by reason of related origin, temporal sequence, or ambiguous geomorphic distinction. In the last case, both components may or may not be present. Such situations are identified by a compound designation marked by a hyphen. Examples are: 'FGz-LGz' indicating ice-contact delta indistinguishable from glaciolacustrine delta, or 'FGlk-MSh' indicating ice-contact kame and kettle topography that blends with hummocky stagnant ice moraine.

Morphologic Overprint
Where a sequence of geomorphic processes has produced a multi-aspect or compound terrain fabric, the geomorphic modifier suffixes are appended in the inferred order of superposition. 'Mpry' means that a plain of till has been moulded into ridge forms and finally dissected by modern streams. 'FGphr' means that a glaciofluvial plain has been discontinuously covered by ice-contact hummocks and ridges.

Acknowledgements:

Surficial mapping was completed in 2003 as an Alberta Geological Survey (AGS) and Geological Survey of Canada (GSC) collaborative contribution to NRD Project 4450 and the Quaternary mapping initiative under the Alberta Mineral Strategy. Airphoto interpretation by Roger Paulen; Michelle Trommelen and Michelle White provided assistance with fieldwork and compilation of the digital databases. A field field visit from post-doctorate fellow, Konstantin (Kostya) Dlussky, University of Alberta, was greatly appreciated. Digital cartography and GIS were completed by Monica Price and Natasha Clarke. Digital base produced by the Resource Data Division, Alberta Environment, supplied by Spatial Data Warehouse Ltd.

References:

Bayrock, L.A. (1960): Surficial Geology, Appendix; *in* Exploratory soil survey of Alberta map sheets 84J, 84K and 84L, J.D. Lindsay, S. Pawluk and W. Odynsky; Research Council of Alberta, Preliminary Soil Survey Report 60-1, p. 43-49.

Borneuf, D. and Pretula, B. (1980): Hydrogeology of the Zama-Bistcho lakes area, Alberta; Alberta Energy and Utilities Board, EUB/AGS Earth Sciences Report 1980-03, 7 p.

Dyke, A.S., Moore, A. and Robertson, L. (2003): Deglaciation of North America; Geological Survey of Canada, Open File 1574.

EBA Engineering Consultants Ltd. (1984a): Surficial geology of the Hay-Zama lakes area, Alberta, 0106-4060.5; report submitted to Alberta Energy and Natural Resources, 15 p.

EBA Engineering Consultants Ltd. (1984b): Inventory of construction materials, Hay-Zama lakes area, Alberta, 0106-4060.6; report submitted to Alberta Energy and Natural Resources.

EBA Engineering Consultants Ltd. (1984c): Geotechnical evaluation, Hay-Zama lakes area, Alberta, 0106-4060.7; report submitted to Alberta Energy and Natural Resources.

Edwards, W.A.D., Budney, H.D., Berezniuk, T. and Butkovic, L. (2004): Sand and gravel deposits with aggregate potential, Zama Lake, Alberta (NTS 84L); Alberta Energy and Utilities Board, EUB/AGS Map 309, scale 1:250 000.

Fox, J.C., Richardson, R.J.H. and Sham, P.C. (1987): Surficial geology of the Peace River - High Level area, Alberta; Alberta Energy and Utilities Board, EUB/AGS Map 205, scale 1:500 000.

Green, R. and Mellon, G.B. (1962): Geology of Chinchaga River and Clear Hills (north half) map areas, Alberta; Alberta Research Council, Preliminary Report, 62-8, 18 p.

Green, R., Mellon, G.B. and Carrigy, M.A. (1970): Bedrock geology of northern Alberta, NTS 84 and NTS 74D, 74E, 74L and 74M; Alberta Research Council Map 24, scale 1:500 000.

Lemmen, D.L., Duk-Rodkin, A. and Bednarski, J.M. (1994): Late glacial drainage systems along the northwestern margin of the Laurentide Ice Sheet; Quaternary Science Reviews, v. 13, p. 805-828.

Lindsay, J.D., Pawluk, S. and Odynsky, W. (1960): Exploratory soil survey of Alberta map sheets 84J, 84K and 84L; Research Council of Alberta, Preliminary Soil Survey Report 60-1, 49 p.

Mathews, W.H. (1980): Retreat of the last ice sheets in northeastern British Columbia and adjacent Alberta; Geological Survey of Canada, Bulletin 331, 22 p.

Paulen, R.C., Fenton, M.M., Pawlowicz, J.G., Smith, I.R. and Plouffe, A. (2005): Surficial geology of the Little Hay River area (NTS 84L/NW); Alberta Energy and Utilities Board, EUB/AGS Map 315, scale 1:100 000.

Plouffe, A., Smith, I. R., Paulen, R. C., Fenton, M. M. and Pawlowicz, J. G. (2004): Surficial geology, Bassett Lake, Alberta; Geological Survey of Canada, Open File 4637, scale 1:100 000.

Richardson, R.J.H. (1985): Aggregate resources of the Zama Lake map area, NTS 84L; Alberta Resource Council, Map A84L, scale 1:250 000.

Smith, I.R., Plouffe, A., Paulen, R.C., Fenton, M. and Pawlowicz, J.G. (2005): Surficial geology, Hay River, Alberta (NTS 84L/SW); Geological Survey of Canada, Open File 4754, surficial map, scale 1:100 000.

Taylor, R.S. (1960): Some Pleistocene lakes of northern Alberta and adjacent areas (revised); Journal of the Alberta Society of Petroleum Geologists, v. 8, p. 167-185.

Zoltai, S.C. (1993): Cyclic development of permafrost in the peatlands of northwestern Alberta, Canada; Arctic and Alpine Research, v. 25, p. 240-246.

Recommended reference format:

Paulen, R.C., Fenton, M.M., Weiss, J.A., Pawlowicz, J.G, Plouffe, A. and Smith, I.R. (2005): Surficial geology of the Hay Lake area, Alberta (NTS 84L/NE); Alberta Energy and Utilities Board, EUB/AGS Map 316, scale 1:100 000.

Published 2005

Copies of this map may be obtained from:
Information Sales Office
Alberta Geological Survey
Telephone: (780) 422-3767
Web site: www.ags.gov.ab.ca

Map 316

Surficial Geology of the Hay Lake Area, Alberta (NTS 84L/NE)

Geology by: R.C. Paulen, M.M. Fenton, J.A. Weiss, J.G. Pawlowicz, A. Plouffe and I.R. Smith

Scale 1:100 000

2 0 2 4 6 8 10 kilometres
1 0 1 2 3 4 5 6 miles

Projection: Universal Transverse Mercator
Datum: North American Datum, 1983