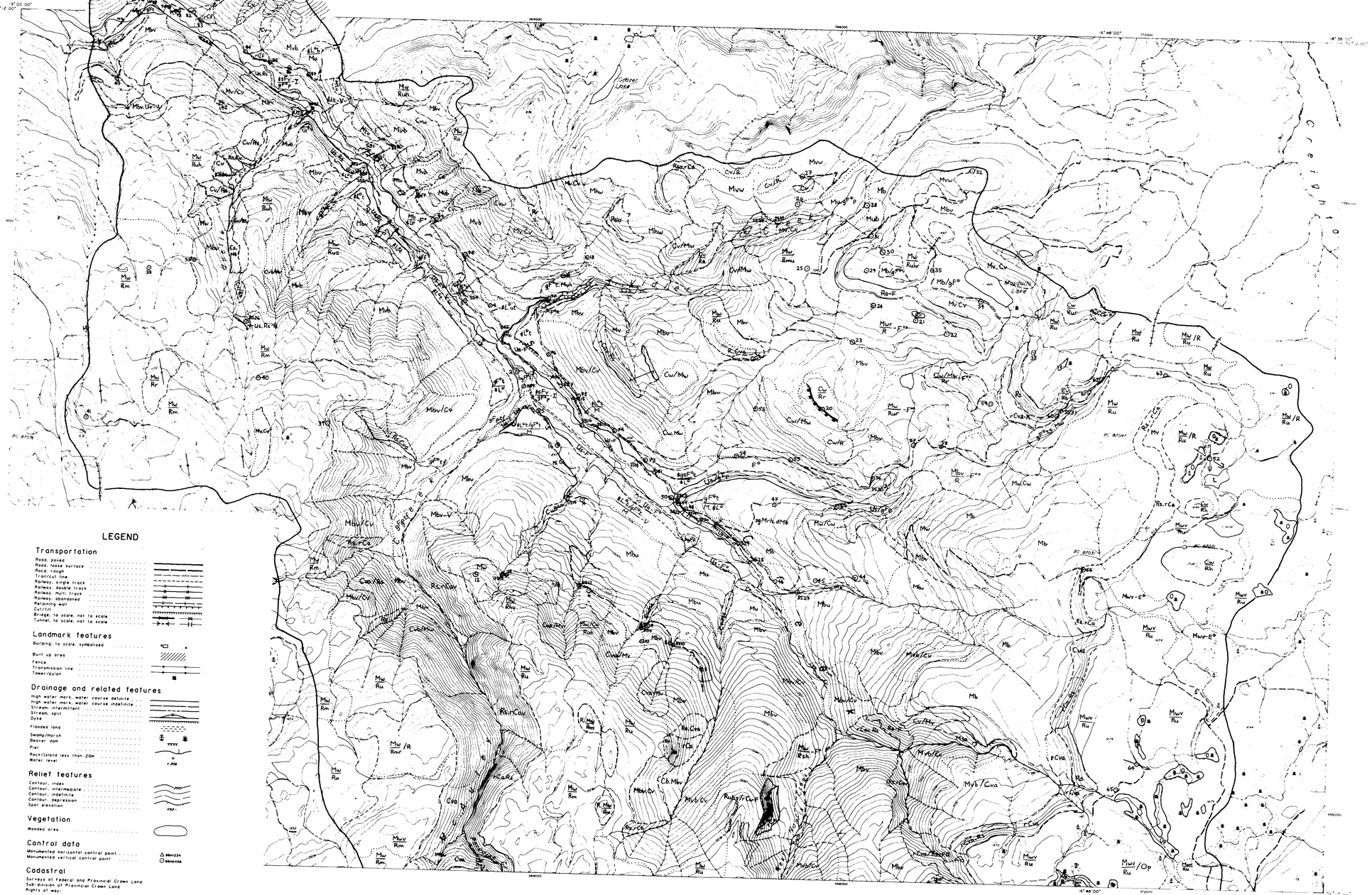

Ministry of Energy, Mines and Petroleum Resources
Geological Survey Branch

OPEN FILE 1991-18

Quaternary Geomorphology and Terrain Map of the Harris Creek Area, British Columbia

Parts of NTS 82L/1, 2
Sheet 1 of 2 (North)

by June M. Ryder

Scale 1:20 000

200 0 200 400 600 800 1000 1200 1400
METRES

Mapping August, 1990, by June M. Ryder
Field checking by J.M. Ryder & Alan Paige
Drafting by Abby Fitch

LEGEND

Transportation

Road, paved
Road, loose surface
Road, rough
Trail/jeep line
Railway, single track
Railway, double track
Railway, multi track
Railway, abandoned
Retaining wall
Cut/fill
Bridge, to scale, not to scale
Tunnel, to scale, not to scale

Landmark features

Building, to scale, symbolized
Built up area
Fence
Transmission line
Tower/pylon

Drainage and related features

High water mark, water course definite
High water mark, water course indefinite
Stream, intermittent
Stream, spill
Dyke
Flooded land
Swamp/marsh
Beaver dam
Pier
Rock/island less than 20m
Water level

Relief features

Contour, index
Contour, intermediate
Contour, indefinite
Contour, depression
Spot elevation

Vegetation

Wooded area

Control data

Monumented horizontal control point — 89H2234
Monumented vertical control point — 89H4436

Cadastral

Surveys of Federal and Provincial Crown Land
Sub-division of Provincial Crown Land
Rights of way:
Township boundary
District lot, Township section line, Indian reserve, Foreshore lot
Mineral claim, Coal lease, Coal licence
1/4 section line on a Township, Lease or Crown subdivision, Rights of way
Surveyed Cadastral Tie Point

For complete reference to symbols, see "Specifications and Guidelines for Digital Topographic and Cadastral Mapping at 1:20000" published by the Ministry of Environment and Parks.

QUATERNARY GEOMORPHOLOGY OF THE HARRIS CREEK AREA

PHYSIOGRAPHY

The drainage basin of Harris Creek lies within the Okanagan Highland, a dissected plateau. The upland surface of the plateau, between 1300 and 2000 metres above sea level, constitutes about two-thirds of the catchment. The remainder consists of the deeply incised valleys of the middle and lower reaches of Harris Creek and its major tributaries. The gently undulating upland surface is separated from the steep valleysides by a well-defined break of slope. The plateau is a composite Tertiary erosion surface (Mathews, 1968). Widespread tectonic uplift during late Pliocene to early Pleistocene time initiated river downcutting, resulting in the development of the present dissected plateau. Glaciation has resulted in minor erosional modification of the upland surface and accumulation of thick drift along lower Harris Creek.

Bedrock in the study area was mapped by Jones (1959). The northwestern and southwestern parts of the study area are underlain, respectively, by acidic plutonic rocks and by gneiss of the Shuswap complex. The eastern part of the basin is underlain by volcanic rocks, primarily the Eocene Kamloops Group (Jones, 1959) but there is a smaller area of the Miocene King Edward Creek Formation (*c.f.*, Mathews, 1968). Tuffs and breccias of the Kamloops Group are widespread, as well as basalt and other flows. Tertiary gravels (conglomerates) were noted in a few places. The volcanic rocks, particularly breccias, form prominent scarps that emphasize the break of slope that bounds the upland surface. In several places, topographic features downslope from these scarps suggest that massive slope movements within the volcanic rocks have affected many square kilometres of the study area. The features are till covered which indicates that they predate the last glaciation.

SURFICIAL MATERIALS AND LANDFORMS

Surficial materials are well exposed in landslide headscarps, river banks, and road cuts along the valley of lower Harris Creek. Elsewhere, small road cuts and roadside borrow pits provided limited information. No deposits appear to be older than Fraser Glaciation. Drift is thickest, up to 150 metres, in lower Harris Creek valley, where several benches are underlain by glaciolacustrine and glaciofluvial sediments and till.

Till mantles both the upland surface and most valley sides. Where the upland surface is underlain by volcanic rocks, extensive areas may have only a thin veneer (20 to 40 cm) of till (Mv), (glacially-smoothed bedrock is commonly exposed in shallow vehicle tracks). Where the upland surface is underlain by gneiss and plutonic rocks, glacial erosion gave rise to linear hills. Depressions between the hills are underlain by relatively thick (probably a few metres) till; ridge crests are thinly or incompletely buried (Mw). Within the valleys, all but the steepest slopes are till-covered (Mv, Mb, Mw). On steep slopes, till commonly contains angular clasts of locally derived rock, and downslope from rock outcrops till has been buried by rubbly colluvium. Till is thickest (several metres) on gentle slopes and along lower Harris Creek where it buries older drift beneath an irregular bench (Mbv, and Mb over L^{fp}_{3}). Low mounds and hummocks of till were mapped near Vidler Creek (Muh) but no other constructional till landforms were identified.

Typically, the till is a moderately to highly consolidated diamicton with 20 to 40 per cent clasts, chiefly pebbles. A variety of clast lithologies are present, with the most abundant rock types corresponding to the lithology of local bedrock. Till matrix texture, (determined by hand-texturing in the field), is also variable, ranging from fine sand to sandy silty clay. As a few sites, matrix texture is directly related to till provenance. For example, sandy till overlies tuff and breccia at S30, sandy till overlies granodiorite at S42, and finer textured tills overlie glaciolacustrine sediments at sites near lower Harris Creek. In general, however, no consistent relation between till provenance and matrix texture was noted. Local conditions of till deposition and, possibly, the nature of older surficial materials that were incorporated into the till, appear to have been the main determinants of till texture. In places, lenses or irregular shaped inclusions of glaciolacustrine and glaciofluvial sediments are present in the till.

Glaciolacustrine sediments, consisting predominantly of horizontally stratified and thinly bedded or laminated silt with minor interbedded clay and fine sand, underlie the benches that border lower Harris Creek. Varve-like strata were noted in places (*e.g.*, SS1, S16) and massive silt is present at some sites. Lower unit of Glaciolacustrine sediments, which is at least 50 metres thick, underlies Fraser Glaciation till and extends down to creek-level. In places, the contact between silt and till is steeply sloping and erosional, but elsewhere, the glaciolacustrine sediments grade upward into till through a transitional zone of interlayered silt, diamictons (probably flow-till) and glaciofluvial gravels. An upper unit of glaciolacustrine sediments, at least 20 metres thick, overlies the till with a similar transitional zone. This upper unit forms a constructional terrace (L^{fp}_{3}) along lower Harris Creek which is particularly well developed near Vidler and McAuley Creeks.

Glaciofluvial sediments occur in several parts of the study area. Well defined terraces (F^{fp}_{3}) along lower Mosquito Creek and the upper part of lower Harris Creek are underlain by outwash sands and pebbly gravels, from 1 to 4 metres thick, that rest on glaciolacustrine sediments. Along Harris Creek downstream from Beetle Creek, erosional remnants (too small to map) of glaciofluvial materials (chiefly silty gravels) are exposed in roadcuts at the base of the northern valleyside (S82, S84, S86); no related landforms were identified. At higher elevations, deltas of gravel and sand constitute small (unmapped) but well defined benches, *e.g.*, at S36, S60, S62. Glaciofluvial gravels are also present in meltwater channels, *e.g.*, in the vicinity of S28. Some relatively extensive areas of hummocky and irregular terrain along lower McAuley and Vidler Creeks are probably underlain by glaciofluvial materials, but were not examined in the field.

Fluvial sediments underlie modern floodplains and alluvial fans. The floodplain of lower Harris Creek is underlain by 0.5 to 1.5 metres of overbank sediments (Fv). These consist of thinly interbedded silt and sand in which paleosols, forest litter, charcoal and wood fragments are commonly preserved. Channel gravels (chiefly pebbles and cobbles) underlie the overbank sediments and are exposed in the active channel zone of the modern creek (gF^{fp}_{0}). A large alluvial fan at the mouth of McAuley Creek consists of coarse, bouldery gravels (gpF^{fp}_{0}).

Colluvium was mapped only where significant accumulations of bedrock-derived material were observed, and where slope steepness suggested that significant downslope movement of disintegrated bedrock had occurred. Talus slopes (Cs) are of limited extent and restricted to steep slopes immediately below rock cliffs (Rs). Elsewhere, mantles of rubbly colluvium, colluvium overlying drift, and rubble intermixed with till due to postglacial slope processes are not separately distinguished; terrain map symbols (Cw, Cv, Cb) indicate only variations in material thickness.

Eolian Sediments, consisting of coarse silt and fine sand, form a thin (about 10 cm), discontinuous veneer on benches and gentle slopes. (not mapped)

QUATERNARY HISTORY

The characteristics and distribution of the Quaternary sediments described above suggest the following sequence of events.

Fraser Glaciation

At the onset of glaciation, Harris Creek was impounded by ice that advanced upstream from the Lumby valley. The thick glaciolacustrine sediments (lower unit) that accumulated in the resulting lake were eventually overridden and partly eroded by the ice.

At the glacial maximum, all of the Harris Creek area was buried by ice. Linear hills on the upland surface to the west of Harris Creek, suggest that ice flowed toward S10°E, corresponding to the regional ice flow direction recorded by Fulton (1975). Striations were measured at two sites (S52, S64) in the northeastern part of the study area. Ice flow toward S70°E is indicated at S64, and intersecting striae at S52 indicate flow toward S10°E and S65 to 80°E. The more easterly ice flow may have occurred briefly during either the waxing or the waning phase of glaciation.

Deglaciation was effected by downwasting rather than by recession of a regional ice front (*c.f.*, Fulton, 1975). The highest parts of the upland surface became ice-free first. Lateral meltwater channels east of Buck Mountain developed when the ice margin had declined to about 1850 metres above sea level, and ekers northwest of Buck Mountain probably formed at about the same time. With further downwasting, meltwater flowed from Creighton Creek basin into Harris Creek basin via two channels at about 1500 metres elevation near site 63. Later, the broad valley at site 28 and Grazer Lake valley also served as spillways.

As downwasting continued, small lakes were held in the upper, ice-free parts of tributary valleys by thick ice that remained in the lower Harris Creek basin. Glaciofluvial deltas developed in these ice-marginal lakes. At sites 36, 60 and 62 delta foresets exposed in small roadside pits indicate flow in the present upstream direction, suggesting that sands and gravels were carried into the lakes by streams flowing off the ice.

Eventually, as the ice thinned, lakes extended to lower and lower elevations, until a single, relatively large lake remained in the valley of lower Harris Creek. The upper glaciolacustrine sediments accumulated here. If this lake was impounded by ice, as is most likely, then Harris Creek basin must have been largely ice-free while ice remained downstream in the Lumby valley. When the lake drained, Harris Creek flowed across the lowest parts of the silty lake floor, depositing outwash sands and gravels.

The Holocene Epoch

During early Holocene time, Harris Creek became entrenched into Fraser Glaciation drift, resulting in formation of the various drift benches. During later Holocene time, lateral erosion by the creek resulted in the development of the present broad floodplain, and alluvial fans have accumulated on this floodplain at the mouths of tributaries. Throughout postglacial time, mass movements such as rockfall and debris flows have resulted in the accumulation of talus and colluvial fans at the foot of steep slopes. Rock slumps (much smaller than the pre-glacial features mentioned above) have occurred along the volcanic rock scarps.

Terrain Map Legend

1.-1 TERRAIN UNIT SYMBOLS

Simple Terrain Units: *e.g.*

Lowercase — process
Uppercase — surficial material
Subscript — surface expression

Note: Two letters can be used to describe any characteristic other than surficial material, or letters may be omitted if information is lacking.

Composite Units: Two or three groups of letters are use to indicate that one or three kinds of terrain are present within a map unit.

e.g.: Mw,Rr — indicates that "Mw" and "Rr" are of roughly equal extent

Mw/Rr — indicates that "Mw" is more extensive than "Rr" (about 2/3 vs 1/3)

Stratigraphic Units: Groups of letters are arranged one above the other where one or more kinds of surficial material overlie a different material or bedrock.

e.g.: Mw/Rr — means that "Mw" overlies "Rr"

1.-2 MATERIALS

C — Colluvium
F — Fluvial sediments
F^{fp} — 'Active' fluvial sediments
L — Glaciofluvial sediments
L^{fp} — Glaciolacustrine sediments
M — Till, Morainal
O — Organic sediments
R — Bedrock
S — Undifferentiated Quaternary sediments

1.-3 TEXTURE OF SURFICIAL MATERIAL

c — clay
m — silt
s — sand
g — gravel
b — boulders
r — cobble

1.-4 GEOMORPHIC PROCESSES

F^{fp} — Glacial meltwater channels
F^{v} — Fluvial (active mass movement)
F^{cd} — Old (Holocene) landslides
F^{cb} — Very old (pre-Holocene) landslides
F^{o} — Infequently subaqueous channel
F^{r} — Rapid mass movement
F^{e} — Gully erosion

1.-5 ON-SITE SYMBOLS AND BOUNDARY LINES

Scarps, escarpments, bluffs
on Quaternary materials
on bedrock
Mass Movement and Erosion Features:
area of recent small slide
area of recent larger slide
recent debris flow
Glacial striations
Glacial meltwater channels
Eskers
Observation/sample site
Sediment source
Terrain Unit Boundary Lines:
definite boundary
indefinite, approximate or gradational boundary
assumed or arbitrary boundary

REFERENCES

Fulton, R.J. (1975): Quaternary geology and Geomorphology, Nicola-Vernon Area, British Columbia; *Geological Survey of Canada, Memoir 380.*

Jones, A.G. (1959): Vernon Map-area, British Columbia; *Geological Survey of Canada, Memoir 296.*

Mathews, W.H. (1968): Neogene geology of the Okanagan Highland, British Columbia; *Canadian Journal of Earth Sciences*, Volume 25, pages 725-731.

LEGEND

Transportation

Road, paved
Road, loose surface
Road, rough
Trail/cut line
Railway, single track
Railway, double track
Railway, multi track
Railway, abandoned
Retaining wall
Cut/fill
Bridge, to scale, not to scale
Tunnel, to scale, not to scale

Landmark features

Building, to scale, symbolised
Built up area
Fence
Transmission line
Tower/pylon

Drainage and related features

High water mark, water course definite
High water mark, water course indefinite
Stream, intermittent
Stream, spill
Dyke
Flooded land
Swamp/marsh
Beaver dam
Pier
Rock/island less than 20m
Water level

Relief features

Contour, index
Contour, intermediate
Contour, indefinite
Contour, depression
Spot elevation

Vegetation

Wooded area

Control data

Monumented horizontal control point
Monumented vertical control point

Cadastral

Surveys of Federal and Provincial Crown Land
Sub-division of Provincial Crown Land
Rights of way:
Township boundary
District lot, Township section line,
Indian reserve, Foreshore lot
Mineral claim, Coal lease, Coal licence
1/4 section line in a Township, Legal or Crown subdivision, Rights of way
Surveyed Cadastral Tie Point

For complete reference to symbols, see "Specifications and Guidelines for Digital Topographic and Cadastral Mapping at 1:20 000" published by the Ministry of Environment and Parks.

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OPEN FILE 1991-18

Quaternary Geomorphology and Terrain Map of the Harris Creek Area, British Columbia

Parts of NTS 82L/1, 2
Sheet 2 of 2 (South)

by June M. Ryder

Scale 1:20 000

200 0 200 400 600 800 1000 1200 1400
METRES

Mapping August, 1990, by June M. Ryder
Field checking by J.M. Ryder & Alan Paige
Drafting by Abby Fitch

Terrain Map Legend

L.1 TERRAIN UNIT SYMBOLS

Simple Terrain Units: e.g.

lithofacies — process
surficial material — surface expression

Note: Two letters may be used to describe any characteristic other than surficial material, or letters may be omitted if information is lacking.

Composite Units: Two or three groups of letters are use to indicate that two or three kinds of terrain are present within a map unit.

e.g., Mw Ru — indicates that "Mw" and "Ru" are of roughly equal extent.

Mw/Ru — indicates that "Mw" is more extensive than "Ru" (about 2/3 or 3/4)

Stratigraphic Units: Groups of letters are arranged one above the other where one or more kinds of surficial material overlie a different material or bedrock.

e.g., Ru/Mw — means that "Mw" overlies "Ru"

L.2 MATERIALS

- C Colluvium
- F Fluvial sediments
- F^{v} Active fluvial sediments
- F^{t} Glaciofluvial sediments
- F^{l} Glaciolacustrine sediments
- M Till, Morainic
- O Organic sediments
- R Bedrock
- V Unconsolidated Quaternary sediments

L.3 TEXTURE OF SURFICIAL MATERIALS

- c clay
- m silt
- s sand
- g gravel
- b boulders
- r rubble

L.4 SURFACE EXPRESSION

- u moderate slope(s) (10-30°)
- m blanket (thickness <5m)
- t veneer (5-10°)
- h hummocky (>30°)
- i gentle slope(s) (2-10°)
- r rolling topography (ridges 2-10°)
- p plain (<2°)
- ridges (>30°)
- s steep slope(s) (>30°)
- l lateral(s)
- v undulating topography (2-10°)
- w veneer (thickness <5m)
- m mantle of variable thickness (thickness 5 to 10m)

L.5 GEOLOGICAL PROCESSES

- G^{m} Glacial meltwater channels
- F^{r} Failing (active mass movement)
- F^{o} Old (dormant) landslides
- F^{rm} Rare (pre-Holocene) landslides
- I Irregularly rough (kames)
- R Rapid mass movement
- V Gully erosion

L.6 ON-SITE SYMBOLS AND BOUNDARY LINES

Slope: escarpments, bluffs
- on Quaternary materials
- on bedrock

Mass Movement and Erosion Features:
- area of recent small slide
- area of recent larger slide
- recent debris flow
- bank erosion (major features only)

- Glacial striations
- Glacial meltwater channels
- Eskers
- 170 Observation/sample site
- 55.0 Sediment source

Terrain Unit Boundary Lines
- definite boundary
- indefinite, approximate or gradational boundary
- assumed or arbitrary boundary