

Physiography and Drainage
This map area lies within the Boundary Ranges of the Coast Mountain physiographic region. The terrain has a rugged plateau character with peaks exceeding 2000 m. Deeply incised narrow valleys cut the plateau surface (Figure 1).

The Wheaton River flows eastward into Bennett Lake. Its main tributaries include Berner, Fenwick, Butte, Summit, Becker and Partridge creeks (Figure 2). Small tarn lakes are present in the well-formed cirques.

The McConnell Glaciation in the Whitehorse area
During the late Wisconsinan McConnell Glaciation (~20 000 years ago), the Whitehorse map area (NTS 105D) was glaciated by ice lobes originating in the Coast Mountains and the Cassiar Mountains of southern Yukon. Initial ice accumulations in the map area probably began in the higher regions of the Coast Mountains. At the height of the last glaciation, ice from the Cassiar lobe covered with the Coast Mountain lobe over this map area. The movement of ice over this area was to the north-westward and was unobstructed by topography.

The pattern of deglaciation is highlighted by periods of differential retreat and fluctuating ice fronts. A readvance of the Cassiar Lobe occurred into this area and had a significant influence on sediment deposition on the landscape. The re-advance flowed westward into the Wheaton River valley, and northward into the map area from the Bennett Lake area via Partridge and Becker creek headwaters. The westward flow of ice would have reached the Wheaton River headwaters where it likely converged with local alpine glaciers (Figure 3). Local alpine glaciers also persisted at this time in the Becker and Butte creek drainages (see circle symbols). As ice retreated eastward out of the Wheaton River valley the drainage was impounded by the ice front and Glacial Lake Wheaton developed. This glacial lake was among the deepest in the greater Whitehorse area reaching depths of 300 m (1000 ft).

Landforms
Wheaton River valley
The floodplain of the Wheaton River changes from a meandering (see "F" picture in legend) to a braided morphology (Figure 4) near the outlet of Berner Creek. This occurs for two reasons: 1) 3 km upstream from the Berner Creek outlet the Wheaton River current increases due to a drainage gradient change 2) the influx of gravel from Berner Creek increases the sediment load being carried by the Wheaton River. The braided river morphology is maintained by the addition of sediment from other tributaries down-valley.

In the southeast corner of the map area, bordering the Wheaton River is an impressive rock glacier extending out of a cirque on northwest side of Mount Ward (Figure 5). This landform is a mass of broken rock with in situ pore ice. It has a distinctive lobate morphology and is actively flowing into the Wheaton River.

Glacial Lake Wheaton shorelines are visible in the vicinity of Summit Creek pass and on the northwest slope of Tally-Ho Mountain. Also remnant of the glacial lake history is a well-preserved perched delta (FDG) in the Whitehorse area (Figure 1).

Figure 1. An aerial view to the southwest looking up the Wheaton River valley. The topographic variability is evident from this photograph. The elevation of the higher plateaus average 1700 m. The higher peaks in the distance have elevations up to 2400 m. The elevation of the valley floor is about 1000 m.

Figure 2. Large active alluvial fans spill into the Wheaton River valley from tributary streams. In this photograph at the base of Tally-Ho Mountain, a debris flow fan extends where the Wheaton River flood traverses the fan (see arrow). These surficial deposits are a good source of aggregate.

Figure 3. An aerial view to the south of a group of unnamed peaks at the headwaters of the Wheaton River. Alpine glaciers still exist in this upland providing a consistent water supply to the drainage. The glacial limit from the late Wisconsinan is visible down-valley from the glacier and is indicated by the arrow.

Figure 4. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

Figure 5. The Mount Ward rock glacier in the southeastern part of the map area. The Wheaton River is eroding into the toe of the rock glacier.

Figure 6. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

Figure 7. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

Figure 8. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

Figure 9. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

Figure 10. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

Figure 11. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

Figure 12. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

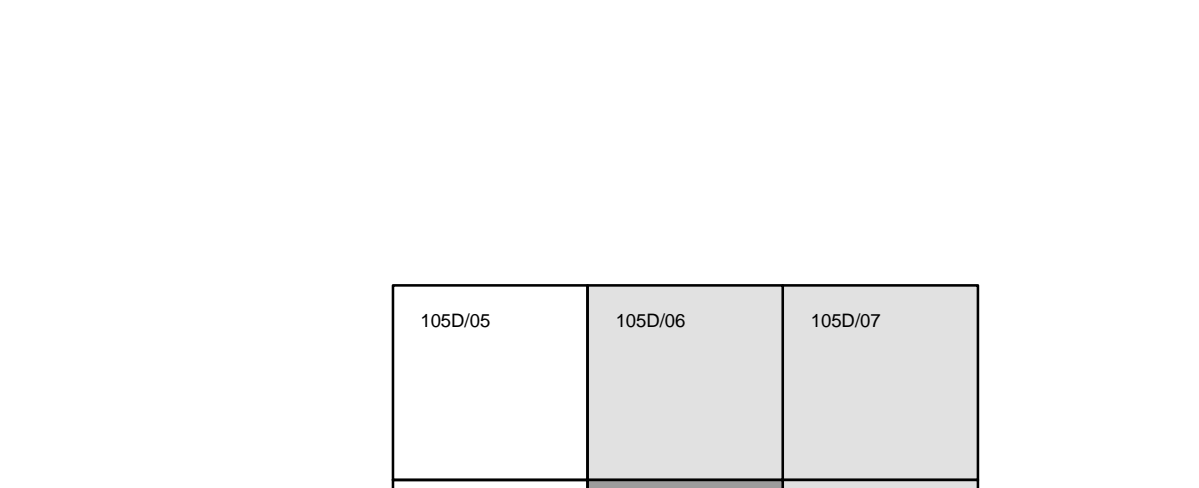
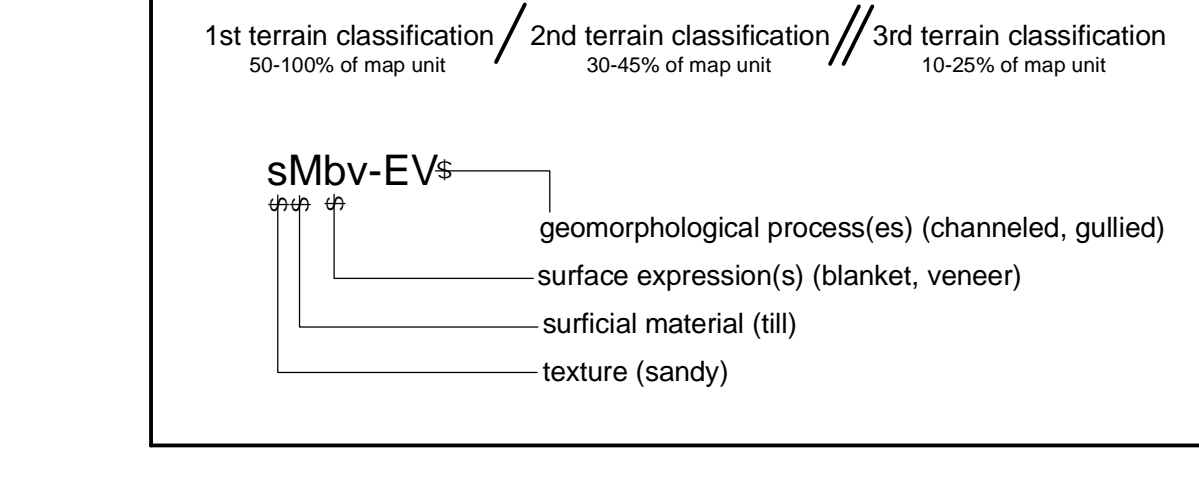
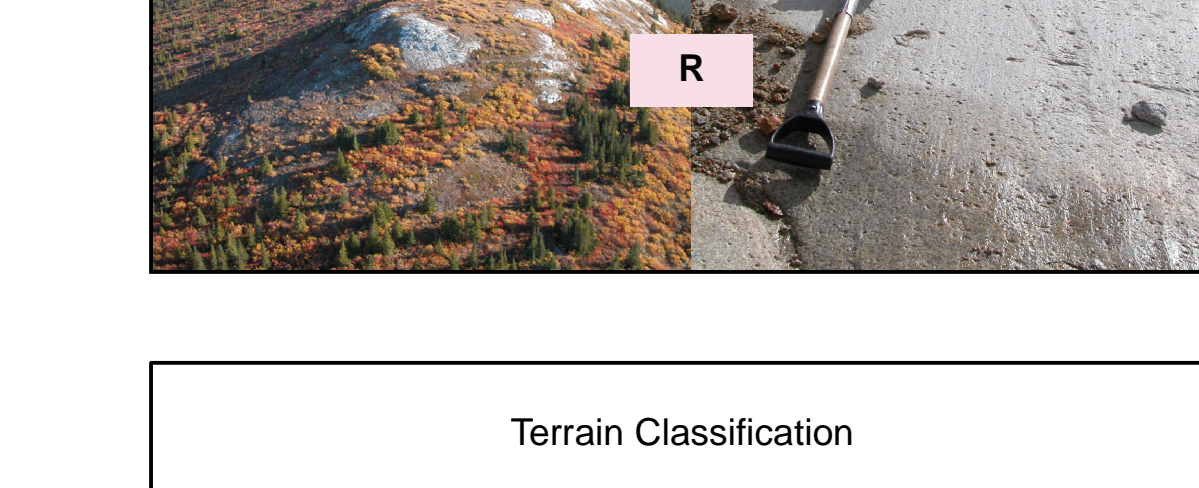
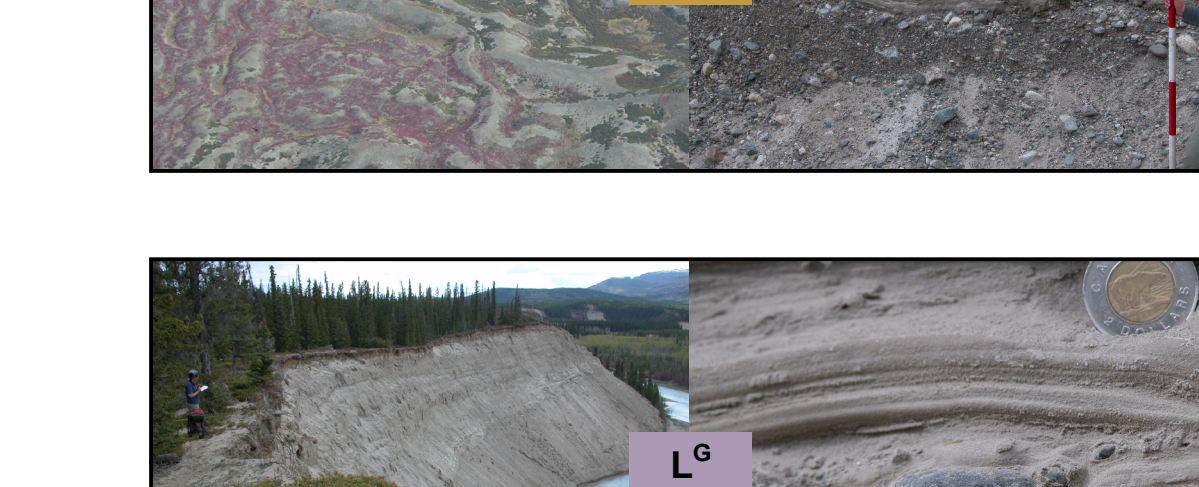
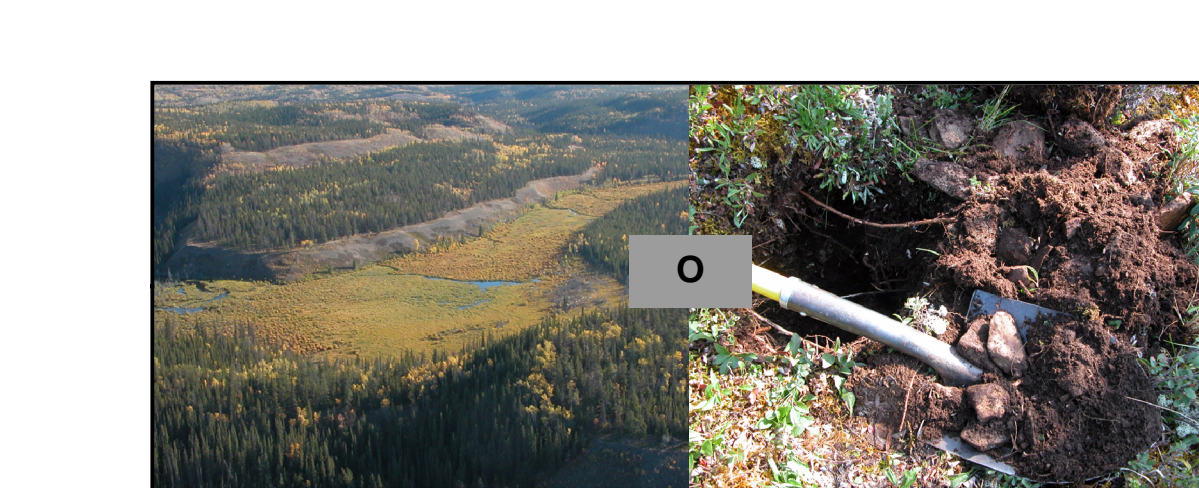
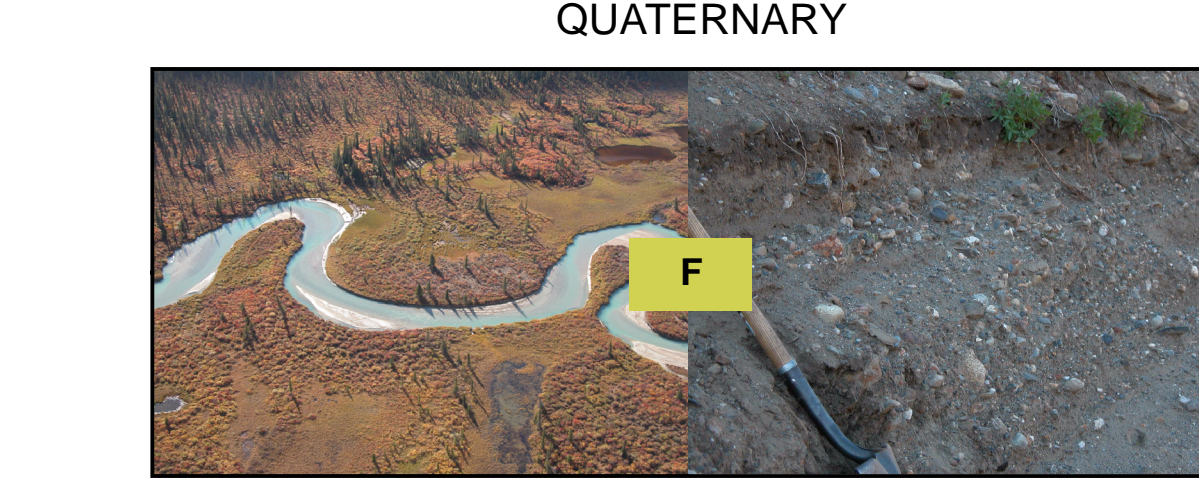
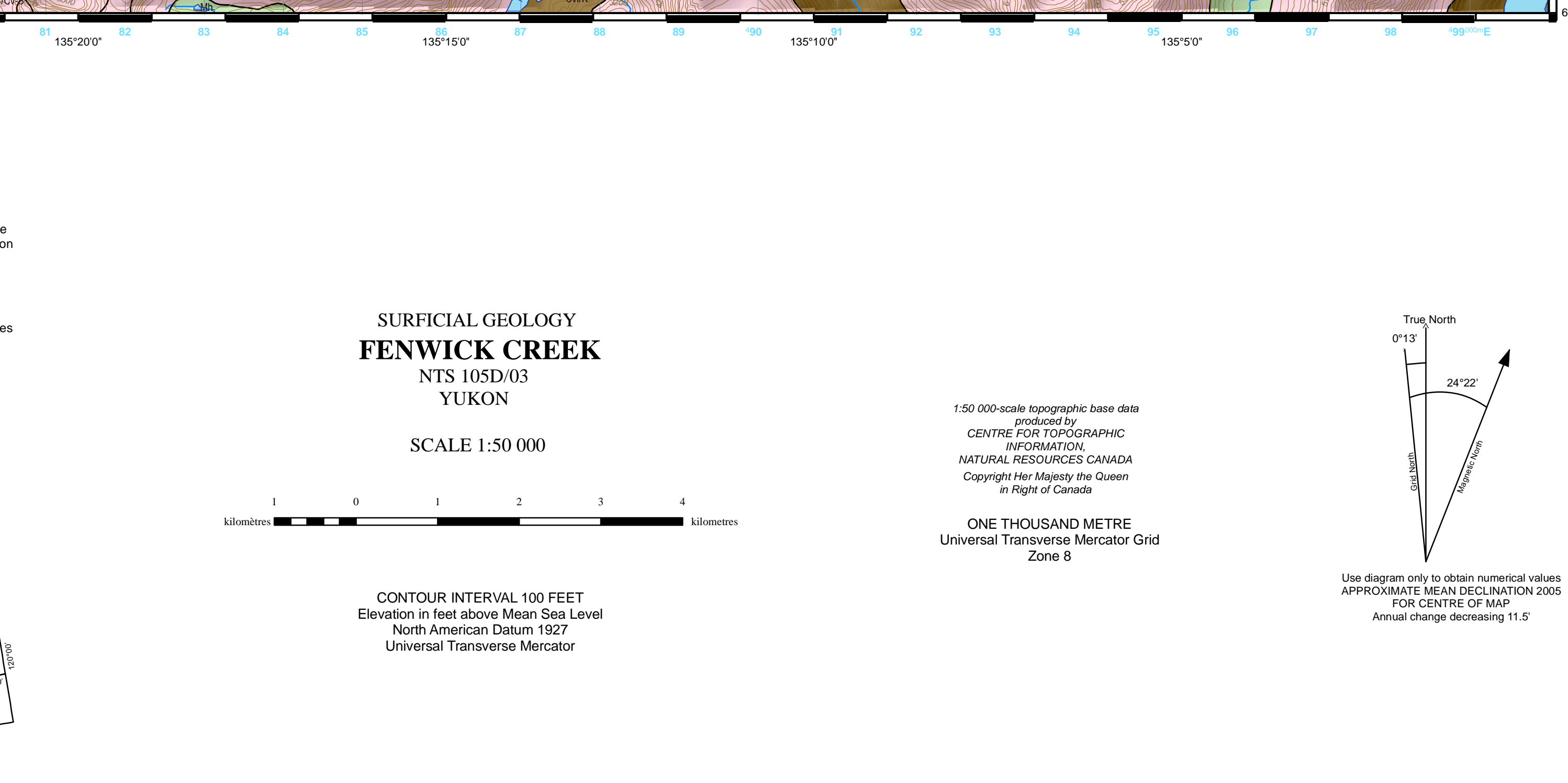
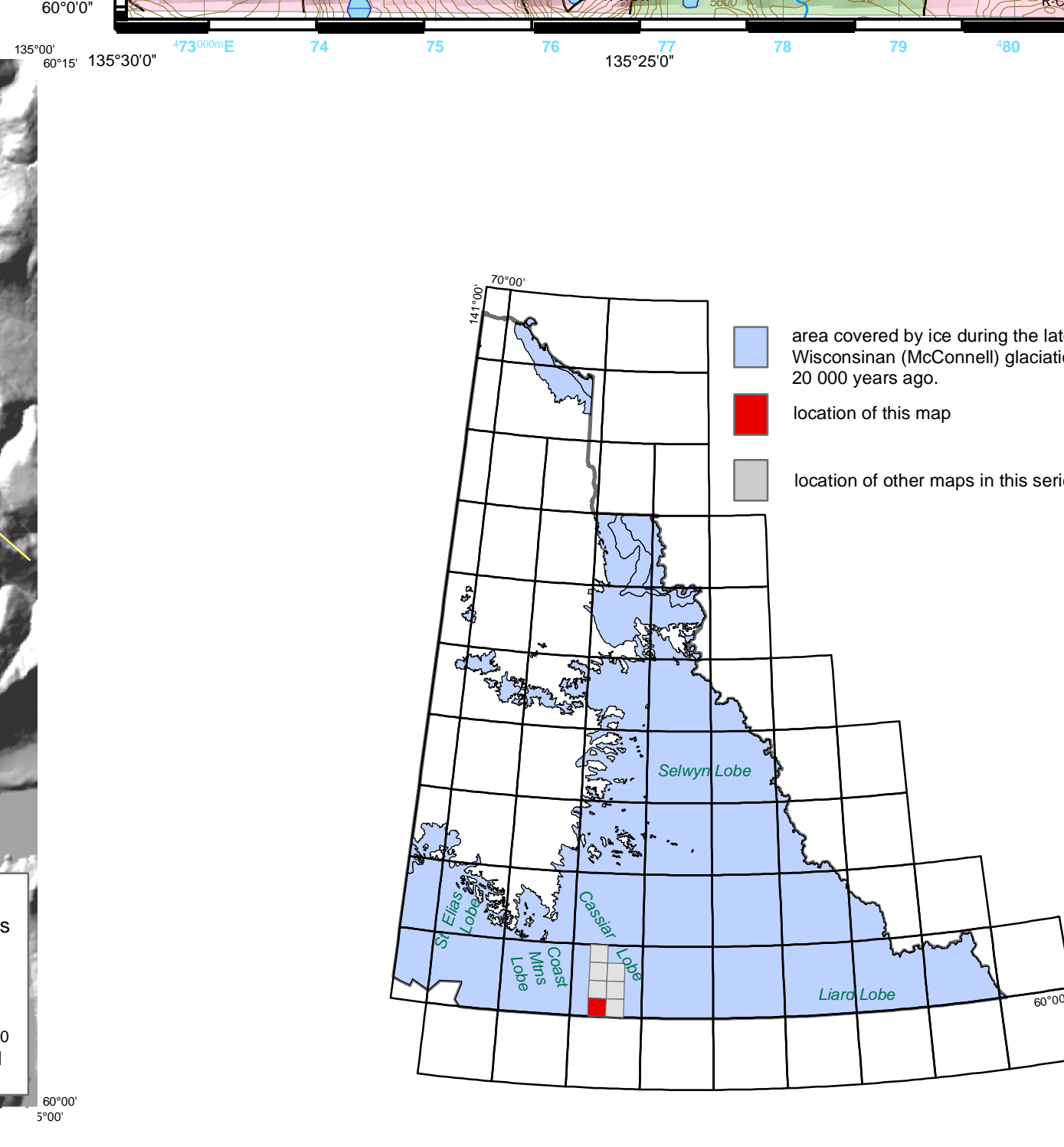
Figure 13. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

Figure 14. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

Figure 15. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

Figure 16. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.

Figure 17. A reach of the Wheaton River below Berner Creek showing the active and inactive portions of the floodplain.



105D/05	105D/06	105D/07
105D/04	105D/03	105D/02
105D/13	105D/14	105D/15

QUATERNARY

Fluvial Deposits: Sediment transported and deposited by streams and rivers, synchronous with about. General Description: deposits consist of gravels and sand, silt, and clay. They are typically rounded and contains interstitial sand. Fluvial deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph of the floodplain shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Organic Deposits: Materials resulting from biological growth, decay and accumulation in soil and peat. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Organic deposits are commonly massive to well-sorted. The bedform photograph shows an extensive drained peat bog near the summit of Tally-Ho Mountain. Organic deposits have accumulated in the poorly drained peat bog near the summit of Tally-Ho Mountain.

Glacier Ice (I) and Deposits (Mh): Areas of snow and ice when eroded or active glacier movement and ice margins retreat to present. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Glacier ice deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Colluvial Deposits: Sediments that have moved from their source position as a result of gravity. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Colluvial deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Late Pleistocene (Wisconsinan) McConnell Glaciation: The McConnell Glaciation was a major glacial advance that occurred in the Whitehorse area. It was characterized by the presence of moraines, alluvial fans, and rock glaciers. The McConnell Glaciation was a major glacial advance that occurred in the Whitehorse area.

Glacial Deposits (F0): Sediment deposited by a glacier. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Glacial deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Glacial Meltwater Deposits (L0): Sediment deposited by meltwater from a glacier. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Glacial meltwater deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Glacial Deposits (M): Sediment deposited by a glacier. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Glacial deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Glacial Deposits (R): Sediment deposited by a glacier. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Glacial deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Glacial Deposits (R): Sediment deposited by a glacier. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Glacial deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Glacial Deposits (R): Sediment deposited by a glacier. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Glacial deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Glacial Deposits (R): Sediment deposited by a glacier. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Glacial deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Glacial Deposits (R): Sediment deposited by a glacier. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Glacial deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Glacial Deposits (R): Sediment deposited by a glacier. General Description: deposits consist of peat, silt, and clay. They are typically rounded and contains interstitial sand. Glacial deposits are commonly massive to well-sorted. The bedform photograph shows the upper Wheaton River floodplain and flood sediments. The above photograph shows the upper Wheaton River floodplain and flood sediments.

Legend

Label	Name	Description
a	scorn	Material that has been transported down a slope and deposited in accumulations at the base of the slope.
b	delta	A deposit of unconsolidated material that through mass wasting migrates of the surface of the underlying material, but still conforms to the general underlying topography. A barrier is greater than 1 m thick and possesses no constructional forms typical of the material's genesis, outside of the underlying and/or are.
d	delta	Fill to gently sloping surface deposited at the mouth of a river in a body of water. Channel scars on the delta surface are commonly visible.
f	terrace	A flat to relatively smooth surface of a cone with a slope gradient from apex to toe to and including 15° (20%), and a longitudinal profile that is either straight, or slightly concave or convex. Commonly applied to bench terraces.
h	hummocky	Step-like irregular (and lobate) surface with multiple ridges and troughs. Commonly applied to bench terraces. Backwash slopes may be steep. Local relief is greater than 1 m. In plan, an assemblage of non-linear, generally chaotic forms that are rounded or irregular in cross-profile. Commonly applied to low-relief glacial terraces.
m	moraine	Erratic (hills) with slopes dominantly between 3 and 15° (5 to 25%) with local relief greater than 1 m. In plan, an assemblage of parallel or sub-parallel linear forms with subdued relief. Commonly applied to bedrock ridges and fans of streambed fill.
p	plain	A level or very gently sloping, unconsolidated (granular) surface with gradients 0.2° to 1° (0.3% to 1.7%). Local surface irregularities generally have a relief of less than 1 m. Applied to glacial/fluvioglacial, organic, deposits, lacustrine deposits and alluvial.
r	ridge(s)	Erratic (hills) with slopes dominantly between 15 and 30° (26 to 70%) composed of unconsolidated materials, bedrock slopes may be steep. Local relief is greater than 1 m. In plan, an assemblage of parallel or sub-parallel linear forms. Commonly applied to partitioned fill plains, eastern, moraine ridges, crosswise ridges and ridge bedrock.
s	step slope	An unconsolidated (granular) surface with gradients greater than 30° (70%), and a smooth longitudinal profile that is either straight, or slightly concave or convex. Local surface irregularities generally have a relief of less than 1 m. bedrock slopes may be more irregular. Commonly applied to bench terraces, gently sloping and bedrock cliffs.
t	terraced	A single or assemblage of step-like forms where each step-like form consists of a sharp face and a horizontal or gently inclined surface (bench) above it. Applied to fluvial and lacustrine terraces and stepped bedrock topography.
v	veneer	A layer of unconsolidated materials that to the minor irregularities of the surface of the underlying material. It is between about 10 cm and 1 m in thickness and possesses no constructional form typical of the material's genesis. Commonly applied to wetland loess and cultural veneers.
x	complex	A combination of several surface expressions.

SURFACE EXPRESSION

Surface expression refers to the form (assemblage of slopes) and pattern of forms expressed by a surficial material at the land surface. The three-dimensional shape of the material is equivalent to bedform. Labels are defined as follows: a) ridge, plain, surface irregularities (hills) and terrace, the material in which unconsolidated surficial materials show the underlying substrate (e.g., veneer). Surface expression is indicated by up to three lower case letters, placed immediately following the surficial material descriptor, listed in order of descending extent.

GEOMORPHOLOGICAL PROCESSES

Geomorphological processes are natural mechanisms of weathering, erosion and deposition that result in the modification of the surficial materials and landforms at the earth's surface. Processes are indicated by up to three upper case letters, listed in order of decreasing importance, placed after the surface expression symbol, and separated from the surface expression by a dash (-).

Group	Process	Label	Description
Erosional Processes	deflation	D	Removal of sand and silt particles from unconsolidated materials by wind.
	gully incision	G	Channelized by subsidence and/or erosion to melting ground in periglacial areas.
	rolling	R	Rolling water: most common and/or snow abscision, resulting in the formation of parallel and subparallel long, narrow features.
	washing	W	Rolling water: locally, spring water (e.g., meltwater), resulting in lag deposits formed by the removal of fines from a mixture of coarse and fine particles.
Mass Movement Processes	avalanche	A	Rapid downslope movement of snow and ice, as well as unconsolidated rock, surficial material and vegetation debris, by flowing or sliding.
	sliding	F	Downward movement of massive or non-massive surficial material and/or bedrock by creeping, flowing or sliding.
Periglacial Processes	cryonivation	C	Movement of surficial materials by heating and/or churning due to frost action (freezing and thawing).
	erosion	N	Erosion of bedrock or surficial materials beneath and along the margin of snow patches by freeze-thaw processes (that undercuts and heaves, meltwater action and snow).
Sedimentation Processes	sedimentation	S	Slow gravitational downward movement of saturated non-frozen overburden across a frozen or otherwise impermeable substrate.
	permafrost processes	X	Processes controlled by the presence of permafrost, and permafrost aggradation or degradation. Applies to areas with long-term permafrost (tundra, tundra, tundra and tundra).
Digital Processes	channeled by meltwater	E	Erosion and channel formation by meltwater alongside, beneath, or in front of a glacier.
	depression	D	Depressions in surficial materials resulting from the melting of buried glacier ice.

TEXTURE

Describes the dominant size of particles in mineral sediments and the fiber content of organic materials. Texture is indicated by up to three lower case letters.

Label	Name	Description
a	blocky	Angular particles greater than 256 mm in size.
b	clayey	More than 50% clay.
c	gravelly	Two or more size ranges of rounded particles greater than 2 mm, but may include interstitial sand.
d	fine	Most of the soil is clay.
e	loose	Rounded particles greater than 256 mm in size.
f	loose	Most of the soil is clay.
g	loose	Rounded particles having a diameter of 2-64 mm.
h	loose	Rounded particles having a diameter of 2-64 mm.
i	loose	Most of the soil is clay.
j	loose	Most of the soil is clay.
k	loose	Most of the soil is clay.
l	loose	Most of the soil is clay.
m	loose	Most of the soil is clay.
n	loose	Most of the soil is clay.
o	loose	Most of the soil is clay.
p	loose	Most of the soil is clay.
q	loose	Most of the soil is clay.
r	loose	Most of the soil is clay.
s	loose	Most of the soil is clay.
t	loose	Most of the soil is clay.
u	loose	Most of the soil is clay.
v	loose	Most of the soil is clay.
w	loose	Most of the soil is clay.
x	loose	Most of the soil is clay.
y	loose	Most of the soil is clay.
z	loose	Most of the soil is clay.

SYMBOLS

	glacially aligned landform; includes: drumlins, crags and talus, rock-free mounds, ridges, grooves and steeps. These landforms indicate glacial flow direction.
	esker, known direction
	esker, unknown direction
	moraine ridge
	glacial meltwater channel - minor
	glacial meltwater channel - major
	glacial lake strand lines
	cirque
	escarpment
	escarpment - falling
	landslide
	recessional glacial limit
	Bond site locations
	roads

GEOLOGICAL BOUNDARIES

	defined
	approximate
	assumed

REFERENCES

- Dak-Rodkin, A., 1999. Glacial limits map of Yukon. Exploration and Geological Services Division, Yukon Region, Indian and Northern Affairs Canada. Geoscience Map 1999-2; also known as Geological Survey of Canada, Open File 3694, 1:1 000 000 scale.
- Lowy, G.W., 2005. Sedimentology, stratigraphy and source rock potential of the Richthofen formation (Jurassic), northern Whitehorse Trough, Yukon. In: Yukon Exploration and Geological Survey 2004, D.S. Emord, L.L. Lewis and G. Bradshaw (eds.), Yukon Geological Survey, p. 177-191.
- Morison, S.R., McKenna, K., and Davies, S., 1982. Soils and surficial geology, Southern Lakes Project (Maps 105D SE, SW, NE, NW). Resource Planning and Management Branch, Department of Renewable Resources, Government of Yukon.
- Mougeot, C., 1997. Soil, terrain and wetland surveys, City of Whitehorse. Mougout GeoAnalysis, Whitehorse, Yukon.
- Wheeler, J.O., 1961. Whitehorse Map-Area, Yukon Territory 105D. Geological Survey of Canada, Memoir 312, 156 p.

RECOMMENDED CITATION

Bond, J.D., Morison, S. and McKenna, K. Surficial Geology of Fenwick Creek (1:50 000 scale). Yukon Geological Survey, Geoscience Map 2005-3.

Digital cartography and drafting by Gary Carriere and Olwyn Bruce, Yukon Geological Survey.

Original mapping and drafting completed by S. Morison, K. McKenna and S. Davies (1982). Subsequent mapping and compilation completed by J.D. Bond (2005-2004).

Any revisions or additional geological information known to the user would be welcomed by the Yukon Geological Survey.

Paper copies of this map may be purchased from Geoscience Information and Sales, c/o Whitehorse Mining Recorder, Energy,

Yukon Geological Survey
Energy, Mines and Resources
Government of Yukon

Geoscience Map 2005-3
Surficial Geology of Fenwick Creek (NTS 105D/03),
Yukon (1:50 000 scale)

by
J.D. Bond, S.R. Morison and K. McKenna