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OPEN FILE 8236

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Introduction

The Geological Survey of Canada (GSC) through the Geo-mapping for Energy and Minerals Program (GEM) has undertaken the Geological Map Flow project (GMF) to develop protocols for the collection, management (compilation, interpretation), and dissemination of surficial and bedrock geology data and map information. This document presents the version 2.3.0 of the science language implemented in the GIS data model and workflow for the production of surficial geology maps and datasets at the GSC. It represents an update by the GSC Surficial Geology Legend Committee to the Surficial Data Model (SDM) version 2.2.0 that was published by Cocking et al., 2016.

Background and objective

The science language for surficial geology maps was designed with the aim of facilitating the transition from the traditional way of publishing paper maps to the production of standardized digital data sets with a structured database. Hence, the focus of this document is based on symbolization with an effort to standardize the scientific terminology used to describe the various entities present on a surficial geology map. The GIS data model and workflow are implemented using the ESRI™ ArcGIS™ geodatabase and software.

The science language originated from an extensive review of existing geological data models and map legends (Canadian and international). It was then refined by a small working group, known as the GSC Surficial Legend Review Committee, through iterative consultations with GSC surficial geology mappers. The first version of the surficial data model was published as version 1.2 (Deblonde et al., 2012). The working group consists of surficial geology mappers, science editors, and GIS experts.

This Open File contains a summary of additions and modifications (new map units, line and point symbols, feature subtypes, notes on usage, etc.), and a revised suggested order of map units as well as symbols for legends. This Open File includes two posters, Appendix 4: Map Unit Polygons and Appendix 5: Geomorphological Features.

New users are encouraged to review Open File 7631 and Open File 7741 for a complete description of the Surficial Data Model. Open File 7631 also contains one poster: 'Appendix A. Science Language Poster version 2.0.'

Following the implementation of version 1.2 of the data model and workflow, all comments and change requests provided by the GSC surficial geology mappers and GIS users were evaluated by the GSC Surficial Legend Review Committee and when required were discussed with the submitters. This Open File presents the resulting updated version of the surficial data model: version 2.3.0. Table A briefly describes how the data model has evolved:

Table A-A brief history of the Surficial Data Model.

Version	Description
1.2	First version available for GSC use
2.0	Minor changes to the geodatabase schema and several additions and modifications to the geomorphological features and map units
2.0.1/2.0.2	Minor typographical edits
2.1.0	Minor additions of new features; addition of geological terms in French in documentation only
2.2.0	Minor additions of new features; removed redundant symbols between geomorphological points and field observations and measurements
2.3.0	Minor additions of new features; addition of new fields to support transferring data to FGP

Submitting changes to the Surficial Data Model

The science language for surficial geology maps produced by the GSC will continue to evolve as per the requirements of surficial geology mappers. The science language will be annually updated if required. Submission for additions or changes by GSC mappers should be made using these editable PDF forms:

Surficial Feature Modification Form (English)	PDF	Use this form to submit suggestions for a symbol for a surficial geological feature.
Formulaire visant la modification d'entités superficielles (Français)	PDF	Utilisez ce formulaire pour soumettre des suggestions pour un symbole pour une structure géologique des dépôts meubles.

Completed forms should be sent to the "Surficial Geology Legend/Légende des formations superficielles" email available in the Natural Resources Canada internal email address list. Questions, comments, and suggested changes by collaborators outside the GSC are welcome. They can be sent to any of the authors of this publication. The annual deadline for submitting suggested changes or additions is November 1st.

All submissions will be reviewed by the Surficial Legend Review Committee by December 1st of that year, and approved changes will be implemented in the surficial data model by February 1st of the following year. Requested changes should be submitted as soon as they are identified by mappers to avoid a large number of review requests in November of each year.

Science language and symbolization

As an integral part of the data model, this document presents changes to the science language and data symbolization required to produce standardized surficial geology data and maps at a scale of 1:100 000; however, the same symbols and units are applicable for surficial geology maps at a range of scales.

The science language is divided into three components:

1. Map units (polygons and boundaries)
2. Geomorphological features (polygons, lines, and points)
3. Field observations and measurements (Field observations and measurements are digitally recorded using a field data collection tool (i.e. GanFeld).)

A summary of the additions and modifications are presented in Appendix 1.

Map Units

Map-unit definition

A map unit is defined as an area of ground distinguishable from surrounding areas by field observation and/or remotely sensed data (e.g. aerial photographs). Map units are based on the physical extent and geometry of the unconsolidated sediments lying between the bedrock and the surface, the sediment properties and characteristics (composition, stratigraphy, surface morphology, thickness, and other properties), and their relationship to other map units. Map units are delineated either in the field or on imagery based on, for example, morphology, thickness, tone, texture, patterns, landform association, vegetation, or feature orientation. These attributes are then used to infer environment of deposition, genesis, and relative geological age. Field sites show where the map unit has been verified with ground observations.

Map-unit designators

A map unit is defined as a combination of upper- and lower-case letters that constitute the map-unit designators (e.g. Cz, Ap) (Fig. 1). One or two upper-case letters defines the dominant primary genesis of the sediments, process and/or environment of deposition, for example:

GL = glaciolacustrine sediments
A = alluvial sediments.

The genesis is followed by one or two lower-case letters that define the category and reflect one of the following (Fig. 1a):

- morphology
- environment of deposition
- thickness of deposit
- secondary processes

If required, the category is followed by a number that defines the subcategory of the map unit (Fig. 1b). The subcategory reflects the following:

- a geological process
- a depositional environment
- the sediment composition
- the structure

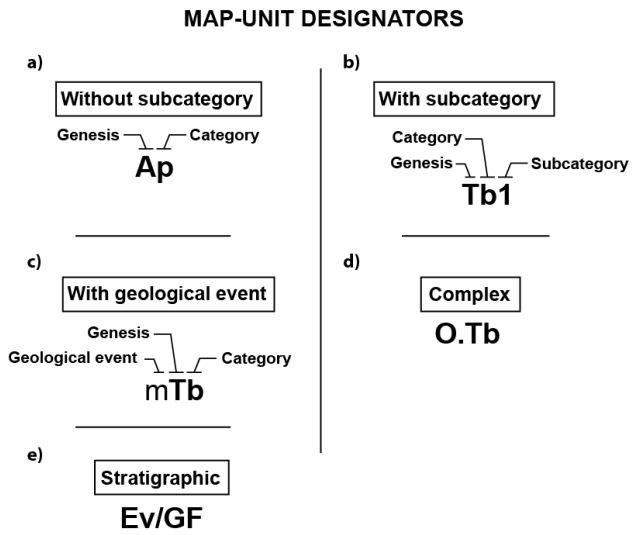

Figure 1 - Map-unit designators as labelled on maps.

If for a given map unit, there is only one subcategory present within the map area (for example, all landslides are retrogressive thaw flow, Cz3), the subcategory is not necessary for the map unit designator but is captured in the database.

In addition to subcategories, map units might need to be differentiated based on geological events. Geological events are defined based on time, provenance, depositional events, or erosional events, and can be divided according to one of the four following characteristics:

1. Chronostratigraphy (e.g. Late Wisconsinan versus Holocene)
2. Ice provenance (e.g. Laurentide versus Cordilleran ice sheets)
3. Glacial and nonglacial intervals of known or unknown absolute age (e.g. Amundsen glaciation and Liverpool Bay interglaciation)

4. Ice readvance (e.g. Tuk Phase ice advance)

The geological-event attribute can be depicted on a map as a prefix in front of the map-unit designator (Fig. 1c). The Appendix presents the current list of geological-event prefixes for map-unit designators. Each prefix is unique.

If a single geological-event attribute is present within a map area, the prefix is not necessary for the map-unit designator but is captured in the database. A prefix is only used for maps with two or more identical map units with different geological-event attribute (e.g. Late Wisconsinan (lw) till versus Neoglacial (n) till). In such a case, the geological-event prefix is mandatory for at least one of the map-unit designators to permit differentiation on the map.

Using the example above, a map with abundant Late Wisconsinan till-blanket polygons and few Neoglacial till-blanket polygons will preferably depict the former as Tb and the latter as nTb. lwTb may not be preferable, as the Late Wisconsinan time and/or provenance attribute (lw) would be the dominant and default geological-event attribute on the map; however, the author has the option to include the attribute prefixes for both types of time and/or provenance polygons, although it is not generally recommended.

As a general principle, the use of a single map-unit designator per polygon is preferred. A maximum of two map-unit designators can be used in cases where the surficial cover forms a complex pattern and the map units are too small to be mapped individually, yet constitute a significant areal extent of the total polygon (e.g. O.Tb designates an area of organic deposits with numerous outcrops of till blanket). In such instances a dot ('.') is used to separate the map-unit designators (Fig. 1d).

Also, a stratigraphic relationship can be shown with a maximum of two map-unit designators separated by a slash ('/') (e.g. Ev/GF indicates Ev (eolian veneer) overlying GF (glaciofluvial sediments) (Fig. 1e). In both cases of using multiple map-unit designators, the first or the overlying designator determines the map-unit colour. The use of complex designators is not recommended where it is otherwise implicit (e.g. Tv.R or Tv/R). The second designator must also be included in the map legend. **Surficial geology mappers are encouraged to limit the use of complex designators and to avoid mapping large areas with complex designators.**

Examples of map-unit information in the database can be found in Appendix 1.

Map-unit legend description

In the legend, map-unit descriptions should be presented in the following order: map-unit name, grain size, structure, colour, minimum and maximum thickness, morphology, stratigraphic relationships, depositional environment, and other characteristic features.

Map-unit legend order

Map-units in the legend should generally follow a chronological order with the oldest at the bottom and youngest at the top. The order might need to be adapted specifically to a map area.

Map-unit boundaries

Five types of geological boundaries are available to mappers: **defined**, **approximate**, **inferred**, **concealed**, and **arbitrary** through water. Defined, approximate, and inferred boundaries are used, in decreasing order, to define the level of confidence of the location of a map-unit boundary. A concealed boundary can be used, for example, where a defined boundary is now under water since the area was flooded following the construction of a water reservoir. Arbitrary boundaries through water are used

during map production to close all polygons under water bodies. This contact type is not shown on the final published map.

Geomorphological features (polygons, lines, and points)

Geomorphological feature definition

Geomorphological features are landforms, sediments, or locations where specific data were collected. Depending on the mapping scale and the size of the feature on the ground, the observation will be represented as a polygon, a line, or a point superimposed on the map-unit polygon. Appendices 5, 6, and 7 show the list of changes to the geomorphological features.

Like the map units, geomorphological features are characterized by the environment of deposition, genesis, and relative geological age. These characteristics may be identical or different from the underlying map unit. For example, drumlins (geomorphological feature) could have the same environment of deposition, genesis, and relative age as the underlying till unit, but an active dune field could have different characteristics than the underlying glaciofluvial map unit. Furthermore, for certain features (e.g. terrace scarp, beach crest) the environment of formation generally can be deduced from the underlying and surrounding polygons, but it is also specified in the database.

Similar to map polygons, geological events can be associated with points, lines, overlay polygons, and field observations. They are not labeled on the map but captured in the database in the 'Geological event name' field.

Field observations and measurements are separated from other point features in the database to maintain this supplemental data collected in the field.

Overlay Polygon (GEM_POLYS)

An overlay polygon feature can either delineate a grouping of common thematic features that are too small to be mapped individually or a feature that is large enough to be shown as an area. The outline of the feature is digitized to be represented as a patterned symbol.

Line (GEM_LINES)

Use a geomorphology line if the feature is too small to be shown as an area, but long enough to show its true length. The location, length, and orientation of the central axis are shown. The linear axis of the feature is digitized to be represented as a linear symbol. All line symbols are drawn to scale using the right-side rule: the arrow appears at the end of the line, and the ornamentation appears on the right side of the line as shown in Figure 2.

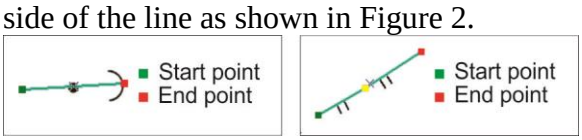

Figure 2 - Line digitizing direction.

Point (GEM_POINTS)

Use a geomorphology point if the feature is too small to be shown to scale as an area or a line. The centre location and orientation are shown. The centre location and direction of the feature are digitized to be represented as a point symbol. All point symbols are oriented with zero degrees pointing to the north and based at the centre of the symbol (Fig. 3).

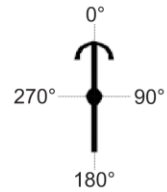

Figure 3 - Point digitizing direction

Field observations and measurements symbolized on maps

Field observations and measurement definition

Field observations and measurement information is recorded using a field data collection tool (i.e. GanFeld). Only the information that can be represented as a symbol on a map is shown in the field observations and measurements table. The central location of the field site is digitized to be represented as a point symbol. Figure 4 shows the different data-collection processes.

In previous versions of the surficial data model, features that can appear as both field observation points and as geomorphology points had different symbols. For example, a hummock was symbolized as 3.14.01.016 in F_STATIONS and 3.14.01.019 in GEM_POINTS despite using the same symbol. This version changes this so F_STATIONS and GEM_POINTS use the same symbol (3.14.01.019).

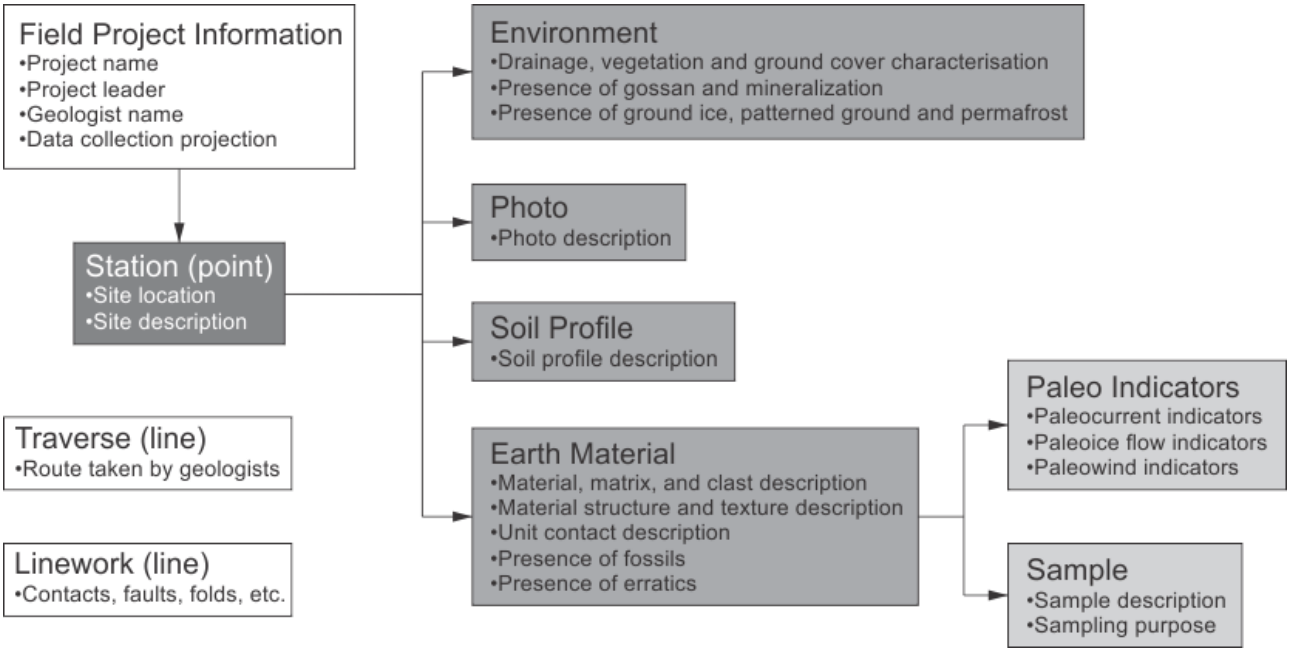

Figure 4 – Field data collection process.

Geomorphological feature order in the map legend

Line and point symbols should be placed below the map units. Like the map units, they should be listed in order of age with the youngest at the top. Generally, features on bedrock are assumed to be oldest. Features formed in subglacial settings are older than those associated with subaerial ice-contact processes, which are assumed to be older than features associated to proglacial sedimentation. Proglacial outwash features are assumed to be older than glacial-lake features. Items that do not have a geological time connotation (e.g. sampling site, gravel pit, field station) are placed at the bottom of the list.

References

Deblonde, C., Plouffe, A., Boisvert, E., Buller, G., Davenport, P., Everett, D., Huntley, D., Inglis, E., Kerr, D., Moore, A., Paradis, S. J., Parent, M., Smith, R., St-Onge, D., and Weatherston, A., 2012. Science language for an integrated Geological Survey of Canada data model for surficial maps, **version 1.2**; Geological Survey of Canada, Open File 7003, 238 p. doi:10.4095/290144

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Cocking, R.B., Deblonde, C., Kerr, D.E., Campbell, J.E., Eagles, S., Everett, D., Huntley, D.H., Inglis, E., Laviolette, A., Parent, M., Plouffe, A., Robertson, L., Smith, I.R., and Weatherston, A., 2016. Surficial Data Model, **version 2.2.0**: Revisions to the science language of the integrated Geological Survey of Canada data model for surficial geology maps; Geological Survey of Canada, Open File 8041, 45 p. doi:10.4095/298767

Acknowledgments

The science language presented here is the result of years of research and collaboration by many research scientists and GIS specialists across the GSC. The GMF project through the GEM program has been the catalyst for the accrued interest and involvement of the GSC community.

The first version of the model (1.2) was reviewed by I. McMartin and J. Bednarski. É. Boisvert, P. Davenport, and S.J. Paradis were major contributors to the initial version of the science language. At one time or another, many people have made a contribution to the model through discussions and comments including J.E. Campbell, A. Duk-Rodkin, A. Dyke, I. McMartin, R. Paulen, and D. Sharpe for the science language, and R. Boivin, M. Boutin, P. Brouillette, V. Dohar, É. Girard, G. Huot-Vézina, G. Lai, D. Lemay, L. MacDonald, K. Shimamura, and S. Williams for the data model.

The current surficial legend review committee includes the surficial geologists A. Plouffe, J.E. Campbell, D.H. Huntley, D.E. Kerr (committee chair), M. Parent, I.R. Smith, and D. St-Onge; the scientific editors E. Inglis, and A. Weatherston; the surficial data model developer C. Deblonde, documentation specialist R. Cocking; and the GIS specialists S. Eagles, D. Everett, and L. Robertson.

Comments and suggestions can be forwarded to any member of the surficial legend review committee.

Appendix 1

New feature classes

P_INDEXMAP_GSC83:
This new polygon feature class stores publication metadata and is used to assist in porting data into the Federal Geospatial Platform (FGP). This feature class can be related to existing feature classes through the new *MAP_PID* field. P_INDEXMAP_GSC83 has the GCS_North_American_1983 projection. The following table shows the data structure:

Field Name	Data Type	Length	Domain	Description
MAP_PID	Text	12		Map specific ID that links to feature classes
GEOSCAN_ID	Long integer	10		Map specific GEOSCAN ID given to a publication within the GEOSCAN database
PUB_SERIES_DID	Short integer	5	PUBLICATION_SERIES_DID	The publication series of the map, e.g. Geological Survey of Canada, Canadian Geoscience Map
PUB_ISSUE	Text	10		The publication issue within the series of the map, e.g. 8041
PUB_MAPNUMBER	Short integer	5		The map sheet number within the issue of the map, e.g. 2
PUB_YEAR	Short integer	5		The year up the map's publication
PUB_SCALE_PID	Long integer	10	SCALE_PID	The cartographic scale of the map publication
PUB_TITLE	Text	250		The title of the map publication
PUB _AUTHOR	Text	500		The authors of the map publication
PROV_TERRI_1_DID	Text	10	PROV_TERR_DID	The first province or territory where the map publication resides
PROV_TERRI_2_DID	Text	10	PROV_TERR_DID	The second province or territory where the map publication resides (where applicable)
CITATION	Text	255		The recommended citation of the map publication
THUMBNAIL_URL	Text	250		The URL of the thumbnail image of the map publication
DOI	Text	14		The digital object identifier given to the map publication
ISBN	Text	17		The international standard book number given to the map publication
CATALOG_ID	Text	22		The catalog ID given to the map publication
PUB_SERIES_TEXT	Text	100		The text version of the publication series
REMARKS	Text	255		Remarks by an author or technical staff to describe the map publication in further detail
ABSTRACT	Text	2147483647		The English version of the abstract as seen in the map publication
RESUME	Text	2147483647		The French version of the abstract as seen in the map publication
SHAPE_Length	Double			
SHAPE_Area	Double			

A field called *MAP_PID* (Text, 12) has been added to each of the following nine feature classes:

- F_LINEWORK
- F_STATIONS
- F_TRAVERSE
- GEM_LINES
- GEM_POINTS
- GEM_POLYS
- GEO_BOUND
- GEO_LABELS
- GEO_POLYS

New features

Notes:
Bold green text denotes the default value for the field.

Ground ice (all)
GEM_POINTS

Ground ice (all)	**3.12.01.019**	

Field Name	Code	Code Description
Feature-type grouping		Permafrost and periglacial features
Feature-type GIS control field	1891002	Ground ice (all)
Feature type	**189**	Ground ice
Feature-type subset	**283**	Unspecified
	141	Segregated ice
	142	Glacier Ice
Feature-type status	**293**	Not applicable
Feature-type environment	**310**	Not applicable
Feature-type direction and/or orientation (azimuth)	Range	Not applicable
Feature-type generation	Range	Not applicable
Feature-type GSC symbol code	**3.12.01.019**	Ground ice (all)
Feature-type notes on symbol usage		• Point of observation is based at midpoint of symbol.

Mineral occurrence (all)
GEM_POINTS

Mineral occurrence (all)	**3.04.01.008**	

Field Name	**Code**	**Code Description**
Feature-type grouping		Bedrock features
Feature-type GIS control field	1901002	Mineral occurrence (all)
Feature type	**190**	Mineral occurrence
Feature-type subset	**283**	Unspecified
	610	Showing
	611	Prospect
	612	Developed prospect
	613	Deposit
	614	Production
	615	Past production
	616	Unknown
Feature-type status	**293**	Not applicable
Feature-type direction (sense)	**300**	Not applicable
Feature-type environment	**310**	Not applicable
Feature-type direction and/or orientation (azimuth)	Range	Not applicable
Feature-type generation	Range	Not applicable
Feature-type GSC symbol code	**3.04.01.008**	Mineral occurrence (all)
Feature-type notes on symbol usage		• Point of observation is based at midpoint of symbol.

- **Removed the default value for all the *HYDRO_INTERSCT_DID* fields**
- **Removed the default value and set null allowed to YES for all the *DISPLAY_PUB_DID* fields**

Changes to map-unit polygons (GEO_POLYS)

- **x: Map unit to be defined (all)**

  Map-unit “x: To be defined (all)” renamed to “**x: Map unit to be defined (all)**”
  Affects the *F_TYPE_DID*, *CONTROL_SID* and *SYMBOL1_DID* fields.

x: Map unit to be defined (all)	2.01.01.010	

Changes to map-unit boundaries (GEO_BOUND)

- **Geological boundary coincident 5341002: default values set to location confidence Defined.**

Changes to geomorphological overlay polygons (GEM_POLYS)

- **Overlay polygon feature to be defined (all)**

  Overlay polygon feature "To be defined (all)" renamed to "**Overlay polygon feature to be defined (all)**"
  Affects the *F_TYPE_DID*, *CONTROL_SID* and *SYMBOL1_DID* fields.

Overlay polygon feature to be defined (all)	2.01.01.009	

Changes to geomorphological lines (GEM_LINES)

- **Line feature to be defined (all)**

  Line feature "To be defined (all)" renamed to "**Line feature to be defined (all)**"
  Affects the *F_TYPE_DID*, *CONTROL_SID* and *SYMBOL1_DID* fields.

Line feature to be defined (all)	2.01.01.009	

- **Minor meltwater channel central axis (marginal, overflow, subglacial, supraglacial or unspecified; direction unknown or unspecified)**

  "Lateral" removed as a subtype.
  Affects the *CONTROL_SID*, *FT_SUBSET_DID* and *SYMBOL1_DID* fields.

Changes to geomorphological points (GEM_POINTS)

- **Point feature to be defined (all)**

  Point feature "To be defined (all)" renamed to "**Point feature to be defined (all)**".
  Affects the *F_TYPE_DID*, *CONTROL_SID* and *SYMBOL1_DID* fields.

Point feature to be defined (all)	2.01.01.006	

- **Change to SENSE_DID attributes**

  The following GEM_POINTS features were given the possible attributes of "unknown" and "unspecified" in the *SENSE_DID* field:
  1. Avalanche track (181002)
  2. Debris-flow track (1821002)
  3. Landslide scar (1831002)
  4. Retrogressive thaw flow (1841002)
  5. Unspecified slope movement (1851002)
  6. Gelifluction-lobe or solifluction-lobe (1261002)
  7. Rock glacier (4311002)
  8. Alluvial fan (4091002)
  9. Ice-contact delta (4161002)

Changes to field station (F_STATION)

- **Field observation feature to be defined (all)**

  Field observation feature "To be defined (all)" renamed to "**Field observation feature to be defined (all)**"
  Affects the *F_TYPE_DID*, *CONTROL_SID* and *SYMBOL1_DID* fields.

Field observation feature to be defined (all)	2.01.01.007	

- **Removed the *HasM* field**

Changes to photo table (F_Photo)

- **Added DIRECTION_DID domain to the *DIRECTION_DID* field to store the direction that the camera was facing.**

Changes to data source table (P_DATA_SOURCE)

- **Changed GEOSCAN_ID field from text to long integer**
- **Changed SOURCE_CITATION field name and field alias to CITATION**

Changes to geological events domain

Notes:
Only items that have changed appear in the columns of version 2.3.0. New (**in blue**) and revised (**in red**) items are highlighted in the table.

- **Replaced descriptions (the description was repeated twice)**
- **Added Recent 'r'**
- **Renamed Reid glaciation to 're'**

Chronostratigraphy

Geological event category	Geological event name	Geological event prefix
CHRONOSTRATIGRAPHY	**Recent**	**r**
	Neoglacial	n
	Early Holocene	eh
	Holocene	h
	Pleistocene	p
	Late Pleistocene	lp
	Middle Pleistocene	mp
	Early Pleistocene	ep
	Wisconsin(an)	w
	Late Wisconsin(an)	lw
	Pre-Late Wisconsin(an)	plw
	Middle Wisconsin(an)	mw
	Early Wisconsin(an)	ew
	Pliocene	pi
	Sangamon(ian)	s
	Quaternary	q
	Middle Quaternary	mq

Interglaciation

Geological event category	Geological event name	Geological event prefix
INTERGLACIATION	Liverpool Bay interglaciation	lbi
	Morgan Bluffs interglaciation	mb
	Cape Collinson interglaciation	cc

Ice provenance

Geological event category	Geological event name	Geological event prefix
ICE PROVENANCE	Laurentide Ice Sheet	l
	Pre-Laurentide Ice	pl
	Cordilleran Ice Sheet	c
	Hybrid montane and Laurentide Ice	hy
	Innuitian Ice	i
	Melville Ice	mi
	Keewatin Sector Ice	ks
	Labrador Sector Ice	ls

Glaciation

Geological event category	Geological event name	Geological event prefix
GLACIATION	Amundsen glaciation	a
	Amundsen glaciation (Russell stade)	ar
	Amundsen glaciation (Viscount Melville lobe)	av
	Amundsen glaciation (M'Clure stade)	am
	Amundsen glaciation (M'Clure stade, Prince of Wales lobe)	amw
	Amundsen glaciation (M'Clure stade, Thesiger lobe)	amt
	Amundsen glaciation (M'Clure stade, Prince Alfred lobe)	amp
	Thomsen glaciation	t
	Banks glaciation	b
	McConnell glaciation	m
	Buckland glaciation	bu
	Pre-Buckland **glaciation**	pbu
	Reid glaciation	**re**
	Pre-Reid glaciations	pr
	Klaza glaciation	k
	Nansen glaciation	ns
	Mountain River glaciation	mm
	Gayna River glaciation	gr
	Vashon glaciation	v
	Pre-Vashon glaciation	pv
	Fraser glaciation	f
	Pre-Fraser glaciation	**pf**
	Illinoian glaciation	il

Glacial advance/readvance

Geological event category	Geological event name	Geological event prefix
GLACIAL ADVANCE/READVANCE	Fraser glaciation ice advance	fa
	Tutsieta Lake Phase ice advance	tl
	Kelly Lake Phase ice advance	kl
	Katherine Creek Phase ice advance	kc
	Sitidgi Stade ice advance	si
	Tuk Phase ice advance	tu
	Toker Point Stade/Member ice advance	tp
	Franklin Bay Stade ice advance	fb
	Mason River glaciation ice advance	mr
	Hadley Bay readvance	hb

Other

Geological event category	Geological event name	Geological event prefix
Other	Uncertain; Uncorrelated; Undifferentiated age	un

Examples of map-unit information in the geodatabase

Database fields	Map-unit designators as labeled on maps				
	Ap	**O.Tb**	**Cz2**	**Ev/GF**	**GFt**
Primary unit. Map-unit GIS control field.	Ap: Alluvial sediments - Floodplain sediments (All)	O: Organic deposits - Undifferentiated deposits (All)	Cz2: Colluvial and mass-wasting deposits - Landslide deposits (Mud flow)	Ev: Eolian sediments - Veneer (All)	GFt: Glaciofluvial sediments - Terraced sediments (All)
Primary unit. Map-unit type.	Alluvial sediments - Floodplain sediments	Organic deposits - Undifferentiated deposits	Colluvial and mass-wasting deposits - Landslide deposits	Eolian sediments - Veneer	Glaciofluvial sediments - Terraced sediments
Primary unit. Map-unit subcategory.	Not applicable	Not applicable	Mud flow	Not applicable	Not applicable
Primary unit. Map-unit label.	Ap	O	Cz2	Ev	GFt
Primary unit. Map-unit geological event.		Holocene			Neoglacial
Primary unit. Map-unit GSC symbol code.	3.01.04.265	3.02.02.012	3.01.01.155	3.01.03.292	3.01.07.249
Relation between primary and secondary units	None	Complex	None	Stratigraphic	None
Secondary unit. Map-unit type.		Glacial sediments - Blanket		Glaciofluvial sediments - Undifferentiated sediments	
Secondary unit. Map-unit subcategory.		Unspecified		Not applicable	
Secondary unit. Map-unit label.		Tb		GF	
Secondary unit. Map-unit geological event.		Reid Glaciation			
Map-unit remarks.	Last flooded in 2006				

Appendix 2

All features in legend order

Short name	Symbol Code	Symbol
Glacier ice or snowpack		
Isn: Glacial Ice or Snowpack - Snowpacks (all)	3.01.15.001	
I: Glacial Ice or Snowpack - Glacier or icefield or icecap (all)	3.01.15.002	
Anthropogenic		
H: Anthropogenic deposits - Undifferentiated (all)	3.01.14.715	RGB: 193 / 139 / 138 CMYK: 24 / 45 / 46 / 0
Organic		
Owf: Organic deposits - Fen deposits (all)	3.01.02.011	RGB: 231 / 231 / 232 CMYK: 9 / 9 / 9 / 0
Owb: Organic deposits - Bog deposits (all)	3.01.02.013	RGB: 189 / 190 / 193 CMYK: 26 / 25 / 24 / 0
Ows: Organic deposits - Salt marsh (all)	3.01.02.015	RGB: 148 / 149 / 153 CMYK: 42 / 42 / 40 / 0
Ov: Organic deposits - Veneer (all)	3.01.02.023	RGB: 181 / 171 / 179 CMYK: 29 / 33 / 30 / 0
Ob: Organic deposits - Blanket (all)	3.01.02.025	RGB: 142 / 129 / 140 CMYK: 44 / 49 / 45 / 0
O: Organic deposits - Undifferentiated deposits (all)	3.01.02.012	RGB: 210 / 211 / 213 CMYK: 18 / 17 / 16 / 0
Eolian		
El: Eolian sediments - Loess (all)	3.01.03.295	RGB: 226 / 211 / 147 CMYK: 11 / 17 / 42 / 0
Er: Eolian sediments - Dunes (all)	3.01.03.299	RGB: 206 / 184 / 65 CMYK: 19 / 28 / 75 / 0
Ev: Eolian sediments - Veneer (all)	3.01.03.292	RGB: 242 / 236 / 208 CMYK: 5 / 7 / 18 / 0
E: Eolian sediments - Undifferentiated sediments (all)	3.01.03.297	RGB: 214 / 195 / 107 CMYK: 16 / 24 / 58 / 0

Colluvial		
Cf: Colluvial and mass-wasting deposits - Fan sediments (all)	3.01.01.107	RGB: 175 / 130 / 96 CMYK: 31 / 49 / 62 / 0
Ca1: Colluvial and mass-wasting deposits - Apron or talus scree deposits (stratified)	3.01.01.097	RGB: 176 / 104 / 89 CMYK: 31 / 59 / 65 / 0
Ca2: Colluvial and mass-wasting deposits - Apron or talus scree deposits (unstratified)	3.01.01.097	RGB: 176 / 104 / 89 CMYK: 31 / 59 / 65 / 0
Ca: Colluvial and mass-wasting deposits - Apron or talus scree deposits (unspecified)	3.01.01.097	RGB: 176 / 104 / 89 CMYK: 31 / 59 / 65 / 0
Cz1: Colluvial and mass-wasting deposits - Landslide deposits (avalanche)	3.01.01.155	RGB: 220 / 145 / 122 CMYK: 14 / 43 / 52 / 0
Cz2: Colluvial and mass-wasting deposits - Landslide deposits (mud flow)	3.01.01.155	RGB: 220 / 145 / 122 CMYK: 14 / 43 / 52 / 0
Cz3: Colluvial and mass-wasting deposits - Landslide deposits (retrogressive thaw flow)	3.01.01.155	RGB: 220 / 145 / 122 CMYK: 14 / 43 / 52 / 0
Cz4: Colluvial and mass-wasting deposits - Landslide deposits (rotational landslide)	3.01.01.155	RGB: 220 / 145 / 122 CMYK: 14 / 43 / 52 / 0
Cz5: Colluvial and mass-wasting deposits - Landslide deposits (translational landslide)	3.01.01.155	RGB: 220 / 145 / 122 CMYK: 14 / 43 / 52 / 0
Cz: Colluvial and mass-wasting deposits - Landslide deposits (unspecified)	3.01.01.155	RGB: 220 / 145 / 122 CMYK: 14 / 43 / 52 / 0
Cg: Colluvial and mass-wasting deposits - Rock glacier (all)	3.01.01.139	RGB: 209 / 137 / 93 CMYK: 18 / 46 / 64 / 0
Cv: Colluvial and mass-wasting deposits - Veneer (all)	3.01.01.092	RGB: 227 / 202 / 192 CMYK: 11 / 21 / 25 / 0
Cb: Colluvial and mass-wasting deposits - Blanket (all)	3.01.01.095	RGB: 194 / 139 / 123 CMYK: 24 / 45 / 52 / 0
C: Colluvial and mass-wasting deposits - Undifferentiated deposits (all)	3.01.01.152	RGB: 240 / 207 / 192 CMYK: 6 / 19 / 25 / 0
Alluvial		
Ap: Alluvial sediments - Floodplain sediments (all)	3.01.04.265	RGB: 255 / 247 / 153 CMYK: 0 / 3 / 40 / 0
Af: Alluvial sediments - Fan sediments (all)	3.01.04.257	RGB: 255 / 229 / 107 CMYK: 0 / 10 / 58 / 0
Ai: Alluvial sediments - Intertidal or estuarine sediments (all)	3.01.04.255	RGB: 255 / 234 / 149 CMYK: 0 / 8 / 42 / 0
At: Alluvial sediments - Terraced sediments (all)	3.01.04.269	RGB: 255 / 242 / 42 CMYK: 0 / 5 / 84 / 0
Av: Alluvial sediments - Veneer (all)	3.01.04.252	RGB: 255 / 248 / 212 CMYK: 0 / 3 / 17 / 0

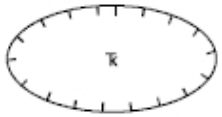
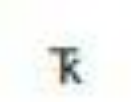
Ab: Alluvial sediments - Blanket (all)	3.01.04.267	RGB: 255 / 245 / 108 CMYK: 0 / 4 / 58 / 0
A: Alluvial sediments - Undifferentiated sediments (all)	3.01.04.263	RGB: 255 / 250 / 194 CMYK: 0 / 2 / 24 / 0
Lacustrine		
Lr: Lacustrine sediments - Beach sediments (all)	3.01.05.582	RGB: 199 / 197 / 226 CMYK: 22 / 23 / 11 / 0
Ld: Lacustrine sediments - Deltaic sediments (all)	3.01.05.585	RGB: 136 / 130 / 189 CMYK: 47 / 49 / 26 / 0
Ln: Lacustrine sediments - Littoral and nearshore sediments (all)	3.01.05.573	RGB: 174 / 185 / 223 CMYK: 32 / 27 / 13 / 0
Lo: Lacustrine sediments - Offshore sediments (all)	3.01.05.577	RGB: 89 / 120 / 186 CMYK: 65 / 53 / 27 / 0
Lv: Lacustrine sediments - Veneer (all)	3.01.05.572	RGB: 199 / 205 / 232 CMYK: 22 / 20 / 9 / 0
Lb: Lacustrine sediments - Blanket (all)	3.01.05.575	RGB: 132 / 147 / 202 CMYK: 48 / 42 / 21 / 0
L: Lacustrine sediments - Undifferentiated sediments (all)	3.01.05.583	RGB: 175 / 172 / 213 CMYK: 31 / 33 / 16 / 0
Marine		
Mt: Marine sediments - Terraced sediments (all)	3.01.06.497	RGB: 117 / 206 / 223 CMYK: 54 / 19 / 13 / 0
Mr: Marine sediments - Beach sediments (all)	3.01.06.497	RGB: 27 / 190 / 210 CMYK: 89 / 25 / 18 / 0
Md: Marine sediments - Deltaic sediments (all)	3.01.05.507	RGB: 22 / 192 / 243 CMYK: 91 / 25 / 5 / 0
Mi: Marine sediments - Intertidal sediments (all)	3.01.06.492	RGB: 200 / 234 / 241 CMYK: 22 / 8 / 5 / 0
Mn: Marine sediments - Littoral and nearshore sediments (all)	3.01.06.493	RGB: 173 / 224 / 234 CMYK: 32 / 12 / 8 / 0
Mo: Marine sediments - Offshore sediments (all)	3.01.06.509	RGB: 0 / 179 / 240 CMYK: 100 / 30 / 6 / 0
Mv: Marine sediments - Veneer (all)	3.01.05.502	RGB: 199 / 235 / 252 CMYK: 22 / 8 / 1 / 0
Mb: Marine sediments - Blanket (all)	3.01.05.505	RGB: 111 / 208 / 246 CMYK: 56 / 18 / 4 / 0
M: Marine sediments - Undifferentiated sediments (all)	3.01.05.503	RGB: 170 / 225 / 250 CMYK: 33 / 12 / 2 / 0

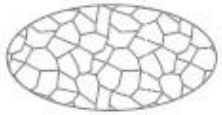
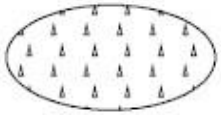
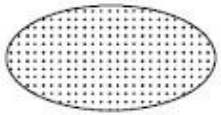
Glaciomarine		
GMr: Glaciomarine sediments - Beach sediments (all)	3.01.09.487	RGB: 59 / 165 / 193 CMYK: 77 / 35 / 24 / 0
GMd: Glaciomarine sediments - Deltaic sediments (all)	3.01.09.525	RGB: 130 / 167 / 196 CMYK: 49 / 35 / 23 / 0
GMi: Glaciomarine sediments - Intertidal sediments (all)	3.01.09.512	RGB: 199 / 225 / 245 CMYK: 22 / 12 / 4 / 0
GMn: Glaciomarine sediments - Littoral and nearshore sediments (all)	3.01.09.513	RGB: 172 / 211 / 240 CMYK: 33 / 17 / 6 / 0
GMo: Glaciomarine sediments - Offshore sediments (all)	3.01.09.519	RGB: 0 / 151 / 217 CMYK: 100 / 41 / 15 / 0
GMf: Glaciomarine sediments - Submarine outwash fan sediments (all)	3.01.09.527	RGB: 82 / 142 / 178 CMYK: 68 / 44 / 30 / 0
GMm: Glaciomarine sediments - Submarine moraine complex (all)	3.01.09.483	RGB: 45 / 166 / 222 CMYK: 82 / 35 / 13 / 0
GMv: Glaciomarine sediments - Veneer (all)	3.01.09.483	RGB: 175 / 210 / 225 CMYK: 31 / 18 / 12 / 0
GMb: Glaciomarine sediments - Blanket (all)	3.01.09.485	RGB: 125 / 186 / 209 CMYK: 51 / 27 / 18 / 0
GM: Glaciomarine sediments - Undifferentiated sediments (all)	3.01.09.515	RGB: 119 / 187 / 231 CMYK: 53 / 27 / 9 / 0
Glaciolacustrine		
GLr: Glaciolacustrine sediments - Beach sediments (all)	3.01.08.645	RGB: 191 / 140 / 173 CMYK: 25 / 45 / 32 / 0
GLd: Glaciolacustrine sediments - Deltaic sediments (all)	3.01.08.613	RGB: 197 / 176 / 201 CMYK: 23 / 31 / 21 / 0
GLn: Glaciolacustrine sediments - Littoral and nearshore sediments (all)	3.01.08.612	RGB: 213 / 200 / 218 CMYK: 16 / 22 / 15 / 0
GLo: Glaciolacustrine sediments - Offshore sediments (all)	3.01.08.637	RGB: 169 / 103 / 170 CMYK: 34 / 60 / 33 / 0
GLf: Glaciolacustrine sediments - Subaqueous outwash fan sediments (all)	3.01.08.615	RGB: 164 / 134 / 173 CMYK: 36 / 47 / 32 / 0
GLm: Glaciolacustrine sediments - Subaqueous moraine complex (all)	3.01.08.617	RGB: 140 / 99 / 149 CMYK: 45 / 61 / 42 / 0
GLh: Glaciolacustrine sediments - Hummocky sediments (all)	3.01.08.635	RGB: 188 / 140 / 191 CMYK: 26 / 45 / 25 / 0
GLv: Glaciolacustrine sediments - Veneer (all)	3.01.08.642	RGB: 225 / 203 / 218 CMYK: 12 / 20 / 15 / 0
GLb: Glaciolacustrine sediments - Blanket (all)	3.01.08.647	RGB: 172 / 104 / 149 CMYK: 33 / 59 / 42 / 0

GL: Glaciolacustrine sediments - Undifferentiated sediments (all)	3.01.08.643	RGB: 213 / 181 / 201 CMYK: 16 / 29 / 21 / 0
Glaciofluvial		
GFp: Glaciofluvial sediments - Outwash plain sediments (all)	3.01.07.249	RGB: 254 / 200 / 48 CMYK: 0 / 22 / 81 / 0
GFt: Glaciofluvial sediments - Terraced sediments (all)	3.01.07.237	RGB: 253 / 189 / 99 CMYK: 1 / 26 / 61 / 0
GFf1: Glaciofluvial sediments - Outwash fan sediments (subaerial)	3.01.07.225	RGB: 252 / 190 / 135 CMYK: 1 / 25 / 47 / 0
GFf2: Glaciofluvial sediments - Outwash fan sediments (subaqueous)	3.01.07.225	RGB: 252 / 190 / 135 CMYK: 1 / 25 / 47 / 0
GFf: Glaciofluvial sediments - Outwash fan sediments (unspecified)	3.01.07.225	RGB: 252 / 190 / 135 CMYK: 1 / 25 / 47 / 0
GFh: Glaciofluvial sediments - Hummocky sediments (all)	3.01.07.215	RGB: 249 / 173 / 129 CMYK: 2 / 32 / 49 / 0
GFc: Glaciofluvial sediments - Ice-contact sediments (all)	3.01.07.217	RGB: 247 / 145 / 90 CMYK: 3 / 43 / 65 / 0
GFk: Glaciofluvial sediments - Kame terrace (all)	3.01.07.219	RGB: 244 / 116 / 52 CMYK: 4 / 55 / 80 / 0
GFr: Glaciofluvial sediments - Esker (all)	3.01.07.229	RGB: 247 / 144 / 52 CMYK: 3 / 44 / 80 / 0
GFv: Glaciofluvial sediments - Veneer (all)	3.01.07.223	RGB: 254 / 215 / 178 CMYK: 0 / 16 / 30 / 0
GFb: Glaciofluvial sediments - Blanket (all)	3.01.07.247	RGB: 255 / 209 / 103 CMYK: 0 / 18 / 60 / 0
GF: Glaciofluvial sediments - Undifferentiated sediments (all)	3.01.07.235	RGB: 254 / 207 / 140 CMYK: 0 / 19 / 45 / 0
Glacial		
Tg: Glacial sediments - Rock-glacierized moraines (all)	3.01.10.357	RGB: 157 / 206 / 119 CMYK: 38 / 19 / 53 / 0
Th1: Glacial sediments - Hummocky till (carbonate/calcareous)	3.01.10.375	RGB: 163 / 202 / 153 CMYK: 36 / 21 / 40 / 0
Th: Glacial sediments - Hummocky till (unspecified)	3.01.10.375	RGB: 163 / 202 / 153 CMYK: 36 / 21 / 40 / 0
Tm1: Glacial sediments - Moraine complex (carbonate/calcareous)	3.01.10.377	RGB: 132 / 187 / 118 CMYK: 48 / 27 / 54 / 0
Tm: Glacial sediments - Moraine complex (unspecified)	3.01.10.377	RGB: 132 / 187 / 118 CMYK: 48 / 27 / 54 / 0
Tr1: Glacial sediments - Ridged till; moraine (carbonate/calcareous)	3.01.10.385	RGB: 162 / 212 / 157 CMYK: 36 / 17 / 38 / 0

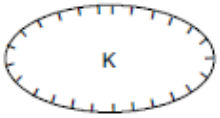
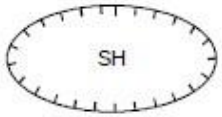
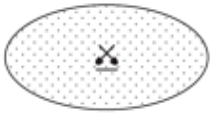
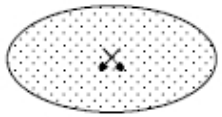
Tr: Glacial sediments - Ridged till; moraine (unspecified)	3.01.10.385	RGB: 162 / 212 / 157 CMYK: 36 / 17 / 38 / 0
Ts1: Glacial sediments - Streamlined till (carbonate/calcareous)	3.01.10.387	RGB: 128 / 198 / 121 CMYK: 50 / 22 / 53 / 0
Ts: Glacial sediments - Streamlined till (unspecified)	3.01.10.387	RGB: 128 / 198 / 121 CMYK: 50 / 22 / 53 / 0
Tp1: Glacial sediments - Till plain (carboncarbonate/calcareous)	3.01.10.439	RGB: 40 / 120 / 79 CMYK: 84 / 53 / 69 / 0
Tp: Glacial sediments - Till plain (unspecified)	3.01.10.439	RGB: 40 / 120 / 79 CMYK: 84 / 53 / 69 / 0
Tx1: Glacial sediments - Weathered till (carbonate/calcareous)	3.01.10.057	RGB: 141 / 124 / 98 CMYK: 45 / 51 / 62 / 0
Tx: Glacial sediments - Weathered till (unspecified)	3.01.10.057	RGB: 141 / 124 / 98 CMYK: 45 / 51 / 62 / 0
Tv1: Glacial sediments - Veneer (carbonate/calcareous)	3.01.10.355	RGB: 185 / 219 / 157 CMYK: 27 / 14 / 38 / 0
Tv: Glacial sediments - Veneer (unspecified)	3.01.10.355	RGB: 185 / 219 / 157 CMYK: 27 / 14 / 38 / 0
Tb1: Glacial sediments - Blanket (carbonate/calcareous)	3.01.10.359	RGB: 133 / 197 / 83 CMYK: 48 / 23 / 67 / 0
Tb: Glacial sediments - Blanket (unspecified)	3.01.10.359	RGB: 133 / 197 / 83 CMYK: 48 / 23 / 67 / 0
T: Glacial sediments - Undifferentiated sediments (all)	3.01.10.373	RGB: 200 / 221 / 189 CMYK: 22 / 13 / 26 / 0
Weathered bedrock or regolith		
Wv: Weathered bedrock or regolith - Veneer (all)	3.01.11.175	RGB: 219 / 145 / 139 CMYK: 14 / 43 / 45 / 0
Wb: Weathered bedrock or regolith - Blanket (all)	3.01.11.169	RGB: 218 / 64 / 52 CMYK: 15 / 75 / 80 / 0
W: Weathered bedrock or regolith - Undifferentiated (all)	3.01.11.177	RGB: 206 / 108 / 108 CMYK: 19 / 58 / 58 / 0
Volcanic deposits		
Vpy: Volcanic deposits - Pyroclastic sediments (all)	3.01.16.705	RGB: 192 / 140 / 156 CMYK: 25 / 45 / 39 / 0
V: Volcanic deposits - Undifferentiated (all)	3.01.16.707	RGB: 174 / 104 / 130 CMYK: 32 / 59 / 49 / 0
Undifferentiated deposits		
U: Undifferentiated deposits - Undifferentiated deposits (all)	3.01.12.082	RGB: 216 / 198 / 192 CMYK: 15 / 22 / 25 / 0

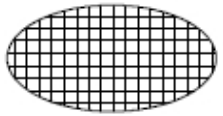
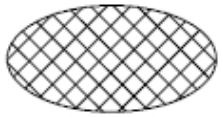
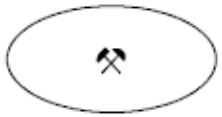
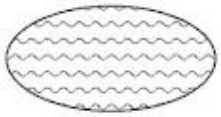
Bedrock		
R1: Bedrock - Sedimentary (all)	**3.01.13.192**	**RGB: 252 / 211 / 201** **CMYK: 1 / 17 / 21 / 0**
R2: Bedrock - Igneous (all)	**3.01.13.187**	**RGB: 242 / 113 / 128** **CMYK: 5 / 56 / 50 / 0**
R3: Bedrock - Metamorphic (all)	**3.01.13.183**	**RGB: 250 / 191 / 190** **CMYK: 2 / 25 / 25 / 0**
R: Bedrock - Undifferentiated (all)	**3.01.13.185**	**RGB: 246 / 152 / 158** **CMYK: 4 / 40 / 38 / 0**
Other (0 and x will not appear on a final map)		
0: Unmapped Area (all)	**2.01.01.008**	no colour no outline
x: Map unit to be defined (all)	**2.01.01.010**	

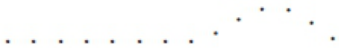
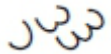
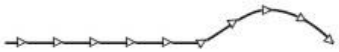
Control	Symbol Code	Symbol Representation	Legend Symbol Representation
Annular Depression (all)	3.14.01.023		
Annular Depression (all)	3.14.01.024		
Nivation Hollow (all)	3.12.01.020 Centroid must be added with CartoRepresentation		
Evaporites (all)	3.14.01.017		
Recently deglaciated area (all)	3.06.01.014 White pattern over colour of geological unit.		
Thermokarst depression (all)	3.12.01.006 Centroid must be added with CartoRepresentation		
Thermokarst depression (all)	3.12.01.006		
Thermokarst-depression observation location (all) (F_ENVIRON)	3.12.01.006		

Patterned ground (all)	**3.12.01.016**		
Patterned ground (all)	**3.12.01.002**		
Patterned-ground observation location (all) (F_ENVIRON)	**3.12.01.002**		
Felsenmeer (all)	**3.12.01.023**		
Felsenmeer (all)	**3.12.01.024**		
Felsenmeer Observation Location (all) (F_ENVIRON)	**3.05.01.005**		
Active Dune Field (all)	**3.05.01.009**		
Dune (direction unknown or unspecified)	**3.05.01.008**		

Dune (direction known)	**3.05.01.009**		
Dune observation location (direction known) (F_PFLOW)	**3.05.01.008**		
Dune observation location (direction known) (F_PFLOW)	**3.05.01.008**		
Extensive gullied terrain (all)	**3.14.01.005**		
Eolian Lag Deposit (deflation surface)	**3.05.01.006**		
Lag deposits (all)	**3.14.01.013**		
Reworked Sediments (all)	**3.14.01.014**		
Surface-boulder concentration (all)	**3.14.01.015**		

Kettle (all)	**3.06.01.013** **Centroid must be added with CartoRepresentation**		
Kettle (all)	**3.06.01.001**		
Area of Sinkholes (all)	**3.04.01.007** **Centroid must be added with CartoRepresentation**		
Sinkhole (all)	**3.04.01.001**		
Pit: large inactive (all)	**3.03.01.009** **Centroid must be added with CartoRepresentation**		
Pit: large active (all)	**3.03.01.009** **Centroid must be added with CartoRepresentation**		
Pit (status inactive or unspecified)	**3.03.01.003**		
Pit (status active)	**3.03.01.002**		

Mine tailing (all)	**3.03.01.007**		
Made Ground (fill) (all)	**3.03.01.006**		
Quarry: large (inactive) (all)	**3.03.01.010** **Centroid must be added with CartoRepresentation**		
Quarry: large (active) (all)	**3.03.01.010** **Centroid must be added with CartoRepresentation**		
Quarry (status inactive or unspecified)	**3.03.01.005**		
Quarry (status active)	**3.03.01.004**		
Peat-bog mining (all)	**3.03.01.008**		
Overlay polygon feature to be defined (all)	**2.01.01.009**		
Geological boundary (confidence defined)	**3.02.01.001**		
Geological boundary (confidence approximate)	**3.02.01.002**		

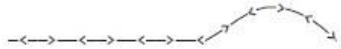
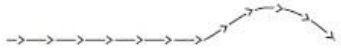
Geological boundary (confidence inferred)	**3.02.01.003**		
Geological boundary (confidence concealed)	**3.02.01.004**		
Geological boundary (confidence arbitrary)	**2.01.01.011**		
Limit of mapping (limit of mapping)	**3.02.01.005**		
Geological boundary coincident with other line feature (confidence defined) (all)	**2.01.01.002**		
Geological boundary coincident with other line feature (confidence approximate) (all)	**2.01.01.003**		
Geological boundary coincident with other line feature (confidence inferred) (all)	**2.01.01.004**		
Geological boundary coincident with other line feature (confidence concealed) (all)	**2.01.01.005**		
Limit of mapping (neatline)	**3.02.01.006**		
Dune Crest (all)	**3.05.01.003**		 **3.15.01.002**
Tension fracture (all)	**3.02.01.006**		
Avalanche track (all)	**3.09.01.008**		
Avalanche Track (all)	**3.09.01.001**		
Debris-flow track (all)	**3.09.01.009**		

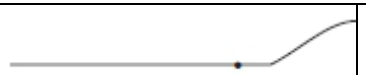
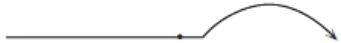
Debris-flow track (all)	**3.09.01.002**		
Landslide escarpment (status inactive or unspecified)	**3.09.01.007**		 **3.15.01.005**
Landslide escarpment (status active)	**3.09.01.006**		 **3.15.01.004**
Landslide scar, unknown (all)	**3.09.01.003**		
Landslide scar, known (all)	**3.09.01.003**		
Retrogressive thaw flow, unknown (all)	**3.09.01.004**		
Retrogressive thaw flow, known (all)	**3.09.01.004**		
Unspecified slope-movement (all)	**3.09.01.005**		
Cryoplanation terrace scarp (all)	**3.12.01.014**		

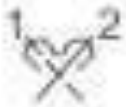
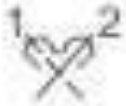
Limit of permafrost (all)	**3.12.01.015**		
Sediment transport direction (direction unknown or unspecified)	**3.14.01.022**		
Sediment transport direction (direction known)	**3.14.01.021**		
Pre-existing coastline (all)	**3.13.01.011**		
Alluvial bar or levee ridge (all)	**3.14.01.009**		
Terrace scarp (all)	**3.13.01.004**		
Ravine scarp (all)	**3.14.01.011**		
Erosional crest (all)	**3.14.01.020**		
Beach crest (all)	**3.13.01.0021**		
Limit of submergence (confidence approximate; environment lacustrine)	**3.11.01.012**		
Limit of submergence (confidence defined; environment lacustrine)	**3.11.01.011**		
Limit of submergence (confidence approximate; environment marine)	**3.11.01.014**		
Limit of submergence (confidence defined; environment marine)	**3.11.01.013**		
Limit of submergence (confidence approximate; environment glaciomarine)	**3.11.01.010**		
Limit of submergence (confidence defined; environment glaciomarine)	**3.11.01.009**		
Limit of submergence (confidence approximate; environment glaciolacustrine)	**3.11.01.008**		

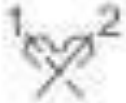
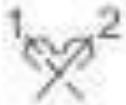
Limit of submergence (confidence defined; environment glaciolacustrine)	3.11.01.007		
Iceberg scour central axis (all)	3.14.01.010		
Iceberg scour (all)	3.14.01.001		
Spillway central axis (direction unknown or unspecified)	-3.10.01.017		
Spillway central axis (direction known)	-3.10.01.012		
Paleodrainage direction (all)	3.10.01.010		
Minor meltwater channel central axis (lateral, marginal, overflow, subglacial, supraglacial or unspecified; direction unknown or unspecified)	3.10.01.009		
Minor meltwater channel central axis (lateral, marginal, overflow, subglacial, supraglacial or unspecified; direction known)	3.10.01.008		
Minor meltwater channel central axis (lateral uphill right)	3.10.01.007		
Minor meltwater channel central axis (lateral uphill left)	3.10.01.006		
Major meltwater channel scarp (all)	3.10.01.005		 Unknown paleodrainage direction: 3.15.01.007  Known paleodrainage direction: 3.15.01.007 + 3.10.01.010

Subglacial meltwater corridor margin (confidence approximate)	**3.10.01.016**		 **3.15.01.013**
Subglacial meltwater corridor margin (confidence defined)	**3.10.01.015**		 **3.15.01.012**
Partly buried channel scarp (all)	**3.10.01.011**		 **3.15.01.008**
Buried valley central axis (direction unknown or unspecified)	**3.10.01.014**		
Buried valley central axis (direction known)	**3.10.01.013**		
Other moraine ridge (minor)	**3.06.01.012**		 **3.15.01.003**
Minor moraine (orientation unknown or unspecified)	**3.06.01.017**		
Minor moraine (orientation known) (F_PFLOW)	**3.06.01.015**		
Major moraine ridge (lateral or laterofrontal)	**3.06.01.006**		
Major moraine ridge (medial)	**3.06.01.008**		
Major moraine ridge (end, interlobate, or unspecified)	**3.06.01.010**		

Major moraine ridge (lateral ice-cored or laterofrontal ice-cored)	3.06.01.007		
Major moraine ridge (medial ice-cored)	3.06.01.009		
Major moraine ridge (end ice-cored, interlobate ice-cored, or unspecified ice-cored)	3.06.01.011		
Ice-contact scarp (all)	3.07.01.007		
Ice-pushed ridge (all)	3.07.01.008		
Ice-thrust ridge (all)	3.07.01.009		
Buried esker ridge (direction unknown or unspecified)	3.07.01.004		
Buried esker ridge (direction known or inferred)	3.07.01.003		
Esker ridge (direction unknown or unspecified)	3.07.01.006		
Esker ridge (direction known or inferred)	3.07.01.005		
Esker ridge (with beach ridges/strandlines; direction unknown or unspecified)	3.07.01.011		
Esker ridge (with beach ridges/strandlines; direction known or inferred)	3.07.01.010		
Crevasse-fill ridge (all)	3.06.01.005		
Buried drumlinoid ridge (all)	3.08.01.015		
Buried drumlinoid (all)	3.08.01.002		

Drumlinoid ridge (all)	**3.08.01.018**		
Drumlinoid (all)	**3.08.01.005**		
Buried drumlin ridge (all)	**3.08.01.014**		
Buried drumlin (all)	**3.08.01.001**		
Drumlin ridge (all)	**3.08.01.017**		
Drumlin (all)	**3.08.01.004**		
Crag-and-tail ridge (all)	**3.08.01.016**		
Crag-and-tail (all)	**3.08.01.003**		
Pre-crag ridge (all)	**3.08.01.040**		
Pre-crag (all)	**3.08.01.0039**		

Pre-crag observation location (all) (F_STATION)	**3.08.01.039**		
Large groove central long axis (direction unknown or unspecified)	**3.08.01.022**		
Large groove central long axis (direction known)	**3.08.01.021**		
Fluted bedrock or drift, central long axis (poorly defined; direction unknown or unspecified)	**3.08.01.034**		
Fluted bedrock or drift (poorly defined; direction unknown or unspecified)	**3.08.01.030**		
Fluted bedrock or drift, measurement location (poorly defined; direction unknown or unspecified) (F_PFLOW)	**3.08.01.030**		 **3.15.01.001**
Fluted bedrock or drift, central long axis (poorly defined; direction known)	**3.08.01.033**		
Fluted bedrock or drift (poorly defined; direction known)	**3.08.01.029**		
Fluted bedrock or drift, measurement location (poorly defined; direction known) (F_PFLOW)	**3.08.01.029**		 **3.15.01.001**
Fluted bedrock or drift, central long axis(well defined; direction unknown or unspecified)	**3.08.01.020**		

Fluted bedrock or drift (well defined or unspecified; direction unknown or unspecified)	**3.08.01.007**		
Fluted bedrock or drift, measurement location (well defined or unspecified; direction unknown or unspecified) (F_PFLOW)	**3.08.01.007**		 **3.15.01.001**
Fluted bedrock or drift, central long axis (well defined; direction known)	**3.08.01.019**		
Fluted bedrock or drift (well defined or unspecified; direction known)	**3.08.01.006**		
Fluted bedrock or drift, measurement location (well defined or unspecified; direction known) (F_PFLOW)	**3.08.01.006**		 **3.15.01.001**
Cirque headwall (all)	**3.06.01.004**		
Arête (all)	**3.06.01.003**		
Ice-flow direction (direction unknown or unspecified)	**3.08.01.025**		
Ice-flow direction (direction known)	**3.08.01.024**		
Limit of glaciation (confidence approximate)	**3.11.01.006**		
Limit of glaciation (confidence defined)	**3.11.01.005**		

Dispersal train margin (confidence approximate; left side)	**3.08.01.043**		**3.15.01.010**
Dispersal train margin (confidence approximate; right side)	**3.08.01.044**		**3.15.01.010**
Dispersal train margin (confidence defined; left side)	**3.08.01.041**		**3.15.01.011**
Dispersal train margin (confidence defined; right side)	**3.08.01.042**		**3.15.01.011**
Ice-stream margin (confidence approximate)	**3.11.01.004**		
Ice-stream margin (confidence defined)	**3.11.01.003**		
Ice-divide (confidence approximate)	**3.11.01.002**		
Ice-divide (confidence defined)	**3.11.01.001**		
Bedrock scarp (all)	**3.04.01.005**		
Lineament or lineation in bedrock (all)	**3.04.01.006**		
Line feature to be defined (all)	**2.01.01.001**		
Palsa or lithalsa (all)	**3.12.01.001**		

Hummock (all)	**3.14.01.019**		
Hummock observation location (all) (F_STATION)	**3.14.01.019**		
Pingo (all)	**3.12.01.003**		
Pingo observation location (all) (F_ENVIRON)	**3.12.01.003**		
Gelifluction-lobe or solifluction-lobe (all)	**3.12.01.022**		
Gelifluction-lobe or solifluction-lobe observation location (all) (F_ENVIRON)	**3.12.01.022**		
Rock glacier (all)	**3.12.01.004**		
Rock-glacier observation location (all) (F_ENVIRON)	**3.12.01.004**		

Rock pingo (all)	**3.12.01.005**		
Rock pingo observation location (all) (F_ENVIRON)	**3.12.01.005**		
Rock-blister observation location (all) (F_ENVIRON)	**3.12.01.012**		
Rock-burst observation location (all) (F_ENVIRON)	**3.12.01.013**		
Paleowind measurements location (all) (F_PFLOW)	**3.05.01.002**		
Deflation landform (direction known)	**3.05.01.001**		
Deflation landform (direction unknown or unspecified)	**3.05.01.007**		
Spring observation location (all) (F_STATION)	**3.14.01.012**		

Piping depression (all)	**3.10.01.002**		
Alluvial fan (all)	**3.10.01.001**		
Delta (direction unknown or unspecified)	**3.13.01.010**		
Delta (direction known)	**3.13.01.001**		
Paleocurrent measurement location (sediments) (F_PFLOW)	**3.10.01.003**		
Paleocurrent measurement location (bedrock erosional forms) (F_PFLOW)	**3.10.01.004**		
Ground ice (all)	**3.12.01.019**		
Ground-ice observation location (all) (F_ENVIRON)	**3.12.01.019**		

Erratic observation location (all) **(F_EARTHMAT)**	**3.14.01.002**	▲	
Kame (all)	**3.07.01.002**	✳	
Till fabric measurement location (direction unknown or unspecified) **(F_PFLOW)**	**3.08.01.026**		
Till fabric measurement location (direction known) **(F_PFLOW)**	**3.08.01.012**		**3.15.01.001**
Striation measurement location (poorly defined; direction unknown or unspecified) **(F_PFLOW)**	**3.08.01.009**		
Striation measurement location (poorly defined; direction known) **(F_PFLOW)**	**3.08.01.008**		**3.15.01.001**
Striation measurement location (well defined; direction unknown or unspecified) **(F_PFLOW)**	**3.08.01.011**		

Striation measurement location (well defined or unspecified; direction known) (F_PFLOW)	**3.08.01.010**		**3.15.01.001**
Striation measurement location from legacy data (poorly defined; direction unknown or unspecified) (F_PFLOW)	**3.08.01.036**		
Striation measurement location from legacy data (poorly defined; direction known) (F_PFLOW)	**3.08.01.035**		**3.15.01.001**
Striation measurement location from legacy data (well defined or unspecified; direction unknown or unspecified) (F_PFLOW)	**3.08.01.038**		
Striation measurement location from legacy data (well defined or unspecified; direction known) (F_PFLOW)	**3.08.01.037**		**3.15.01.001**
Tor (all)	**3.04.01.003**		
Mineral occurrence (all)	**3.04.01.008**	Mn	

Gossan observation location (all) **(F_ENVIRON)**	**3.14.01.004**	Ⓖ	
Small outcrop (all)	**3.04.01.002**	×	
Drillhole location (all)	**3.03.01.001**	⊙	
Fossil observation location (all) **(F_EARTHMAT)**	**3.14.01.003**	Ⓕ	
Station location (remote observation, waypoint, or unspecified) **(F_STATION)**	**3.14.01.008**	⌖	
Station location (ground observation or stratigraphic section) **(F_STATION)**	**3.14.01.007**	○	
Sample analysis results (dating) **(F_SAMPLE)**	**3.14.01.018**	Ⓓ 142	
Sample location (all) **(F_SAMPLE)**	**3.14.01.006**	● 1400	

Point feature to be defined (all)	**2.01.01.006**	?	
Field observation feature to be defined (all) (F_STATION)	**2.01.01.007**	?	

Appendix 3

General Notes
Version 2.3.0

- GDB_Surf_v2_3_0(8).gdb
- Surficial Geodatabase version 2.3.0
- Built in ArcGIS 10.2
- GanFeld version Spring 2015
- Geodatabase release date 2017-04-12

Changes since v2.2.0

2. **New feature class** P_INDEXMAP_GSC83 and related *MAP_ID* field
    1. Added new feature class P_INDEXMAP which can be related to existing feature classes through the new *MAP_PID* field.
    2. Added the *MAP_PID* (text 12) field to the following feature classes: F_LINEWORK, F_STATIONS, F_TRAVERSE, GEM_LINES, GEM_POINTS, GEM_POLYS, GEO_BOUND, GEO_LABELS, GEO_POLYS
3. **Modified feature classes and tables**
    1. F_STATION: Removed the *HasM* field in F_STATION
    2. F_PHOTO: added DIRECTION_DID domain to the *DIRECTION_DID* field
    3. P_DATA_SOURCE table:
        1. Changed *GEOSCAN_ID* field from text to long integer data type
        2. Changed *SOURCE_CITATION* field name and field alias to *CITATION*
4. **New feature types**
    1. Mineral occurrence (1901002) added as point feature in GEM_POINTS
    2. Ground ice (1891002) added as point feature in GEM_POINTS
5. **Modified feature types:**
    1. GEM_LINES: renamed to "Line feature to be defined"
        1. *CONTROL_SID*: 5551002
        2. *F_TYPE_DID*: 555
        3. *SYMBOL_DID*: 2.01.01.001
    2. GEM_POINTS: renamed to "Point feature to be defined"
        1. *CONTROL_SID*:5561002
        2. *F_TYPE_DID*:556
        3. *SYMBOL_DID*: 2.01.01.006
    3. GEM_POLYS: renamed to "Overlay polygon feature type to be defined"
        1. *CONTROL_SID*: 5541002
        2. *F_TYPE_DID*: 554
        3. *SYMBOL_DID*: 2.01.01.009
    4. GEO_LABELS and GEO_POLYS: renamed to "Map unit to be defined"
        1. *CONTROL1_SID*: 7931002
        2. *UTYPE1_DID*, UTTYPE2_DID: 793
        3. *SYMBOL1_DID*: 2.01.01.010
    5. F_STATION renamed to "Field observation to be defined"
        1. *SYMBOL_DID*: 2.01.01.007
    6. GEM_LINES: removed lateral from Minor meltwater channel (~~lateral~~, marginal, overflow, subglacial, supraglacial or unspecified; direction unknown or unspecified)

        1. *CONTROL_SID*: 4971064 Minor meltwater channel (marginal, overflow, subglacial, supraglacial or unspecified; direction unknown or unspecified)
        2. *FT_SUBSET_DID*: removed Lateral from the domain pick list
        3. *SYMBOL_DID*: 3.10.01.009 renamed to Minor meltwater channel (marginal, overflow, subglacial, supraglacial or unspecified; direction unknown or unspecified)
6. **Modified field default values**
    1. Removed the default value and set null allowed to YES for all the *DISPLAY_PUB_DID* fields
    2. Removed the default for all the *HYDRO_INTERSCT_DID* fields
    3. Geological boundary coincident 5341002: reset default values to location confidence Defined.
7. **New field attributes** for *SENSE_DID***:** sense unknown and unspecified attributes added to the following points:
    1. Avalanche track (181002)
    2. Debris-flow track (1821002)
    3. Landslide scar (1831002)
    4. Retrogressive thaw flow (1841002)
    5. Unspecified slope movement (1851002)
    6. Gelifluction-lobe or solifluction-lobe (1261002)
    7. Rock glacier (4311002)
    8. Alluvial fan (4091002)
    9. Ice-contact delta (4161002)
8. **Changes to domain** GEO_EVENT_PID:
    1. replaced descriptions (the description was repeated twice)
    2. added “Pre-Fraser glaciation”
    3. renamed “Pre-Buckland” to “Pre-Buckland glaciation”
    4. added “Recent” as ‘r’
    5. renamed “Reid glaciation” as ‘re’