

TOPOGRAPHIC MAPS: *The basics*

Is a topographic map similar to a road map?

Both types of maps show roads, water features, cities and parks, but that's where the similarity ends.

Topographic maps show contours, elevation, forest cover, marsh, pipelines, power transmission lines, buildings and various types of boundary lines such as international, provincial and administrative, and many others.

Topographic maps show a universal transverse mercator (UTM) grid, allowing the user to determine precise positions. In basic terms, topographic maps allow the user to see a three-dimensional landscape on a two-dimensional surface.

What do the colours mean?

A variety of colours can be found on a map, each relating to different types of features.

Black shows cultural features such as buildings, railways and power transmission lines. It is also used to show geographical names (toponymy), certain symbols, geographic coordinates and precise elevations.

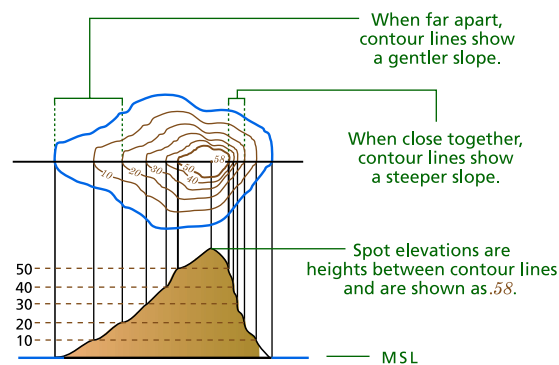
Blue represents water features, such as lakes, rivers, falls, rapids, swamps and marshes. The names of water bodies and water courses are also shown in blue, as are magnetic declination and UTM grid information.

Green indicates vegetation such as wooded areas, orchards and vineyards.

Some northern areas of Canada are mapped in black and white (monochrome).

What are contour lines?

Contour lines connect a series of points of equal elevation and are used to illustrate relief on a map. They show the height of ground above mean sea level (MSL) either in metres or feet, and can be drawn at any desired interval. For example, numerous contour lines that are close to one another indicate hilly or mountainous terrain; when further apart they indicate a gentler slope; and when far apart they indicate flat terrain.



Topo tip:

- Use contour lines to determine elevations of mountains and flat areas. The closer together the lines are, the steeper the slope.
- Contour elevation numbers indicate the direction of elevation by always reading (pointing) uphill.

What is scale?

Maps are made to scale. In each case, the scale represents the ratio of a distance on the map to the actual distance on the ground. A standard Canadian topographic map is produced at 1:50 000, where 2 cm on the map represents 1 km on the ground.

$$\frac{\text{MAP DISTANCE}}{\text{GROUND DISTANCE}} = \frac{2 \text{ cm}}{1 \text{ km}} = \frac{2 \text{ cm}}{100\,000 \text{ cm}} = \frac{1}{50\,000}$$

$$\text{SCALE} \Rightarrow 1:50\,000$$

Medium-scale maps (e.g. 1:50 000) cover smaller areas in greater detail, whereas small-scale maps (e.g. 1:250 000) cover large areas in less detail. A 1:250 000 scale national topographic system (NTS) map covers the same area as sixteen 1:50 000 scale NTS maps.

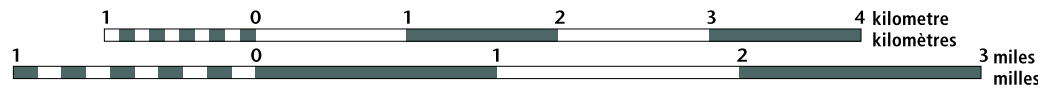
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Topo tip:

- Know what map scale you're using to measure distance. Refer to the scale bar at the bottom of the map.

How do I measure distance on a map?

Use the scale bar found at the bottom of every NRCan topographic map to determine distances between points or along lines on the map sheet. Use the secondary division on the left of the scale bar for measuring fractions of a kilometre.



Scale 1:50000 Échelle

1 centimetre on the map represents 500 metres on the ground 1 centimètre sur la carte représente 500 mètres au sol

What is a grid?

A grid is a regular pattern of parallel lines intersecting at right angles and forming squares; it is used to identify precise positions. To help you locate your position accurately on the surface of the Earth (or map sheet), topographic maps have two kinds of referencing systems:

- universal transverse mercator (UTM) projection (easting/northing)
- geographic: degrees and minutes (longitude/latitude)

The projection used for topographic maps is UTM.

The UTM grid is a square grid system of lines depicted on maps and based on the transverse mercator projection. It can be used to accurately locate the position of features on the map by distance or direction. To express your location in grid coordinates or geographic coordinates, read the following section.

How can I find or express a location on a map?

You can find or express a location on a map by using geographic coordinates (longitude, latitude) or by using UTM grid coordinates (easting, northing).

Geographic coordinates are expressed in degrees, minutes and seconds and can be determined on the map by using the longitude and latitude graticules placed along the edges of the map. Latitude graticules are placed along the east and west edges of the map and longitude graticules are placed along the north and south edges of the map. The longitude and latitude of your location can be determined by projecting your location to the map edges and then by reading the corresponding latitude and longitude values.

UTM grid coordinates are expressed in metres and can be determined on the map by using the UTM grid lines. These grid lines are equally spaced horizontal and vertical lines superimposed over the entire map. The coordinate value for each grid line can be found along the edge of the map. Northing values can be read along the east or west edges of the map and easting values can be read along the north or south edges of the map. The easting and northing of your location can be determined by projecting your location to the nearest horizontal and vertical grid lines and then reading the corresponding easting and northing values.

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As an example, the position of the sportsplex located in the top right corner of 92-G/3 Lulu Island of British Columbia is located in UTM Zone 10 and the coordinates are 498400m.E. and 5453100m.N. The same position can also be described using geographic coordinates 123°01'E longitude, 49°14'N latitude.

Topo tip:

- Use a roamer to help locate features (see the illustration at left).
- Always measure over to the east and then up to the north. In other words, find the easting, then the northing.

Topo tip:

- Determine your easting first, and then find your northing. (In the house, then up the stairs.)

How can I determine where I am on a map using a GPS receiver?

If you have a GPS receiver, your location can be determined very quickly. This satellite receiving system displays a position in terms of latitude, longitude, and height, providing you with precise coordinates for map reference. (Some receivers also provide a direct conversion of position to a selected map grid such as UTM.) With this GPS coordinate, you can then use the geographic or UTM grid reference system on the map to determine where you are.

How do I find a grid reference?

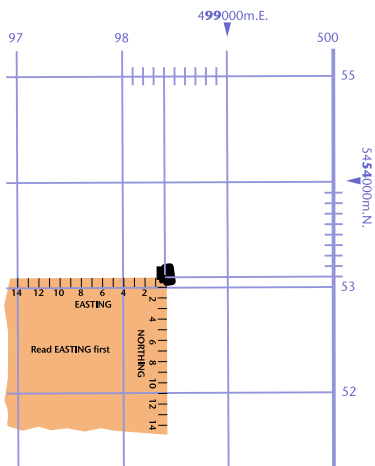
To find the map reference of a feature located at 984531 on a 1:50 000 scale topographic map,

Determine the easting:

- Read the grid line value left of the feature: **98**.
- Estimate tenths of a square to the right (eastward) to feature: **4**. Your easting is **984**.

Determine the northing:

- Read the grid line value below the feature: **53**.
- Estimate tenths of a square up (northward) to the feature: **1**. Your northing is **531**.
- The map reference for this feature is **984531**.



Topo tip:

- Users should ensure that the datum on their GPS are the same as the datum on the map. The datum are typically located on the bottom of the map sheet.

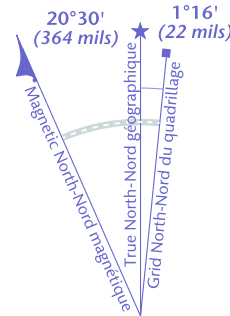
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How can I determine where I am on a map without using a GPS?

If you do not have a GPS receiver, identify as many features around you as you can, man-made or natural, and locate those same features on your map. Then orient the map, in relation to yourself, so that its orientation corresponds to the ground features that you have identified. If this is difficult to do, use a compass to help you orient the map to north and try again to identify surrounding features. By estimation, or by using a compass, take bearings to the known features and then from the known features, plot the bearing lines. The intersection of these lines should indicate your location.

Topo tip:

- *A map is oriented when it is made to correspond to the ground features it represents. If you know your location and can also identify the position of a distant object, you can orient your map by turning it so it corresponds to the ground features.*



How do I navigate with a compass and a topographic map?

Navigating by compass requires determining bearings with respect to true or grid north from a map sheet and converting them to magnetic bearings for use with a compass. One way of doing this is described in the following steps:

- 1- Place the compass on the map with the direction-of-travel arrow pointing along the desired line of travel.
- 2- Rotate the compass dial so that the parallel lines within the capsule line up with the grid lines on the map. Convert the grid bearing to a magnetic bearing by using the information given (as in the accompanying diagram) on the map sheet. If declination is west, add it to the grid bearing; if declination is east, subtract it from the grid bearing.

Adjust the dial to read the value of the magnetic bearing opposite the direction-of-travel arrow. Make certain to account for the difference between grid north and true north.

- 3- Now pick up and rotate the whole compass until the red end of the needle points to the north marker on the dial. The direction-of-travel arrow on the compass card will point to your destination. Choose a landmark in that direction and walk toward it.

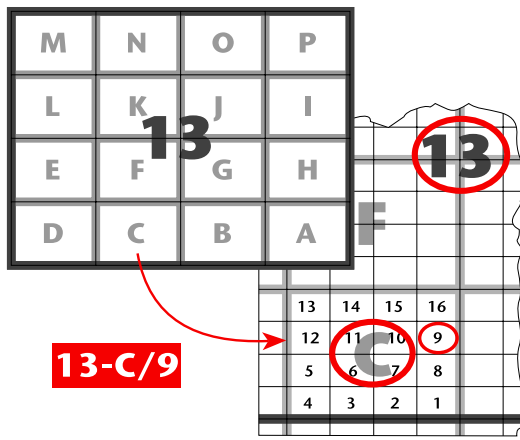
Material provided courtesy of the National Geomagnetism Program, Geological Survey of Canada.

geomag.nrcan.gc.ca/mag fld/compass-eng.php

Topo tip:

- *Using a compass along with a topographic map ensures obtaining an exact direction for locating features. An approximate but quick way to orient your map is to align the compass needle (when it is pointing north) with the top of the map. Remember that north is always at the top of a topographic map.*

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How are map sheet areas defined?

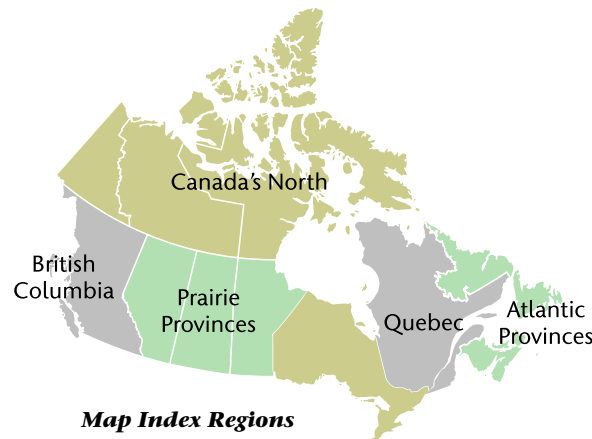
Topographic maps produced by NRCan conform to the National Topographic System of Canada. They are available in two standard scales: 1:50 000 and 1:250 000. The area covered by a given map sheet is determined by its location in Canada. The 1:250 000 scale maps are identified by a combination of numbers and letters, from **A** through **P** (e.g. 13C). The 1:250 000 blocks are divided into 16 segments (**1** to **16**), forming blocks used for 1:50 000 scale mapping (e.g. 13C/9 identifies Little Drunken River, Newfoundland and Labrador).

How do I know which map sheet I need?

The most direct process to determine the map you require is to visit the topographic maps section of the GeoGratis Website at geogratias.ca.

To order a Canadian topographic map, you must know either the location (longitude/latitude) or the name of your area of interest (e.g. a major city, or a large body of water). You may also order by map sheet number.

Paper index maps are available from local map dealers and at map libraries across Canada. Index maps for each of the regions can also be downloaded from GeoGratis at nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9763.



Map Index Regions

Where can I obtain a topographic map?

There are four sources for a topographic map:

- *map dealers across Canada and worldwide*
- *a regional distribution centre*
- *a certified map printer*
- *the GeoGratis Web site, where high quality, print-ready copies of topographic maps can be downloaded for free geogratias.ca*

To find a map dealer in your area, consult the Yellow Pages™ under MAPS. If there are no local dealers accessible to you, or if your local dealer does not carry the maps you require, contact any of our regional distribution centres listed on our Web site at nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9783?destination=node/10580.

A certification program to accredit map printers for on-demand printing of NRCan topographic maps is now implemented. All official NRCan topographic maps are available from certified map printers, who ensure accessibility to high-quality paper maps. Maps published by certified map printers carry a special holographic seal of quality. Maps bearing this seal are authentic copies of NRCan topographic maps and are easily recognized by map users.

Topographic terminology

Bearing: The horizontal angle at a given point, measured clockwise from magnetic north or true north to a second point.

Classified roads: Roads for which surface type, width and use are identified.

Contour lines: Lines on a map connecting points of equal elevation above mean sea level; using contour lines, relief features can be profiled into a three-dimensional perspective.

Elevation: Vertical distance from a datum (usually mean sea level) to a point or object on the Earth's surface.

Horizontal datum: The positional reference or basis for the geographic location of features on a map.

Legend: A description, explanation table of symbols, or other information, on a map or chart to provide a better understanding and interpretation of it.

Magnetic north: Direction to which a compass needle points.

Mean sea level: The average height of the surface of the sea for all stages of tide, used as a reference surface from which elevations are measured.

National Topographic System: An orderly index system suitable for a series of maps of different scales for the coverage of Canada.

Projection: Geometric representation of the curved surface of the Earth on a flat sheet of paper.

Relief: The physical configuration of the Earth's surface, depicted on a topographic map by contour lines and spot heights.

Spot elevation: A point on a map where height above mean sea level is noted, usually by a dot and elevation value; it is shown wherever practical (road intersections, summits, lakes, large flat areas and depressions).

Symbols: A diagram, design, letter or abbreviations, placed on maps, that (by convention, usage or reference to a legend) is understood to stand for or represent a specific feature or object.

Topography: Surface features both natural and man-made, collectively depicted on topographic maps.

Unclassified roads: Roads for which the surface is unidentified.

For more definitions and useful information on topographic maps, visit the *National Topographic Series Polychrome Map Standards and Specifications* publication at geogratis.gc.ca/api/en/nrcan-nrcan/ess-sst/a8db604e-3305-59a6-a77b-0f03b8cb963d.html.

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