Natural Resources
Canada
Geomatics Canada

Ressources naturelles
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Géomatique Canada

CanMatrix (georeferenced)

(1:50 000 and 1:250 000 Topographic Raster Maps)

Standards and Specifications for GeoGratis
Edition 1.1

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Canada

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1. Introduction

The Centre for Topographic Information in Ottawa (CTI-O) has set up a program for producing raster topographic maps of the Canadian landmass. These digital topographic maps have been produced by scanning paper topographic maps at the 1:50 000 and 1:250 000 scales.

The Centre for Topographic Information in Sherbrooke (CTI-S) is responsible for distributing the digital raster maps produced by CTI-O. The digital raster product as distributed by CTIS is known as **CanMatrix (georeferenced)**.

CanMatrix (georeferenced) can be used in a variety of ways such as the base information in an emergency measures program. Moreover, since *CanMatrix (georeferenced)* is basically a raster image, it can also be used as background data for a variety of applications. This can be of significant interest to users of global positioning systems (GPS), navigators, hikers, and tourists who, without being geomatics specialists, are nevertheless comfortable with digital topographic data. Lastly, *CanMatrix (georeferenced)* lends itself to creating value-added products.

This product once again points to CTI's and the federal government's determination to offer products for the general public in order to promote geomatics among non-specialists.

2. Data Source

2.1. Scales

CanMatrix (georeferenced) comprises raster digital data produced by scanning paper topographic maps of Canada at the 1:50 000 and 1:250 000 scales. Consequently, each *CanMatrix (georeferenced)* file or dataset contains map data at the 1:50 000 or 1:250 000 scale, depending on the scale of the source map.

2.2. Contents

CanMatrix (georeferenced) was produced by scanning federal-government topographic maps at the 1:50 000 and 1:250 000 scales. Only the front side of these maps, however, have been scanned. As a result, each *CanMatrix (georeferenced)* file or dataset contains all the information on the front of the paper map scanned. This takes in all the topographic information included within the neatline (or NTS (National Topographic System) division) as well as the entire map surround outside of the neatline (that is, information in the border of the map).

2.3. Types of Source Data

Since *CanMatrix (georeferenced)* files are basically digital images of scanned paper maps, they must therefore faithfully represent the source topographic maps. This means that the data in *CanMatrix (georeferenced)* files may be polychrome, monochrome, or a photomap.

2.4. Coverage

In all, about 1000 topographic maps at the 1:250 000 scale have been scanned to produce as many *CanMatrix (georeferenced)* files at the same scale, whereas about 12 000 topographic maps at the 1:50 000 scale have been scanned to produce the same number of *CanMatrix (georeferenced)* files at the same scale. CTI completed coverage of the country with *CanMatrix (georeferenced)* data in May 2003.

3. Product Specifications

3.1. Data Sets

The Canadian topographic maps at the 1:50 000 and 1:250 000 scales on which *CanMatrix (georeferenced)* has been built follow National Topographic System [1] (NTS) divisions. Since *CanMatrix (georeferenced)* files are directly derived from scanning these maps, it follows that *CanMatrix (georeferenced)* files or data sets comply with NTS divisions. Dataset coverage varies according to the area's geographic location within Canada. **Figure 1** provides an idea of NTS divisions at the 1:250 000 scale for the entire Canadian landmass.

Figure 1
NTS divisions of Canada at the 1:250 000 scale
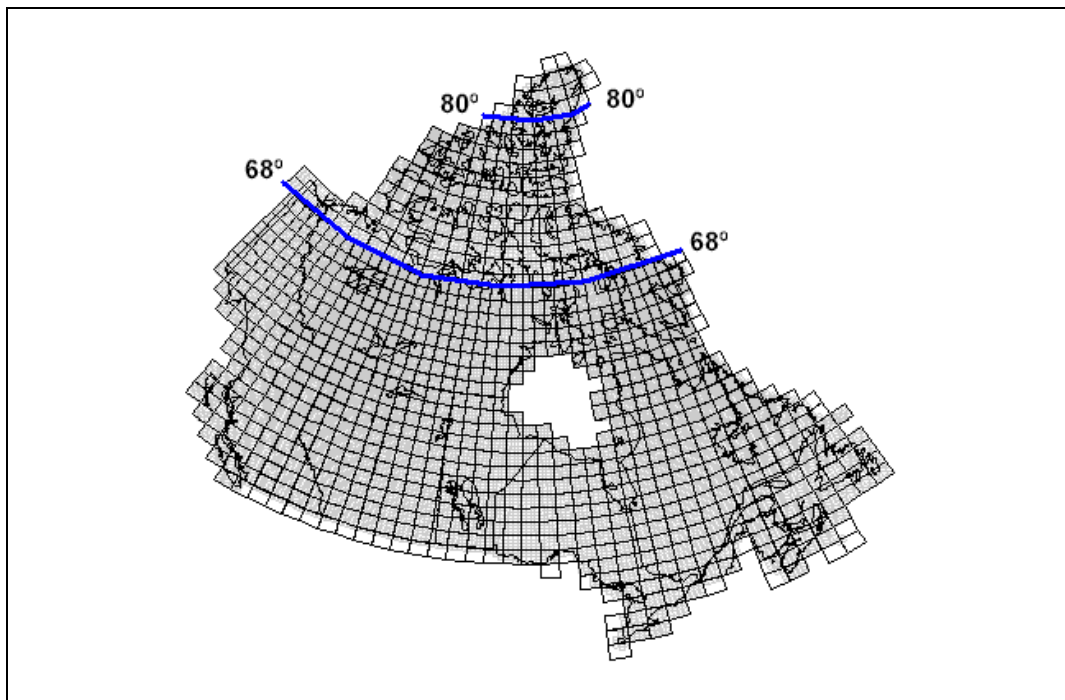
Under the NTS, Canada is divided into quadrants that vary in size depending on dataset (or map) scale and latitude as described in the following table.

Dataset Latitude	1:50 000 Scale (Latitude by Longitude)	1:250 000 Scale (Latitude by Longitude)
North of 80°	15' by 2°	1° by 8°
68° to 80°	15' by 1°	1° by 4°
South of 68°	15' by 30'	1° by 2°

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1 For more information about the NTS, visit: http://maps.nrcan.gc.ca/topo101/index_e.php

Most *CanMatrix (georeferenced)* files represent complete map sheets and therefore conform to regular NTS divisions. Nevertheless, some are half sheets based on regular NTS divisions, while others cover more than a map sheet. The latter occurs when a map includes an area theoretically belonging to an adjacent sheet. Such maps are said to have a "border break." A border break is a cartographic technique used when it is required to extend a portion of the cartographic detail of a map beyond the neatline into the margin. This occurs when a complete map is not justified for a given NTS map sheet, because the area to be mapped is too small. This additional information is then placed on the adjacent map which becomes a map with a border break.

3.2. Horizontal and Vertical Reference Systems

The data in *CanMatrix (georeferenced)* files have been georeferenced horizontally using the North American Datum of 1983 (NAD83). The elevation data in CanMatrix files come from orthometric elevations, expressed in reference to mean sea level (Canadian Vertical Geodetic Datum). Since CanMatrix files are two-dimensional (2D), the elevation data referred to here are those that could be seen on a map, such as contours.

3.3. Map Projection and Measuring Unit

CanMatrix (georeferenced) data are represented in the Universal Transverse Mercator projection (UTM)[2] and the measuring unit used for horizontal coordinates (X, Y) is the metre.

3.4. Data Resolutions

CanMatrix (georeferenced) files are available in a resolution of 300 dots per inch (dpi).
Figures 2 to 4 below provide an idea of how different types of *CanMatrix (georeferenced)* files appear when displayed.

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2 A description of the UTM projection can be found at: http://maps.NRCan.gc.ca/maps101/utm.html

Figure 2
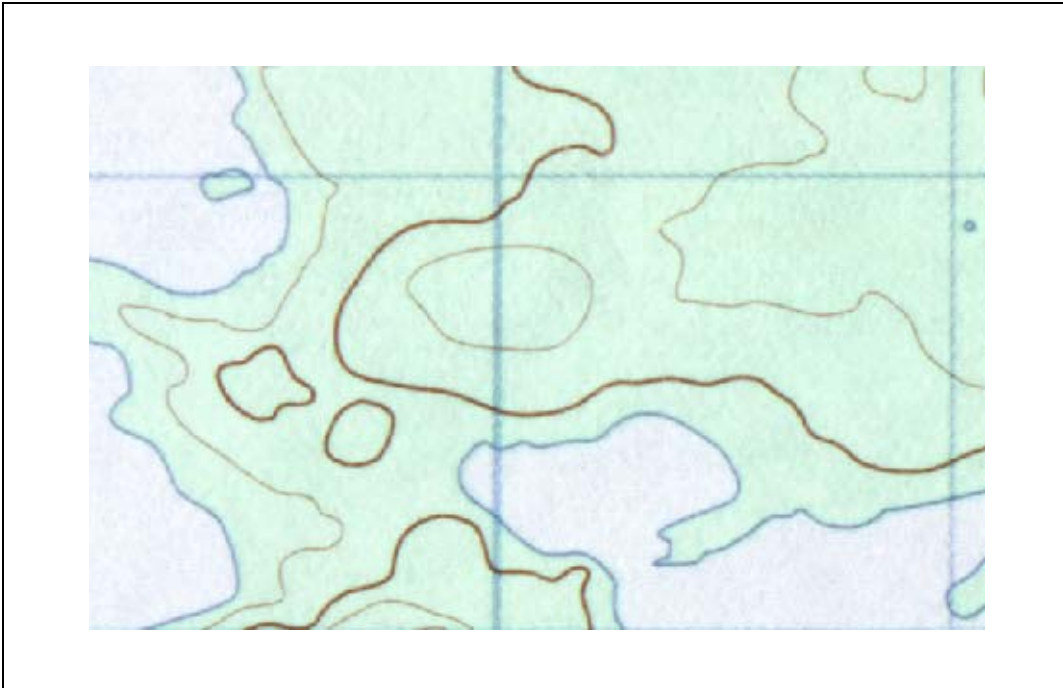Portion of a *CanMatrix (georeferenced)* polychrome file at a resolution of 300 dpi.

Figure 3
Portion of a *CanMatrix (georeferenced)* monochrome file at a resolution of 300 dpi.
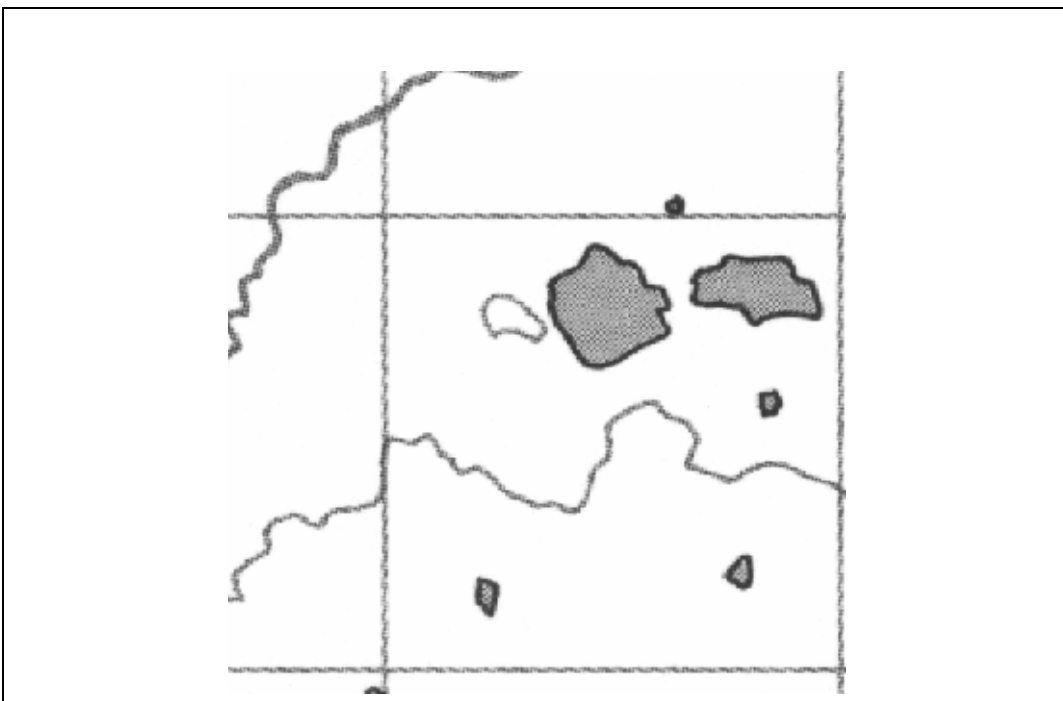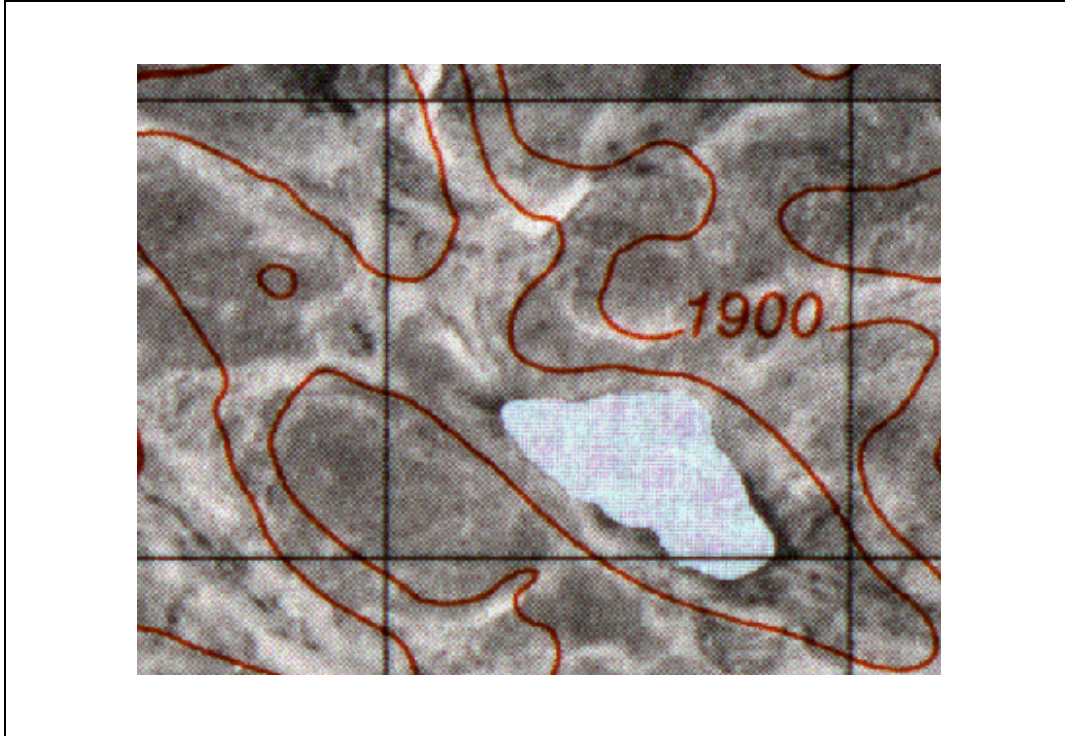
Figure 4
Portion of a *CanMatrix (georeferenced)* photomap file at a resolution of 300 dpi.

3.5. Pixel Size

Each pixel in a *CanMatrix (georeferenced)* file represents a surface that is dependent on file resolution and scale. As a result, each pixel in a *CanMatrix (georeferenced)* file at the 1:50 000 scale with a resolution of 300 dpi represents an area whose side measures 4.233 m. Similarly, each pixel in a *CanMatrix (georeferenced)* file at the 1:250 000 scale with a resolution of 300 dpi represents an area whose side measures 21.167 m.

3.6. Format of *CanMatrix (georeferenced)* Files

CanMatrix (georeferenced) files are in the GeoTIFF format[3] (Georeferenced Tagged Image File Format; .tif), in which each pixel is georeferenced based on the horizontal reference system mentioned above.

3.7. Radiometry of *CanMatrix (georeferenced)* Files

The radiometry corresponds to the number of bits used to save the information for a pixel. All CanMatrix (georeferenced) files have a radiometry of 8 bits (256 grayscale levels). In CanMatrix (georeferenced) files derived from polychrome maps, the 8-bit radiometry is associated with a pseudo-color table, which provides the means for conveying the colors in the original map.

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3 For more information about the GeoTIFF format, visit: http://www.remotesensing.org/geotiff/geotiff.html.

3.8. File Size

In most cases, *CanMatrix (georeferenced)* files in GeoTIFF format (.tif) range in size from 5 to 80 megabytes (MB), with an average of about 30 MB.

CanMatrix (georeferenced) files are compressed (PKZIP), however, before delivery, which reduces their size. The reduction ratio of CanMatrix (georeferenced) files normally varies from 10% to 80%, depending on the dataset and product resolution.