Natural Resources Canada
Geomatics Canada

Ressources naturelles Canada
Géomatique Canada

CanMatrix

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

Standards and Specifications
Edition 1.0

Centre for Topographic Information
Customer Support Group
2144 King St. West, Suite 010
Sherbrooke (QC) Canada J1J 2E8
1-800-661-2638 (Canada and USA)
http://www.CTIS.NRCan.gc.ca

August 2003

Canada

TABLE OF CONTENTS

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***.

CanMatrix can be used in a variety of ways such as the base information in an emergency measures program. Moreover, since *CanMatrix* 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* 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.

CTI completed coverage of the country with *CanMatrix* data in May 2003.

2. Data Source

2.1. Scales

CanMatrix 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* 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 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* 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* 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* files may be polychrome, monochrome, or a photomap.

2.4. Coverage

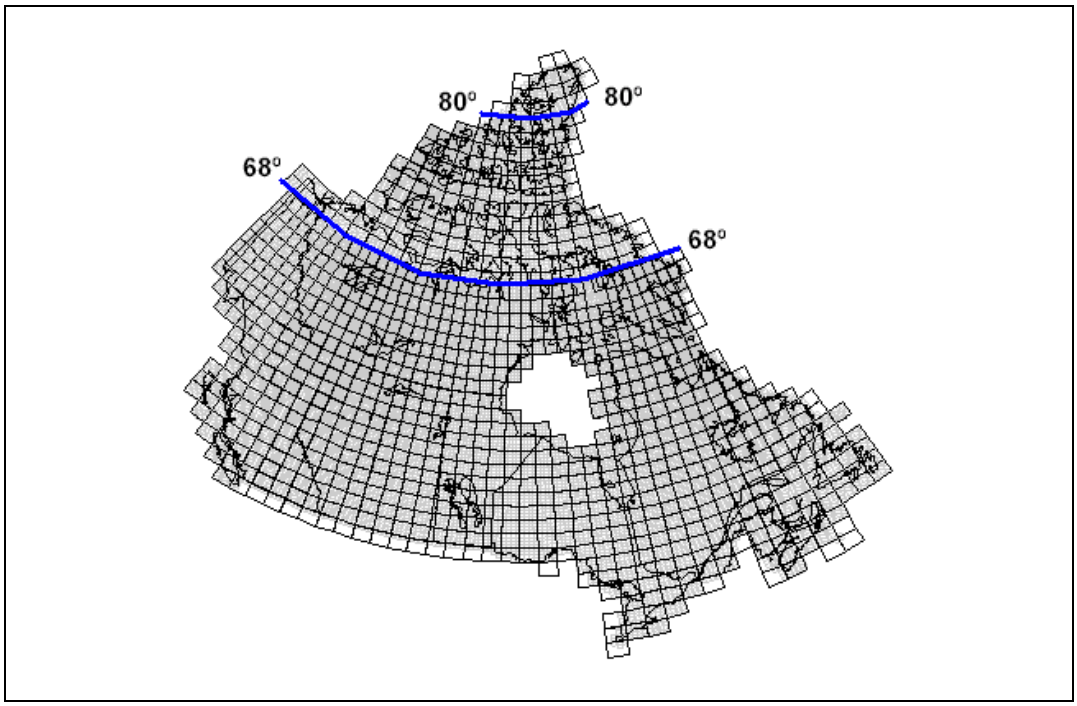
In all, about 1000 topographic maps at the 1:250 000 scale have been scanned to produce as many *CanMatrix* files at the same scale, whereas about 12 000 topographic maps at the 1:50 000 scale have been scanned to produce the same number of *CanMatrix* files at the same scale. CTI completed coverage of the country with *CanMatrix* 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* has been built follow National Topographic System [1] (NTS) divisions. Since *CanMatrix* files are directly derived from scanning these maps, it follows that *CanMatrix* 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°

1 For more information about the NTS, visit: http://maps.NRCan.gc.ca/maps101/nts.html

Most *CanMatrix* 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* 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 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 files are available in two resolutions: 160 and 300 dots per inch (dpi). Since resolution directly influences pixel size and therefore the number of pixels in a *CanMatrix* file, a low-resolution file (e.g. 160 dpi) has fewer pixels than a high-resolution file (e.g. 300 dpi). Consequently, a low-resolution *CanMatrix* dataset requires less storage memory than the same dataset at high resolution. A low-resolution *CanMatrix* file has larger pixels and appears coarser and less accurate when displayed compared to a high-resolution file. **Figures 2 to 7** below provide an idea of how different types of *CanMatrix* files appear when displayed.

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* polychrome file at a resolution of 300 dpi.

Figure 3
Portion of a *CanMatrix* polychrome file at a resolution of 160 dpi.

Figure 4
Portion of a *CanMatrix* monochrome file at a resolution of 300 dpi.

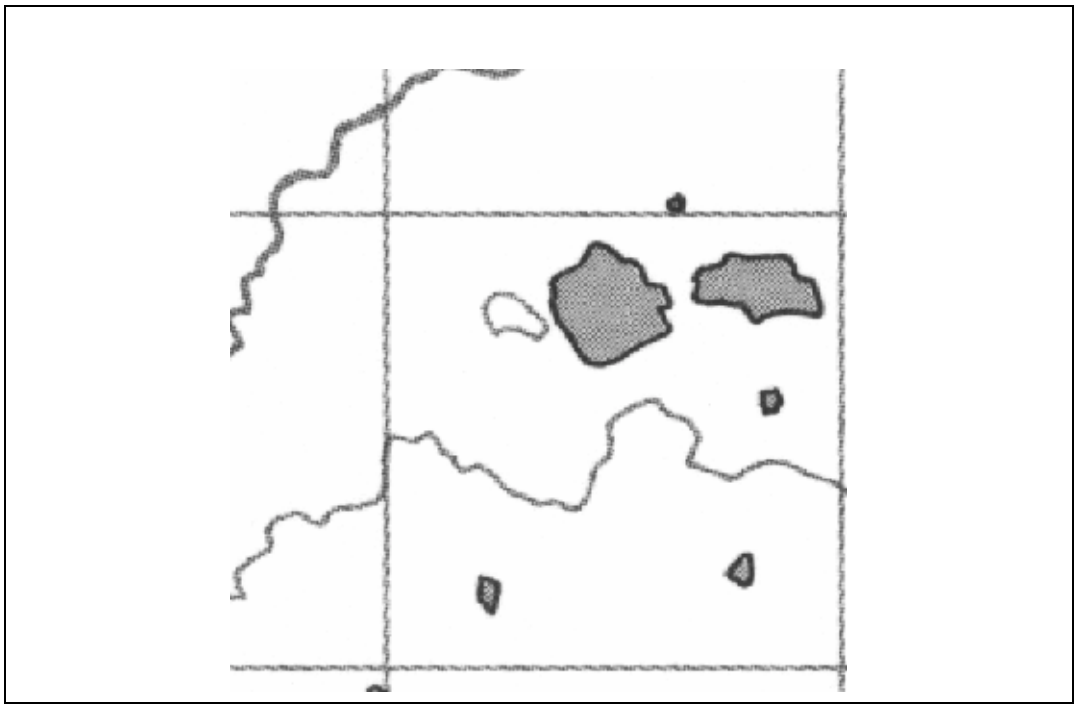


Figure 5
Portion of a *CanMatrix* monochrome file at a resolution of 160 dpi.

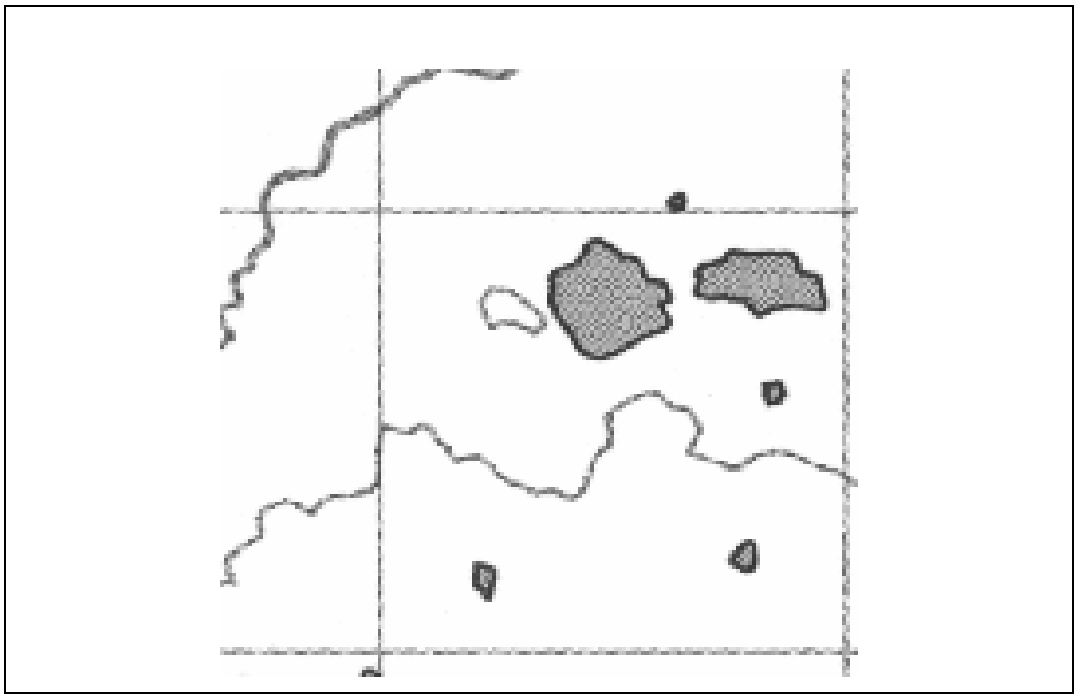


Figure 6
Portion of a *CanMatrix* photomap file at a resolution of 300 dpi.

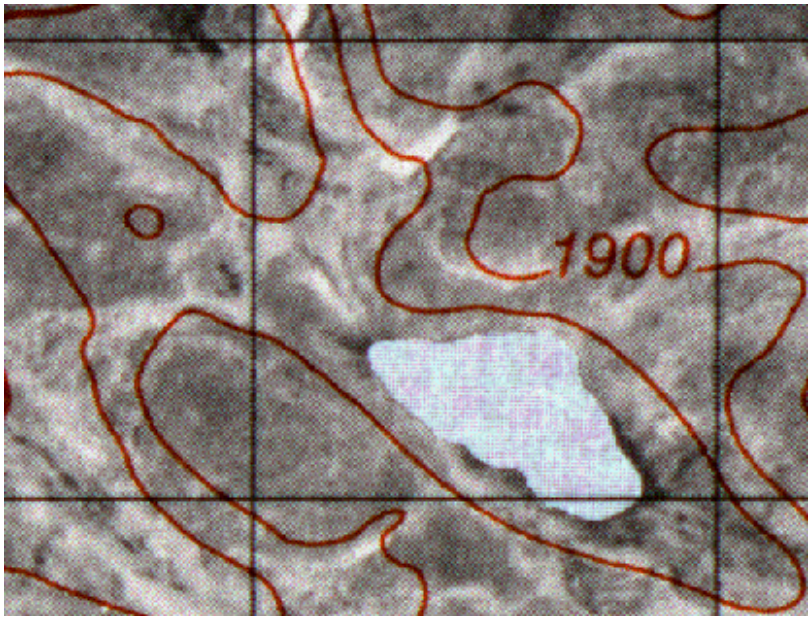
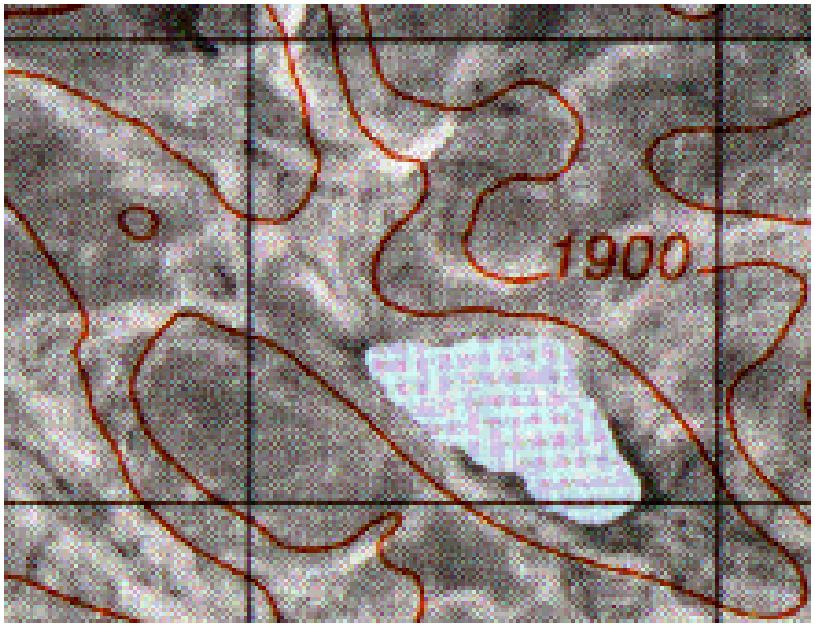


Figure 7
Portion of a *CanMatrix* photomap file at a resolution of 160 dpi.



3.5. Pixel Size

Each pixel in a *CanMatrix* file represents a surface that is dependent on file resolution and scale. As a result, each pixel in a *CanMatrix* file at the 1:50 000 scale with a resolution of 300 dpi represents an area whose side measures 4.233 m. This dimension increases to 7.938 m if the resolution of the dataset is reduced to 160 dpi. Similarly, each pixel in a *CanMatrix* file at the 1:250 000 scale with a resolution of 300 dpi represents an area whose side measures 21.167 m. This dimension increases to 39.688 m if the resolution of the dataset is reduced to 160 dpi.

3.6. Format of *CanMatrix* Files

CanMatrix 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. This format uses Packbit compression, which doesn't alter the data and results in no loss of data.

3.7. Radiometry of *CanMatrix* Files

The radiometry corresponds to the number of bits used to save the information for a pixel. All CanMatrix files have a radiometry of 8 bits (256 grayscale levels). In CanMatrix 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.

3.8. File Size

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

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

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

Filename: canmatrix_standards_200308.doc
Directory: I:\dbndt\produits\canmatrix\normes_specs
Template: C:\Documents and Settings\barnabe\Application Data\Microsoft\Templates\Normal.dot
Title: CanMatrix, Standards and Specifications, Edition 1.0
Subject: Standards and Specifications of the CanMatrix product (Topographic Raster Maps at the 1:50000 and 1:250000 scales)
Author: Centre for Topographic Information - Sherbrooke (CTI-S), Natural Resources Canada (NRCan)
Keywords: CanMatrix, Topographic Raster Maps, GeoTIFF Format, pixel, scanned data, digital data from scanning
Comments:
Creation Date: 2003-09-15 17:33
Change Number: 34
Last Saved On: 2005-03-21 15:23
Last Saved By: barnabe
Total Editing Time: 2 655 Minutes
Last Printed On: 2005-03-21 15:23
As of Last Complete Printing
Number of Pages: 9
Number of Words: 1 543 (approx.)
Number of Characters: 7 717 (approx.)