



***Saskatchewan Geographic Location:***

***Latitude: 49 – 60 degrees North***

***Longitude: 102 – 110 degrees West***

***Basic User Guide***

***Version 2.0***

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## ***Introduction***

### ***The Saskatchewan Geospatial Imagery Collaborative***

The Saskatchewan Geospatial Imagery Collaborative (SGIC) is a partnership of organizations sharing knowledge and costs relating to acquisition and use of remotely sensed imagery for mutual and public benefit. The collaborative operates servers providing a web mapping client and an OGC-standard Web Map Service (WMS) and Web Map Tile Service (WMTS) for sharing geospatial imagery. Members of the public are welcome to use a limited set of the SGIC's geospatial imagery holdings, while SGIC members gain access to an expanded set of imagery products.

### ***What This Manual Covers***

This manual covers basic usage of three interfaces to the SGIC's geospatial imagery products:

- The SGIC Web Mapping Client – a web browser-based interface for searching and viewing geospatial imagery; and,
- The SGIC Web Map Tile Service – an OGC (Open Geospatial Consortium) standards-compliant interface for requesting map tiles over the internet.
- The SGIC Web Map Service – an OGC service for requesting complete map images

This manual applies to both free public access and to SGIC members-only access. It also has two appendices for further reading:

- Appendix A – Introduction to Geospatial Data; and,
- Appendix B – Introduction to SGIC Hardware / Software

# **Chapter 1**

## **Using the SGIC web mapping client**

### **Introduction**

The web mapping client provides a web browser-based interface for users of the SGIC's data. It provides all of the functionality needed to add data to a map image, view data, and download it to the user's computer.

### **Loading**

The web mapping client is loaded by navigating a web browser to the URL <https://www.flysask2.ca> and clicking on the View Imagery button. The Log In link at the top right of the page will also redirect to the web mapping client after a successful login.

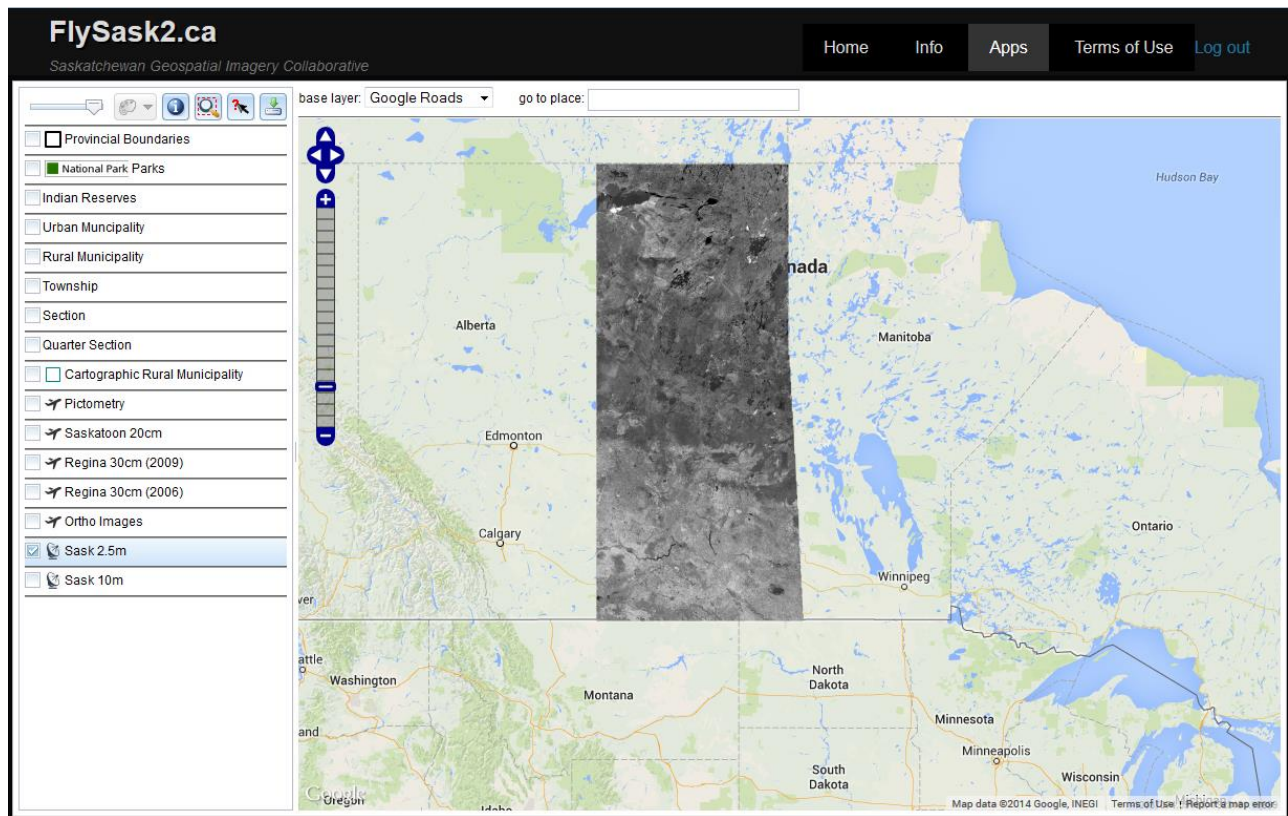
Note that because of the web mapping client application's use of OGC Web Services to obtain its data, it is not possible to use the application without a network connection to the internet.

### **Application Components**

A view of the SGIC web mapping client application as it appears once the user has loaded it is shown in Figure 1. The user interface is divided into three "panels;"

- Header Panel – the header panel, running across the top of the web browser, shows the menu which provides access to the rest of the portal. This pane also provides a logout button to allow the user to end their session;
- Layers List – the layers list, running down the left hand edge of the web browser shows the layers which are available to the logged in user. The toolbar at the top provides various operations available on the selected layer. The user may "drag and drop" layers to rearrange them.
- Map Panel – the map panel displays map data in a geographic projection. It also has controls for panning and zooming the map, switching the base layer and a gazetteer for quickly zooming to specific locations.

The map panel is initialized to show a satellite image of Saskatchewan, overlaid on a Google Maps street layer background. The background may be switched to any of the selections available in the drop list.



*Figure 1. SGIC Web Mapping Client Application*

### ***Using the Map Panel***

Although you can pan and zoom the map using the control in the upper left, the application supports directly panning and zooming the display using the mouse. Click on a portion of the map and hold the mouse button down while dragging to pan the display. To zoom the display, rotate the center wheel on your mouse. It is also possible to select a specific zoom extent by holding down the shift key on your keyboard and dragging a rectangle over the area in question. This operation is shown in Figure 2.

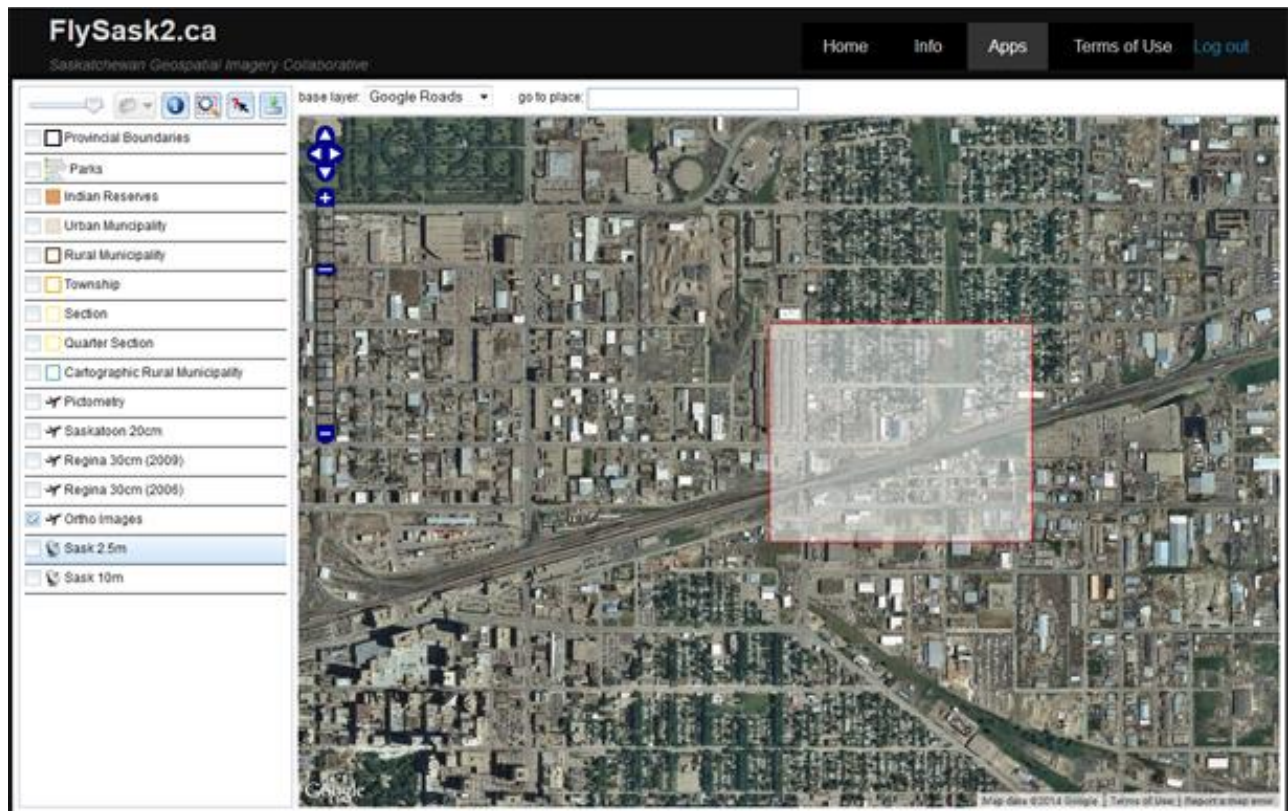





Figure 2. Zooming to a specific extent by holding down the shift key

### Using the Layer Tools

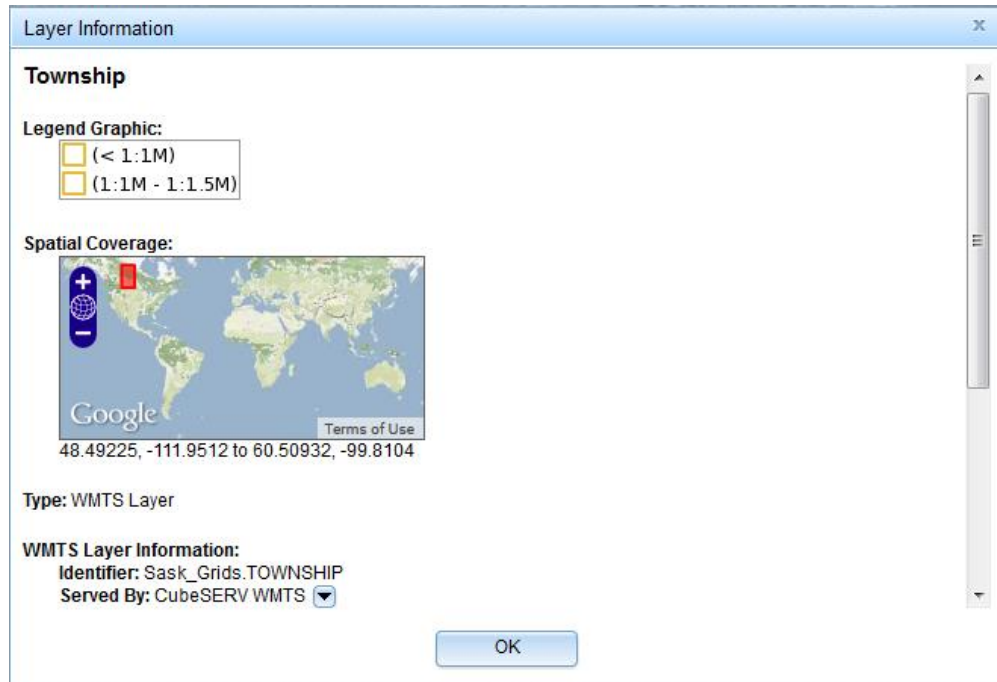
Six tools are provided on the layer toolbar to assist the user in viewing and manipulating geospatial data.






Figure 3. The Layer Toolbar

- Opacity Slider – The opacity slider (  ) adjusts the transparency of the selected layer. This can be very useful in providing context by revealing the Google Maps data beneath the layer.
- Style Selector – Occasionally, there will be multiple styles available for a layer. This may include optional vector styling for feature layers or multi-band compositions for imagery. The style selector (  ) is normally disabled, as shown, but will be enabled if one of the above conditions exists.
- Layer Info – The layer info button (  ) brings up more detailed information about the selected layer, as shown in Figure 4.





*Figure 4. Layer Info Panel*

- Zoom To Extent Tool – the zoom to extent tool () causes the map window to pan and zoom to the extent of the currently selected data set. This can be useful in locating small high resolution data sets.
- Identify Tool – the identify tool () enables “point and click” query mode on the currently selected layer and is used to perform an attribute query on individual map features in vector layers only. It is disabled if you select a raster layer.
- Download Tool – the download () tool provides a way for users to save a geospatial image file on their computer. Its use is covered in a separate manual.

## **Conclusion**

With this simple to use yet powerful set of web mapping tools, SGIC users are able to create accurate and detailed map images showing raster imagery and vector features.

# ***Appendix A - Introduction to Geospatial Data***

## ***Introduction***

Geospatial data consists of information that is tied to a location on the surface of the earth. For example, when a digital image captured by an aircraft is given an accurate location, it becomes useful for visualizing the surface of the earth and for identifying the features that are visible in the photograph.

Our goal with the SGIC system is to share geospatial data in a way that people can use it to make accurate maps. This introduction to geospatial data has been written to give administrators a basic understanding of how geospatial data is organized and what is involved in using it to draw a two-dimensional map on the computer screen.

## ***Types of Geospatial Data***

Geospatial data typically comes in one of two types:

- Vector Data – this is data that represents shapes, such as points, lines, ellipses, and polygons, tied to locations. For example, vector data representing the locations of the roads in Saskatchewan is available and consists of a series of lines with each endpoint specified with a geographic location. Vector data is available in a variety of formats, such as:
  - ESRI Shapefile
  - OGC Geographic Markup Language
- In addition to location information, vector data is often supplied with a database of attributes for each location. For example, the road vector data contains attributes for each line segment that describe the highway number, how many lanes are available on the highway, and what sort of surface the highway is paved with.
- Raster Data – this is data in bitmap format that represents a digital image of the surface of the earth. For example, an image captured by a camera on an orbiting satellite can be assigned to a location by identifying control points on the surface of the earth and then used for visualization purposes. Raster data is available in a variety of formats, such as:
  - TIFF
  - GeoTIFF
  - JPEG
  - Windows Bitmap
  - ECW
  - MrSID

Some of these formats, such as GeoTIFF, include the geographic location in a single file. Others, such as JPEG, must be provided with a 'World file' that describes the geographic extent of the location that the image covers.



Geospatial data is typically organized in sets called 'themes,' with each theme containing a number of 'features.' Each feature corresponds to a specific type of object in the data. For example, the national road network data set is a theme containing geospatial data on roads in Canada, organized into features such as linear road segments. As new data becomes available for a given feature a new 'version' of the feature may be made available, such as when new roads are added to the road segment feature in the national road network theme. With a selection of features, it is possible to draw complicated maps by superimposing layers of vector features on top of a raster feature.

## **Ellipsoids**

The earth is not precisely spherical – it is an ellipsoid, sometimes referred to as a spheroid. Furthermore, it is not perfectly flat – mountains and valleys on the surface of the earth are captured by a shape known as the geoid. The spheroid and geoid are illustrated in Figure 1. In order to understand how to draw geospatial data on a flat computer screen, it is important to know what model of the spheroid to use with the data. The common models used in Canada are known as GRS80 or WGS84.

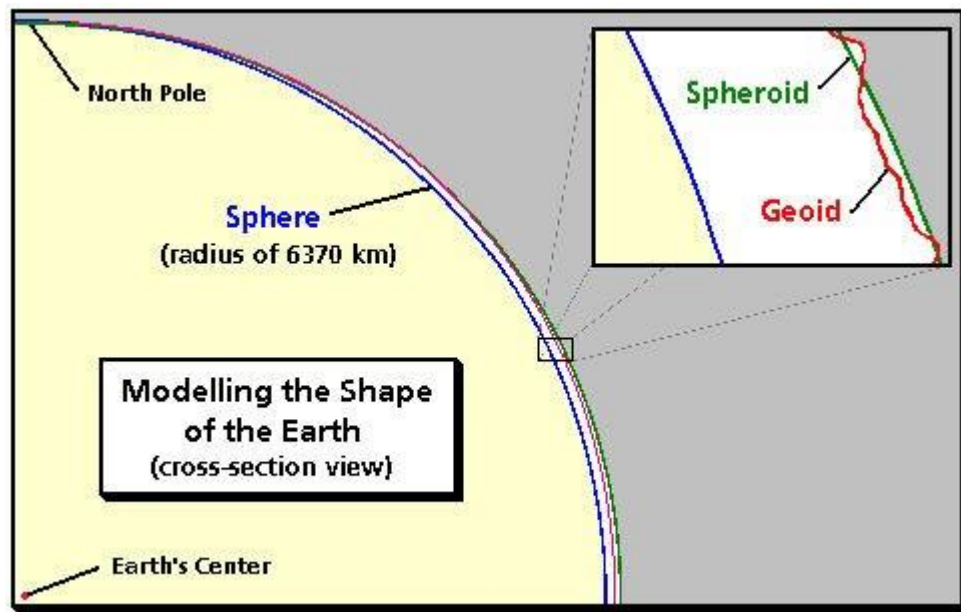
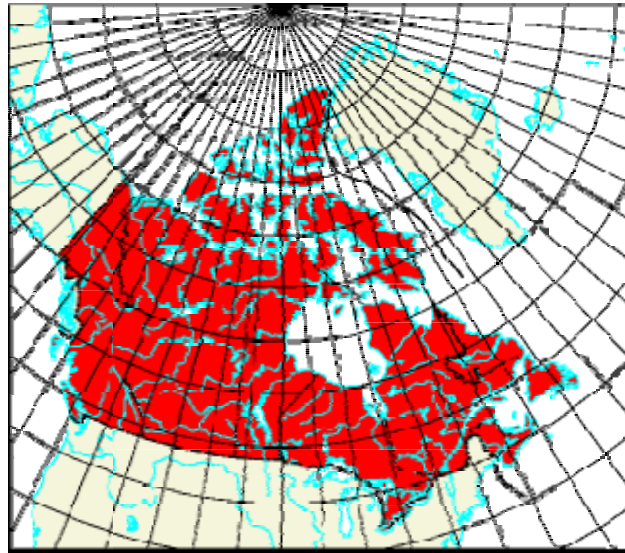


Figure 1. Modeling the Shape of the Earth. Credit: Dylan Prentiss, Department of Geography, University of California, Santa Barbara.

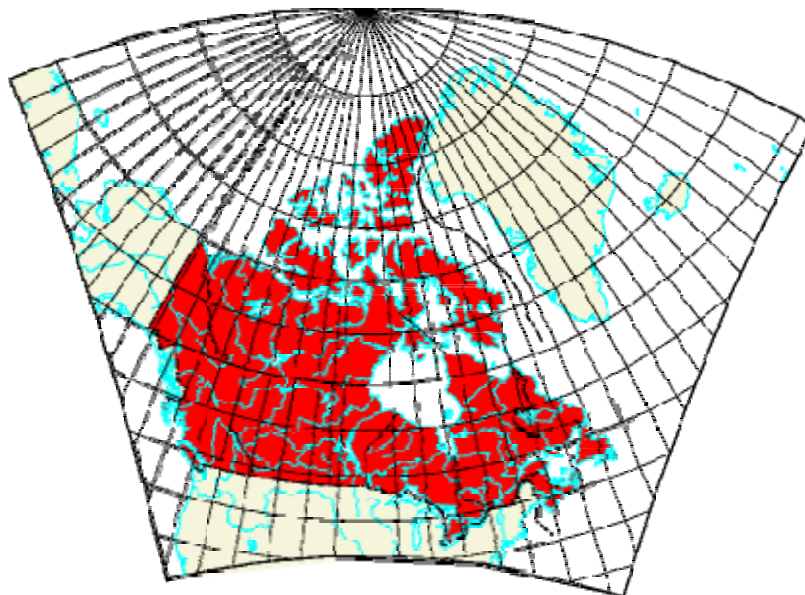
## **Projections**

In order to give an accurate representation of the surface of the earth on a flat two-dimensional computer screen, geographic data must be projected. This involves selecting a mathematical algorithm for displaying the surface of the earth in two dimensions, and applying this algorithm to the data. Shifting geospatial data from one projection to another is known as reprojection.

There are thousands of projections used with geospatial data, each of which is ideal for representing a particular portion of the earth. Each projection also causes other portions of the earth to appear distorted. For example, in Canada, it is common to see maps presented in a cylindrical (geographic) projection, but this tends to make the northern portions of the prairie provinces and the territories look excessively large. To correct for this, a Lambert conformal conic projection is often seen on maps, which gives the northern parts of the country a more natural appearance. This is shown in Figure 2. A transverse Mercator projection is also used commonly for small-scale paper maps, which allows for accurate navigation over the area of the map but would cause distortion over a larger scale. An example of a transverse Mercator projection for Canada is shown in Figure 3.



*Figure 2. Map of Canada, Lambert Conformal Conic Projection. Credit: The Atlas of Canada.*



*Figure 3. Map of Canada, Transverse Mercator Projection. Credit: The Atlas of Canada.*

## Co-ordinate Systems

Co-ordinate systems allow a user of geospatial data to identify a location on the surface of the earth. The most common co-ordinate system in use is the “Geographic” co-ordinate system. In this system a measure of latitude consists of an angular measure in degrees, minutes, and seconds north or south of the equator. Similarly, a measure of longitude consists of an angular measure in degrees, minutes and seconds east or west of the prime meridian running through Greenwich, England. It is common to see degrees of longitude west of the prime meridian expressed as a negative number – for example, the Alberta-Saskatchewan border is longitude  $-110^{\circ}$ . Latitude and longitude may also be expressed in decimal degrees, where the minutes and seconds of an angle are converted to a decimal portion of a degree.

A combination co-ordinate system and map projection used extensively in Canada is the Universal Transverse Mercator (UTM) system. In this system, the earth is divided into zones six degrees wide. These zones are then ‘unwrapped’ into rectangular strips, one north of the equator and one south of the equator. Measurements are then taken as a northing and easting from the edges of the UTM zone, measured in metres. UTM Zones for Canada are shown in Figure 4.

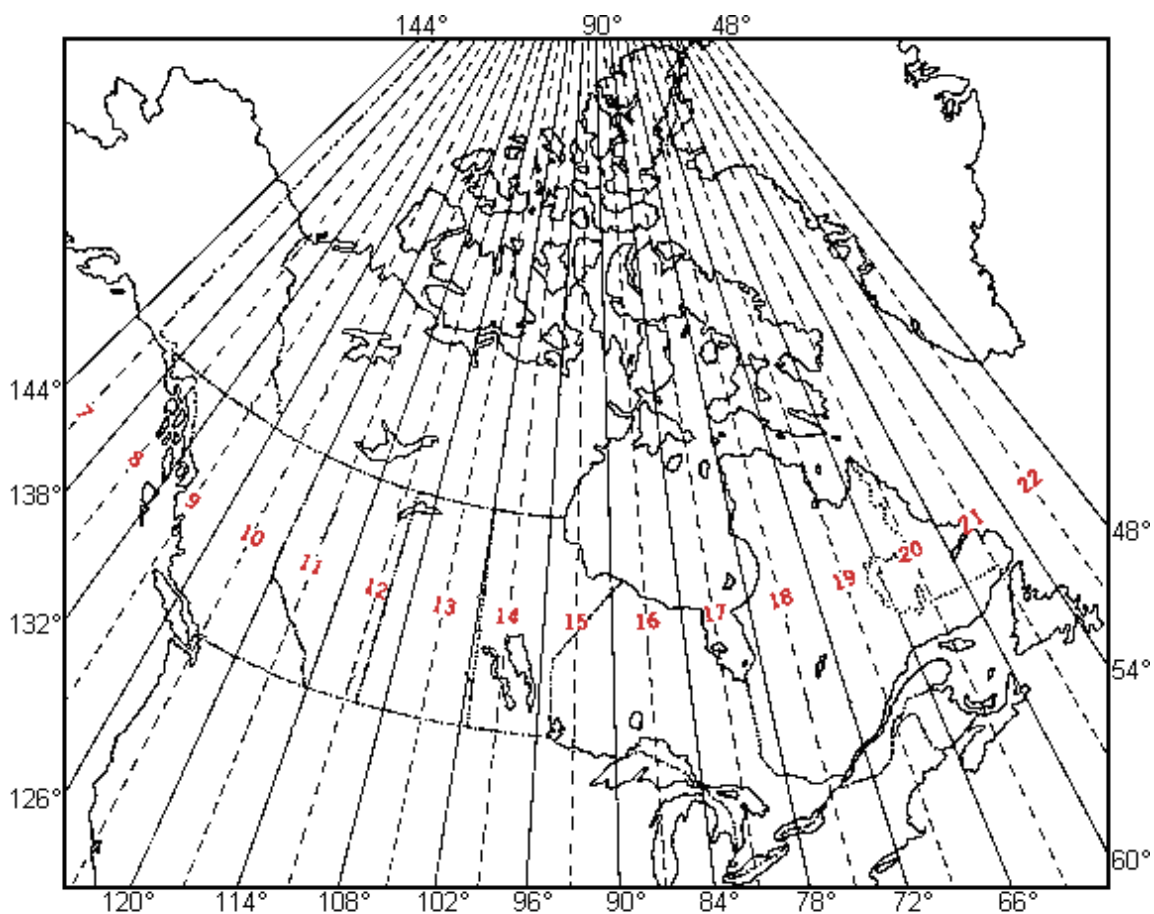


Figure 4. UTM Zones and Central Meridians for Canada. Credit; Natural Resources Canada, Centre for Topographic Information

Co-ordinates may include a third measurement representing the elevation of a location above the surface of the earth. Elevation information can be used to create three-dimensional visualizations of the surface of the earth and the features on it.

## ***Datums***

In order for users of geospatial data to be able to arrive at the same location on the surface of the earth, their measurements must start from a common reference location, or datum. Shifting geospatial data from one datum to another is known as datum shifting.

In Canada, the North American Datum 1927 (NAD27) was used for many years, and a large volume of data still exists that uses this datum. More recently The North American Datum 1983 has come into general use, based on the GRS80 ellipsoid, and users of geospatial information are encouraged to adopt this datum for new data whenever possible.

## ***Spatial Reference Systems***

Combining information on projection, co-ordinate system, and datum allows us to arrive at a complete description of the spatial reference system used to describe geospatial data. In order for users of geospatial data to obtain an accurate map, they must know the original spatial reference system for their data, the final spatial reference system they want to arrive at, and the mathematical algorithms needed to reproject and shift the data between the two.

Fortunately, software libraries are available which contain the algorithms needed to reproject and shift geospatial data. One of the most commonly-used libraries for this purpose is the “proj4” open source library. It uses a string representation to describe spatial reference systems. For example, a UTM zone 13N NAD83 projection using the GRS80 ellipsoid could be described in the proj4 format as:

```
+proj=UTM +zone=10N +ellps=GRS80 +datum=NAD83 +units=m
```

Another useful development in spatial reference systems has been the definition of a standard set of spatial reference identification codes by the European Petroleum Survey Group (EPSG). For example, EPSG code 26910 corresponds to a proj4 text description of the UTM projection described in the previous paragraph.

Sometimes vector data is supplied with a projection (.prj) file that describes what projection the data is in. If this information is not provided in a projection file, it is usually available in the metadata accompanying the vector data.

## ***Scale***

The two-dimensional map generated on the computer screen from geospatial data has to apply a scale factor in order to show all of the data. Map scales are expressed in a format such as screen units:map units. So, for example, a 1:10 million map scale, means that one centimeter measured on the screen corresponds to 10 million centimeters measured on the ellipsoid. A 1:25 million map scale is useful for displaying all of Canada on the screen, while topographic maps are often drawn at scales of 1:250,000 or 1:50,000. Examples of a 1:50,000

map sheet and a 1:250,000 map sheet for the same area of Canada are shown in Figures 5 and 6.



Figure 5. Sample of NTS 1:50,000 Map Sheet 031G05 for Ottawa. Credit: Natural Resources Canada, Centre for Topographic Information

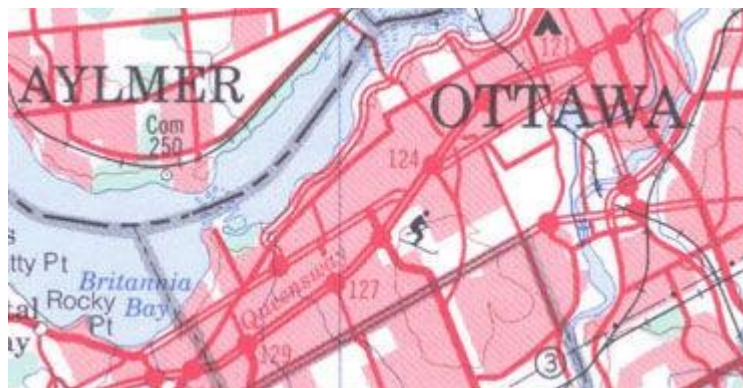


Figure 6. Sample of NTS 1:250,000 Map Sheet 031G for Ottawa. Credit: Natural Resources Canada, Centre for Topographic Information

## Metadata

Metadata, or 'data about the data,' is available with most geospatial data sets to describe information such as the spatial reference system. It also describes the technical steps



that were used to prepare the data, and explains the attribute data that is included in the data set. Metadata is usually provided in an .xml file in the FGDC format, which includes a number of standardized fields. In other cases, metadata may be provided in a format such as a .pdf file.

### ***Using Geospatial Data***

In the SGIC web mapping application, we have attempted to strike a balance between ease of use and the need for precise data. The application uses a universal transverse mercator projection (UTM/Zone13N), EPSG code 26913, in order to simplify user operations such as selecting a download extent. Users can choose a different projection by selecting the Spatial Reference Tab and choosing from a list.

Data in the geospatial database provided for the application is organized into themes, features, and versions. Maps in the application consist of layers containing features from the mapping database, and can either be set up to use the most recent version of a feature or a numbered version. The catalogues that users interact with are generated from maps, and are used to select layers for display on the screen.

A key consideration for administrators, especially when adding new data to the system, is to know what projection the data is in before it is added. This can usually be obtained from the metadata available for the file, or from a .prj file if one has been supplied. All projections in the application are specified using EPSG codes. Data is stored in the spatial database in the projection that it was supplied in, and is reprojected to EPSG code 26913 (UTM/Zone13N projection, NAD83 datum, WGS84 ellipsoid).

The application provides a facility for storing metadata. If metadata is supplied, it is made available to the user by clicking on the metadata icon next to a feature in the web mapping application's catalog control.

### ***References***

The Atlas of Canada – Map Making.

[http://atlas.nrcan.gc.ca/site/english/learningresources/carto\\_corner/index.html](http://atlas.nrcan.gc.ca/site/english/learningresources/carto_corner/index.html)

Natural Resources Canada, Centre for Topographic Information.

[http://maps.nrcan.gc.ca/index\\_e.php](http://maps.nrcan.gc.ca/index_e.php)