

THE CITY OF GREATER SUDBURY COORDINATE SYSTEMS

1.0) NORTH AMERICAN DATUM OF 1927 (NAD27) UTM ZONE 17

The first reference system used in the Sudbury area was NAD(27), with coordinates published in the UTM Zone 17 projection. The development of a control survey network started in the 1970s using classical triangulation methods with densification following standard terrestrial techniques. This network is now obsolete and no longer maintained. Some of the physical control stations are part of the NAD83 reference system.

2.0) NAD 1983 CANADIAN SPATIAL REFERENCE SYSTEM NAD83(CSRS) UTM ZONE 17

The City of Greater Sudbury (City) has recently transitioned to NAD83(CSRS) establishing a new control survey network using Global Navigation Satellite Systems (GNSS) technology. The City currently publishes coordinates in UTM Zone 17 - Version 6, Epoch 2010.0

3.0) MTM ZONE53 MAP PROJECTION

Zone53 is a custom projection optimized for both the geography and topography of the City. Compatible with NAD27, the projection has a combined grid and elevation scale factor of 1.0000 at the Central Meridian (81W) using a mapping plane elevation of 260 m.

Zone53 is suitable for lower order survey work that does not encompass a significantly large area or cover long distances. It is a local coordinate system so grid distances equal ground distances, allowing survey work on a simple plane surface. This eliminates the application of both grid and elevation scale factors while geo-referencing.

The Zone53 plane is at an elevation of 260 m which be subtracted from the local height when determining elevation factors. This projection is not for use in locations of significant relief such as areas of low elevation distant from the central meridian, areas of high elevation near the central meridian, or for higher accuracy survey requirements.

The system error is generally less than 10 ppm in most City of Greater Sudbury communities, which meets the accuracy requirements of typical survey equipment and procedures used on local projects.

3.1) Zone53 Parameters

Central Meridian:	81W
Origin Latitude:	0.00
False Northing:	-5,102,269.934
False Easting:	50,000
Scale Factor (at CM):	1.00004075874
Units:	Meters

3.2) MTM Zone53 2D-Coordinate Conversion to/from NAD27 UTM Zone-17

Conversion Factor = 1.000440935

Conversion from UTM to Zone53

Northing: $((\text{Northing}-5,148,000) \times 1.000440935) + 48,000$

Easting: $((\text{Easting}-500,000) \times 1.000440935) + 50,000$

Conversion from Zone53 to UTM

Northing: $((\text{Northing}-48,000) / 1.000440935) + 5,148,000$

Easting: $((\text{Easting}-50,000) / 1.000440935) + 500,000$

4.0) MTM ZONE 81

MTM Zone81 is a custom map projection for use with NAD83(CSRS). Like its predecessor MTM Zone53, Zone81 is a custom projection optimized for both the city's geography and topography. The projection has a combined grid and elevation scale factor of 1.0000 at the Central Meridian (81W) using an orthometric elevation of 260 m and the GRS80 ellipsoid height of 224 m.

Zone81 is suitable for a lower order of survey work that does not encompass a significantly large area or cover long distances. It is a local coordinate system with a scale factor of 1.0000 so grid distances equal ground distance. This eliminates the application of both scale and elevation factors while geo-referencing, and allowing survey work on a simple plane surface.

The Zone81 plane is at an elevation of 260m which be subtracted from the local orthometric height when determining elevation factors. This projection is not for use in locations of significant relief such as areas of low elevation distant from the central meridian, areas of high elevation near the central meridian, or for higher accuracy requirements.

The system error is generally less than 10 ppm in most City of Greater Sudbury communities, which meets the accuracy requirements of typical survey equipment and procedures used on local projects.

4.1) Zone81 Parameters

Central Meridian:	81W
Origin Latitude:	0
False Northing:	-4,302,242.022
False Easting:	150,000
Scale Factor (at CM):	1.00003517
Units:	Meters

4.2) MTM Zone81 2D-Coordinate Conversion to/from UTM Zone-17:

MTM Zone81 Scale Factor / UTM Scale Factor = Conversion Factor
Conversion Factor = $1.00003517 / 0.9996 = 1.000435344$

Conversion from UTM to Zone81

Northing: $((\text{Northing}-5,150,000) \times 1.000435344) + 850,000$
Easting: $((\text{Easting}-500,000) \times 1.000435344) + 150,000$

Conversion from Zone81 to UTM:

Northing: $((\text{Northing}-850,000) / 1.000435344) + 5,150,000$
Easting: $((\text{Easting}-150,000) / 1.000435344) + 500,000$

5.0) CANADIAN GEODETIC VERTICAL DATUM 1928

The current vertical datum used by the City is the Canadian Geodetic Vertical Datum 1928 (CGVD28) based on mean sea level.

A new vertical datum Canadian Geodetic Vertical Datum of 2013 (CGVD2013) is based on geoid modeling, rather than by geodetic leveling and is compatible with GNSS technologies. CGVD28 will continue to co-exist with CGVD2013. The City does not publish CGVD2013 elevations.

6.0) GRID SHIFT

CGS grid shift files to model the differences between NAD27 coordinates and the NAD83(CSRS) were developed using common stations of the two networks. File CGS27V6A.gsb transforms between NAD27-76 coordinates and CSRS Version 6, Epoch 2010.0. File CGS83V6A.gsb transforms between NAD83-Original (as determined by MAY76v20) to CSRS Version 6, Epoch 2010.0.