

Custom Map Workflows:

Workflow 1 – Converting a downloaded GeoTiff (calibrated) Canadian Government 1:50,000 topographical map to a Garmin Custom Map for use on the Garmin Oregon 450 handheld GPS plotter. (Other devices similar).

- 1) Download the NRC (Natural Resources Canada) topo map index in .pdf or .tiff format, for the province you are interested in, from here:

<http://geogratis.cgdi.gc.ca/geogratis/en/option/select.do?id=777039C7-69ED-B1A1-A4AE-62113E4F1481>

Alternatively, you can download this file

ftp://ftp2.cits.rncan.gc.ca/pub/index/nts_snrc.kmz

And open it in Google Earth to see the index grid overlaid on Google Earth.

From viewing the index, note the map sheets you need to cover the area you are interested in (e.g. 031f02)

- 2) Download the NRC (Natural Resources Canada) geotiff maps that you are interested in from:

ftp://ftp2.cits.rncan.gc.ca/pub/cantopo/50k_geotiff/

If the sheet you need is not available in this directory (i.e. not available in geotiff format) you will need to download the regular image TIFF file and calibrate it. This procedure will be covered separately in a different document.

- 3) This is a good time to determine any re-scaling (compressing) requirements of the map(s) you want to load on your Garmin. Garmin custom maps are loaded on your handheld device as a number of 1024 x 1024 pixel “tiles”. The maximum number of tiles you can load at any one time is 100 (whether these tiles are all from one map or from several). Consequently, the higher the resolution of the map you begin with, the more tiles it will take to display it on your handheld Garmin. If the maps are of high enough resolution, you may run out of tiles before you are able to load all the maps you want. The way around this is to re-scale or reduce the resolution of the maps, which means fewer tiles will be required to reproduce the map, and therefore there will be more tiles left to cover a greater total area. The cost will be some loss of quality in the map displayed on the handheld. MAP2CMAPC supports this re-scaling when creating Garmin Custom Maps using a <Rescale Map> function (see Step 17, Edit -> Rescale Map, below). Before we get to that step though, we can estimate what our re-scale percentage should be, based on the file size of the map(s) we have downloaded. Proceed as follows:
 - a. Note the image size of the downloaded map (e.g. sheet 031f02 is 12179 x 8658 pixels.)

- b. Divide each dimension by 1024. e.g. $12179 / 1024 = 12$ $8658 / 1024 = 8.5$.
- c. Multiply the two results together to get the total number of tiles. E.g. $12 * 8.5 = 101$ tiles. This is only a rough estimate, as we are going to save some tiles by cropping the unwanted margins of the map sheet. Reduce this number by 30% to account for tiles we will not have to use as we will be cropping the unwanted borders off the map. As it turns out, sheet 031f02, when cropped to just the map, takes 70 tiles to reproduce at full resolution.
- d. Decide if you can afford to “spend” this many tiles per sheet. If not, you will have to use the re-scale function in step 17. To determine an approximate re-scale percentage, divide 100 (total number of tiles you have) by the number of map sheets you need to load (based on the area coverage you want). Say I want to cover an area of four map sheets – that means each map can be no more than $100/4 = 25$ tiles. If we re-scale the map by 50% it will be 6089 x 4329. This equates to 5.9 x 4.2 tiles, or 24 tiles. Minus 30% savings for cropping the border, and we arrive at 17 tiles to cover one map at 50% re-scale. This would let us cover our four maps in $17 * 4 = 68$ tiles, giving us plenty to spare.

Here is a table giving rough numbers of total tiles required vs. re-scale percentage for the NRC geotiff maps:

Rescale	Horiz pixels	Vert Pixels	Horiz Tiles	Vert Tiles	Number Tiles	Less 30% (crop margin)	Total Tiles Required
100%	12284	8810	12	9	103	31	72
90%	11056	7929	11	8	84	25	59
80%	9827	7048	10	7	66	20	46
70%	8599	6167	8	6	51	15	35
60%	7370	5286	7	5	37	11	26
50%	6142	4405	6	4	26	8	18
40%	4914	3524	5	3	17	5	12
30%	3685	2643	4	3	9	3	7
20%	2457	1762	2	2	4	1	3
10%	1228	881	1	1	1	0	1

- 4) Open the downloaded geotiff map in a graphics viewer program and view it full size (e.g. IrfanView, Ctrl-H).
- 5) Note the Projection, Datum, and UTM Grid Zone located on the bottom or side margin of the map. The data will look something like this:

Transverse Mercator Projection
Projection transverse de Mercator
North American Datum 1983
Système de référence nord-américain 1983

1000 metre Universal Transverse
Mercator Grid

Zone 18

Quadrillage universel transverse
de Mercator de 1000 mètres

Grid Zone
Designation

18T

Désignation de la
zone du quadrillage

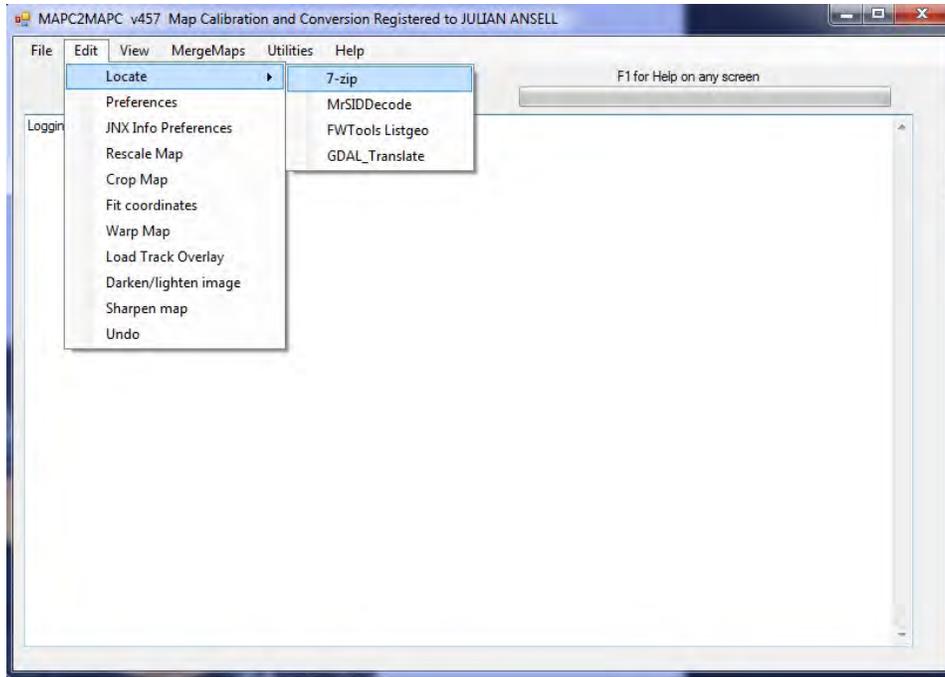
For example, from the map 031f02, We get:

- **PROJECTION:** Transverse Mercator Projection
- **DATUM:** North American Datum 1983 (NAD83)
- **GRID:** Universal Transverse Mercator Grid (UTM)
- **GRID ZONE:** Zone 18

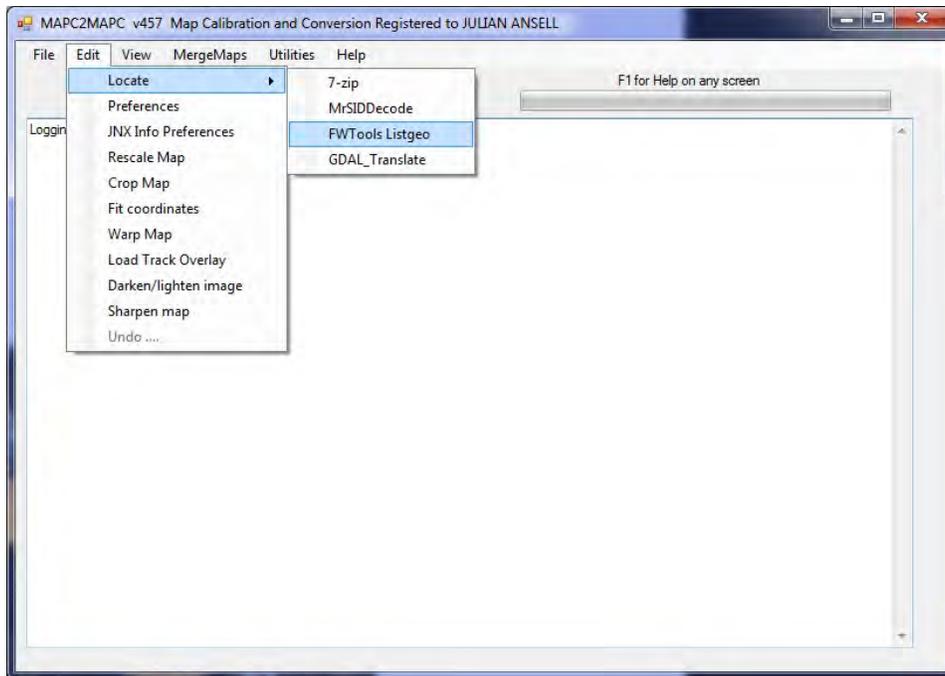
- 6) If you haven't already done so, download and install MAP2CMAPC software, available here:

<http://www.the-thorns.org.uk/mapping/down.html>

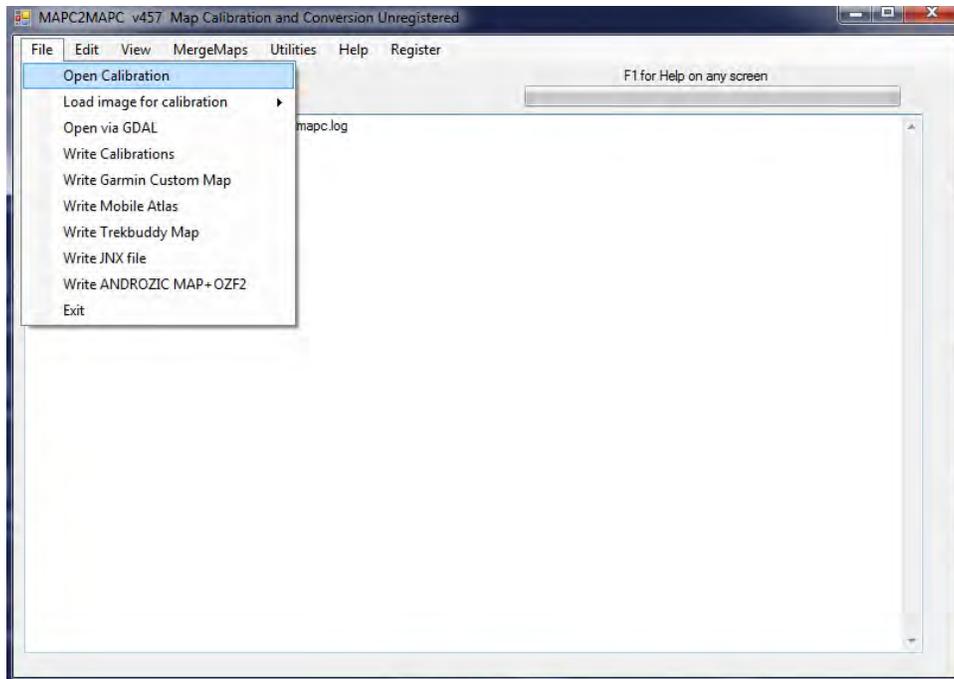
- 7) Download and install the following software (MAP2CMAPC needs these to operate): Make sure to note where the .exe executable files are installed on your system.
- a. 7-Zip >>>> From <http://www.7-zip.org/> (This is a compression algorithm used to create the .kmz file format)
 - b. FWTools >>>> From <http://fwtools.maptools.org/> (This is a set of Open Source GIS binaries for Windows).
- 8) Start MAP2CMAPC
- 9) Select Edit -> Locate -> 7-zip, and in the dialog that opens, navigate to and select the 7z.exe file that was installed when you installed 7-Zip. For example, in C:\Program Files (x86)\7-Zip\



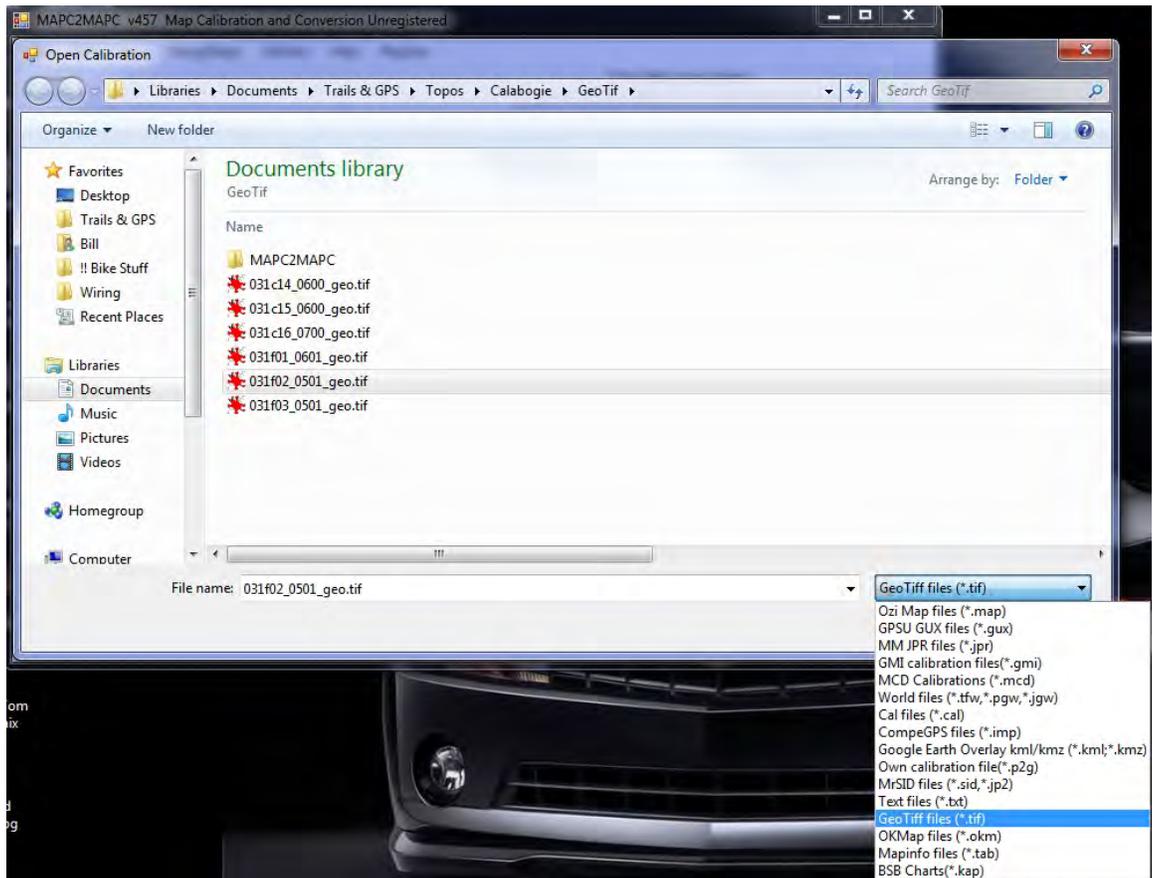
- 10) Select Edit -> Locate -> FWTools Listgeo, and in the dialog that opens, navigate to and select the listgeo.exe file that was installed when you installed FWTools. For example, in C:\Program Files (x86)\FWTools2.4.7\bin\



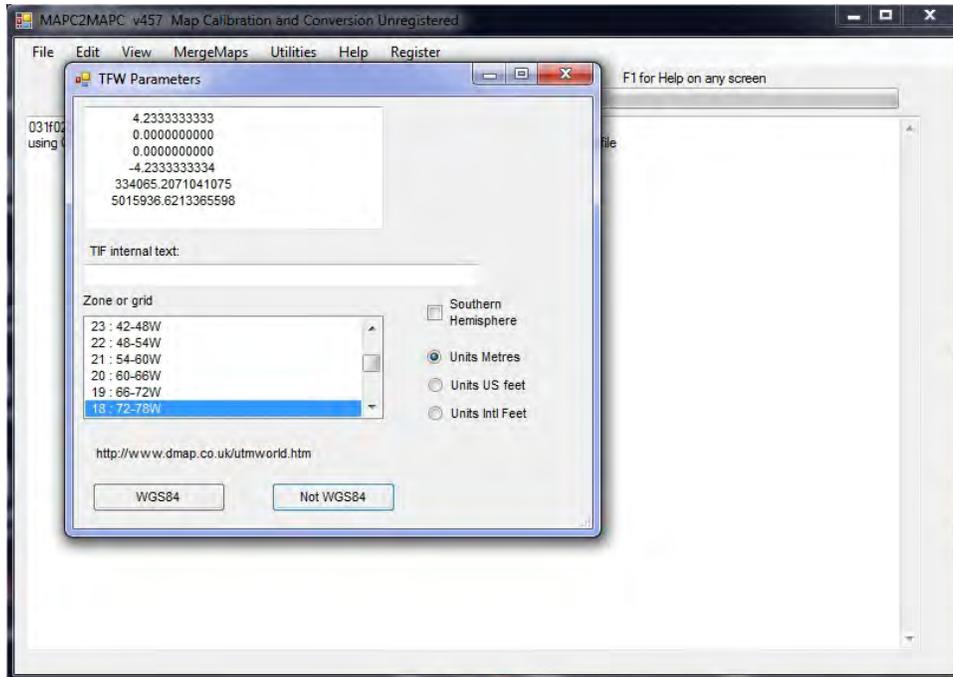
- 11) Open the map in MAP2CMAP with File -> Open Calibration



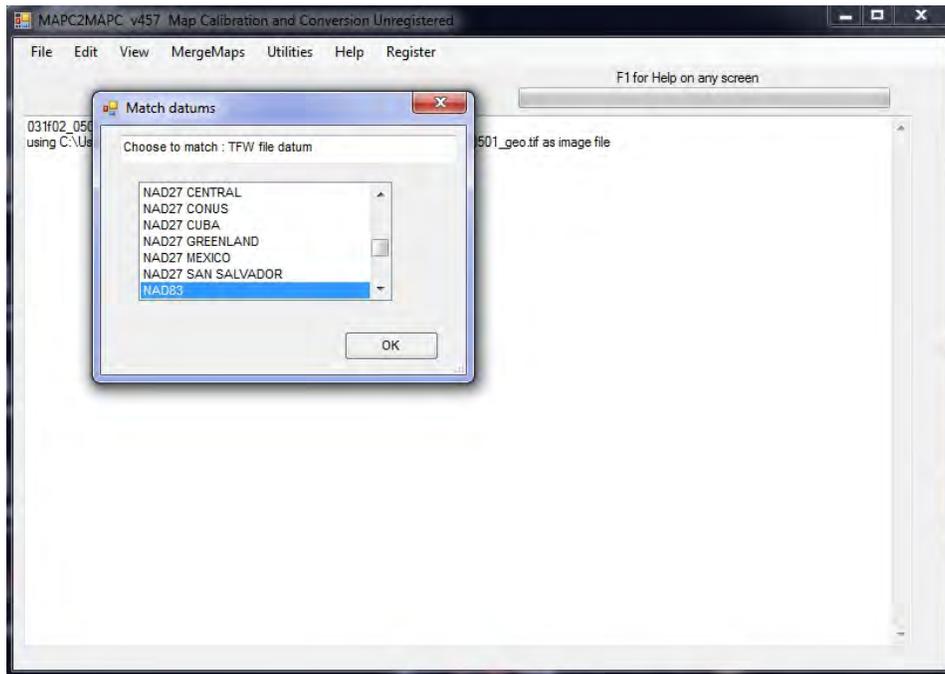
12) In the dialog box, select geotiff for file type, then select the map



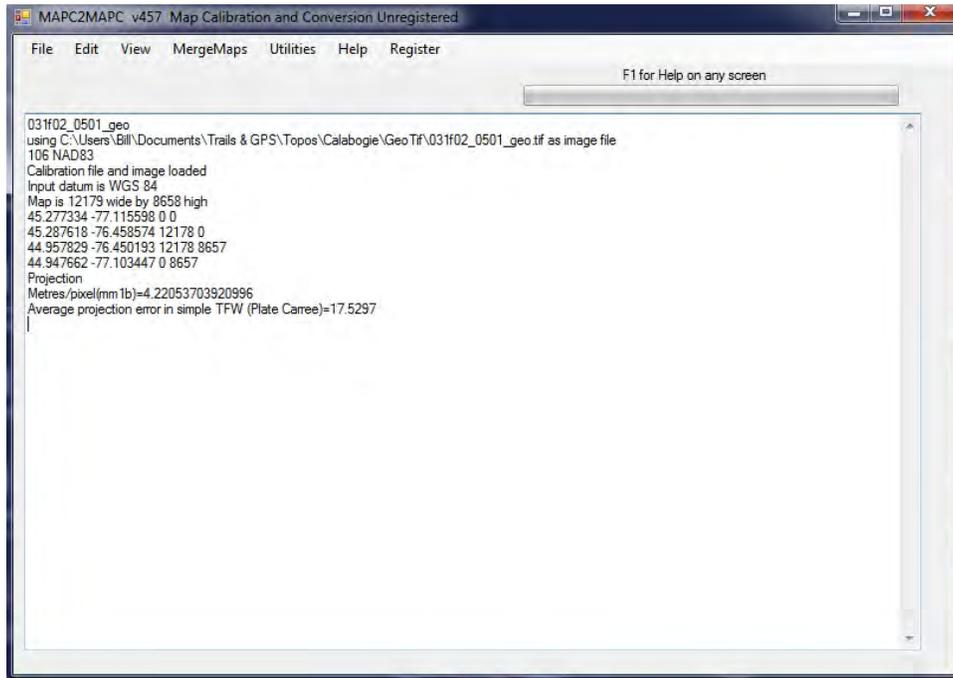
- 13) In the dialog that opens, select the UTM zone of the map (from step #5), then click <Not WGS84> since the downloaded map's Datum is NAD83 and not WGS84.



- 14) From the dialog that opens, select the Datum of the map (e.g. NAD83) from step #5, click <OK>.

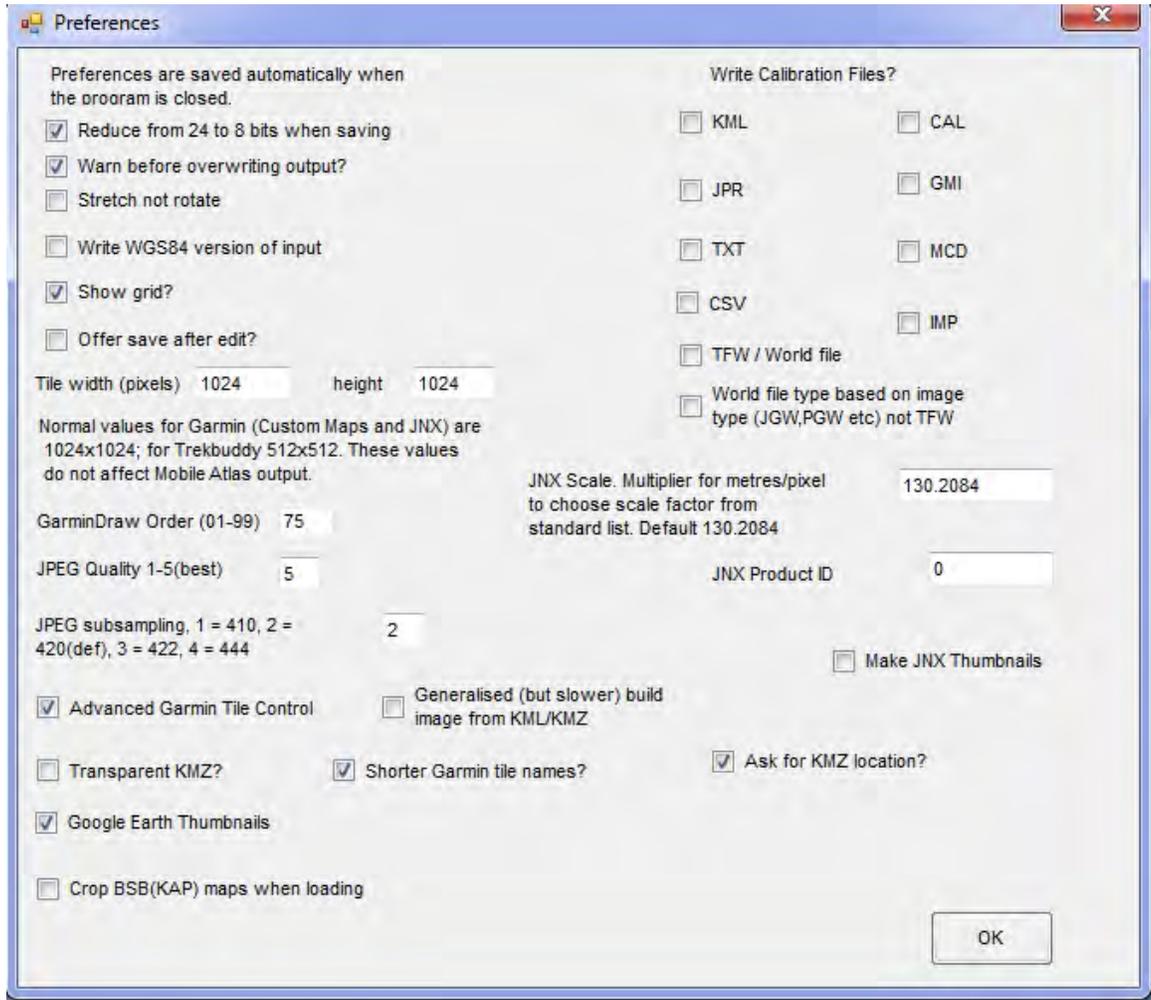


- 15) The map loads and is ready to be viewed, edited (cropped, re-scaled, warped, etc.) , and finally exported as a Garmin custom map KMZ file.



- 16) Note that the map has been “converted” to WGS84 datum on import, as shown by the 5th line down in the above screenshot. As such, one should now always select “WGS84” when prompted for the datum (e.g. when warping).

17) Click Edit -> Preferences, and set up as follows:

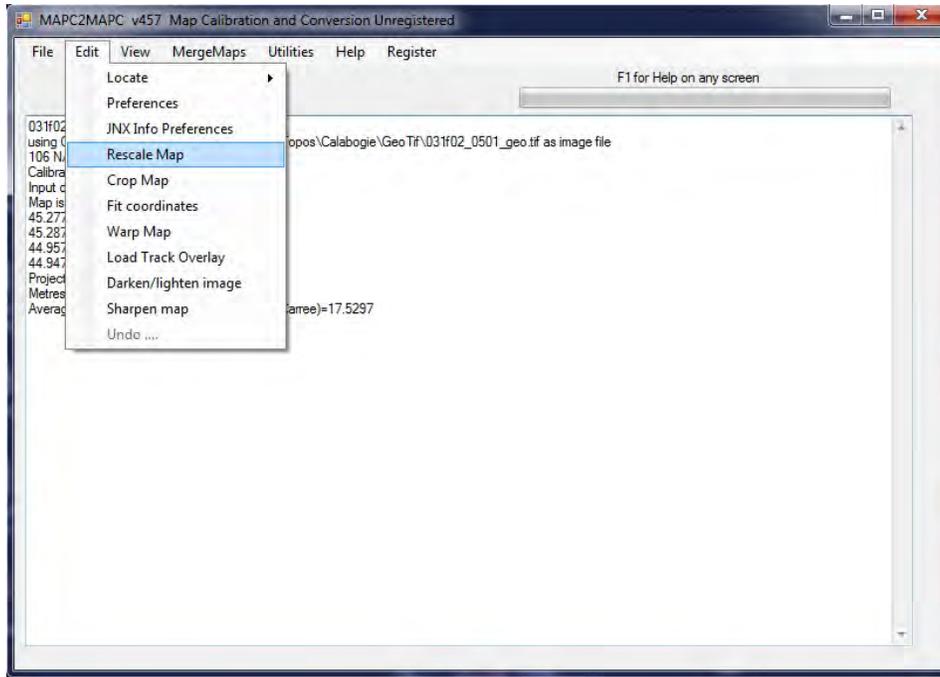


Note that selecting <Write WGS84 version of input> has no effect as the geo tiff map has already been converted to WGS84 Datum on import, as described above in Step #16.

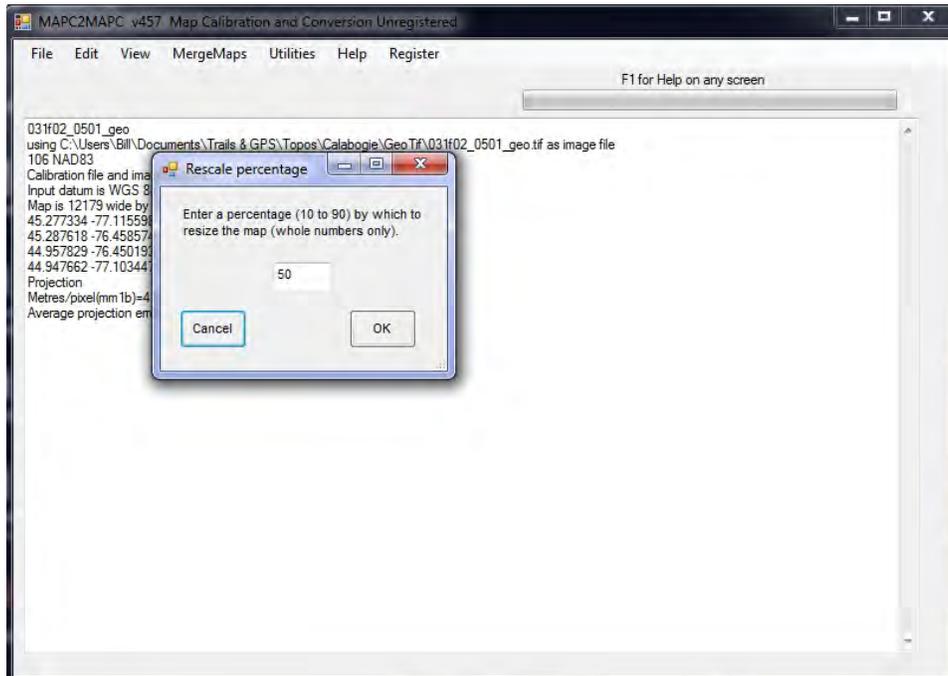
Note that if you check <Transparent KMZ?>, the final .kmz file will be semi-transparent when viewed in Google Earth, although it will always be 100% opaque (solid) when viewed in Garmin BaseCamp or on the Garmin handheld.

Note: The GarminDraw Order (01-99) value is used to determine whether to draw the custom map on top of or underneath any existing vector maps on the Garmin handheld device. Values of 01-49 will cause the custom map to be drawn underneath any vector maps, whereas values from 50-99 will cause it to be drawn on top of any vector map.

- 18) Rescale the map if required, depending on the size of the map and the number of tiles it will take up on your Garmin (see calculation, step #3). Select Edit -> Rescale Map

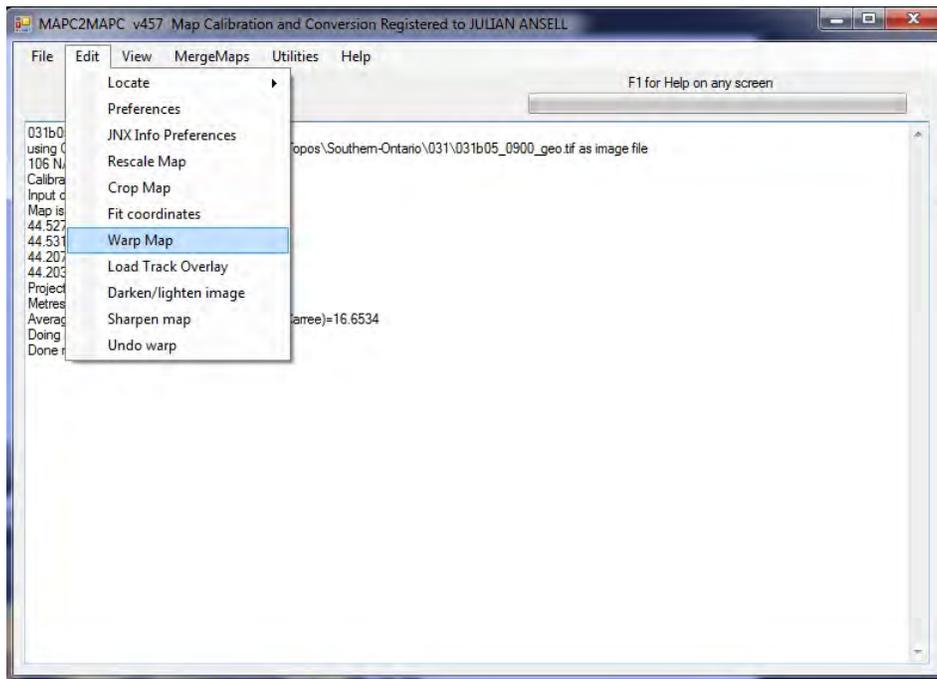


- 19) In the dialog that opens, enter <50> (or whatever your desired value is – larger number = better quality map that consumes more tiles) and click <OK>

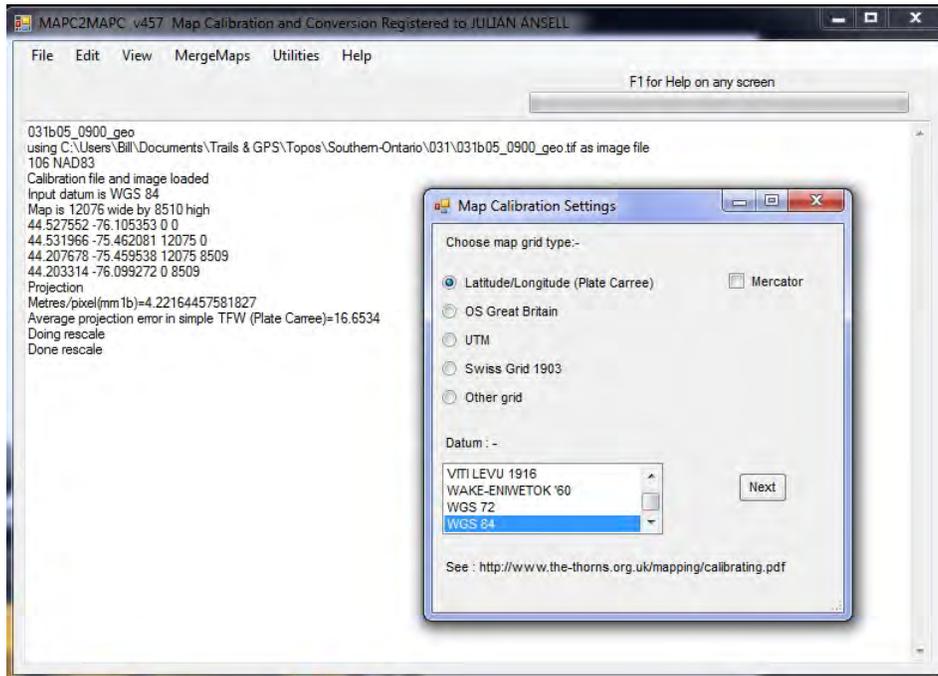


Note that rescaling these maps by, for example, 50% results in a single sheet requiring 20 “Garmin Tiles” as opposed to the approx. 70 tiles required for a non-rescaled map. Different degrees of rescaling (higher or lower than 50%) will result in differing amounts of “tile savings”. Note that the Oregon 450 only allows a maximum of 100 tiles. The less you rescale the map, the more tiles you use, the better the “resolution” of the map (i.e. the farther you can zoom in when viewing the map before pixilation occurs), but the more tiles it will take. Users will have to experiment to find which degree of rescaling best fits their needs.

20) Warp the map to make it North-up and equirectangular (straight edges), in preparation for cropping the borders. Select Edit -> Warp Map

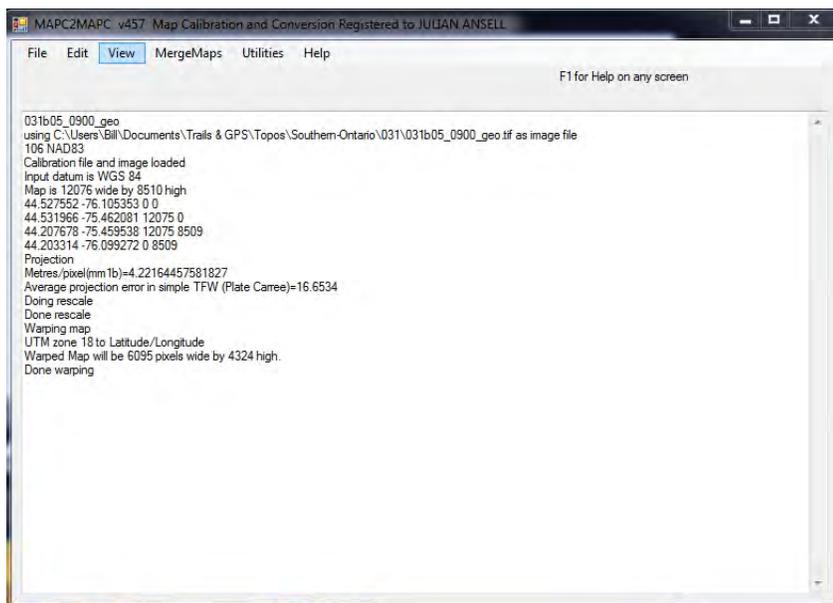


21) In the dialog that opens, select the following settings. Click Next.

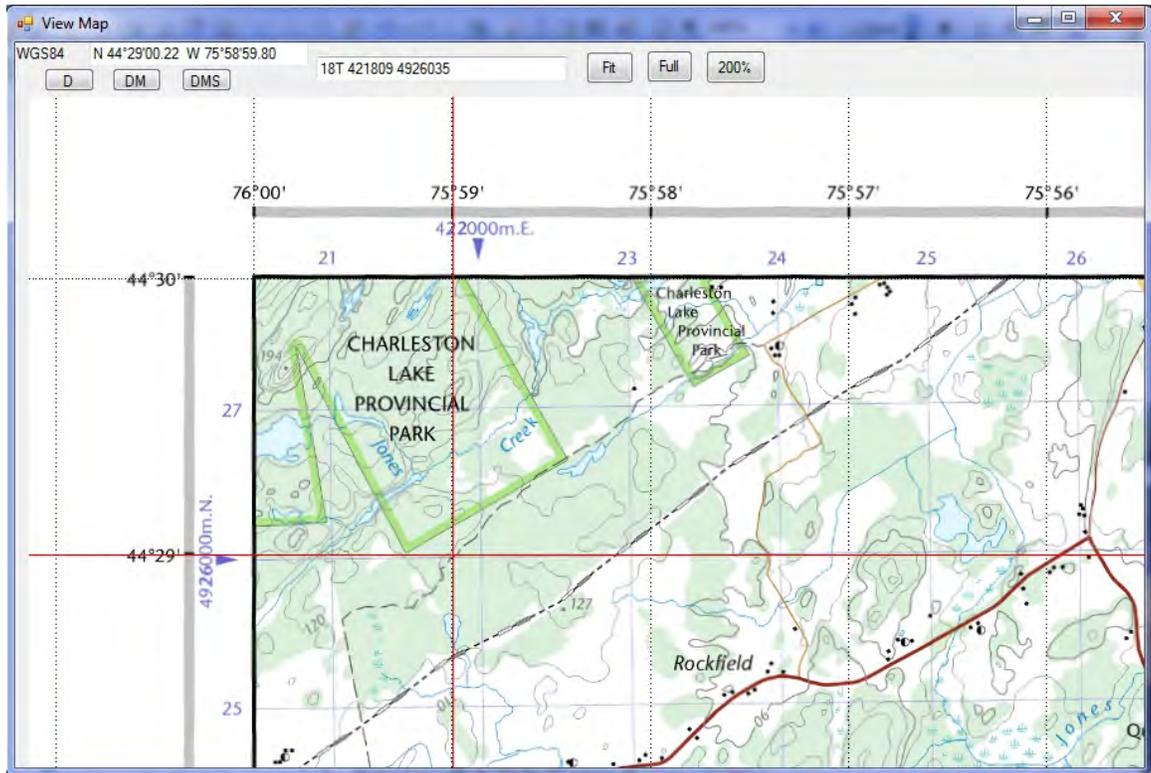


Note that the values entered here are what you want the map to be after you have warped it. I have selected Lat/Lon (Plate Carree) and WGS84 as both Google Earth and the Garmin work well with this datum and grid at the relatively small scales (small areas) covered by these topo maps.

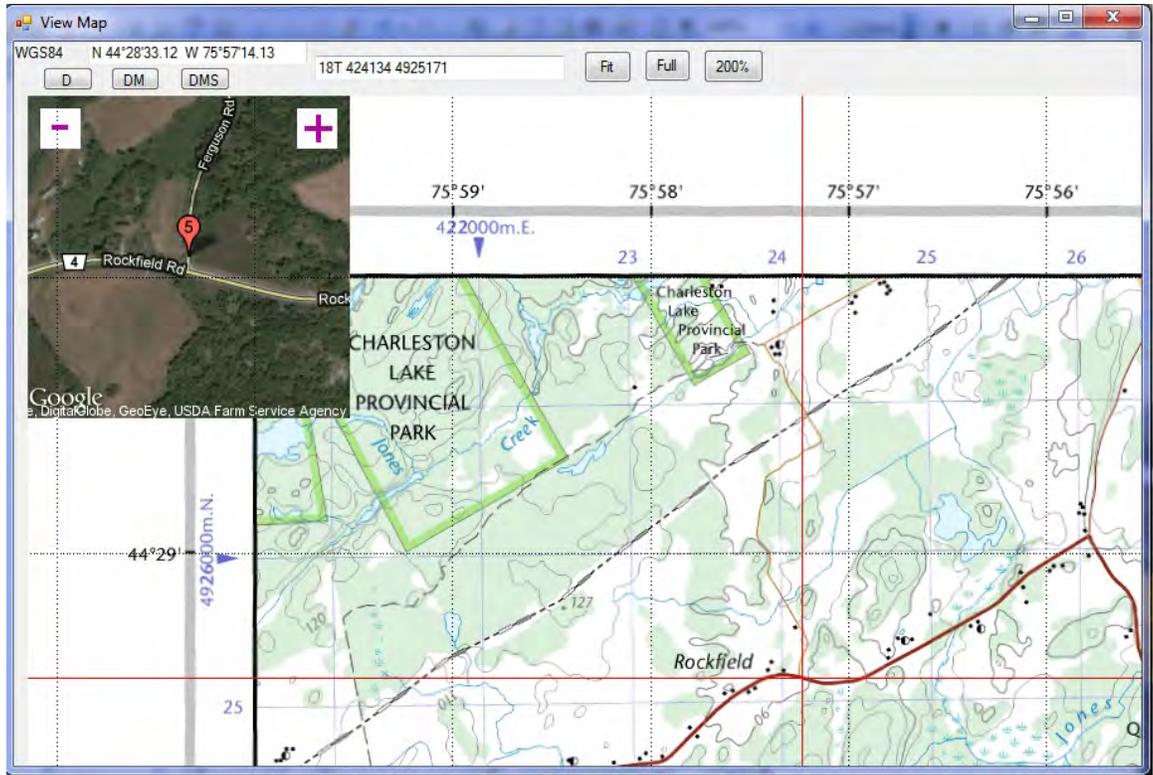
22) View map to check everything is ok, and check the co-ordinates of some known points. Click <View>



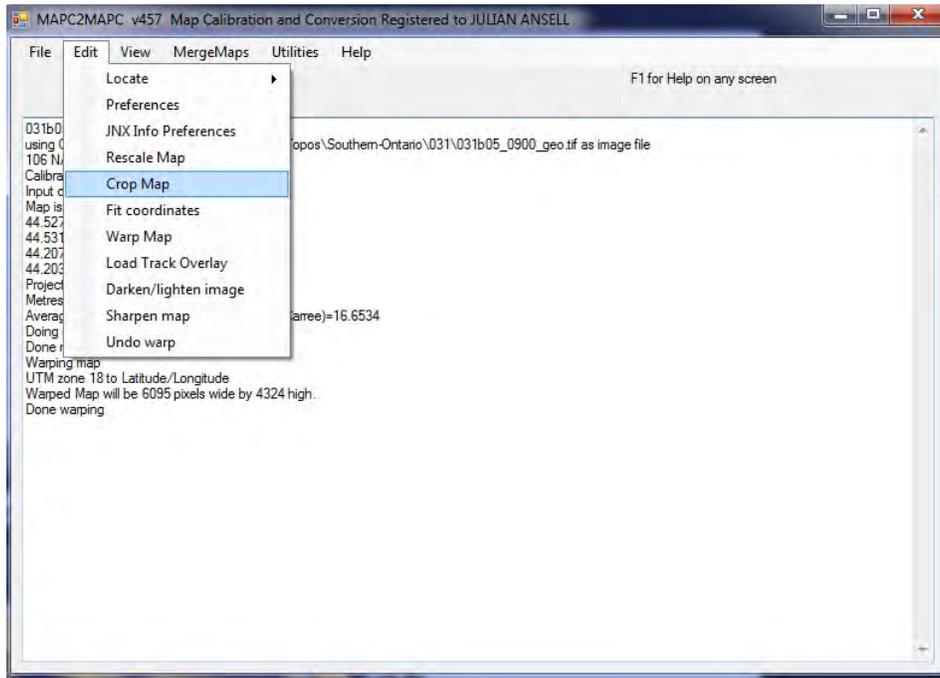
- 23) Use the cursor, map, map's grid, and the crosshair readouts at the top left to check that the grid and calibration are ok. Also check a couple of known locations (i.e. place crosshairs on location and read coordinates from the top left – compare with known values)



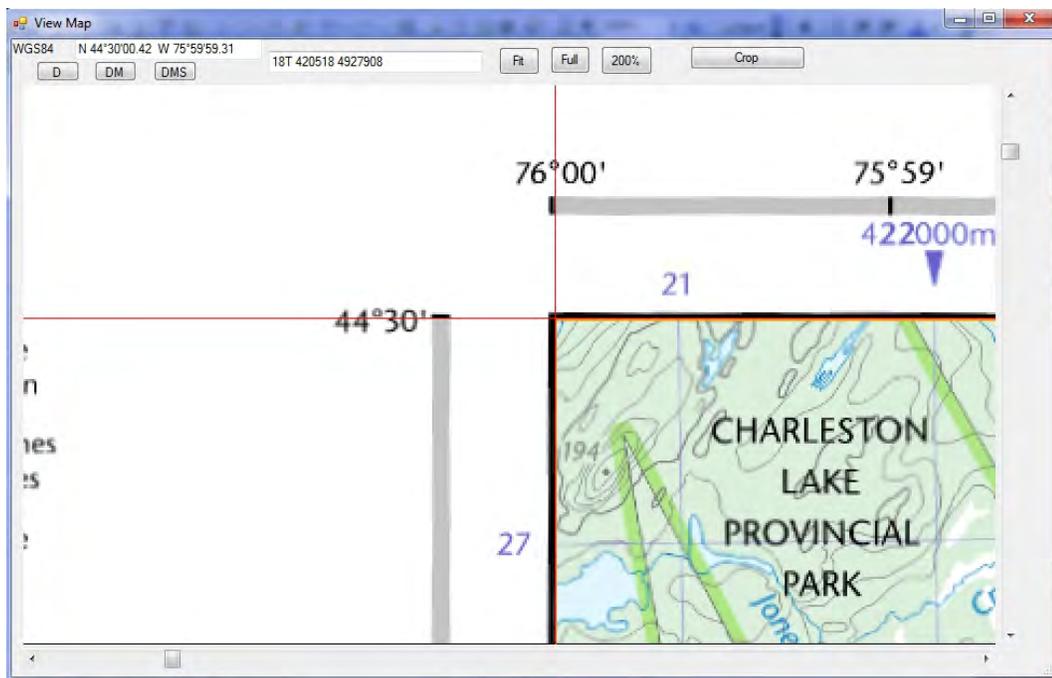
24) If you are connected to the internet, you can right-click on an area of the map and a Google Earth thumbnail image, centred on the point at which you clicked, will pop up. This is another easy way to check coordinates.



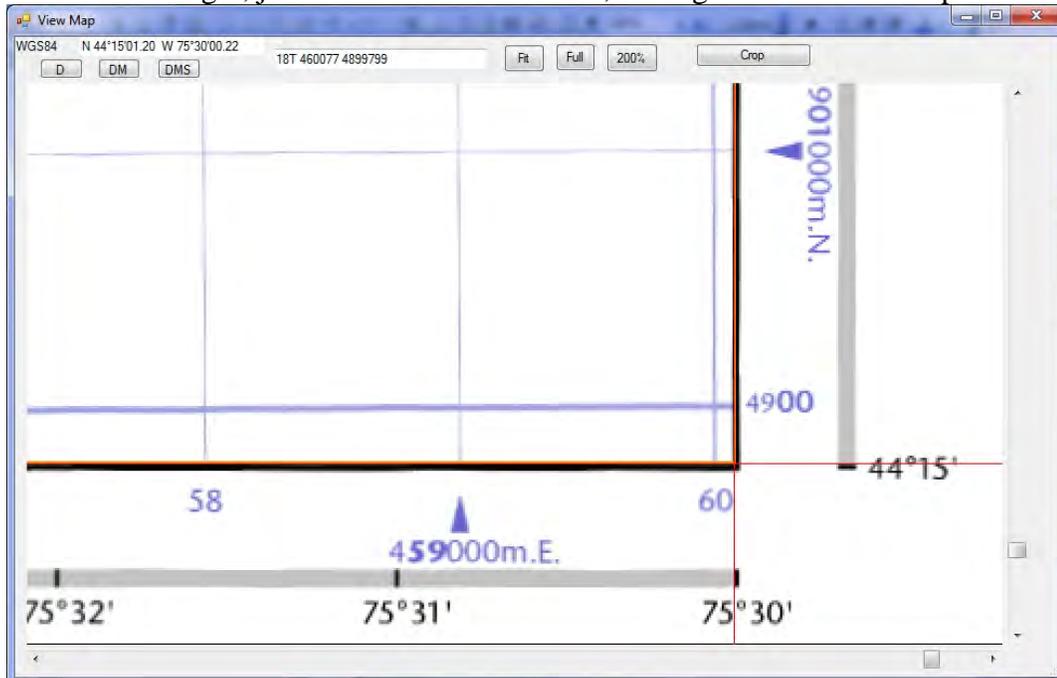
25) Close Map View window, then select Edit -> Crop Map



26) Click 200% to blow up the view, then using the scroll bars (you may have to drag the corner of the window open a bit to see the scroll bars fully) locate the top left corner of the actual map image. Position the crosshairs at the top left corner, just inside the black border, and left click to set this point.

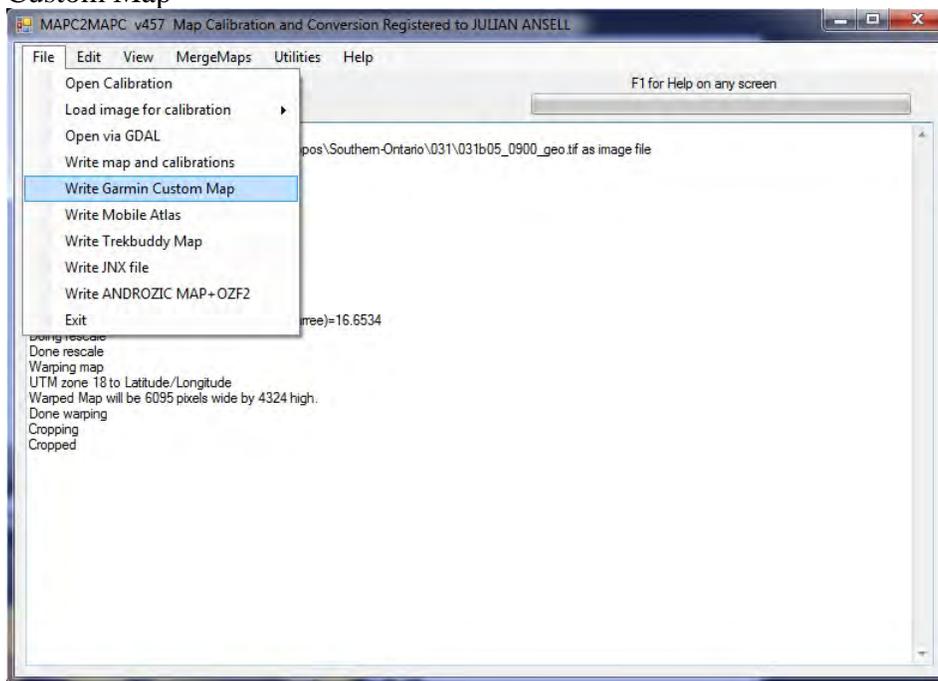


- 27) Scroll to the bottom right corner using the scroll bars, then position the crosshairs at the bottom right, just inside the black border, and right click to set this point.

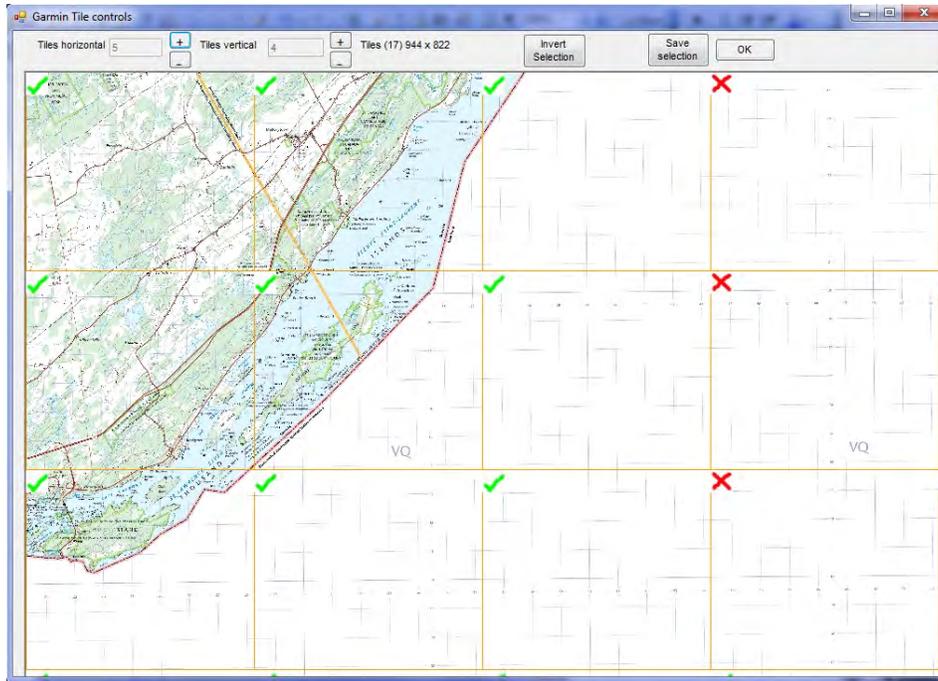


- 28) Select <crop>. Then view the map again and check it. Close the map view window.

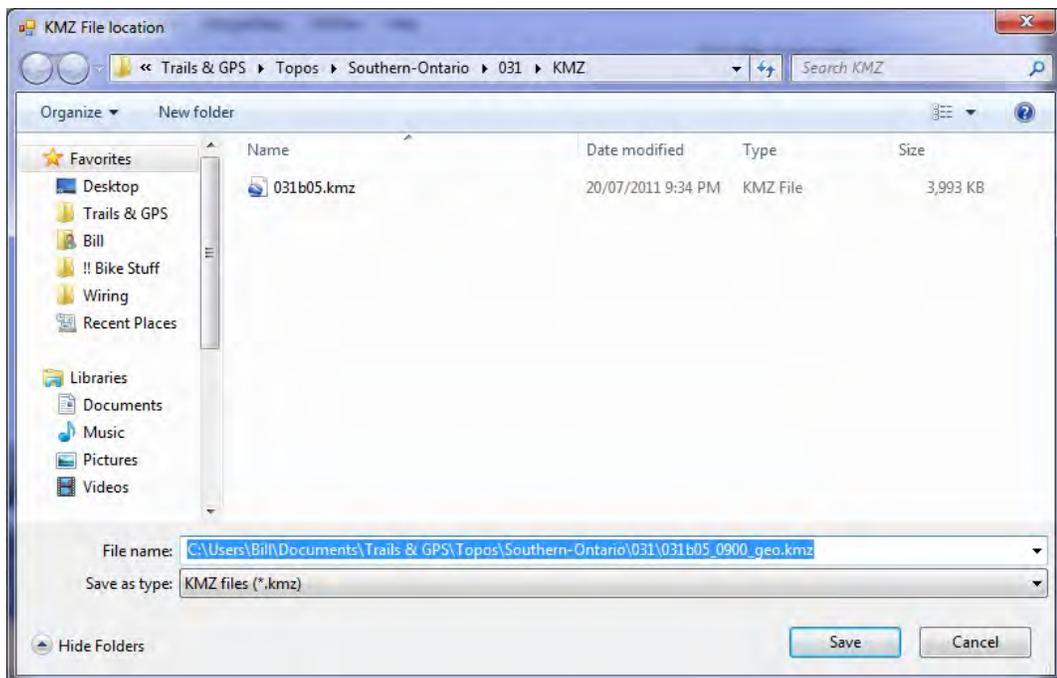
- 29) Save the map as a Garmin Custom Map .kmz. Select File -> Write Garmin Custom Map



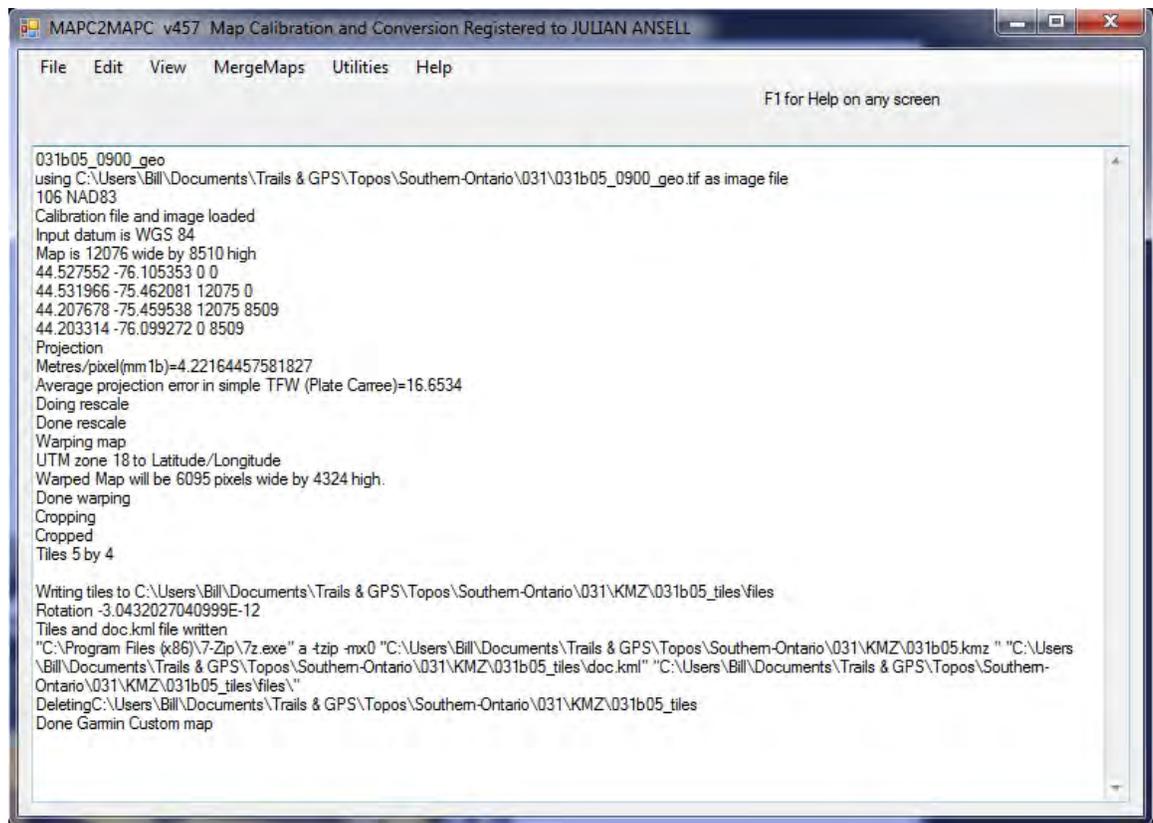
30) If you selected <Advanced Garmin Tile Control> in the Edit -> Preferences dialog (step 9) , the Garmin Tile Control window will open and allow you to uncheck any unneeded tiles (to save tile #'s because of the 100 tile Garmin limit)



31) Uncheck the tiles you don't want (a red X appears) then click <ok>. Choose a location and name for the custom map and click <save>.



- 32) When the custom map file is done, the MAP2CMAPC screen will announce that it is done like this:



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MAPC2MAPC v457 Map Calibration and Conversion Registered to JULIAN ANSELL
File Edit View MergeMaps Utilities Help
F1 for Help on any screen

031b05_0900_geo
using C:\Users\Bill\Documents\Trails & GPS\Topos\Southern-Ontario\031\031b05_0900_geo.tif as image file
106 NAD83
Calibration file and image loaded
Input datum is WGS 84
Map is 12076 wide by 8510 high
44.527552 -76.105353 0 0
44.531966 -75.462081 12075 0
44.207678 -75.459538 12075 8509
44.203314 -76.099272 0 8509
Projection
Metres/pixel(mm 1b)=4.22164457581827
Average projection error in simple TFW (Plate Carree)=16.6534
Doing rescale
Done rescale
Warping map
UTM zone 18 to Latitude/Longitude
Warped Map will be 6095 pixels wide by 4324 high.
Done warping
Cropping
Cropped
Tiles 5 by 4

Writing tiles to C:\Users\Bill\Documents\Trails & GPS\Topos\Southern-Ontario\031\KMZ\031b05_tiles\files
Rotation -3.0432027040999E-12
Tiles and doc.kml file written
"C:\Program Files (x86)\7-Zip\7z.exe" a -tzip -mx0 "C:\Users\Bill\Documents\Trails & GPS\Topos\Southern-Ontario\031\KMZ\031b05.kmz " "C:\Users\
\Bill\Documents\Trails & GPS\Topos\Southern-Ontario\031\KMZ\031b05_tiles\doc.kml" "C:\Users\Bill\Documents\Trails & GPS\Topos\Southern-
Ontario\031\KMZ\031b05_tiles\files\"
Deleting C:\Users\Bill\Documents\Trails & GPS\Topos\Southern-Ontario\031\KMZ\031b05_tiles
Done Garmin Custom map
```

- 33) Exit MAP2CMAPC, and open the .kmz file in Google Earth to make sure everything makes sense.

- 34) Copy the .kmz file to your Garmin's custom maps directory: (e.g. G:\garmin\custom maps\

Note, you can only enable or disable all custom maps on your Garmin as a group. Therefore if you have two .kmz files in the custom maps directory, they are both enabled together or disabled together. And remember that the total of all custom maps cannot exceed 100 tiles.

- 35) If you have not already done so, be sure to support John, author of MAP2CMAPC, by sending the very small amount required for a registered version of the software. Go to <http://www.the-thorns.org.uk/mapping/> and click on the Paypal <Buy Now> button.