

Water Renovation in Ukraine

Project no. 22320101



• Visegrad Fund

Data Processing in GIS

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The project is co-financed by the Governments of the Czechia, Hungary, Poland and Slovakia through Visegrad Grants from International Visegrad Fund. The mission of the fund is to advance ideas for sustainable regional cooperation in Central Europe.

Data Processing in GIS

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Plan:

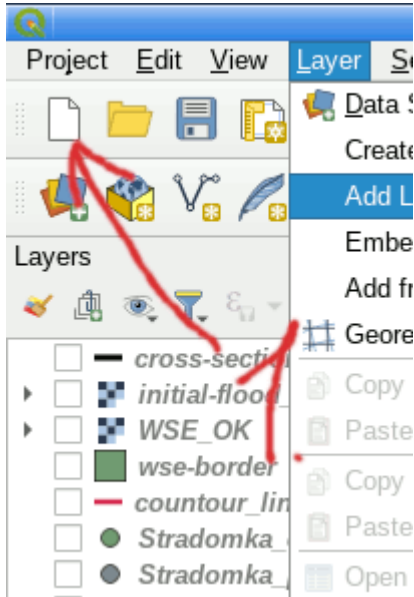
1. new project
2. project data (DTM, river, ortofotomap)
3. data analysis
4. drawing new objects
5. data export

modeling of flow

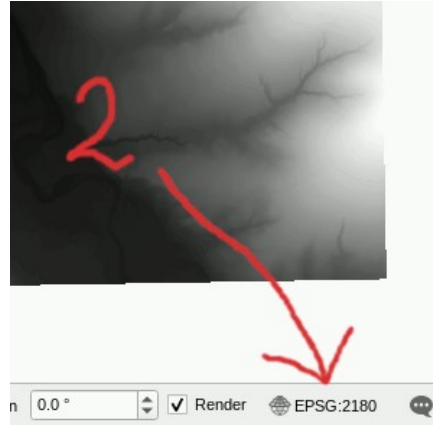
6. data import
7. generating flood zones

Data Processing in GIS – new project

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set the right coordinate system in Poland EPSG:2180



in Ukraine

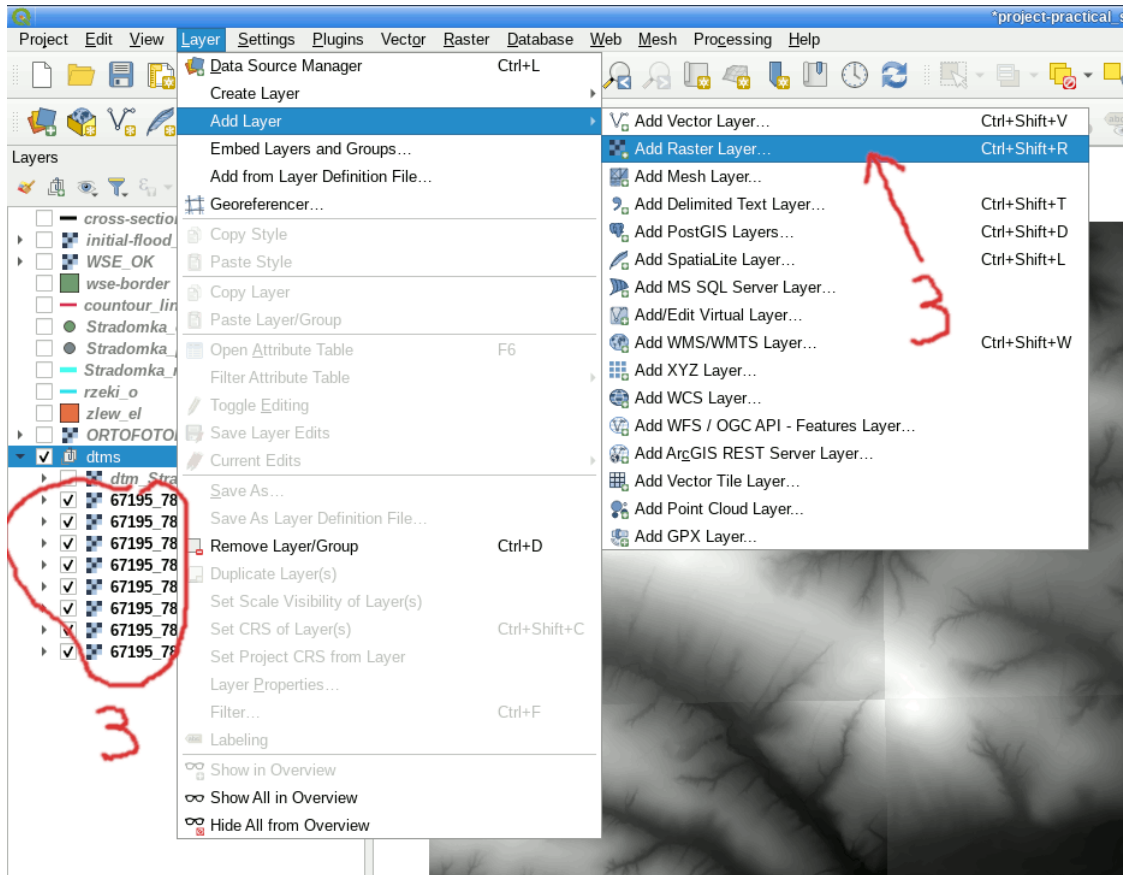
create new project

Save project in good location !!!

Predefined Coordinate Reference Systems <input type="checkbox"/> Hide deprecated CRSs	
Coordinate Reference System	Authority ID
▼ Projected	
▼ Transverse Mercator	
UCS-2000 / Ukraine TM zone 10	EPSG:6384
UCS-2000 / Ukraine TM zone 11	EPSG:6385
UCS-2000 / Ukraine TM zone 12	EPSG:6386
UCS-2000 / Ukraine TM zone 13	EPSG:6387
UCS-2000 / Ukraine TM zone 7	EPSG:6381
UCS-2000 / Ukraine TM zone 8	EPSG:6382
UCS-2000 / Ukraine TM zone 9	EPSG:6383

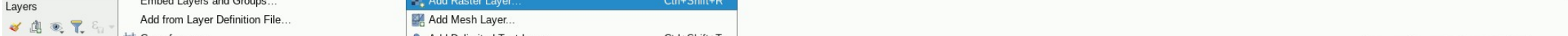
Data Processing in GIS – project data

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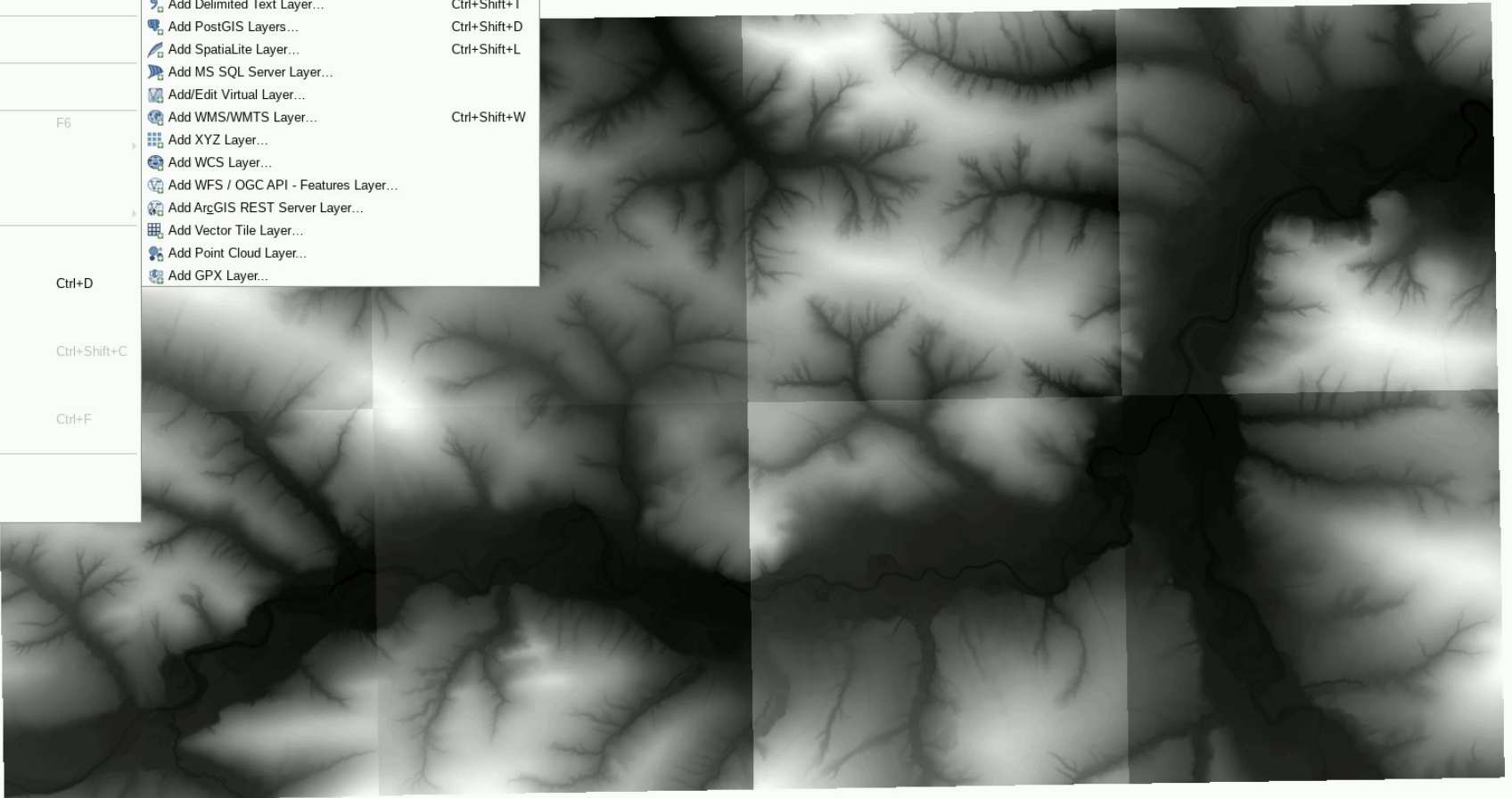
add rasters

and set their CRS to the proper one
(for this project epsg:2180)



- Create Layer
- Add Layer
- Embed Layers and Groups...
- Add from Layer Definition File...
- Georeferencer...
- Copy Style
- Paste Style
- Copy Layer
- Paste Layer/Group
- Open Attribute Table F6
- Filter Attribute Table
- Toggle Editing
- Save Layer Edits
- Current Edits
- Save As...
- Save As Layer Definition File...
- Remove Layer/Group Ctrl+D
- Duplicate Layer(s)
- Set Scale Visibility of Layer(s)
- Set CRS of Layer(s) Ctrl+Shift+C
- Set Project CRS from Layer
- Layer Properties...
- Filter... Ctrl+F
- Labeling
- Show in Overview
- Show All in Overview
- Hide All from Overview

- Add Vector Layer... Ctrl+Shift+V
- Add Raster Layer... Ctrl+Shift+R
- Add Mesh Layer...
- Add Delimited Text Layer... Ctrl+Shift+T
- Add PostGIS Layers... Ctrl+Shift+D
- Add Spatialite Layer... Ctrl+Shift+L
- Add MS SQL Server Layer...
- Add/Edit Virtual Layer...
- Add WMS/WMTS Layer... Ctrl+Shift+W
- Add XYZ Layer...
- Add WCS Layer...
- Add WFS / OGC API - Features Layer...
- Add ArgGIS REST Server Layer...
- Add Vector Tile Layer...
- Add Point Cloud Layer...
- Add GPX Layer...



Data Processing in GIS – project data

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The screenshot displays the QGIS interface with the 'Data Source Manager | Vector' dialog box open. The 'Source Type' is set to 'File'. The 'Encoding' is set to 'Automatic'. The 'Source' field is empty. Below this, the 'Open OGR Supported Vector Dataset(s)' dialog is open, showing a file browser view of the 'Desktop' directory. The file list is as follows:

Name	Size	Type	Modified
rzeki_o.dbf	33.8 MB	Document	29 May 2021
rzeki_o.prj	383 bytes	Text	27 Sep 2010
rzeki_o.shp	67.4 MB	ESRI Shapefile	29 May 2021
rzeki_o.shp.xml	13.5 kB	Markup	27 Oct 2003
rzeki_o.shx	457.3 kB	ESRI Shapefile Index	29 May 2021
zlew_el.dbf	7.8 MB	Document	3 Sep 2020
zlew_el.prj	383 bytes	Text	27 Sep 2010
zlew_el.shp	149.0 MB	ESRI Shapefile	3 Sep 2020
zlew_el.shp.xml	10.8 kB	Markup	27 Oct 2003
zlew_el.shx	239.2 kB	ESRI Shapefile Index	3 Sep 2020

The 'Open OGR Supported Vector Dataset(s)' dialog also shows a search bar with 'All files' selected and 'Cancel' and 'Open' buttons at the bottom.

insert vector layers

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load the ortofotomap

1. the data

<https://www.geoportal.gov.pl/uslugi/usluga-przegladania-wms>

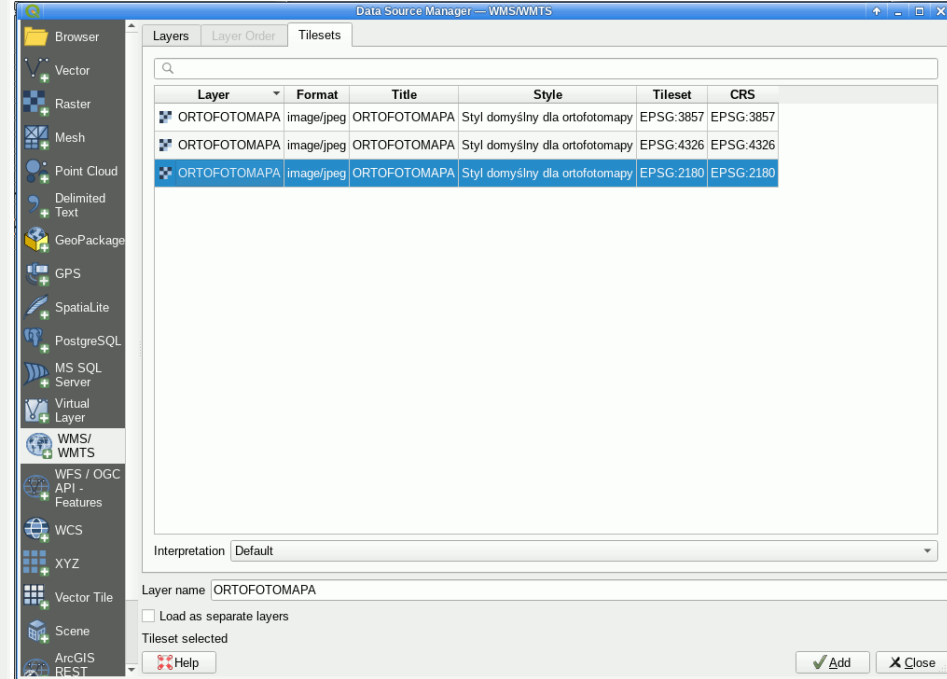
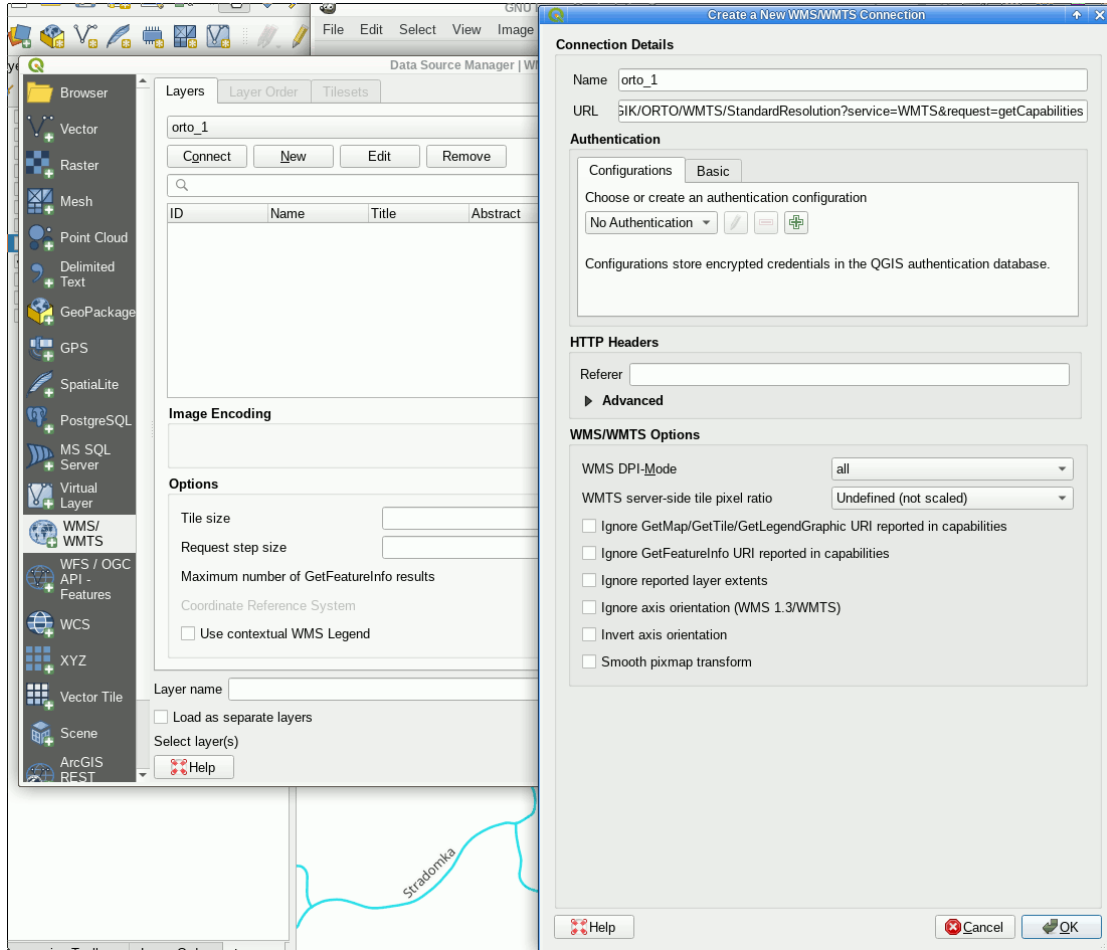
<https://mapy.geoportal.gov.pl/wss/service/PZGIK/ORTO/WMTS/StandardResolution>

2. the addition

[?service=WMTS&request=getcapabilities](https://mapy.geoportal.gov.pl/wss/service/PZGIK/ORTO/WMTS/StandardResolution?service=WMTS&request=getcapabilities)

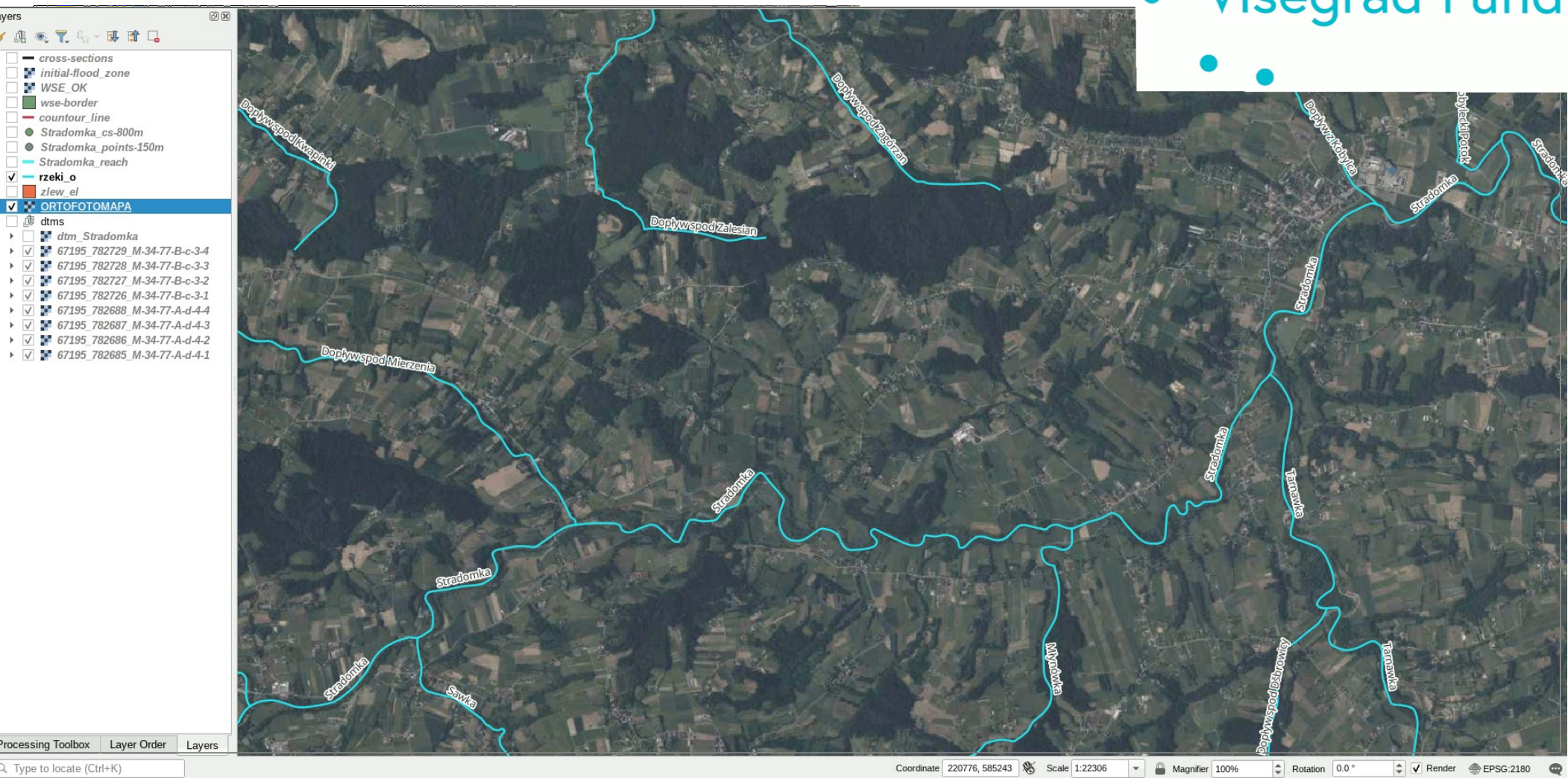
Data Processing in GIS – project data

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Data Processing in GIS – project data

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Data Processing in GIS – data analysis

merge rasters

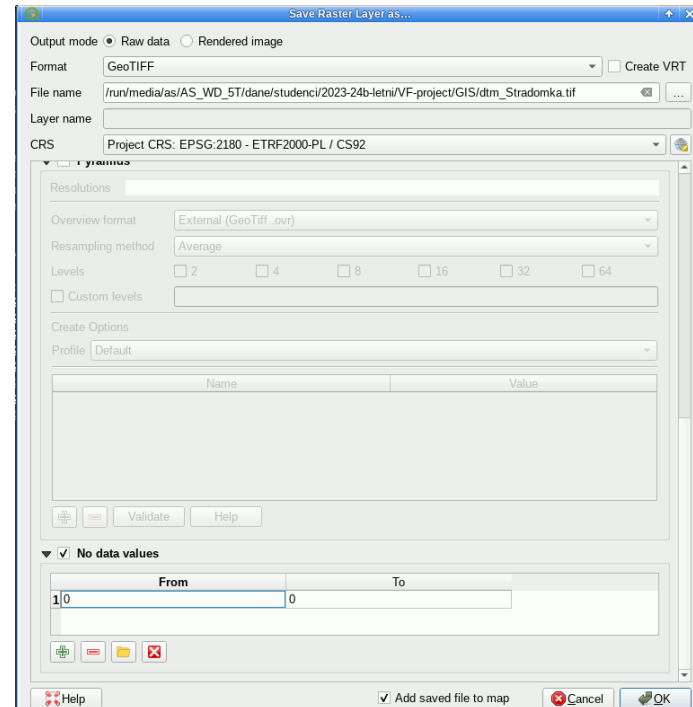
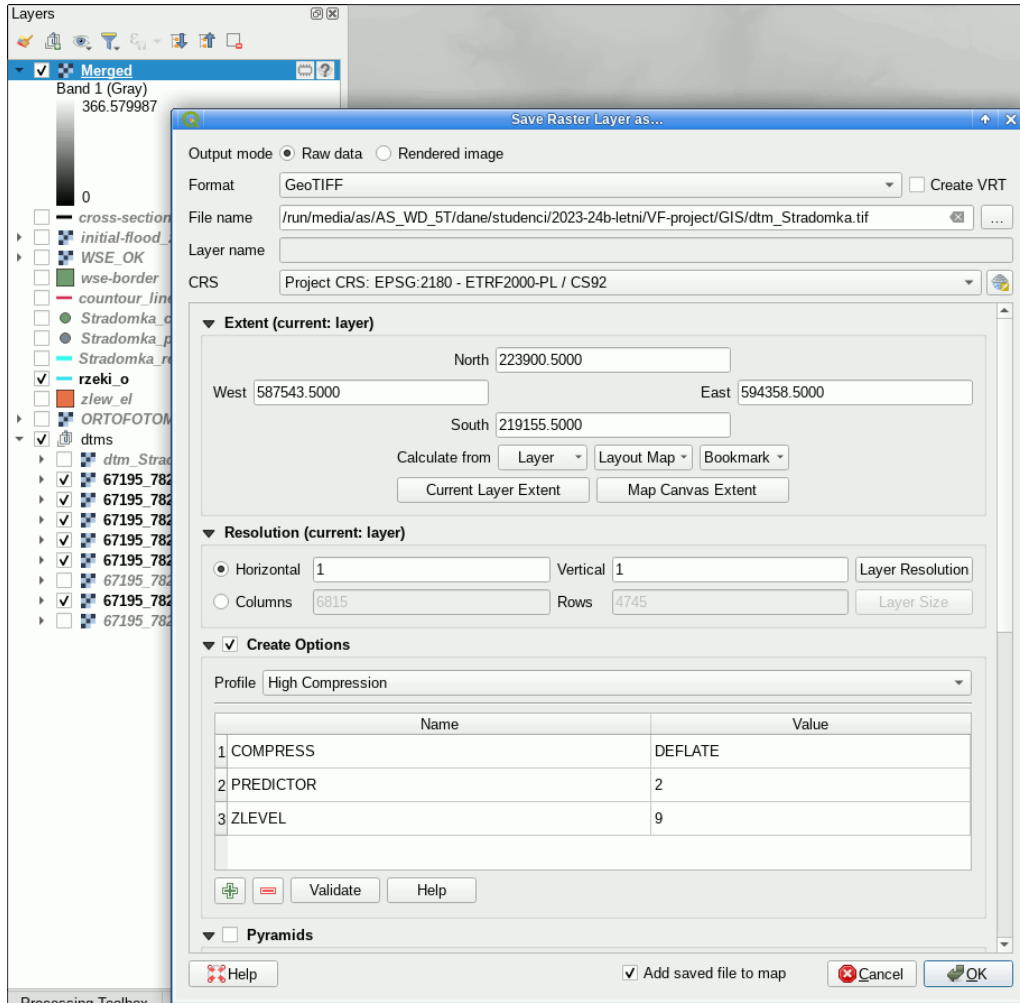
The screenshot shows the QGIS interface with the 'Merge' dialog box open. The 'Parameters' tab is active, showing 'Input layers' with '0 inputs selected'. The 'Output data type' is set to 'Float32'. Under 'Advanced Parameters', the 'Merge' section is expanded, showing '[Save to temporary file]' and a checked option 'Open output file after running algorithm'. The 'GDAL/OGR console call' field contains the error message: 'Invalid value for parameter 'input layers''. The background shows a map with a cyan line labeled 'Stradomka' and a list of layers on the left, including '67195_782728_M-34-77-B-c-3-3'.

Data Processing in GIS – data analysis

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export merged raster to file

- set path and name
- set projection
- set compression
- set no data values



Data Processing in GIS – data analysis

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set good legend

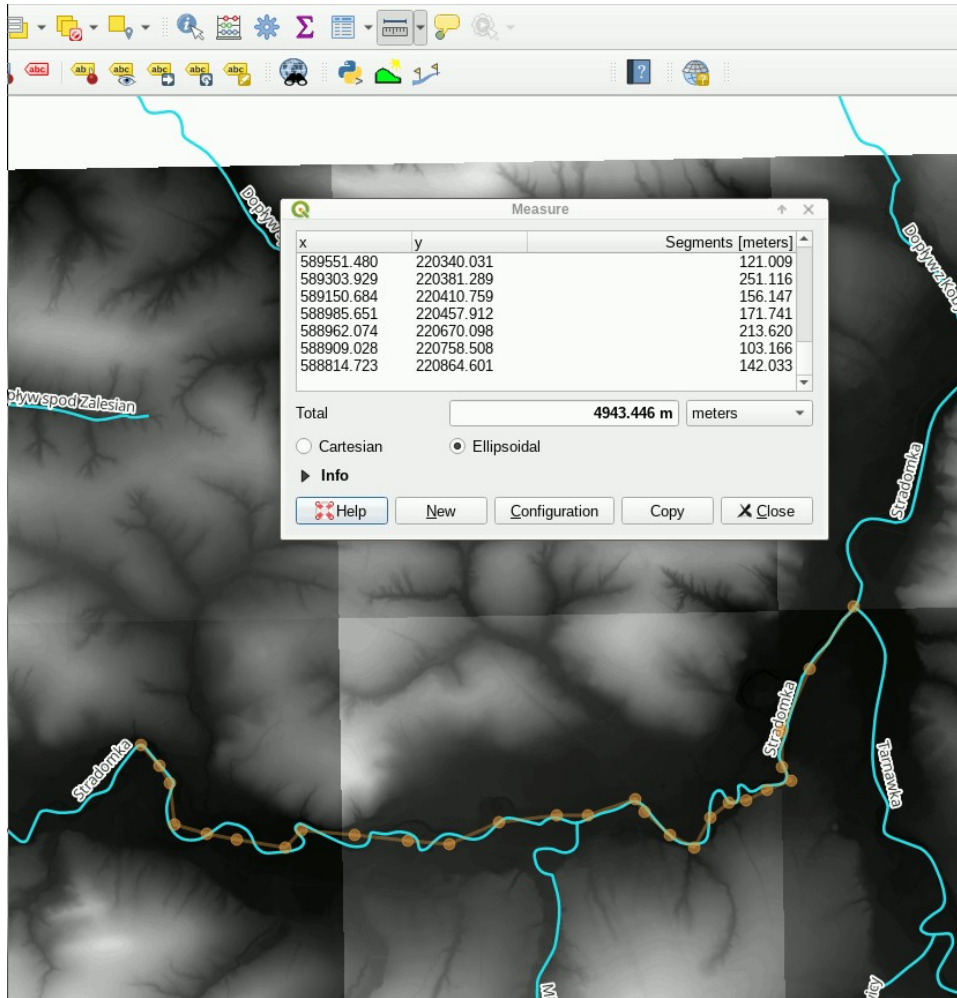
The screenshot displays the QGIS interface with a Digital Terrain Model (DTM) of Stradomka. The background map shows a color-coded elevation model. On the left, the Layers panel lists various data layers, with 'dtm_Stradomka' selected. The 'dtm_Stradomka' layer is currently rendered in grayscale. The 'Layer Properties - dtm_Stradomka - Symbology' dialog box is open, showing the 'Band Rendering' tab. The 'Render type' is set to 'Singleband pseudocolor'. The 'Band' is 'Band 1 (Gray)'. The 'Min / Max Value Settings' are set to 224.179927 and 270. The 'Interpolation' is 'Linear'. The 'Color ramp' is a continuous color scale from dark purple to dark red. The 'Label precision' is set to 4. Below the color ramp, a table shows the resulting color classes and their labels:

Value	Color	Label
224.179927	Dark Purple	224.1800
235.6349945	Blue	235.6350
247.0899964	Light Green	247.0900
258.5449982	Orange	258.5450
270	Dark Red	270.0000

The 'Layer Rendering' tab is also visible, showing 'Blending mode' set to 'Normal', 'Brightness' at 0, 'Gamma' at 1.00, 'Contrast' at 0, and 'Saturation' at 0. The 'Legend Settings...' button is visible in the bottom right of the dialog box.

Data Processing in GIS – data analysis

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zoom to loaded DTM's

measure the length of some kilometers
and choose the river reach

Data Processing in GIS – drawing new objects

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create new
vector layer

The screenshot shows the QGIS interface with the 'New Shapefile Layer' dialog box open. The dialog is titled 'New Shapefile Layer' and contains the following fields and options:

- File name: /run/media/as/AS_WD_5T/dane/studentci/2023-24b-letni/VF-project/GIS/Stradomka_reach.shp
- File encoding: UTF-8
- Geometry type: LineString
- Additional dimensions: None, Z (+ M values), M values
- Project CRS: EPSG:2180 - ETRF2000-PL / CS92

The 'New Field' section includes:

- Name: (empty text box)
- Type: abc Text (string)
- Length: 80
- Precision: (empty text box)
- Buttons: Add to Fields List, Remove Field

The 'Fields List' table is as follows:

Name	Type	Length	Precision
id	Integer	10	

Buttons at the bottom: Help, Cancel, OK.

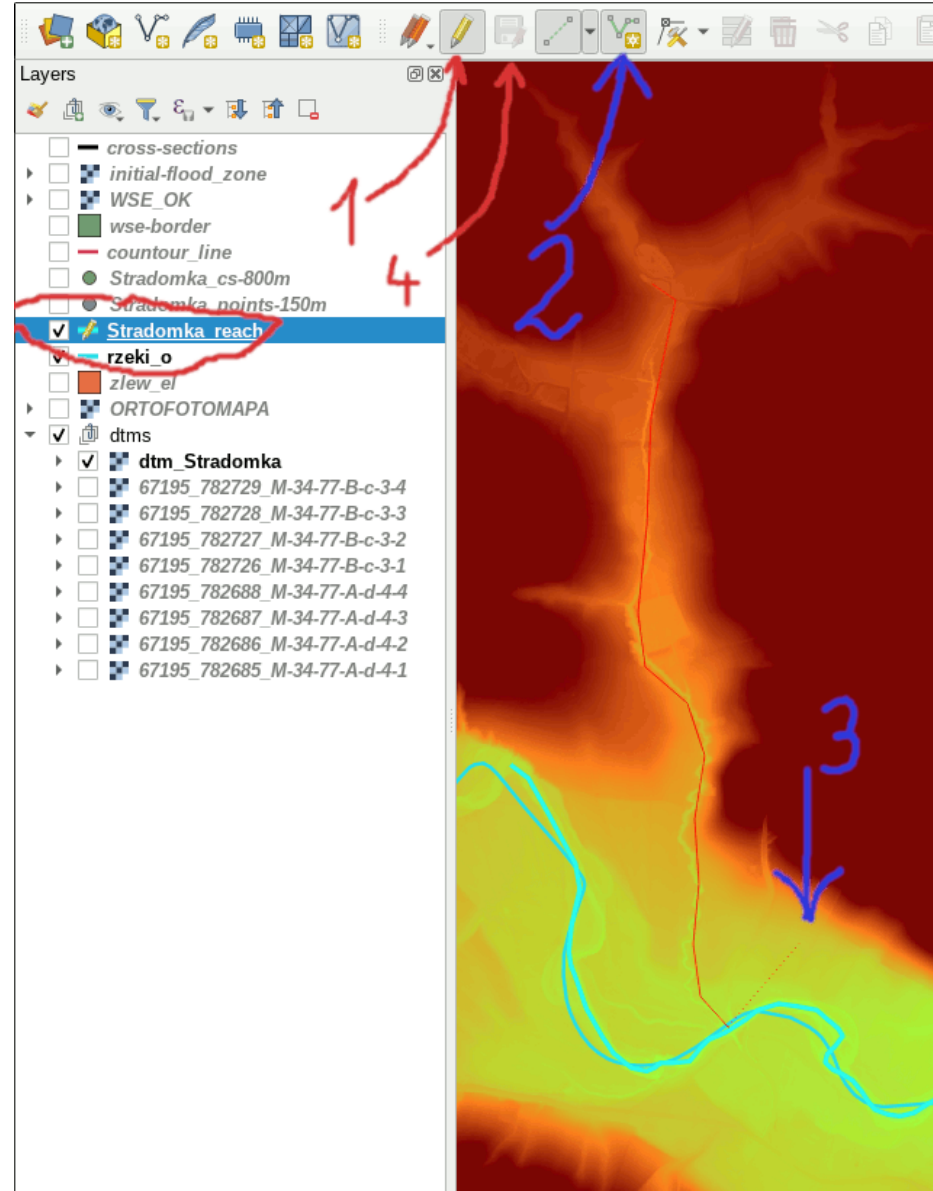
Data Processing in GIS

- drawing new objects

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RIVER CHANNEL

1. edit layer
 2. toggle drawing
 3. draw by left button
finish by right button
fill data in table (or left blank)
 4. save objects in layer
 - 5 – 1. – switch editing off
- set layer properties



Data Processing in GIS – drawing new objects

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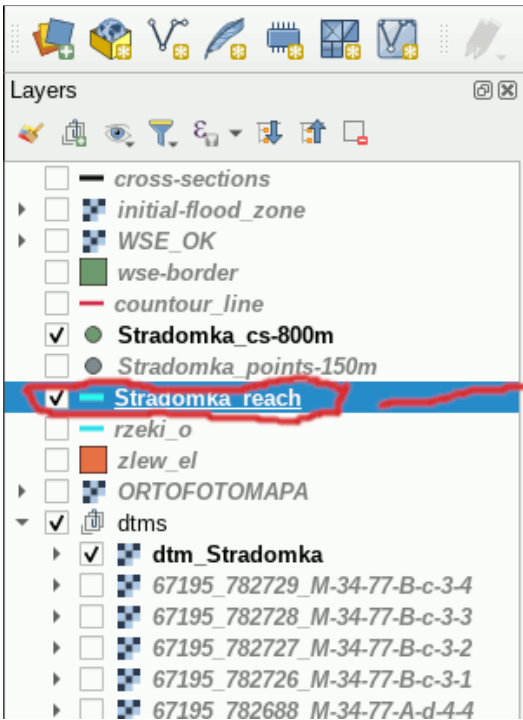
QCHAINAGE PLUGIN

The screenshot displays the QGIS interface with the QChainage plugin dialog box open. The 'Basic' tab is selected, and the 'Stradomka_reach' layer is chosen in the 'Select Layer to chainage' dropdown. The 'Chainage every' value is set to 800.00000000 meters. The 'Output Layername' is 'chain_Stradomka_reach'. A red arrow points from the 'Stradomka_reach' layer in the Layers panel to the dropdown menu. Another red arrow points from the 'Chainage every' input field to the right. The background is a heatmap of a river network.

qchainage - measure distance along lines – points on river
- location of cross-sections, - coordinates of river nodes for channel data export

Data Processing in GIS – drawing new objects

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important !!!

in this exercise:

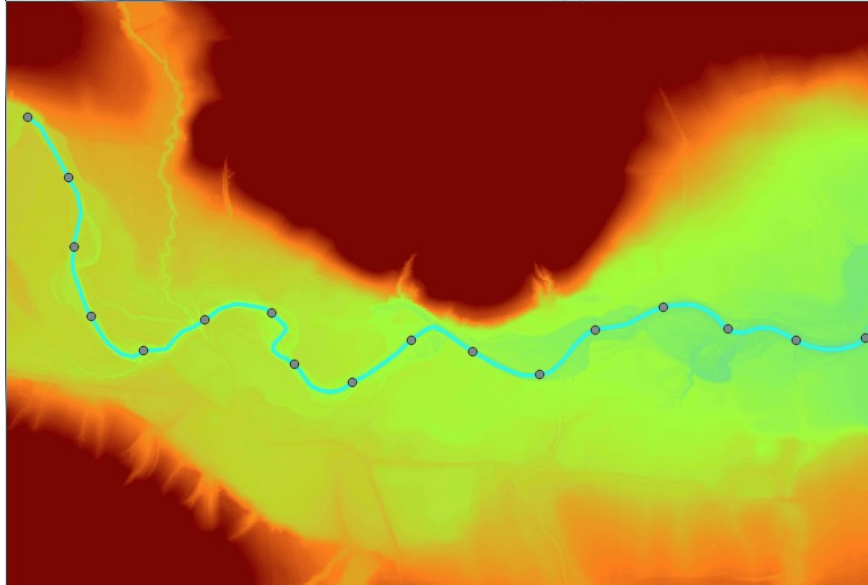
- 150m points layer

is used to reflect the run of the river channel in Mike model

- 800m points layer

is used to import data (water surface elevation) from Mike to cross-section location

Data Processing in GIS – data export



points measured
along lines

in 150m points layer
add X and Y coordinate fields

export x coordinates
to WGS

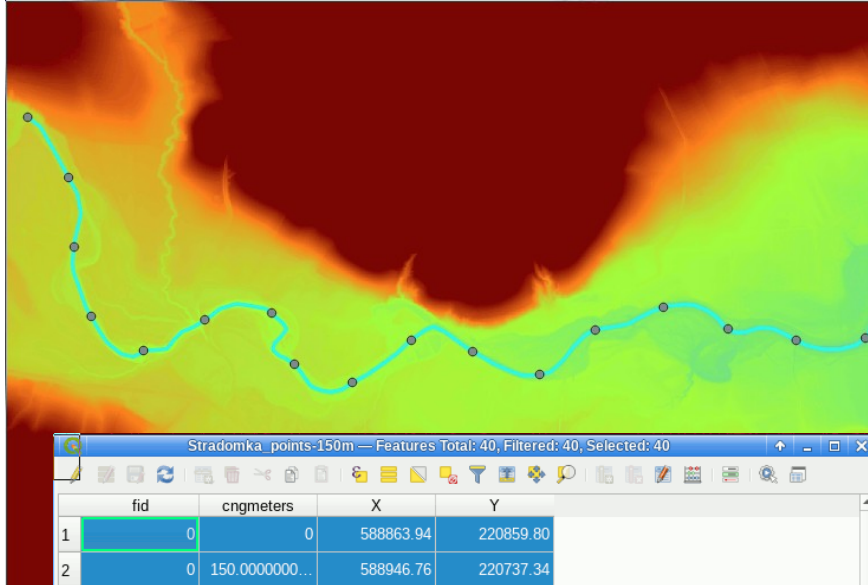
```
x(transform($geometry, layer_property(@layer_name, 'crs'),'EPSG:4326'))
```

```
to epsg:2180
```

for y coordinates replace x with y

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Data Processing in GIS – data export



RIVER CHANNEL
(150m point layer)

open layer attribute table

CTRL-A
select all features

CTRL-C
copy values to clipboard

CTRL-V
paste values to notepad and then to
spreadsheet (i.e. MS Excel)

in excel change data order to be ready for import to
Mike

fid	cngmeters	X	Y
1	0	588863.94	220859.80
2	0	150.000000...	588946.76
3	0	300.000000...	588958.20
4	0	450.000000...	588993.34
5	0	600.000000...	589100.54
6	0	750.000000...	589228.06
7	0	900.000000...	589364.56
8	0	1050.000000...	589410.82
9	0	1200.000000...	589531.14
10	0	1350.000000...	589652.08
11	0	1500.000000...	589778.96
12	0	1650.000000...	589917.09

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Data Processing in GIS – drawing new objects

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create contour lines and save them as a vector layer in the project location

The screenshot shows the QGIS interface with the 'Contour' tool dialog box open. The main map displays a Digital Terrain Model (DTM) with contour lines. The 'Contour' dialog box is open, showing parameters for the 'dtm_Stradomka' layer, including an interval of 2.500000 and an attribute name 'eLEV'. The GDAL/OGR console call is visible at the bottom of the dialog.

Parameters

Log

Input layer
dtm_Stradomka [EPSG:2180]

Band number
Band 1 (Gray)

Interval between contour lines
2.500000

Attribute name (if not set, no elevation attribute is attached) [optional]
eLEV

Offset from zero relative to which to interpret intervals [optional]
0.000000

Advanced Parameters

Contours
[Save to temporary file]

Open output file after running algorithm

GDAL/OGR console call

```
gdal_contour -b 1 -a ELEV -i 2.5 -f "GPKG" /run/media/as/AS_WD_5T/dane/studenci/2023-24b-letni/VF-project/GIS/dtm_Stradomka.tif /tmp/processing_uCCKJe/288ac1d804b648be88113c6983e87e95/OUTPUT.gpkg
```

0%

Help Advanced Run as Batch Process... Close Run

Data Processing in GIS – drawing new objects

CROSS-SECTIONS

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- create new vector layer - polylines

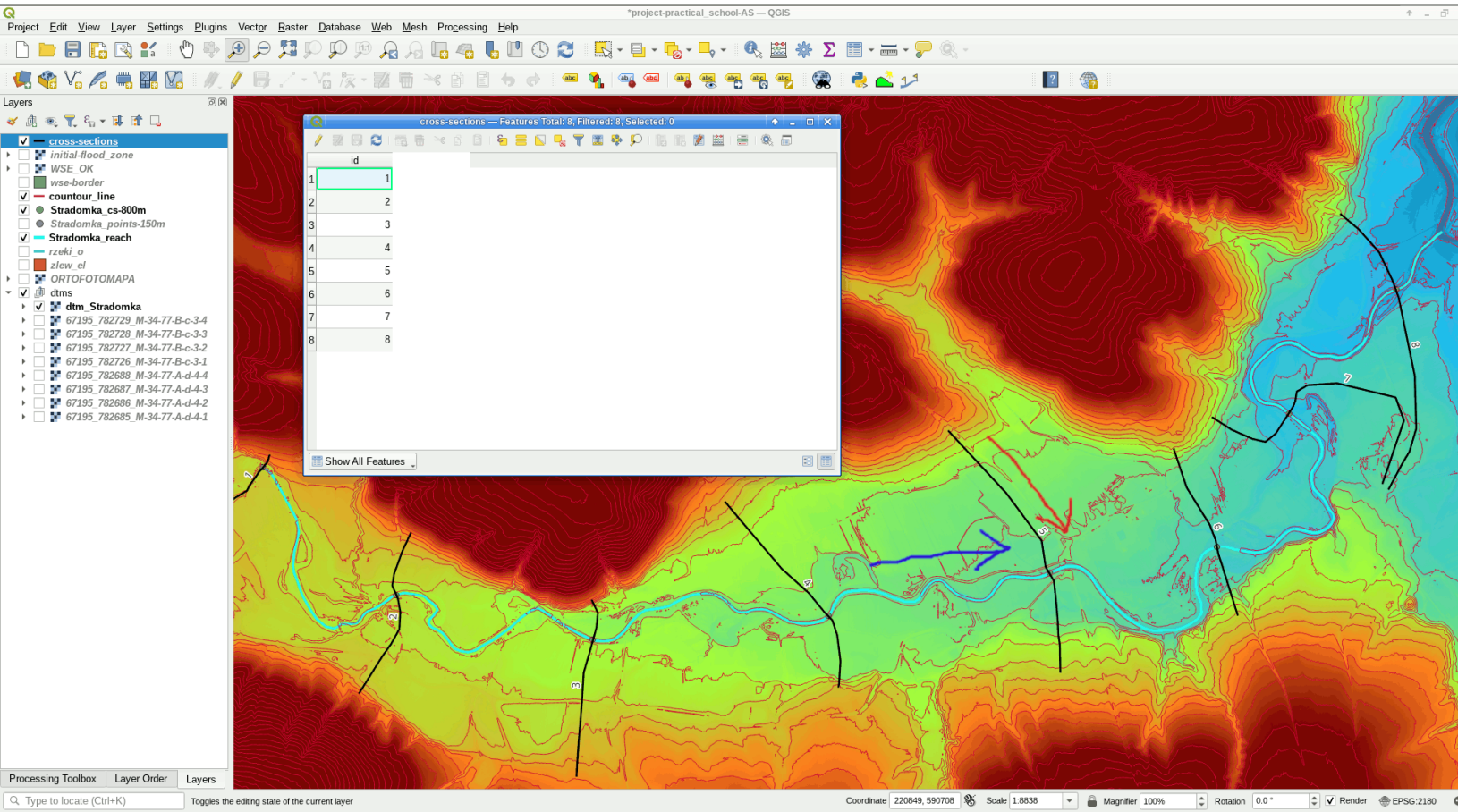
- draw elements from left to right perpendicularly to countour lines

- set numbers of every cross-section

- save layer

- close editing

- save project



Data Processing in GIS – data export

PROFILE TOOL PLUGIN (icon name: Terrain Profile)

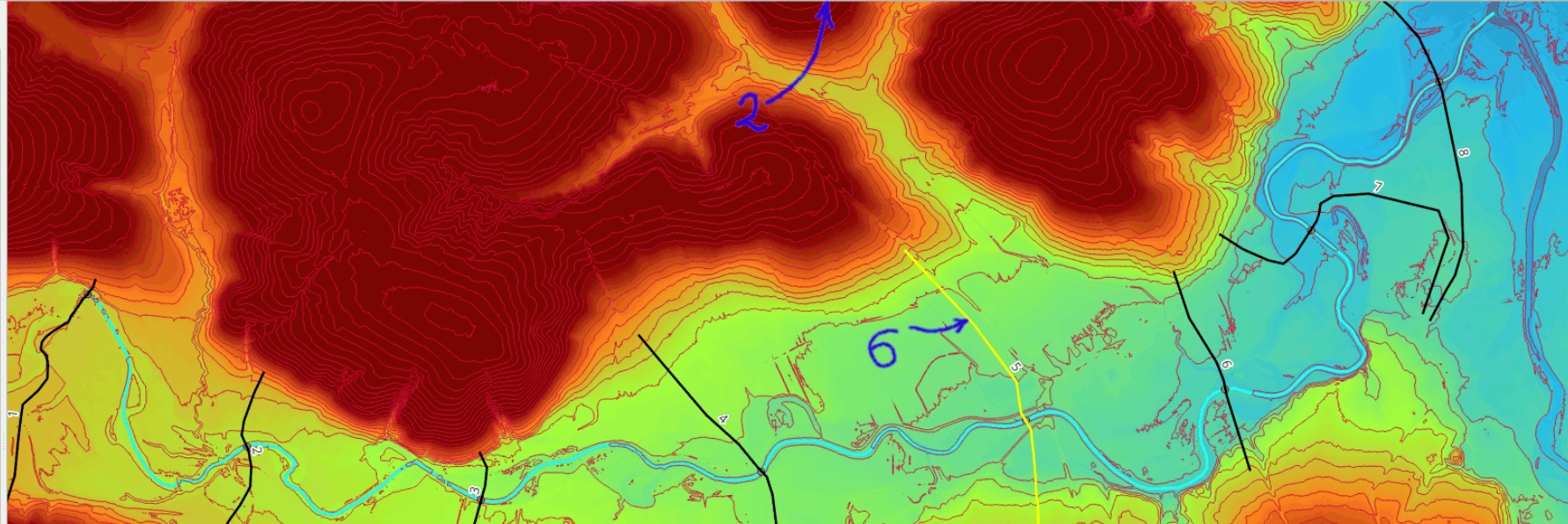
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- 1 – select dtm
- 2 – start plugin
- 3 – add dtm layer
- 4 – select cross-section layer
- 5 – choose picked features
- 6 – pick cross-section feature
- 7 – copy table to clipboard

paste data to notepad

repeat points 4 – 7
until all data is copied

- Layers
- [-] cross-sections
 - initial_flood_zone
 - WSE_OK
 - wse-border
 - countour_line
 - Stradomka_cs-800m
 - Stradomka_points-150m
 - Stradomka_reach
 - rzeki_o
 - zlew_el
 - [-] ORTOFOTOMAPA
 - [-] dtms
 - dtm_Stradomka
 - 67195_782729_M-34-77-B-c-3-4
 - 67195_782728_M-34-77-B-c-3-3
 - 67195_782727_M-34-77-B-c-3-2
 - 67195_782726_M-34-77-B-c-3-1
 - 67195_782688_M-34-77-A-d-4-4
 - 67195_782687_M-34-77-A-d-4-3
 - 67195_782686_M-34-77-A-d-4-2
 - 67195_782685_M-34-77-A-d-4-1



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-
-

Flow Modeling

(classes by Maciej Wyrębek)

Data Processing in GIS – data import

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To import data from Mike View:

- assign water level elevation in spreadsheet with coordinates of cross-sections points location
(in this exercise point vector layer of raster 800m)
- import txt or csv data from spreadsheet prepared in order
X Y Z c-s_number,
where: c-s_number is cross-section number,
Z – is a water elevation for modeled flood wave
- create buffer layer from points layer
- copy Z values from buffer layer to cross-sections layer
(spatial join)

Data Processing in GIS – data import

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File name: /run/media/as/AS_WD_5T/dane/studenci/2023-24b-letni/VF-project/res_from_Mike

Layer name: res_from_Mike Encoding: UTF-8

File Format

CSV (comma separated values) Tab Colon Space

Regular expression delimiter Semicolon Comma Others:

Custom delimiters Quote: " Escape: "

Record and Fields Options

Geometry Definition

Point coordinates X field: X Z field: Z

Well known text (WKT) Y field: Y M field:

DMS coordinates

No geometry (attribute only table) Geometry CRS: Project CRS: EPSG:2180 - ETRF2000-PL / CS92

Layer Settings

Sample Data

	X	Y	cr_no	cngmeters	Z
	1.2 Decimal (double)	1.2 Decimal (double)	123 Integer (32 bit)	123 Integer (32 bit)	1.2 Decimal (double)
1	588863.943267473	220859.804649921	1	0	253.3
2	589270.098326586	220470.832885871	2	800	250.87
3	589868.103727522	220335.143586747	3	1600	247.49
4	590585.358937664	220407.267482586	4	2400	245.04
5	591260.606073744	220537.299212542	5	3200	241.35
6	591770.022258632	220617.069867975	6	4000	240.53
7	591989.823066657	221023.587519639	7	4800	238.05

import data from file named res_from_Mike

delimiter is tab

geometry definition
X is X, Y is Y Z is Z (water)

set proper CRS

Data Processing in GIS – data import

imported layer is a point one

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The screenshot displays a GIS interface with several components:

- Layer List (Left):** A tree view showing various layers. The layer 'res_from Mike' is highlighted with a red circle.
- Data Table (Bottom Left):** A table titled 'res_from Mike' with 8 rows and 5 columns: X, Y, cr_no, cngmeters, and Z. The first row is highlighted in green.
- Map (Center):** A map showing a blue area with a black line and a cyan line. A red circle highlights a specific point on the map.
- Measure Tool (Right):** A 'Measure' dialog box showing a table of coordinates and segment lengths. The total distance is 1.071 m.

x	y	Segments [meters]
592316.268	221401.597	
592315.513	221401.414	0.777
592315.361	221401.163	0.294

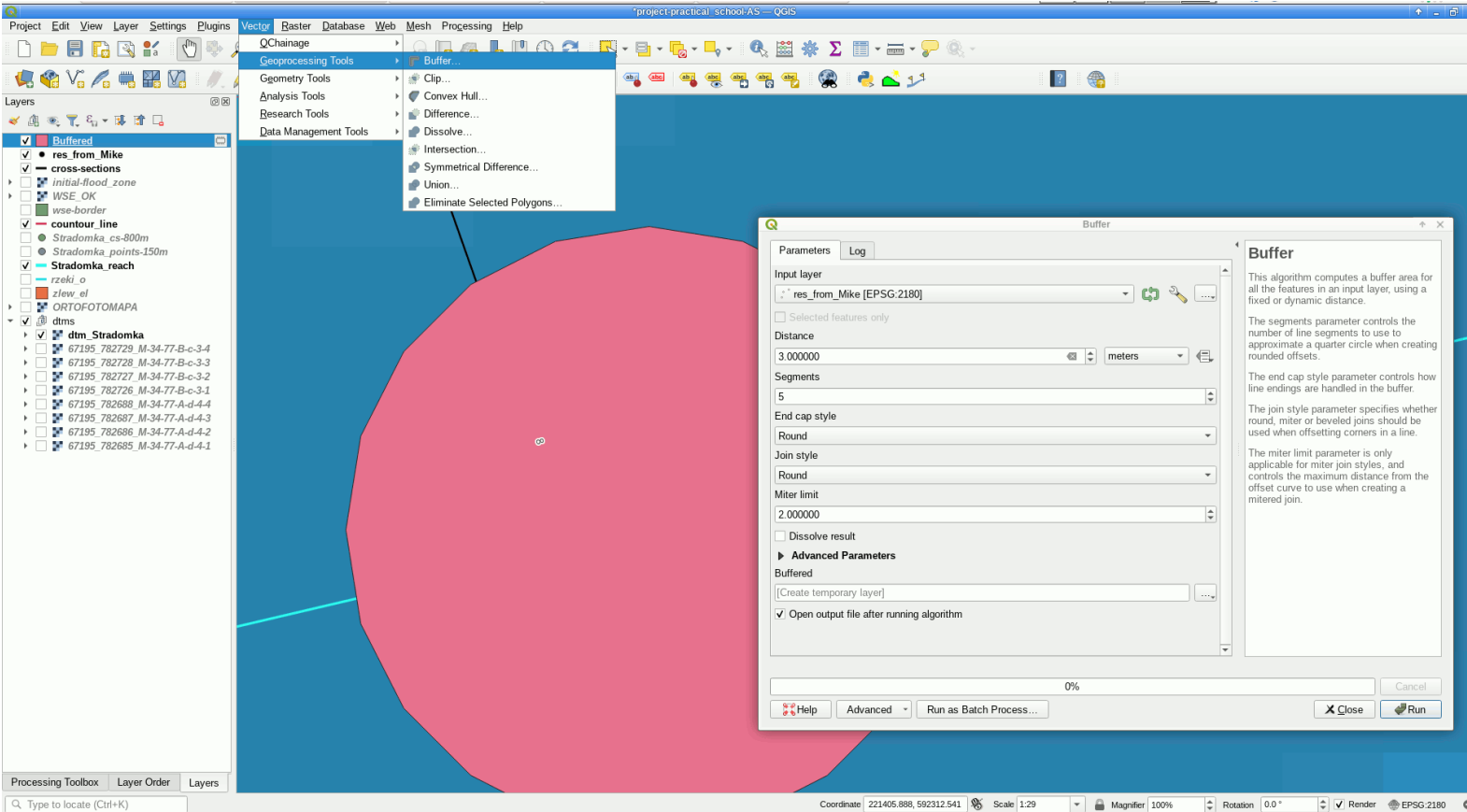
X	Y	cr_no	cngmeters	Z
588863.9432...	220859.8046...	1	0	253.3
589270.0983...	220470.8328...	2	800	250.87
589868.1037...	220335.1435...	3	1600	247.49
590585.3589...	220407.2674...	4	2400	245.04
591260.6060...	220537.2992...	5	3200	241.35
591770.0222...	220617.0698...	6	4000	240.53
591989.8230...	221023.5875...	7	4800	238.05
592316.2383...	221401.7018...	8	5600	234.9

points location is different then cross-sections location

the max difference can be found and measured with Measure

Data Processing in GIS – data import

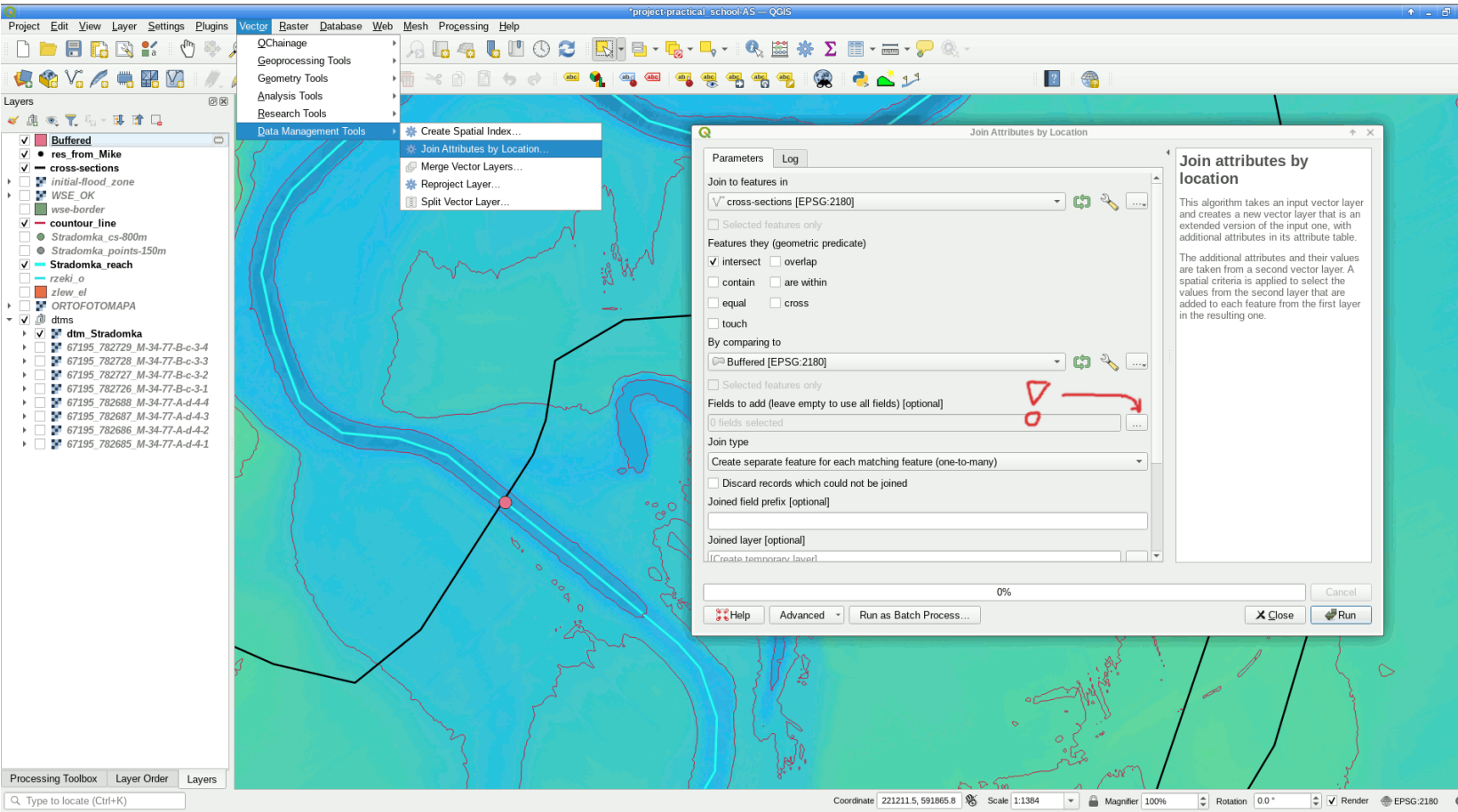
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-
-



buffer layer is created
with radius set to
3 meters

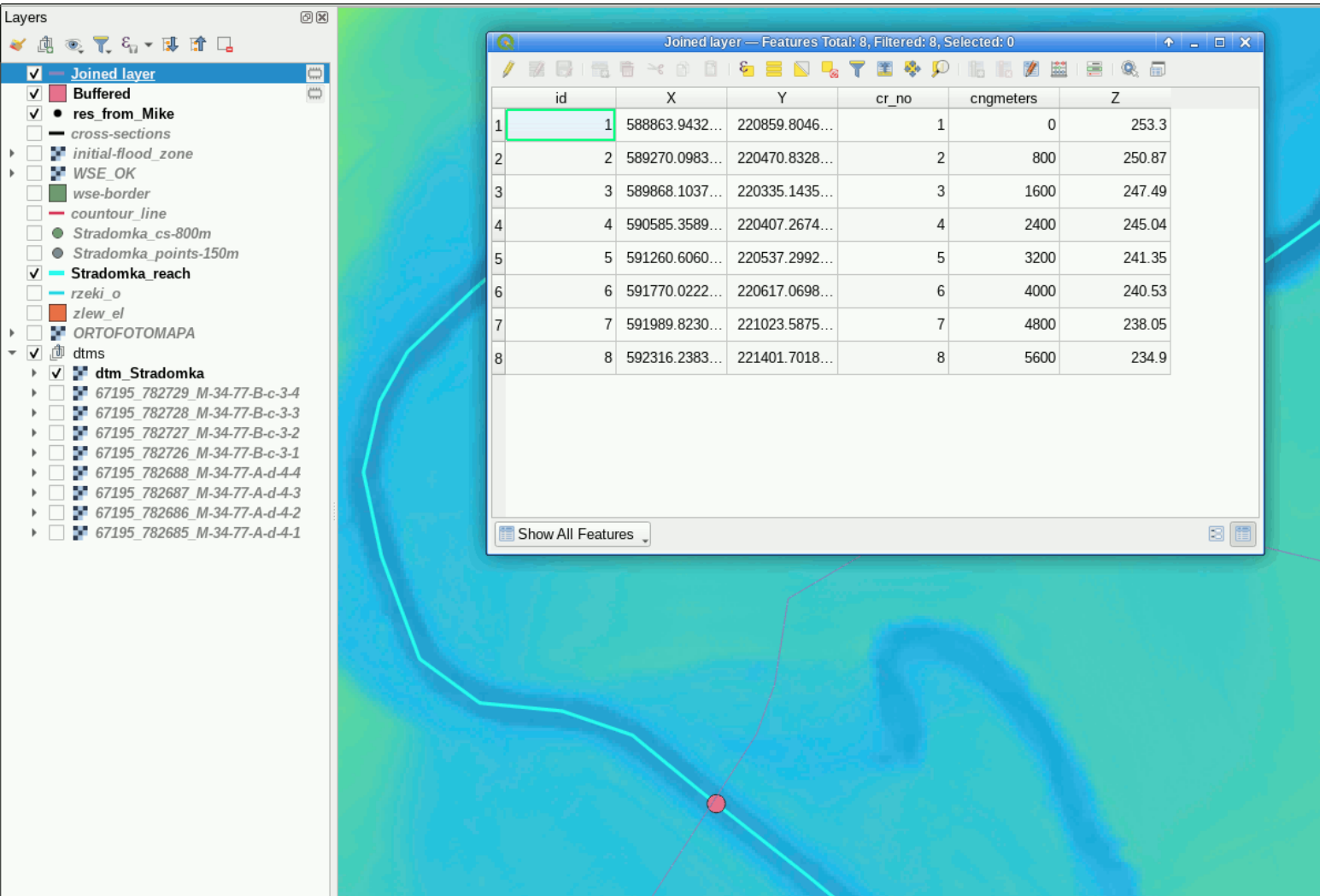
Data Processing in GIS – data import

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data collected
in layer buffer
is copied to
layer
cross-sections
by location

Data Processing in GIS – data import



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data collected
in layer buffer
is copied to
layer
cross-sections
by location

it's worth to
export this as a
vector layer

This data can be used to interpolate water surface elevation between cross-sections

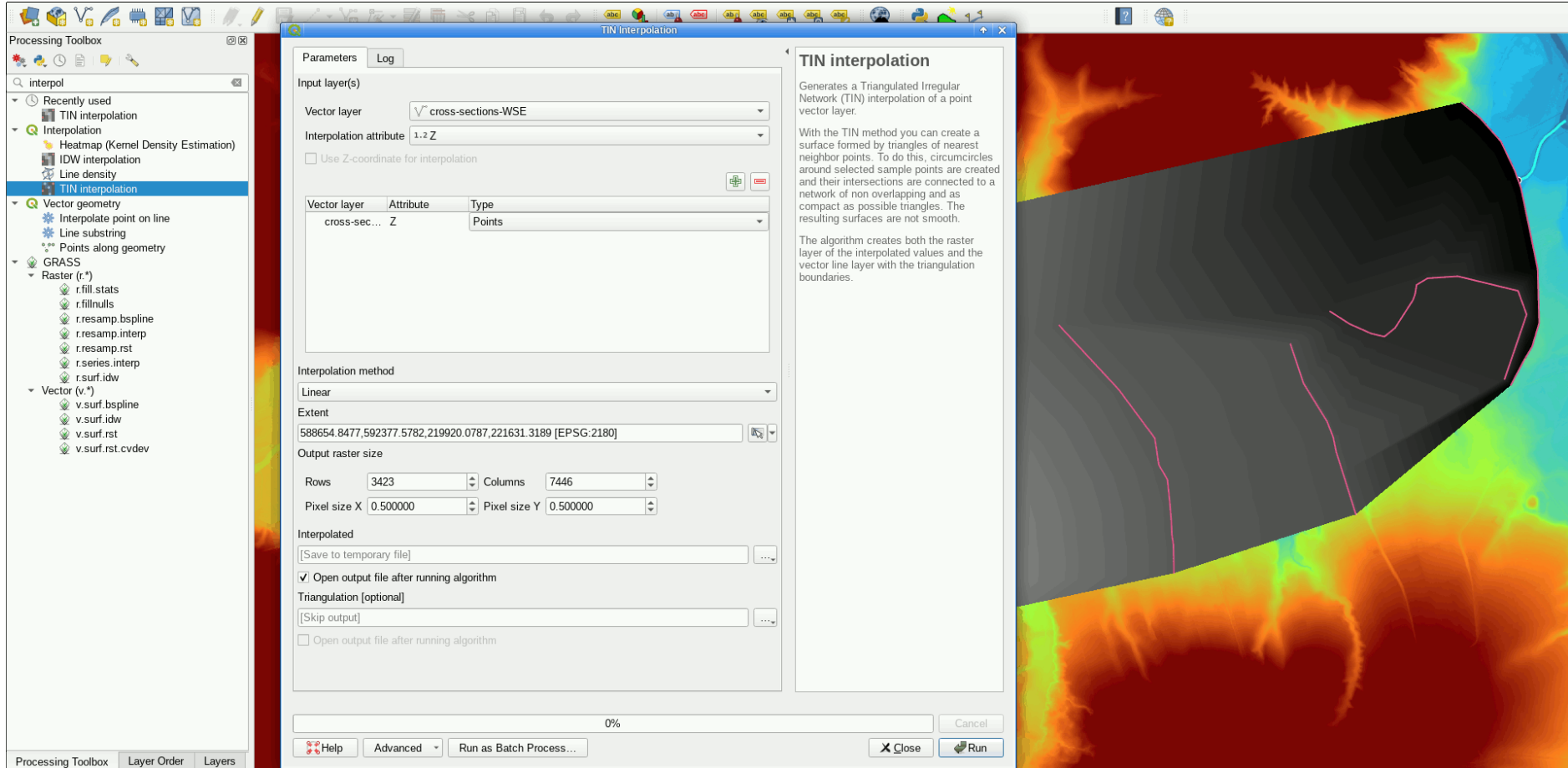
the TIN interpolation is used on the base of Z values

the borders and CRS of the new raster are taken from the cross-sections vector layer

it's important to properly set the created raster resolution (here set to 0.5 m)

details can be found at the next slide ...

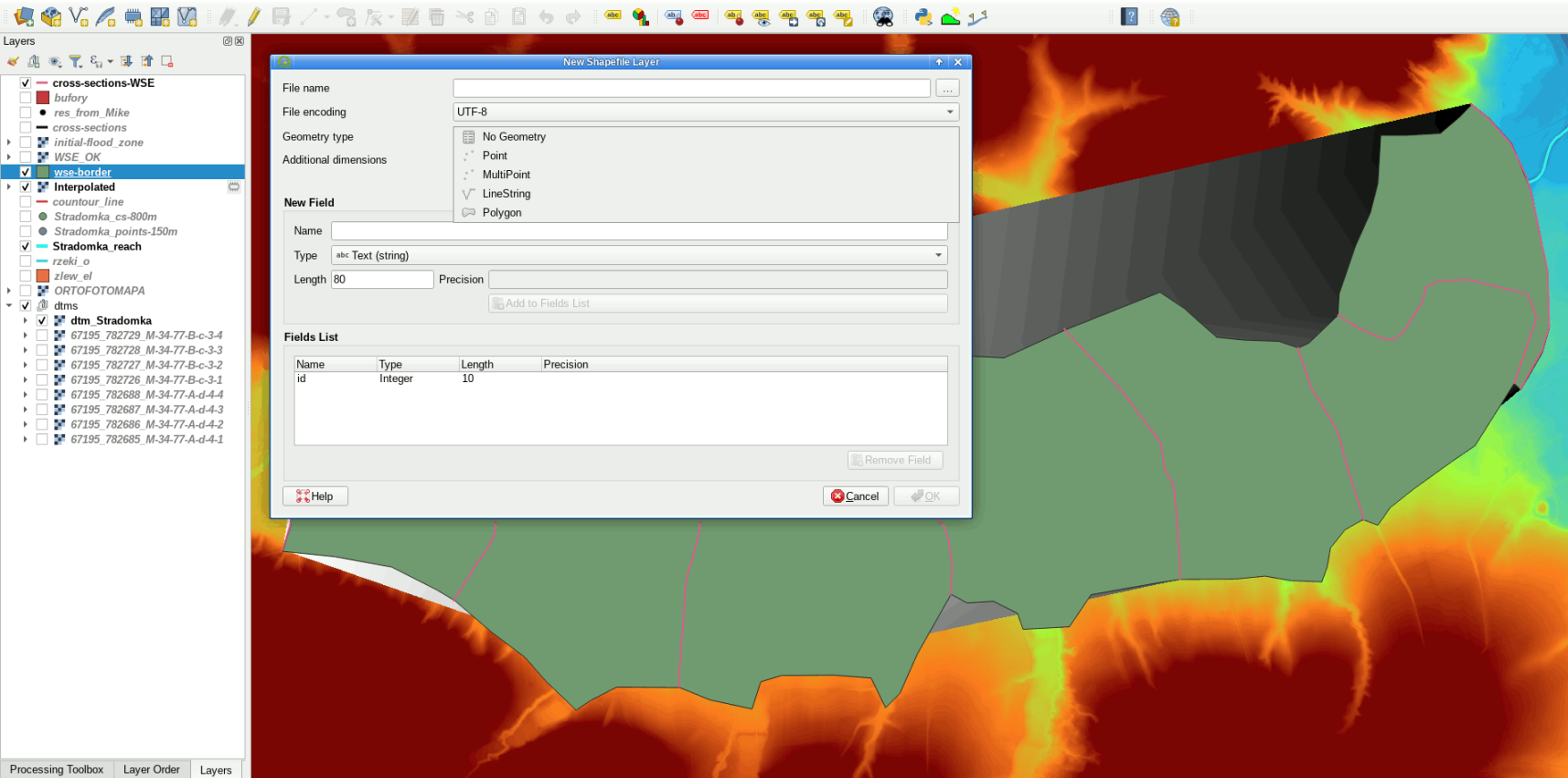
Data Processing in GIS – data import



the borders of the raster flow outside the cross-sections range – it has to be corrected^{32 / 37}

Data Processing in GIS – data import

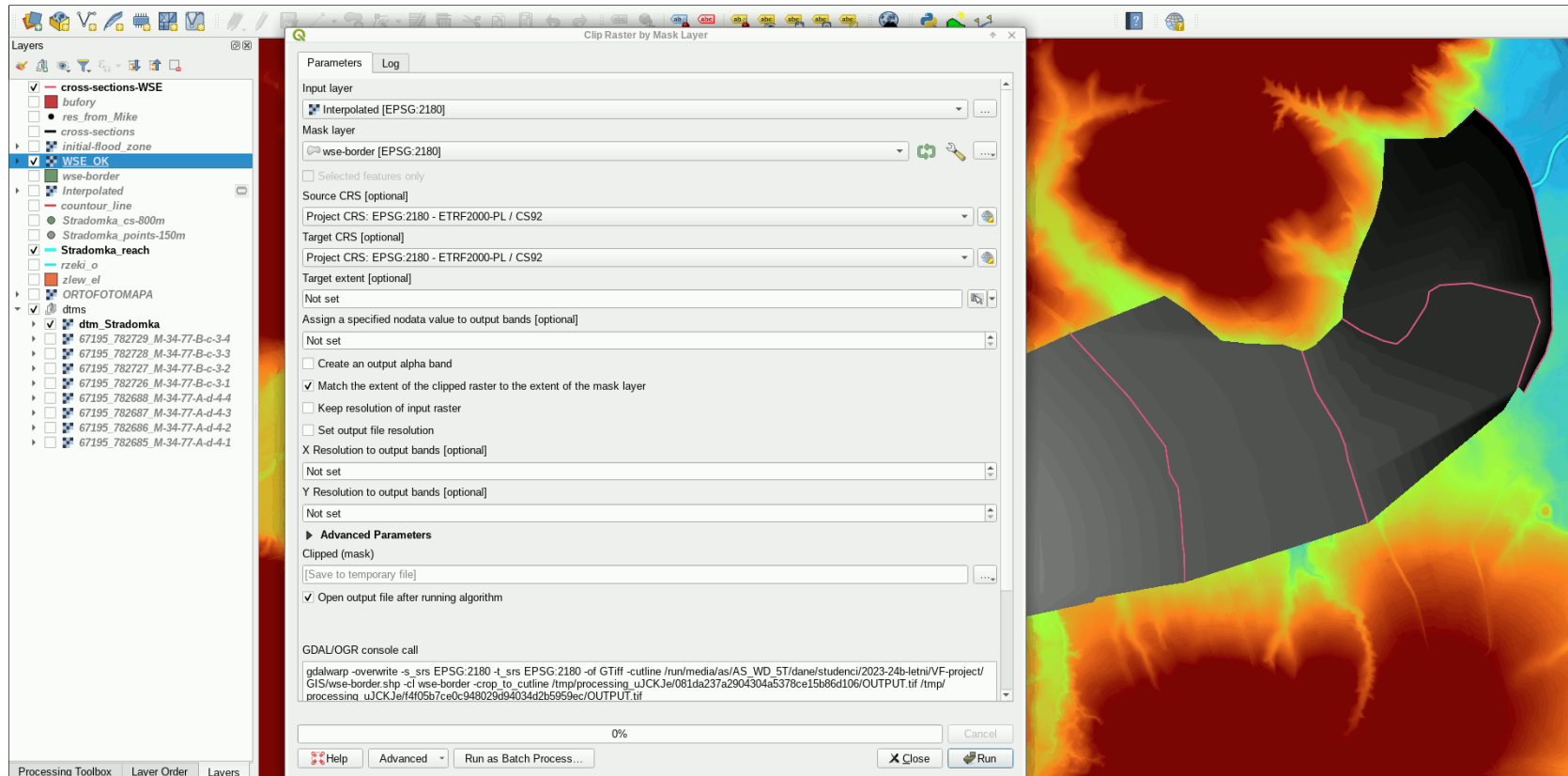
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new vector polygon layer is created to draw the proper borders of the WSE raster

Data Processing in GIS – data import

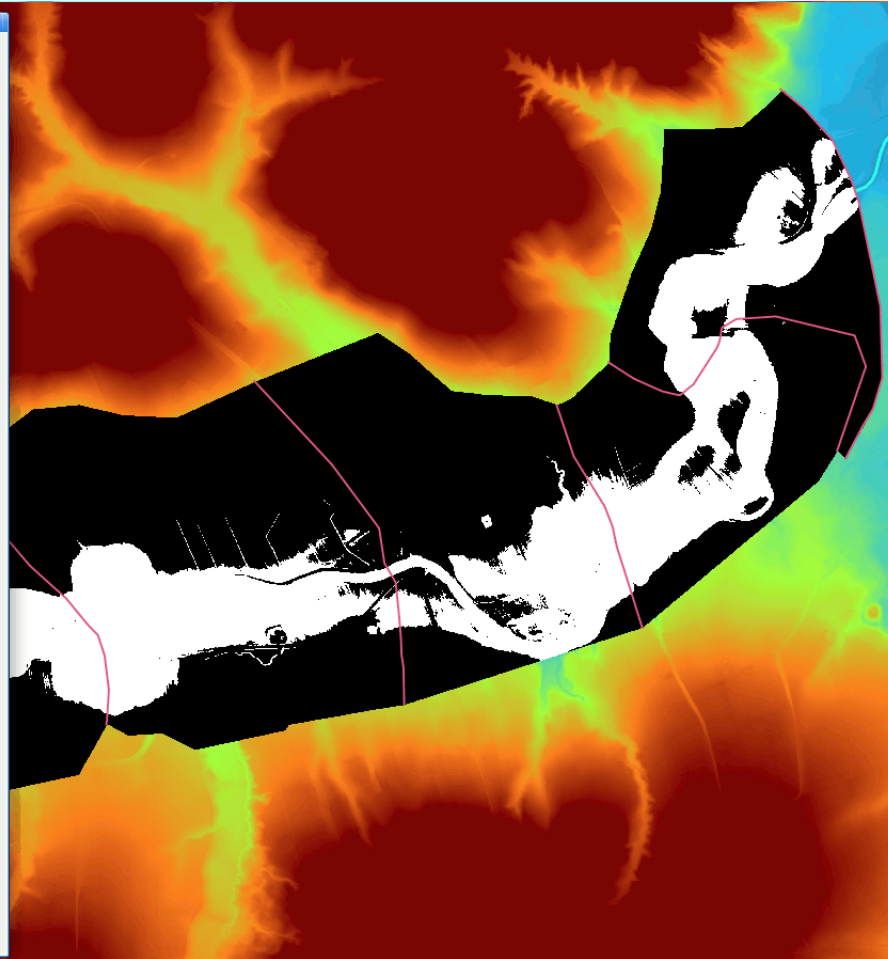
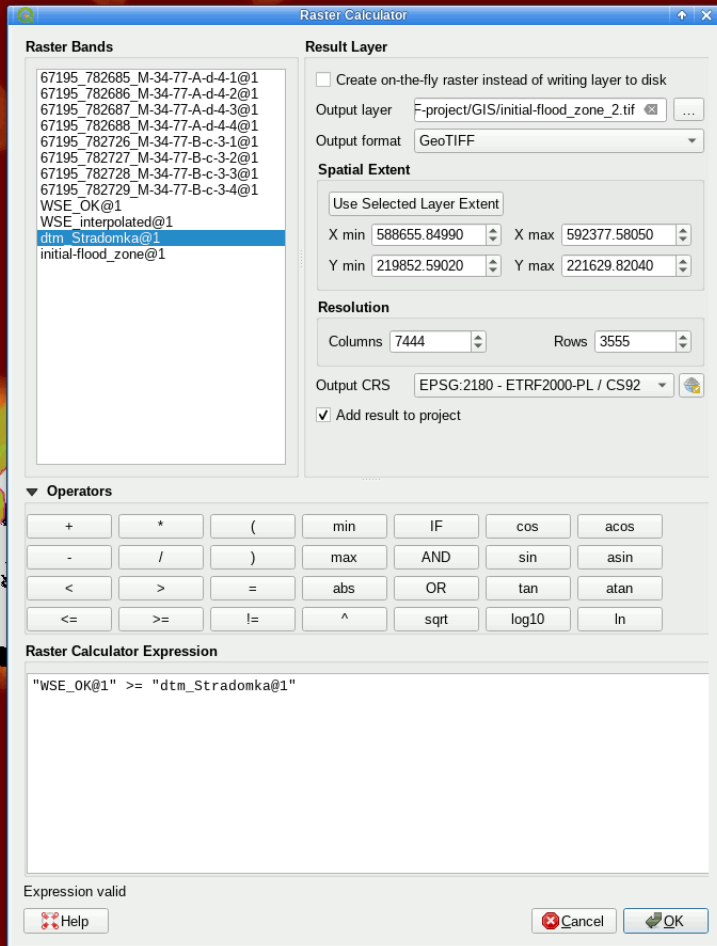
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the raster can be shrink by the “clip raster by mask layer” procedure

Data Processing in GIS – generating flood zones

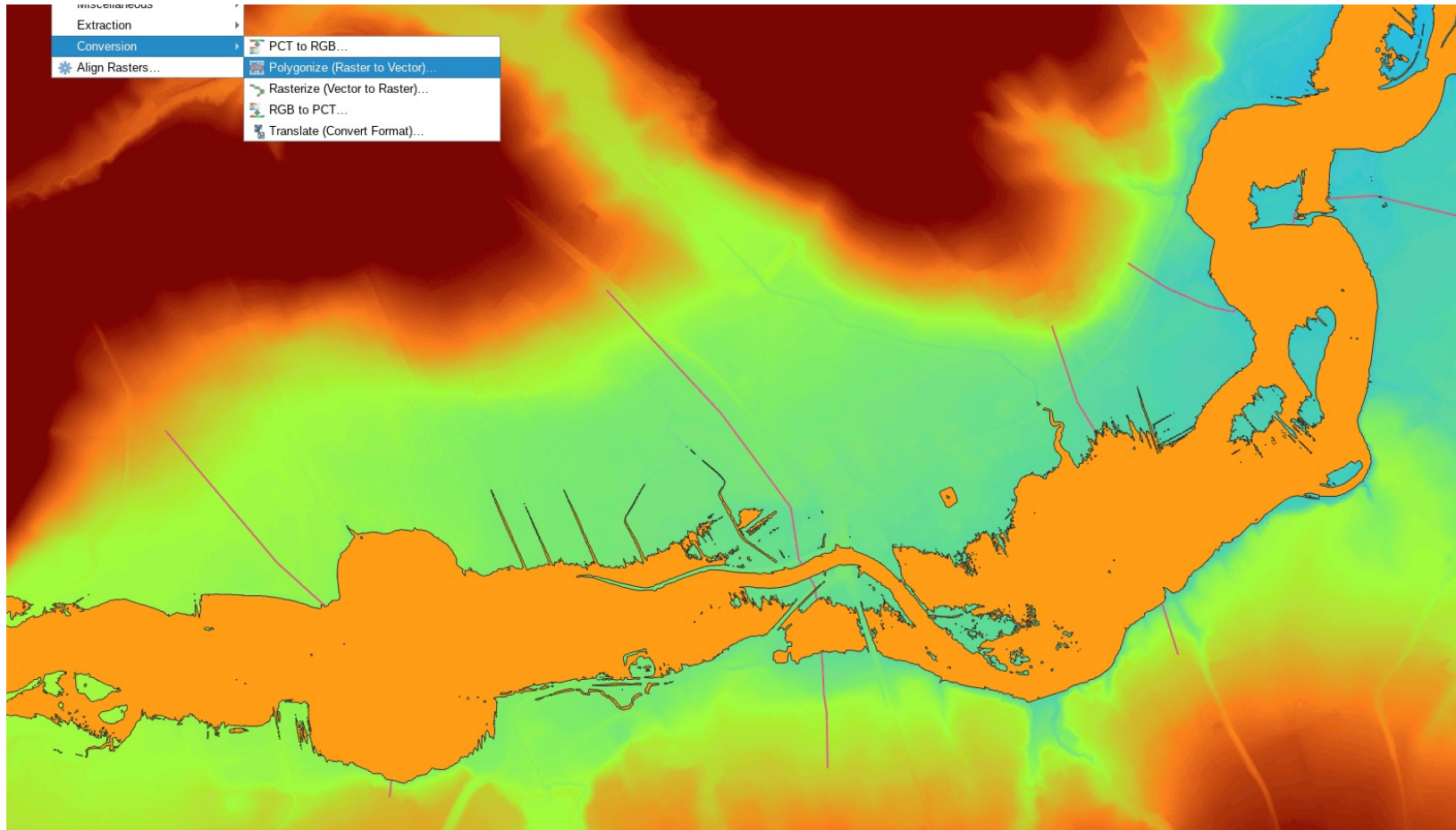
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The raster of flood zones can be generated in raster calculator with the expression comparing the raster of water surface elevation to the raster of DTM model

Data Processing in GIS – generating flood zones

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The vector layer can be created with the Raster to vector procedure

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THANK YOU