**Problem 1 – Determine the regions vulnerable to flood risk due to river overflow during the raining season**

**1.1 – Create one vector gds representing all vulnerable regions to river flooding (vulnerable\_regions)**

After downloading 2 GeoTiff files of the river area (river\_north and river\_south), and reproject them to the CRS ETRS-TM06 (EPSG: 3763), the files were merged and clipped according to the coordinates provided (see diagram 1).

The areas where the elevation is less or equal than 17 meters where selected and converted into a vector layer, as the solution we are looking for is a vector gds. This layer has an attribute named “elevation” with the values 0 and 1. The features where elevation is equal to 1 (meaning the elevation is less or equal to 17 meters) were extracted and saved into a layer named vulnerable\_regions.

The spatial operation dissolve was used (dissolving all fields), to eliminate the existing boundaries and to calculate the total area of vulnerable region, in square kilometers.

NOTE: Because of the clip we previously did, there were some features in this file that were not of interest for this study case, so we deleted them by selecting the features and hitting “delete selected features”.

**1.2. Classify flooding areas as high, moderate and low risk, and calculate their area in hectares**

The same GeoTiff was used and, with the raster calculator we were able to divide the area according to the risk of flooding. We considered 1 for high risk, 2 for moderate risk and 3 for low risk. This set of operations produced a GeoTiff that was named DEM\_high\_moderate\_low. This layer was clipped by using the vulnerable\_regions layer as mask.

After being converted to a vector file, the layer was dissolved by the “risk” attribute. Finally, the areas, in hectares, were calculated by the level of risk of flooding.

**Problem 2 – Classify parcels by their soil use.**

The parcel assigned to our group was the number 13, that was extracted from the layer EditingZones through a select operation. In this problem, parcel 13 was divided into 10 new parcels with the goal to assign a soil use and owner to each parcel.

Before started to divide the polygon, a suitable environment was created: the snapping tool was enabled to avoid gaps among neighboring polygons; to avoid overlapping, the avoid intersection tool was also enabled

The split features tool was used to create the parcels inside the polygon. Afterwards, two columns were added to the attribute table – SoilUseCod, for the soil use type, and NId, for the parcels owner’s ID’s. The features were selected using the tool Select feature(s), and the values were added with the field calculator.

**Problem 3 – Classify all the parcels of the Region by their soil use and owner**

**3.1. Create a gds file representing all parcels, including the one created in problem 2 (ParcelsNew\_22062)**

To join all information about soil use and the parcels owners, the operating “join attribute by location” was used. This created a new layer based on SoilUse and Cadastre, with the SoilUseCod and NId as attributes.

The unclassified areas of the layer Cadastre were identified by doing a difference between that same layer and the layer previously created in this problem 3, as shown in diagram 2. These areas were considered as soil use code 50 (Other). The two layers (SoilUse\_OwnerID and SoilUse\_Other) were merged and the NULL values for the SoilUseCod were set according to the expression on the diagram.

By merging this final layer, named SoilUse\_Other\_OwnerID, with the gds parcel\_13 created in problem 2, we get to the ParcelsNew\_22062 gds.

**3.2. Build a legend based on soil use**

A categorized legend was created according to the SoilUseCod, in the symbology section of the layer properties, choosing “SoilUseCod” as value.

**3.3. Calculate the areas, in hectares, for each owner, and for each soil use class**

To calculate the area of each owner, a dissolve operation was made based on ParcelsNew\_22062 layer, dissolving the NId field and using the field calculator to add a new field named “areaHa” using the expression areaHa = $area/10000.

Repeat the operation dissolve but dissolving the SoilUseCod field instead. Use the same expressing to calculate the area.

**3.5. Create a gds representing only agriculture and forest regions (Use\_22062)**

By making two separate “select by expression” with the following expressions, two vector files are created where agriculture (SoilUse\_A) and forest (SoilUse\_F) are represented, respectively.

* "SoilUseCod" = '10' OR "SoilUseCod" = '11' OR "SoilUseCod" = '12' OR "SoilUseCod" = '13' OR "SoilUseCod" = '14'
* "SoilUseCod" = '15'

By adding and updating a column SoilUse with “SoilUse” =’A’ and “SoilUse” = ‘F’, the attribute table is completed. Finally, by merging this two layers, the gds “Use\_22062” is created.