Basic Work using the “Stratigraphy” Program

Program: Stratigraphy

File: Demo_manual_40.gsg

This manual is used as a basic tool to introduce the GEO5 Stratigraphy program. In this manual, we will show you, how to create a 3D model of a subsoil corresponding to the given conditions, create a cross-section of the model and paste it to the “Slope stability” program.

During the modeling, it is advisable to respect this input procedure:

- Defining the construction site
- Creating a terrain model
- Inputting boreholes and field tests
- Creating of soil profiles from field tests
- Creating geological sections
- Creating the 3D geological model
- Defining of the cross-sections for other analysis in other GEO5 programs

In each section, there are notes, that explain how the data input works in real-life situations, that are much more complex.

Input data:

The terrain is defined by six points, their coordinates [x; y; z] are: [0; 0; 0], [0; 10; 0], [7; 0; 3], [7; 10; 3], [20; 0; 5], [20; 10; 5].

We have results from three boreholes:

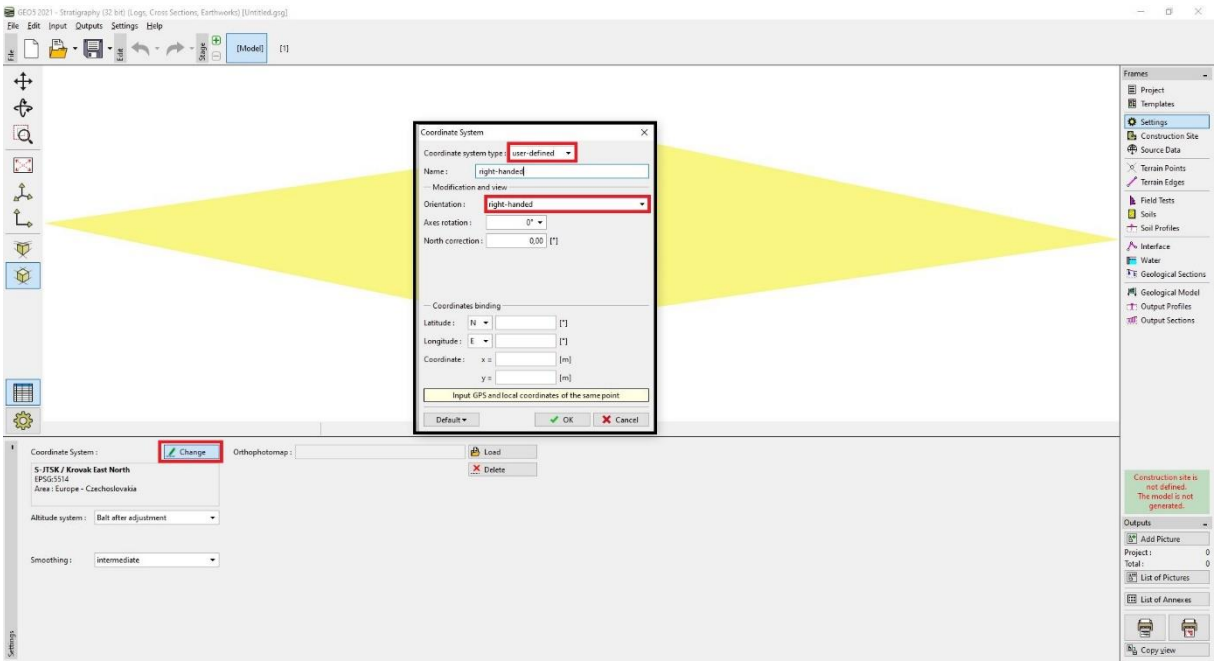
BH1 – [2.0;4.0], 3 layers (1.5m Landfill, 0.9m Silt, 4.1m Clay)

BH2 – [3.0;9.5], 3 layers (1.2m Landfill, 1.4m Silt, 3.5m Clay)

BH3 – [11.0;3.0], 2 layers (1.6m Landfill, 4.2m Clay)

Solution:

In the “Settings” frame, change the coordinate system by clicking on the “Change” button. In the dialog window, select the “user-defined” coordinate system type and set the “right-handed” orientation.

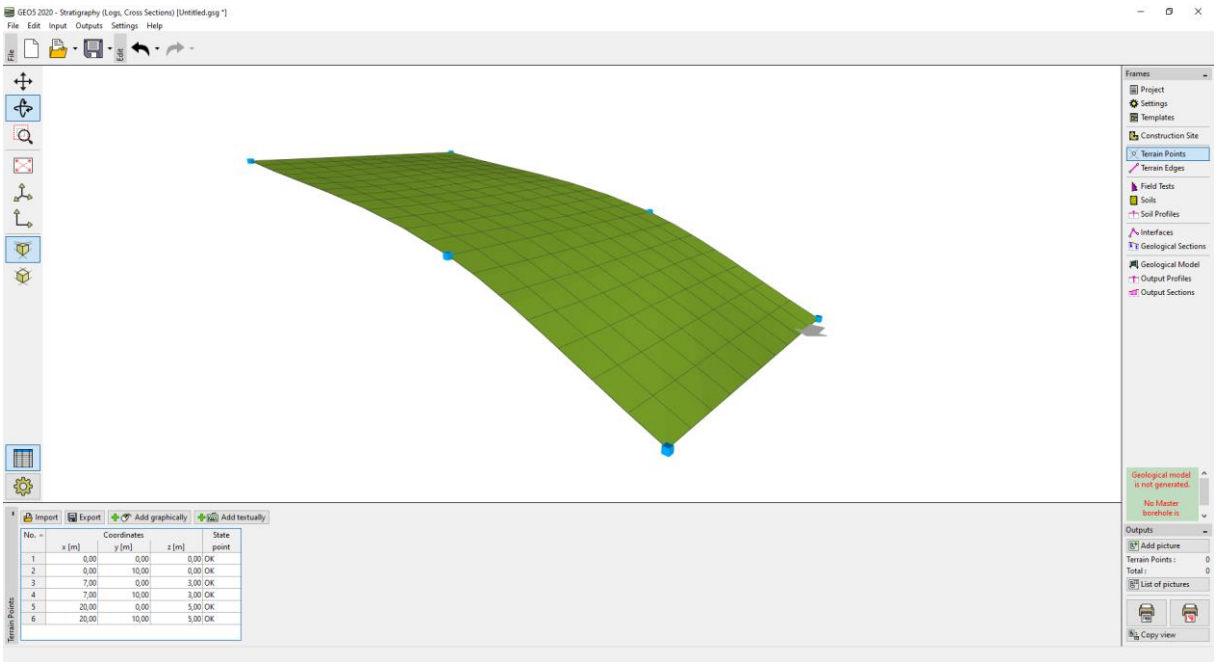


Note: For real constructions, the coordinate system used in the given country or region is selected. In the Czech Republic, it is the JTSK and all coordinates are then added into this coordinate system.

In the “Construction site” frame leave the Type of construction site as “Rectangle” and the checkbox “Generate the ranges automatically”

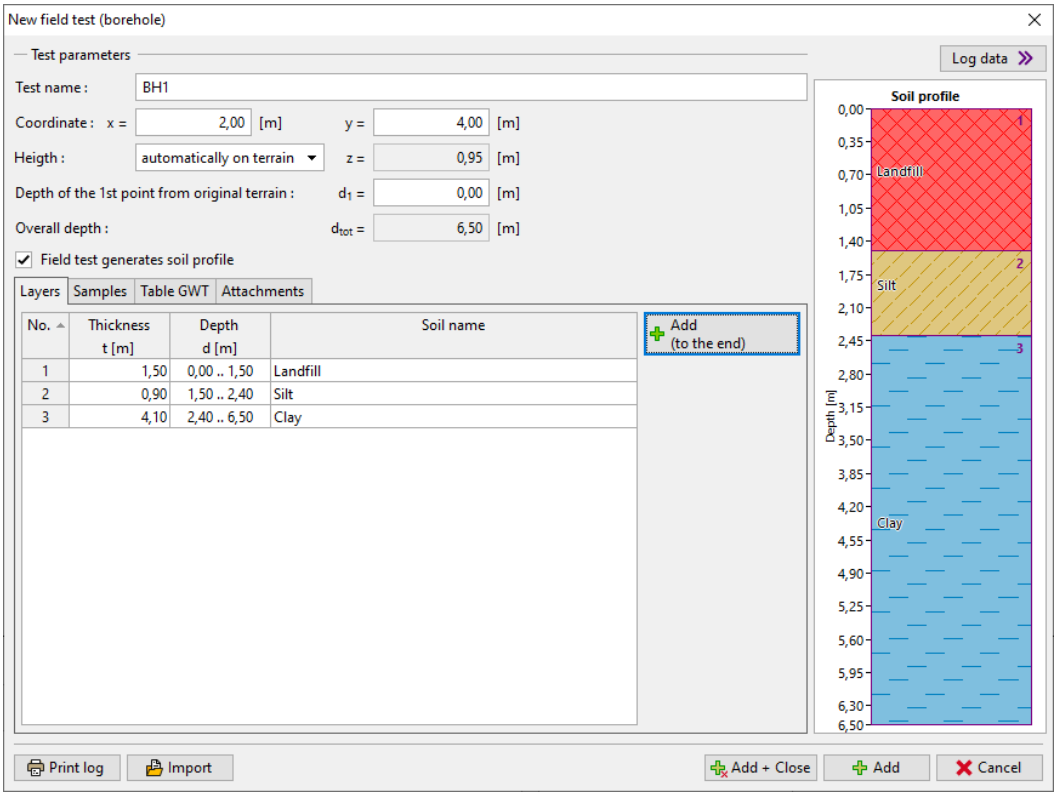
Note: If we use a real coordinate system (like JTSK), we can display the location of the construction site in Google Maps.

In the “Terrain Points” frame we enter the points [0; 0; 0], [0; 10; 0], [7; 0; 3], [7; 10; 3], [20; 0; 5], [20; 10; 5]. The digital model will be created automatically.

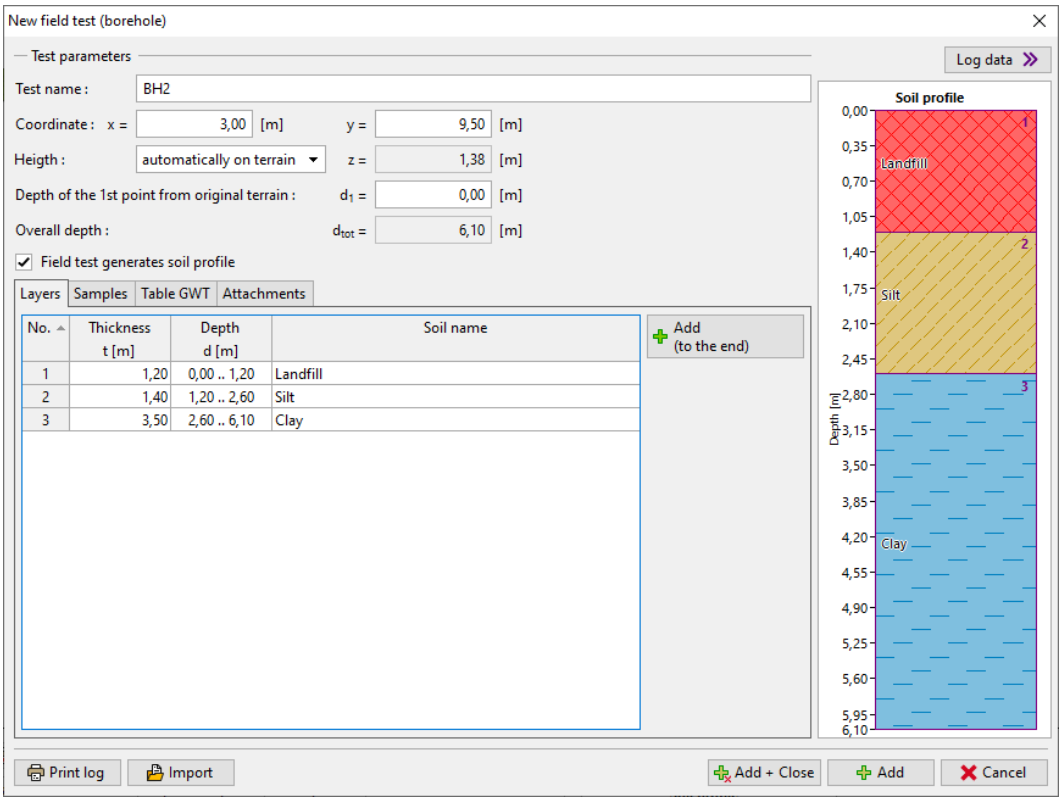


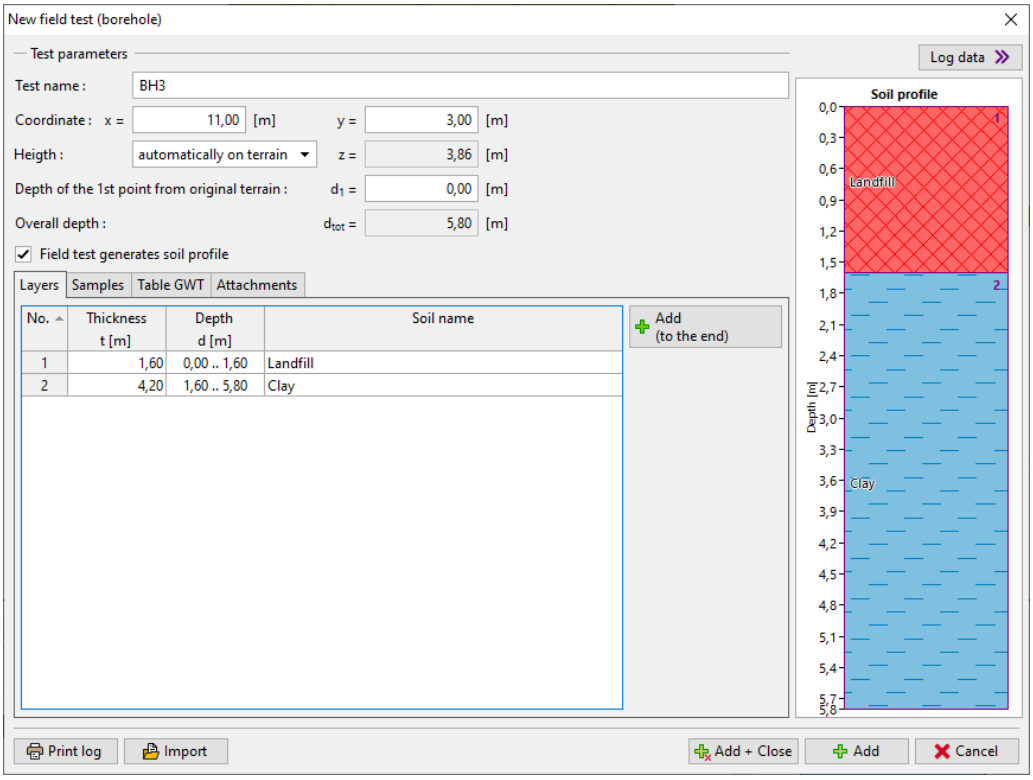
Note: In a real task the points are usually imported from geodetical measurements, so it is not necessary to input them.

In the “Field Tests” frame we will add a field test “Borehole” and input the thickness of the layers. For each soil, select the appropriate pattern and colour.



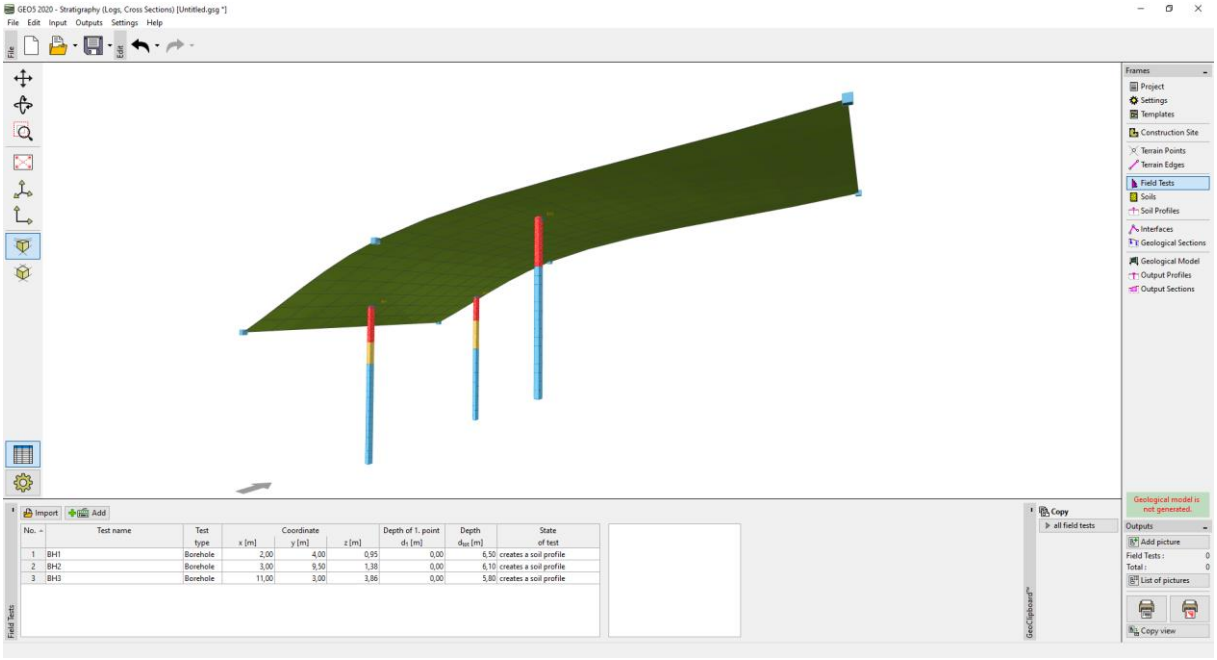
When inputting the second and third borehole, we can either copy the first borehole and edit the layer thickness or re-enter the borehole and only assign the already entered soils from the catalog.





Note: For a real borehole, we usually enter a much larger number of layers and descriptions. We can also enter the information about the water, taken samples, upload photos and other attachments. Description of how to create borehole documentation is in the EM no. 42 – Creation of Field Test Documentation.

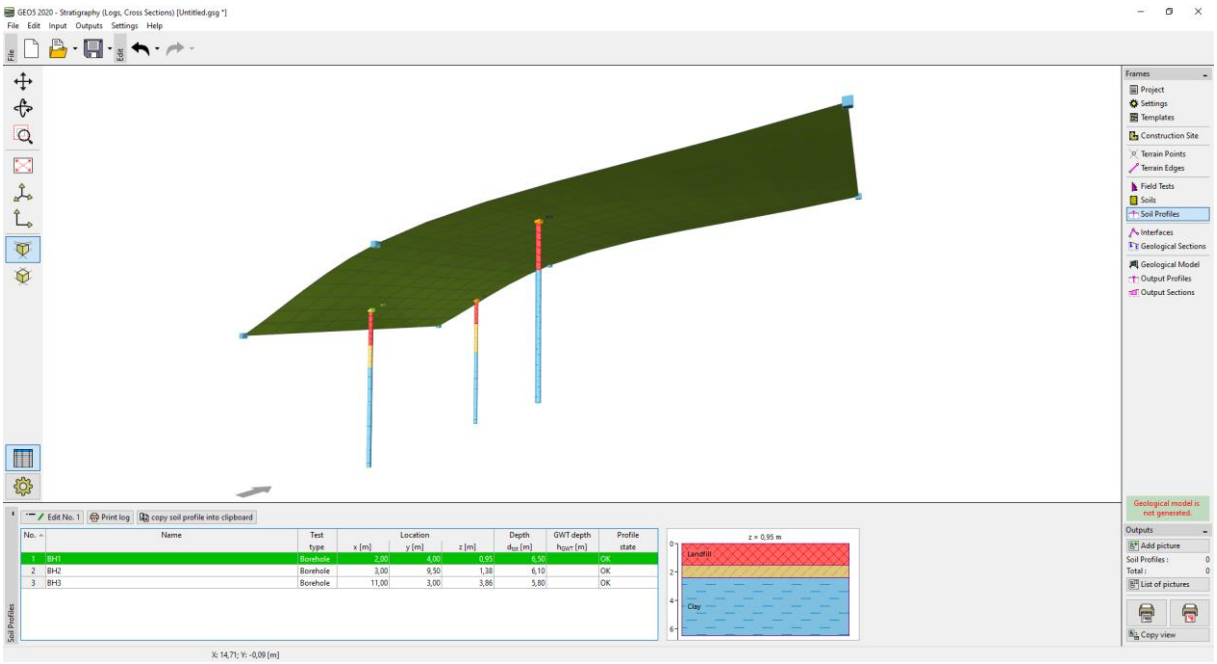
After entering, the boreholes should look as in the picture below:



In the “Soils” frame, using the “Adopt from the field tests” button, create a soil list.

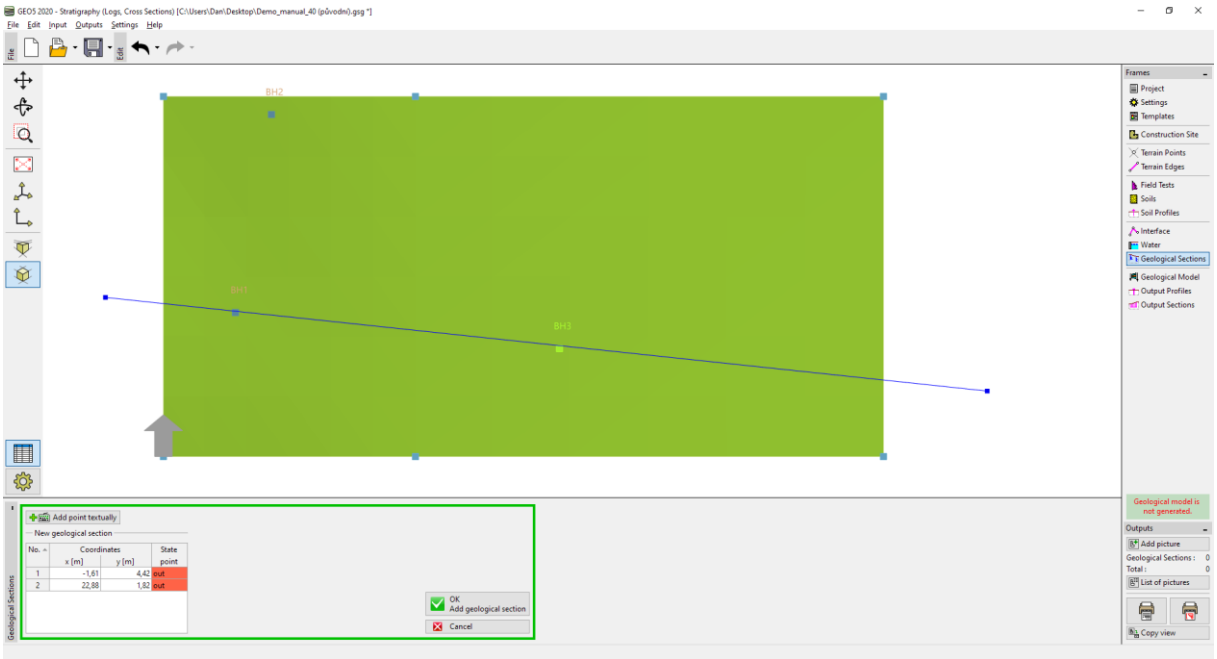
Note: In a real geological survey we can have a large number of soils with minimal differences. For a geotechnical model, it is suitable to merge these soils into a “Geotechnical type” and work with those. The soils (geotechnical types) that we input here will be used not only in a 3D subsoil model but will be transferred to other GEO5 programs too.

In the “Soil Profiles” frame we check the automatically created soil profiles from the inputted boreholes.

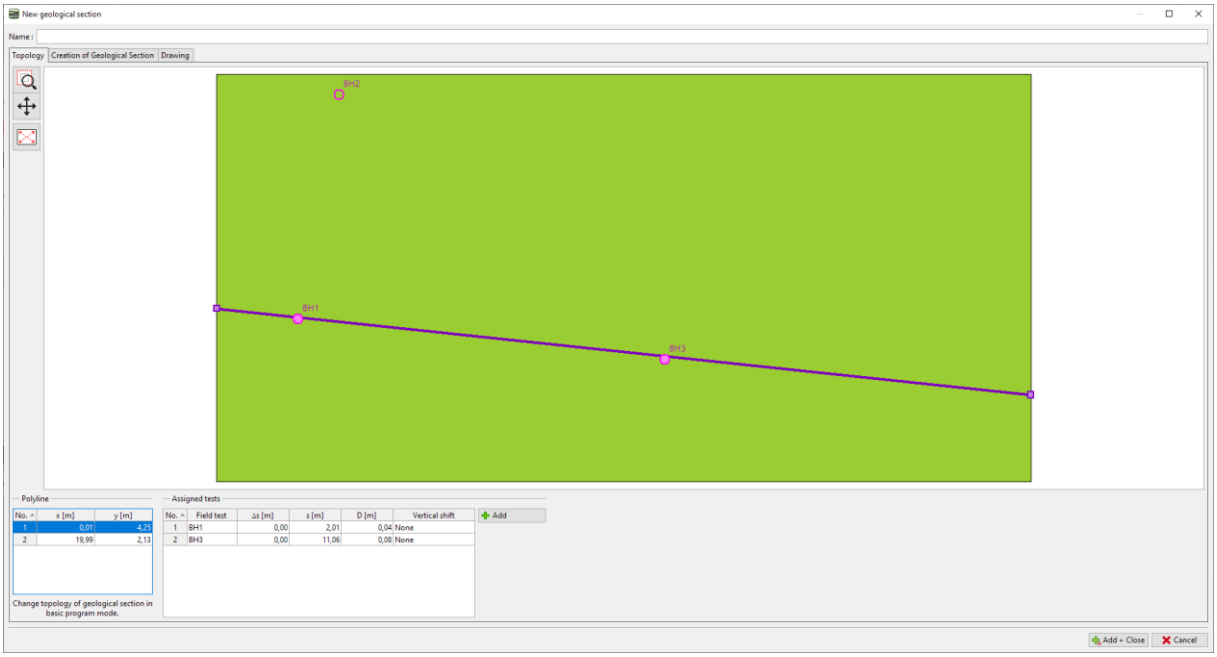


Note: The reason for the existence of Soil profiles is similar to that of “Soils”. Complex and detailed boreholes need to be simplified for the geotechnical model. Penetration tests (CPT, SPT) can be interpreted into geological profiles too. This can be done either in this frame or when making geological sections. Creation of earth profiles from field tests is described in EM number 43 – Creation of Soil profiles from Field tests.

In the “Geological Sections” frame we will enter the shape of the section. It is appropriate for the section to go through the inputted boreholes.



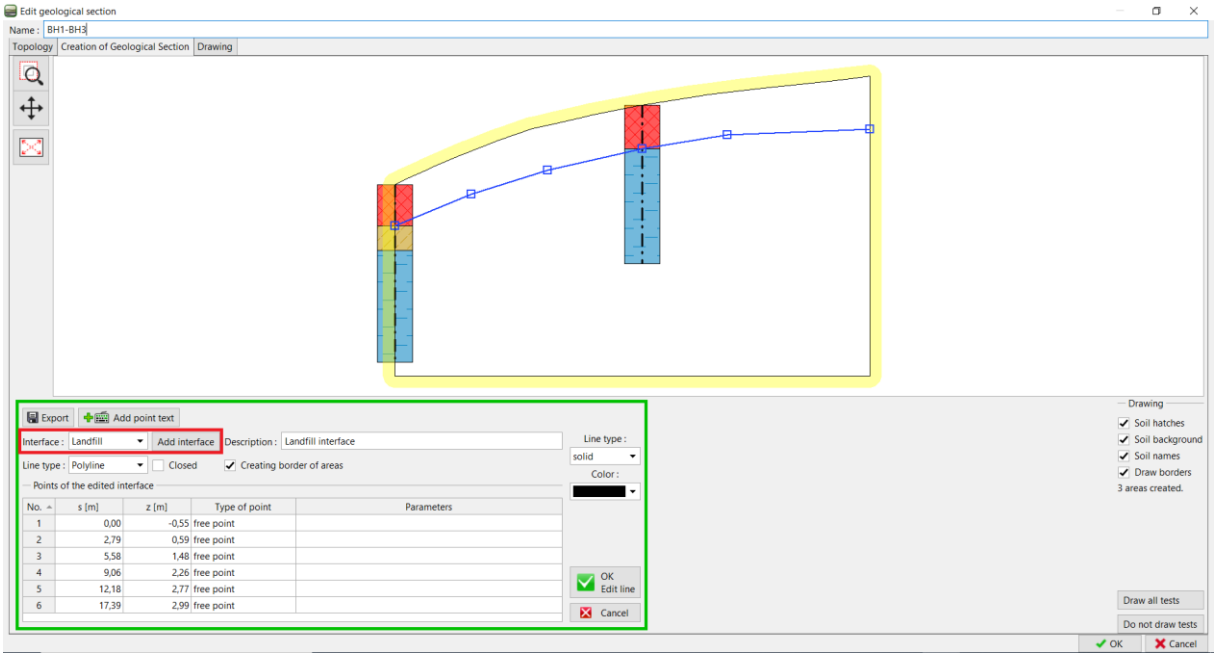
After input, the cross-section is cut into the dimensions of the construction site and opened in the dialog window for edit – in the "Topology" tab. Here, we assign tests that we want to display in the cross-section.



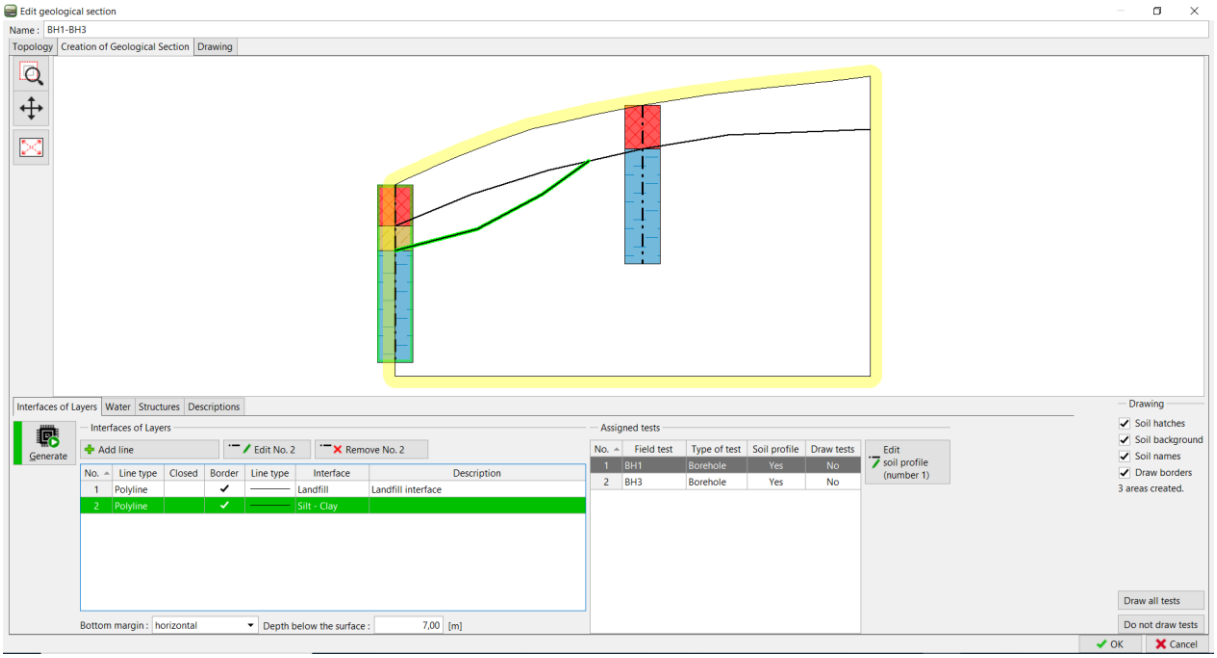
Note: Geological sections are a basic element when creating a 3D subsoil model. Here you can draw your idea of layers. The 3D model will then respect your assignment. Tests and ground profiles that do not pass through the section can be displayed as well.

In our example, we see two boreholes. Firstly, we will create a line between the landfill and other soils. Inputting is similar to CAD programs. When entering, you can snap on to existing lines or boreholes. These lines can be rearranged to the desired position. **We do not give the exact coordinates of points here, because it is just our estimation of the layers.**

Next, we will click on the "Add interface" button and define a new interface "Landfill" – it will add the input interface points into the creation of the 3D subsoil model.

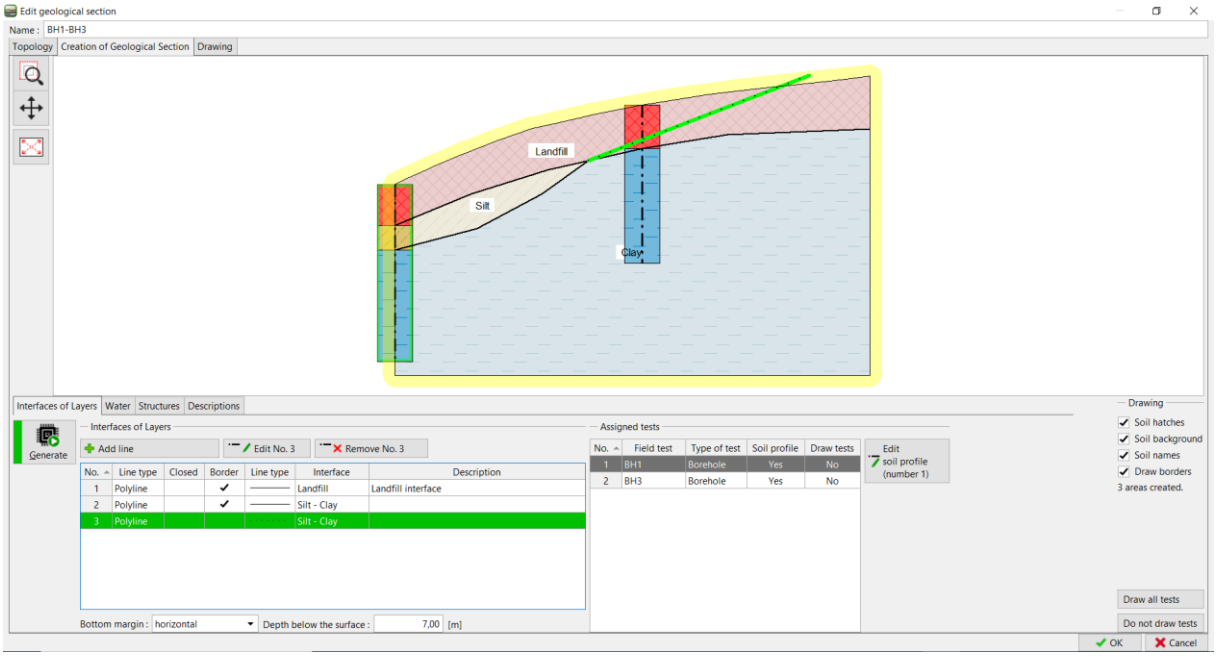


We will define the interface between silt and clay the same way. Do not forget to create a new interface “Silt – Clay”

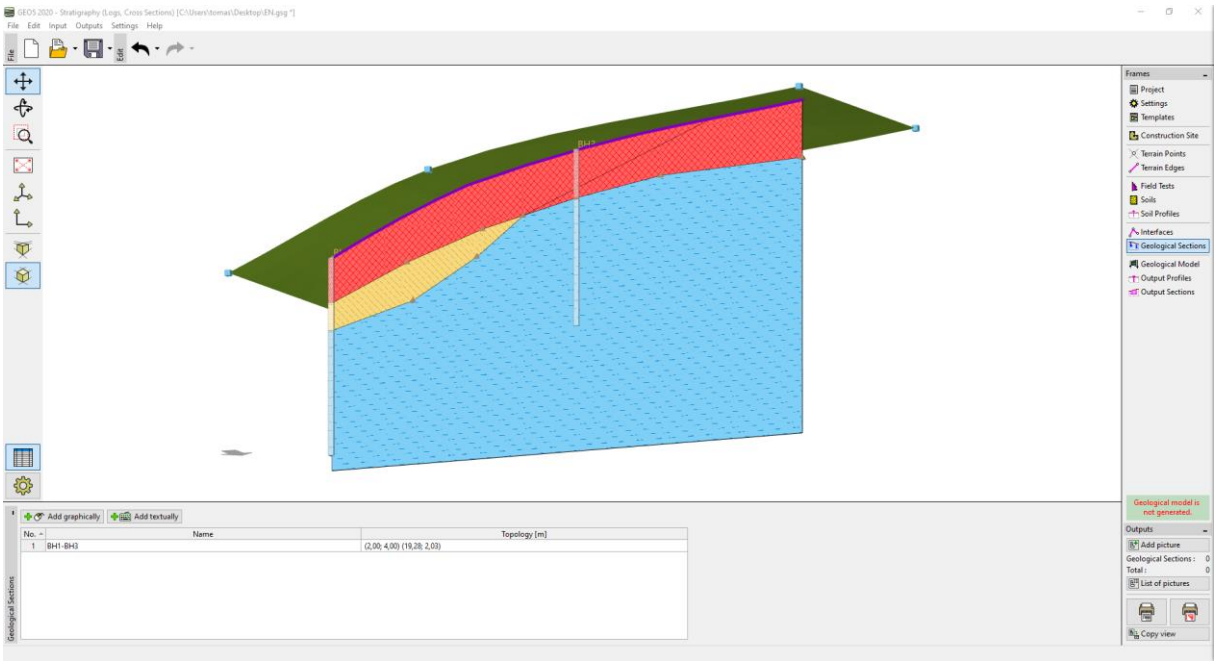


By clicking the “Generate” button, we can verify the input by generating the soil areas.

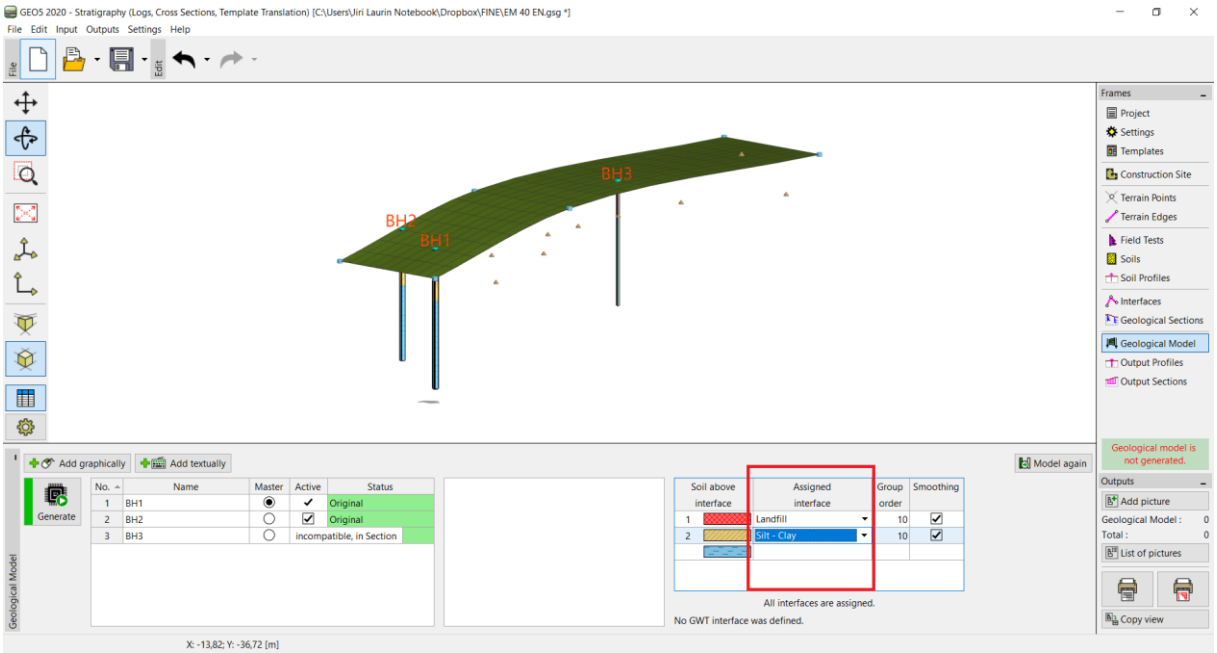
In the case of the lens, it is appropriate to define the position of the layer outside of the lens too. We enter a new line behind the lens and assign it to an already created “Silt-Clay” interface. For clarity, we will choose the line type as “auxiliary”. (Auxiliary lines are displayed as dotted lines and are not shown in the final drawings)



After entering, the geological section will be displayed

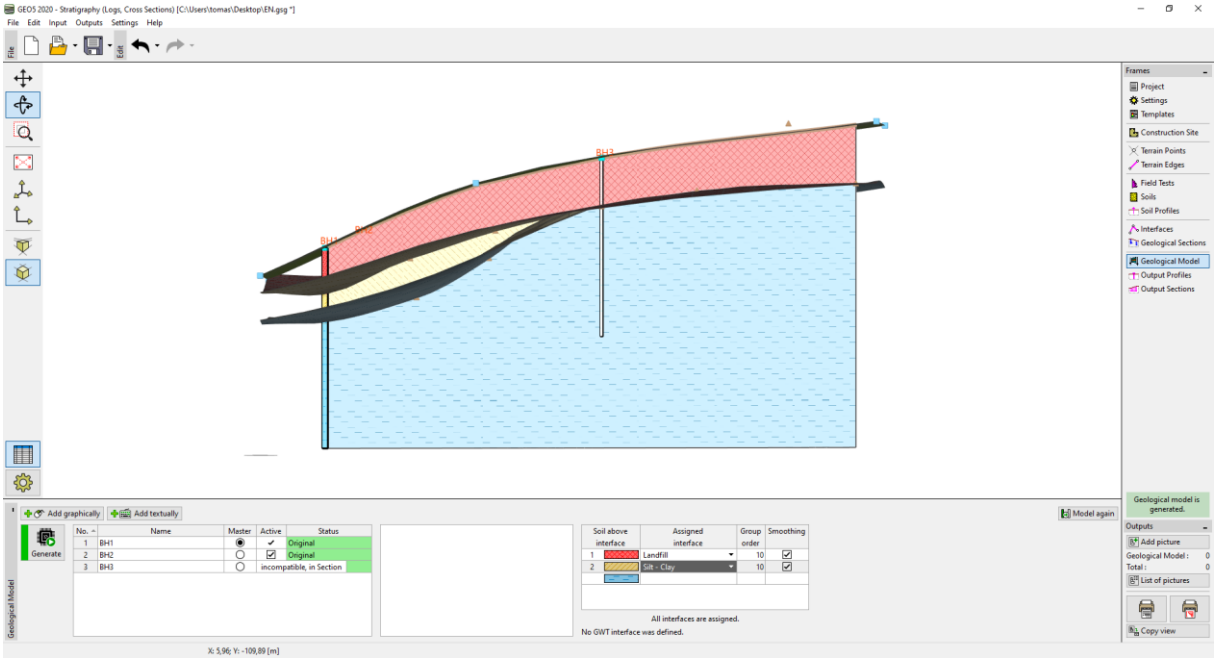


In the “Geological Model” frame we select the “Master Borehole”. Mater borehole determines the number and the order of soils in the model. This borehole has to contain all of the soils in the model. In the table, we assign the interfaces, that we had defined during the creation of the Geological section.

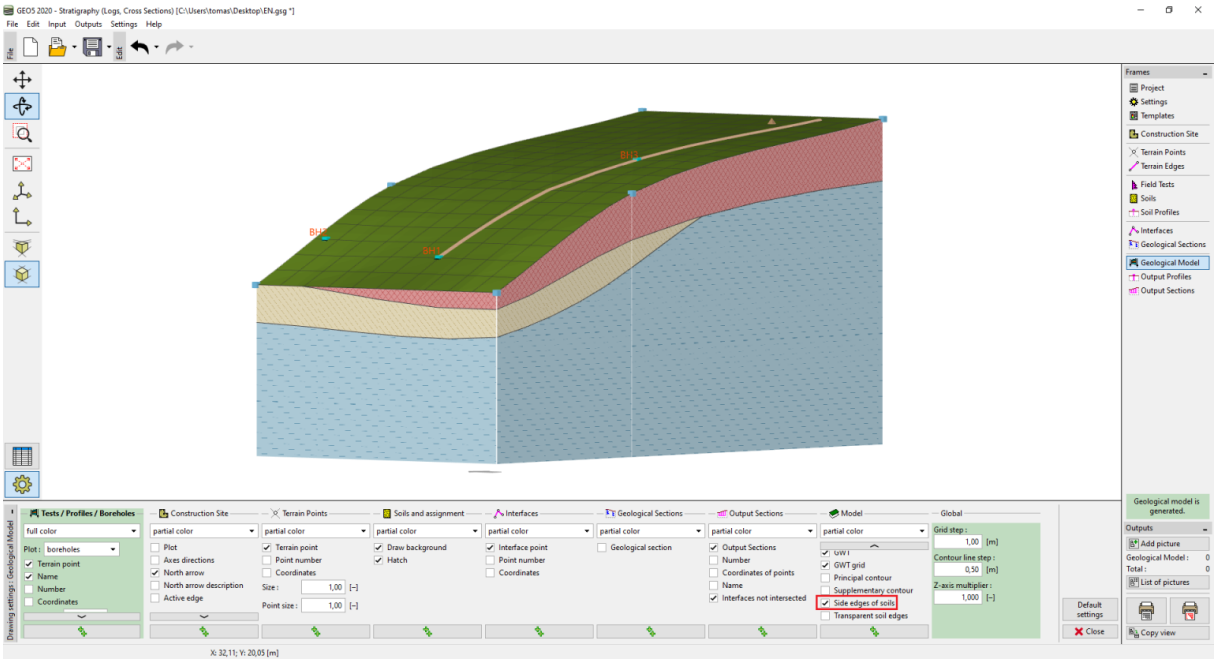


Note: Master borehole must contain all soils (or soil layers), that are present in the model - even those that are not physically in the area of this borehole. This is common when we create a model with lens or faults. For more information, view EM 41– Advanced Modeling in the Stratigraphy Program.

We will create the model by clicking the “Generate” button.

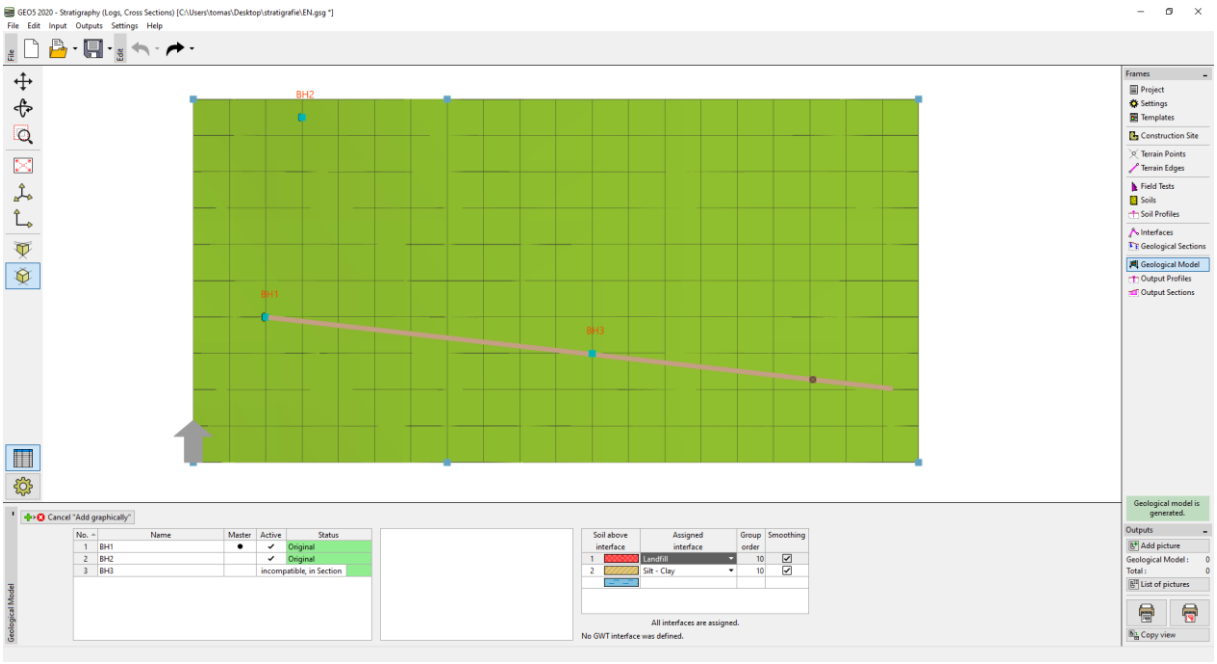


Let's go to the Drawing settings and adjust the model's view.

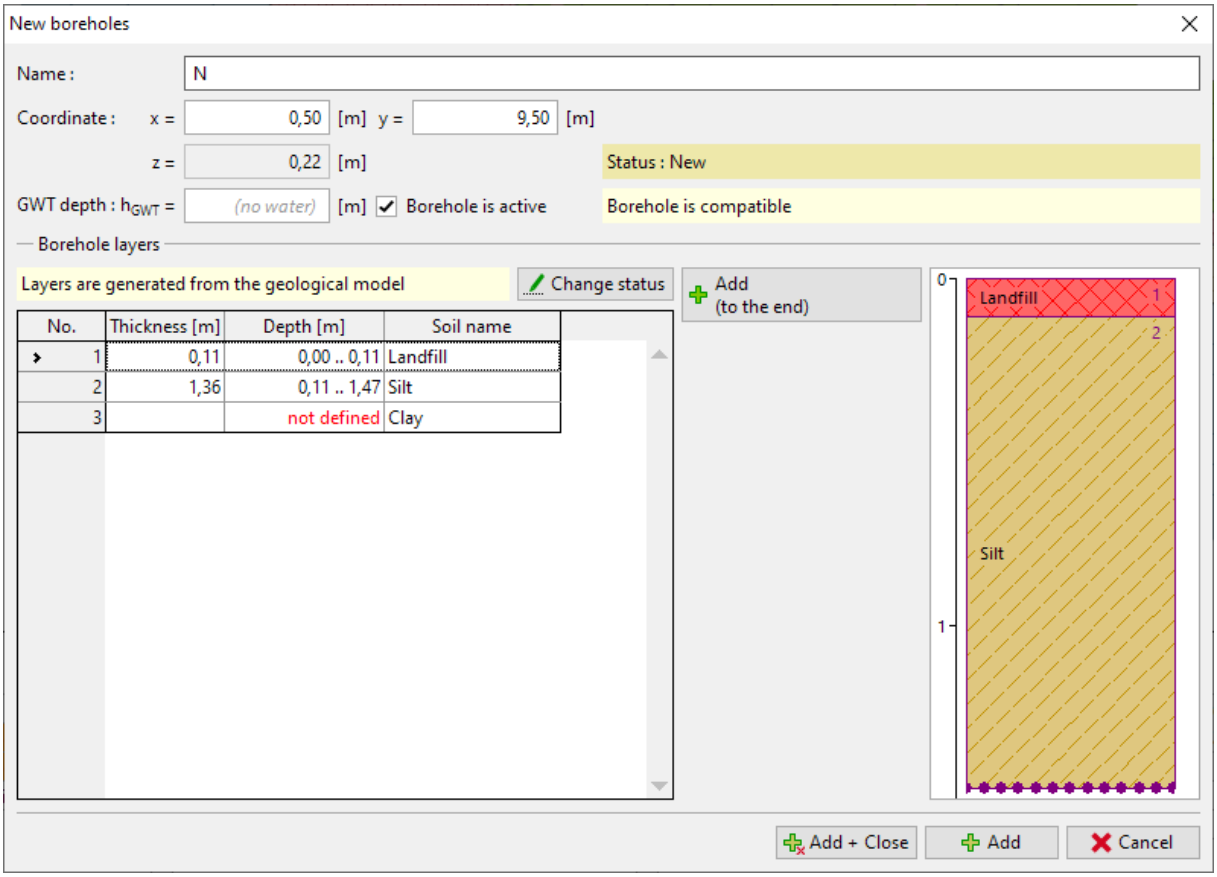


The created model of the subsoil can be further modified using new boreholes. For example, we assume that the landfill layer on the front side will be constant. We can make this adjustment by adding a new borehole.

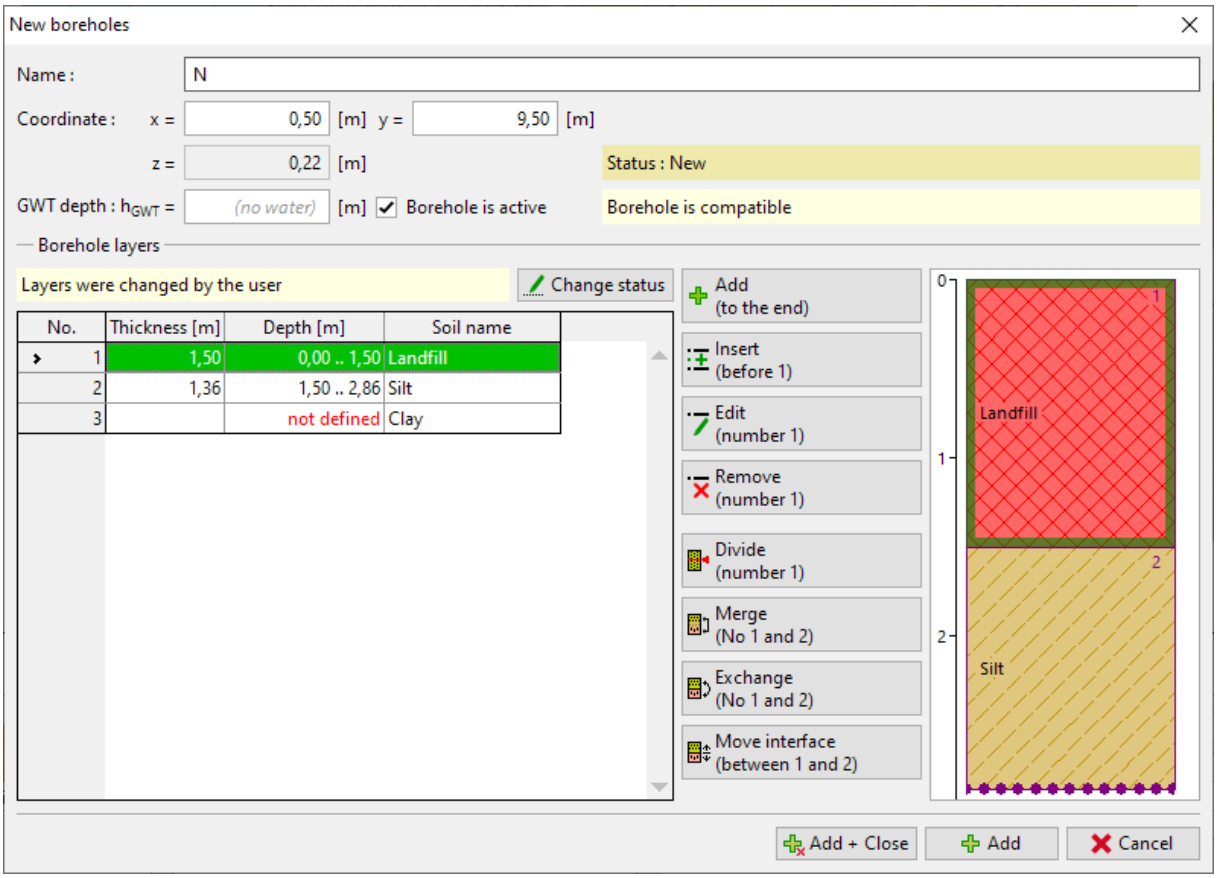
We will add the coordinates by clicking the “Add graphically” button and placing it to the area we want to modify – here we choose the coordinates [0.5,9.5], left from the BH2 borehole.



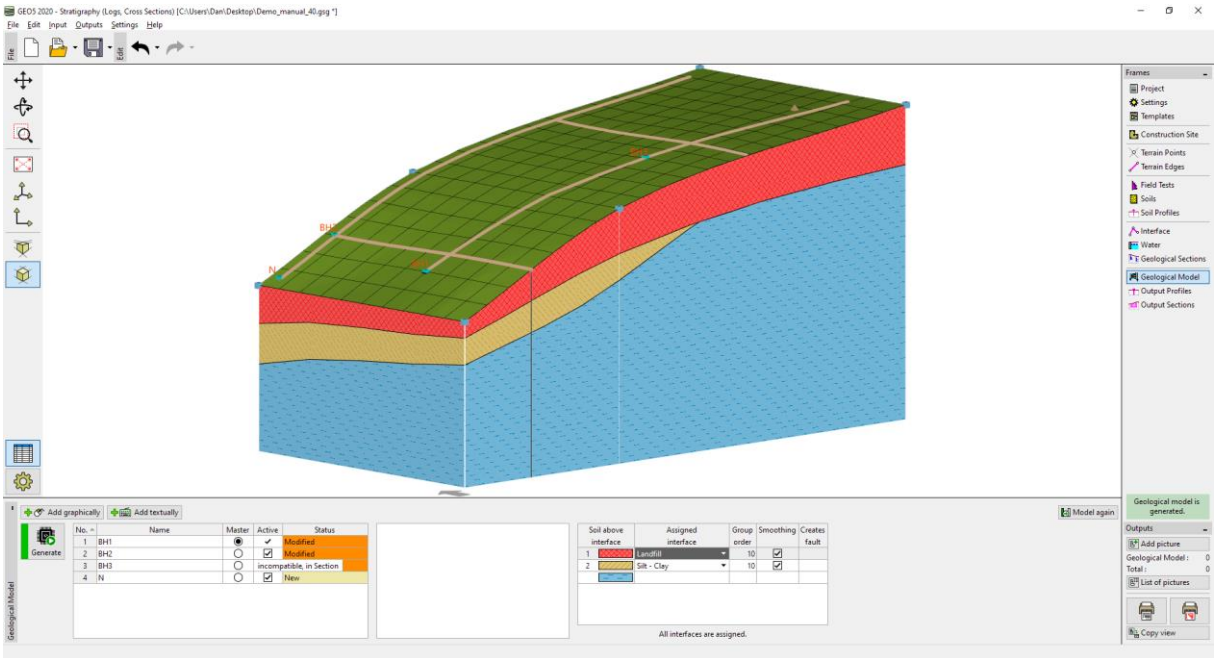
The borehole will be created according to the existing subsoil model.



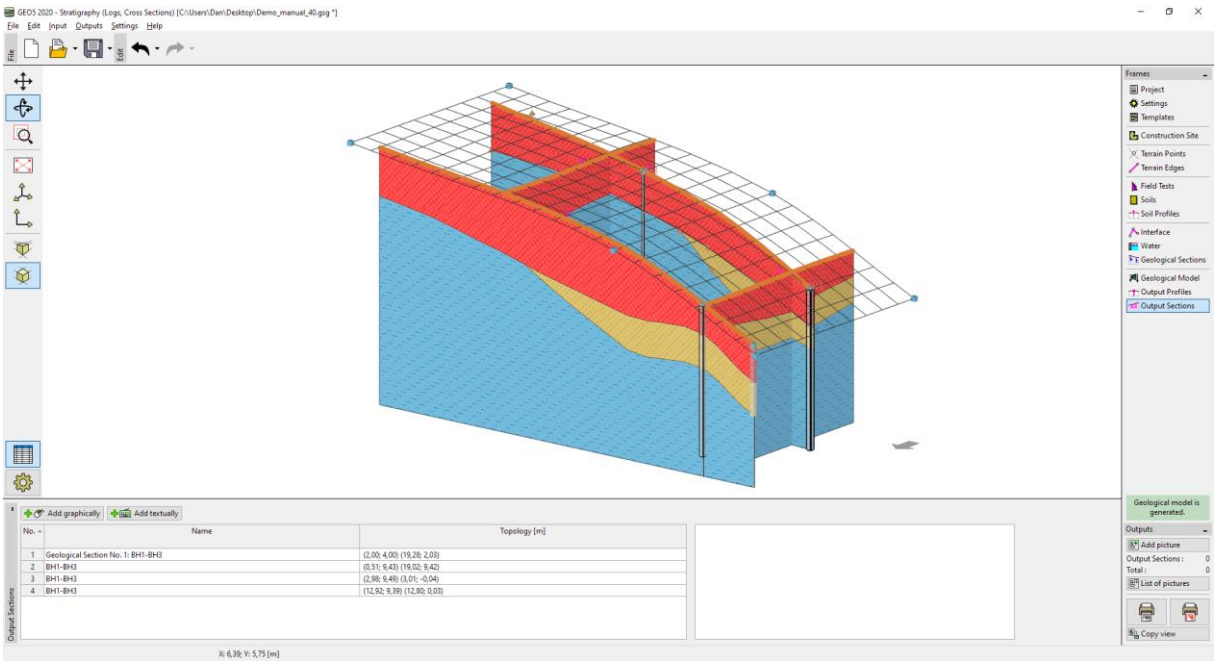
We will change the thickness of the landfill layer to 1.5m and generate the model again.



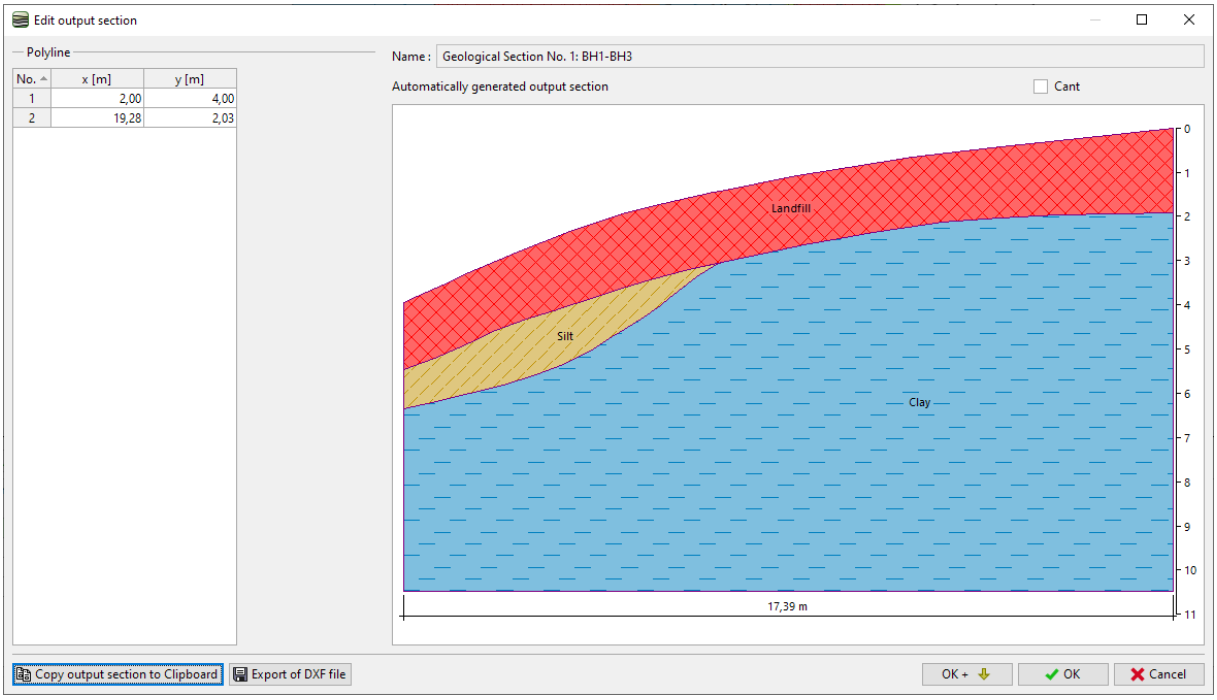
Now the model is created according to our assumptions.



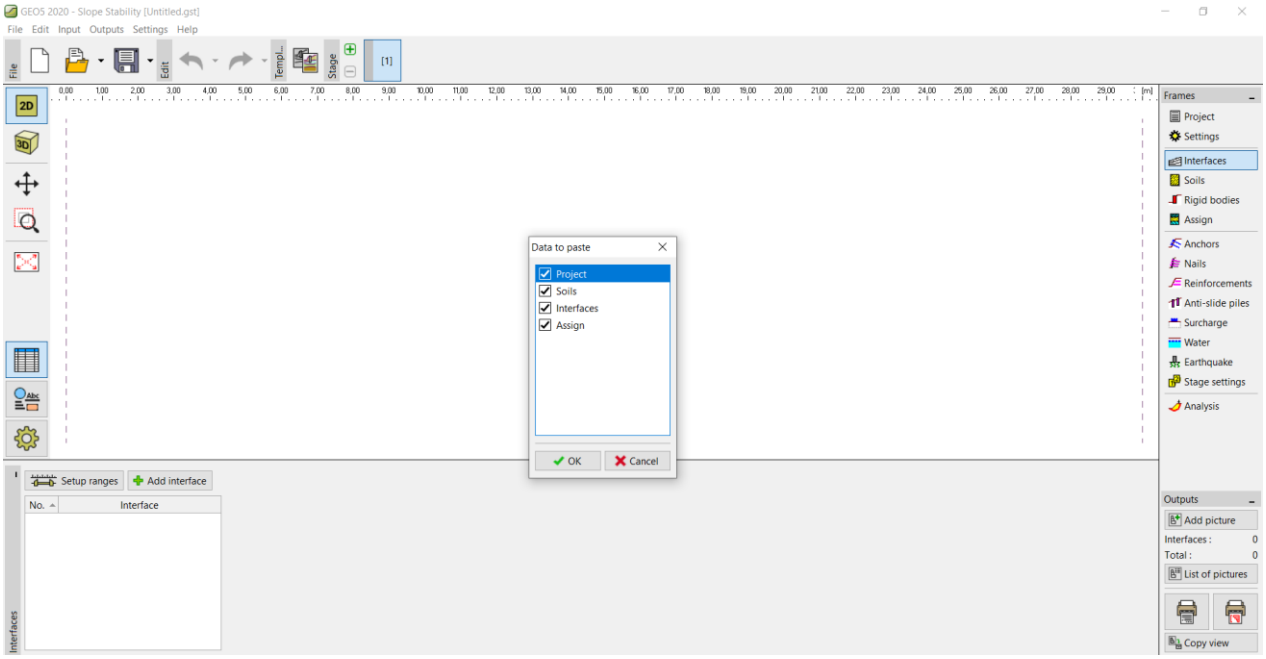
In the “Output sections” frame, we can enter any number of sections in the model. This view can be very clear and useful.

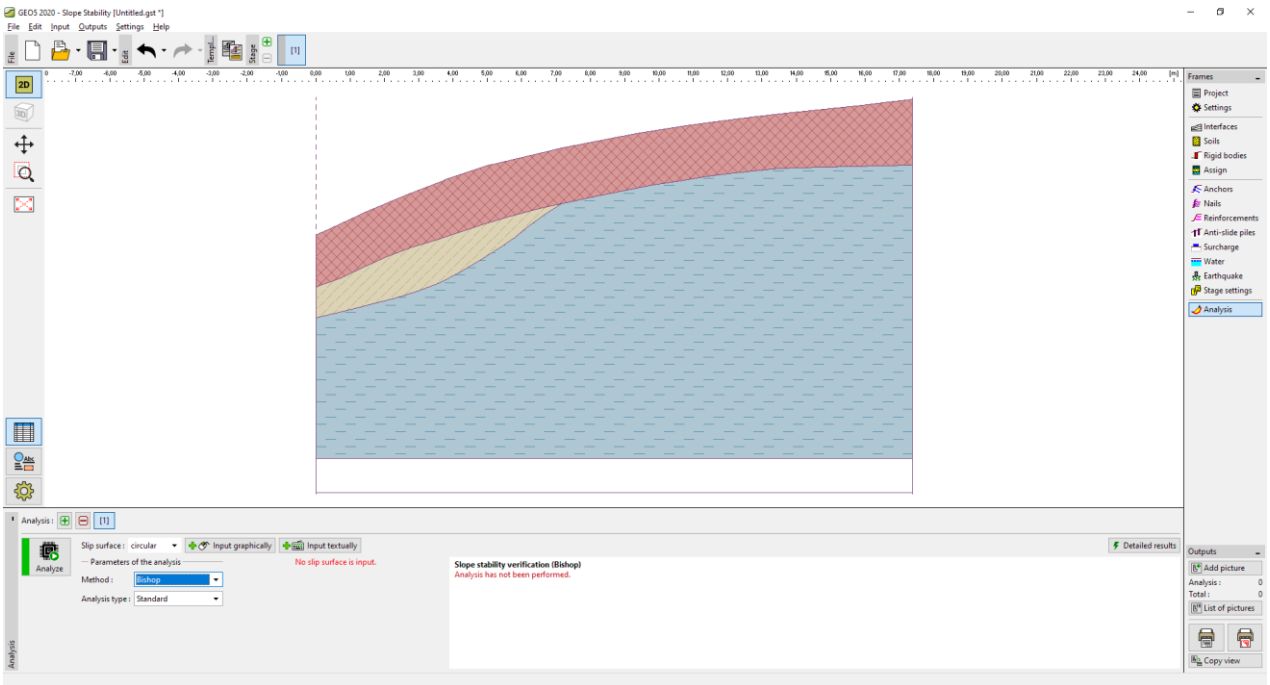


Created sections can be copied into other GEO5 programs. We will open the created section and copy the section to the clipboard by clicking the “Copy output section to Clipboard” button.



We will open the “Slope stability” program, in the menu, we select “Edit” and “Paste Data”. In the dialog window, we will select the data to paste.





This is the basic example of working with the Stratigraphy program.

Other engineering manuals about the Stratigraphy program are:

- *EM 41 - Advanced Modeling in the Stratigraphy Program*
- *EM 42 - Creation of Field Test Documentation*
- *EM 43 - Interpretation of Field Tests into the Soil Profiles*
- *EM 44 - Creation of User-defined Template*
- *EM 45 - Annexes in GEO5 programs*
- *EM 46 - Modeling in the Stratigraphy - Earthworks*

- *EM 47 - Export and Import of Field Tests in the Stratigraphy*
- *EM 49 - Conducting Geological Surveys - Data Collector Mobile App*
- *EM 50 - Basic Work with the Point Cloud Program*