Watershed Case Study

Case Study · https://mes100.com/docs/watershed-case-study/

Introduction:

A watershed is an area where the flow from a higher point drains all the water running to a common outlet. It combines with the other watersheds forming a network of streams that all drain into larger bodies of water, such as lakes and oceans. Topography determines where the water flows.

Problem:

It is essential to determine the pre-development flow discharge for a development area, where engineers are required to determine the overland flow time and time of concentration which involves the calculation of the length, and slope of a catchment. However, it is not easy to manually determine the location of those catchments and the streamline based on the topography although rough estimation can be performed.

Solution:

In MiTS, a method to delineate watersheds is developed to give users a picture of the location/area of catchment and streamlines. TauDEM (Terrain Analysis Using Digital Elevation Models) is used as a tool for the extraction and analysis of hydrologic information from topography.

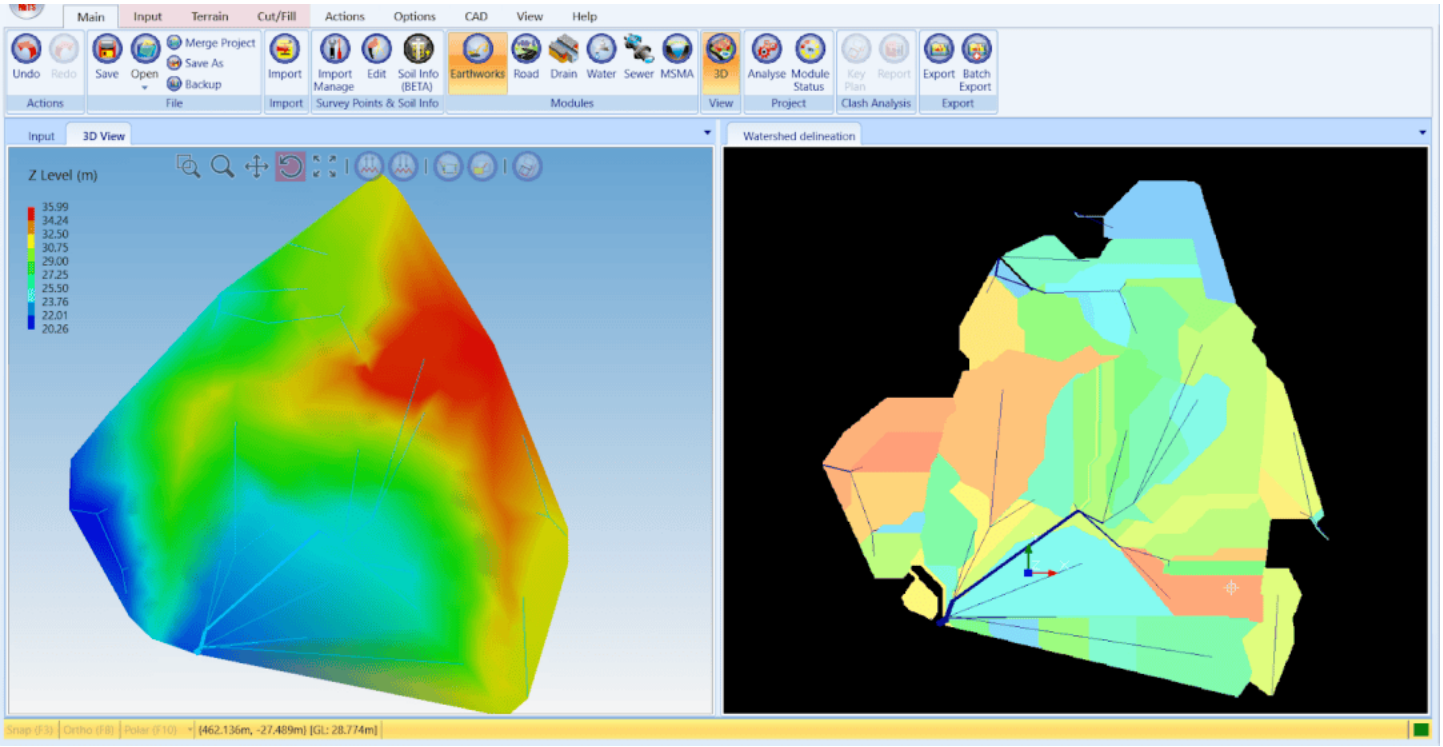
Result:

Following are several examples of watershed analysis juxtaposing between 3D view and the catchment. The colour of the catchment won’t reflect any elevation but it is indicating each of the catchments. The streamlines thickness also denotes the amount of flow, the thicker the line, the bigger the stream.

The elevation of the topography can be referred to in 3D view, where the blue colour shade is the lowest point. In comparison to the watershed analysis, the streamlines are thickened as they approach the blue area, indicating that the flow has accumulated from the higher spot.

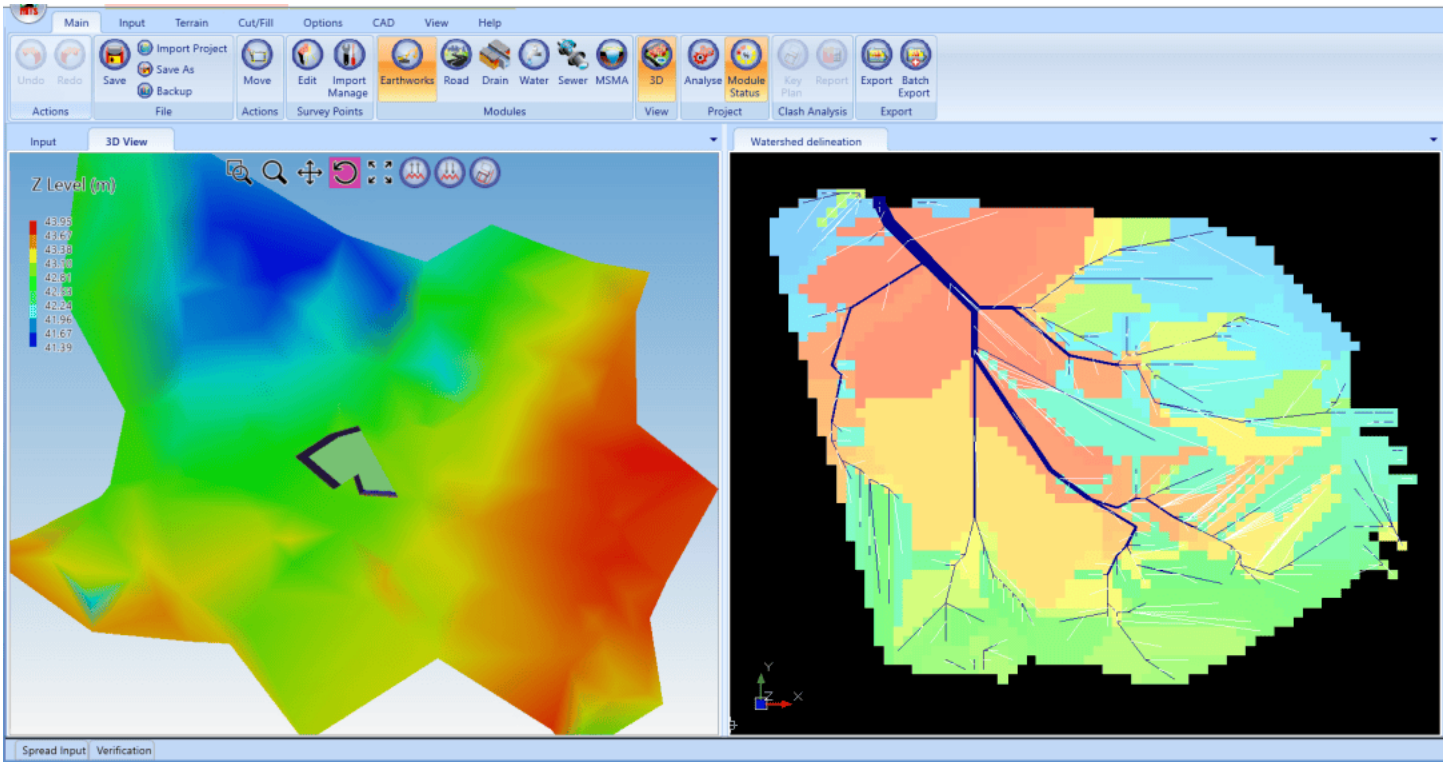
You can try on your project or use the provided project files below as an example.

1.Download **Project File**



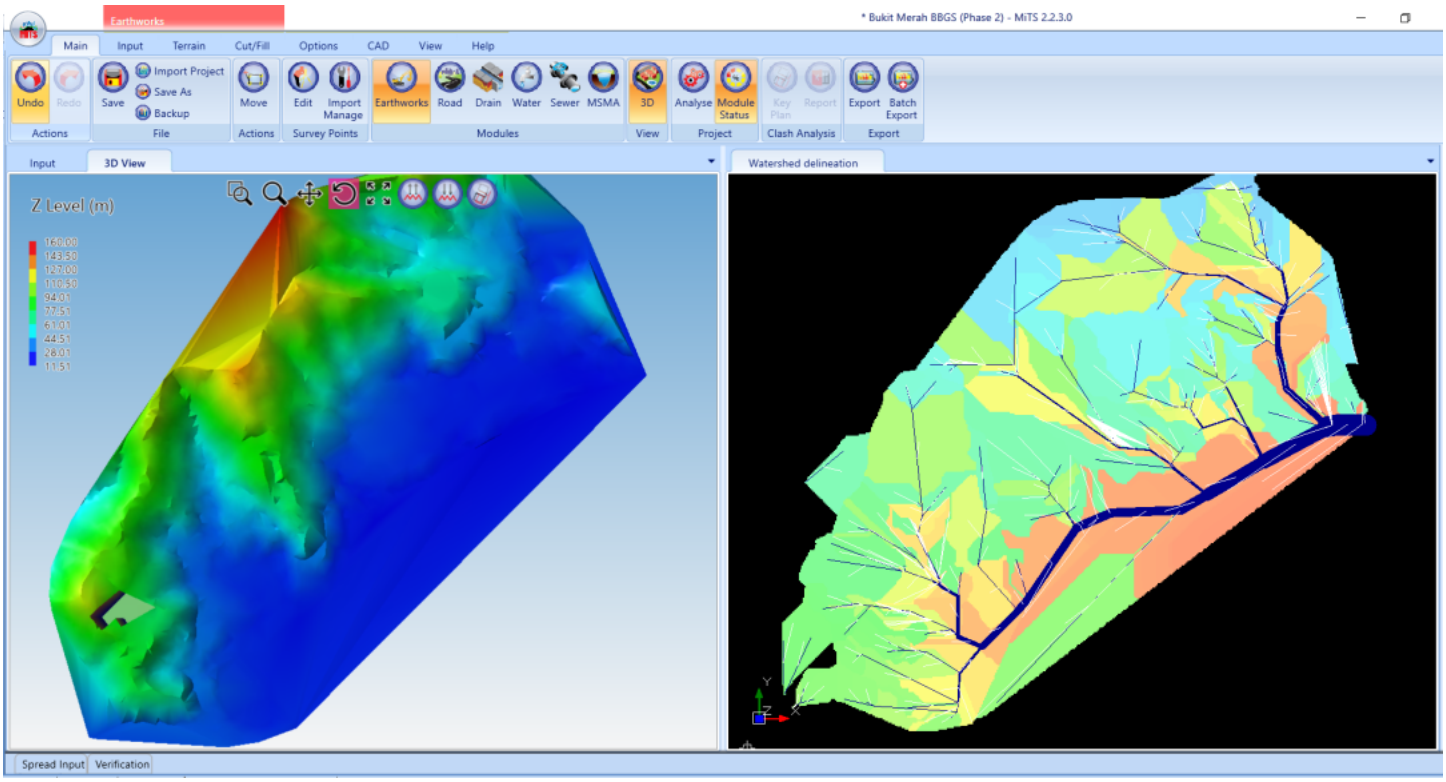
The streamline (right image) thickens as it flows to the left side, and matches with the 3D view.

2. Download **Project File**



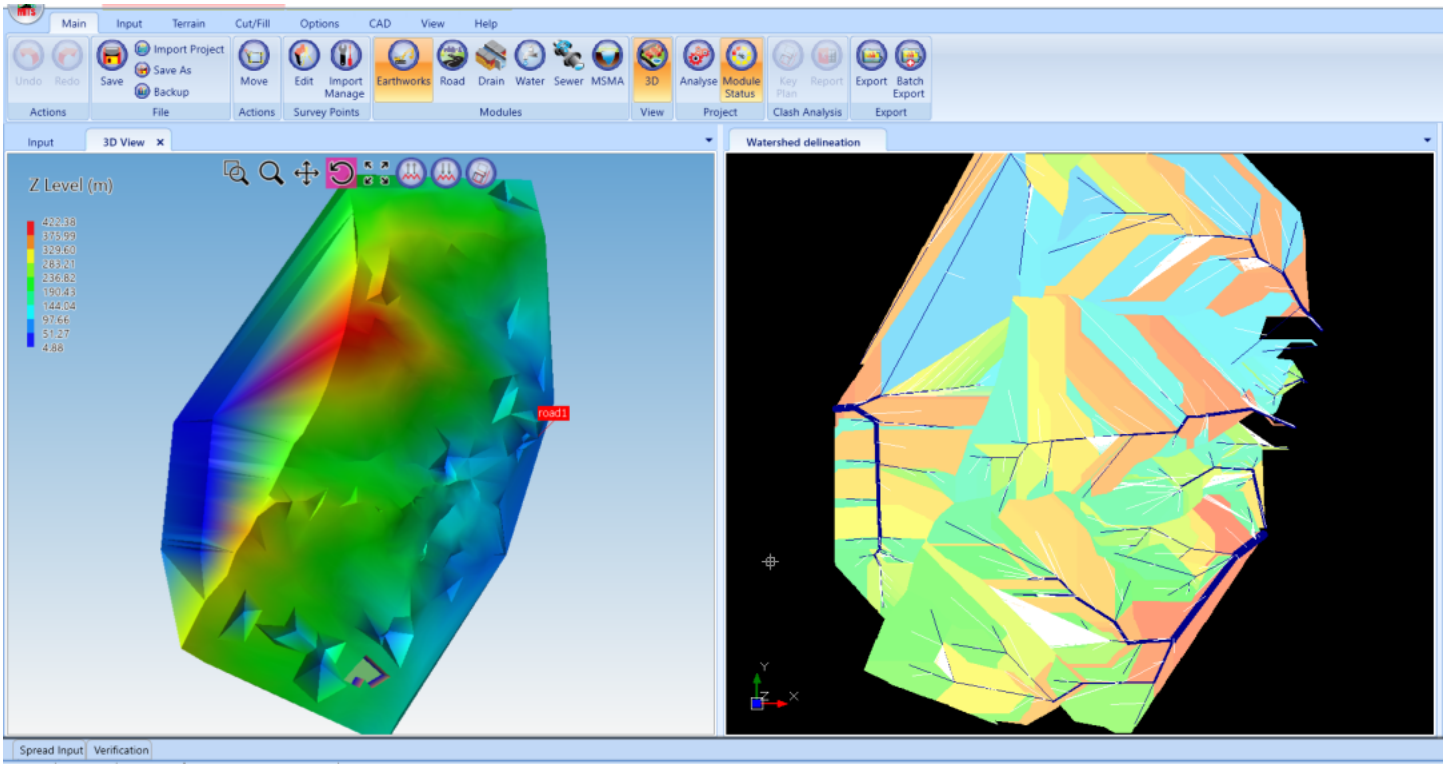
The elevation is gradually decreasing from the red shade to the blue in the 3D view. The streamline generated also flows towards the upper part as shown in the 3D.

3. Download **Project File**



The lowest elevation is located on the right side, hence the flow accumulates towards right area as indicated in the 3D and watershed analysis.

4. Download **Project File**



As indicated in the 3D view, the highest point is situated at the centre and decreases in elevation to the sides. Streamlines also thicken to the sides indicating that the streams flow to the sides coming from the centre.

Comparison Between Software-Generated Streamline vs Actual Streamline

A comparison between existing drain and watershed analysis was conducted using the software. Given a drawing with existing earth drain with survey points. The **drawing** and **project file** can be downloaded as per the link.

The location of the existing earth drain is as in the image below, indicated with a red-color line.

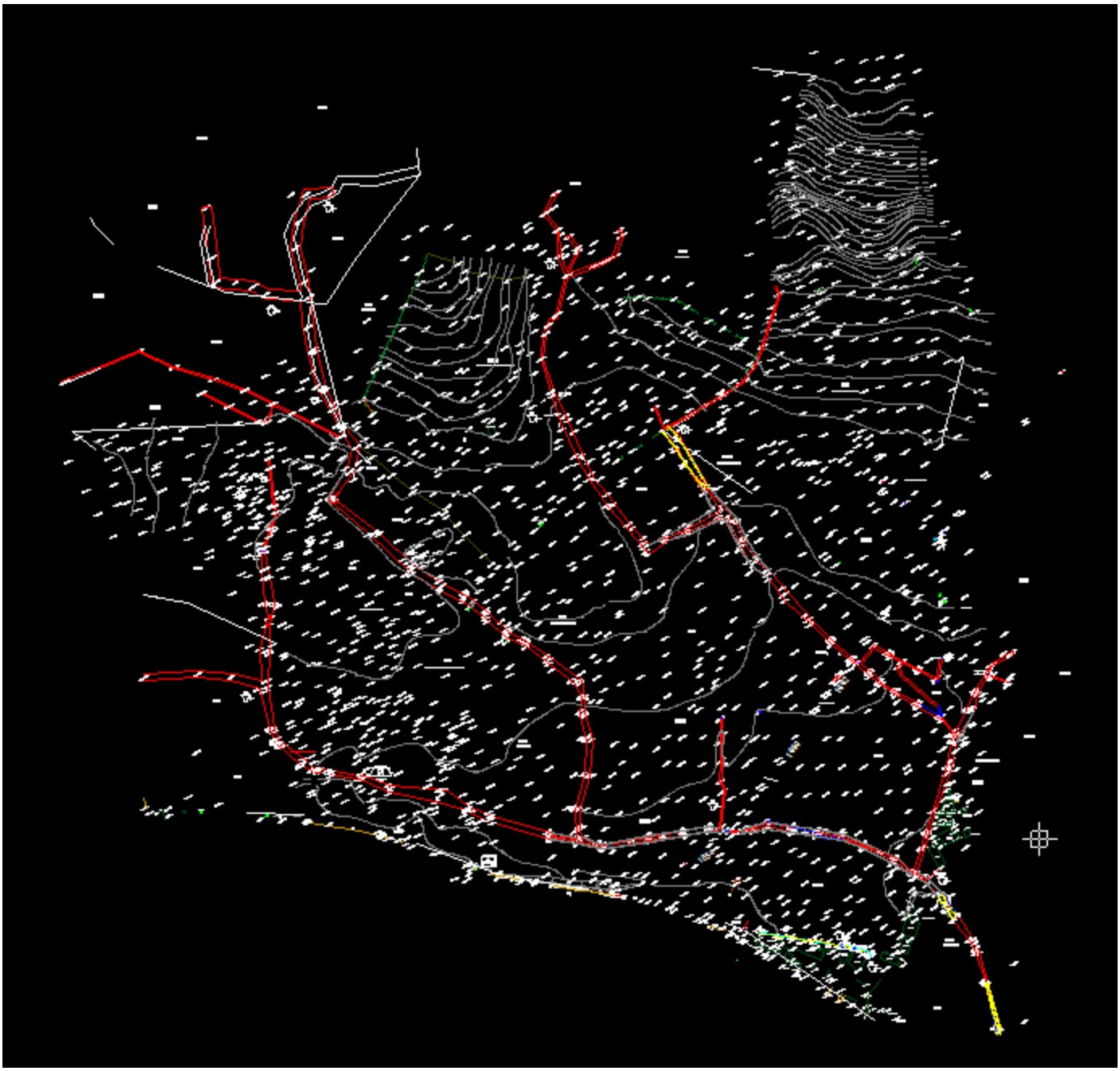


Image of key plan drawing consists of an **earth drain and survey points**

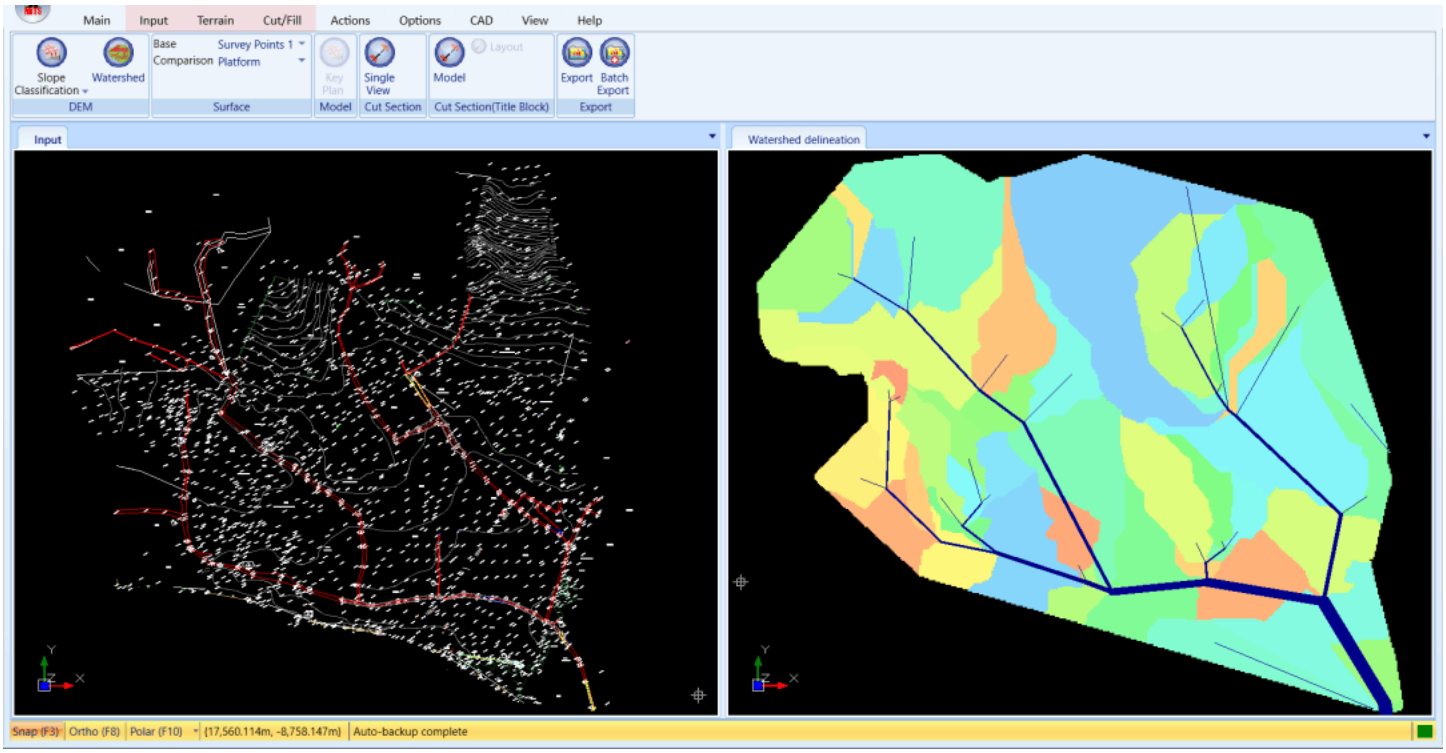


Image of key plan imported into MiTS and watershed analysis

Based on the data, you are required to estimate the discharge given the existing drain, which therefore requires you to determine the catchment and streamlines.

By using MiTS watershed delineation, streamlines and catchments are generated based on the topography. As you can see, the line thickens as it approaches towards the bottom right, which indicates that the area is the lower land. You can also compare the result with the 3D view to see the condition of the topography.

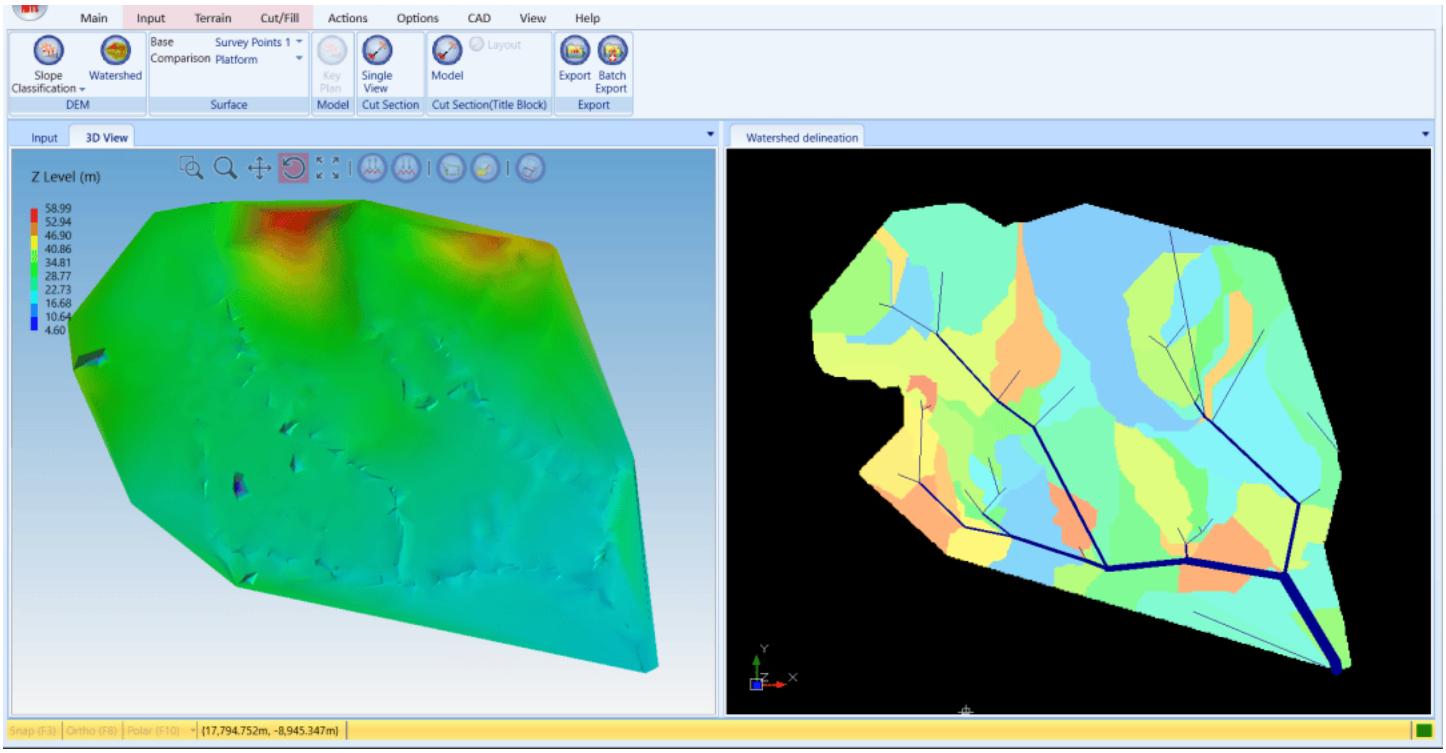
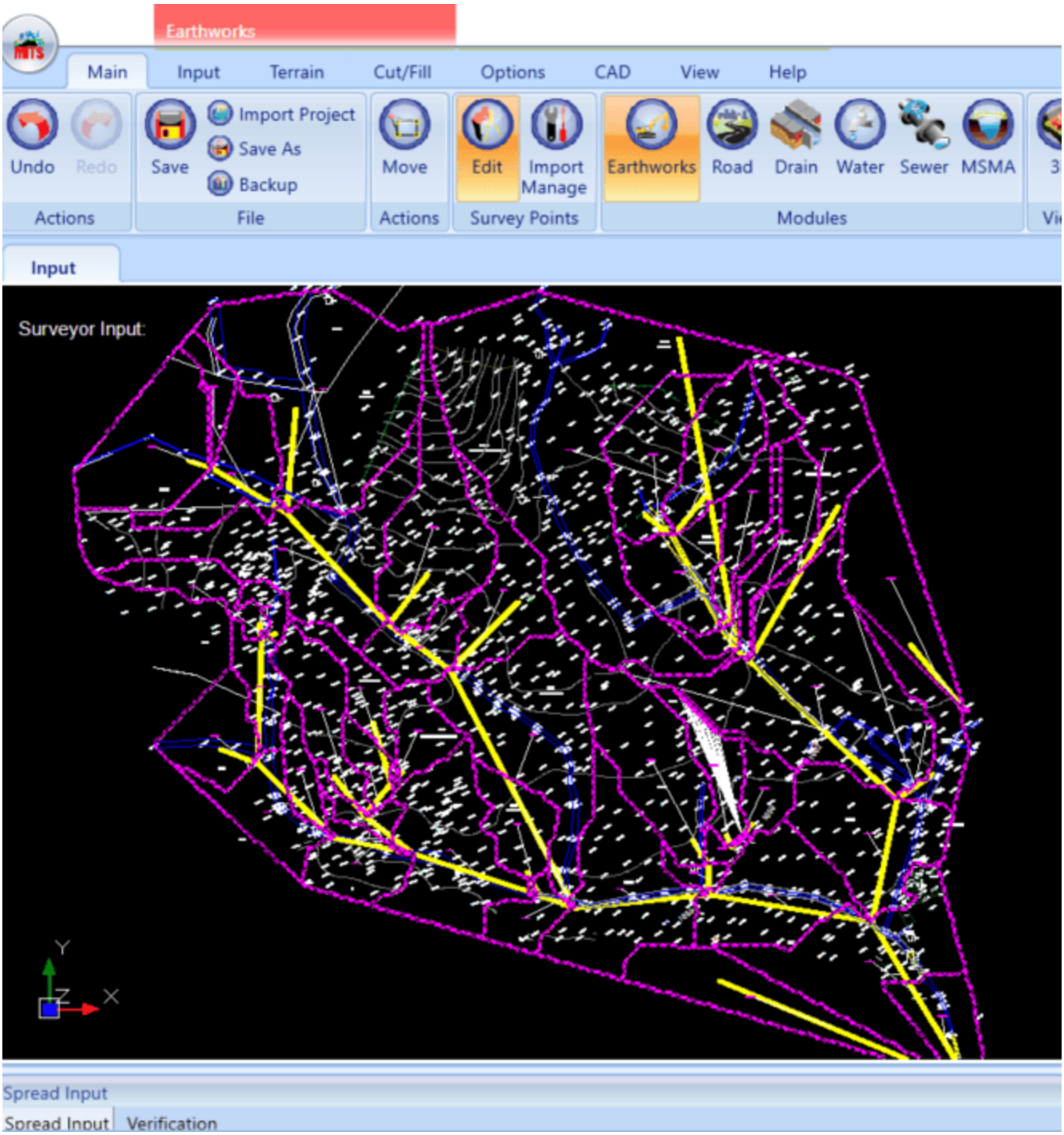


Image of 3D view and watershed analysis

Based on the 3D view, the highest point (red shade) is located at the upper part and gradually decreases towards the bottom right area. The watershed analysis also shows the right behaviour with the minimum thickness upstream and accumulating towards the bottom area with increasing thickness.

From watershed analysis, you can also obtain the catchment area and the overland flow. The catchments are indicated with different colours of shades indicating each of the catchments and the overland flow is denoted as a white colour line connecting from a catchment towards the streamline. From the analysis, users are able to estimate the area and length even more accurately, rather than through rough estimation.

If users want to directly use the information from the watershed analysis, you are required to superimpose the watershed image to the key plan. Users can use the superimposed watershed image as a tracing drawing and manually create the catchments following the tracing, or easily import the catchment from the ACAD. The rest such as the streamlines and the overland flow length can be created manually following the tracing. An example of the superimposition result is the image below.



Superimposed drawing as tracing

(**Project File**)

The yellow lines and purple lines indicate the streamlines and catchments generated by the computer, whereas the blue line indicates the actual streamline drawn by the surveyors. You can see that what is observed in nature and the computer generation is highly fidel to one another, and hence validating **our computer simulation result**.

One can tune the parameter as explained in the **blog** to obtain more or less fine details of the streamlines.

Conclusion:

Based on the watershed modelling, the computer can delineate streamlines and catchments to the streamlines with a high degree of fidelity. Based on this, users can now sort of scientifically compute the hydrograph and have the feel of where and how the water flows more accurately, instead of just relying on guesswork and hunches to draw the catchments and compute the tc quantities such as streamline lengths and slopes and so on.

You can also read other details pertaining to watershed such as how to use the feature or what approach we use as per the link;

Watershed Analysis: Automatic streamline and catchment delineation in MiTS 2;

Watershed Delineation Guideline

Related



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I'm the Benevolent Dictator for Life for MiTS Software cum Editor of this website. Read more here.

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