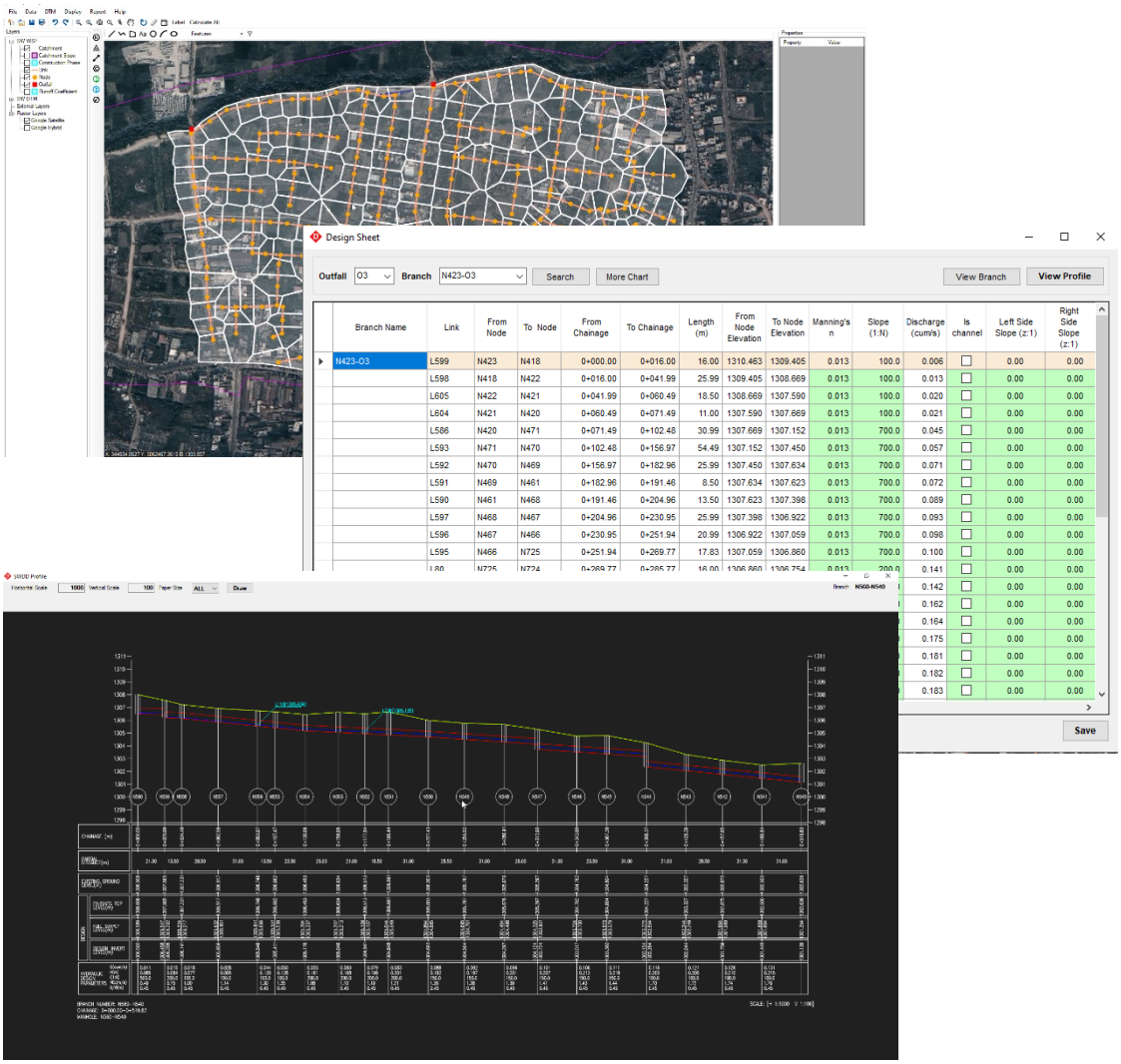
SW SWDD RM V2

Operation Manual

Version 2.0.0.0
June, 2022



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System Requirements

- Built-in tool, DTM for topographic map preparation.
- Support online tile imagery and offline images for background reference.
- Support Digital Elevation Model for design.
- Export drawing in print-ready format.

System Requirement

Operating System: Windows-based OS (Windows 10 Recommended)

Supported OS: Windows 7 with SP1, Windows 8.1, Windows 10

Microsoft .NET Framework 4.8

Processor: 2.5 GHz (3+ GHz recommended)

Memory: 4 GB (8GB recommended)

Disk space: 2.0 GB.

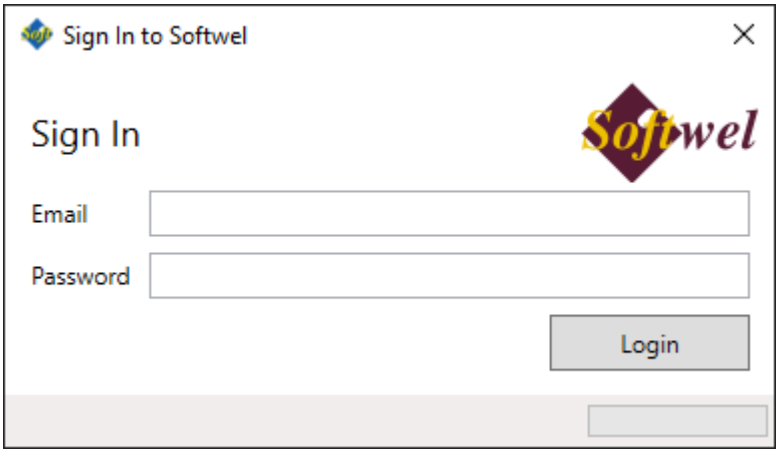
DirectX 10

Installation Note

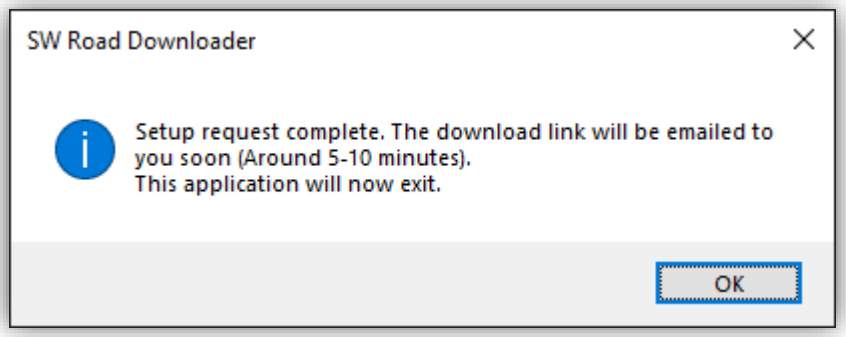
1) Setup Instructions for SW SWDD RM

Note: Microsoft .NET Framework 4.8 is required to run the Software. You can download it from Microsoft official page.

- Register an account with Softwel. You can register an account from Softwel official page.
- Once you register, an e-mail will be sent to you containing the activation link. Click on the link to sign in and activate your Softwel account.
- Go to the Downloads page of Softwel.
- Download the SW SWDD Setup Download Utility.
- Run the Setup Download Utility.
- Enter your Softwel account email and password to sign in.



- Softwel will now prepare your installer and you will receive the download link and your product key in your email. This may take up to 10 minutes. The download link will only be valid for 24 hours.



- Download the setup from the link e-mailed to you and run it.
    - The setup will ask for a product key. The product key has the format XXXXX-XXXXX-XXXXX-XXXXX-XXXXX. Enter the complete product key, including dashes.
    - Once installed, you can start SW SWDD RM from your desktop or the Start menu.

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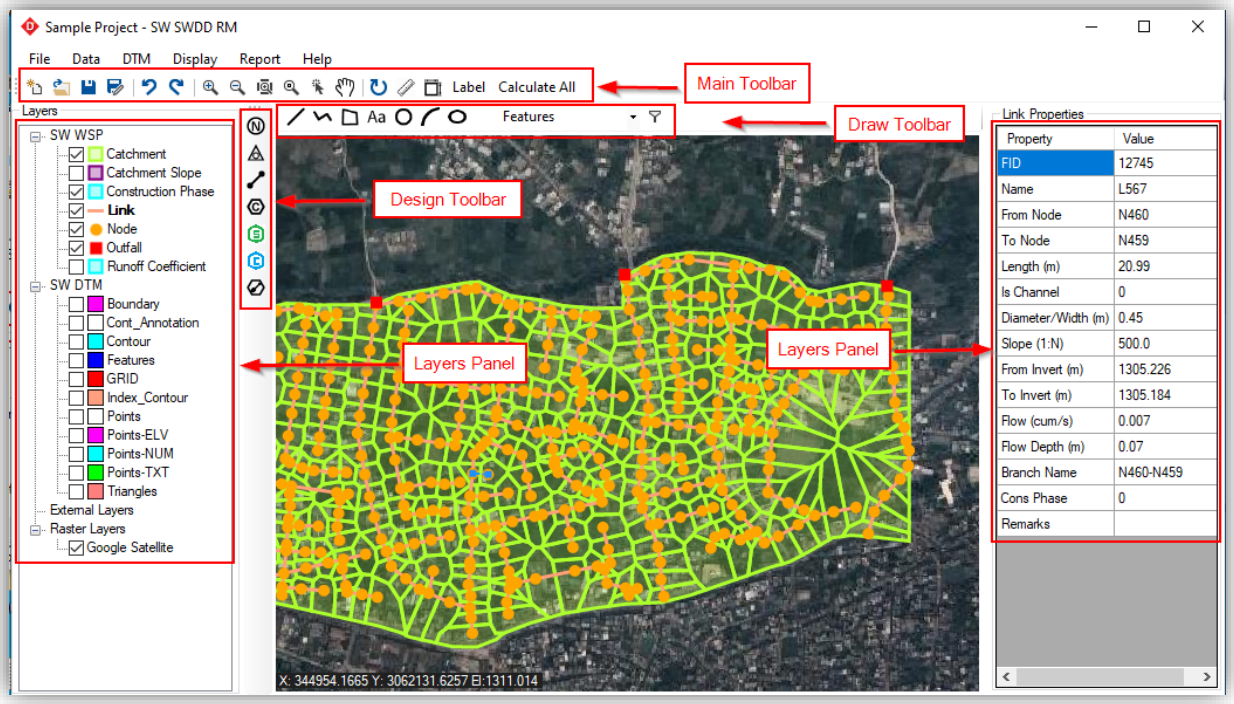
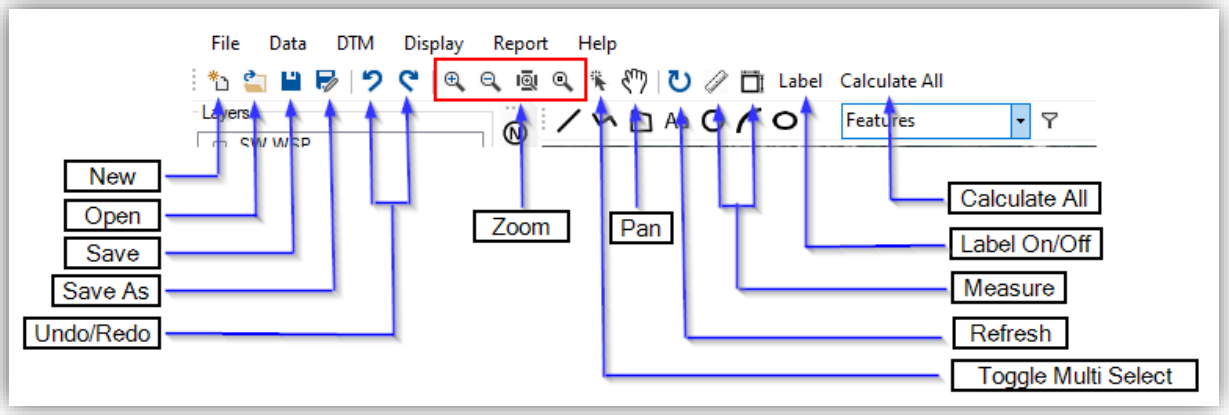
1 INTRODUCTION (USER INTERFACE)

1.1 Main Window (Plan Window)



1.2 Main Toolbar



1. New

Quits the current project to open a new project

2. Open

Quits the current project to open another existing project

3. Save / Save as

“Save” saves the current project. “Save as” allows users to save the project by modifying the

file name and directory.

4. Undo / Redo

This button is used to undo and redo the actions

5. Zoom In / Out

This button is used to magnify and shrink the display in the viewport

6. Zoom Window

This button allows users to pick two corners of a rectangle and zooms in on the drawn rectangle

7. Zoom Extent

This button is used to move the viewport and zooms in on the working area. This tool can also be accessed by pressing the middle mouse button twice

8. Toggle Multi Select

This button allows users to select multiple data.

9. Pan

This button allows the user to move the displayed content in the viewport. This tool can also be accessed with the middle mouse button

10. Undo / Redo

This button is used to undo and redo the actions

11. Refresh

This button refreshes the current view to show changes in the view.

12. Measure

These tools are used to measure the length of lines, area and perimeters of polygons

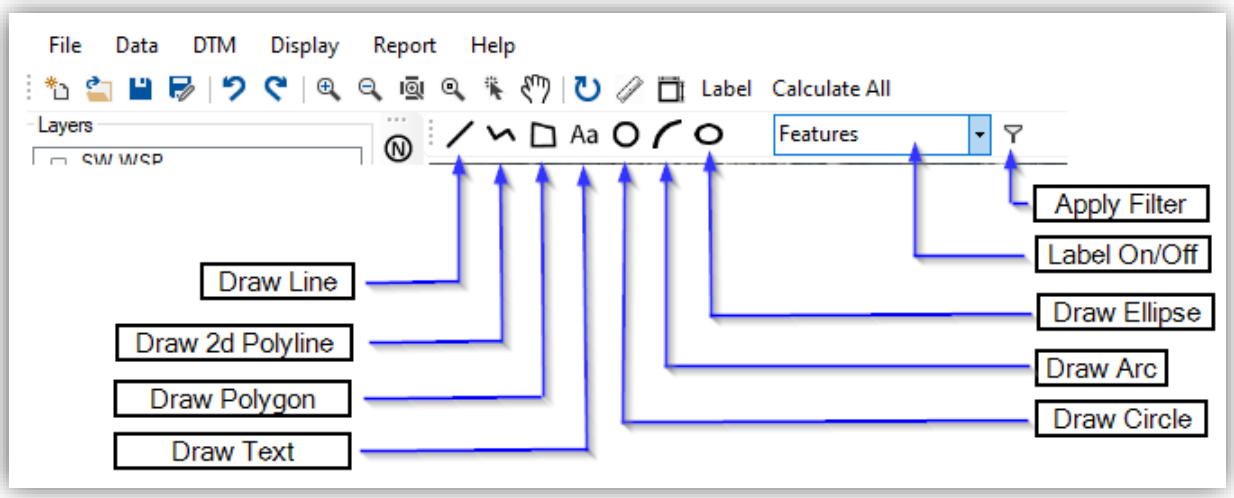
13. Label

Toggles the labels for Node and Link on or off. The labels to be shown can be modified in the “Display>Label Settings.” menu.

14. Calculate All

It checks all the networks, identifies invalid features and errors, calculates the length, area, elevation of the networks.

1.3 Draw Toolbar

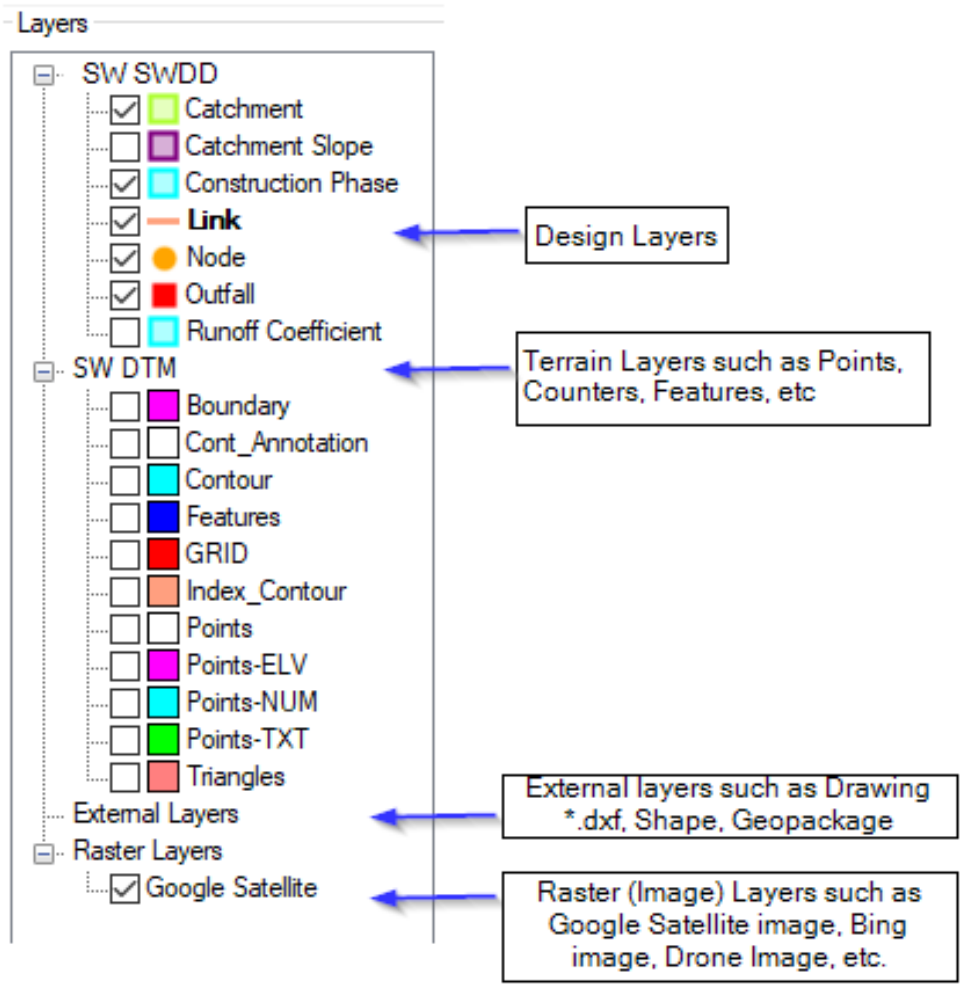


- While using “Draw Toolbar”, the mouse right-click completes the command, keyboard “Backspace” key undo the inserted vertex.
- “Draw 3D-Polyline” is used to draw the 3d-features that indicate the terrain undulation such as road edge, steps in terrain, cutting edge, etc.
- All the drawn features are added under the active layer. So the user has to change the active layer as per requirement.

1.4 Design Toolbar

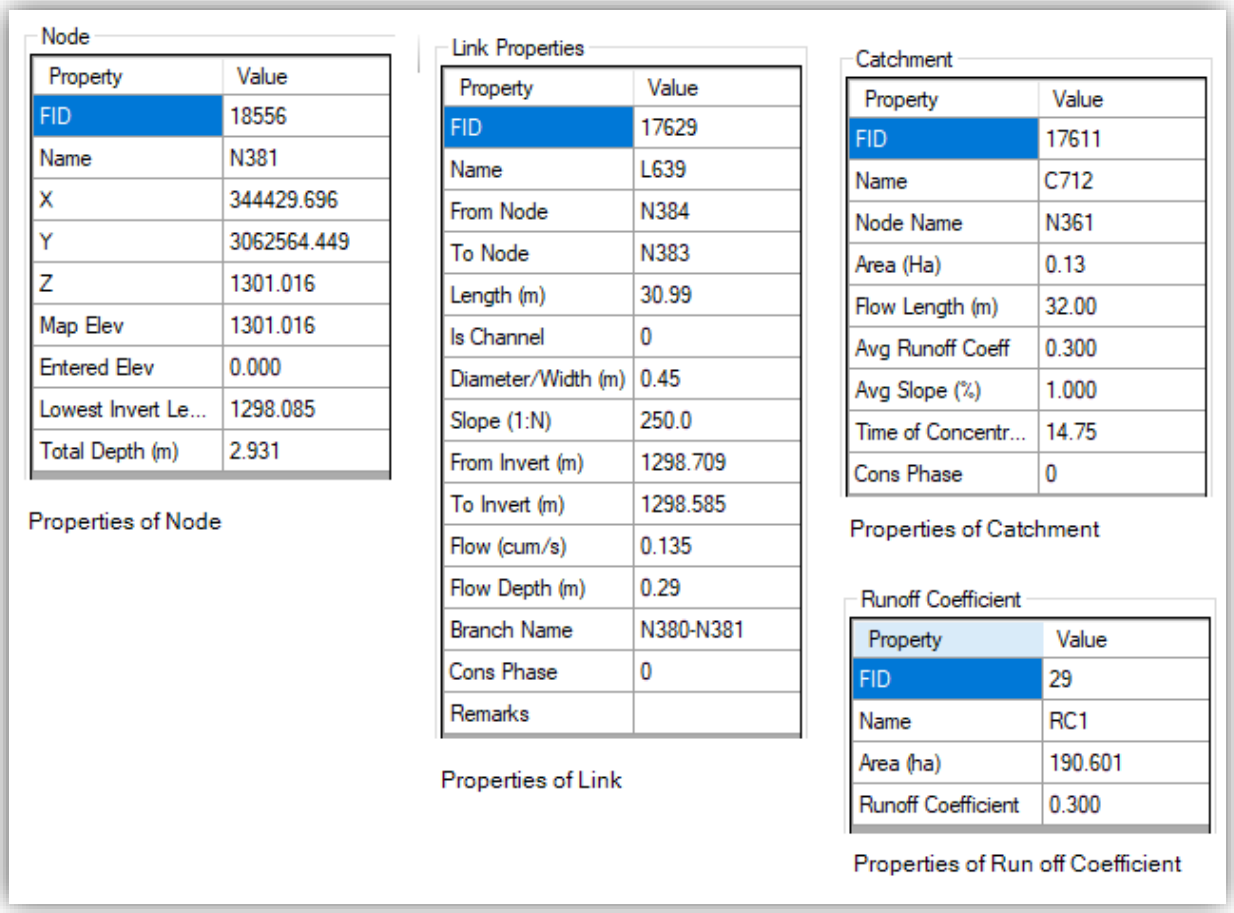
1.5 Layers Panel:

It controls the display of all the designed layers (such as Catchment, Links, Node, Outfall, etc, drawn terrain layer (such as points, features, contours, etc), imported external layers (drawing file (*.dxf), shape (*.shp), geopackage (*.gpkg), etc) and imported raster layers (satellite imagery, topographic map, drone images in *.tif or *.mbtiles format).


Layers
SW SWDD
Catchment
Catchment Slope
Construction Phase
Link
Node
Outfall
Runoff Coefficient
SW DTM
Boundary
Cont_Annotation
Contour
Features
GRID
Index_Contour
Points
Points-ELV
Points-NUM
Points-TXT
Triangles
External Layers
Raster Layers
Google Satellite
Design Layers
Terrain Layers such as Points, Counters, Features, etc
External layers such as Drawing *.dxf, Shape, Geopackage
Raster (Image) Layers such as Google Satellite image, Bing image, Drone Image, etc.

1.6 Properties Panel:

The properties panel is located on the right side of the display. This panel allows users to view the parameters of the design elements such as catchment area, node, link, etc. The properties panel for each element can be accessed by simply clicking on the element.



Node

Property	Value
FID	18556
Name	N381
X	344429.696
Y	3062564.449
Z	1301.016
Map Elev	1301.016
Entered Elev	0.000
Lowest Invert Le...	1298.085
Total Depth (m)	2.931

Properties of Node

Link Properties

Property	Value
FID	17629
Name	L639
From Node	N384
To Node	N383
Length (m)	30.99
Is Channel	0
Diameter/Width (m)	0.45
Slope (1:N)	250.0
From Invert (m)	1298.709
To Invert (m)	1298.585
Flow (cum/s)	0.135
Flow Depth (m)	0.29
Branch Name	N380-N381
Cons Phase	0
Remarks	

Properties of Link

Catchment

Property	Value
FID	17611
Name	C712
Node Name	N361
Area (Ha)	0.13
Flow Length (m)	32.00
Avg Runoff Coeff	0.300
Avg Slope (%)	1.000
Time of Concentr...	14.75
Cons Phase	0

Properties of Catchment

Runoff Coefficient

Property	Value
FID	29
Name	RC1
Area (ha)	190.601
Runoff Coefficient	0.300

Properties of Run off Coefficient

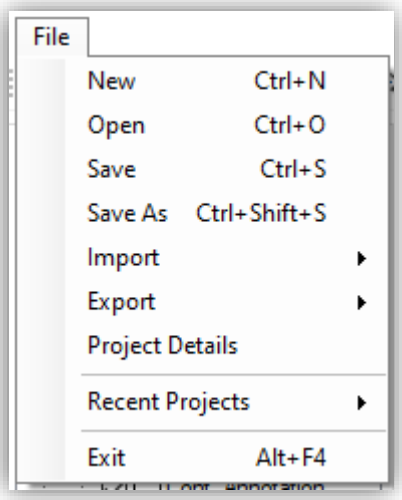
2 MAIN MENU

The entire system is grouped into menus based on their similarity of functions. The following table provides the summary of the menus and the sub-sequent section provides details of each of the menus and the sub-menus

Menus	Description
File	Allows users to create a new project, import data from SW maps, and export map to dxf, google earth and shape file.
Data	All of the data that is required for designing the drainage is entered here. Eg: Node, Link, catchment, runoff coefficient, etc.
DTM	Surveyed points are processed, contours and terrain surfaces are generated. The source of terrain file required for the design is selected whether the source is internal DTM, external DTM or Grid.
Display	The options for labelling different items are available in this menu.
Report	It exports the quantities of pipe networks.
Help	It displays the general information of software development teams, contact details and the tool for updating the software.

3 FILE

The file menu has been divided into the following sub-division.



3.1 New

Create a new project with default settings. Users can do nothing without creating a project.

3.2 Open

Open existing project

3.3 Save

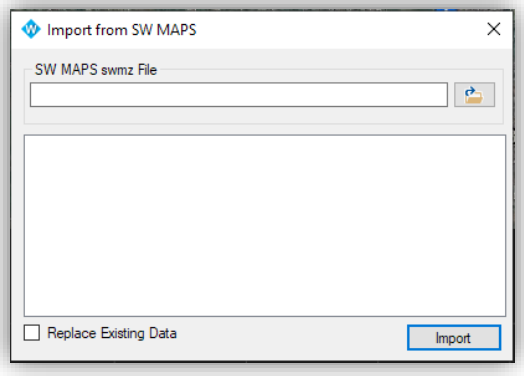
Save the project

3.4 Save As

Save the project in a new copy and continue in it.

3.5 Import

Imports swmz files from SW Maps.



3.6 Export

Exports the project file. DXF, KML and shape files can be exported.

3.7 Project Detail

Displays the detail about the project file such as the file name and path. The project info

category includes the name of the surveyor and the designer, both of which can be edited during or after the creation of the project file along with the projection system of the map.

3.8 Recent Projects

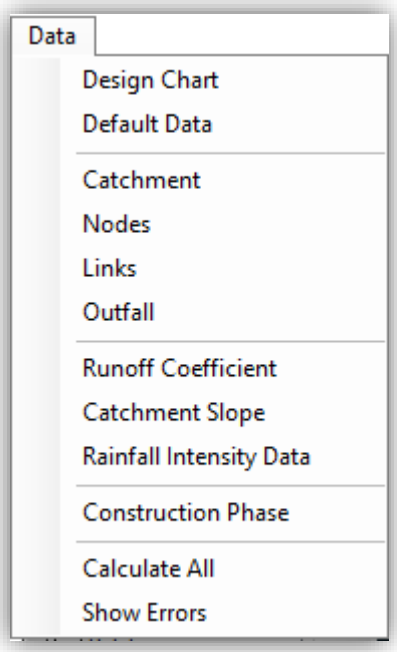
Displays the list of the recently opened projects for quick opening.

3.9 Exit

Exit the project file.

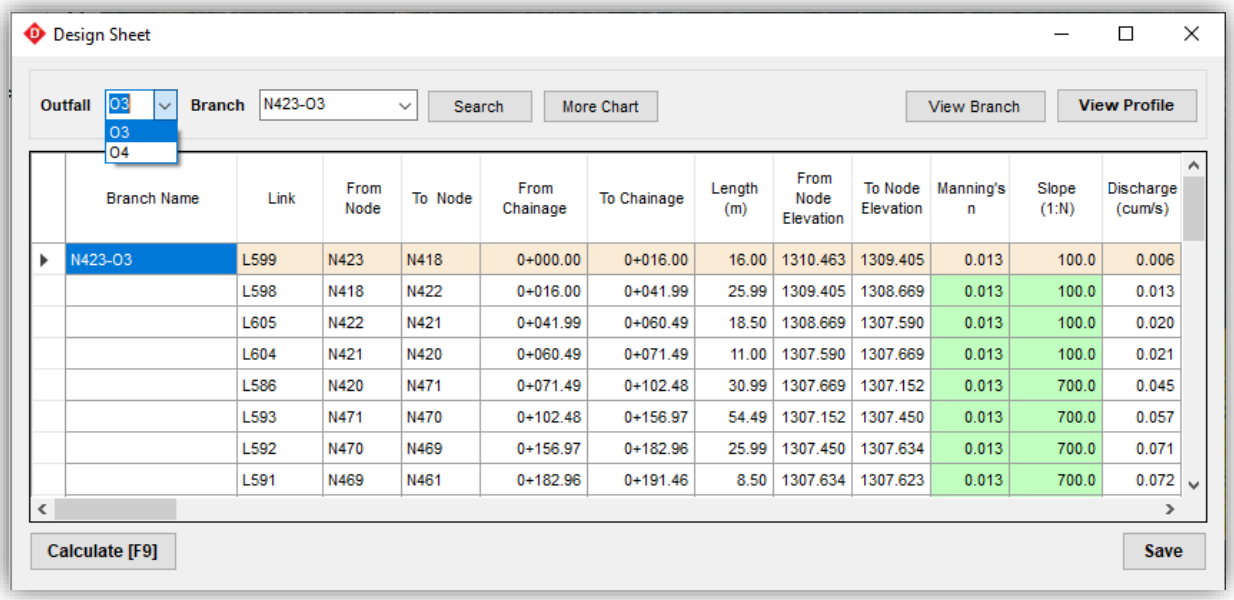
4 DATA

Before proceeding to design, the design requirement and criteria need to be entered. In this menu, all the design requirements and criteria are entered. The Data menu is subdivided into the following sub-menu.



4.1 Design Chart

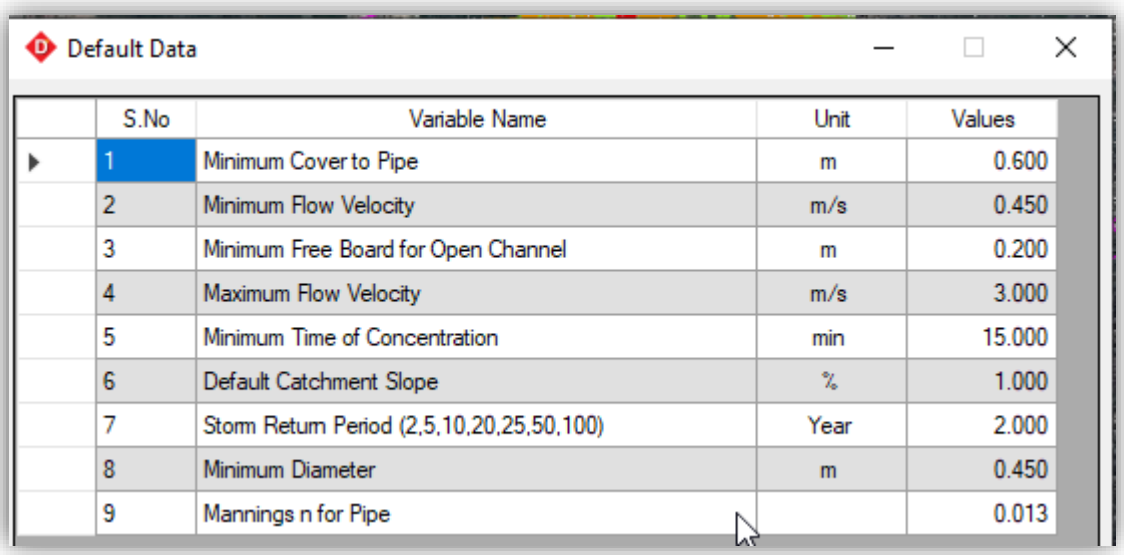
It is the main design table. It is used to design the geometry and hydraulic properties of the drain. The drain size, longitudinal profile, discharge, vertical drops, etc are designed in this table.



Branch Name	Link	From Node	To Node	From Chainage	To Chainage	Length (m)	From Node Elevation	To Node Elevation	Manning's n	Slope (1:N)	Discharge (cum/s)
N423-O3	L599	N423	N418	0+000.00	0+016.00	16.00	1310.463	1309.405	0.013	100.0	0.006
	L598	N418	N422	0+016.00	0+041.99	25.99	1309.405	1308.669	0.013	100.0	0.013
	L605	N422	N421	0+041.99	0+060.49	18.50	1308.669	1307.590	0.013	100.0	0.020
	L604	N421	N420	0+060.49	0+071.49	11.00	1307.590	1307.669	0.013	100.0	0.021
	L586	N420	N471	0+071.49	0+102.48	30.99	1307.669	1307.152	0.013	700.0	0.045
	L593	N471	N470	0+102.48	0+156.97	54.49	1307.152	1307.450	0.013	700.0	0.057
	L592	N470	N469	0+156.97	0+182.96	25.99	1307.450	1307.634	0.013	700.0	0.071
	L591	N469	N461	0+182.96	0+191.46	8.50	1307.634	1307.623	0.013	700.0	0.072

4.2 Default Data

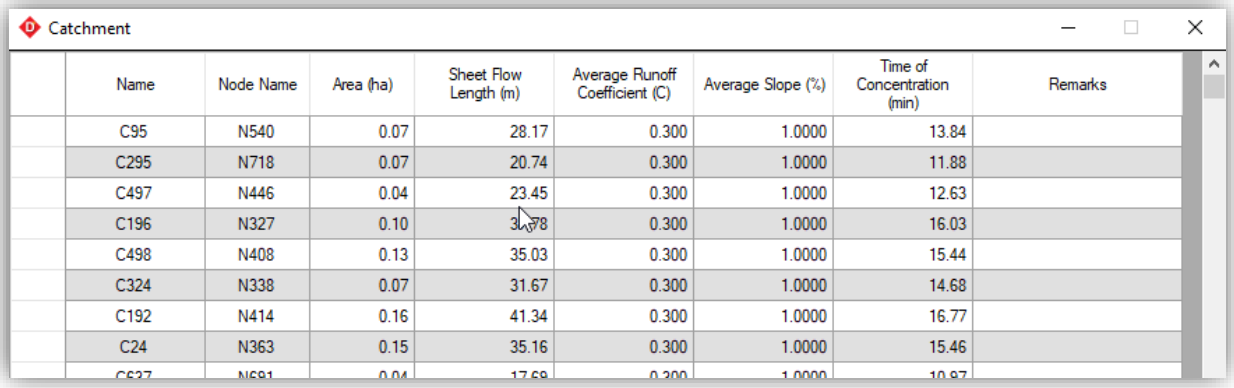
It is the table for defining default data to be considered in calculation.



S.No	Variable Name	Unit	Values
1	Minimum Cover to Pipe	m	0.600
2	Minimum Flow Velocity	m/s	0.450
3	Minimum Free Board for Open Channel	m	0.200
4	Maximum Flow Velocity	m/s	3.000
5	Minimum Time of Concentration	min	15.000
6	Default Catchment Slope	%	1.000
7	Storm Return Period (2,5,10,20,25,50,100)	Year	2.000
8	Minimum Diameter	m	0.450
9	Mannings n for Pipe		0.013

4.3 Catchment

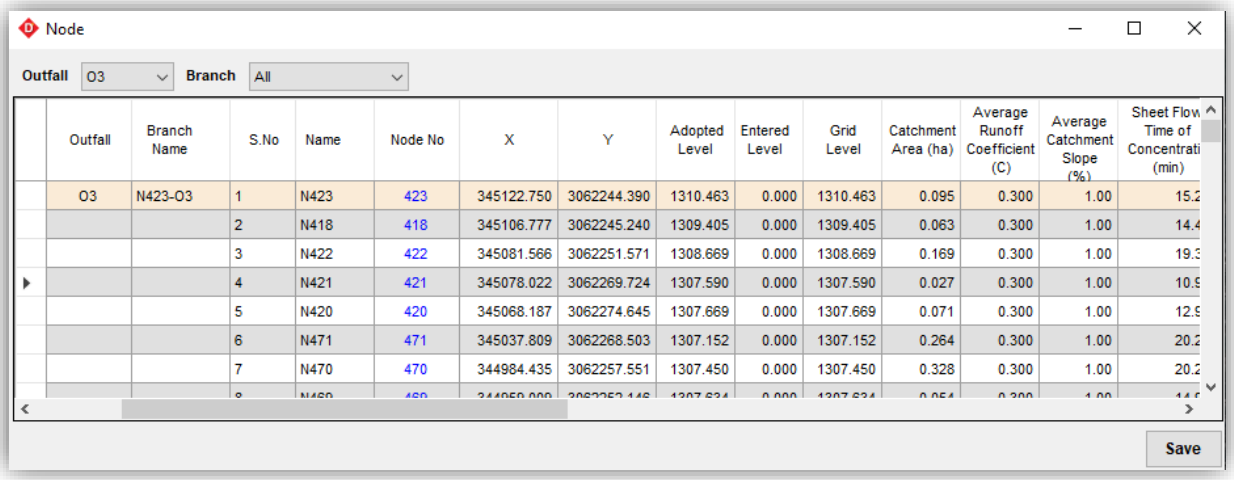
This table displays the properties of the catchment area. The properties can not be changed from this table. This is only for viewing.



Name	Node Name	Area (ha)	Sheet Flow Length (m)	Average Runoff Coefficient (C)	Average Slope (%)	Time of Concentration (min)	Remarks
C95	N540	0.07	28.17	0.300	1.0000	13.84	
C295	N718	0.07	20.74	0.300	1.0000	11.88	
C497	N446	0.04	23.45	0.300	1.0000	12.63	
C196	N327	0.10	3[illegible]78	0.300	1.0000	16.03	
C498	N408	0.13	35.03	0.300	1.0000	15.44	
C324	N338	0.07	31.67	0.300	1.0000	14.68	
C192	N414	0.16	41.34	0.300	1.0000	16.77	
C24	N363	0.15	35.16	0.300	1.0000	15.46	
C637	N691	0.04	17.69	0.300	1.0000	10.97	

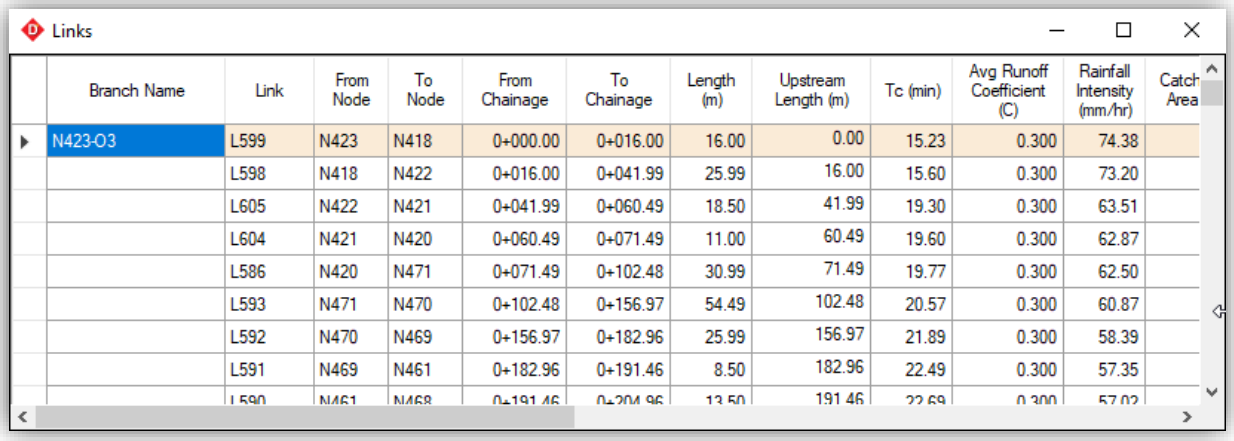
4.4 Nodes

This table displays the properties of Nodes. Most of the properties are read-only while the finished ground level can be edited in the table.



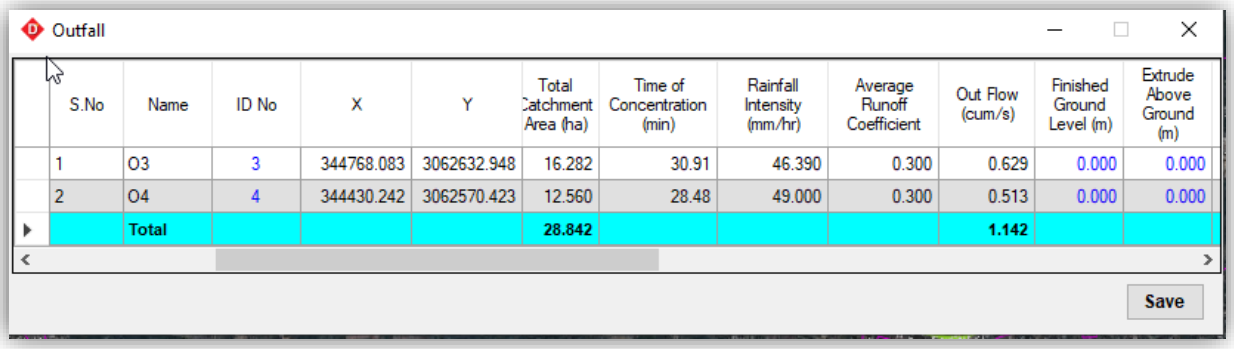
4.5 Links

It is also a read-only table. It displays the properties of the drainage network.



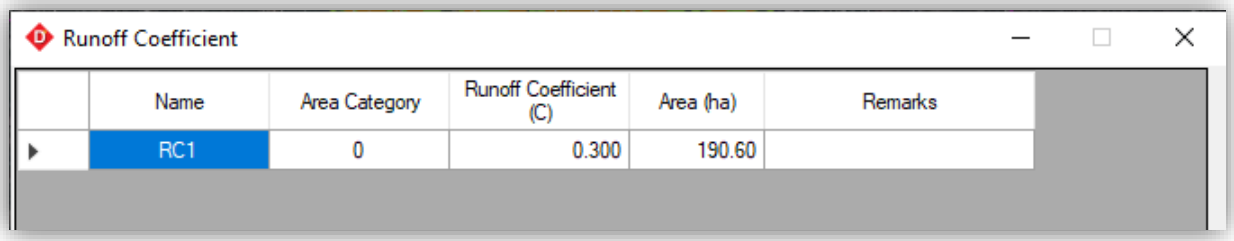
4.6 Outfall

It displays the properties of the outfall. The finished ground level, high flood level, bed level, preferred bed level can be added to the table.



4.7 Runoff Coefficient

This table is used to define the runoff coefficient of the catchment area.



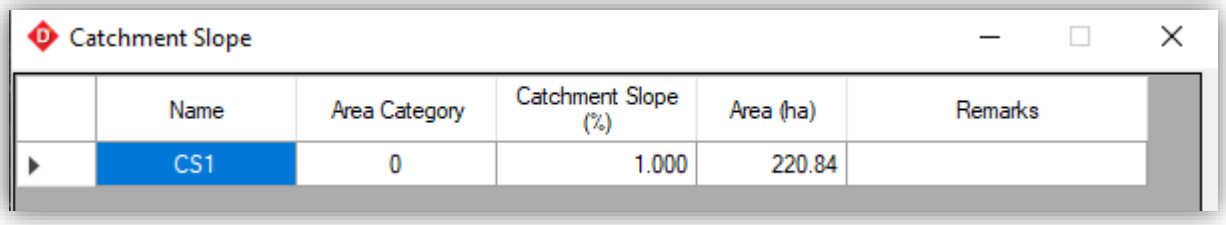
Runoff Coefficient for the different surfaces.

Type of ground surface	Coefficient of surface runoff
Road:	
Pavement	0.70-0.90
Permeable pavement	0.30-0.40
Gravel road	0.30-0.70
Shoulder or top of slope:	
Fine soil	0.40--0.65
Coarse soi l	0.10-0.30
Hard rock	0.70-0.85
Soft rock	0.50-0.75
Grass plot of sand:	
Slope 0- 2%	0.05--0.10
Slope 2- 7%	0.10--0.15
Slope 7%	0.1 5--0.20
Grass plot of clay:	
Slope 0- 2%	0.13--0.17
Slope 2- 7%	0.18--0.22
Slope 7%	0.25--0.35
Roof	1.00
Unused bare land	0.20-0.40
Athletic field	0.40-0.80
Park with vegetatio n	0.10-0 .25
Mountain with a gentle slope	0.30
Mountain with a steep slope	0.50
A paddy field or water	0.70-0.80
Farmland	0.10-0.30

Source: Guidelines for surface runoff coefficients by the Ministry of Education, Culture, Sports, Science and Technology, Japan

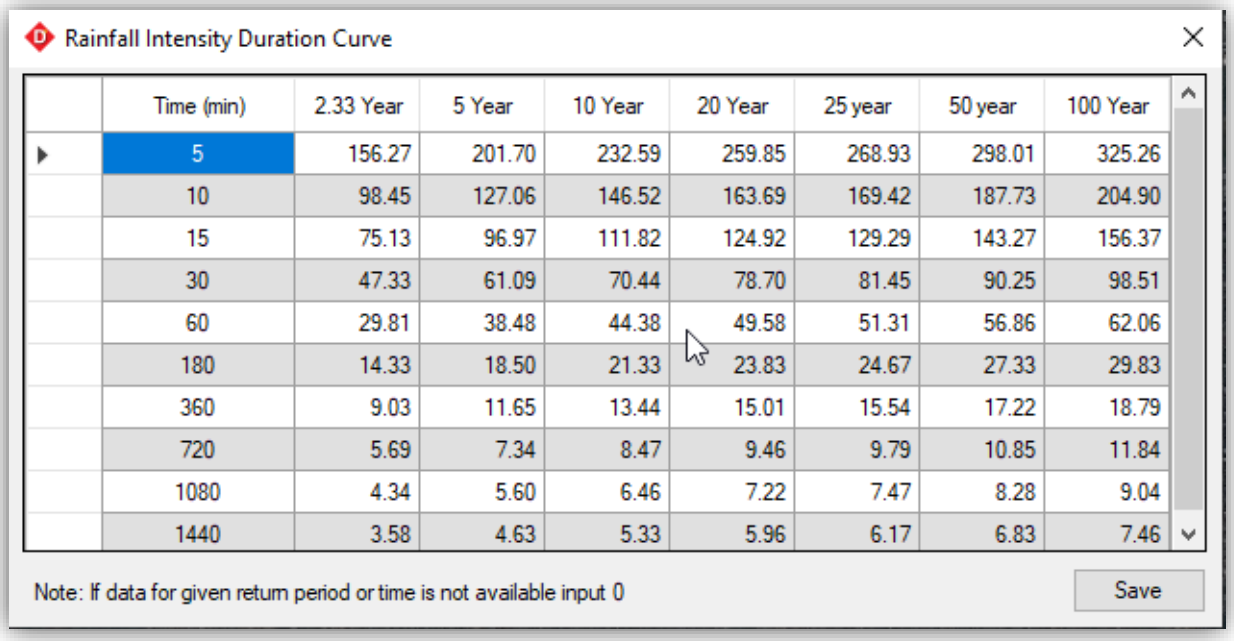
4.8 Catchment Slope

This table is used to define the slope of the catchment area. If we do not define it in this table, it will use the default slope defined in Data>Default Data.



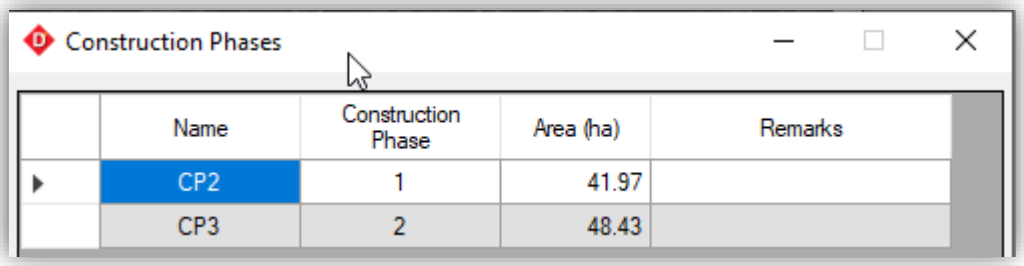
4.9 Rainfall Intensity Data

In this table, rainfall intensity distribution data is input which will be used for the calculation of the discharge. If data is not input, 0 value is considered.



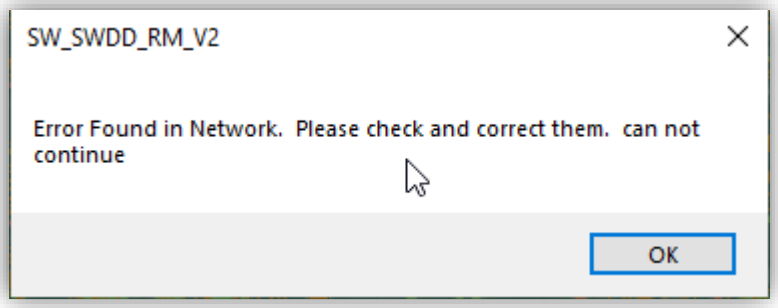
4.10 Construction Phase

If the construction of the project goes on multiple phases, then the construction phases need to be defined. Otherwise, it is not compulsory to input this table.



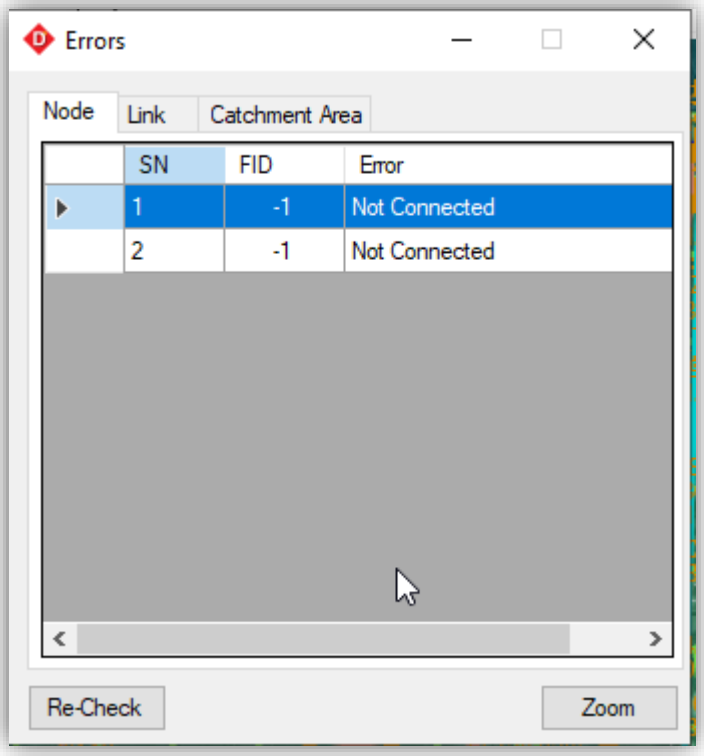
4.11 Calculate All

It is the same function as the toolbar “Compute All” does. It checks all the networks, identifies invalid features and errors, calculates the length, area, elevation of the networks. If there are any errors, the computation will not complete and an error message is displayed.



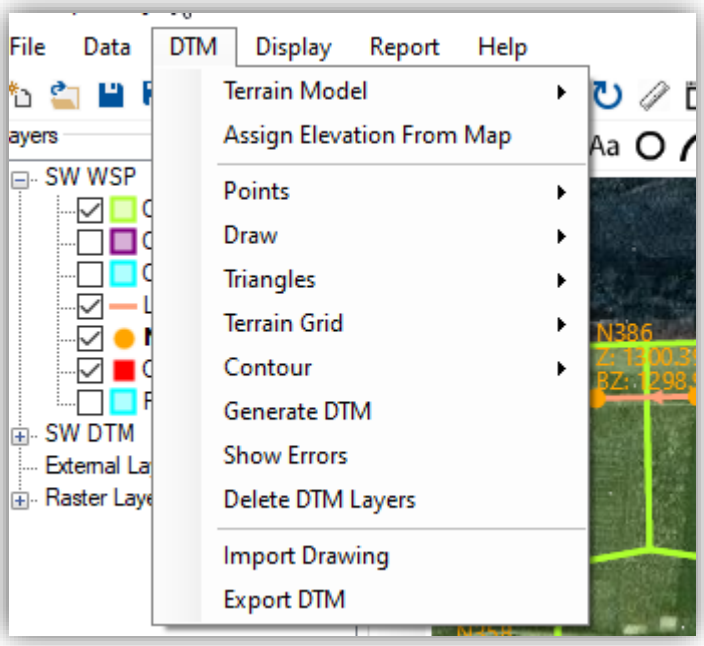
4.12 Show Errors

While computing if there are some errors, an Error Message is displayed. it displays those errors in tabular form. The location of Error can be identified using “Zoom” to the error location and can be corrected.

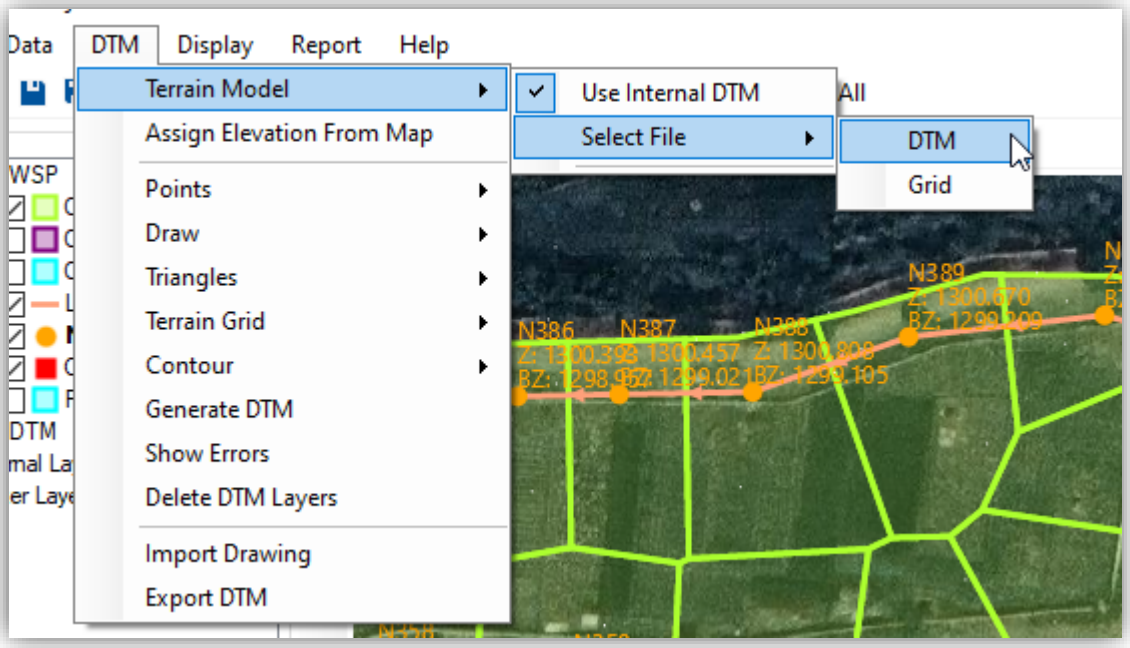


5 DTM

It is the built-in tool for the generation of a topographic map and terrain model. The available tools in the Terrain menu are as shown in the figure.



5.1 Terrain Model

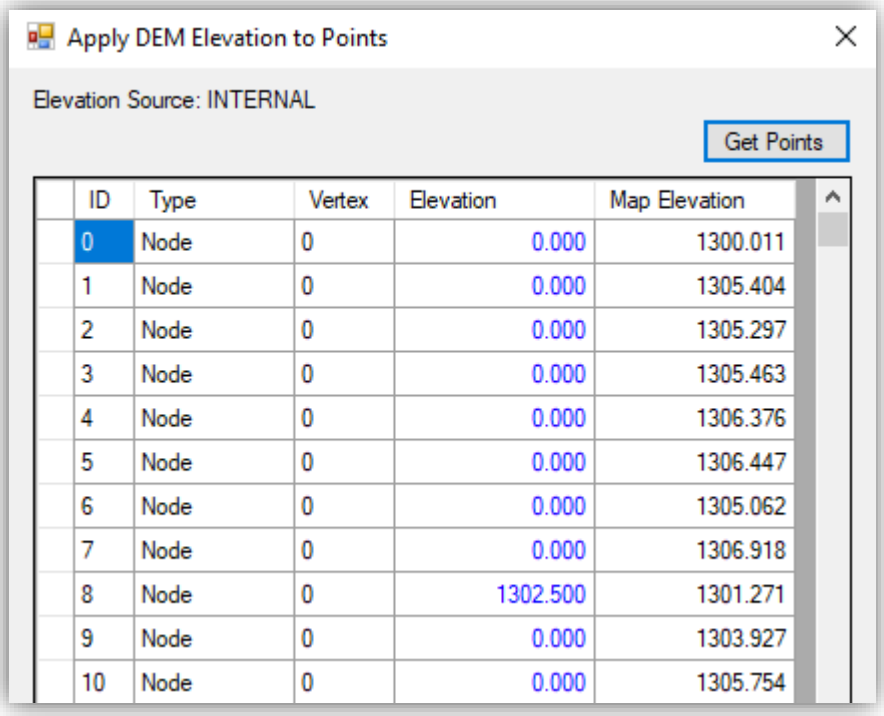


This sub-menu specify the terrain file to be used for design. The terrain file may be an internal DTM or external DTM/Grid file. If the data is processed and DTM is created within the software, the “Internal Dtm” can be used. Otherwise, external DTM or Grid can be imported for the terrain data.

.dtm is the old format of the digital terrain model generated by SW-DTM software. Now, Grid (*.tif) is also supported by the current version. Users can import terrain from different DEM sources such as SRTM, Palsar, etc.

5.2 Assign elevation from Map

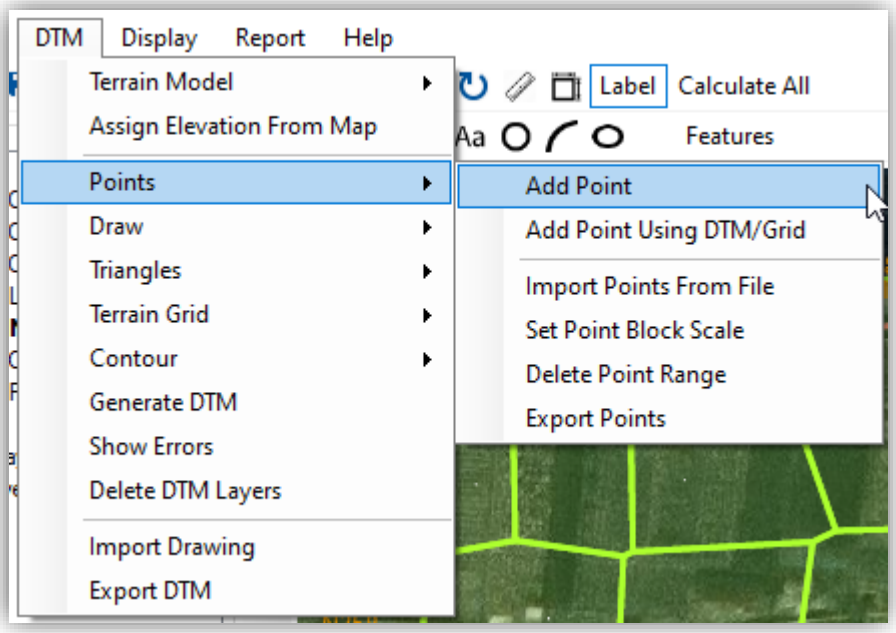
It assigns the elevation of the node from the terrain data. If the elevation assigned to some node is not correct, we can overwrite the elevation by manual input in the table.



ID	Type	Vertex	Elevation	Map Elevation
0	Node	0	0.000	1300.011
1	Node	0	0.000	1305.404
2	Node	0	0.000	1305.297
3	Node	0	0.000	1305.463
4	Node	0	0.000	1306.376
5	Node	0	0.000	1306.447
6	Node	0	0.000	1305.062
7	Node	0	0.000	1306.918
8	Node	0	1302.500	1301.271
9	Node	0	0.000	1303.927
10	Node	0	0.000	1305.754

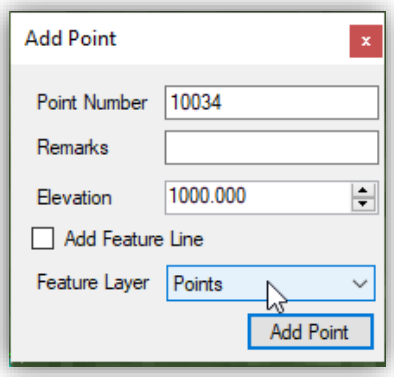
5.3 Points

This sub-menu deals with the points data. It may be the surveyed data or generated data.



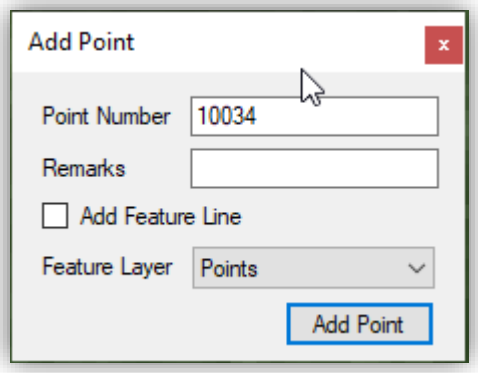
5.3.1 Add Point

It adds points with user-defined elevation.



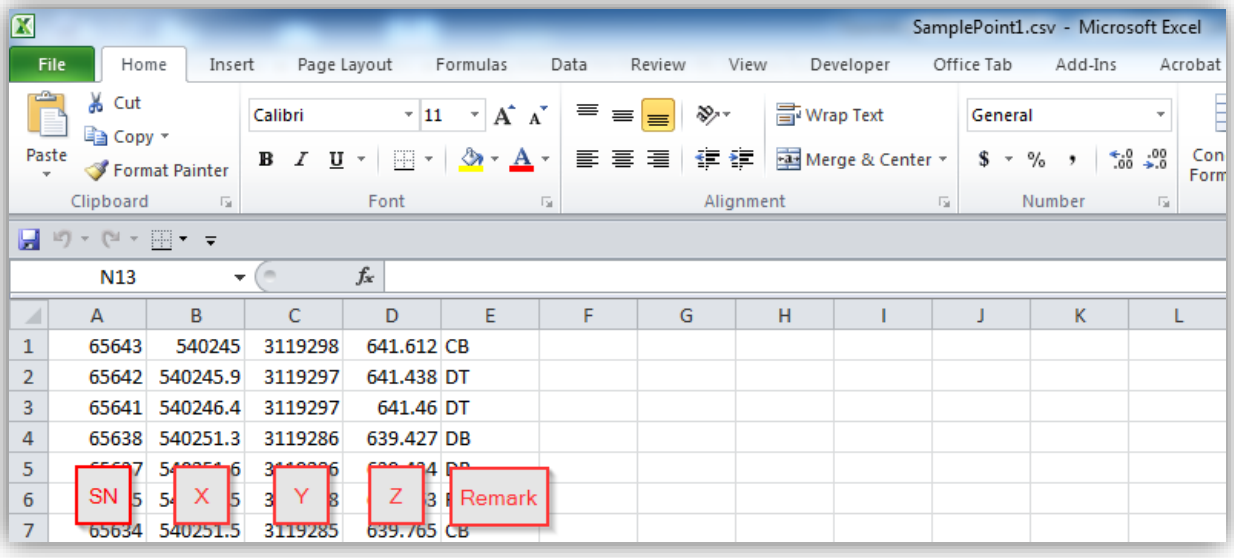
5.3.2 Add Point Using DTM/Grid

It adds points with the elevation from the terrain model or Grid.



5.3.3 Import Points from File

It imports the surveyed points from *.csv format. The data must be stored in the order “Serial Number, X, Y, Z, Remark”. The data must be without a table heading.



5.3.4 Set Point Block Scale

It Changes the display scale of the point in plan view.

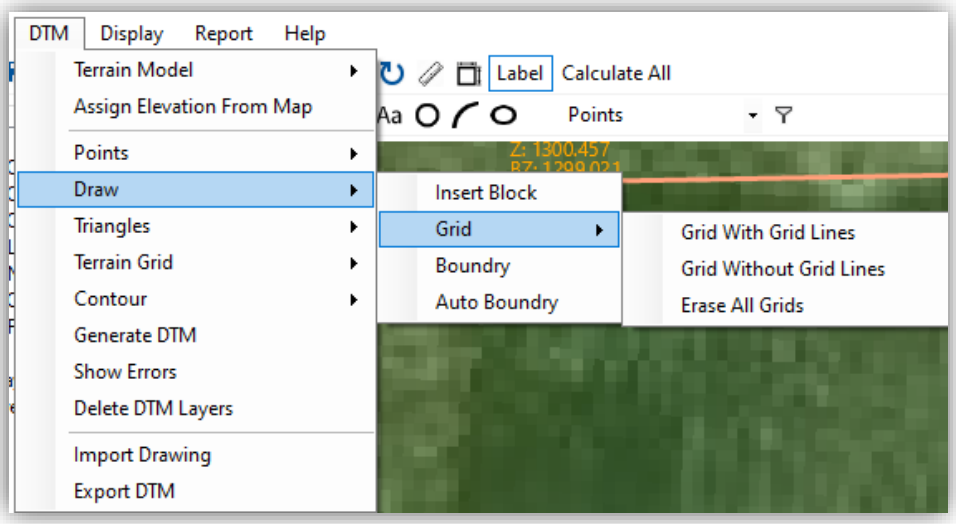
5.3.5 Delete Point Range

It deletes the points based on the user-defined point number range.

5.3.6 Export Points

It exports the points to *.csv format.

5.4 Draw



5.4.1 Insert Block

This tool is used to insert the survey stations and benchmark blocks in the plan. The coordinates of benchmark and stations must be saved in *.CSV format. The order of data must be in the order “ Serial Number, X, Y, Z, Station Name”.

5.4.2 Grid

This tool is used to draw the grids and coordinates in the plan.

5.4.3 Add Boundary

It creates a boundary line around the survey data for the triangulation of points.

5.4.4 Auto Boundary

It detects the data and creates boundary lines around the survey data automatically.

5.5 Triangles

5.5.1 Draw Triangles

It draws the triangles obtained after triangulation.

5.5.2 Erase Triangles

It erases the drawn triangulation.

5.6 Terrain Grid

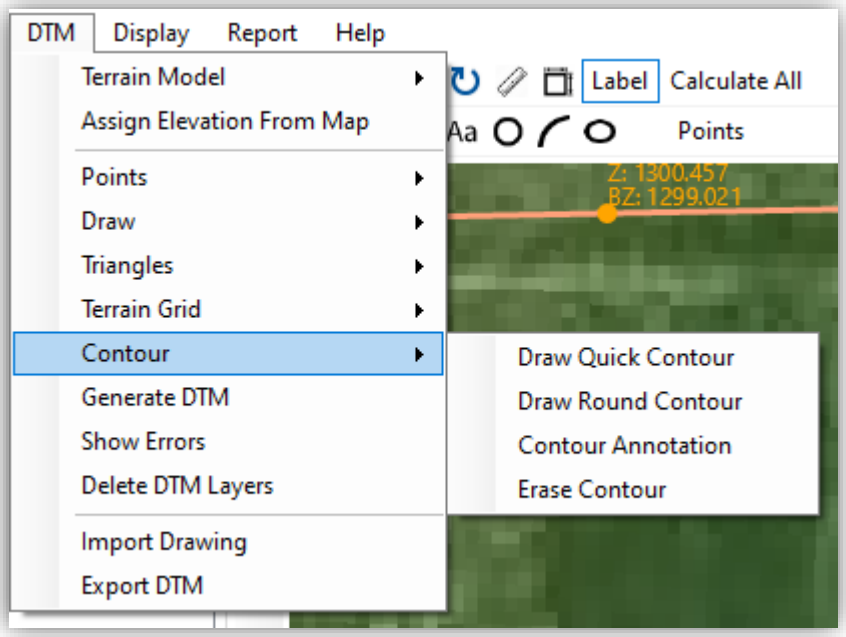
5.6.1 Show Grid Extents

When the source of the terrain is a grid, it displays the extent of the grid terrain in Plan.

5.6.2 Erase Grid Extents

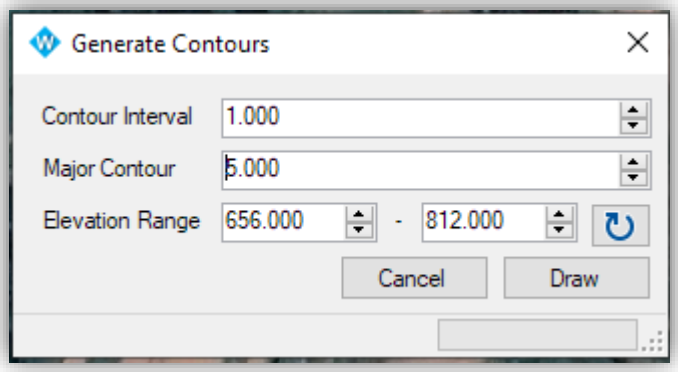
It erases the extents of the grid terrain from Plan.

5.7 Contours



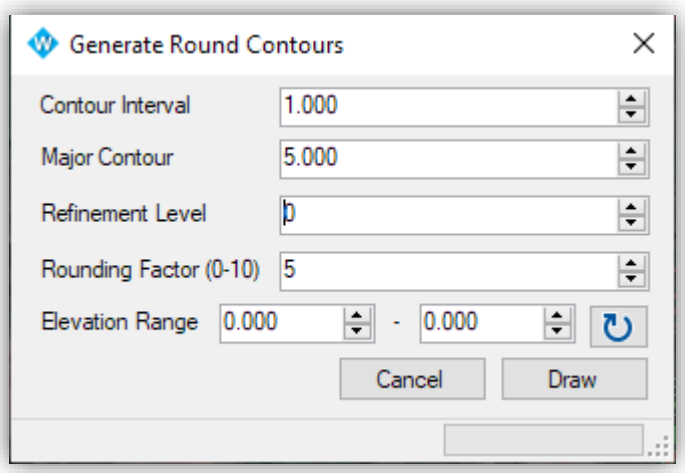
5.7.1 Draw Quick Contour

It allows the user to draw contours with the specified interval.



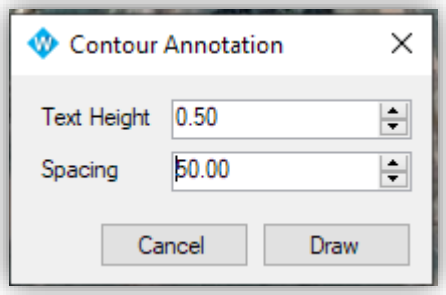
5.7.2 Draw Round Contour

It allows the user to draw smooth and round contours with the specified interval. Option for refinement level and rounding factors are provided in the form. Users can modify as per requirement. Higher the refinement level and rounding factor, smoother will be the contour with longer processing time.



5.7.3 Contour Annotation

It allows the user to annotate the elevation of contour at a specified distance.



5.7.4 Erase Contour

It erases all the contours in DTM layers (not from imported external layers).

5.8 Generate DTM

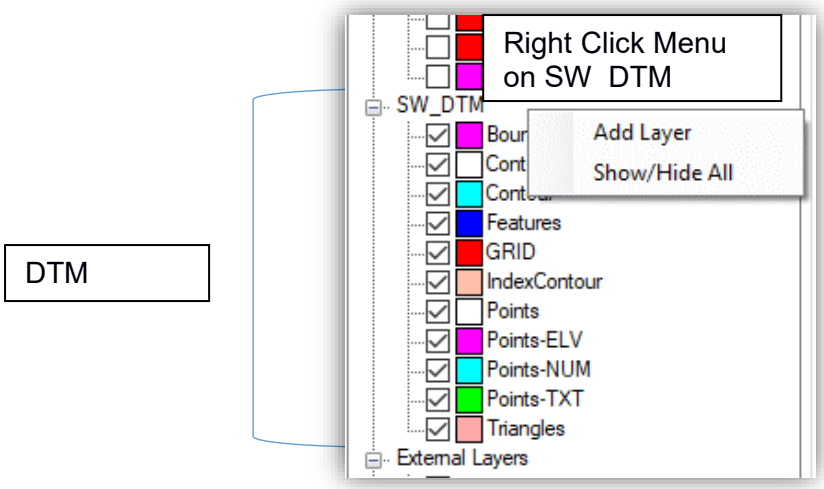
It processes all the points and features and generates dtm file which will be used as an internal dtm while updating terrain. This function is equivalent to “Points>Process Points” and “Triangle>Triangulation” in SW DtM.

5.9 Show Errors

While generating dtm, the system may encounter errors due to features intersections. These errors can be viewed from this sub-menu.

5.10 Delete DTM Layers

It deletes the layers under SW_DTM. If the layers are default layers in SW_DTM, only objects in these layers are deleted.



5.11 Import Drawing

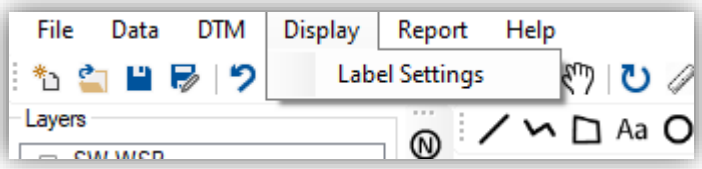
When surveyed data is processed outside the SWDD, all the features need to be importe. This sub-menu imports such drawings including points, features, etc. These drawings can be further processed and modified within SWDD unlike the “Import dxf” in layer panel which cannot be edited.

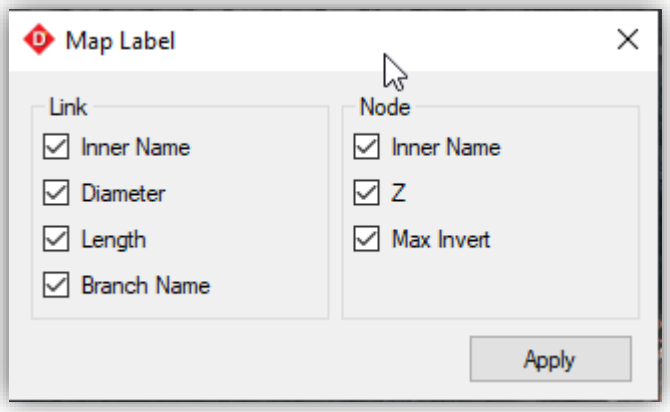
5.12 Export DTM

It exports the generated dtm file in the format *.dtmb so that the same terrain file can be used in another project.

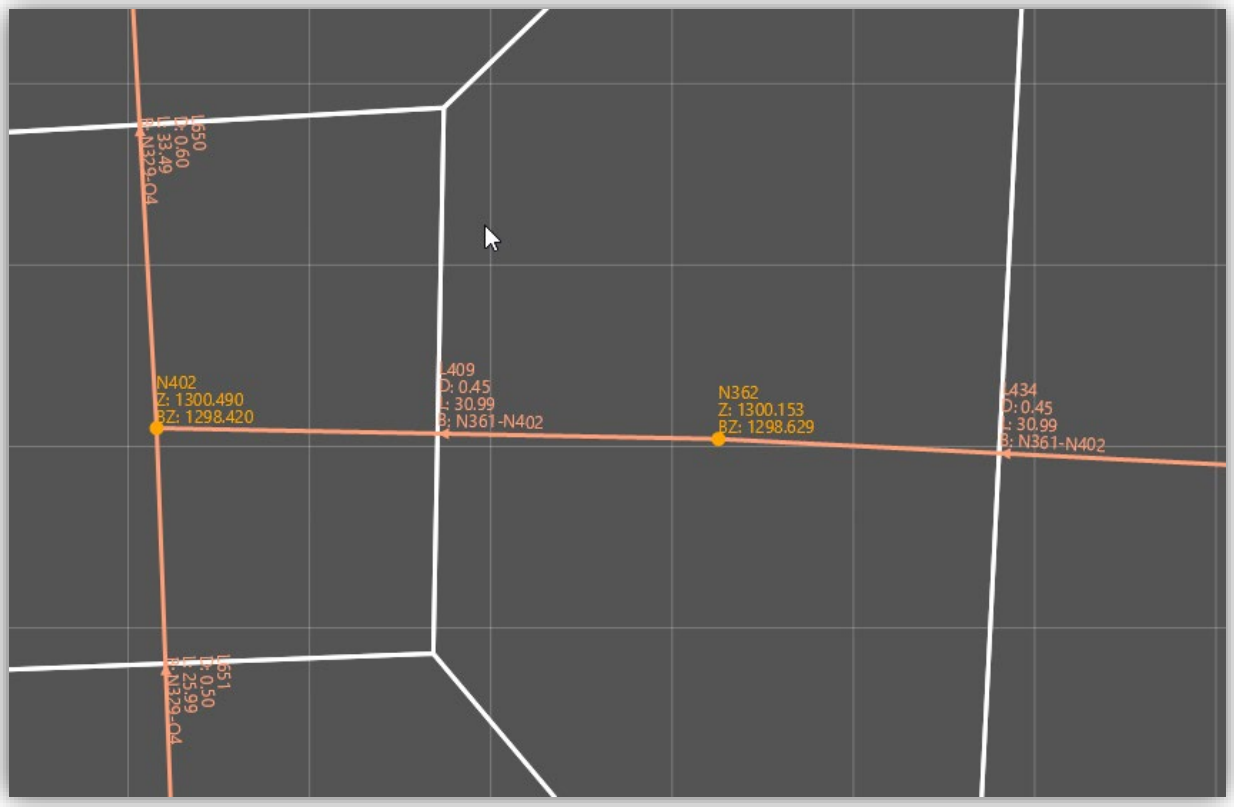
6 DISPLAY

The display menu contains the options for choosing properties to be labelled in map.



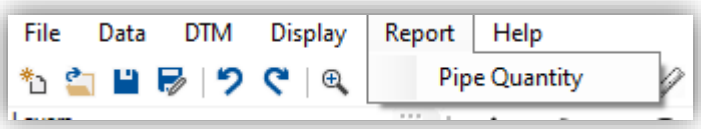


The display of the label can be toggled using the “Label” button on toolbar.



7 REPORT

This menu is used to export the quantity of pipe which will be required for the construction of the drainage network.



8 HELP

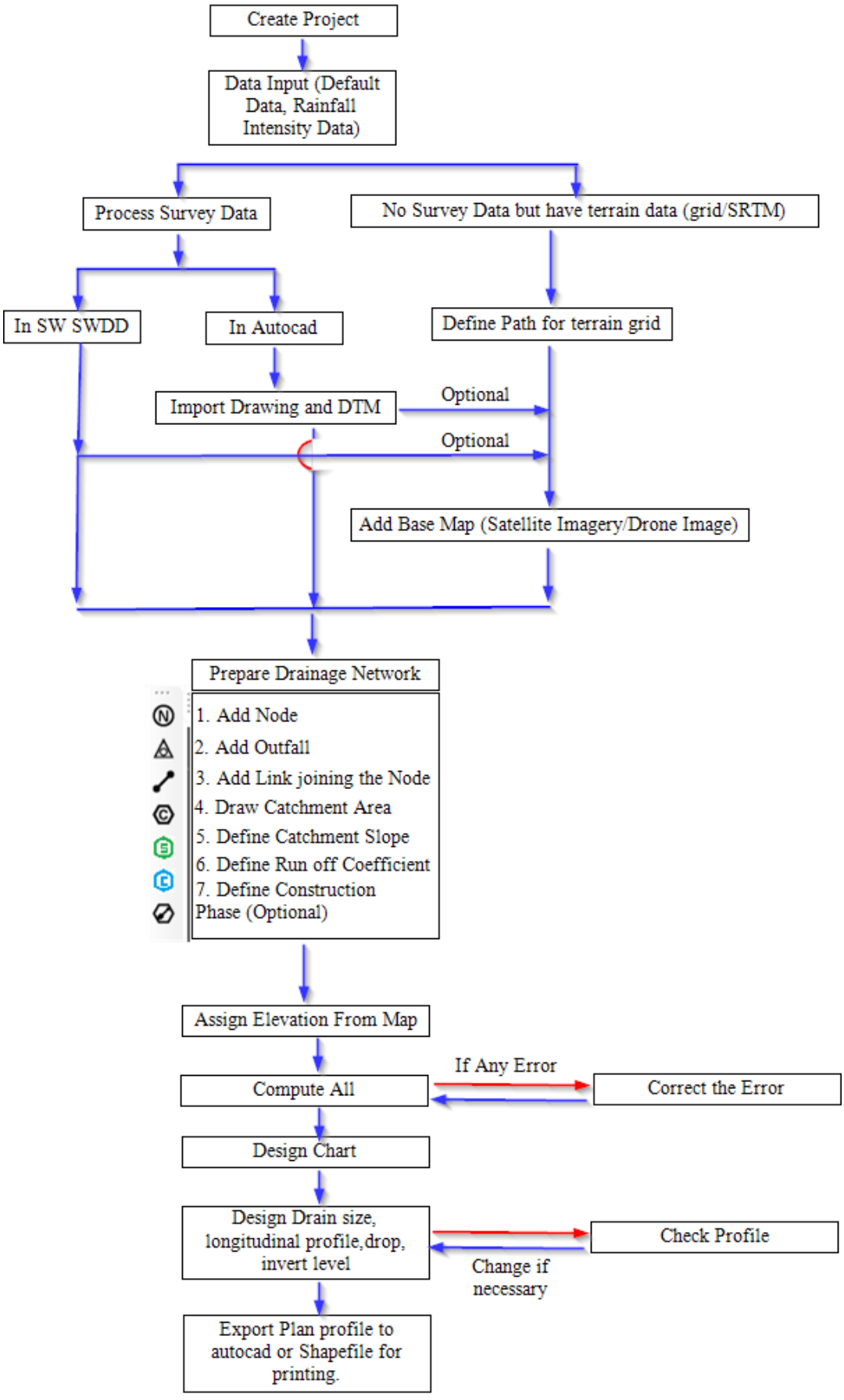
8.1 Check for Updates:

Checks for any updates and notifies users if updates are available. It is recommended to check for updates regularly for a better experience with the software.

8.2 About

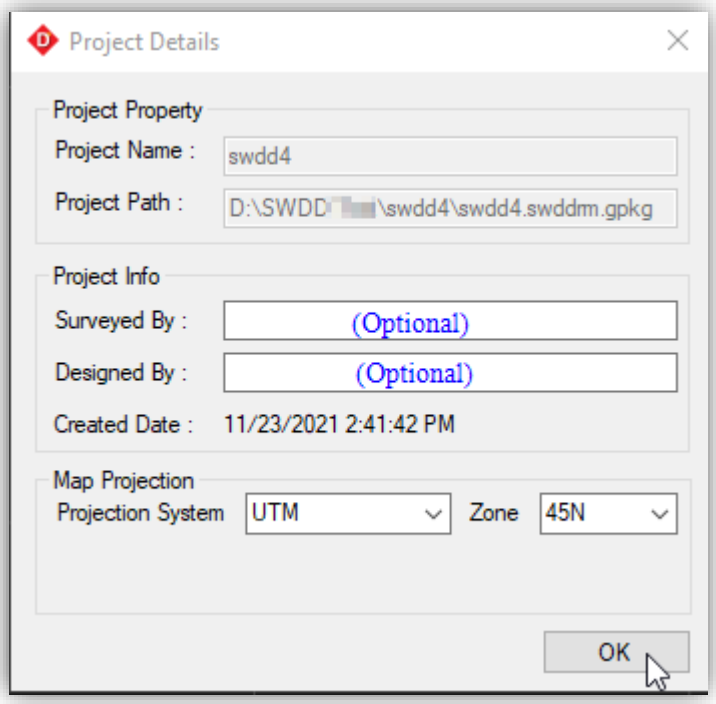
Displays the build number, licence status and contact information of the developer, Softwel (P) ltd.

9 DESIGN WORKFLOW



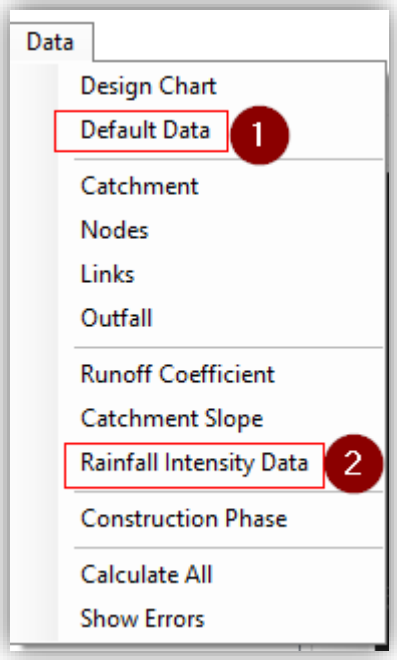
9.1 Create Project (File>New)

Create the project using Menu (File>New) or shortcut Ctrl+N. This will create a project file with the file extension *.swddrm.gpkg. Input the project details such as project information (optional) and map projection system. By default, it is set to UTM-45N. It can be changed at any time during the design.



9.2 Data Input

Input the Default data for different Parameters and Rainfall Intensity Data.



Default Data will be used as criteria for design (minimum cover to pipe, minimum flow velocity, maximum flow velocity, etc.) and values if we do not supply the data (Catchment slope, manning's n for Pipe, etc.)

Default Data

	S.No	Variable Name	Unit	Values
▶	1	Minimum Cover to Pipe	m	0.600
	2	Minimum Flow Velocity	m/s	0.600
	3	Minimum Free Board for Open Channel	m	0.200
	4	Maximum Flow Velocity	m/s	3.000
	5	Minimum Time of Concentration	min	15.000
	6	Default Catchment Slope	%	1.000
	7	Storm Return Period (2,5,10,20,25,50,100)	Year	2.000
	8	Minimum Diameter	m	0.600
	9	Mannings n for Pipe		0.013

Rainfall intensity Duration Curve data is used for the calculation of discharge. Initially, 0 value will be there in the table. We have to input the data as per the location of the project area and available rainfall data.

Rainfall Intensity Duration Curve

	Time (min)	2.33 Year	5 Year	10 Year	20 Year	25 year	50 year	100 Year
	5	156.27	201.70	232.59	259.85	268.93	298.01	325.26
	10	98.45	127.06	146.52	163.69	169.42	187.73	204.90
	15	75.13	96.97	111.82	124.92	129.29	143.27	156.37
	30	47.33	61.09	70.44	78.70	81.45	90.25	98.51
	60	29.81	38.48	44.38	49.58	51.31	56.86	62.06
	180	14.33	18.50	21.33	23.83	24.67	27.33	29.83
	360	9.03	11.65	13.44	15.01	15.54	17.22	18.79
	720	5.69	7.34	8.47	9.46	9.79	10.85	11.84
	1080	4.34	5.60	6.46	7.22	7.47	8.28	9.04
▶	1440	3.58	4.63	5.33	5.96	6.17	6.83	7.46

Note: If data for given return period or time is not available input 0

Save

9.3 Survey Data Processing for the terrain.

If there are detailed topographic survey data, it can be processed either within SW SWDD software or in Autocad using the SW DTM software. The approach is the same for both methods.

9.3.1 Processing in SW SWDD

i. Import survey data from csv format to SW SWDD. (Menu>DTM>Points>Import Points from File) The points data in csv format should be in order Serial Number, Easting(X), Northing (N), Elevation (Z) and Remarks. The data should not contain the heading. The imported points will be plotted in the map.

ii. Draw the boundary around the imported data. (Menu>DTM>Draw>Boundary/Auto Boundary)

iii. Draw feature lines such as roads, houses, etc to prepare a topographic map.(Toolbar>Draw 3d Polyline/Draw 2d Polyline)

iv. Generate DTM. If an error is observed while generating DTM, resolve the error and generate dtm again. (Menu>DTM>Generate DTM)

9.3.2 Processing in Autocad using SW DTM

The procedure is the same for processing in AutoCAD. The tool used for the process will be SW DTM.

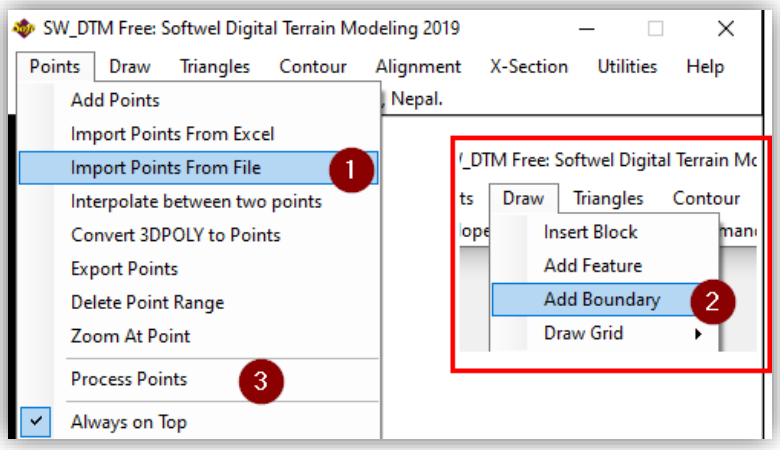
i. Launch Autocad and SW DTM

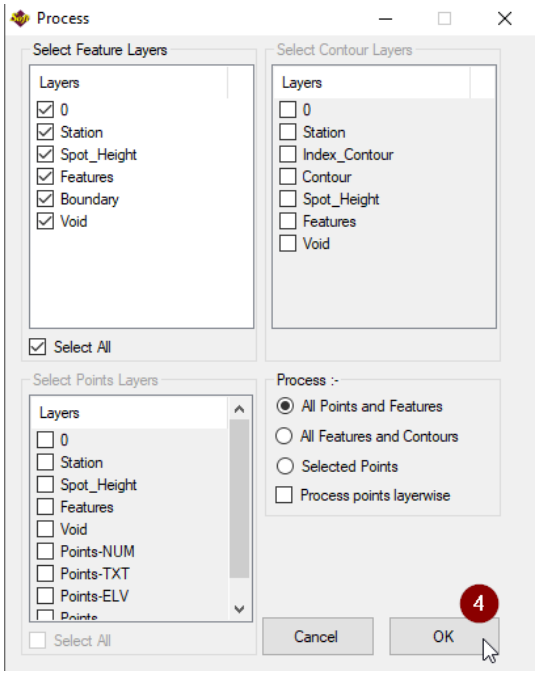
ii. Import points from excel to AutoCAD (SW DTM>Points Menu>Import Points from File). The points will be plotted on Autocad.

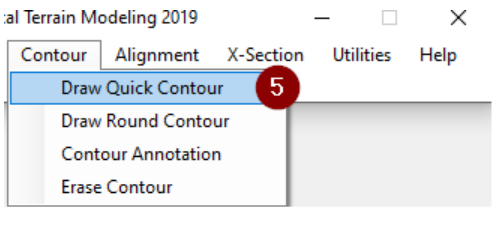
iii. Draw the boundary around the imported data. (SW DTM>Draw Menu>Add Boundary)

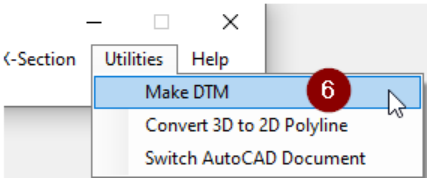
iv. Draw feature lines such as roads, houses, etc to prepare a topographic map.(Toolbar>Draw 3d Polyline/Draw 2d Polyline)

v. Process Points. (This is equivalent to Generate DTM in SWDD)







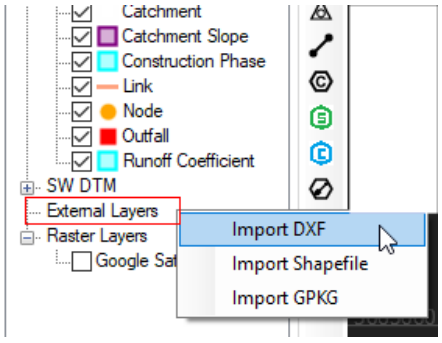


vi. Draw Contours (SW DTM>Contour Menu>Draw Quick Contour/Draw Round Contour)

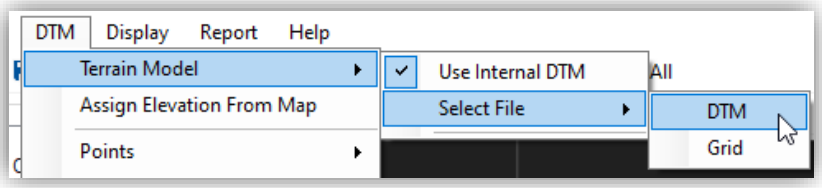
vii. Save the DTM file (SW DTM>Utilities Menu>Make DTM)

viii. Save the Drawing file in *.dxf format to import it in SW SWDD.

ix. Open SW SWDD Project and import drawing file. (SW SWDD>Layer Panel>Right Click on External Layer>Import Dxf). Locate the saved drawing file and import it.



x. Define the DTM file. (SW SWDD>DTM menu>Terrain Model>Select file>DTM). Locate the saved DTM file in step vii.

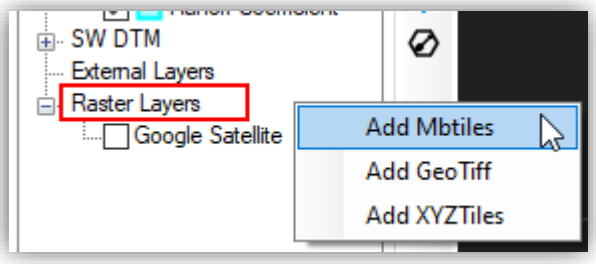


9.3.3 Terrain model from Drone Survey

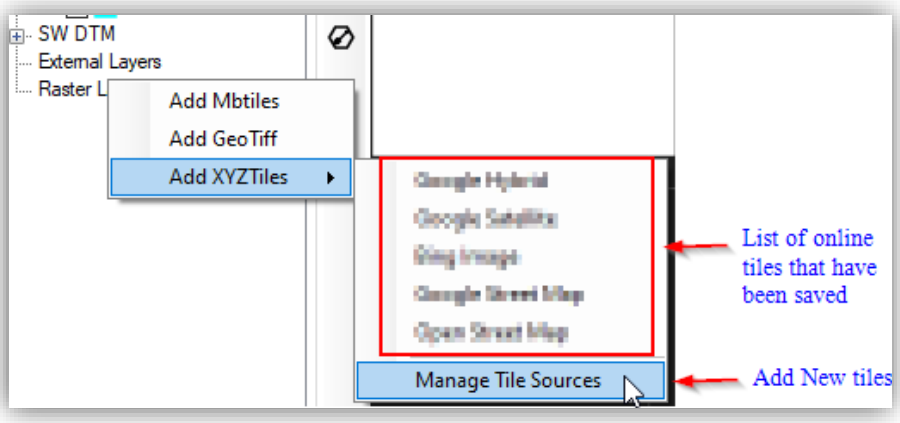
i. The terrain model obtained from the drone survey is in the form of a raster image (*.tif). Define the terrain model from DTM Menu>Terrain Model>Select File>Grid) and locate the DEM file.

ii. Draw Grid Model extent to identify the area with terrain model. (DTM menu>Terrain Grid<Show Grid Extents). This will draw a red rectangle which indicates that the data is available inside this rectangle.

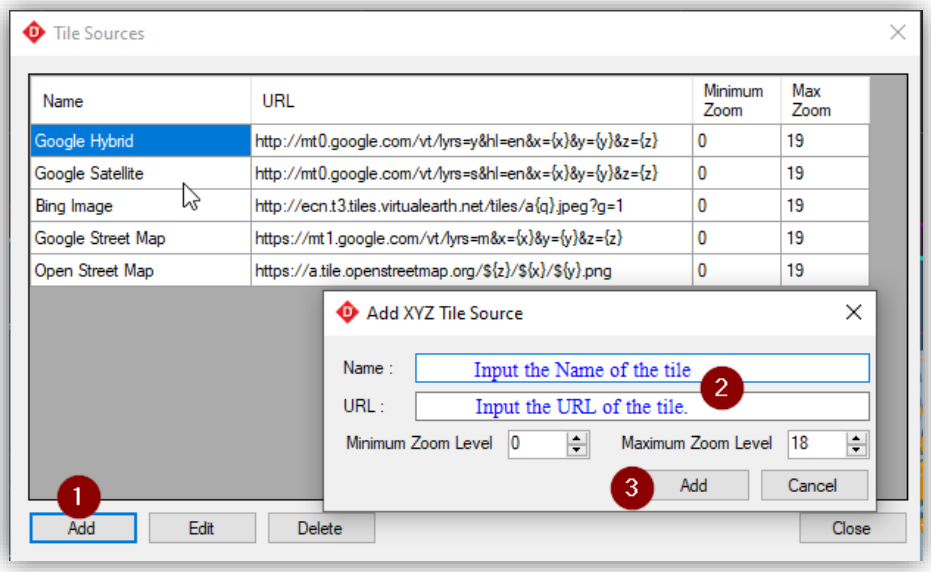
iii. Add a base map for reference. The base map may be drone imagery or satellite imagery. Raster imagery can be added from the Layers panel>Right click on Raster Layers> choose the suitable options from the list (Mbtiles, GeoTiff, XYZ tiles).



iv. If the offline tile is not available we can add online tiles from XYZ tiles. (Layers panel>Right click on Raster Layers>Add XYZTiles>Manage Tile Souce)

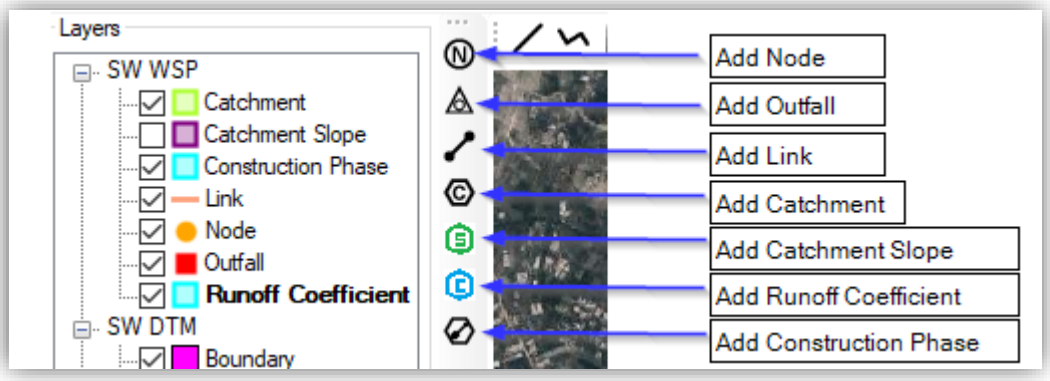


v. Manage Tile Source will open new dialogue box.



vi. We have to provide the name of the tile, URL link for tile and maximum zoom level. Then it will be saved in the list. (Eg: the URL link for google satellite image is "http://mt0.google.com/vt/lyrs=s&hl=en&x={x}&y={y}&z={z}".

9.4 Prepare Drainage Network



9.4.1 Add Node

Add the node at every bend using the Design Toolbar. If the drain is covered pipe network, the node indicates the position of the manhole.

9.4.2 Add Outfall

Similarly, add an outfall at the end of the manhole.

9.4.3 Add Link Joining the Node

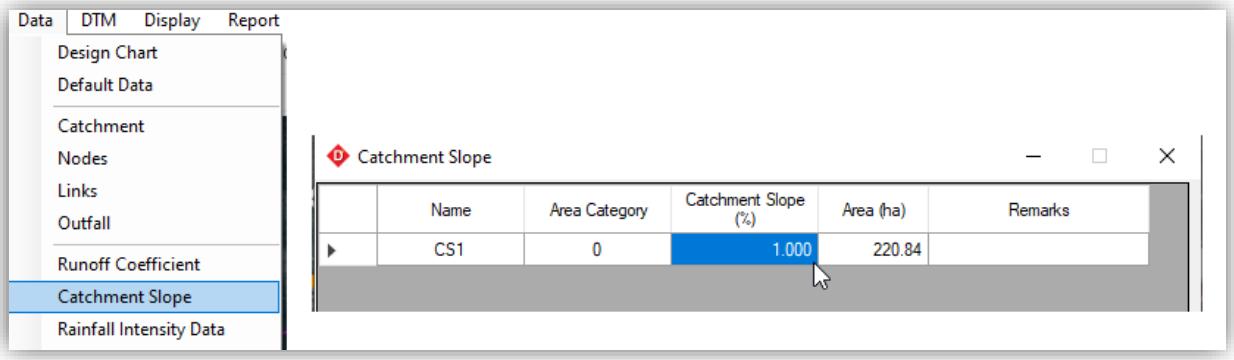
Connect the manholes with the link. The link should start from one manhole and ends at another consecutive manhole or outfall. Each link should not connect more than two manholes (link can not continue after the second manhole. So right-click will end a link and start to draw another link from the same manhole.

9.4.4 Draw Catchment Area

Based on the slope of the land, define the catchment of each node. One node can not have multiple catchments and one catchment can not have multiple nodes.

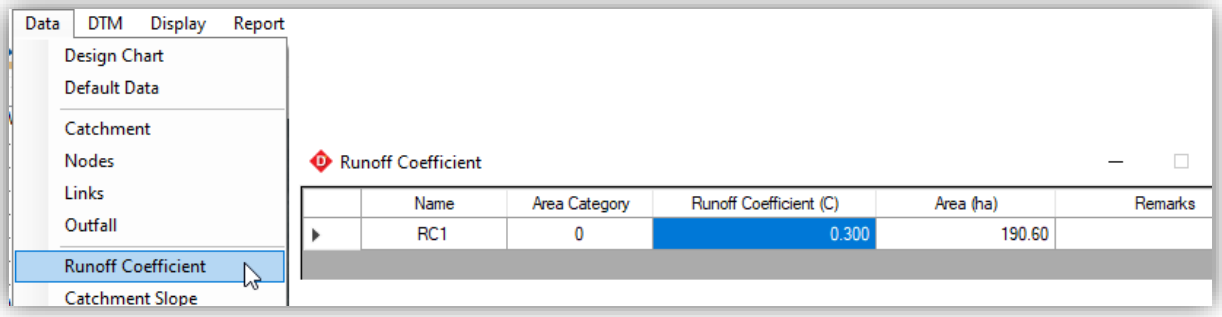
9.4.5 Define Catchment Slope

Based on the slope of the land, draw a polygon that has some uniform catchment. If the ground has a different type of slope at various places, then draw multiple catchment slopes, one polygon for each slope value. After drawing the slope polygon, open Menu>Data>Catchment Slope to input the value of the catchment slope.



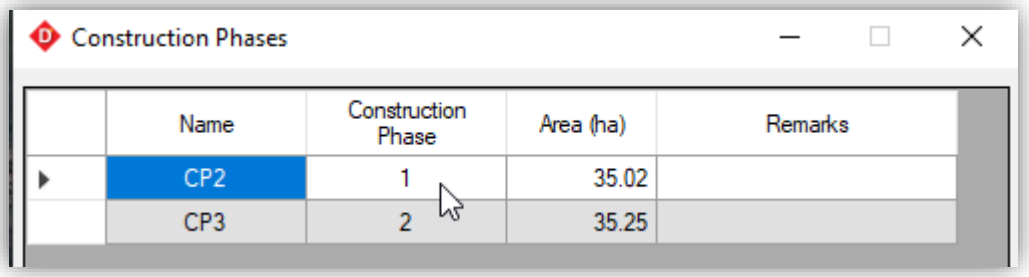
9.4.6 Define Runoff Coefficient

Similarly, do the same as catchment slope. This time draw polygon based on the type of landuse. Delineate the area for forest, road, cultivated land, settlement, etc. After delineating, input the value of runoff coefficient for each type of landuse from Menu>Data>Runoff Coefficient.



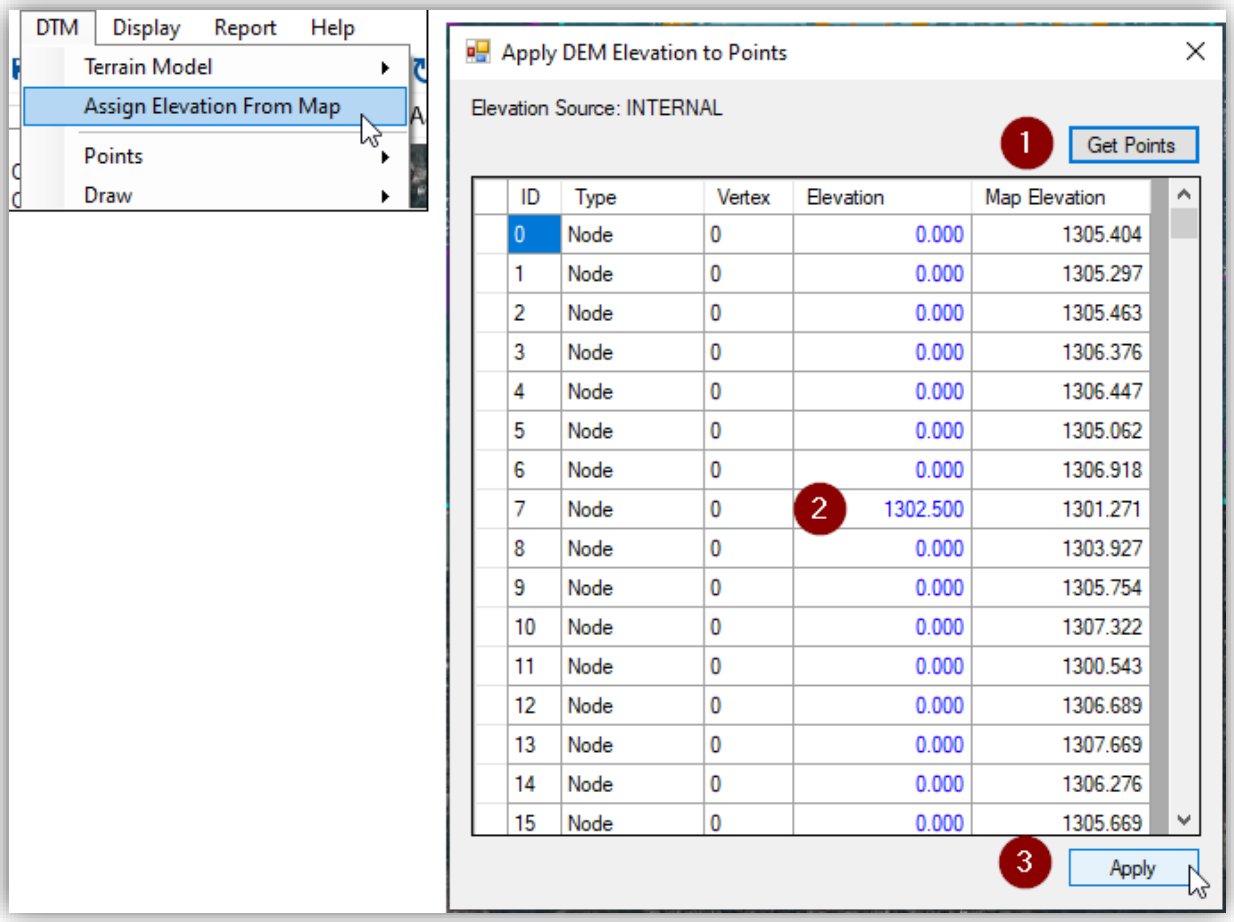
9.4.7 Define Construction Phase

When the construction of the drainage is to be done in multiple phases, we can define the area for different phases. For this, we have to delineate the area by drawing polygons for different phases. Then define the phases from Menu>Data>Construction Phase. So if we do not define the phases, it is considered as only one phase.



9.5 Assign Elevation from Map

After drawing all the nodes, link and catchment, we assign elevation of the node from the terrain model.



Pressing on “Get Points” will collect the elevation of all the nodes from the map. If we want to overwrite the elevation, we can manually input it in the “Elevation” column and apply it.

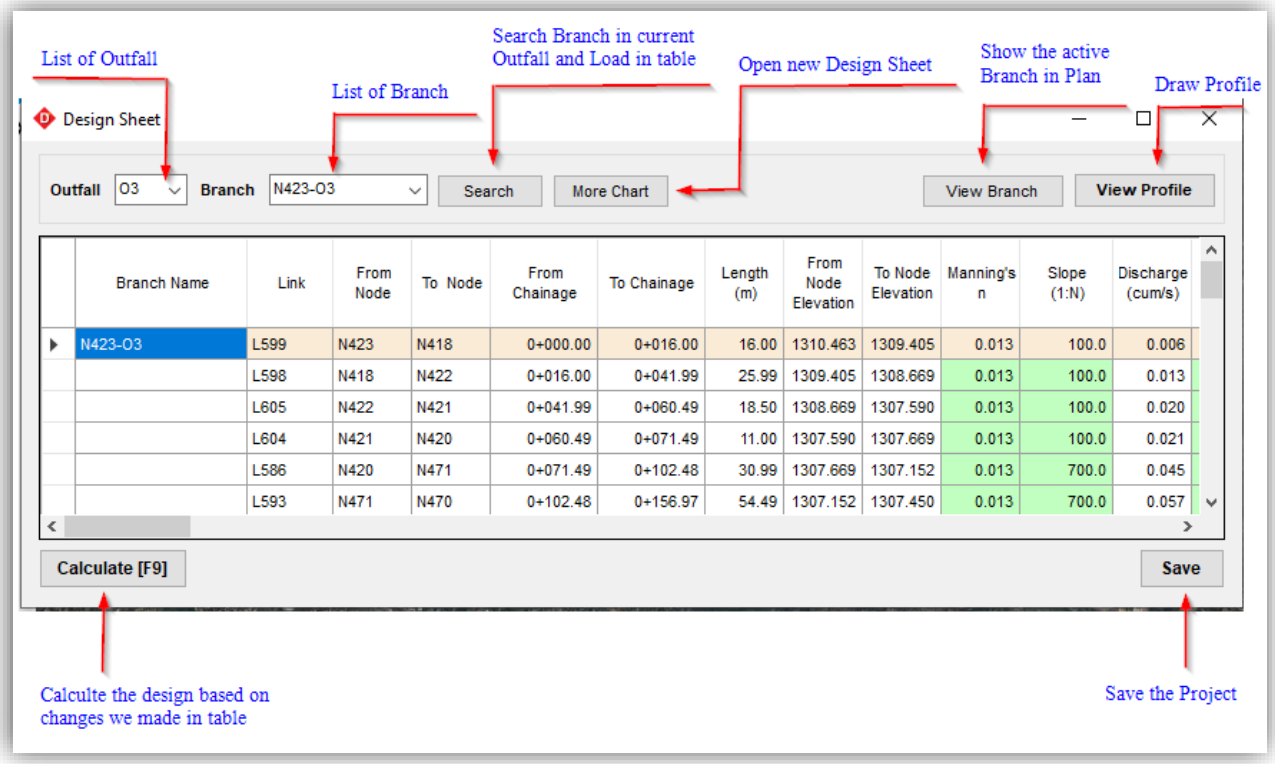
9.6 Compute All

After assigning the elevation, compute all will compute the area of catchment, check the network, etc.

9.7 Design Chart

It is the table for the hydraulic design of the drain. It can be opened from Menu>Data>Design Chart.
In the Design Sheet, the green filled cells are editable and the rest of the cells are non-editable. Red coloured texts are those values that do not satisfy the design criteria. It can be observed in Velocity, Cover/Freeboard, Invert Level Difference for Link1 and Invert Level Difference for Link 2.
Design can be done by two methods.

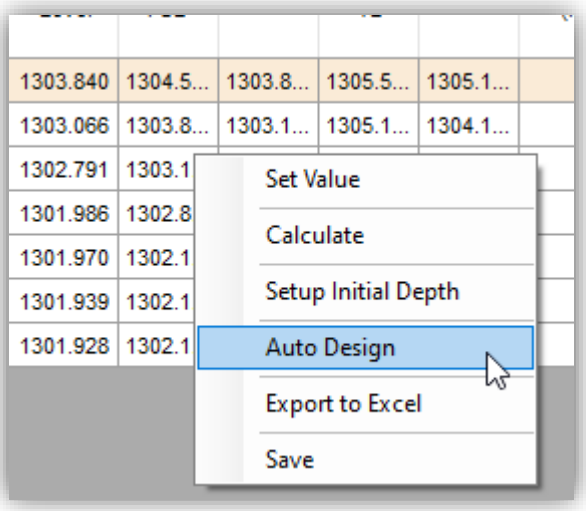
1. Auto Design
2. Manual Design



Branch Name	Link	From Node	To Node	From Chainage	To Chainage	Length (m)	From Node Elevation	To Node Elevation	Manning's n	Slope (1:N)	Discharge (cum/s)
N423-O3	L599	N423	N418	0+000.00	0+016.00	16.00	1310.463	1309.405	0.013	100.0	0.006
	L598	N418	N422	0+016.00	0+041.99	25.99	1309.405	1308.669	0.013	100.0	0.013
	L605	N422	N421	0+041.99	0+060.49	18.50	1308.669	1307.590	0.013	100.0	0.020
	L604	N421	N420	0+060.49	0+071.49	11.00	1307.590	1307.669	0.013	100.0	0.021
	L586	N420	N471	0+071.49	0+102.48	30.99	1307.669	1307.152	0.013	700.0	0.045
	L593	N471	N470	0+102.48	0+156.97	54.49	1307.152	1307.450	0.013	700.0	0.057

9.7.1 Auto Design

Auto Design is a quick method to design. It plays with the longitudinal slope of the drain, drain size and drop to satisfy the minimum cover or freeboard to the drain to complete the design. Though it is quick, it may not be the economical and perfect design.
For the Auto Design, load the design sheet and right-click on the data. Click on “Auto Design”. Then the design will be done by the program.

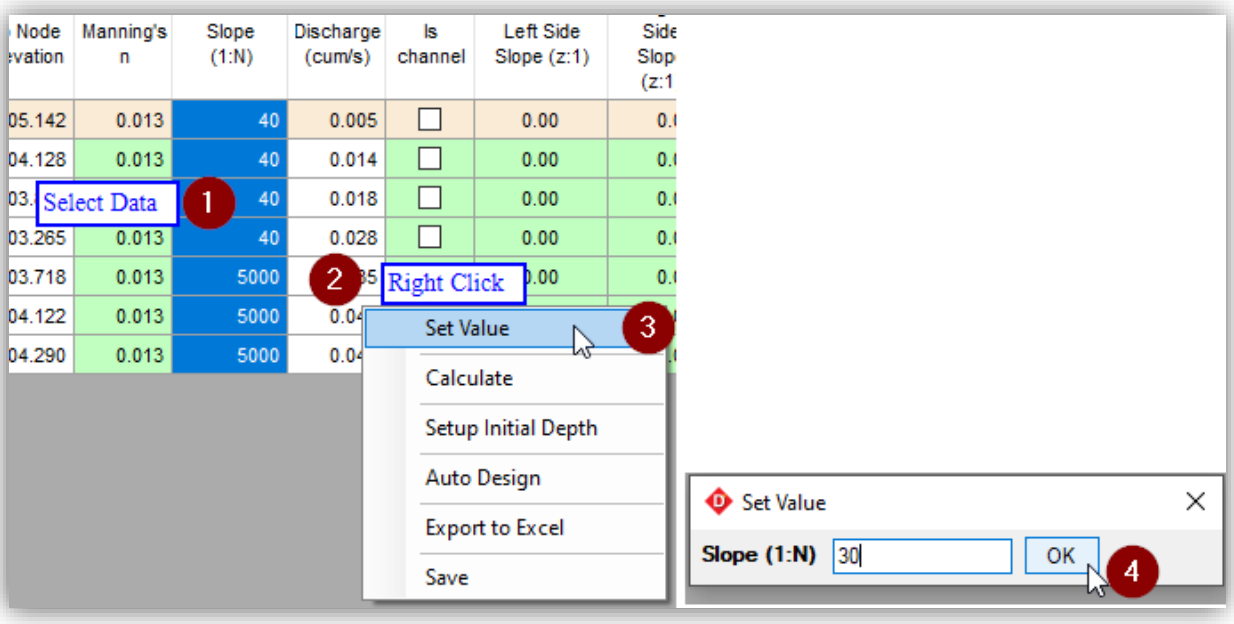


9.7.2 Manual Design

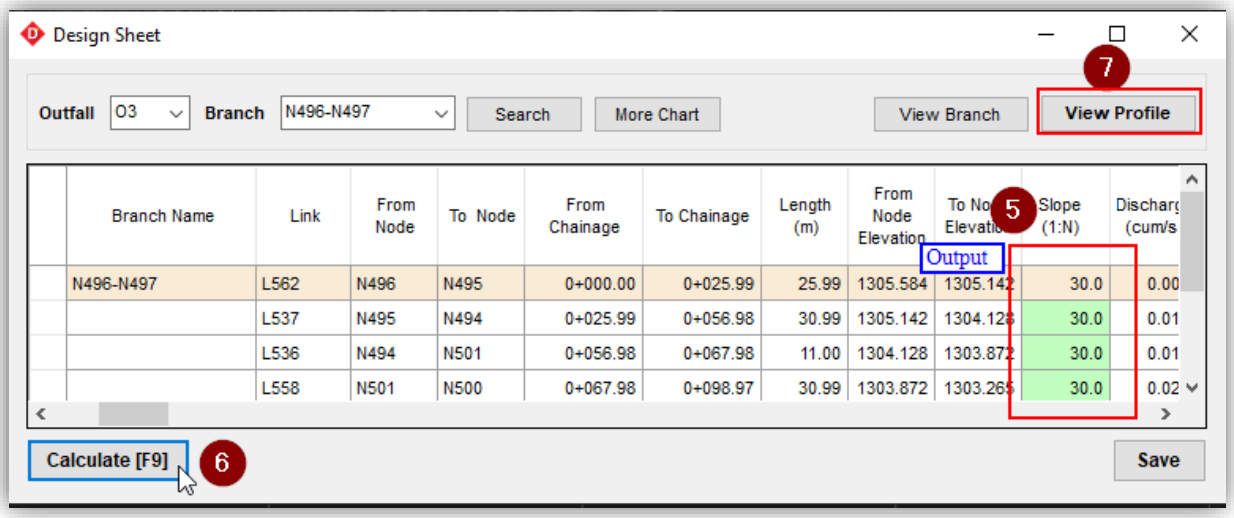
Manual design is done by playing with the longitudinal drain slope, size of drain and vertical drop in the longitudinal drain.

i. The design starts with the minimum size of the drain. If we are using pipe drain, the minimum size of drain defined in Menu>Data>Default Data>>Minimum Diameter of pipe will be used.

ii. Assign some slope in the “Slope” column so the status does not show the “Increase Dia” message.

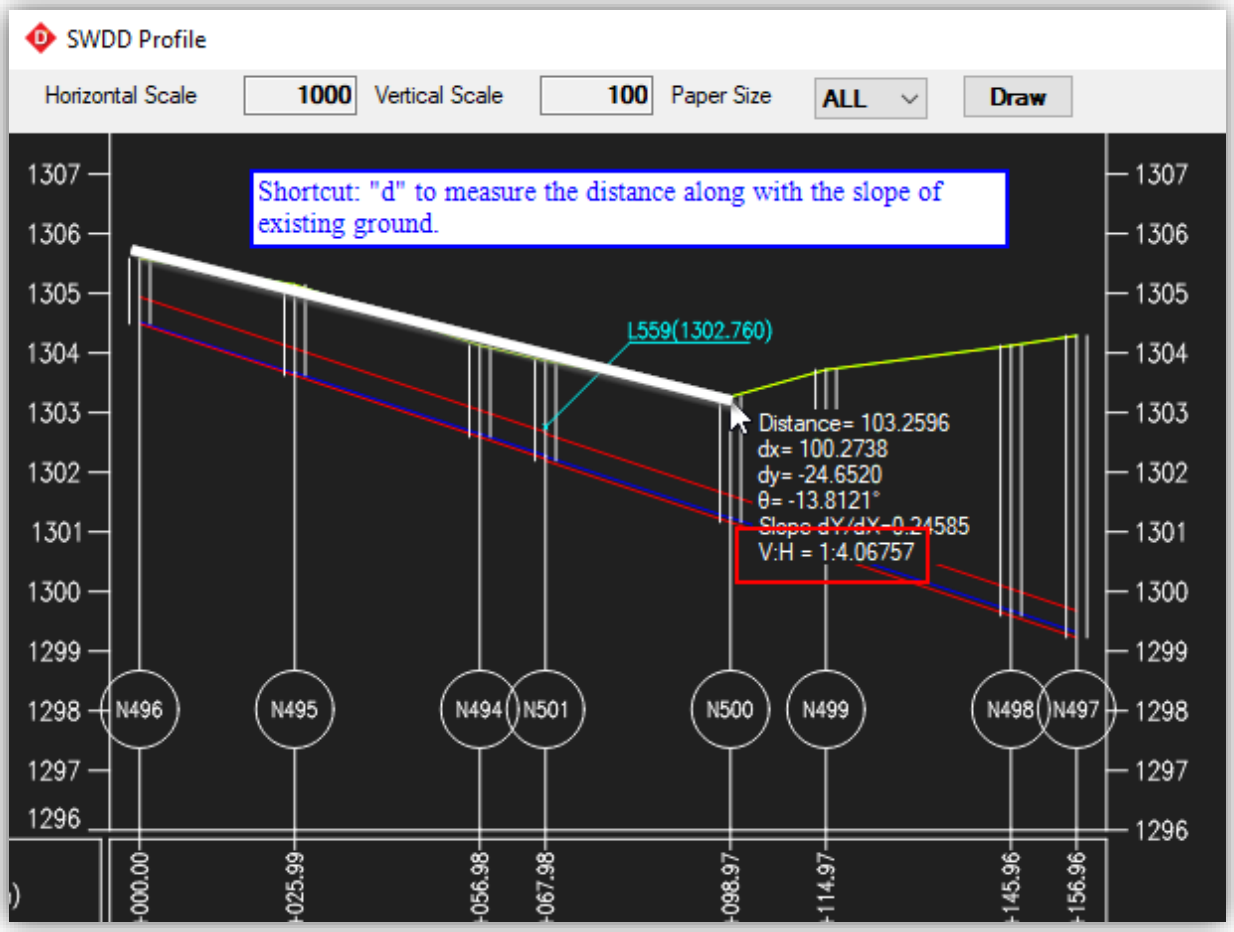


iii. After Assigning slope to all the rows, click on “Compute” (Shortcut: **F9**) to re-calculate the design.



iv. Then click on “View Profile” to check the profile of the drain.

v. Shortcut: d to measure the distance along with the slope of existing ground. In this example: V:H=1:4.06757. The ratio of the Horizontal and vertical scale is 1000/100=10. So appropriate Scale is 4.06757x10=40.....So set the slope equals 40 in this range and Compute again.



vi. After computing, check the sufficiency of pipe size. If the size is not sufficient, increase the size of the drain. (If it is RCC Pipe, Available pipe sizes are **150, 200, 225, 250, 300, 350, 400, 450, 500, 600, 700, 750, 800, 900, 1000, 1200 & 1500 mm).** If the size of the drain is changed, apply the drop by the difference in size and Compute (F9).

vii. If the size of the drain is already a maximum allowable and can not be increased, then increase the slope of the drain to increase the discharge capacity of the drain.

viii. Check the cover/freeboard. If it is not sufficient, add a drop for sufficient cover and Compute (F9).

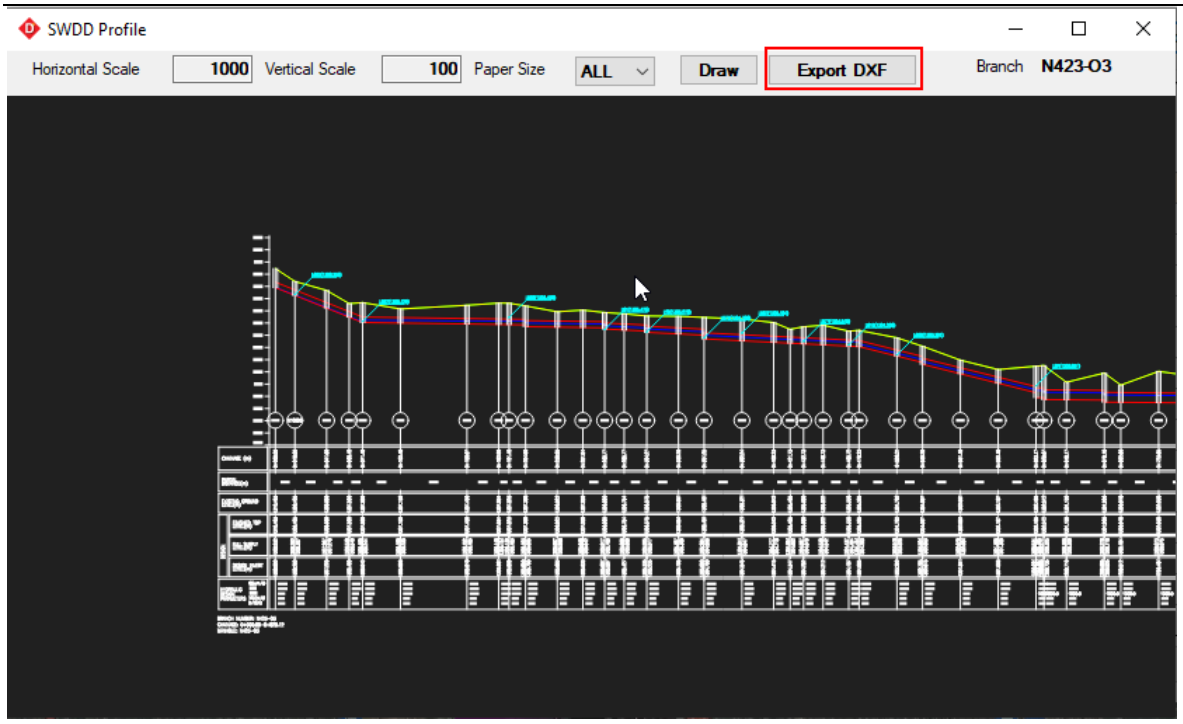
ix. Check the Inlet Level Difference for Link 1 and 2. If it is below the invert level of the bed (Red coloured text), add a drop to make it above the invert level and Compute (F9).

x. Repeat the procedure for the next stretch from step 4.

xi. After completing this branch select the next branch and repeat all the steps.

9.8 Export Drawing

After completion of the design, the plan of the design network can be exported from Menu>File>Export>Autocad Dxf or Google Earth Kml or Shapefile. Then the plan can be composed in Autocad or any GIS Software. Kml file can be used for viewing the plan in Google Earth.
Similarly, the longitudinal profile can be exported from profile view>Export Dxf.


SWDD Profile
Horizontal Scale
1000
Vertical Scale
100
Paper Size
ALL
Draw
Export DXF
Branch
N423-O3