



CIVIL 3D 2018

Maryland Training Session #4
Surfaces

Surfaces

A surface is a three-dimensional geometric representation of an area of land, or, in the case of volume surfaces, is a difference or composite between two surface areas

Surfaces are made up of triangles or grids, which are created when AutoCAD Civil 3D connects the points that make up the surface data

To use a surface in your drawing, you can create an empty surface and then add data to it. You can also import existing files containing surface information, such as LandXML, TIN , or DEM files

Points or contours are usually a primary part of the original surface information and are supplemented with breaklines and boundaries

Boundaries define the visible area of a surface. Only the area within the boundary is included in calculations, such as for total area and volume. You can also define masks to hide or show parts of a surface for editing or presentation purposes, while still including that area in calculations

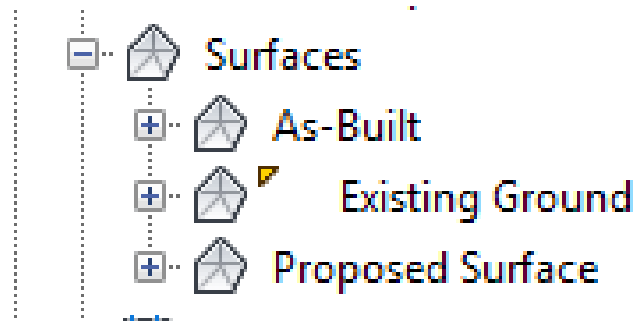
Breaklines are used on TIN surfaces to define linear features that triangles cannot cross, such as retaining walls or streams. Breaklines affect triangulation of the surface



Creating and Adding Data to a Surface

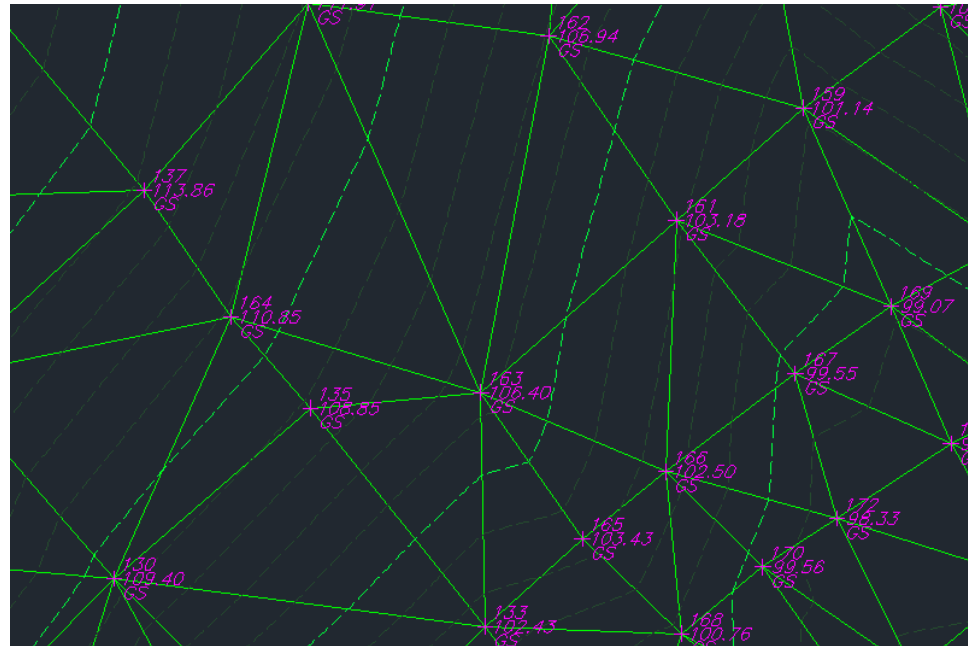
Creating and Adding Data to a Surface

- When you create a surface, its name is displayed in the Surfaces collection in Toolspace on the Prospector tab. From this location, you can perform other operations, such as adding data and editing the surface. When first created, the surface is empty, so it is not visible in the drawing.
- The MD Templates have been setup with 3 Surfaces:
 - Existing Ground – used for existing ground
 - Proposed – used for the proposed ground
 - As-Built – used for completed designs
- After data has been added to a surface, it becomes visible in the drawing in accordance with the display settings specified in the referenced surface style



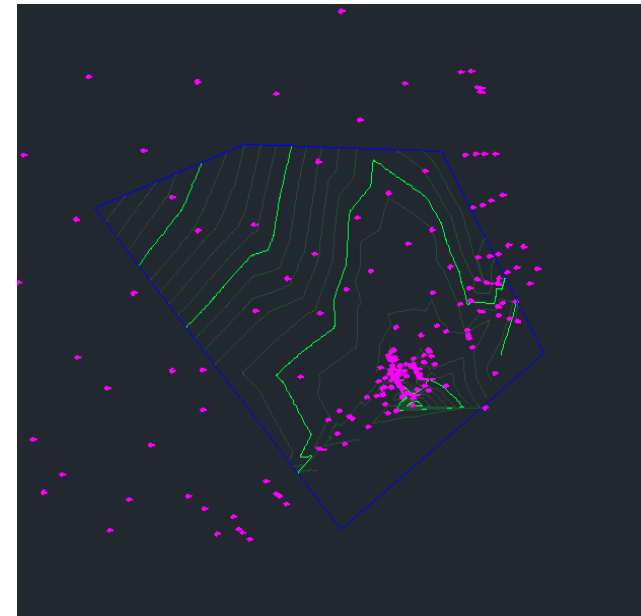
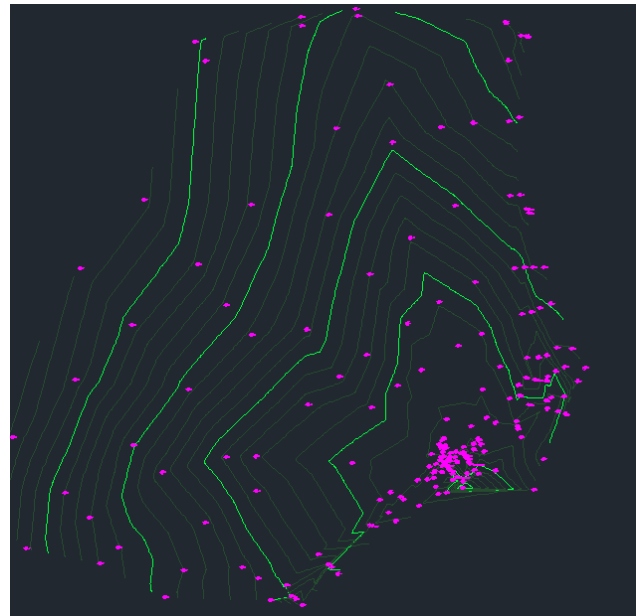
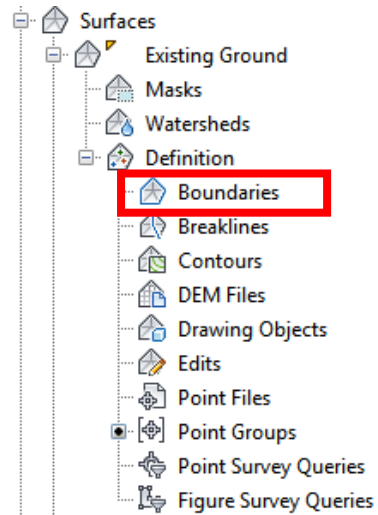
TIN Surfaces

- ▶ A TIN surface is composed of the triangles that form a triangulated irregular network. A TIN line is one of the lines that makes up the surface triangulation.
- ▶ To create TIN lines, AutoCAD Civil 3D connects the surveyed points that are closest together. The TIN lines form triangles. The elevation at any point in the surface is defined by interpolating the elevations of the vertices of the triangles that the point lies in.



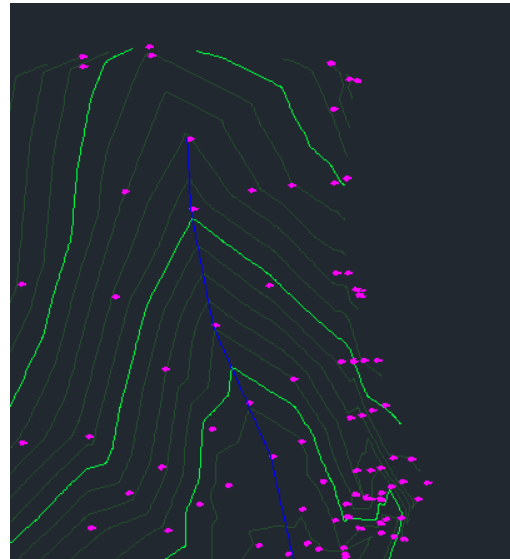
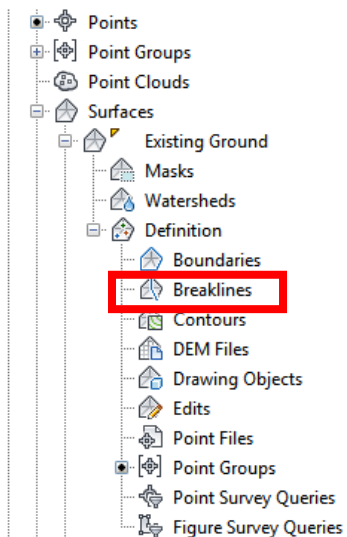
Boundaries

- ▶ Boundaries are closed polylines that affect the visibility of the triangles either inside or outside the polylines. An outer boundary defines the extents of the surface. All triangles inside the boundary are visible, and all triangles that are outside the boundary are invisible. Areas hidden by boundaries are not included in calculations, such as total area and volume.
- ▶ Surface boundaries are defined by selecting existing polygons in the drawing. The surface definition displays the numerical ID and a list of vertices for each boundary.



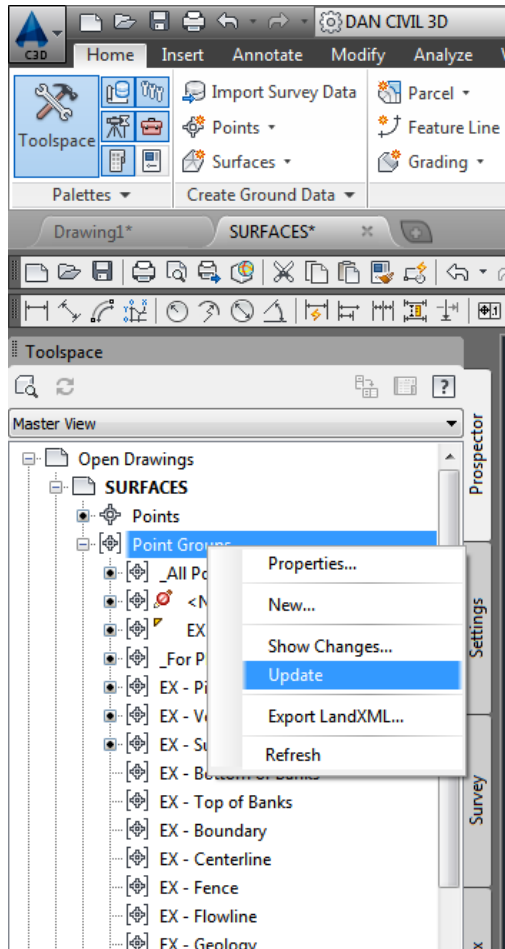
Breaklines

- ▶ Breaklines define linear surface features, such as retaining walls, curbs, tops of ridges, and streams. Breaklines force surface triangulation to run along the breakline; triangles do not cross a breakline.
- ▶ Breaklines are critical to creating an accurate surface model. Breaklines are important because it is the interpolation of the data, not just the data itself, that determines the shape of the model.
- ▶ You can use 3D lines or 3D polylines as breaklines. Each vertex on the polyline is converted to a TIN point with the same XYZ coordinates. For 3D lines, each line that you select is defined as a two-point breakline.

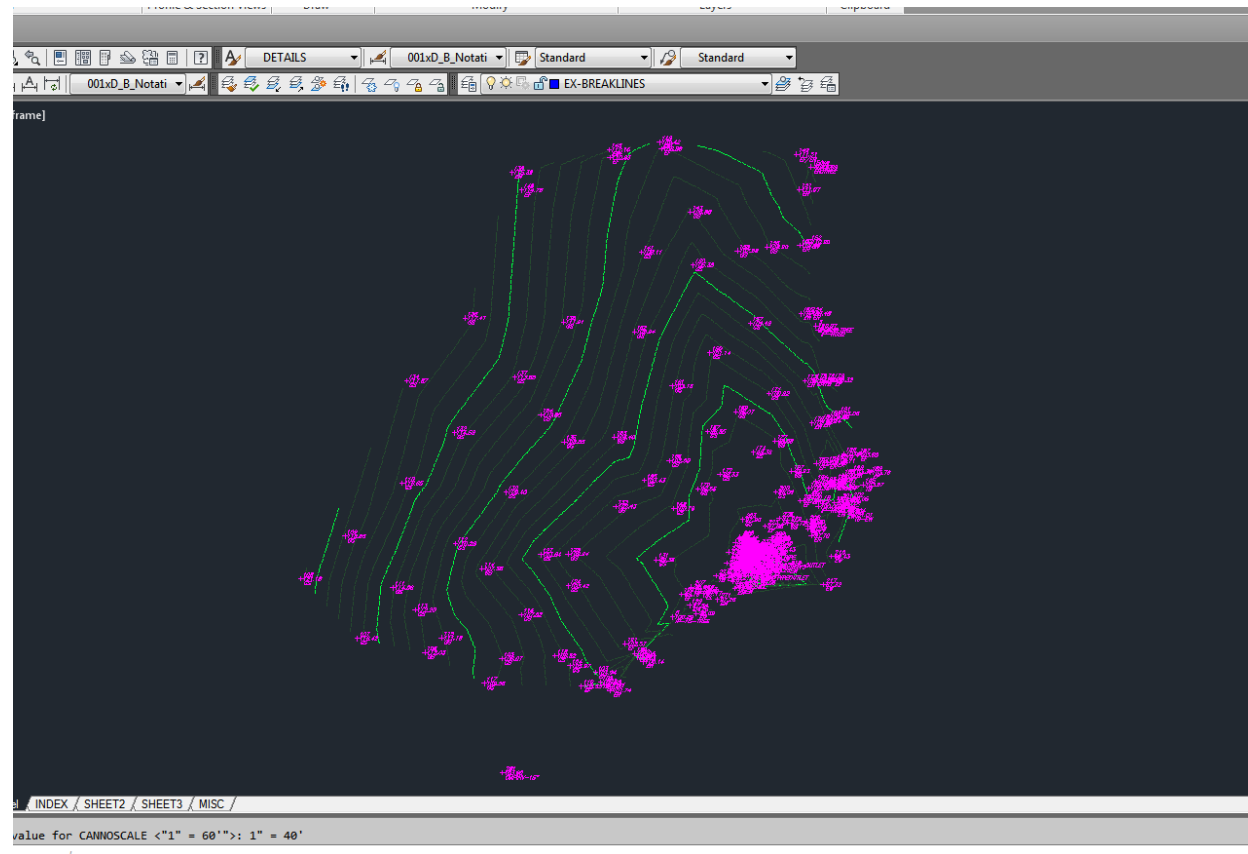


Creating a Surface

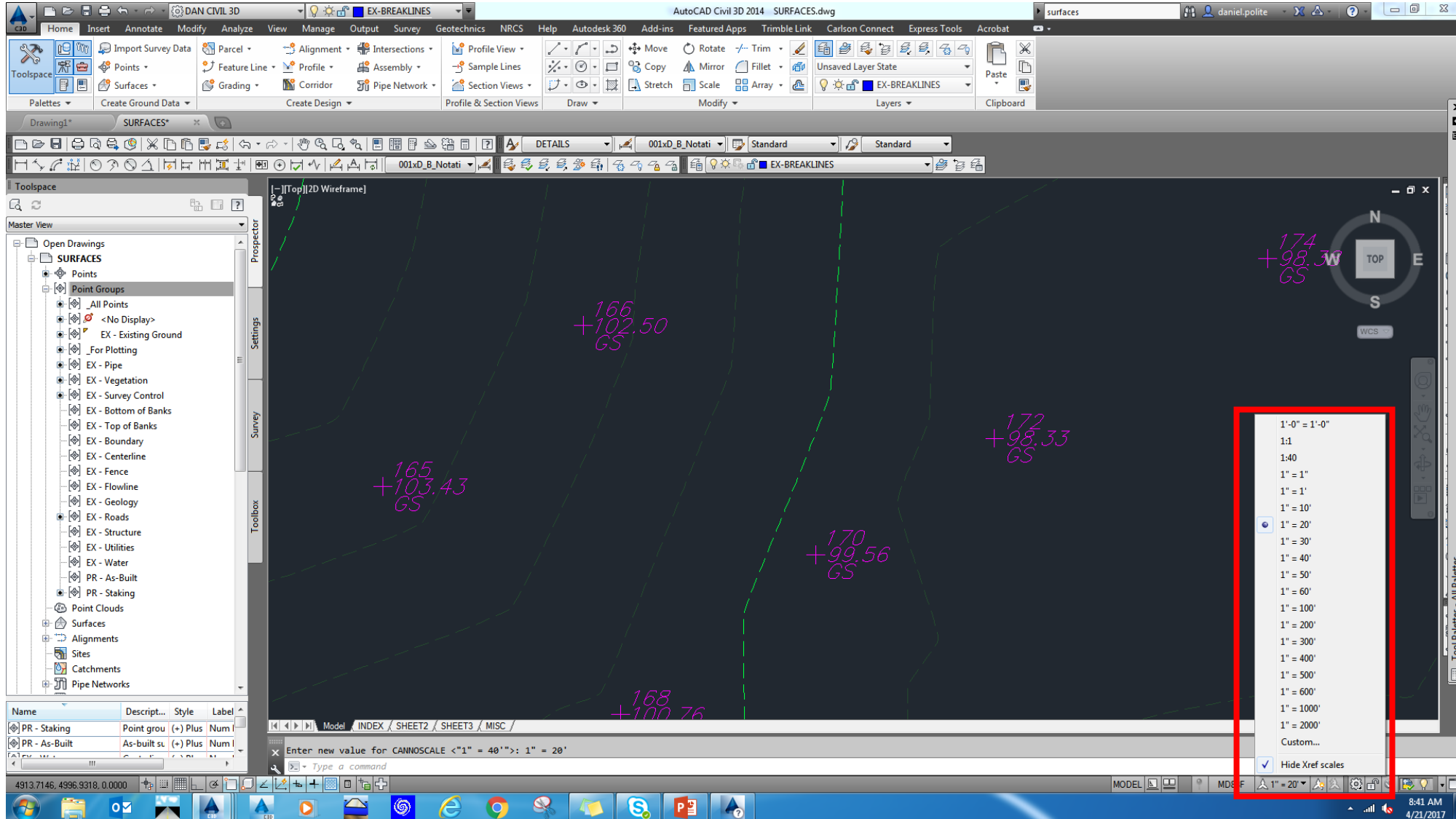
- ▶ Once you add your points into the drawing, you will have to update all the points in order for the surface to show



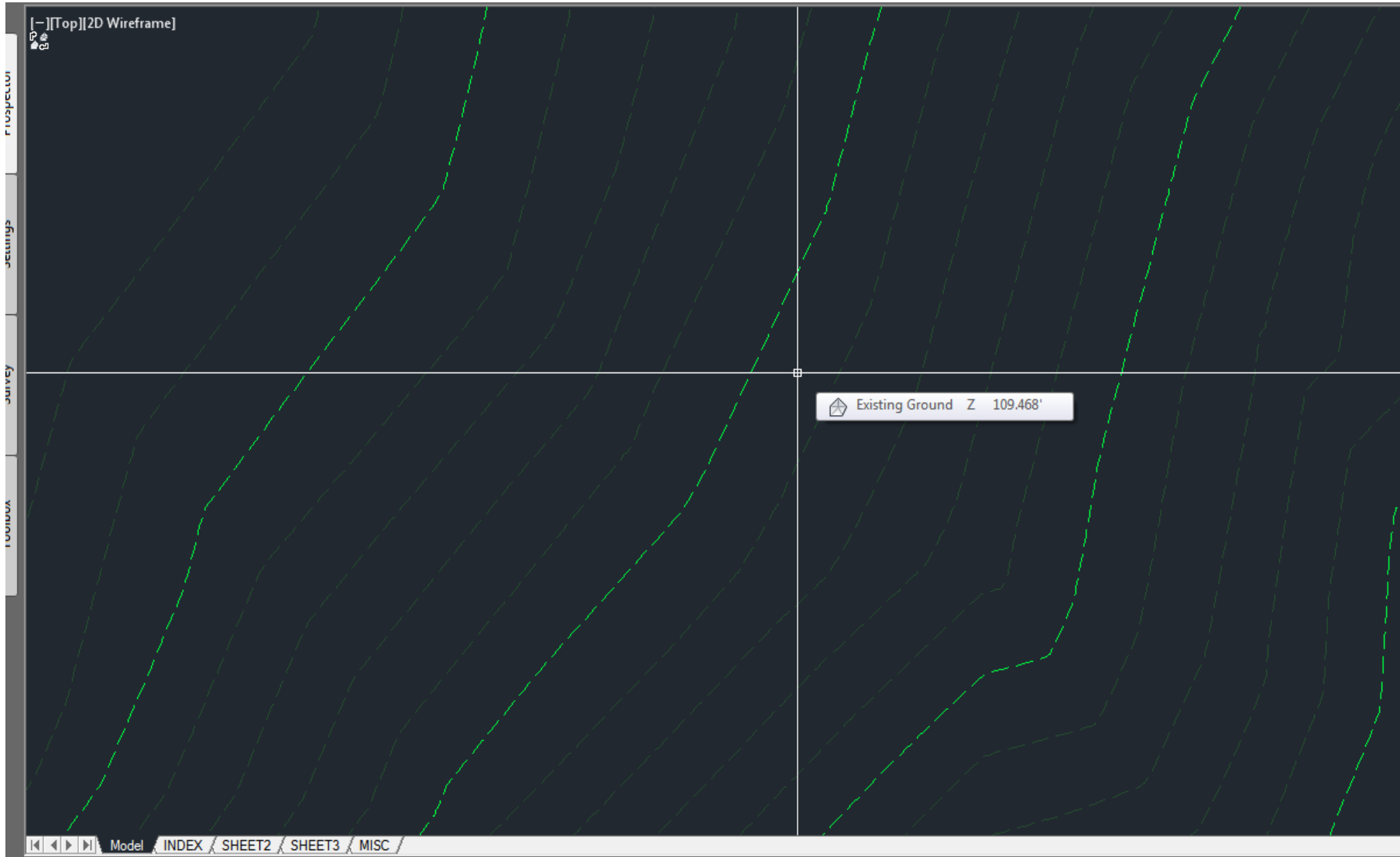
If you don't see anything on your screen...in the command line type ZE



▶ You can change the scale of the points so you can see them



- ▶ You can see any elevation in the surface that you created by just holding the mouse over a location



Surface Properties

Right Click on Existing Ground

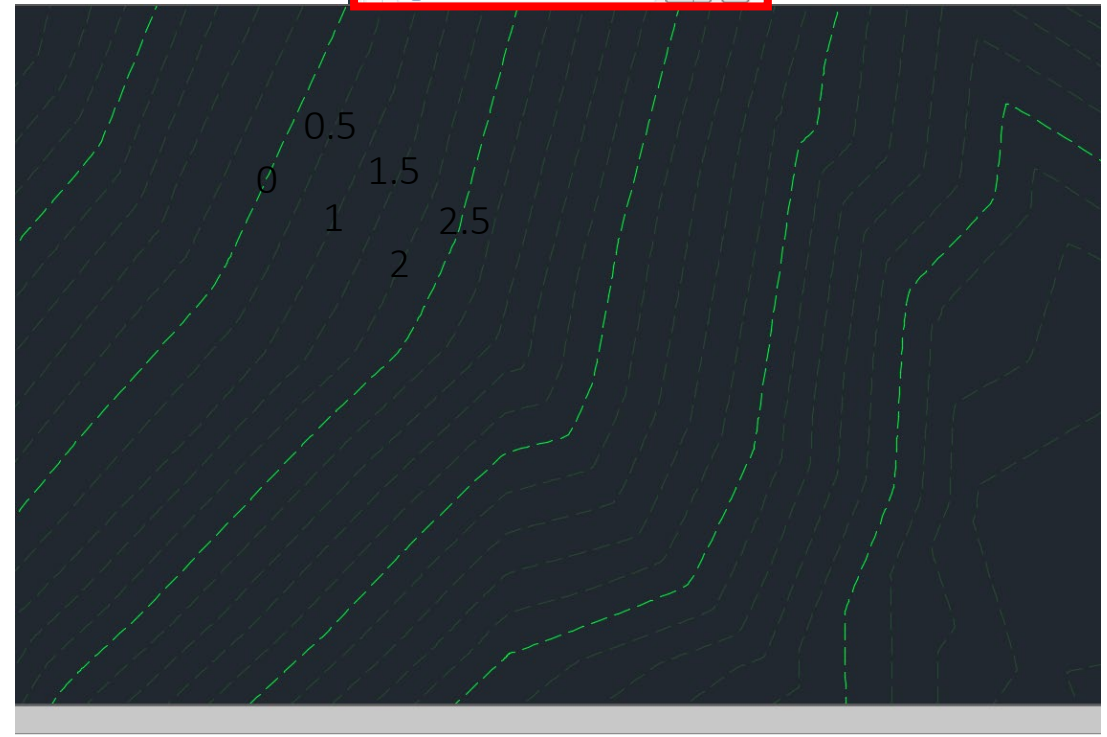
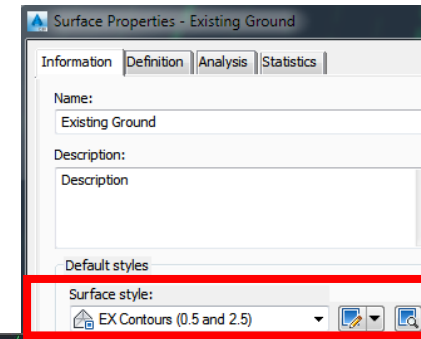
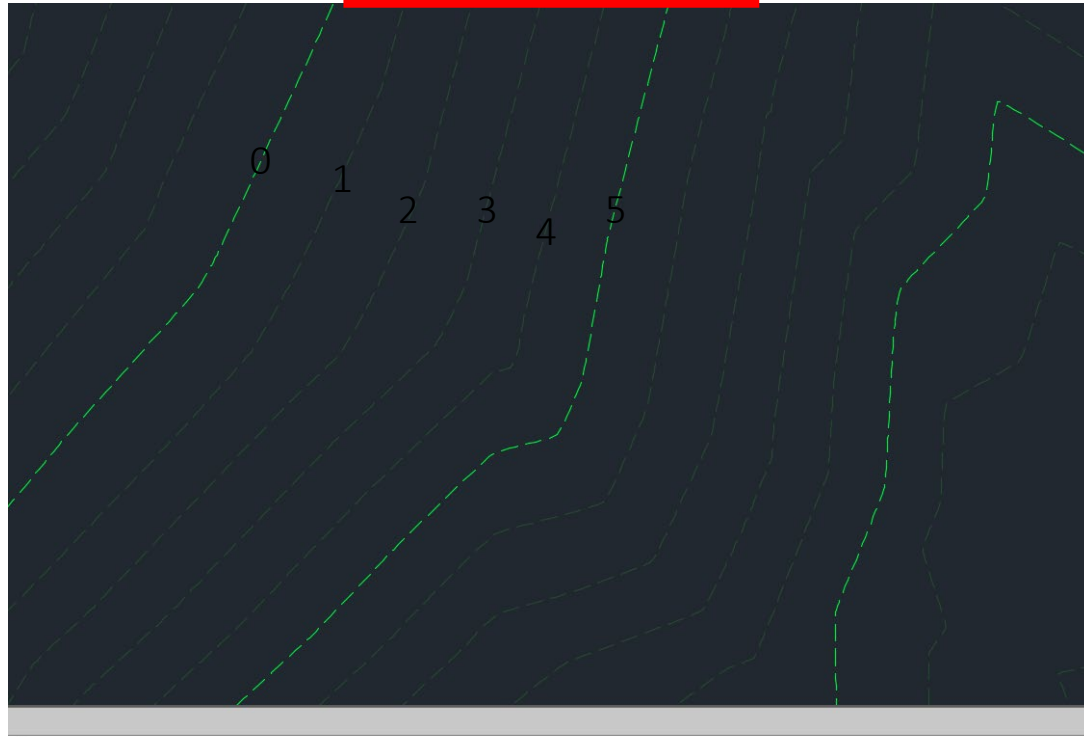
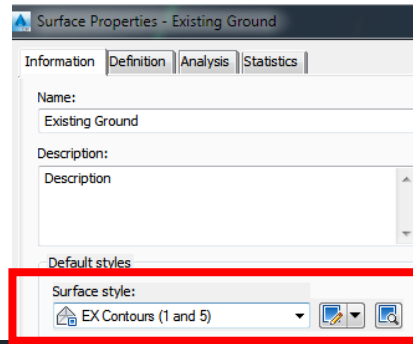
Name of the Surface

Surface Style

User may turn the contours on and off (_No Display) or change the contour intervals

The image illustrates the process of accessing and modifying surface properties. It shows the 'Toolspace' tree on the left with 'Existing Ground' selected. A context menu is shown with 'Surface Properties...' highlighted. The 'Surface Properties - Existing Ground' dialog box is open, showing the 'Name' field set to 'Existing Ground' and the 'Surface style' dropdown set to 'EX Contours (1 and 5)'. A detailed view of the 'Surface style' dropdown menu is shown on the right, listing various surface styles such as '_Border', '_Grid', '_No Display', '_Triangles', and various contour styles like 'Contours (1 and 5) and Triangles'.

Contour Intervals



Contour Labels

- **Single Contour Labels**

Use specified contour label to add single contour labels to a surface

- **Multiple Contour Labels**

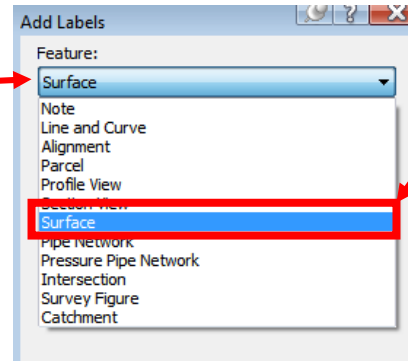
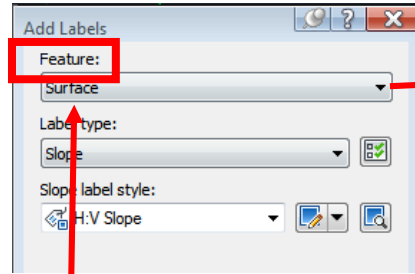
You can create contour labels by specifying line segments that cross contour lines of a surface. Use a line or polyline of an existing object as a label line or draw label lines on the fly for single or multiple contours.

- **Multiple Contour Labels at an Interval**

You can use specified contour labels to add multiple contour labels to a surface at a specified interval. Create contour labels by drawing a contour label line that crosses surface contours and specify the interval between the labels

Multiple Contour Labels

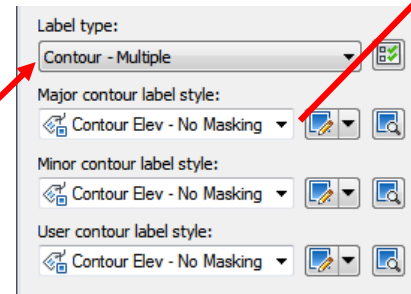
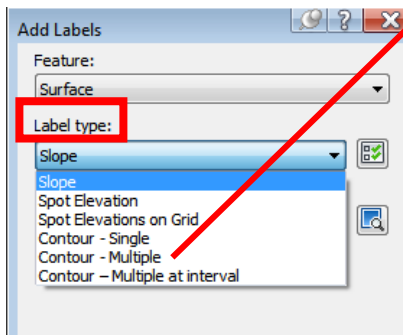
Feature



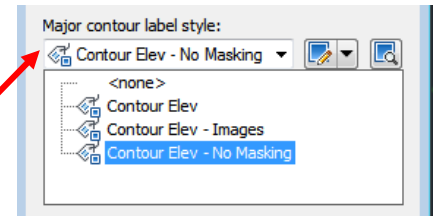
Select Surface from the drop down

Right Click on Existing Ground...Select Add Label

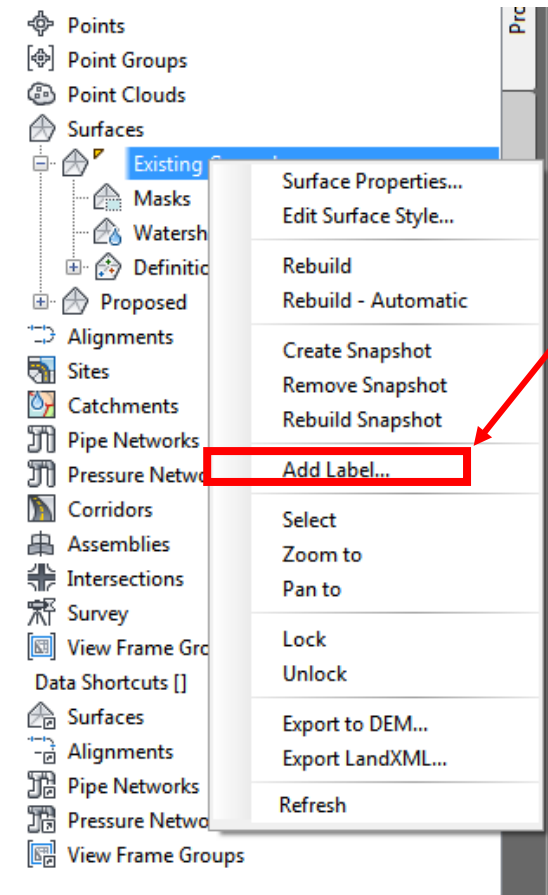
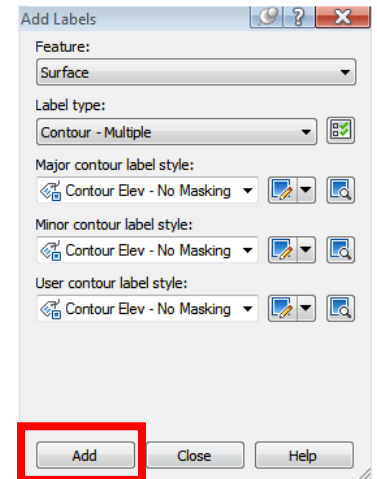
Label Type



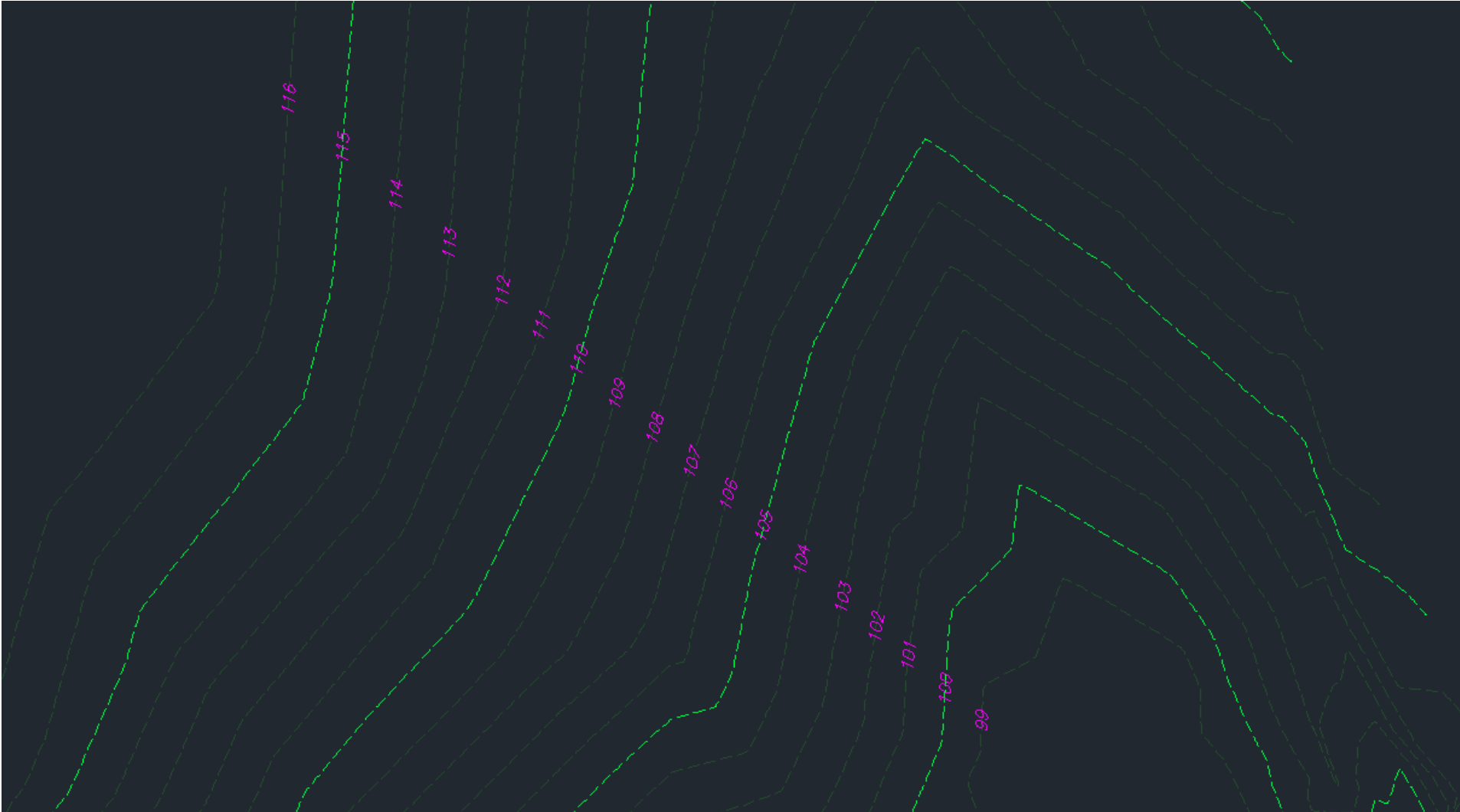
Select No Masking on all labels



Click Add

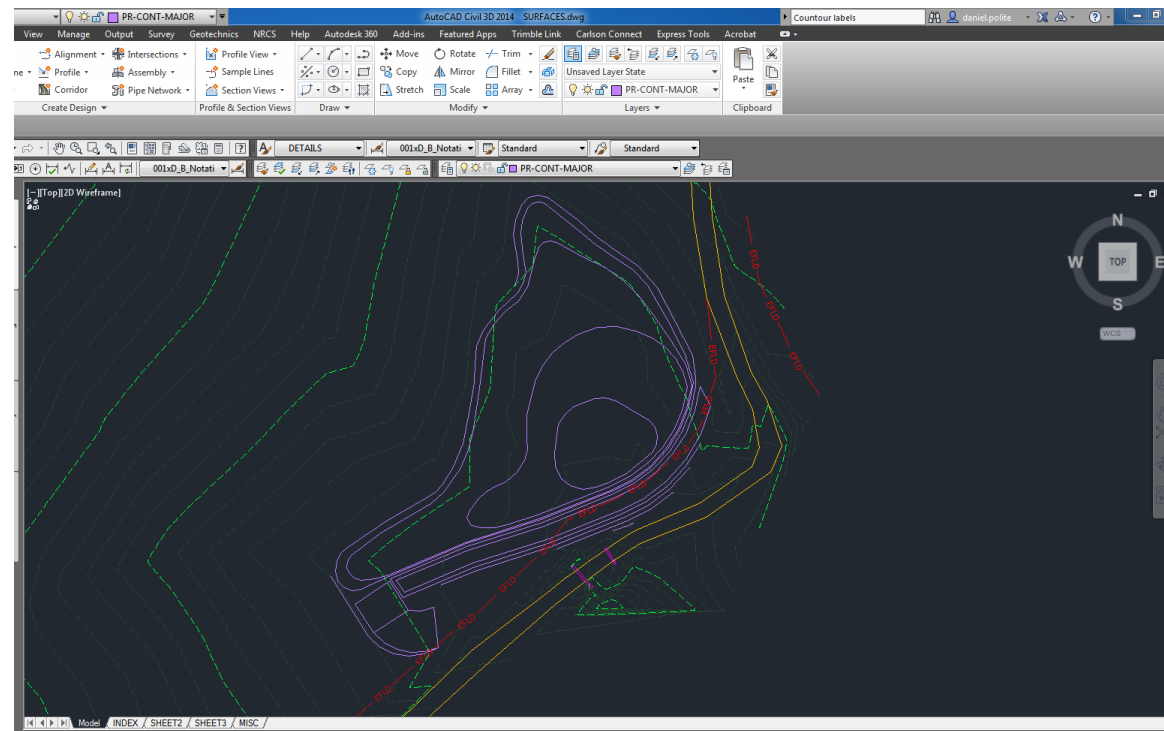


- ▶ Once you click Add...Select the Surface you want to add the labels to
- ▶ Select the first point and second point, contours will be labeled between the 2 points that you selected



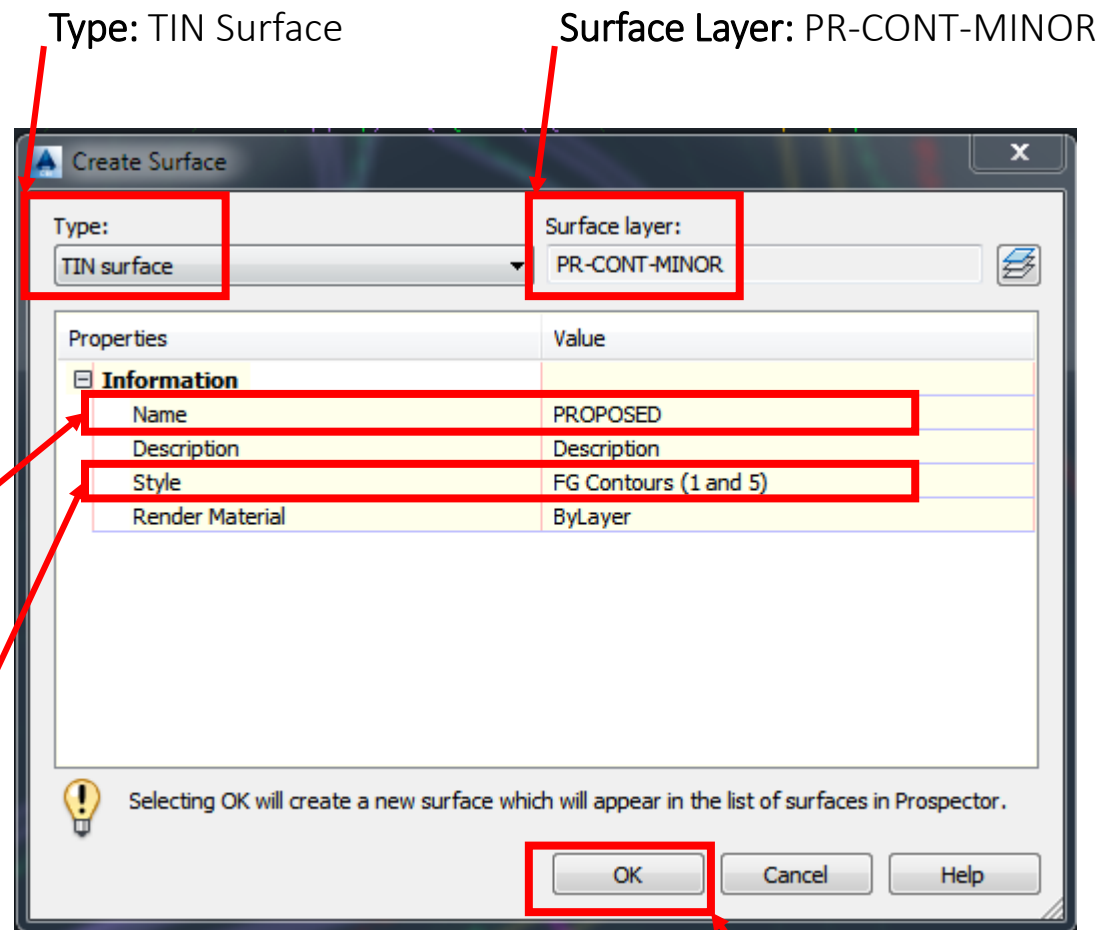
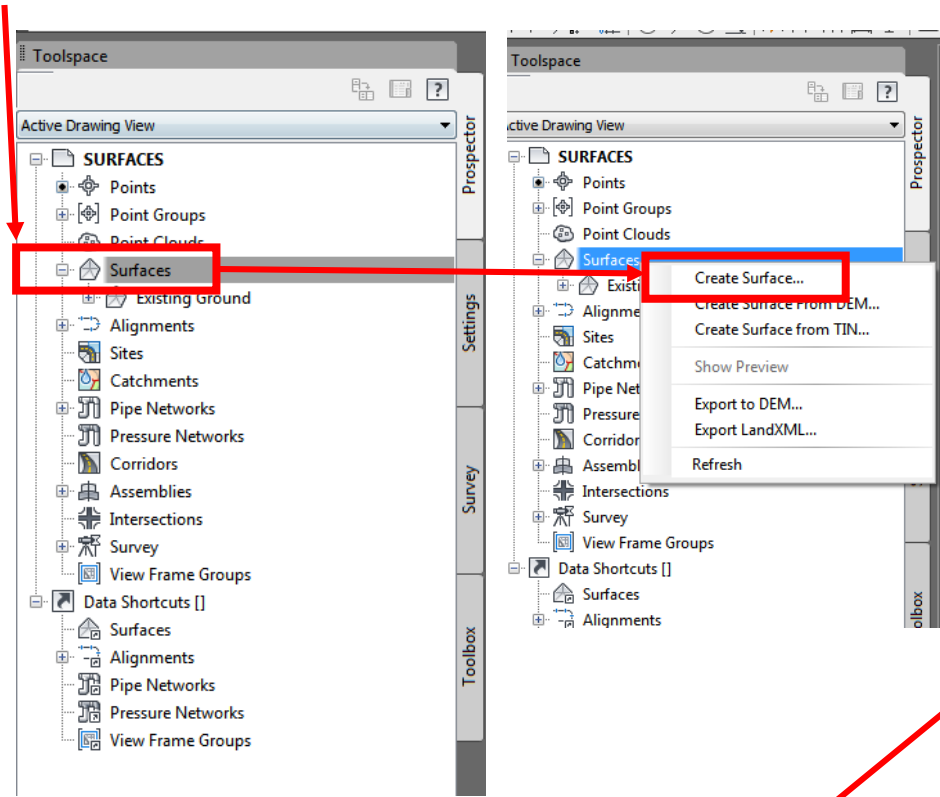
Creating a Proposed Surface

- ▶ The proposed surface is created by drawing polylines and assigning elevations to them (the same way that we have done in Carlson). Another way of doing this is by creating Feature Lines. We will learn about Feature Lines at a later date.
- ▶ The proposed surface will be used for Profiles and Cross Sections and also to calculate Cut/Fill amounts



Creating a Surface(not on a Template)

Toolspace>Surfaces>Right Click>Create Surface

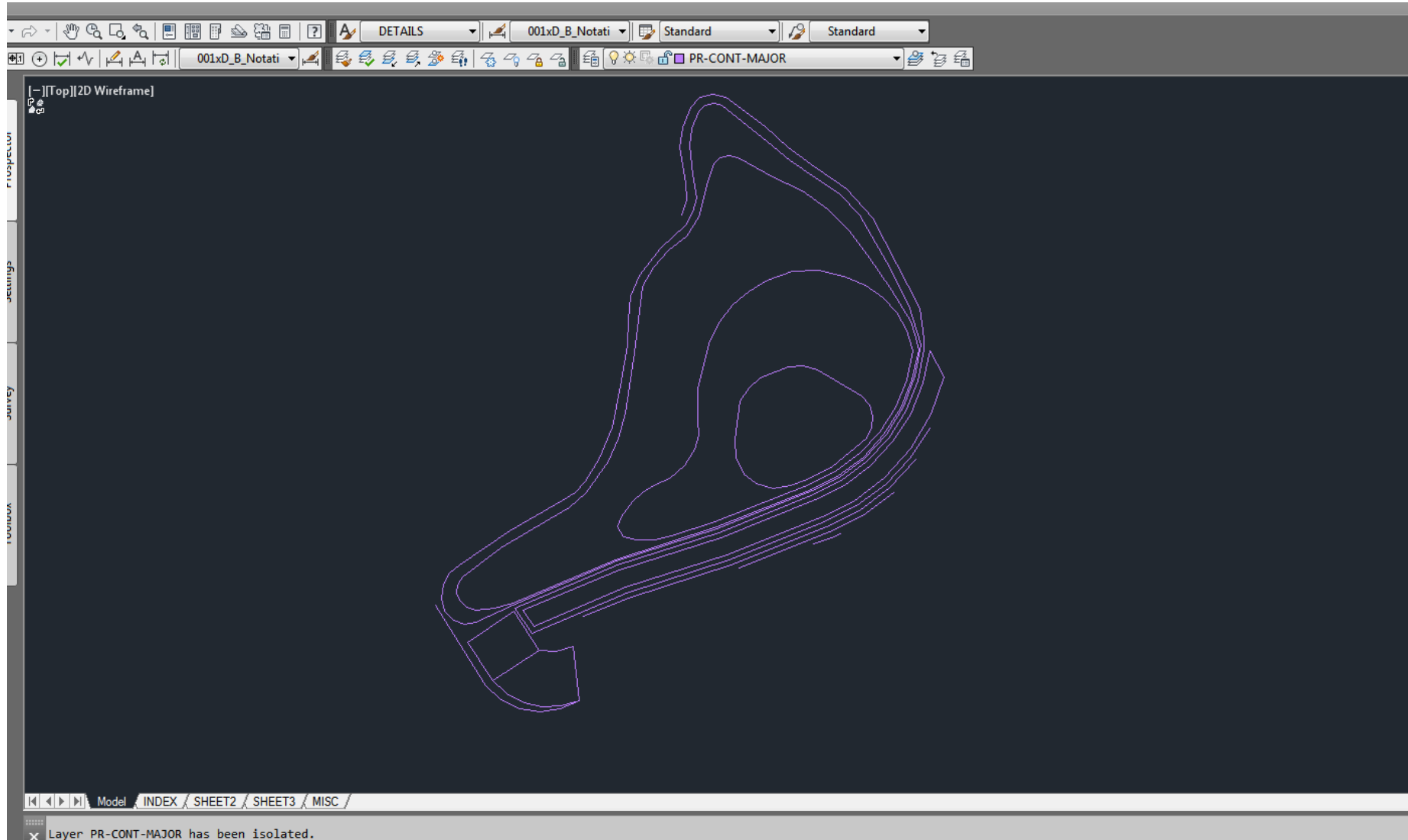


Name: Name the surface to what you want (usually PROPOSED is ok)

Style: Select FG Contours (1 and 5) (might have to select smaller intervals depending on the site)

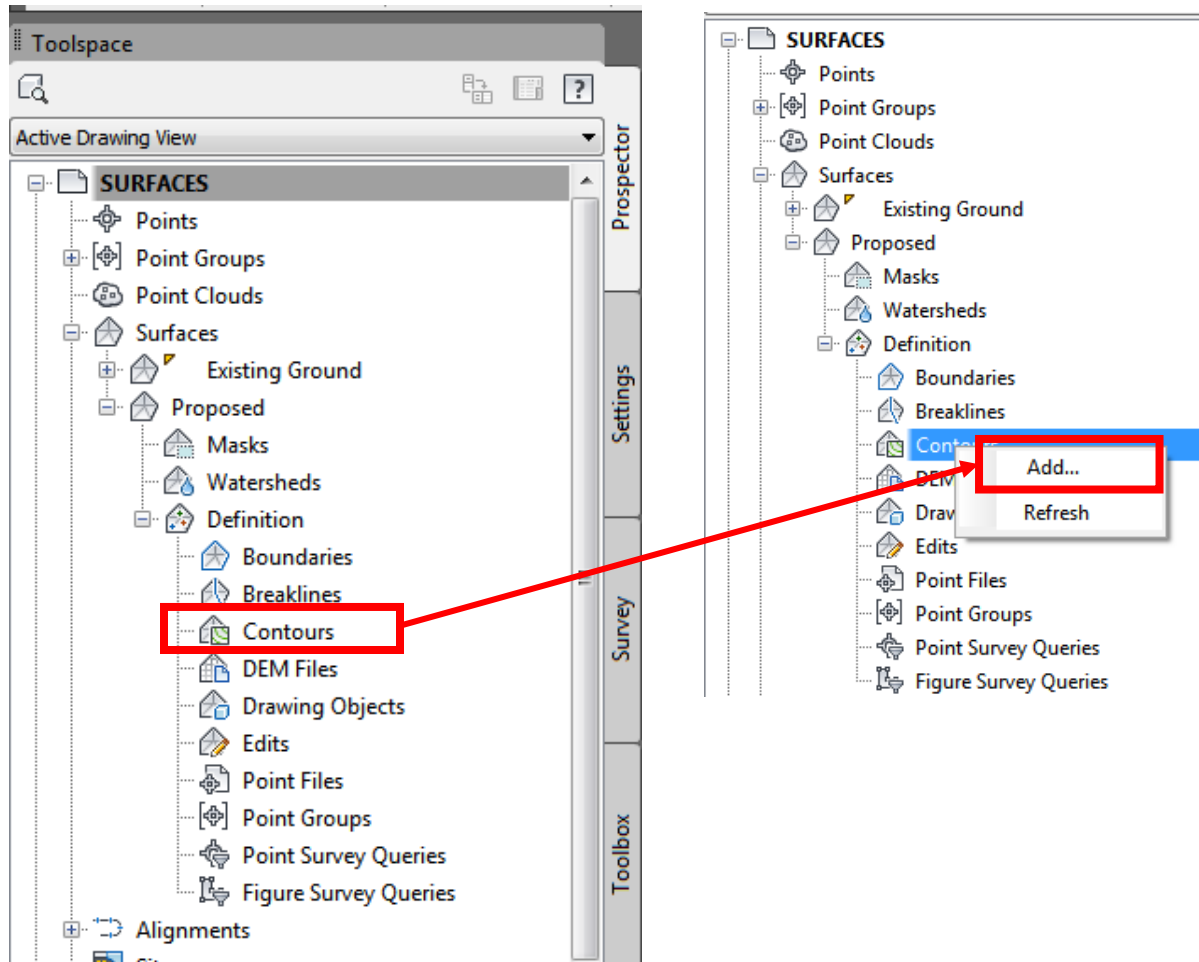
Click OK

- Isolate the proposed contours....Command Line>LAYISO>select the proposed contours

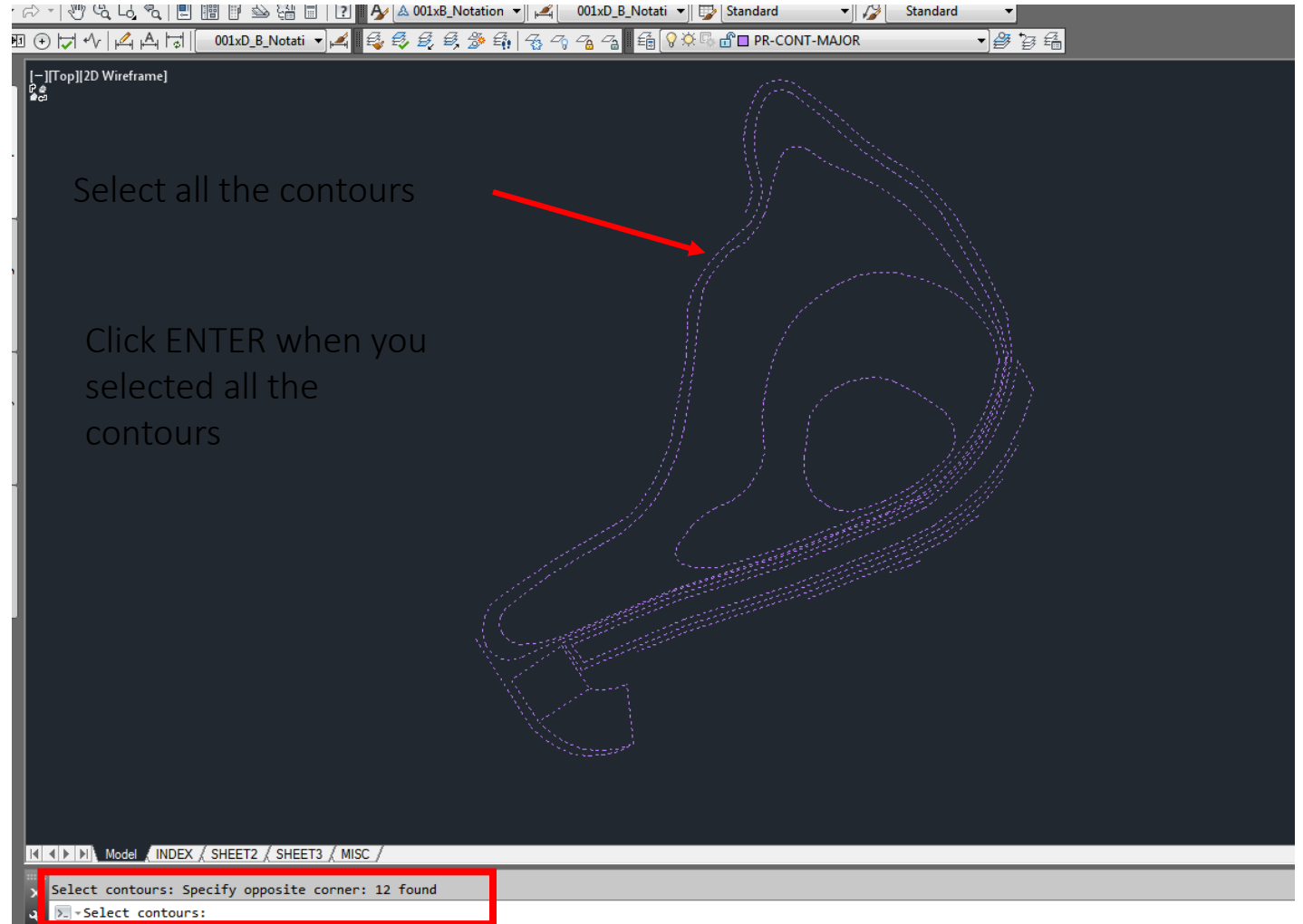
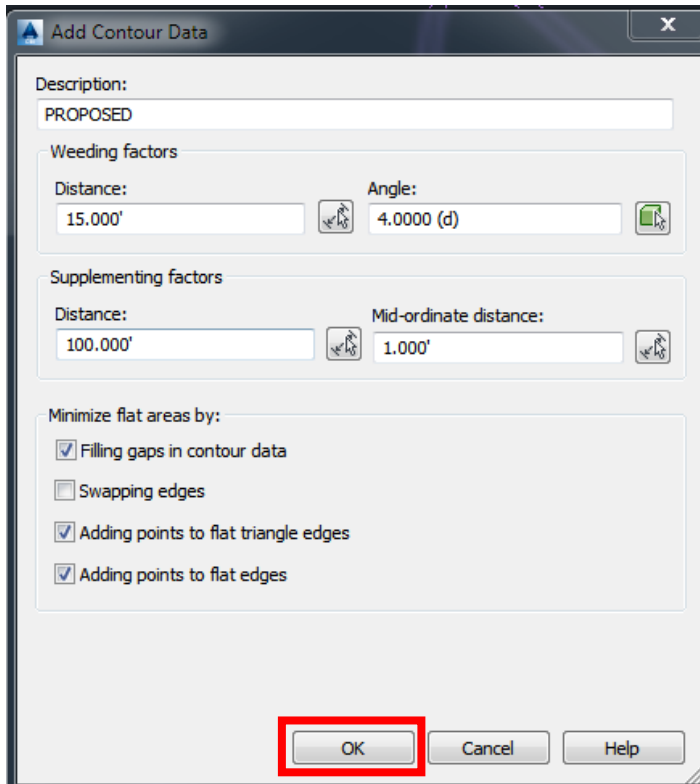


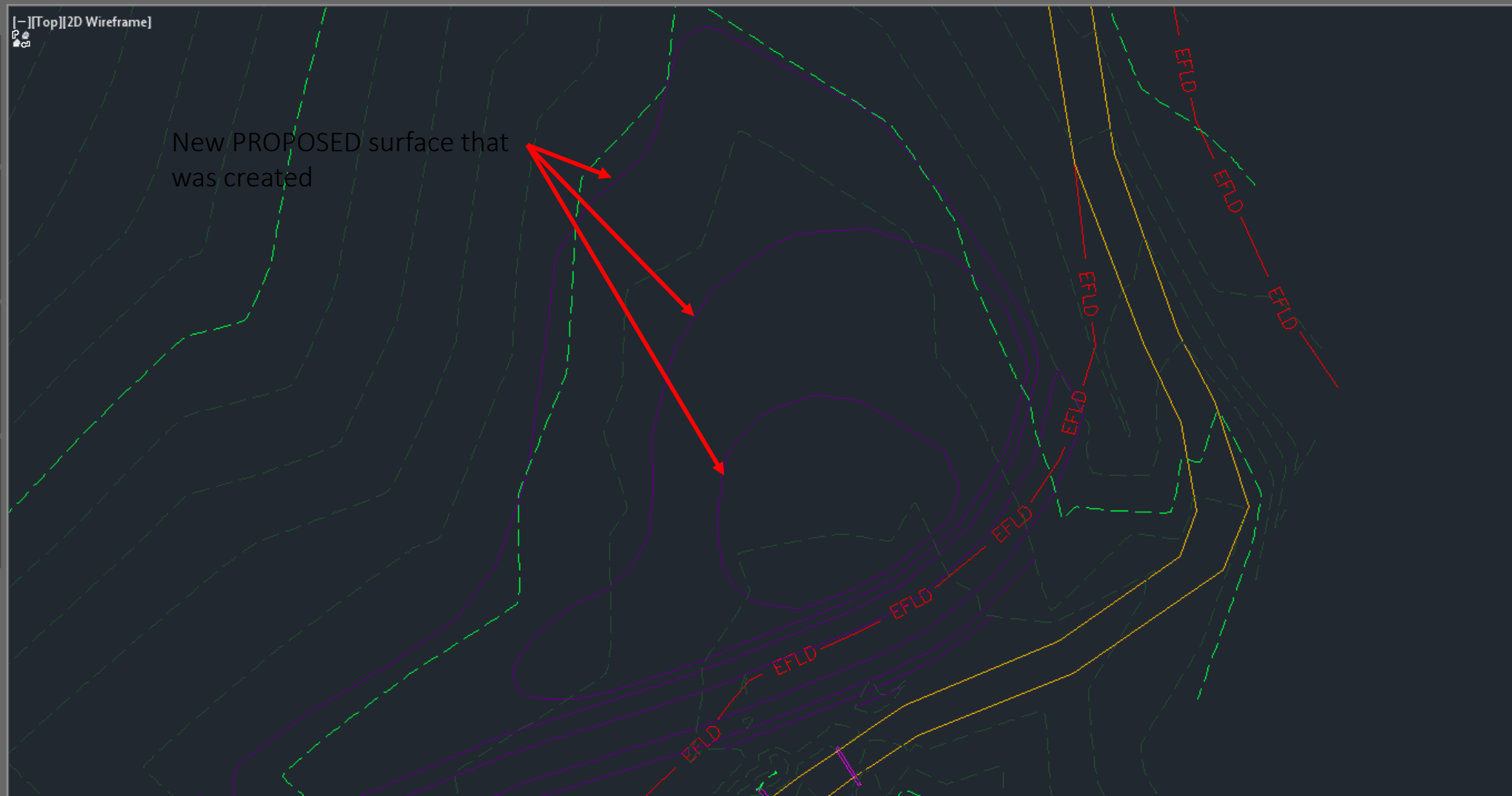
- Now you need to add the polylines that you created into the surface

Toolspace>Surfaces>Proposed>Definition>Contours>Right Click>Add...



- Description: PROPOSED

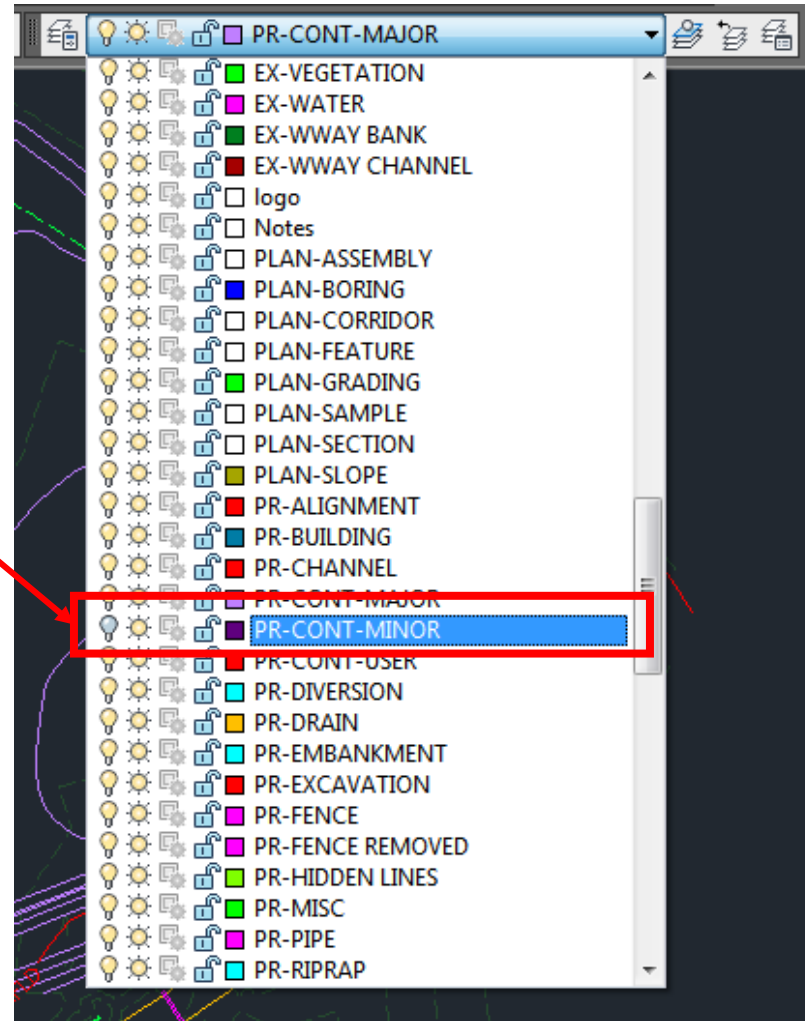




New PROPOSED surface that was created

- Turn off the PROPOSED surface layer, this should be under LAYERS>PR-CONT-MINOR

Turn Layer OFF

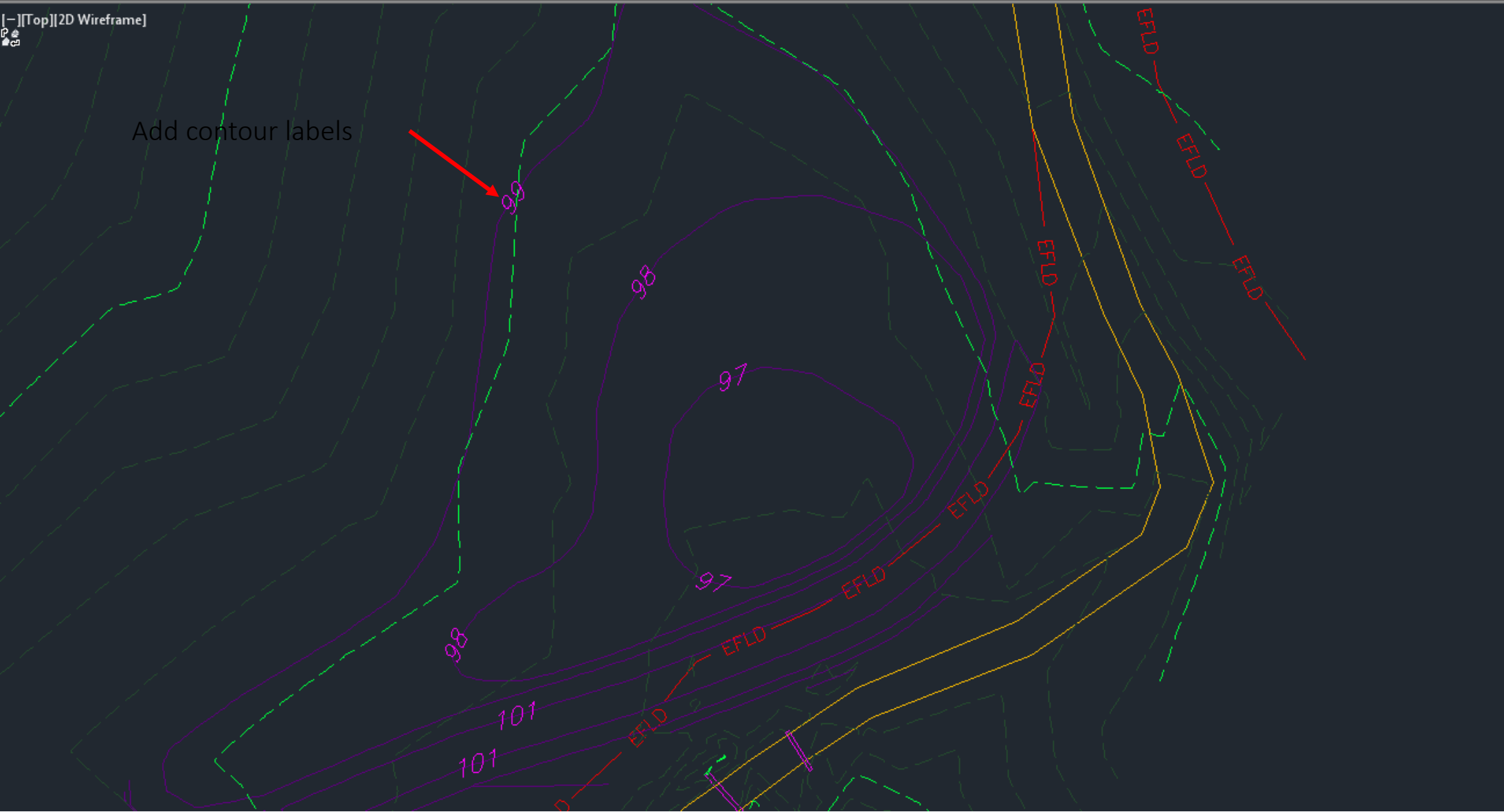


001xB_Notation | 001xD_B_Notati | Standard | Standard

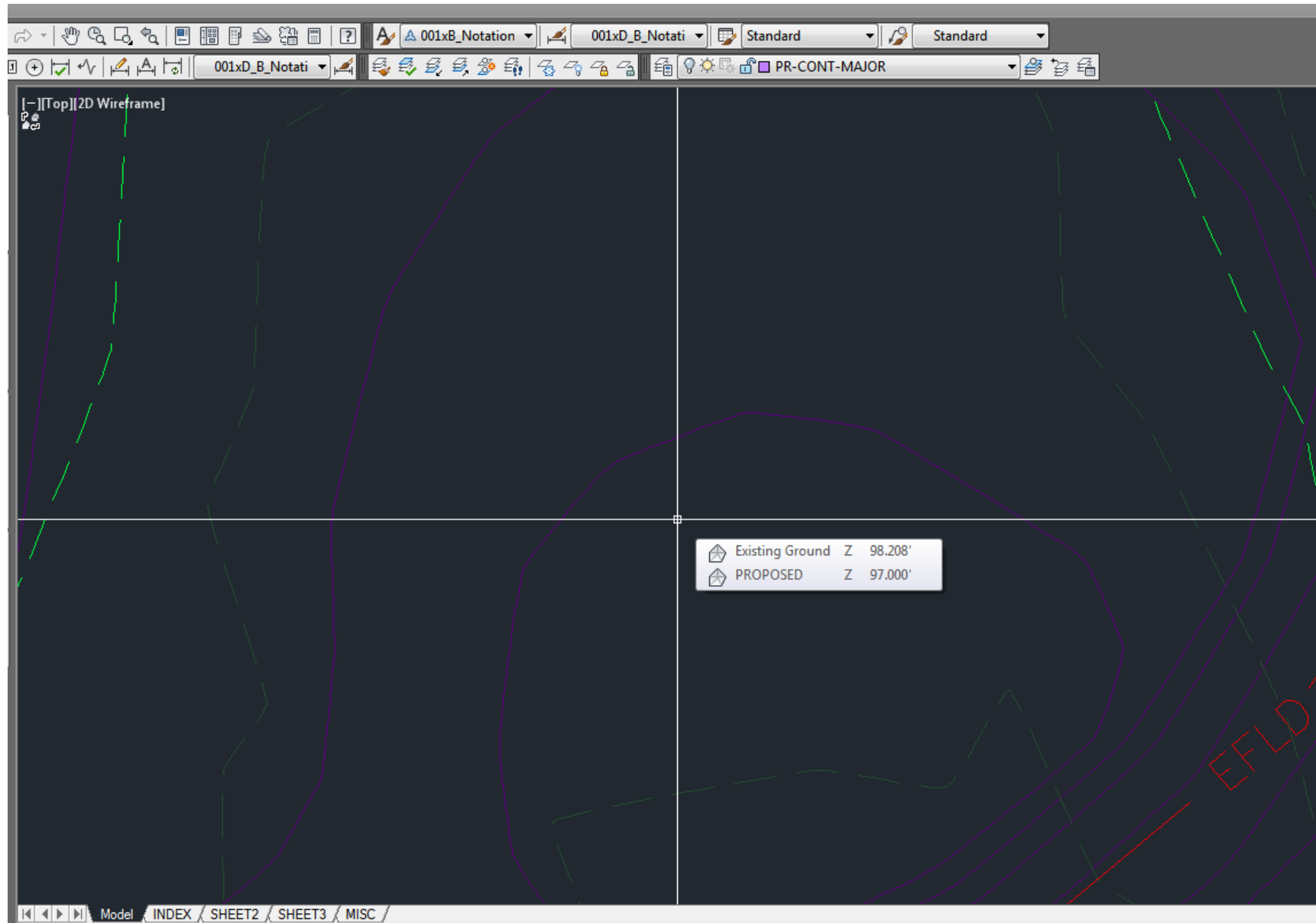
001xD_B_Notati | PR-CONT-MAJOR

[-] [Top] [2D Wireframe]

Add contour labels

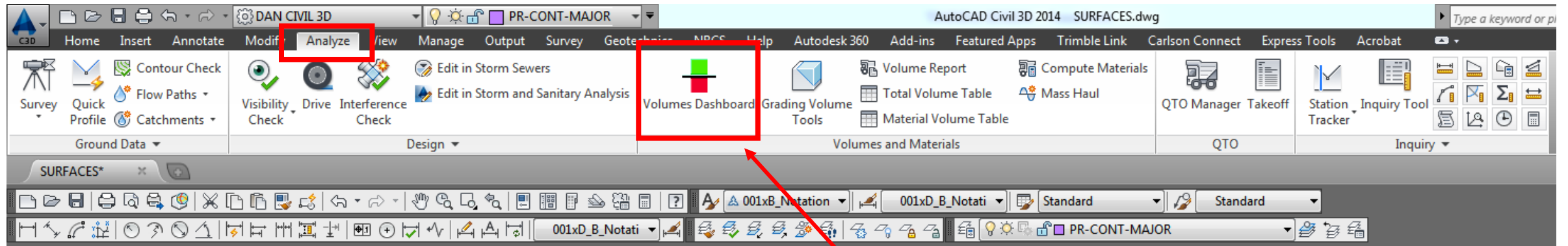


- ▶ You can see any elevation in the existing surface and the PROPOSED surface that you created by just holding the mouse over a location



Cut/Fill Calculations

Now that you have an Existing Surface and a Proposed Surface created, you can now compare the two to come up with your volumes.



► Analyze Tab>Volume Dashboard...Click on this

▶ Panorama opens up for the Cut/Fill Dashboard

The screenshot displays the Volumes Dashboard interface. The top menu bar includes options like Modify, Analyze, View, Manage, Output, Survey, Geotechnics, NRCS, Help, Autodesk 360, Add-ins, Featured Apps, Trimble Link, Carlson Connect, Express Tools, and Acrobat. The dashboard toolbar contains various tools such as Visibility Check, Drive, Interference Check, Volumes Dashboard, Grading Volume Tools, Volume Report, Total Volume Table, Material Volume Table, Compute Materials, Mass Haul, QTO Manager, Takeoff, Station Inquiry Tool Tracker, and Inquiry Tool Tracker.

On the left side, a summary panel shows the following data:

- Total Cut: 0.00 Cu. Yd.
- Total Fill: 0.00 Cu. Yd.
- Net: 0.00 Cu. Yd. <Fill>

The main area of the dashboard is a table with the following columns:

Name	B	Mid-Ordinate ...	Cut Factor	Fill Factor	Style	2d Area(Sq. Ft.)	Cut(adjusted)(Cu. ...	Fill(adjusted)(Cu. ...	Net(adjusted)(Cu. ...	Net Graph

The table body is currently empty. The bottom left corner of the interface is labeled 'Panorama' and 'Fill'.

Click Create new volume surface

Check Check Tools Material Volume Table

Total Cut: 0.00 Cu. Yd.
Total Fill: 0.00 Cu. Yd.
Net: 0.00 Cu. Yd. <Fill>
Cut

Create new volume surface
Click here to create a new volume surface and add it to the dashboard

Name	Style	2d
------	-------	----

Fill out the information as shown

Properties	Value
Information	
Name	CUTFILL
Description	Description
Style	
Render Material	ByLayer
Volume surfaces	
Base Surface	Existing Ground
Comparison Surface	PROPOSED
Cut Factor	1.000
Fill Factor	1.000

Selecting OK will create a new surface which will appear in the list of surfaces in Prospector.

OK Cancel Help

Total Cut: 1303.04 Cu. Yd.
Total Fill: 633.42 Cu. Yd.
Net: 669.62 Cu. Yd. <Cut>
Cut

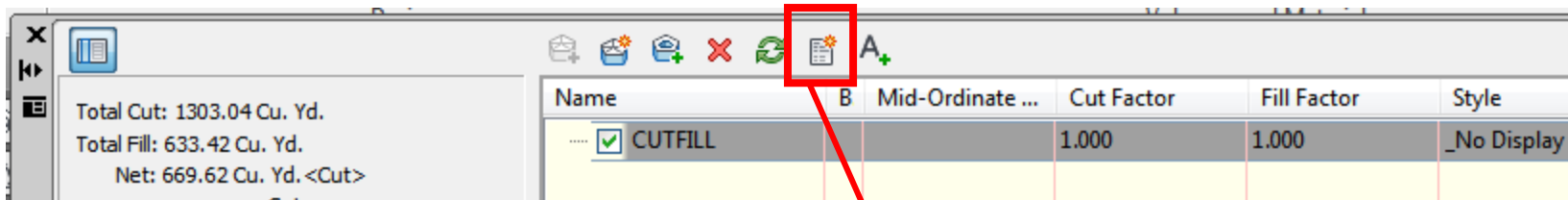
Name	B	Mid-Ordinate ...	Cut Factor	Fill Factor	Style	2d Area(Sq. Ft.)	Cut(adjusted)(Cu. ...	Fill(adjusted)(Cu. ...	Net(adjusted)(Cu. ...	Net Graph
✓ CUTFILL			1.000	1.000	_No Display	45987.46	1303.04	633.42	669.62<Cut>	

This gives you the cut/fill amounts

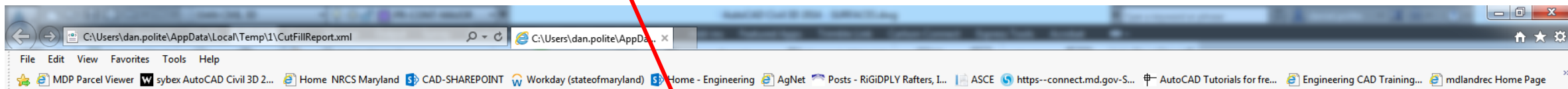
Make sure the STYLE is set to _No Display

Fill

Volume Dashboard



This will allow you to create a report and print it as a PDF



Cut/Fill Report

Generated: 2017-04-30 22:35:27
By user: Dan.Polite
Drawing: N:\CAD\C3D TRAINING 2016\TRAINING SESSION #4 - SURFACES\N:\CAD\C3D TRAINING 2016\TRAINING SESSION #4 - SURFACES\SURFACES.dwg

Volume Summary

Name	Type	Cut Factor	Fill Factor	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
CUTFILL	fill	1.000	1.000	45987.46	1303.04	633.42	669.62<Cut>

Totals

	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Total	45987.46	1303.04	633.42	669.62<Cut>

* Value adjusted by cut or fill factor other than 1.0

Name	B	Mid-Ordinate ...	Cut Factor	Fill Factor	Style
<input checked="" type="checkbox"/> CUTFILL			1.000	1.000	_No Display

This will allow you to insert the cut/fill information into your drawing

AutoCAD Civil 3D 2014 SURFACES.dwg

001xD_B_Notati

001xD_B_Notati

1-TEXT

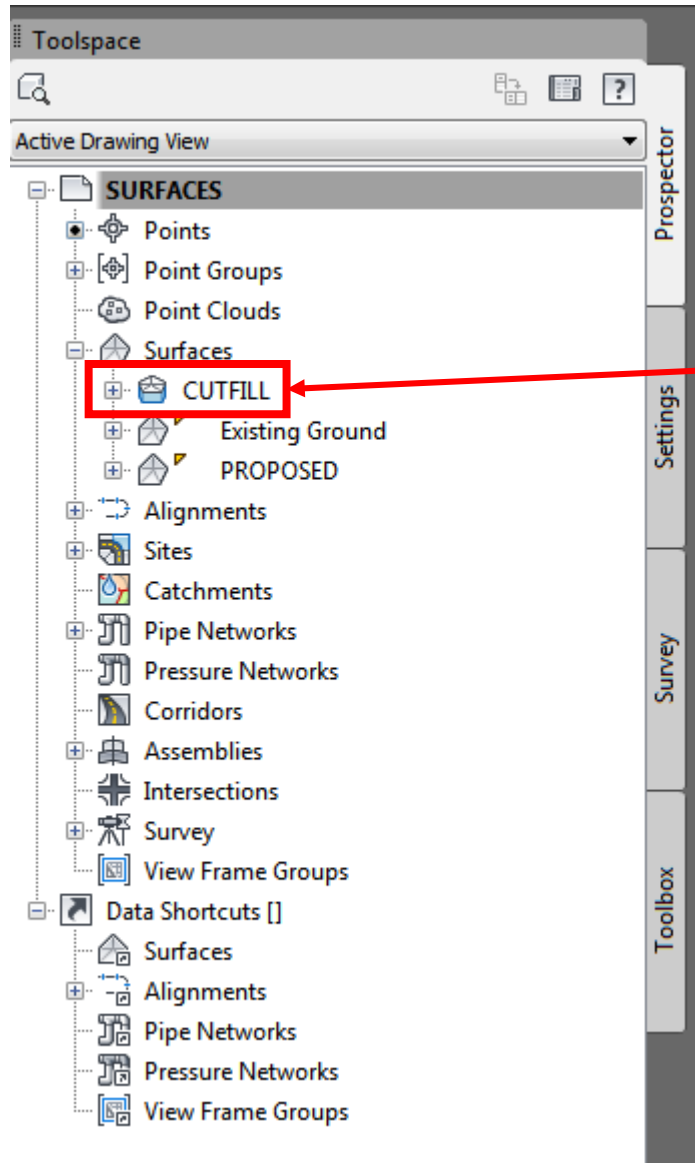
Prospector

Settings

[-][Top][2D Wireframe]

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
CUTFILL	1.000	1.000	45987.46 Sq. Ft.	1303.04 Cu. Yd.	633.42 Cu. Yd.	669.62 Cu. Yd.<Cut>
Totals			45987.46 Sq. Ft.	1303.04 Cu. Yd.	633.42 Cu. Yd.	669.62 Cu. Yd.<Cut>



This is the CUTFILL surface that you created. It should not be displayed if you set the STYLE correct.

- ▶ You can see all 3 surfaces that have been created when you hover over any location within the proposed area

