



Obtaining a Volume on an Area with No Defined Channel

By Roy Goyette

The process is fairly simply and requires 3 steps:

1. Create an ADVANCED CHANNEL DESIGN template (*.CHN) of the area of interest.
2. Take this template into the TIN MODEL program and, using your collected data, build a TIN model of the area.
3. Use the TIN model to calculate a volume using a TIN-to-Channel method.

In our example, the area in question is an elevation so the entire process here is represented as an elevation and the HYPACK® geodetic parameters are set to elevation mode.

We have a channel in a river where the location of the channel moves according to the controlling authority's decisions. Since there really is no static design template, we needed a method to just compute volumes in a cut zone for payment. The authority conducts a survey in the area in question then creates cut zones for the dredger to clean out, and so they maintain the channel for navigation.

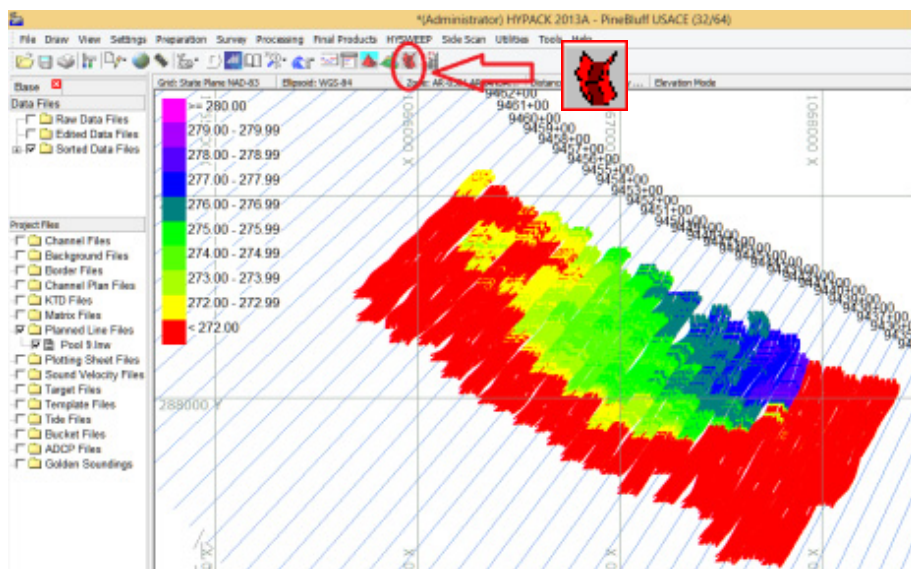
In our example, the final elevation is 272 feet and they allow for a 0.5 foot over dredge. The authority has provided us three cut zones with the X and Y coordinates for the four corners of each cut, and an XYZ file of the entire area surveyed. Additionally they have provided us with section lines that do not contain any templates and they require a volume for the entire cut down to the final elevation and a report of the amount of material to be dredged between each station.

CREATING THE DESIGN TEMPLATE

Our first step is to create a design of the cut in ADVANCED CHANNEL DESIGN to the final elevation of the cut.

After loading the planned line file (*.LNW), the XYZ file to the project, and setting my geodetic parameters to the right coordinates and elevation mode I'm ready to begin.

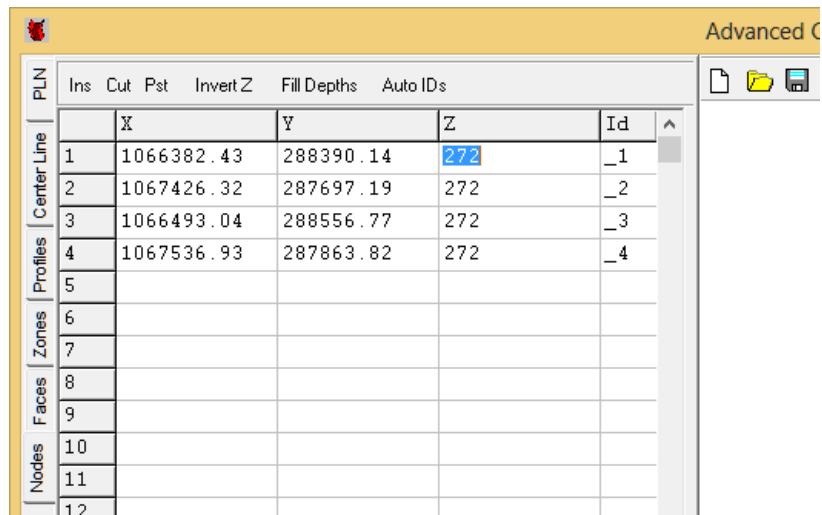
1. **Open ADVANCED CHANNEL DESIGN (ACD).** Select UTILITIES-ADVANCED CHANNEL DESIGN or click the ACD icon. (You may have to configure the tool bar with the ACD icon.)



2. In the Node tab, enter the information provided.

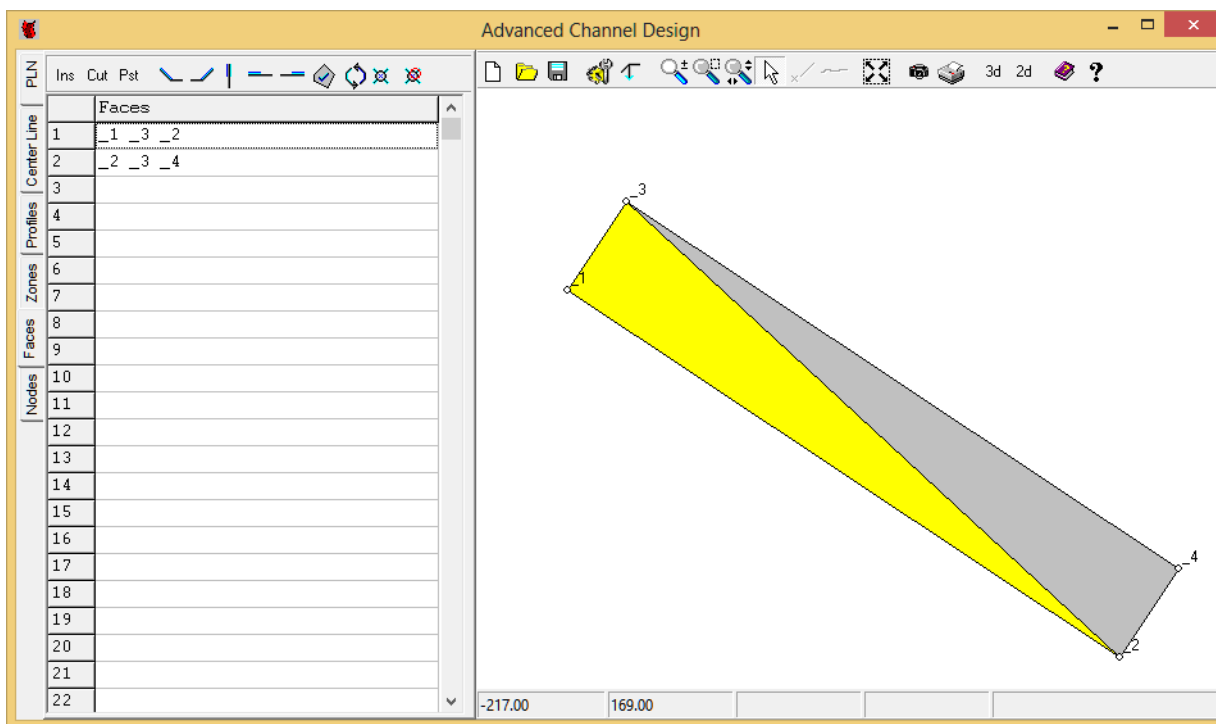
- Enter the X and Y of the four corners of the cut to be calculated.
- Enter the final elevation as the depth on the Nodes tab.

3. Click [Auto ID] to assign IDs to the nodes.



PLN	Ins	Cut	Pst	Invert Z	Fill Depths	Auto IDs
Center Line						
1				X	Y	Z
2						Id
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

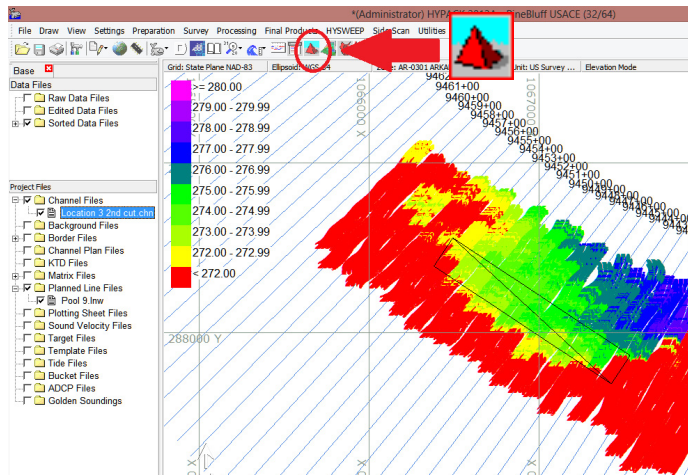
4. In the Faces tab, create the faces for your design. Since triangles are the best face design, I entered the node IDs to create two faces in the form of triangles. I enter the IDs in a counter clockwise direction.



5. Save the Advanced Channel Design.

BUILDING THE TIN MODEL

1. Open the TIN MODEL program.

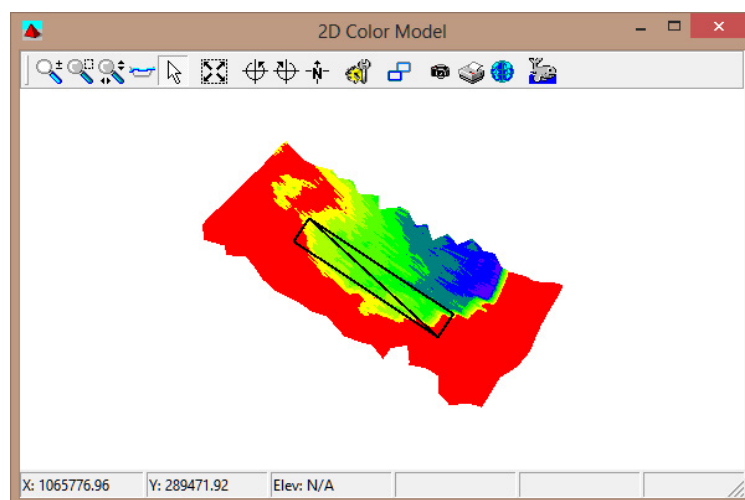


2. Select FILE-NEW and enter the information for building the model.

- **Input file:** The XYZ from the survey.
- **Channel Plan file:** The CHN that I created.
- **TIN Max Side:** 2 times the separation of the survey lines
- Set to **Elevation Mode**.

3. Click [OK] and the model is built.
4. Check the model to ensure you have good coverage. Select 2D-FILL and check that there are no open spaces where there should be none.

It looks good. Time to calculate a volume.

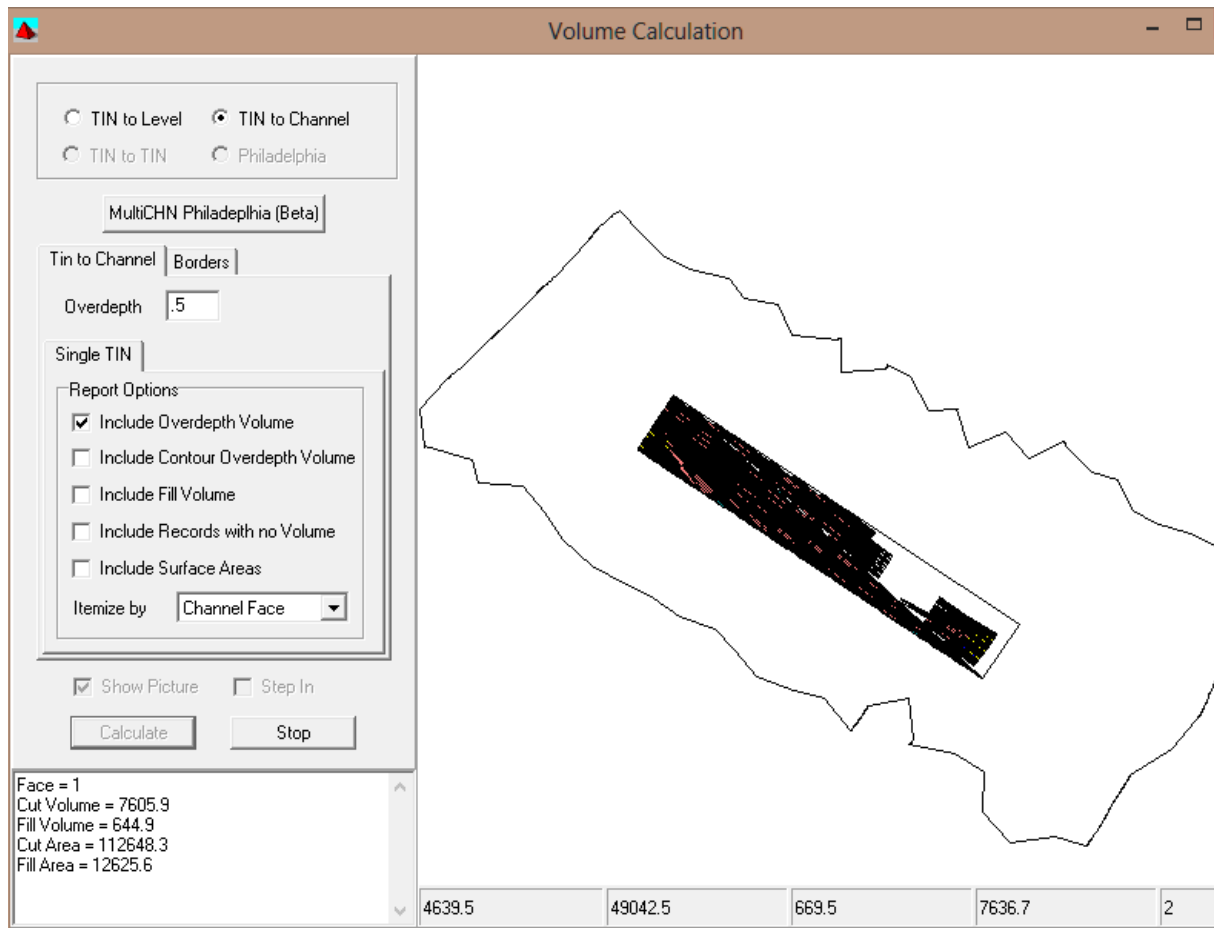


CALCULATING THE TIN-TO-CHANNEL VOLUMES

1. In the **TIN MODEL** menu, select **CALCULATE-VOLUME**. The Volume Calculate window opens.

The choices are enabled according to the information I have used to build my TIN model.

In my example, because I've only provided an XYZ and a CHN, I have two choices: TIN-to-Level or TIN-to-Channel.



2. Set the parameters for the volumes calculation and click [Calculate].
 - Select the **TIN-to-Channel** option.
 - To allow for the half foot of over depth, enter 0.5 in the **Overdepth** field and check the **Include Overdepth Volume** check box.

And we're off to the races!

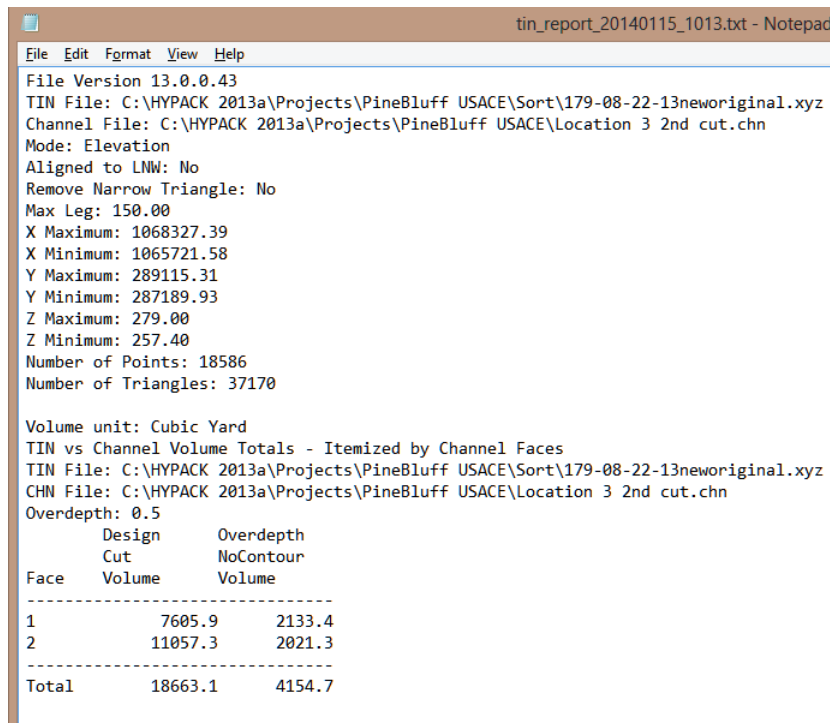
If I select the **Show Picture** option, a graphic of the area will show to the right.

Tip: If it's a huge area and I know it's going to take a long time to calculate, I can opt not to show the picture and cut the calculation time dramatically.

3. When it's finished, exit the **Calculate Volume** window.

4. **Generate your Volumes Report** using the EXPORT-REPORT menu options. I can either view the report or print it out depending on my needs.

It's important to note that the totals are separate, not combined, so a total for the entire area down to the overdepth would require you to add the two totals together.



```
tin_report_20140115_1013.txt - Notepad
File Edit Format View Help
File Version 13.0.0.43
TIN File: C:\HYPACK 2013a\Projects\PineBluff USACE\Sort\179-08-22-13neworiginal.xyz
Channel File: C:\HYPACK 2013a\Projects\PineBluff USACE\Location 3 2nd cut.chn
Mode: Elevation
Aligned to LNW: No
Remove Narrow Triangle: No
Max Leg: 150.00
X Maximum: 1068327.39
X Minimum: 1065721.58
Y Maximum: 289115.31
Y Minimum: 287189.93
Z Maximum: 279.00
Z Minimum: 257.40
Number of Points: 18586
Number of Triangles: 37170

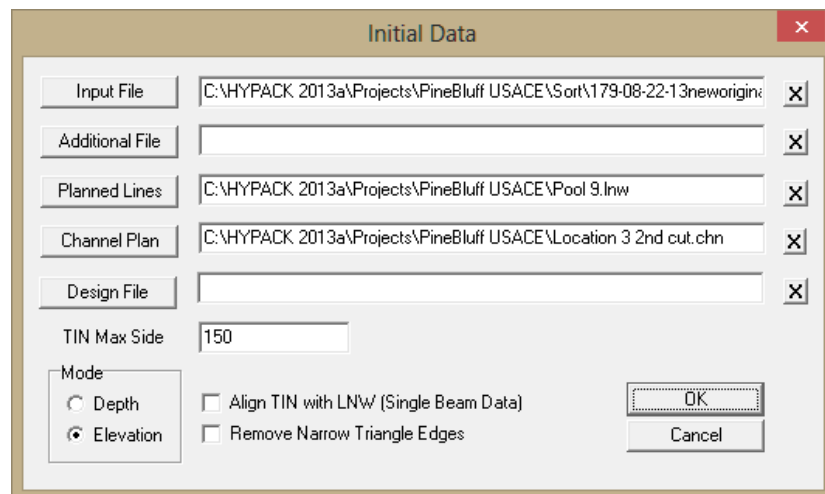
Volume unit: Cubic Yard
TIN vs Channel Volume Totals - Itemized by Channel Faces
TIN File: C:\HYPACK 2013a\Projects\PineBluff USACE\Sort\179-08-22-13neworiginal.xyz
CHN File: C:\HYPACK 2013a\Projects\PineBluff USACE\Location 3 2nd cut.chn
Overdepth: 0.5
Design Overdepth
Cut NoContour
Face Volume Volume
-----
1 7605.9 2133.4
2 11057.3 2021.3
-----
Total 18663.1 4154.7
```

CALCULATING VOLUMES BY SECTIONS

To calculate the volume by sections, I have to include the planned line file in the TIN model. You can build a new TIN model or modify the model from the TIN-to-Channel calculations.

1. **Create your TIN model with the planned line.**
To build a new TIN model, select FILE-NEW and enter the following parameters and click [OK].

- **Input file:** The XYZ from the survey.



- **Channel Plan file:** The CHN that I created.
- **Planned Lines:** The Line file.

To modify the model from the TIN-to-Channel calculations, select MODIFY-PLANNED LINES and select the required LNW file.

2. Select **CALCULATE-VOLUME** and set the “Itemize By” drop-down option to **Sections**.

The screenshot shows the 'Calculate Volume' dialog box. The 'TIN to Channel' radio button is selected. The 'Overdepth' is set to .5. The 'Report Options' section has several checkboxes: 'Include Overdepth Volume', 'Include Contour Overdepth Volume', 'Include Fill Volume', 'Include Records with no Volume', and 'Include Surface Areas'. The 'Itemize by' dropdown is set to 'Sections'. The 'Show Picture' checkbox is checked, and the 'Step In' checkbox is unchecked. The 'Calculate' button is highlighted. The output text at the bottom shows various volume and area calculations.

Fill Area = 0.0
10839+00 to 10840+00
Cut Volume = 0.0
Fill Volume = 0.0
Cut Area = 0.0
Fill Area = 0.0
Channel Volume Totals
Cut Volume = 18663.1
Contour Volume = 8193.1
Fill Volume = 2595.6
Cut Area = 221213.7
Fill Area = 29355.4

3. Click [Calculate] and we're off again.

The screenshot shows the 'Calculate Volume' dialog box after clicking the 'Calculate' button. The 'TIN to Channel' radio button is selected. The 'Overdepth' is set to .5. The 'Report Options' section has several checkboxes: 'Include Overdepth Volume', 'Include Contour Overdepth Volume', 'Include Fill Volume', 'Include Records with no Volume', and 'Include Surface Areas'. The 'Itemize by' dropdown is set to 'Sections'. The 'Show Picture' checkbox is checked, and the 'Step In' checkbox is unchecked. The 'Calculate' button is highlighted. The output text at the bottom shows various volume and area calculations.

Cut Area = 17034.5
Fill Area = 2087.6
9444+00 to 9445+00
Cut Volume = 1865.7
Fill Volume = 0.0
Cut Area = 19113.9
Fill Area = 0.0
9445+00 to 9446+00
Cut Volume = 1813.5
Fill Volume = 0.0
Cut Area = 19105.4
Fill Area = 0.0

The Final Sections Report

tin_report_20140115_1112.txt - Notepad

File Edit Format View Help

Mode: Elevation
Aligned to LNW: No
Remove Narrow Triangle: No
Max Leg: 150.00
X Maximum: 1068327.39
X Minimum: 1065721.58
Y Maximum: 289115.31
Y Minimum: 287189.93
Z Maximum: 279.00
Z Minimum: 257.40
Number of Points: 18586
Number of Triangles: 37170

Volume unit: Cubic Yard
TIN vs Channel Volume Totals - Itemized by Section Files
TIN File: C:\HYPACK 2013a\Projects\PineBluff USACE\Sort\179-08-22-13neworiginal.xyz
CHN File: C:\HYPACK 2013a\Projects\PineBluff USACE\Location 3 2nd cut.chn
LNW File: C:\HYPACK 2013a\Projects\PineBluff USACE\Pool 9.1nw

Section	Design Cut Volume
9441+00 to 9442+00	129.8
9442+00 to 9443+00	756.6
9443+00 to 9444+00	1868.3
9444+00 to 9445+00	1865.7
9445+00 to 9446+00	1813.5
9446+00 to 9447+00	1948.9
9447+00 to 9448+00	2119.3
9448+00 to 9449+00	1980.3
9449+00 to 9450+00	1682.4
9450+00 to 9451+00	1499.6
9451+00 to 9452+00	1350.8
9452+00 to 9453+00	1022.4
9453+00 to 9454+00	522.6
9454+00 to 9455+00	103.1
Total	18663.1