CHaMP GIS Tutorials

Field Season 2013

This collection of tutorials (and associated datasets) are intended to teach basic GIS methods used in the CHaMP Topographic Processing Workflow.

## System Requirements

The following Software should be installed on your computer in order to complete these tutorials:

* Windows 7 or higher
* Spectra Precision (*formerly TDS*) ForeSight Version 2.2.5
* ArcGIS 10.1
  + Arc Advanced (*formerly ArcInfo*) License Level
  + Spatial Analyst Extension (Available and Enabled)
  + 3D Analyst Extension (Available and Enabled)
* CHaMP Topographic Processing Toolbar for ArcGIS 10.1 version 3.00 or higher
* CHaMP Coordinate Transformation Tool for ArcGIS 10.1 version

## Preparing the Tutorial Data

Extract the contents of the ZIP folder to your computer. The tutorials refer to data contained within this folder. **It is recommended to extract this to your root directory (i.e. C drive) for easy access and to avoid potential GIS filename complications.**

Table of Contents

[System Requirements 1](#_Toc359333356)

[Preparing the Tutorial Data 1](#_Toc359333357)

[Vector Editing Tutorial #1 3](#_Toc359333358)

[Objectives 3](#_Toc359333359)

[Required Datasets 3](#_Toc359333360)

[Site Metadata 3](#_Toc359333361)

[Explore the Data 3](#_Toc359333362)

[Map Layers and Table of Contents 3](#_Toc359333363)

[Labels and Symbology 4](#_Toc359333364)

[Looking at the Attribute Tables 4](#_Toc359333365)

[Editing Vector Features 5](#_Toc359333366)

[Deleting Vertices in Polygons 6](#_Toc359333367)

[Adding Vertices to Polygons 6](#_Toc359333368)

[Finish and Close 7](#_Toc359333369)

[TIN Editing Tutorial #1 8](#_Toc359333370)

[Objectives 8](#_Toc359333371)

[Required Datasets 8](#_Toc359333372)

[Site Metadata 8](#_Toc359333373)

[Explore the Data 8](#_Toc359333374)

[Start the Interactive TIN Editor 9](#_Toc359333375)

[Delete a TIN Node 10](#_Toc359333376)

[Adjust the Z-value of a Node 10](#_Toc359333377)

[Editing Breaklines 10](#_Toc359333378)

[Connecting Nodes with a Breakline 11](#_Toc359333379)

[Continue Editing the TIN 12](#_Toc359333380)

[Finish and Close 12](#_Toc359333381)

[TIN Editing Tutorial #2 13](#_Toc359333382)

[Objectives 13](#_Toc359333383)

[Required Datasets 13](#_Toc359333384)

[Site Metadata 13](#_Toc359333385)

[Explore the Data 13](#_Toc359333386)

[Checking the Survey Extent 14](#_Toc359333387)

[Checking for Artificial Dams 14](#_Toc359333388)

[Start the Interactive TIN Editor 14](#_Toc359333389)

[Turning TIN Triangles on or off 15](#_Toc359333390)

[Removing Artificial Dams 16](#_Toc359333391)

[**Continue Editing the TIN** 16](#_Toc359333392)

[Finish and Close 16](#_Toc359333393)

[TIN Editing Tutorial #3 17](#_Toc359333394)

[Objectives 17](#_Toc359333395)

[Required Datasets 17](#_Toc359333396)

[Site Metadata 17](#_Toc359333397)

[Explore the Data 17](#_Toc359333398)

[Check the TIN 17](#_Toc359333399)

[Start the Interactive TIN Editor 18](#_Toc359333400)

[**Edit the TIN** 19](#_Toc359333401)

[Finish and Close 19](#_Toc359333402)

[Vector Editing Tutorial #2 20](#_Toc359333403)

[Objectives 20](#_Toc359333404)

[Required Datasets 20](#_Toc359333405)

[Site Metadata 20](#_Toc359333406)

[Explore the Data 20](#_Toc359333407)

[Digitizing Polygons 20](#_Toc359333408)

[Finish and Close 21](#_Toc359333409)

[Resources 21](#_Toc359333410)

# Vector Editing Tutorial #1

Vector objects, or “features,” come in three forms: points, polylines and polygons. Points represent a location (XY, or XYZ) in space. Polylines represent the linear distance between two or more points (vertices). Polygons represent an enclosed area using lines and vertices. In addition to spatial information, all features can have additional information, or “attributes” associated with them.

### Objectives

* Turning on and off and Layers and Labels
* Learn to look at the attribute tables
* Learn add and delete vertices to a Polygon/Line.

### Required Datasets

* Vector\_Editing\_1.mxd (Map Document)
* MOCK2012-000031\_2013.gdb (Survey Geodatabase)

### Site Metadata

Site Name: MOCK2012\_000031

Projection: UTM 11N  
Watershed: Upper Grande Ronde

Visit Year: 2012

## Explore the Data

1. Start ArcGIS and click *cancel* if the ArcMap Getting Started box appears.

******

1. Go to File-> Open and select the following Map Document:

***…\CHaMP\_GIS\_Tutorials\Data\Vector\_Editing\_1\Vector\_Editing\_1.mxd***

1. Explore the survey data
   1. What types of GIS layers do you see listed under the Table of Contents?
   2. How does this correspond with what is currently displayed on the map?

## Map Layers and Table of Contents

The Table of Contents lists all the layers in the map in *drawing order*. This means layers at the top of the list will be drawn on top of layers at the bottom of the list. The Table of Contents also shows which layers are currently visible. With the Table of Contents, you can:

* Drag the layer’s name to re-arrange the order of the layers in the Table of Contents.
* Turn a layer on by clicking on the check-box next to the layer. The layer will become visible and a check mark will appear in the box.
* Turn a layer off by clicking the empty box next to the layer. The layer will hide and the check will disappear.

**TIP**: Hiding/Showing Multiple Layers  
If you want to hide or show all the layers at once, hold the Control key down while you click on a checkbox.

* View a simple legend of the layer’s feature symbology ( right below each layer’s name). You can hide or show each layer’s legend by clicking on the “-“ or “+” box next to each layer’s name.

**NOTE**  
Starting with ArcGIS 10.0, the Table of Contents can be displayed one of several ways. Always make sure “List by Drawing Order” is displayed when working in ArcMap:



## Labels and Symbology

Look at the **Topo** Points features displayed on the map. These features currently have labels that display the Point Number of each Topo Point. Sometimes it’s easier to look at points and lines without the labels.

1. Turn on the **Topo Points** layer and Turn off all the other layers.
2. Right Click on the **Topo Points** and uncheck Label Features. The labels are now hidden in the map.
3. Right click on **Topo Points** again and turn the labels back on.

Symbology refers to the set of symbols and rules used to display the feature data on the map. For CHaMP, it is recommended to use the custom symbology developed for the program. However, there are times when you need to change or adjust a layer’s symbology.

**Example 1**

To look at the symbology Properties:

1. Right Click on the **Breaklines** layer and Select Properties.
2. Click on the Symbology tab. Use the Scroll button to view all of the created Symbology.
3. Click Cancel to close the Properties window without making changes.

**Example 2**

To make changes to the Symbols:

1. Right Click on the **Survey\_Extent** layer.
2. Left Click on the beige box. This opens the Symbol Selector window.
3. Choose the Blue with a black border (4th line down right side).
4. Click OK then click OK again on the Layer Properties box.
5. The layer’s symbology will change accordingly.

## Looking at the Attribute Tables

All GIS layers have an attribute table associated with them to store tabular information about each feature. You can add fields or delete fields, as well as add or update values in the table.

1. Right Click on the Breaklines layer and Select the Open Attribute Table option.
2. You should now see a box with a table pop up on your screen.
3. Right Click on the “Description” box and sort by Ascending Value.

You can select a set of features by attribute values using the Select By Attributes and the Switch Selection tools.



1. Click the Select by Attributes button.
2. In the Select by Attributes Window:
   1. Double Click “Line Type” from the list of field names.
   2. Click the Equal (=) button.
   3. Click the “Get Unique Values” button
   4. Double Click ‘HARD’
   5. Click Apply and look at the attribute table.
3. All of the “Hard Breakline” features are now selected (i.e. highlighted in blue) in both the attribute table and the map.
4. Click on the Switch Selection Button. Now all of the “Soft Breakline” features are selected instead of the Hard breakline features.
5. Click the Clear Selection Button to unselect all features.

## Editing Vector Features

This section describes the general Editing workflow for vector data. Refer to specific sections in this tutorial for instructions on how to edit specific features.

To edit vector features in ArcGIS, you must start an “Edit Session”.

1. Click the Editor menu on the Editor toolbar and Select Start Editing.  
   
2. The rest of the Editor toolbar will become active.
3. Select the Edit Features Button (small black triangle).
4. Double click on a feature to start editing that feature. The Vertex Editing toolbar will then appear and will provide additional editing tools.
5. When you are finished editing a feature, double click outside of the feature (i.e. and empty section of the map).
6. You have finished editing all of the features you want to edit, click on the Editor Menu and Select “Stop Editing”. **Make sure to Save your Edits!**

**TIP**If you have data from multiple workspaces (locations) in your map document, you might get a warning message when you start an edit session. In this case, it is usually easier to right click on the Layer Name in the table of contents and select Edit Features -> Start Editing.

## Deleting Vertices in Polygons

This example describes how to remove extra vertices to modify a polygon’s shape.

1. Turn off all they layers except for the Topo Points and the Survey\_Extent Layers.
2. Explore the Survey Extent layer. Notice that there is a large indentation in the polygon near the upper left of the survey.
3. Zoom in to the spot in question.
4. Start an Editing Session and use the Edit Features Tool.
5. Click on the triangle, then **Double Click** on the polygon edge. You can now see all the vertices of the polygon as Green squares.
6. From the Edit Vertices Toolbar, Select the Delete Vertices tool.  
   
7. Click on each of the three vertices that make up the hole in the polygon.
8. Once you have deleted all three, Click Save Edits in the Editor toolbar.
9. Are there any other areas in the polygon that need to be repaired?

## Adding Vertices to Polygons

Adding vertices to a polygon allows you to add more detail to the shape.

1. With the Edit Session still active, Turn on the “Breaklines” and “EdgeOfWater\_Points” layers
2. Zoom in to the left end of the polygon.
   1. Does the polygon follow the points and lines?
   2. We are going to add vertices along the end of the polygon to create a more realistic survey extent.
   3. Make sure Snap to Points and **Snap to Vertices** are selected.



* 1. **Double Click** on the line and Zoom in if necessary.
  2. Select the Add Vertices tool and click on the **edge of the Polygon** anywhere close to the desired location.



* 1. Next, **click and hold** on the new vertex and drag it on top of the nearest Topo Point and release. The line should snap to the point.
  2. Repeat these steps until you reach the opposite edge of the polygon. Use both points and line vertices as anchors.

The line should now follow the edge of the survey extent more closely.

Continue to scan the Polygon for additional problems and make note of them.

|  |  |
| --- | --- |
| **Location** | **Problem (Describe)** |
| Upper Left | Hole in Survey Extent |
| Left End | Polygon edge does not follow Survey Points |
|  |  |
| -- Feel free to add any other errors you find - - | |
|  |  |
|  |  |

## Finish and Close

1. On the Editor Toolbar, select Stop Editing and Save
2. Save the ***mxd*** document.
3. Close ArcMap if you are finished the tutorials, otherwise continue to the TIN Editing 1 tutorial.

# TIN Editing Tutorial #1

Triangulated Irregular Networks (TINs) are a surface representation of topography. Since they both display the topography and are easily edited, they are a useful data format to use for converting survey data into DEMs, which are better suited for data analysis.

### Objectives

* Learn to identify and repair points and lines with vertical errors in a TIN

### Required Datasets

* TIN\_Edting\_1.mxd (Map Document)
* LEM00002-000007\_2012.gdb (Survey Geodatabase)
* TIN\_1
* TIN\_1\_Clean
* WSETIN\_1

### Site Metadata

Site Name: LEM00002-000007  
Projection: UTM 12N  
Watershed: Lemhi  
Visit Year: 2012

## Explore the Data

1. Open the following Map Document in ArcGIS:   
    ***…CHaMP\_GIS\_Tutorials\Data\TIN\_Editing\_1\TIN\_Editing\_1.mxd***
2. Explore the survey data
   1. We have turned on the point number labels for the Topo Points layer to help navigate this tutorial. You can turn the visibility of this (and any other layer) by clicking on the checkbox next to the layer name in the Table of Contents.
3. Explore the TIN.
   1. Start exploring the TIN by turning off all layers except for the TIN.
   2. At a glance do you notice anything strange?
   3. Take a look at the Range of elevations listed for the TIN in the Table of Contents. Are they reasonable?
4. Turn on the TopoPoints layer. Look for point “147”.
   1. Notice how the color banding rapidly covers 3 bands.
      1. This is typical of a “Bust Point” where the Z value was incorrectly collected for the point. Often this is caused by an incorrect Rod-height entered in the Total station.
      2. The opposite of a Bust Point is a “Sink Point,” where the Z-value of a point is less than what it should be.

**TIP – Create a Spatial Bookmark**  
When you have an interesting feature in a map that you want to quickly reference again, Create a Spatial Bookmark under the bookmarks menu, Create Bookmark. Provide a name in the dialog box, then, Click OK.   
You can reference the bookmark again by clicking on the bookmark name under Bookmarks/View Bookmark.

* 1. Look at Line starting at point “81”. Notice the how the line makes a “trough” outside of the channel. On its own, this could be a natural feature (i.e. oxbow lake, pool, etc), however, the crew’s field notes indicate that this is an error.

1. Continue to scan the TIN for additional problems and make note of them.

|  |  |
| --- | --- |
| **Location** | **Problem** |
| Point 147 | Bust point (High Z value) |
| Line starting at Point 81 | Suspicious Trough (lower Z values) |
| Point 200 |  |
| Area around points 443, 628, and 438 | Artificial Prism (describe below) |
| Points 920, 346, 347 |  |
| -- Feel free to add any other error you find - - | |
|  |  |
|  |  |

## Start the Interactive TIN Editor

1. Make sure the TIN you wish to edit is selected in the Layer box in the 3D Analyst Toolbar.



1. Start the TIN Editing Session



**IMPORTANT – TIN Edits**  
Any edits you make to the TIN can only be undone to the last time the TIN was saved. It is recommended that you save your TIN often, but thoughtfully, since saving makes the edits permanent. If you do make or save an un-repairable edit, you can always create a new TIN from your data.

## Delete a TIN Node

1. Navigate to point “200”. Since this area is already well defined by the breaklines and nearby points, we will choose to delete this point from the TIN.
2. Click the Delete Node Tool  
   
3. Click on the Node under the label of point “200”. Notice how the TIN is adjusted after the Point is removed. Does this look more reasonable?

**TIP – Points are NOT nodes**After you delete a node from the TIN, the point feature in the survey class will still show up, creating the appearance that you did not actually delete the node.

## Adjust the Z-value of a Node

1. Return to point “147**”**. In this case, the surveyors only use rod heights in increments of 0.5m so rod –height errors are easy to fix (Surveying Tip!). There are also few points around this node, so keeping this point is important for providing information for the TIN.
2. Zoom in to the point.
3. Click the Adjust Node Z-Value Tool. A box will appear that lets you set the z-value of a node. 
4. Click on the Point. We will raise z-value of the node by 0.5m increments until the node is at the correct elevation.
   1. Change the Z value in the box to “1684.996**”** and click OK. Does this look correct?
   2. Change the Z value in the box to “1684.496” and click OK. How does it look now?

## Editing Breaklines

1. Return to the breakline with points “81”, “74”, “68”, and “797”. This is an example of a “trough”, caused by a series of rod-height elevation errors.
2. We have two choices:
   1. Try using the Adjust Z-node tool for each node in the breakline. Remember, the crew used 0.5m intervals for their rod heights, so adjust each node +/- 0.5m until it looks correct.
   2. Using the Delete Breakline tool. This is a last-resort tool since we are losing a significant amount of survey information at this location, but sometimes is the only way to repair the data. In this case, deleting this line does not negatively impact the TIN.  
      

**Editing Breaklines can be tricky…**Adjusting and editing breaklines is not as straight forward as you might think. Breaklines are not simple features that connect two nodes; rather, they are able to *insert* nodes in the TIN as needed to keep the Delaunay Triangulation. If you delete a node, move or add a breakline, additional nodes may be added along the breakline. To avoid this:  
- Do as much editing of the breaklines as you can in ArcMap or ForeSight, before they are incorporated in a TIN  
- If you delete a node in the TIN along a breakline, it will usually add another along the breakline. You may have to keep deleting these “artificial nodes” until you reach the next actual “surveyed node.”

## Connecting Nodes with a Breakline

1. Move to Points “443”and “438”, and look at the ‘prism’ along the bank that protrudes into the channel. In this case, the survey team forgot to connect this pair of Toe (to) lines at the base of the bank. The tin elevations at this location are higher than the surrounding channel, and have a shallower slope instead.

We will add a hard breakline between these points by connecting the end nodes of the breaklines.

1. Click on the Connect TIN Nodes Tool.   
   

In the popup box, select “Hard” line type.   


1. Click on the end node of one of the breaklines, then click on the end node of the other breakline.
2. Look in the area of the prism you just repaired. Is there another one nearby? If so, then make the repair.

**TIP – Artificial Notches**  
The inverse of the artificial prism we fixed in this example is known as a “notch.” Typically, these appear at the top and sides of a bank where “Top of Bank (tb)” lines are not connected. It is generally good practice to keep Top of bank lines as continuous as possible, even if the slope of the bank becomes shallower. This helps prevent the formation of such notches.

## Continue Editing the TIN

1. Continue to repair any errors you listed in the table, and scan for any other errors in the TIN, repairing them along the way.
2. Take this opportunity to explore how the tools we have discussed affect the TIN (Remember to SAVE your tin before you attempt this!). Try deleting a ‘good’ breakline or node and see how the TIN changes. Then, use the Undo since Last Save command under the TIN Editing Menu to restore your TIN.
3. To compare your edited TIN to a clean version of the TIN, add TIN\_Clean to the map.

## Finish and Close

1. On the TIN Editing Toolbar, select Save, then select Stop Editing TIN to exit the TIN editing mode.
2. Save the ***mxd*** document and close ArcMap if you are finished the tutorials, otherwise continue to the TIN Editing 2 tutorial.

# TIN Editing Tutorial #2

Triangulated Irregular Networks (TINs) are a surface representation of topography. Since they both display the topography and are easily edited, they are a useful data format to use for converting survey data into DEMs, which are better suited for data analysis.

### Objectives

* Learn to identify and repair area-of-interpolation errors due to survey extent.
* Learn to identify and repair Cross channel dams.

### Required Datasets

* TIN\_Editing\_2.mxd (Map Document)
* CBW05583-240498\_2012.gdb (Survey Geodatabase)
* TIN\_2
* TIN\_2\_Clean
* WSETIN\_2

### Site Metadata

Site Name: CBW05583-240498  
Projection: UTM 11N  
Watershed: John Day  
Visit Year: 2012

## Explore the Data

1. Open the following Map Document in ArcGIS: ***…\CHaMP\_GIS\_Tutorials\Data\TIN\_Editing\_2\TIN\_Editing\_2.mxd***
2. Explore the survey data
   1. The point number labels for the Topo Points layer have been turned on to help navigate this tutorial. You can turn the visibility of this (and any other layer) by clicking on the checkbox next to the layer name in the Table of Contents.
3. Explore the TIN.
   1. Make the TIN visible by checking the box next to it in the Table of Contents
   2. At a glance do you notice anything strange?
   3. Take a look at the Range of elevations listed for the TIN in the Table of Contents. Are they Reasonable?

**TIP – Quickly Visualizing 3D Data in ArcCatalog**If you are having trouble visualizing certain parts of the TIN in the map view, you can use ArcCatalog (stand-alone application, not the ArcCatalog panel in ArcMap) to quickly visualize the TIN in a 3-D environment.  
1) Open ArcCatalog, navigate to the TIN, and click on it.  
2) Select the Preview Tab.  
3) At the bottom of the Preview Window, select Preview: 3D view.

You can now pan, rotate, and zoom in on the TIN to help visualize the 3D aspects of the TIN surface.

## Checking the Survey Extent

1. Look at the edge of the TIN at the **downstream area** of the site.
   1. Notice how the TIN connects points with higher elevations across both sites of the banks, forming a “dam.” Is this a likely part of the stream topography?
   2. Compare the TIN the Survey Extent Polygon and the Topo Points layer. The Topo Points have a tighter density where the channel crosses the edge of the survey. The survey extent polygon should have been cleaned up to reflect the change in density across the channel.
2. Look at the area northwest and around point“191” (north is by default at the top of the map in ArcMap).
   1. The area interpolated by in the TIN is very far between points (i.e. point “173” and point “352”). Do you trust the topography represented in this part of the tin?
   2. Compare the TIN the Survey Extent Polygon and the Topo Points layer. Topo Points were not generally collected in this area of the survey. The survey extent polygon should have been cleaned up to exclude this area inside of this curve.

## Checking for Artificial Dams

1. Look at the area between points “70” and “73’.
   1. Notice lowest elevations in this part of the channel are the same as the edge of water breaklines. The TIN appears ‘flat’ between the “edge of water” breaklines and in fact the topography is not actually represented in this part of the channel.
2. Continue to scan the TIN for additional problems and make note of them.

|  |  |
| --- | --- |
| **Location** | **Problem (Describe)** |
| Downstream end of Channel |  |
| Area around and NW of point 191 |  |
| Area between points 73 and 70 |  |
| -- Feel free to add any other errors you find - - | |
|  |  |
|  |  |

## Start the Interactive TIN Editor

1. Make sure the TIN you wish to edit is selected in the Laye*r* box in the 3D Analyst Toolbar.



1. Start the TIN Editing Session



**IMPORTANT**  
Any edits you make to the TIN can only be undone to the last time the TIN was saved. It is recommended that you save your TIN often, but thoughtfully since saving makes the edits permanent. If you do make or save an un-repairable edit, you can always create a new TIN from your data.

## Turning TIN Triangles on or off

1. Navigate to the **downstream edge** of the channel. Since this is a small section, we will choose to ‘hide’ this triangle from the TIN.
2. Click the Modify TIN Area Tool.  
   
3. In the box that pops up, set the   
   
4. Click on the Triangle. Notice how the TIN is adjusted after the Point is removed. Does this look more reasonable?

**TIP – Edit the Survey Extent Polygon**  
Ideally the best way to repair Extent errors in the TIN is to edit the Survey Extent and generate a new TIN. This way, these changes are preserved if you need to generate new tins in the future.

1. Navigate to the area around point “191”.
2. Turn the triangle bounded by points “352”,”350” and “173” off.
3. Continue to turn off TIN triangles, working your way inside the curve towards point 191 until you feel comfortable with the area represented by the tin. Since you have not visited the site, you might be more conservative than you would be for a site you have personally visited and surveyed.

## Removing Artificial Dams

1. Navigate to the area around points “70” and “73”.
2. Click on the Connect TIN Nodes Tool.   
   
3. In the popup box, select “Soft” line type.  
   
4. Click on the node for point “70”, then, Click on the node for point “73”.
   1. A new breakline will define the lower elevation of the channel. This does add some interpolated elevations to this part of the channel; however, this is more realistic than what the tin was previously showing. For small sections of stream, this is an acceptable edit.

**TIP – Thalweg lines prevent Dams**In narrow sites where it is difficult to capture a high density of points to maintain a pattern of equilateral triangles in the channel, survey the Thalweg as a continuous line (wg). This will force the TIN to maintain the low elevation of the channel to the thalweg line and prevents the formation of artificial dams.

**Continue Editing the TIN**

1. Continue to repair any errors you listed in the table, and scan for any other errors in the TIN, repairing them along the way.
2. Take this opportunity to explore how the tools we have discussed affect the TIN (Remember to SAVE your tin before you attempt this!). Try deleting a ‘good’ breakline or node and see how the TIN changes. Then, use the Undo since Last Save command under the *TIN Editing Menu* to restore your TIN.
3. To compare your edited TIN to a clean version of the TIN, add TIN\_Clean to the map.

## Finish and Close

1. On the TIN Editing Toolbar, select Save and Exit TIN
2. Save the ***mxd*** document and close ArcMap if you are finished the tutorials, otherwise continue to the TIN Editing 3 tutorial.

# TIN Editing Tutorial #3

Triangulated Irregular Networks (TIN’s) are a surface representation of topography. Since they both display the topography and are easily edited, they are a useful data format to use for converting survey data into DEM’s, which are better suited for data analysis.

### Objectives

* Apply the lessons from TIN Editing 1 and 2 on a practice TIN

### Required Datasets

* TIN\_Editing\_3.mxd (Map Document)
* WENMASTER-000195\_2011.gdb (Survey Geodatabase)
* TIN\_3
* TIN\_3\_Clean

### Site Metadata

Site Name: WENMASTER-000195  
Projection: UTM 11N  
Watershed: Wenatchee  
Visit Year: 2011

## Explore the Data

1. Open the following Map Document in Arc GIS: ***…\CHaMP\_GIS\_Tutorials\Data\TIN\_Editing\_3\TIN\_Editing\_3.mxd***
2. Explore the survey data
   1. The point number labels for the Topo Points layer have been turned on to help navigate this tutorial. You can turn the visibility of this (and any other layer) by clicking on the checkbox next to the layer name in the Table of Contents.
3. Explore the TIN.
   1. Make the TIN visible by checking the box next to it in the Table of Contents.
   2. At a glance do you notice anything strange?
   3. Take a look at the Range of elevations listed for the TIN in the Table of Contents. Are they Reasonable?

## Check the TIN

1. Check the Survey Extent
   1. Where the channel enters the stream
   2. Where the channel exits the stream
   3. Inside meanders/areas lacking survey points
   4. Remainder of the outer extents of the survey
2. Elevation Errors
   1. Bust Points
   2. Sink Points
   3. Artificial Ridges
   4. Artificial Troughs
3. Banks
   1. Notches
   2. Prisms
4. Crossed Hard Breaklines
5. Artificial Dams
6. Continue to scan the TIN for additional problems and make note of them.

**Location: Problem:**

## Start the Interactive TIN Editor

1. Make sure the TIN you wish to edit is selected in the *Layer* box in the 3D Analyst Toolbar.



1. Start the TIN Editing Session



**IMPORTANT**  
Any edits you make to the TIN can only be undone to the last time the TIN was saved. It is recommended that you save your TIN often, but thoughtfully since saving makes the edits permanent. If you do make or save an un-repairable edit, you can always create a new TIN from your data.

**Edit the TIN**

1. Repair any errors you listed in the table, and scan for any other errors in the TIN, repairing them along the way.
2. Take this opportunity to explore how the tools we have discussed affect the TIN (Remember to SAVE your tin before you attempt this!). Try deleting a ‘good’ breakline or node and see how the TIN changes. Then, use the Undo since Last Save command under the TIN Editing Menu to restore your TIN.
3. To compare your edited TIN to a clean version of the TIN, add TIN\_Clean to the map.

## Finish and Close

1. On the TIN Editing Toolbar, select Save and Exit TIN
2. Save the ***mxd*** document and close ArcMap if you are finished the tutorials, otherwise continue to the Vector Editing 2 tutorial.

# Vector Editing Tutorial #2

Vector data can be created one of two ways – through the “geoprocessing” of other vector datasets, or by manually creating (“digitizing”) features. This tutorial focuses on how to manually create and edit vector data features using ArcGIS.

### Objectives

* Digitizing New Channel Unit Polygons

### Required Datasets

* Vector\_Editing\_2.mxd (Map Document)
* MOCK2012-000031\_2013.gdb (Survey Geodatabase)

### Site Metadata

Site Name: MOCK2012\_000031

Projection: UTM 11N  
Watershed: Upper Grande Ronde

Visit Year: 2012

## Explore the Data

1. Open the following Map Document in Arc GIS:   
   ***…\ChaMP\_GIS\_Tutorials\Data\Vector\_Editing\_2\Vector\_Editing\_2.mxd***
2. Turn on the “Channel Unit Markers”, “WaterExtent” and “DEM” layers. All other layers should be off.
3. On the **CHaMP Topo Processing Toolbar** select the Digitize Channel Unit Polygons tool under the Topo Processing menu.
4. Select the ***Survey Geodatabase*** as the input
5. Click OK to run the tool.

An empty Channel Units Field layer will be added to the map.

## Digitizing Polygons

Channel Units are identified in the field and captured by using “Unit Boundary” points in the survey. Since crew judgment is needed in determining the arrangement of these polygons, they need to be created (digitized) manually.

1. Start an Editing Session.
2. In the Editor menu, Select the Editing Windows option then Select the Create Features option.
3. Zoom in to the layer where the Channel Unit Markers say “u1”
4. Make sure Point and Vertex Snapping is turned on.
5. In the Create Features Window, Select Unit Number “01”.
6. Move your cursor to an area just outside of the Water Extent polygon. Click anywhere in this location to create the first vertex of the polygon.
7. Move your cursor down the edge of the Water Extent polygon (still outside of it) towards one of the “u1” points. Click again to create a new vertex.
8. Continue Clicking around the outside of the Water Extent polygon until you are even with the “u2” points. Cross the Water Extent polygon with your cursor, clicking on each of the “u2” points as you go. You will see a new polygon taking shape.
9. Now on the other side of the Edge of Water polygon, start digitizing back towards your first vertex.
10. Once your polygon is complete, double click to stop.
11. To create the next Channel Unit, select Unit Number “02” in the Create Features Window.
12. Start your Unit 2 polygon on the edge of the Unit 1 polygon. Cross the Water Extent polygon, clicking at each Channel Unit Marker “u2”, then up the side until you reach “u3”.
13. You do not need to be neat with the polygon outside of the channel; it just needs to completely enclose the Water Extent Polygon, but avoid gaps or overlaps between channel units in the water extent. Use point snapping to match the vertices of the other polygons.
14. Continue with the exercise until you reach the end of the site.

## Finish and Close

1. On the Editor Toolbar, select Stop Editing and Save.
2. Close the Create Features Window.
3. The polygons you created will be clipped automatically to the water extent with a later tool.
4. Save the ***mxd*** document and close ArcMap.

You have completed the CHaMP GIS tutorials – Good Job!

# Resources

**ArcGIS 10.1 Help**http://resources.arcgis.com/en/help/main/10.1

**TIN Editing Toolbar**  
http://resources.arcgis.com/en/help/main/10.1/index.html#//006000000006000000