Tools, Tips, and Workflows

LP360 Under the Hood: Cross-sections

LP360

BSAU | AWG

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Revision 1.0

As we outlined in a previous “LP360 – Under the Hood”, we have added volumetric analysis to LP360. This feature was first released with 2013.2 at the end of last year with an enhanced version in our recent Experimental (EXP) release.

An important element of the analysis associated with volumes is the generation of cross-sections. We have had this function as a tool in LP360 for ArcGIS for some time. This cross section tool allowed one to specify a feature as the “alignment” path, define a spacing for cross sections along the alignment (e.g. every 5 meters) and the length of each cross section. As noted in a previous edition of our newsletter, we aim to move functions such as this to our Point Cloud Task (PCT) engine in LP360. Moving to a PCT allows functions to be chained together into “macros”, resulting in more streamlined, powerful analysis.

With the above in mind, we have added a Cross Section Point Cloud Task to LP360. This PCT is available in both LP360 for ArcGIS as well as LP360 x64 (our 64 bit Windows standalone version of LP360). When we moved this from a toolbar function into a PCT, we also did a nice enhancement – you can now “clip” cross sections to a circumscribing polygon. This is a very nice tool when combined with the Volumetric PCT; you can generate a polygon attributed by volumetric results and use this same polygon for clipping cross-sections.

This new tool is very straightforward to use. From the Point Cloud Task “Task Selection” tool, choose “Cross Sections” (see Figure 1). Give the task a name of your choice.

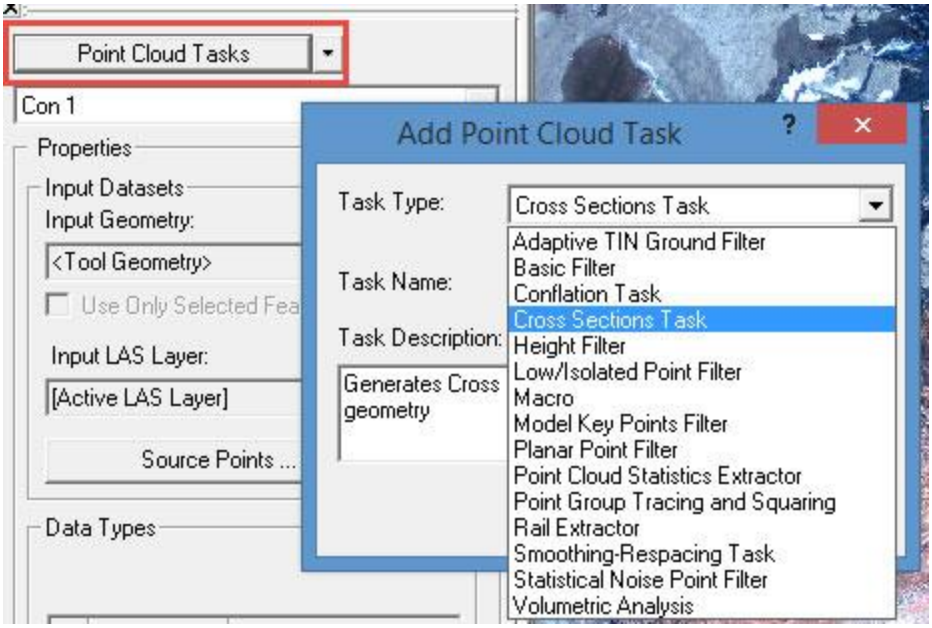

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Figure 1: Creating a Cross Sections task

Let's examine the inputs for this PCT. The Cross Sections PCT dialog is depicted in Figure 2.

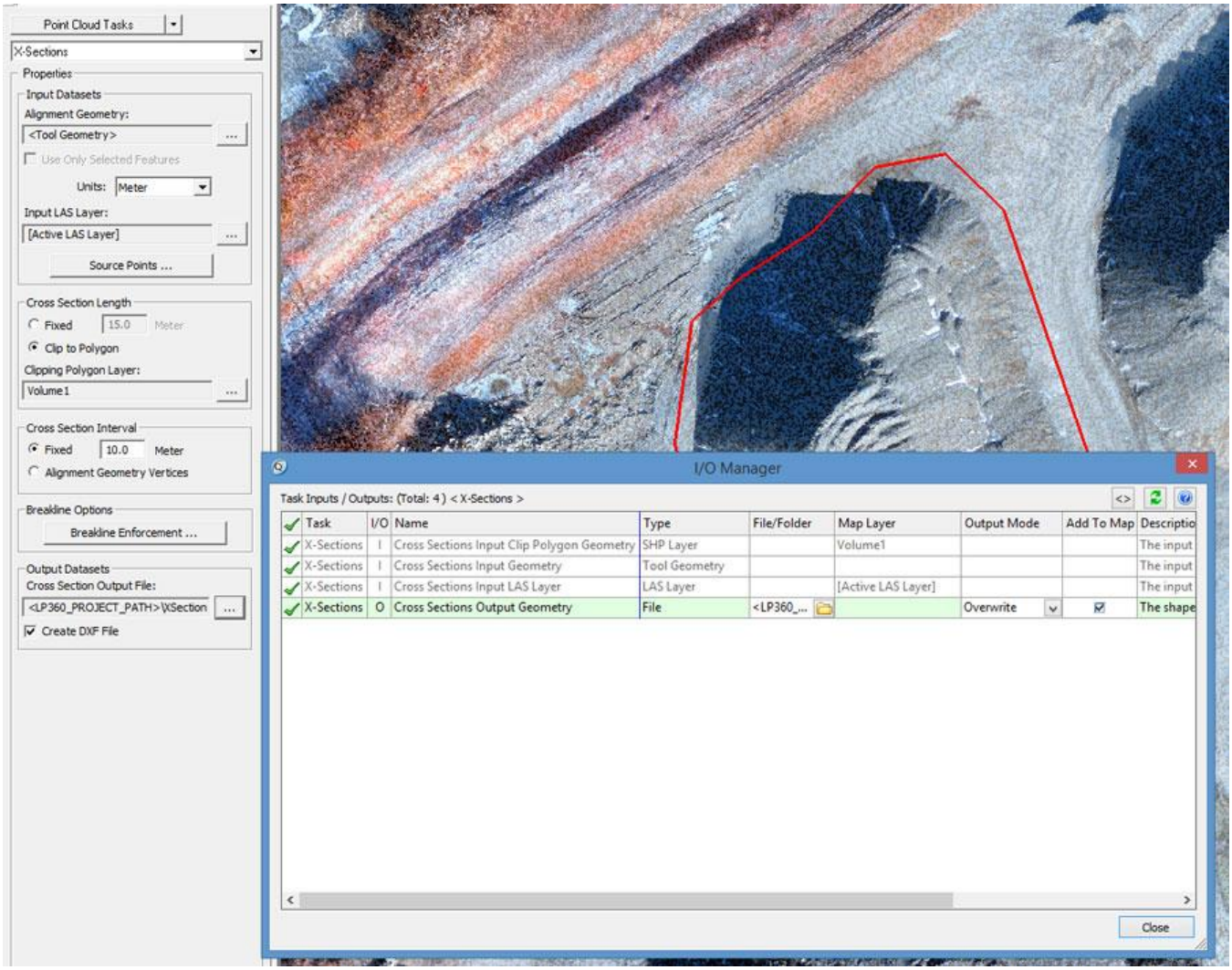

Figure 2: The Cross Sections PCT dialog

Cross Sections are based on an alignment. An alignment is simply the polyline that will define the geometry to which the cross sections will be perpendicular. If you are not clipping the cross sections, it will be the centerline. As an example, the alignment is usually the centerline of a roadway if you are computing roadway cross sections.

The first choice (moving down the dialog of Figure 2) is to choose the Alignment. You can use polylines from a shape file, a polyline layer in the Table of Contents of ArcGIS (or LP360 if using LP360 x64) or you can sketch an alignment using the polyline tool on the PCT toolbar. We have set this field to <Tool Geometry>, indicating that we will use the PCT polyline tool to sketch in an alignment.

The second choice is the LAS data that will define the surface to which we will drape the cross sections. This can be any LAS layer in the project. The default is the Active LAS Layer which causes the tool to use

the LAS layer set in the Active LAS Layer drop-down of the main LP360 toolbar. If you have a single LAS layer in your project, it is the Active layer by default.

Next is the Cross Section Length. You can chose cross sections of a predetermined length ("Fixed") or you can have LP360 clip the cross sections to a circumscribing polygon. This choice is a "radio button", meaning you pick one method or the other. The Fixed length option requires that you specify the absolute length of the cross section. With this choice, the cross section will be centered on the alignment with ½ the length to each side of the alignment line. With "Clip to Polygon", the cross sections will extend from the alignment to the boundary of the circumscribing polygon, regardless of length. This is the selection I have made in this example. Note that no cross sections are drawn in areas where the alignment is not circumscribed by the selected polygon. If you choose "Clip to Polygon", the Clipping Polygon section of the dialog becomes active. You can choose either a polygon layer in the Table of Contents or a Shape file. In my selection, I have chosen a layer in the TOC called "Volume 1." You can see the upper edge of my polygon (red line) in the Map View of Figure 2.

The next section allows you to set the cross section interval along the alignment. You can choose a fixed spacing (say every 10.0 meters as in our example) or a cross section at each vertex of the alignment. The vertex choice can be useful for doing time series analysis where you want to ensure that the cross sections originate at the same point each time you run the analysis (note that in our next "Under the hood" we will present a new PCT for spacing vertices on lines and polygons).

The next section of the dialog allows you to enforce breaklines in the elevation model. When we create cross sections, we do so by draping the cross section line over a Triangulated Irregular Network (TIN) constructed from the underlying LAS points. The Breakine Enforcement option allows you to introduce breaklines into the model. The use of breaklines was discussed in a multipart series in previous issues of this newsletter (previous issues are available from www.qcoherent.com/newsletter).

The last section, "Output Datasets", allows you to specify the name and location of the shape file that will contain the cross sections. This setting, like all others, uses the Point Cloud Task Input/Output Manager. Again, this feature was presented in a previous issue of the newsletter. Note that you can optionally create cross sections in DXF format. If you check the "Create DXF File" box, a DXF file with the same base file name and location as specified for the shape file output will be created.

Figure 3 shows the alignment that I have sketched over a stockpile that I previously enclosed with a polygon that appears in the Volume layer of the TOC. Note that this alignment begins some meters outside the polygon in the upper left, passes through the polygon and then exits from the lower right.

Figure 3: Drawing the Alignmen

The resultant cross sections are depicted in Figure 4. Note that, as specified, no cross sections were drawn outside the polygon. The cross sections are spaced 10 meters apart within the polygon. The first cross section appears a multiple of 10m from the origin along the alignment that I drew in the previous step.

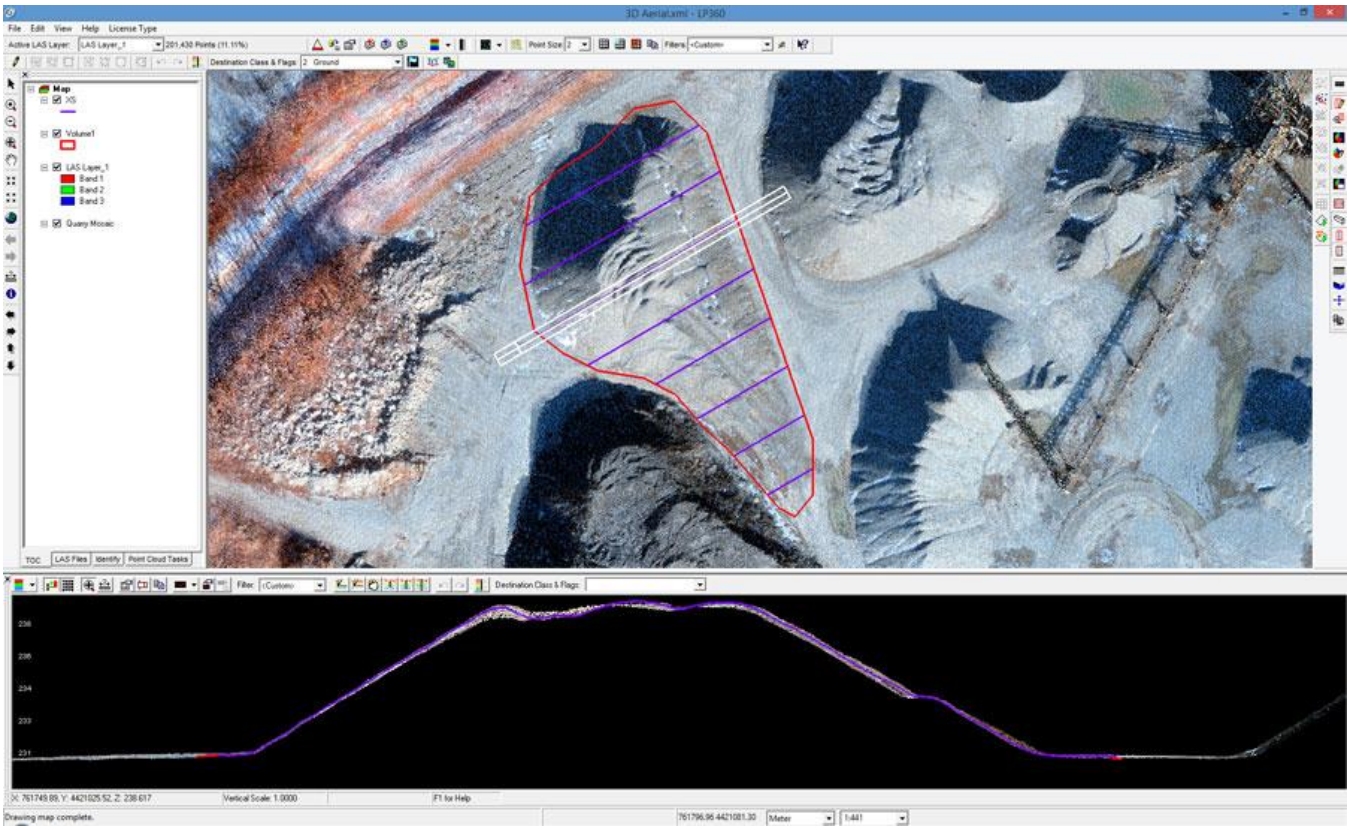

Figure 4: The cross sections

You will note also in the next EXP release that we now display graphics in the profile and 3D windows in LP360 x64. This is, in fact, depicted in the profile view of Figure 4. By simply drawing a second alignment perpendicular to the first (make sure the file setting in the Input/Output Manager for cross section output is set to “append”), you can create a 3D “hatched” cross section model. An example of such a model depicted in the LP360 3D view is shown in Figure 5.

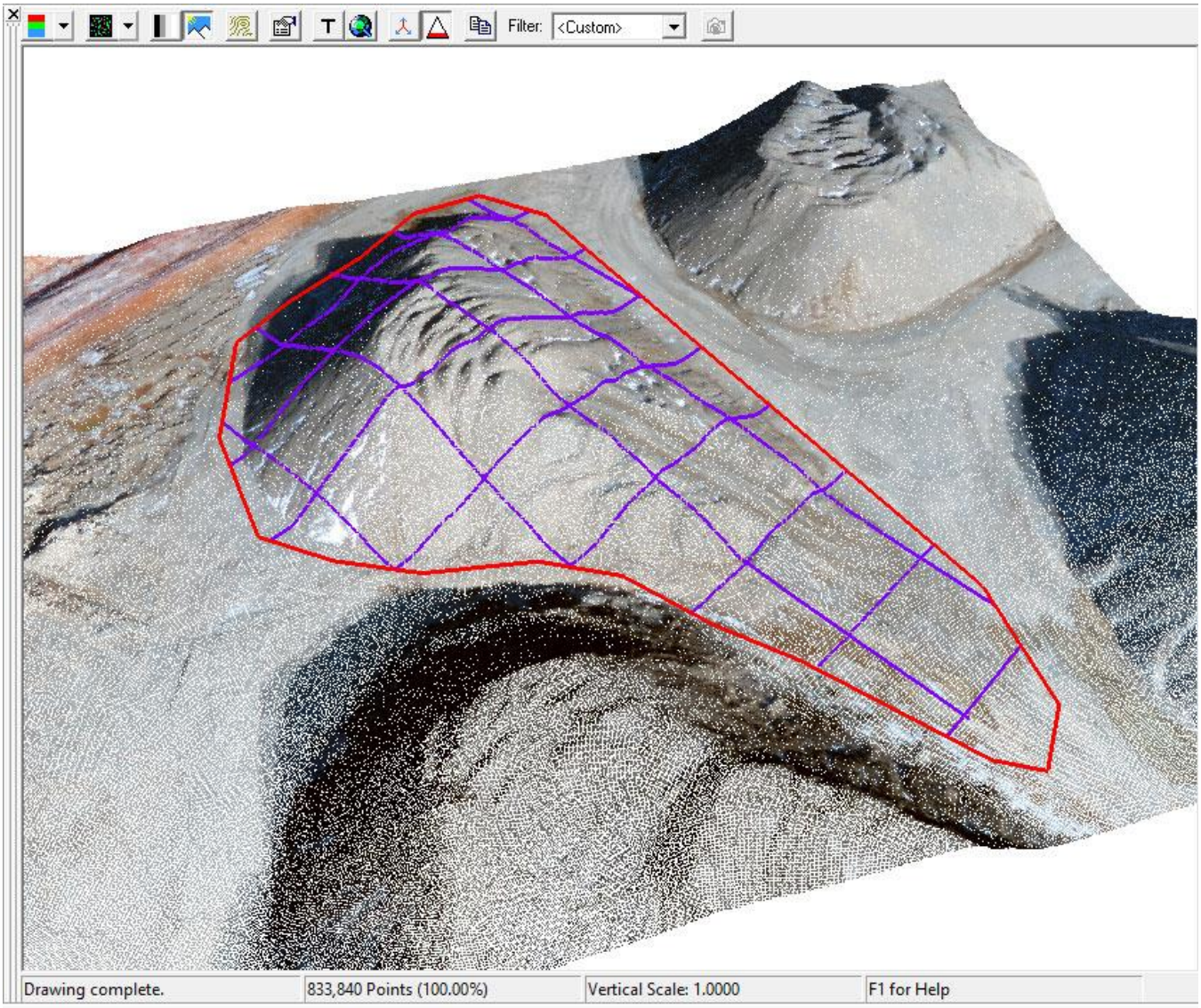

Figure 5: A 3D model using perpendicular cross sections

I am very excited with this new feature in LP360. Combined with the new volumetrics tools, LP360 now offers a very powerful platform for 3D analysis work. We see this as very useful in the general stockpile and quarry analysis market, whether the base LAS data are collected with LIDAR or with point clouds correlated from imagery.

The next EXP release of LP360, containing these cross section tools, will be posted as soon as we complete the addition of our control point measuring tools to LP360 x64.

Until next time, happy cross sectioning!!