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Flowcharts Hands On: Channels, Planned Lines and Zones in ADVANCED CHANNEL DESIGN

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This article continues our series of *Flowcharts Hands On* articles based on the Flowcharts found in the HYPACK® Help menu, and in the Appendix of the HYPACK® User Manual. The flowcharts are provided to guide you in processing your data.

In previous articles, we've looked at preparing tide and sound velocity corrections files that you can use to apply such corrections in the editing process, cleaning your single beam data in the 32-bit SINGLE BEAM EDITOR and 64-bit SINGLE BEAM EDITOR, and thinning your data with sounding selection programs.

If we want to calculate volumes relative to the project channel design template, we must create the HYPACK® files against which the volumes programs will compare your survey data. We can create all of these files in ADVANCED CHANNEL DESIGN (PREPARATION-EDITORS-ADVANCED CHANNEL DESIGN).

You can calculate volumes in either the TIN MODEL or CROSS SECTIONS AND VOLUMES program. (Each has advantages and disadvantages.) The following table shows the project files you need to calculate your desired volumes.

TABLE 1. *Support Files for Volume Calculations*

Volume Calculation	Program	Required Project Files
Sections (Philadelphia)	TIN MODEL	• 3D Planned Lines
Sections (Philadelphia)	CROSS SECTIONS AND VOLUMES	• 3D Planned Lines *Tip:* Use this planned line during your survey to embed the template in the data.
Channel—Faces, Zones and Lines	TIN MODEL	• CHN with Zones. • 2D LNW

Sections by Zone	CROSS SECTIONS AND VOLUMES	• Planned Line and Channel template information.
		  • Channel and 2D Planned Lines
		  OR
		  • 3D Planned Lines
		Tip: Use this planned line during your survey. Line names must match those in the ZEL.
		• Zone Edge Listing (*.ZEL)

In ADVANCED CHANNEL DESIGN, open a CHN from your sample project. Take a look at the contents of each tab and see where it is represented in the graphical display.

Experiment with different channel parameters; change the channel settings and click [Generate CHN] to see the results. You can save the new CHN, then load multiple CHN versions in the project to compare the differences in the HYPACK® area map.

Assign zones the channel file. Use different Volume Calculation settings, and save the result to a different name. When you calculate volumes, you can compare the calculations.

Experiment with different line options; change the settings in the Center Line tab and click [Generate LNW] to see the results. You can save the new LNW, then load multiple LNW versions in the project to compare the differences in the HYPACK® area map.

CREATING A SIMPLE CHANNEL IN ADVANCED CHANNEL DESIGN

This example shows a simple channel in the Single Beam Processing HandsOn project.

1. **In the PLN tab, click [Start Empty PLN]** to display the tabs required to enter your template data.
2. **Enter your Center Line information.** Once you have entered your XY coordinates, ADVANCED CHANNEL DESIGN can automatically calculate the chainage values for you.

FIGURE 1. *Center Line Tab*

> Type the coordinates directly into the tab.

OR

> Click [Load Cnt Line] and load the points in an XYZ file or the waypoints of a single line defined in a planned line (*.LNW) file.

3. **Calculate chainage.** Set your starting chainage for the first waypoint then click Calc Chainage. The calculated distances fill the Chainage column.

4. **Enter your toe line and any turning basin coordinates, each with side slope information**.

> Type the coordinates directly into the tab.

OR

> Click [Load from File] and load the points in an XYZ file or the waypoints of a single line defined in a planned line (*.LNW) file.

IMPORTANT: The first and last basin points must also appear in the points for the adjacent toe line.

FIGURE 2. *Toe Line Coordinates*

FIGURE 3. *Left Basin Coordinates*

5. **Set your channel parameters**. The options in the PLN tab provides flexibility to customize your channel information to your needs.

   > **Top of Bank** defines the level for the Left and Right banks relative to chart datum.

   > **Extension** extends the planned lines beyond the intersection with the top of bank.

   > **Align Toe Lines with Center Line** calculates positions for the ends of the toe lines such that the end of the generated channel is perpendicular to the end point of the center line.

FIGURE 4. *Channel Parameters*
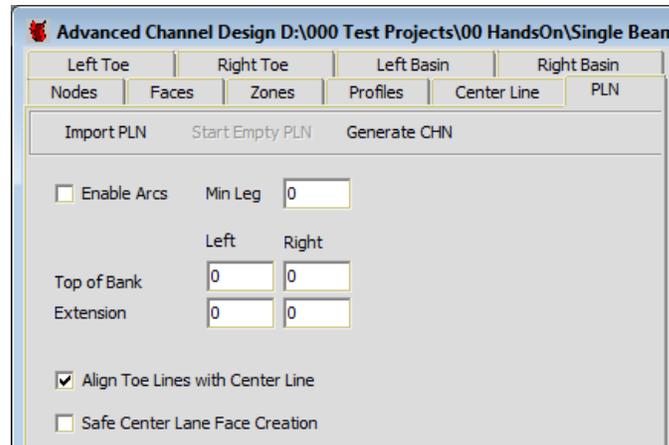
6. **Generate your channel.** Click [Generate CHN]. The results draw in the Map View.
7. **Save your channel file.** Click the save icon and name your file. It will be saved, by default, to the project folder with the CHN extension.

In the Single Beam Processing HandsOn project, we named the channel PLN Method.CHN).

FIGURE 5. *Resultant Channel—Full Channel (left), Zoomed North End (right)*
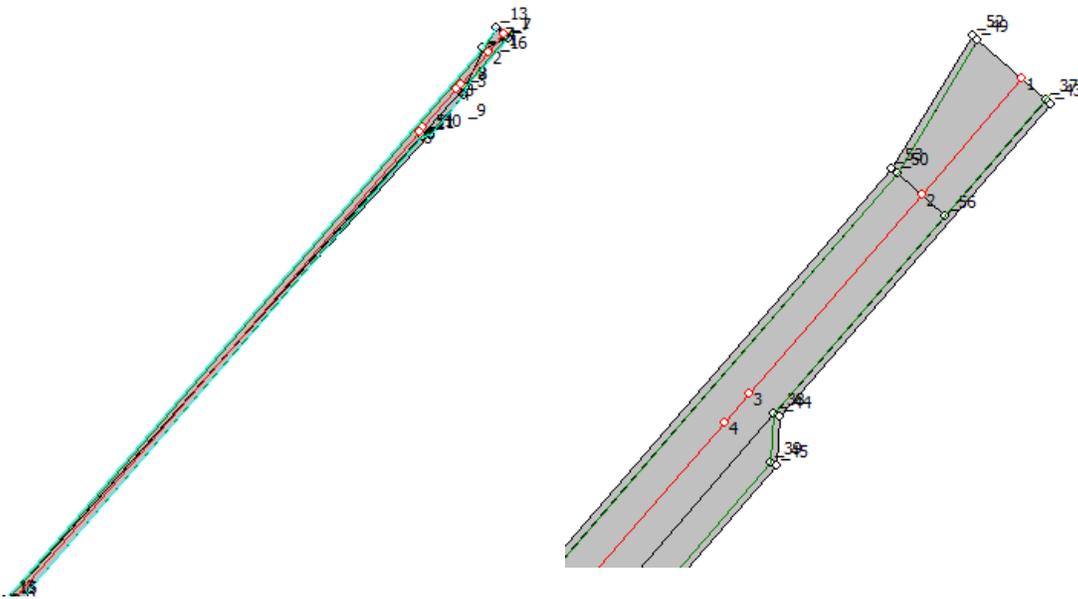
CREATING 3D PLANNED LINES IN ADVANCED CHANNEL DESIGN

Where you have a simple channel, ADVANCED CHANNEL DESIGN can generate cross-channel lines spaced along the center line and according to a few additional, selected options.

1. **Create a simple channel plan file (*.CHN).**

a. Click [Start Empty PLN] and enter the waypoints and slope information for the center line, toes and (optionally) any turning basins.

b. Set the channel parameters.

c. Click [Generate CHN] and name your channel.

2. **Enter the center line waypoints in the Center Line tab** if they are not already there from your channel creation method.

NOTE: If you used the center line offset method to create your channel, use the same center line waypoints in the Center Line tab as you began with in the Nodes tab.

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3. **Set your planned line parameters** in the Center Line tab.

FIGURE 6. Center Line Parameters

> **Spacing** equals the distance between lines along the center line.

> **Maximum Cross Distance** defines the distance from the center line the program should search when looking for the intersection between the planned line and the top of bank line. The Maximum Cross Distance also can affect the rotation of lines when the Smart Corners option is selected. Set the Maximum Cross Distance large enough so that all of the top of bank lines can be found, but not so large that more lines than necessary overlap beyond the toes.
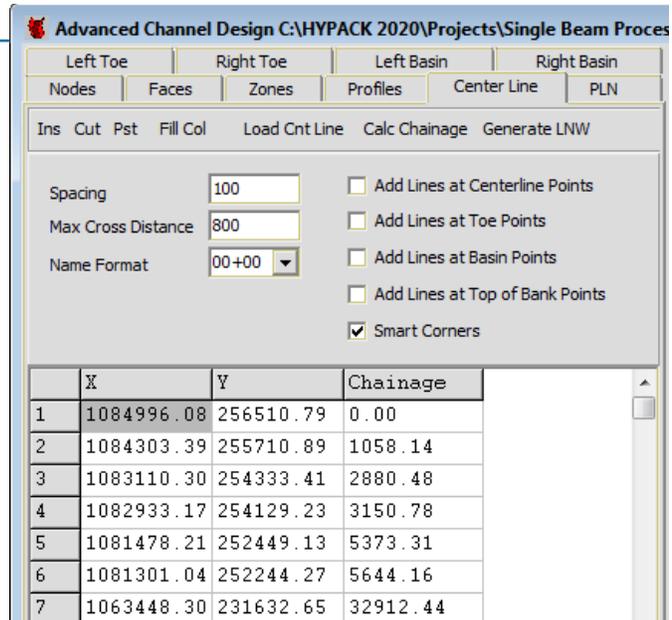
In addition to creating perpendicular lines at fixed intervals along the center line, ADVANCED CHANNEL DESIGN provides several modifications. These options can improve volumes calculations if your channel has a curve or other variation in the channel template.

> **Add Lines at Center Line Points** generates a planned line at each center line waypoint.

> **Add Lines at Toe Points** generates a profile line at each waypoint in the toe line.

> **Add Lines at Basin Points** generates a profile line at each waypoint in the basin line.

> **Add Lines at Top of Bank Points** generates a profile line at each waypoint in the top of bank line.

> **Smart Corners** rotates lines about the intersection of the planned line and the channel center line so that the line does not intersect with any other planned line.

NOTE: Smart Corners generates the most accurate results when computing volumes in the CROSS SECTIONS AND VOLUMES program.

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4. **Generate your lines.** Click [Generate LNW]. The lines appear in the map display.
5. **Verify the cross sections**. The map view provides an overhead view of your line file with your channel. Click [2D] to see the sections. Select a line in the Profiles tab. The selected line appears in red in the map view and the corresponding section appears in the 2D view.

> Check whether the Maximum Distance long enough so the lines reach from the center line to the farthest top-of-bank point.

> Check that the line positioning in the channel will provide the most accurate volume calculation results.

> Check that each template is complete and as expected.

You can experiment with different parameters and regenerate lines as much as you want. You can also add and remove lines from the preview using the check boxes in the Profiles list.

FIGURE 7. *Verifying Channel Formation*
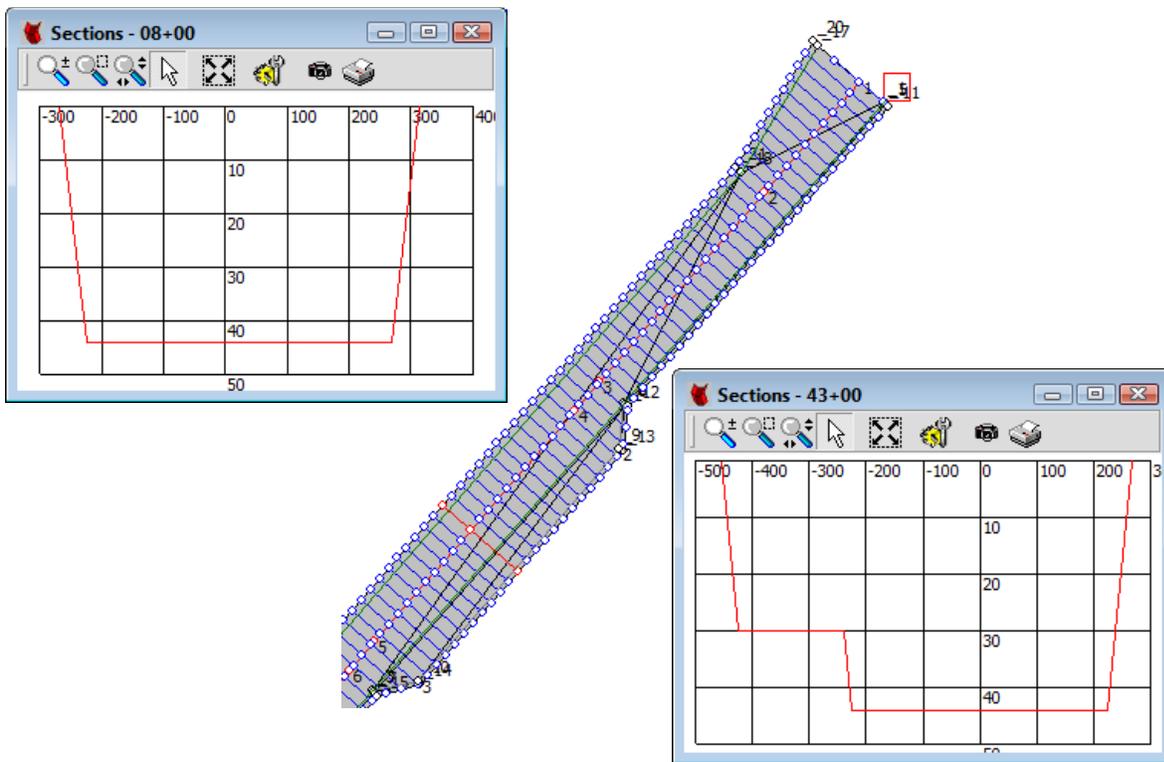
6. **Save your generated line file.**
   a. **In the Profiles tab, click [Save LNW].** A Save LNW dialog appears.

FIGURE 8. *Save LNW Dialog*
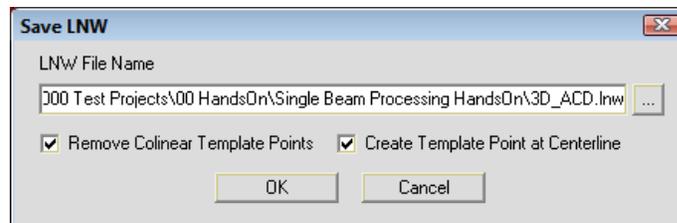
   b. **Name your file, set your options and click [OK].**

> **NOTE:** Click [...] and name your file to assure the project folder location.

> **Remove Colinear Template Points**. Without this option, the program generates a template point at each location where the LNW crosses the edge of a face. If you check this option, when your template has multiple consecutive points at the same depth, the program includes only the first and last template point at each depth.
> **Create Template point at Centerline:** *Required by the Philadelphia volumes calculation method.*

DEFINING ZONES

Zones enable you to calculate volumes by zone in both TIN MODEL and CROSS SECTIONS AND VOLUMES. TIN MODEL reports volumes for each zone in the channel file. CROSS SECTIONS AND VOLUMES reports the volume in each zone for each section.

Once you have defined your channel, you can define your channel zones in the Zones tab:

1. **Open the Zones tab.** The map view will display your channel with a cross-hatched pattern.
2. **Name each reporting zone.**
   a. **Click [Add]**. The Zone Attributes dialog appears.

   FIGURE 9. *Adding your Zones*

   b. **Enter the zone name**.
   c. **Choose the zone color.** Click in the color box and select from the colors dialog. (The color is only to clearly distinguish between zones in the map view.)
   d. **Enter the Volume Calculation options**:
      - **Apply for All Zones** applies the Overdepth and Overdepth Method settings to all zones in the channel. Otherwise, you can set those options for each zone.
      - **Overdepth**: Allowable distance to dredge past the design grade.
      - **Overdepth Method**: Contour or Non-contour. Select None if your overdepth is zero.
   e. **Click [OK]**.
   f. **Repeat the process for each zone**.
3. **Assign each face in the channel file to a zone**. ADVANCED CHANNEL DESIGN paints the selected faces with the zone color.
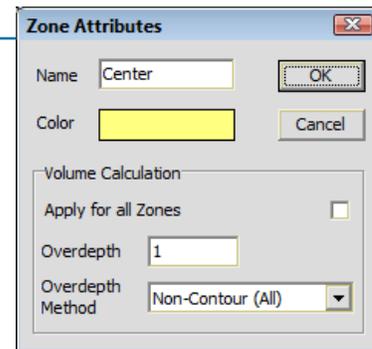
> **NOTE:** Vertical walls can not be assigned to zones.

   a. **Select the target zone** by clicking in the list on the left.
   b. **In the map view, select each face that belongs to that zone.**

- **Use the Arrow cursor to select each face that belongs to the selected zone.** ADVANCED CHANNEL DESIGN paints the faces with the zone color as you click on each one.
- **To create a polyline selection**, use the Select tool to mark polyline points through the zone. Right-click the last point. ADVANCED CHANNEL DESIGN assigns every face intersected by the polyline to the selected zone.
- **To use the polygon function**, use the Select tool to define the zone area, enclosing its faces. Right-click close to your beginning point. Every face intersected with, and located within, the polygon is then assigned to the selected zone.

c. **Repeat the process for each zone**.

IMPORTANT: Be sure every face has been assigned to a zone.

FIGURE 10. *Zones Assigned to Each Channel Face in the Single Beam Project*
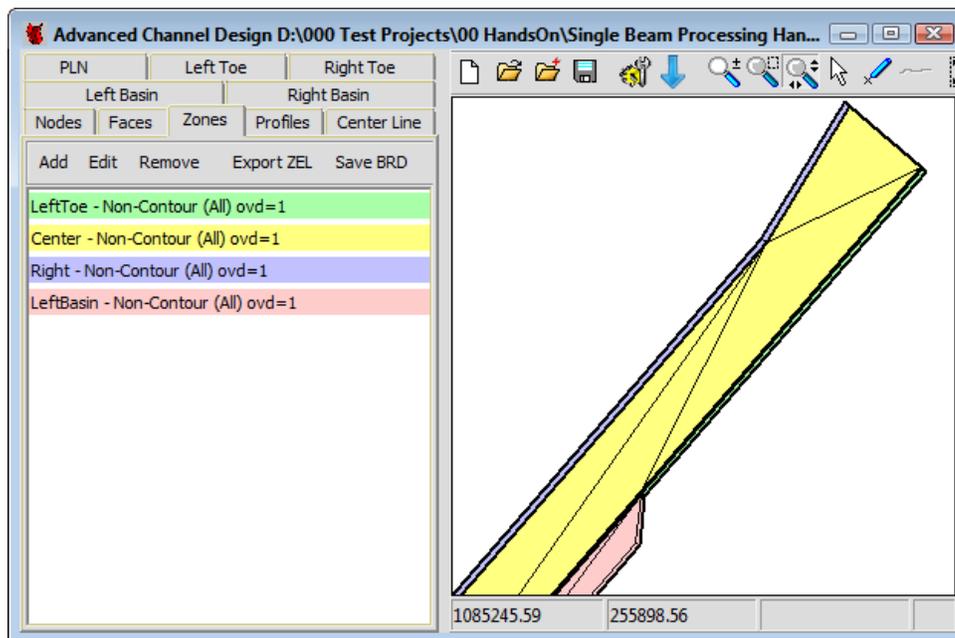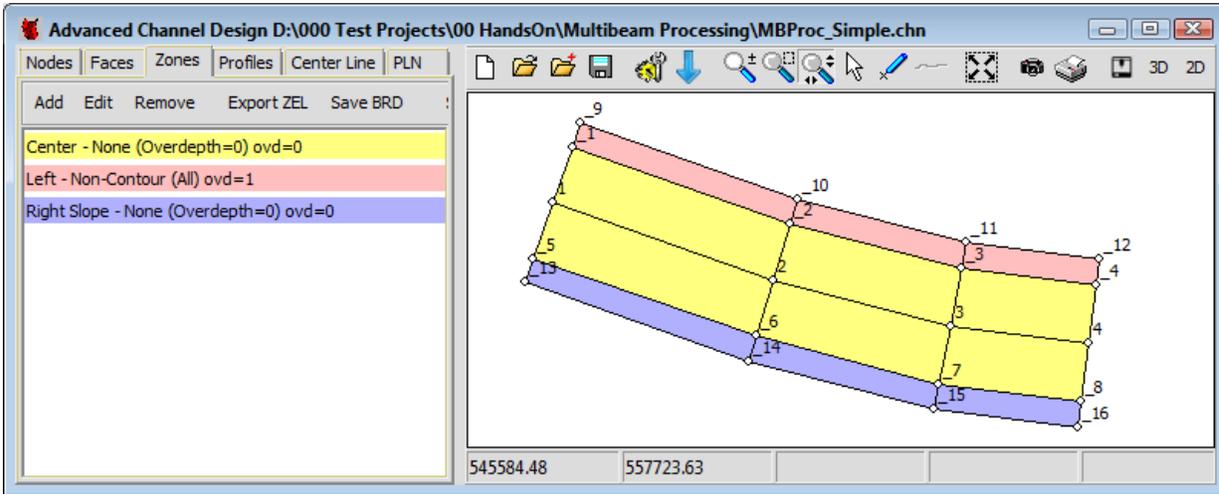
FIGURE 11. *Zones Assigned to Each Channel Face in the Multibeam Project*

4. **Save the channel.** In the ADVANCED CHANNEL DESIGN shell, click the File Save icon and name your file. It is saved, by default, to your project folder.

EXPORTING A ZONE EDGE LISTING

If you plan to calculate volumes by zone in the CROSS SECTIONS AND VOLUMES program, you must also generate a Zone Edge Listing (ZEL) file.

To generate a Zone Edge Listing, you will need the following:

*   **A channel file (*.CHN)** that meets the following specifications:
    > Each face must be assigned to a zone.
    > It must begin before the first survey line and extend past the last line in your survey line file.
    > The survey lines must extend past the top-of-bank in the channel file.
*   **The planned line file** used to collect your data.

IMPORTANT: The line names in the ZEL file must match the line names of the base survey in CROSS SECTIONS AND VOLUMES.

In the Single Beam Processing HandsOn project, the EDT0710.LOG sample data we have been using was not collected with the line file we generated in this example (3D_ACD.LNW).

To enable us to do zone volumes in CROSS SECTIONS AND VOLUMES, we have used TIN MODEL to cut new section files using the 3D_ACD.LNW file. The new section files, EDT0710_TINSections.LOG, have line names that match those in the ZEL file. This is a reasonable workaround; however, the volumes are then calculated using depths that were mathematically generated in TIN MODEL. *They are not the exact soundings you logged.*

Alternatively, we could use the 2D Lines.LNW, which has lines that correspond to the EDT0710.LOG. While this option gives us volumes, the irregularly spaced survey lines would negatively affect the volumes results.

1. **Load your channel file with zones defined.**
2. **In the Profiles window, click [Read LNW] load your planned line file that matches the ZEL file**. (3D_ACD.LNW)
3. **In the Zones tab, click [Export ZEL]**, name your output file and click [Save].