Surfer

Powerful gridding, mapping, and 3D modeling system.

Quick Start Guide

Surfer® Registration Information

Your **Surfer** product key is located in the download instructions email and in your account at MyAccount.GoldenSoftware.com.

Register your **Surfer** product key online at www.GoldenSoftware.com. This information will not be redistributed.

Registration entitles you to free technical support, download access in your account, and updates from Golden Software.

For future reference, write your product key on the line below:

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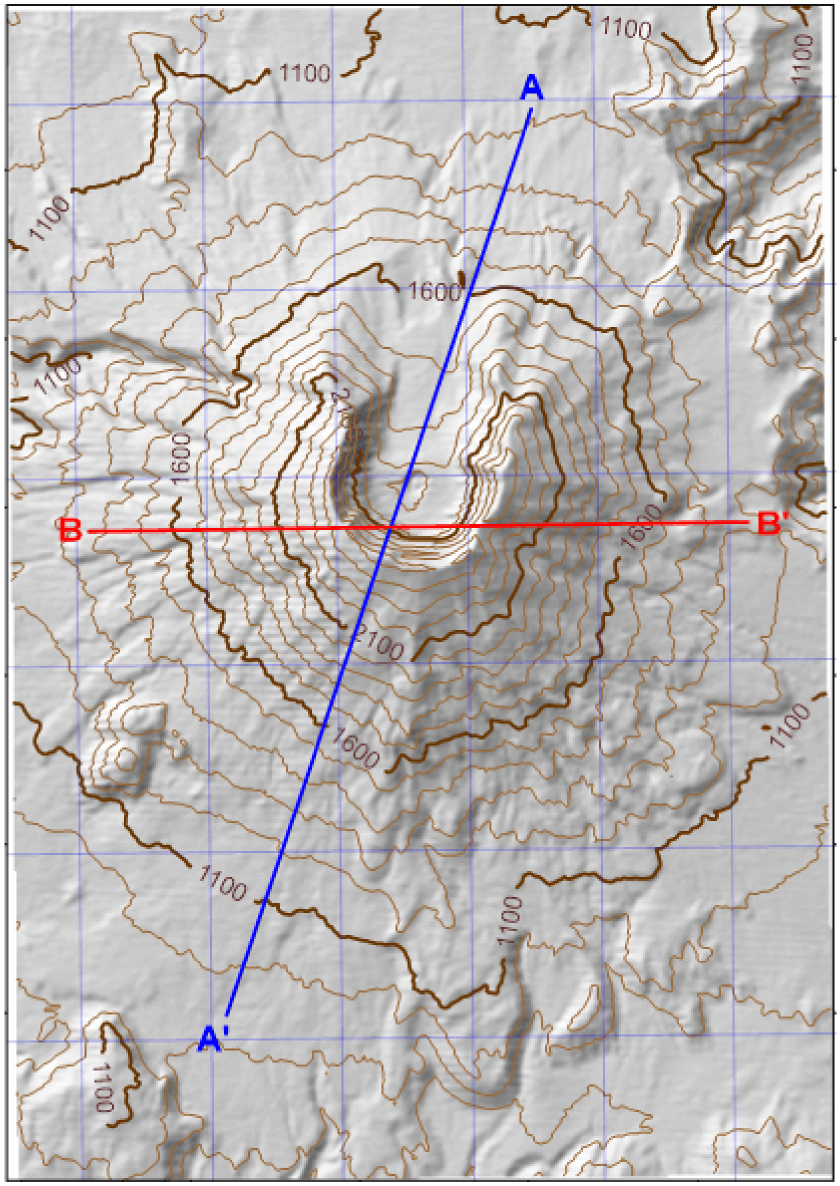
Surfer® Quick Start Guide

Powerful Gridding, Mapping, and 3D Modeling
for Scientists and Engineers



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Introduction to Surfer

Welcome to **Surfer**, a powerful gridding, mapping and 3D modeling package for scientists, engineers, educators, or anyone who needs to generate maps quickly and easily. Producing publication-quality maps and models has never been quicker or easier. Adding multiple map layers and objects, customizing the map display, and annotating with text creates attractive and informative maps. Virtually all aspects of your maps can be customized to produce the exact presentation you want.

Surfer's grid-based mapping features interpolate irregularly spaced XYZ or XYZC data into a regularly spaced grid. Grids may also be imported from other sources, such as the United States Geological Survey (USGS). The grid is used to produce different types of maps including contour, color relief, and 3D surface maps among others. 3D grids enable even more in depth investigations of your site through 2D slice maps and 3D volume renders, isosurfaces, image slices, block renders, and more.

An extensive suite of gridding methods is available in **Surfer**. The variety of available methods provides different interpretations of your data, and allows you to choose the most appropriate method for your needs. In addition, data metrics allow you to map statistical information about your gridded data. Surface area, projected planar area, and volumetric calculations can be performed quickly in **Surfer**. Cross-sectional profiles can also be computed and exported.

The grid files can be edited, combined, filtered, sliced, queried, and mathematically transformed. For example, grids can be sliced to create cross-sectional profiles, or the **Grids | Calculate | Isopach** command can be used to create an isopach map from two grid files. Grids can be edited with an intuitive user interface in the grid editor.

Scripter

The **Scripter** ™ program, included with **Surfer**, is useful for creating, editing, and running script files. A script is a text file containing a series of instructions for execution when the script is run that automates **Surfer** procedures. By writing and running script files, simple mundane tasks or complex system integration tasks can be performed precisely and repetitively without direct interaction. **Surfer** also supports ActiveX Automation using any compatible client, such as Visual BASIC. These two automation capabilities allow **Surfer** to be used as a data visualization and map generation post-processor for any scientific modeling system.

New Features

The new features in **Surfer** are summarized:

- Online in the *New Features in Surfer* Knowledge Base article
- Online in the *New Features in Surfer Beta* Knowledge Base article

Who Uses Surfer?

People from a variety of disciplines use **Surfer**. Since 1984, over 100,000 scientists and engineers worldwide have discovered **Surfer's** power and simplicity. **Surfer's** outstanding gridding and contouring capabilities have made **Surfer** the software of choice for working with XYZ data. Over the years, **Surfer** users have included hydrologists, engineers, geologists, archeologists, oceanographers, biologists, foresters, geophysicists, medical researchers, climatologists, educators, students, and more! Anyone wanting to visualize their XYZ data with striking clarity and accuracy will benefit from **Surfer's** powerful features!

System Requirements

The system requirements for **Surfer** are:

- Windows 10, 11 or higher
- 64-bit operation system support
- 1024x768 or higher monitor resolution with a minimum 16-bit color depth
- At least 1GB free hard disk space. 500GB or larger hard drive with 25% disk space available recommended.
- At least 512MB RAM for simple data sets, 16GB RAM recommended
- .NET Framework 4.8. (Note: .NET Framework 4.8 is preinstalled on Windows 10 and later versions)

3D View requirements:

- Graphics supporting OpenGL v3.2 or later
- Dedicated graphics card (e.g. NVIDIA, AMD) highly recommended.
- Graphics emulators, such as VMs and Parallels for Mac, may not support all the required features for viewing data in the 3D view.

Fine Tuning Surfer Performance

- Issues with 3D View features may be corrected by upgrading to the latest graphics drivers.
- Many heavily computational operations, including gridding and contouring, are multi-threaded and processor reliant. A faster processor will improve **Surfer's** performance.
- For processing very large data files, such as LiDAR or some vector data files, fast and large RAM storage capacity is recommended.
- Click the **File | Options** command and on the **General** page, set the *Max number of processors* to use all processor cores.
- For improved performance, you can disable "Save auto recovery information" (**File | Options | General | Save auto recovery information**). However, disabling this feature means you will lose any unsaved work if the program closes unexpectedly. Auto-recovery is highly recommended to protect your data.

Installation Directions

Golden Software recommends installing only the latest version of **Surfer**.

Installing **Surfer** requires Administrator rights. Either an administrator account can be used to install **Surfer** or the administrator's credentials can be entered before installation while logged in to a standard user account. Golden Software does not recommend installing the current version of **Surfer** in the same location as any previous versions of **Surfer**.

To install **Surfer** from a download:

- Log into Windows under the account for the individual who is licensed to use **Surfer**.
- Download **Surfer** according to the emailed directions you received.
- Double-click on the downloaded file to begin the installation process.
- Once the installation is complete, run **Surfer**.
- License **Surfer** by activating a single-user license product key or connecting to a license server.

Updating Surfer

If you need the full product installation file for an update, you have several options. You can download the latest version of your software (**Surfer**, **Grapher**, **Voxler**, or **Strater**) from our downloads page. If you're the software owner or have registered it, you can also download your specific licensed version from the "My Products" page of your Golden Software My Account. You can also email your registered Surfer product key to surfer-support@goldensoftware.com and request to download the full product update.

See the Check for Update topic in the help for additional information.

Uninstalling Surfer

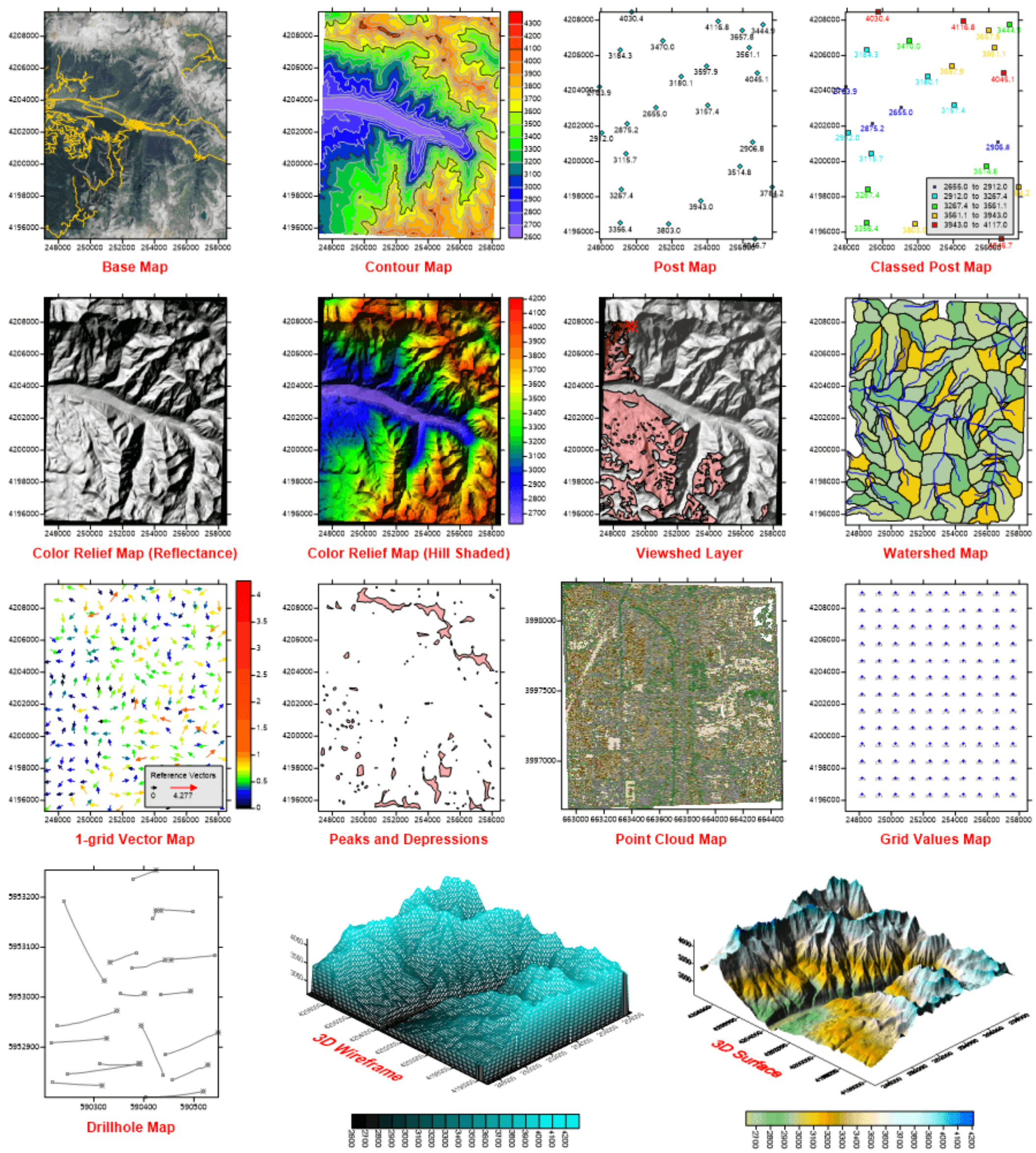
To uninstall **Surfer** from Windows, open *Settings* by pressing Windows key plus I (capital i), then go to **Apps | Installed apps**. Scroll through the list or use the search bar to find **Surfer**, click the three-dot menu next to it, and select *Uninstall*. Follow the on-screen instructions to complete the process. If prompted, restart your computer to ensure all associated files are removed. Alternatively, you can uninstall via the **Control Panel**, navigate to **Programs and Features**, locate **Surfer**, and select *Uninstall* from there.

Surfer Trial Functionality

The **Surfer** trial is a fully functioning time-limited trial. This means that commands work exactly as in the full program for the duration of the trial. The trial has no further restrictions on use. The trial can be installed on any computer that meets the system requirements. The trial version can be licensed by activating a product key or connecting to a license server.

Three-Minute Tour

We have included several sample files with **Surfer** so that you can quickly see the variety of **Surfer's** capabilities. Only a few files are discussed here, and these examples do not include all of **Surfer**'s many map types and features. The **Contents** window is a good source of information as to what is included in each **Surfer** file. The different types of maps that can be created is found in the program help in the *Map Types* topic.

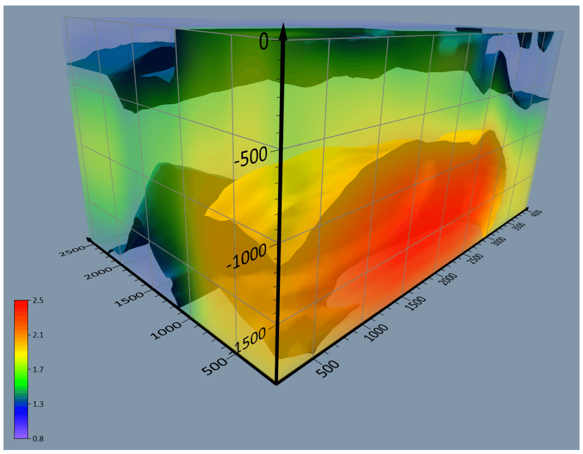


***Surfer**, a powerful contouring, gridding, and surface mapping package, produces publication-quality maps. Virtually all aspects of your maps can be customized to produce the exact presentation you want.*

To access the example files from your computer:

1. Open **Surfer**.
2. Click the **File | Open** command.
3. In the **Open** dialog, navigate to the **Surfer** Samples folder located in C:\Program Files\Golden Software\Surfer\Samples by default.
4. Select the sample .SRF file of interest and click *Open*. The sample file is now displayed. Repeat as necessary to see the files of interest.

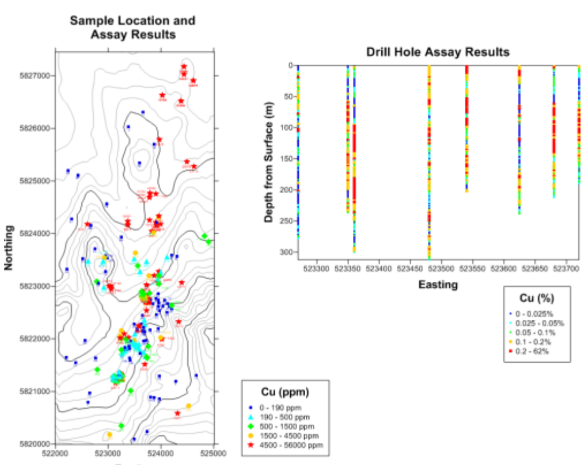
Examples of Surfer Capabilities



View Data in 3D

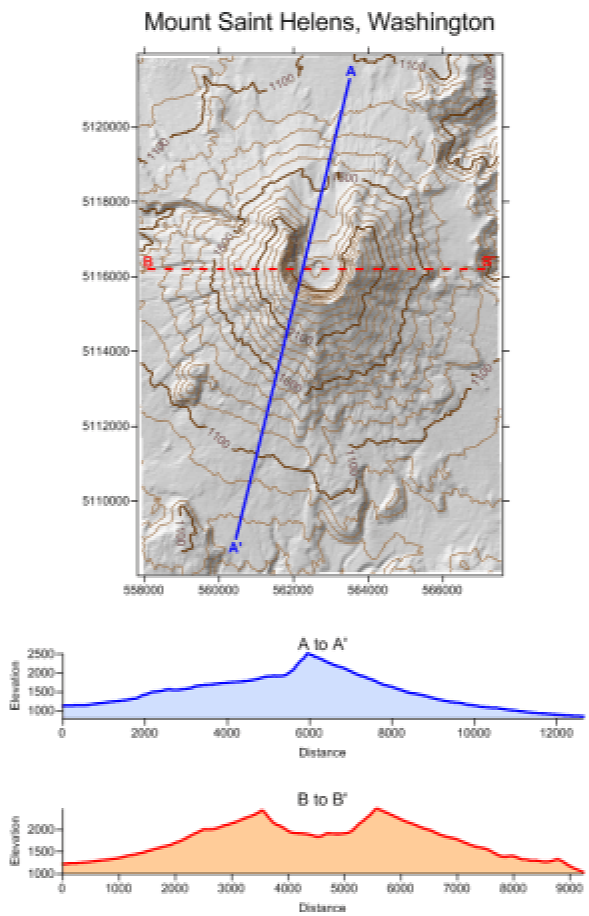
Explore the capabilities of *3D View* with our sample files, showcasing 3D contours, points, vector objects, drillholes, and volumes. To see these in 3D, open the SRF file, select the map in the Contents window, and then click **Map Tools | View | 3D View**.

The *3DView.SRF* file also contains a flight path you can experience by clicking **3D View | Fly-Through | Play** within the **3D View** window.



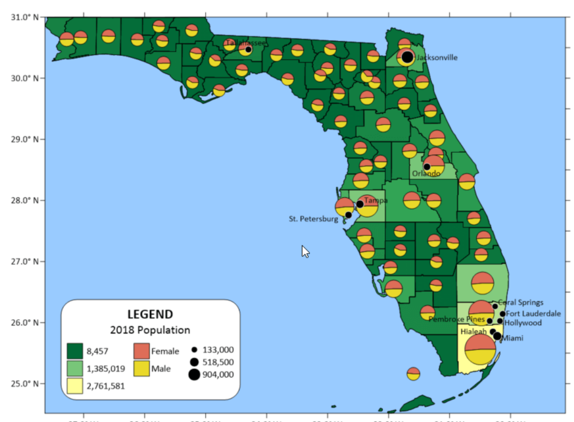
Present Scientific Research

The *Classed Post.SRF* sample file displays two maps. The left map is a contour map with a classed post map layer displaying the location of the sample of copper in parts per million and assay results over a study area. The right map is a classed post map that displays the drillhole assay results by comparing the depth from surface to the Easting. A classed post map legend has been added to each map.



Display Complex Spatial Data

The *Profile.SRF* file contains a map with two base map layers, a contour layer, and a shaded relief layer. The base maps were created with the **Map Tools | Add to Map | Profile** command. At the bottom of the page, the A and B profile lines are displayed, showing two elevation profiles across the Mount St. Helens map.



Layer Multiple Types of Data

The *BaseSymbology(PieChart).SRF* sample file was created from one post layer and two base layers. The post layer displays circular symbols relatively sized according to population count in various cities throughout Florida. The base layer depicts population in all the counties in Florida using *Unclassed Colors* symbology. The Pies base layer uses *Pie Chart* symbology to depict the proportion of women to men in each county.

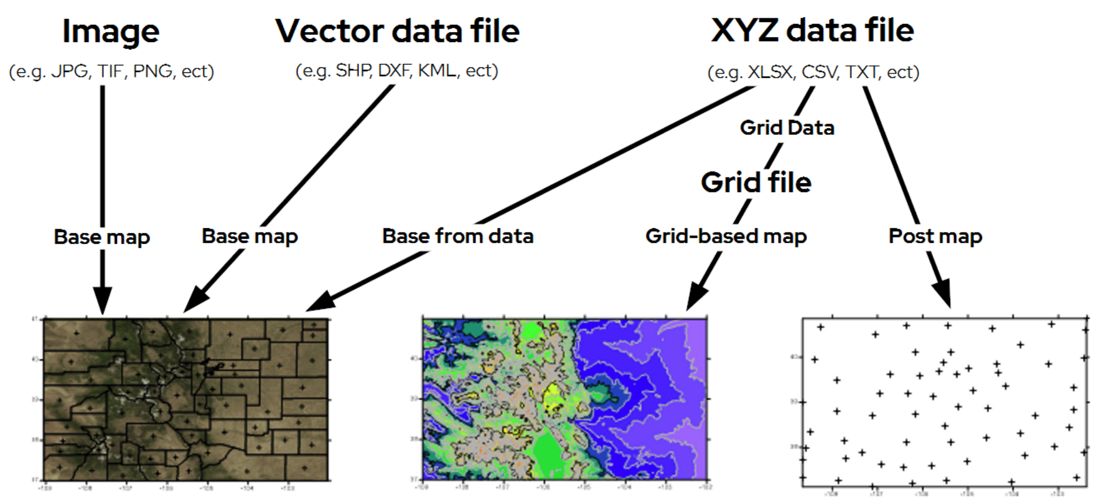
Create a Grid from XYZ Data

The most common application of **Surfer** is to create a grid-based map from an XYZ data file. An XYZ data file has X data, Y data, and Z data delimited into separate columns (for example, longitude, latitude, and elevation). The **Grid Data** command uses an XYZ data file to produce a grid file. The grid file is then used by most of the **Home | New Map** commands to produce maps. Post maps, base maps, point cloud, and drillhole maps do not use grid files.

The general steps to progress from an XYZ data set to a finished grid-based map are as follows:

1. Create an XYZ data file. This file can be created in a **Surfer** worksheet window or outside of **Surfer** (using an ASCII text editor or Microsoft Excel, for example).
2. To display the data points, click the **Home | New Map | Post** command.
3. Create a grid file .GRD from the XYZ data file using the **Home | Grid Data | Grid Data** command.
4. To create a map, select the map type from the **Home | New Map** commands. Select the grid file from step three. New grid-based maps that can be created include contour, 3D surface, 3D wireframe, color relief, peaks and depressions, 1-grid or 2-grid vector, watershed, and grid values maps.
5. Click on the map to display the map properties in the **Properties** window where you can customize the map to fit your needs.
6. Click the **File | Save** command to save the project as a **Surfer** .SRF file which contains all the information needed to recreate the map.

This flowchart is designed to clarify the relationships between various data file types – XYZ, grid, vector, and image – and the maps that can be created from them. The example illustrates the process of generating a contour map from a grid file. However, it's crucial to understand that this is just one example, and other relationships exist. For example, image files, including GeoTIFFs (which frequently contain elevation data), can also be used as grid files to produce grid-based maps.



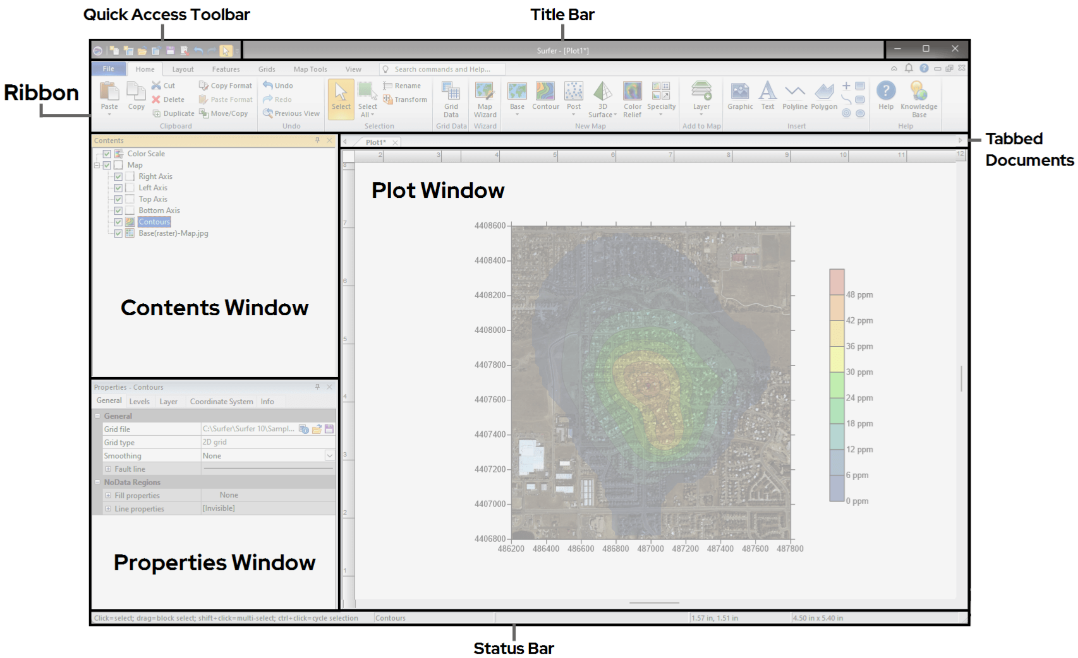
Using Scripter For Automation

Tasks can be automated in **Surfer** using Golden Software's **Scripter** program or any ActiveX Automation-compatible client, such as Visual BASIC. A script is a text file containing a series of instructions for execution when the script is run. **Scripter** can be used to perform almost any task in Surfer. Scripts are useful for automating repetitive tasks and consolidating a sequence of steps. **Scripter** is installed in the same location as Surfer. Refer to the *Surfer Automation* topic in the help for more information about **Scripter**. We have included several example scripts so that you can quickly see some of **Scripter's** capabilities.

1. Open **Scripter** by navigating to the installation folder, C:\Program Files\Golden Software\Surfer\Scripter. Right-click on the *Scripter.exe* application file and select **Run as administrator**.
2. Choose the **File | Open** command.
3. Select a sample script .BAS file. These are located in the C:\Program Files\Golden Software\Surfer\Samples\Scripts folder.
4. Click the **Script | Run** command and the script is executed. Most sample scripts open **Surfer** and display a map in the plot window.

Surfer User Interface

Surfer contains four document window types: the plot document, worksheet document, 3D view, and grid editor. Maps are created and displayed in the plot document and 3D view. The worksheet document displays, edits, transforms, and saves data in a tabular format. The grid editor displays and edits Z values for the grid with various editing tools.



*This is the **Surfer** plot window with the **Contents** and **Properties** windows on the left and the worksheet and grid editor tabs on the top of the horizontal ruler.*

Surfer Layout

The following table summarizes the function of each component of the **Surfer** layout.

Component Name	Component Function
Title Bar	The title bar lists the program name plus the saved Surfer .SRF file name (if any). An asterisk after the file name indicates the file has been modified.
Quick Access Toolbar	All window types in **Surfer** include the quick access toolbar to the left of the title bar. The quick access toolbar contains buttons for many common commands. The quick access toolbar can be customized to add or remove buttons with the **Customize Ribbon** command.
Ribbon	The ribbon includes all of the commands in **Surfer**. Commands are grouped under the File menu and various tabs. Some commands and tabs are only available in specific views. For example, the **Features | Insert | Polyline** command is only available in the plot window. The ribbon commands can be modified and rearranged with the **Customize Ribbon** command. On the upper right side of the ribbon is a bell icon that will display a red badge/circle for unread but not important, and red exclamation for unread and important user-specific notifications to be read.

Tabbed Documents	The plot, 3D view, worksheet, and grid editor windows are displayed as tabbed documents. The tabs may be reordered by clicking and dragging. When more than one window is open, tabs appear at the top of the document, allowing you to click on a tab to switch to a different window. When a document contains unsaved changes, an asterisk (*) appears next to its tabbed name.
Contents	The **Contents** window contains a hierarchical list of all the objects in a Surfer plot document, grid editor, or 3D view window displayed in a tree view. The objects can be selected, added, arranged, or edited. Changes made in the **Contents** window are reflected in the plot document, grid editor, or 3D view and vice versa. The **Contents** window is initially docked at the left side of the window.
Properties	The **Properties** window contains all of the properties for the selected object or objects. Changes made in the **Properties** window are reflected in the plot document, grid editor, or 3D view. The properties in the **Properties** window are grouped by page. The **Properties** window is initially docked below the **Contents** window.
Status Bar	The status bar displays information about the current command or activity in **Surfer**. The status bar is divided into five sections. The sections display basic plot commands and descriptions, the name of the selected object, the cursor map coordinates and units, the cursor page coordinates, and the dimensions of the selected object.

Opening Windows

Selecting the **File | Open** command opens grid files and data files as maps. The **File | New | Plot Document** command creates a new plot window. The **File | New | Worksheet** command creates a new worksheet window. The **Map Tools | View | 3D View** command opens a 3D view of the selected map. The **Grids | Editor | Grid Editor** command opens a grid in the grid editor.

Changing the Layout

The plot, worksheet, grid editor, 3D view window, **Properties** window, and **Contents** window are in a docked view by default. However, they can be displayed as floating windows. The visibility, size, and position of each item may be changed.

Visibility

Use the **View | Show/Hide** commands to toggle the display of the rulers, drawing grid, status bar, **Contents** window, and **Properties** window. Alternatively, click the or buttons in the **Contents** and **Properties** windows to auto-hide or close the windows.

Right-click the ribbon or quick access toolbar to minimize the ribbon, move the quick access toolbar above or below the ribbon, and customize the ribbon or quick access toolbar.

Auto-Hiding the Contents or Properties Windows

Click the button to auto-hide a docked **Contents** or **Properties** window. The window slides to the side of the **Surfer** main window and a tab appears with the window name.

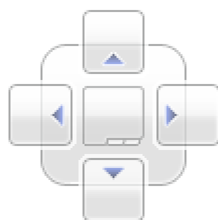
Position the mouse pointer over the tab to view the window. Move your mouse away from the window and the window "hides" again. Click inside the window to anchor it at its current position. Click in another window to release the anchor and hide the window. Click the button to return the window to a docked position.

Size

Drag the sides of the application window, **Contents** window, **Properties** window, or document window to change its size. If a window is docked, its left and right bounds are indicated by a cursor, and its upper and lower bounds are indicated by a cursor. Click and drag the cursor to change the size.

Position

To change the position of a docked window, click the title bar and drag it to a new location. To dock the **Contents** or **Properties** windows, use the docking mechanism. Double-click the window's title bar to toggle between floating and docked modes. Left-click the title bar of a window and drag it to a new location while holding the left mouse button. The docking mechanism displays with arrow indicators as you move the window.



*The docking mechanism makes it easy to position the **Contents** and **Properties** windows.*

When the cursor touches one of the docking indicators in the docking mechanism, a blue rectangle shows the window docking position. Release the left mouse button to allow the window to be docked in the specified location.

Restoring the Windows to Their Original Locations

If the **Contents** or **Properties** windows have moved or become invisible, or if they are in undesired locations, you can use the **View | Windows | Reset Windows** command to move them back to their original locations. You must restart **Surfer** for the changes to take effect.

Menu and Tab Commands

The ribbon contains the commands that allow you to add, edit, and control the objects on the plot, worksheet, grid editor, or 3D view window page.

Plot Document Commands

When viewing a plot document, the main ribbon tab commands are available:

File	Open and save files, import or export data, print, and set options and defaults
Home	Contains common editing, selection, feature, grid, and map commands
Features	Draw features and perform geoprocessing
Layout	Set the page display and arrange or position maps and objects in the plot document
Grids	Perform grid operations
Map Tools	Add map layers, and edit or analyze maps and map layers
View	Controls the display of toolbars, status bar, rulers, grids, and managers, resets window positions, tracks cursor between map and worksheet, and controls the zoom level of the plot

Point Cloud Commands

The commands for editing the points within a point cloud layer are located on the **Point Cloud** ribbon. The **Point Cloud** tab is only displayed when a point cloud layer is selected.

3D View Commands

The commands for changing the view, creating fly-throughs, and copying images in the 3D view window are located on the **3D View** ribbon. The **3D View** tab is only displayed while viewing a map in the 3D view.

Worksheet Commands

The primary commands when viewing a worksheet window are located on the **Data** ribbon. However, many of the **File** menu and **Grid** tab commands are also available when viewing a worksheet window, and a few of the **Home** and **View** tab commands are available as well.

Grid Editor Commands

The primary commands when viewing a grid in the grid editor are located on the **Grid Editor** tab. The **Grid Editor** tab includes commands and tools for editing the grid values.

The **Application/Document Control Menu** commands control the size and position of the application window or the document window.

Status Bar

The status bar is located at the bottom of the **Surfer** window. The status bar displays information about the current command or activity in **Surfer**. Click the **View | Show/Hide | Status Bar** check box to show or hide the status bar. A check mark next to **Status Bar** indicates that the status bar is displayed. Clear the **Status Bar** check box to hide the status bar.

Status Bar Sections

The status bar is divided into five sections. The left section displays information about the selected command or item in the **Properties** window. The second section shows the selected object name or the number of objects/points in the selection. The middle section shows the cursor coordinates in map units, if the cursor is placed above a map. The fourth section shows the cursor coordinates in page units of inches or centimeters. The right section displays the dimensions of the selected object.

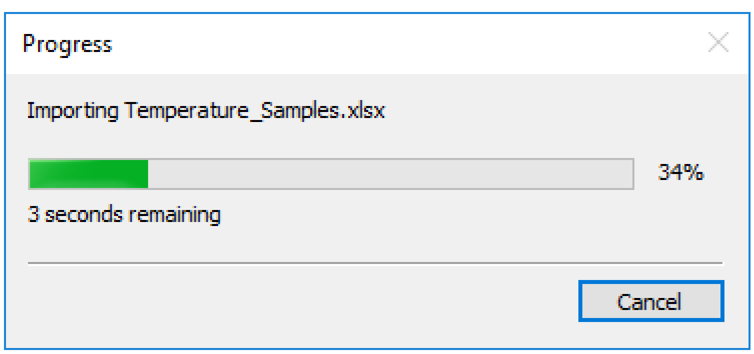
When viewing a grid in the **grid editor**, the first three sections of the status bar display a description for the selected property in the **Properties** window, the active grid node grid coordinates, and the map coordinates of the cursor location.

Adjust Section Width

The status bar section widths can be adjusted to display additional text. If "..." is displayed at the end of the text, additional text can be displayed. To change the width, place the cursor over a section division. When the cursor changes to a , left-click and drag the divider left or right to a new location.

Progress

The **Progress** dialog indicates the progress of a procedure, such as gridding. The percent of completion and time remaining will be displayed. Click *Cancel* to stop the current process.

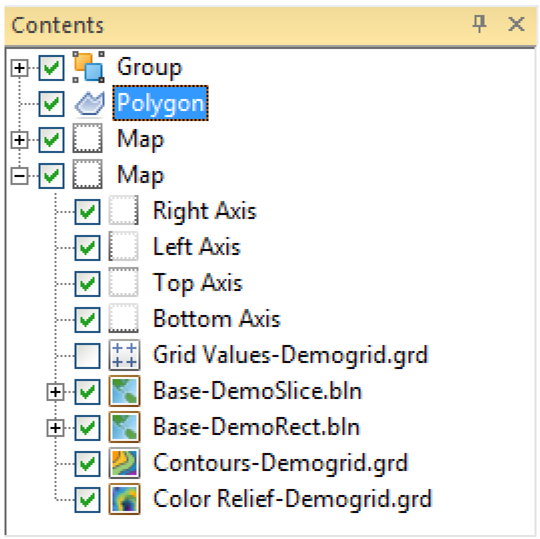


*The progress of a procedure is shown in the **Progress** dialog.*

When the program does not know how much time is required to complete a task, the *Indeterminate* mode is displayed in the **Progress** dialog. This indicates that the program is actively completing the task, with an unknown time of completion. The program is not frozen.

Contents

The **Contents** window contains a hierarchical list of all objects in the plot, grid editor, or 3D view window. The objects can be selected, arranged, moved, renamed, or deleted in the **Contents** window. Changes made in the **Contents** window are reflected in the plot, grid editor, or 3D view window and vice versa.



*The **Contents** window displays the structure of all the objects in the plot window.*

Object Tree

If an object contains sub-objects, a ⊞ or ⊟ is located to the left of the object name. Click on the ⊞ or ⊟ button to expand or collapse the list. For example, a map object normally contains at least one map layer (e.g. Contours) and four axes. The *Map* object may contain many other objects. To expand the *Map* tree, click on the ⊞ control. You can also select the item, and press the PLUS key on the numeric keypad or press the RIGHT ARROW key on your keyboard. To collapse a branch of the tree, click on the ⊟ control. You can also select the item, and press the MINUS key on the numeric keypad or press the LEFT ARROW key. The expansion state of sub-objects in the **Contents** window is retained in the **Surfer** file .SRF. Use the *Expand new Contents window items* option in the **Options** dialog to control the expansion state of new objects in **Contents** window.

Selecting Objects

To select an item in the **Contents** window, click on the item or press the arrow keys, and the object text is highlighted. The selection handles in the plot change to indicate the selected item. If you select an object in the plot window, its name is selected in the **Contents** window as well. More than one nested object can be selected at a time.

To select multiple objects at the same level in the tree, hold down the CTRL key and click on each object. To select multiple contiguous objects at the same level in the tree, select the first object, and then hold down the SHIFT key and click on the last object.

Click on a base layer or a group in the **Contents** window and an orange left-hand arrow with a small pushpin appears. Clicking on the pin either pins or unpins the layer or group for editing. When a layer or group is pinned, only objects within the pinned layer or group can be selected. This feature is useful for selecting objects in the plot window.

Arranging Objects

To change the display order of the objects with the mouse, select an object and drag it to a new position in the list above or below an object at the same level in the tree. The pointer changes to a black arrow if the object can be moved to the cursor location, or a red circle with a diagonal line if the object cannot be moved to the indicated location. Alternatively, select an object and use the **To Front**, **To Back**, **Forward**, and **Backward** commands. These commands can be accessed in the **Layout | Move** command group or by right-clicking on an object in the **Contents** window.

Moving Features

Features such as points, polylines, and polygons can be moved between base (vector) layers and the plot document. The **Home | Clipboard | Move/Copy to Layer** command can be used to move or copy features. Features can also be moved in the **Contents** window. To move a feature to another base (vector) layer, select the feature and drag it to a new position within another base (vector) layer. To move a feature to the plot document, select the feature and drag it to a new position above, between, or below the top-level objects in the **Contents** window.

Editing Features in Groups

Features such as points, polylines, and polygons can be added, edited, and removed from composite objects such as groups and base (vector) layers. A special edit mode is enabled to do so. Edit mode is started and stopped automatically by the application. Ensure that edit mode is not enabled before using the **Export** command either by clearing the selection or selecting a non-composite object.

Object Visibility

Each object in the **Contents** window includes an icon indicating the type of object and a text label for the object. All objects also have a check box that indicates if the object is visible. A ☑ indicates the object is visible. A ☐ indicates the object is not visible. Click on the check box to change the visibility state of the object. Invisible objects do not appear in the plot window and do not appear on printed output. The visibility check box also controls the visibility for all of its sub-objects. For example, if a *Map* object is made invisible then the axes and layers within the *Map* will also be hidden. Note that if a surface is made invisible, any overlays also become invisible. Select multiple objects to toggle the visibility for multiple objects at one time.

Locked Objects

Objects and layers can be locked to prevent changes to their size and position with the **Layout | Position | Lock** command. When an object or layer is locked, a small lock icon appears in the lower-right corner of the visibility check box. When a map, group, or base layer object is locked, all of its sub-objects are automatically locked.

Renaming Objects

To edit an object's text ID, select the object in the **Contents** window and then click again on the selected item (two slow clicks) to edit the text ID associated with an object. Allow enough time between the two clicks so it is not interpreted as a double-click. Enter the new name into the box. Alternatively, right-click on an object name and select *Rename Object*, select the object and click the **Rename** command, or select the object and press F2 on the keyboard. Enter an ID in the **Rename Object** dialog and click *OK*.

Deleting Objects

To delete an object, select the object and press the DELETE key. To move a map layer from one map to a new map, click on the map layer and click the **Map Tools | Layer Tools | Break Apart** command. Or right-click on the map layer and select **Break Apart Layer**. Select multiple objects and press DELETE to delete multiple objects at one time.

Scroll the Contents Window

If the list of objects in the **Contents** window is long, you can use the scroll bar on the side of the **Contents** window to scroll down to an object. Alternatively, you can use the mouse scroll wheel to scroll down. To scroll down using the mouse, click once in the **Contents** window to select the window. Roll the mouse wheel backward to scroll lower in the **Contents** window. Roll the mouse wheel forward to scroll higher in the **Contents** window.

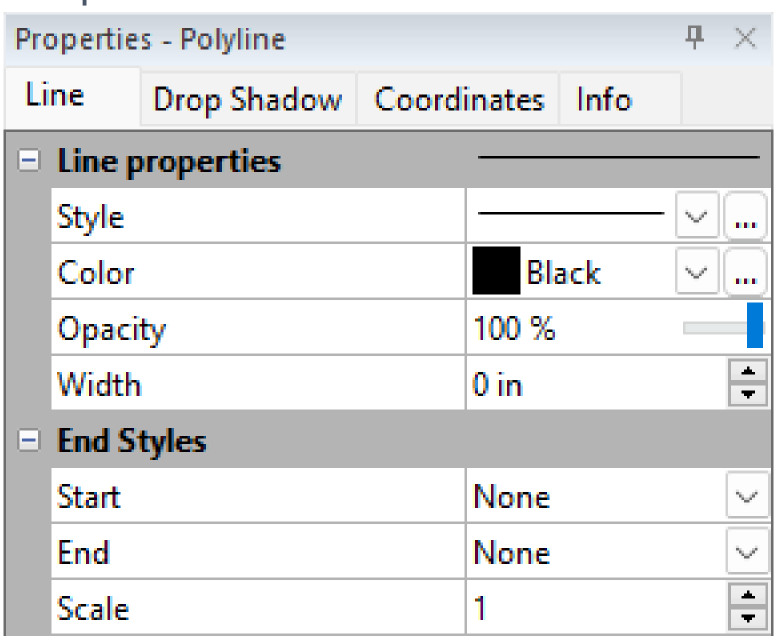
Properties

The **Properties** window allows you to edit the properties of a selected object, such as a contour map or axis. The **Properties** window contains a list of all properties for the selected object. The **Properties** window can be left open so that the properties of the selected object are always visible.

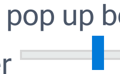
To display the properties for an object, click once on the object in the **Contents** window or in the plot window. The properties are displayed in the **Properties** window. When the **Properties** window is hidden or closed, double-clicking on an object in the **Contents** window opens the **Properties** window with the properties for the selected object displayed. To activate the **Properties** window, click inside the **Properties** window or press ALT+ENTER on the keyboard.

For information on a specific feature or property that is shown in the **Properties** window, refer to the help page for that **Properties** window page. For instance, if you are interested in determining how to set the *Fill colors* for a contour map or how to save data for a post map, refer to the contour map *Levels* topic or post map *General* topic in the program help, respectively.

Changing Properties



*The **Properties** window displays the properties associated with the selected object.*

The **Properties** window displays the properties for selected objects. To change a property, click on the property's value and select a new property from the pop up box, scroll to a new number using the  buttons, select a new value using the slider , select a new value from the list or palette, or type a property value. Objects in the plot, grid editor, or 3D view window automatically update after you select an item from a palette, use one of the controls, or press ENTER after typing a new value.

For example, a polyline has *Style, Color, Opacity, Width,* and *End Styles* properties. Changing the *Color* requires clicking on the current color and selecting a new color from the *color palette*. Changing the *Width* requires highlighting the current width and typing a new number or scrolling to a new number. Changing the *Opacity* requires highlighting the current value and typing a new number or clicking on the slider bar and dragging it to a new value.

You can modify more than one object at a time. Only shared properties can be changed are when multiple objects are selected. For example, you can click on a polyline in the **Contents** window. Hold the CTRL key and click on a polygon. You can then change the *line* properties of both objects at the same time. *Fill* properties, which are available if only a polygon is selected, are not available as the polyline does not have fill properties.

Some properties are dependent on your other selections. For example, there is a *Pattern Offset* section on the **Fill** page. This section is only available when an image fill type is selected as the *Pattern.*

Expand and Collapse Features

Features with multiple options appear with a ⊞ or ⊟ to the left of the name. To expand a group, click on the ⊞ icon. To collapse the group, click on the ⊟ icon. For example, the expanded *Filled Contours* section in the **Levels** page contains three options, *Fill contours, Fill colors,* and *Color scale*.

Keyboard Commands

To activate the **Properties** window, press ALT+ENTER on the keyboard. When working with the **Properties** window, the up and down arrow keys move up and down in the **Properties** window list. The TAB key activates the highlighted property. The right arrow key expands collapsed sections, e.g., *Filled Contours*, and the left arrow collapses the section.

Property Defaults

Use the **File | Options** command to change the default settings. Default settings for rulers, drawing grid, line, fill, text, symbol, label format, and advanced settings that control each map type can be set from the **Options** dialog.

Property Information Area

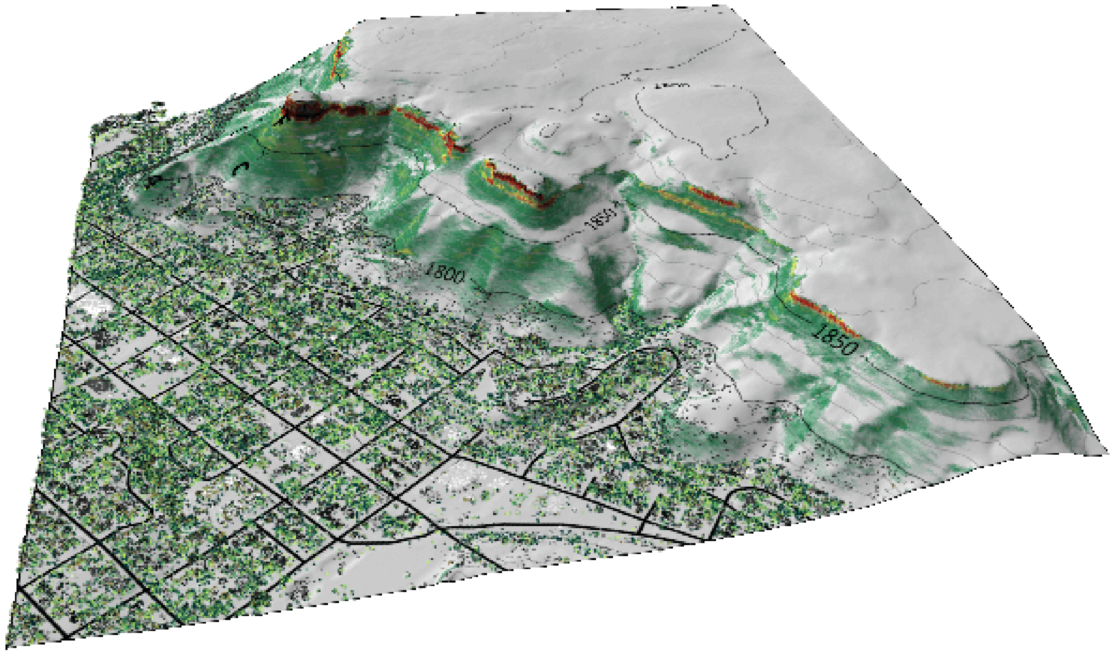
If the *Show property info area* is checked on the **Options** dialog **User Interface** page, a short help statement for each selected command is presented in the **Properties** window.

3D View Window

Click the **Map Tools | View | 3D View** command () or the *3D View* button in the *Map* frame **View** properties page to open a 3D view window of the selected map. A new 3D view is created for the selected map. A 3D view can also be created by right-clicking a map or map layer and clicking **3D View** in the context menu. To create a 3D view, the map must include at least one of the following: a grid-based layer, a base from data, a post or classed post layer, a point cloud layer, a drillhole layer, or a base (vector) layer with a 3D object. The document tab includes the file name and view number. For example, when a 3D view is created for a map in the Plot1 plot window, the plot window tab name is *Plot1:1* and the 3D view window tab name is *Plot1:2*.

The 3D view window displays a map in a three-dimensional view space.

- Grid-based layers from the plot window are rendered as surfaces (XYZ grids) or volumes (XYZC grids) in the 3D view. The visualizations from the grid-based maps are also overlaid on the surface. For example, contour lines or color relief layers will be overlaid on the surfaces. Contour may also be rendered as 3D polyline objects.
- Base (vector and raster), post, and classed post layers are overlaid on the surfaces as textures.
- 3D vector objects in a 3D view can include: points with elevation data from base layers, post layers, and classed post layers; 3D lines and polygons from base layers; and contour lines. Polymeshes in base layers are also displayed as 3D vector objects.
- Drillhole layers are rendered as drillhole paths.
- Point cloud layers are rendered as a 3D point cloud.
- The 3D view window only displays layers that are visible in the map in the plot window. Show or hide surfaces, textures, and vector data in the 3D view by selecting or clearing the visibility check boxes in the 3D view **Contents** window. Completely remove a surface, texture, or vector data from the 3D view by switching to the plot window and turning the visibility off for the associated map layer.



The 3D view displays the map in a three-dimensional space. This map includes contour, color relief, post, base, and point cloud layers.

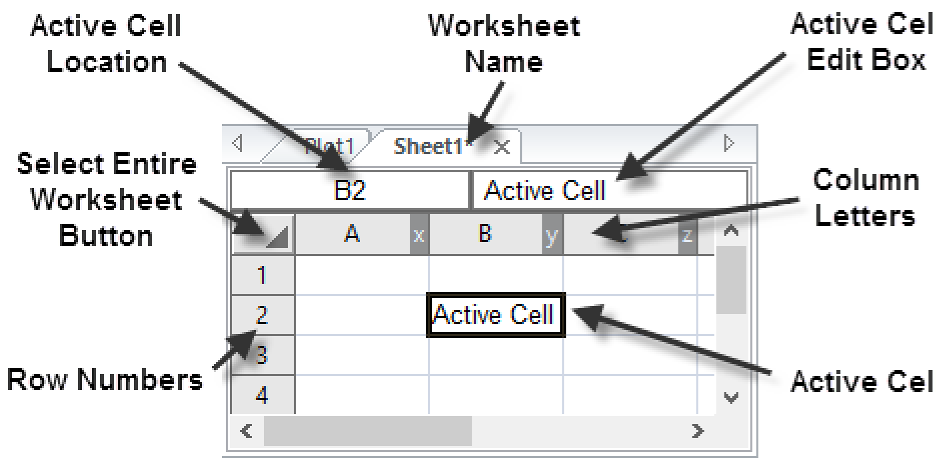
Worksheets

Worksheet windows are a view of the data file and are designed to display, edit, enter, and save data. The worksheet windows have several useful and powerful editing, transformation, and statistical operations available. In addition, a coordinate system can be assigned to the data file. Several import and export options are available for opening data files from other spreadsheet programs. The components of the worksheet window are displayed below.

To enter data in a worksheet, click the **File | Open** command to open an existing data file or click the **File | New | Worksheet** command to create a blank worksheet. The components of the worksheet window are discussed below.

Worksheet Window

The following image and table explain the purpose of the Worksheet window components.



The components of a worksheet window shown above are described in the table below.

Component	Function
Column Letters	The letter that identifies a column of the worksheet.
Row Numbers	The number that identifies a row of the worksheet.
Active Cell	The cell highlighted with a bold outline. The active cell receives data input (numeric values or text strings) from the keyboard. Only one cell is active at a time.
Active Cell Location	The location of the active cell, specified by column letter and row number.
Active Cell Edit Box	The box displaying the data or text contained in the active cell. Data typed into an empty cell appears in both the edit box and the active cell.
Worksheet Name	The name of the data file displayed in the worksheet or the worksheet number prior to saving.
Select Entire Worksheet Button	The button used to select all cells in the worksheet. Located in the top left corner of the worksheet.

Grid Editor

The **Grids | Editor | Grid Editor** command, the button, and the **Map Tools | Edit Layer | Grid** commands open the grid editor as a new document.

- The **Grids | Editor | Grid Editor** command and the button open a grid file with the **Open Grid** dialog.
- The **Map Tools | Edit Layer | Grid** command opens the grid file from the selected map layer in the plot document. You can also edit the grid for a map layer by right-clicking on the map layer and clicking **Edit Grid**. This command enables the **Update Layer** command in the grid editor. The **Map Tools | Edit Layer | Grid** command is not available for 1-grid vector and 2-grid vector layers. When accessed this way, the

grid editor will display any Post, Classed Post, and vector or raster Base layers in the Map as context layers.

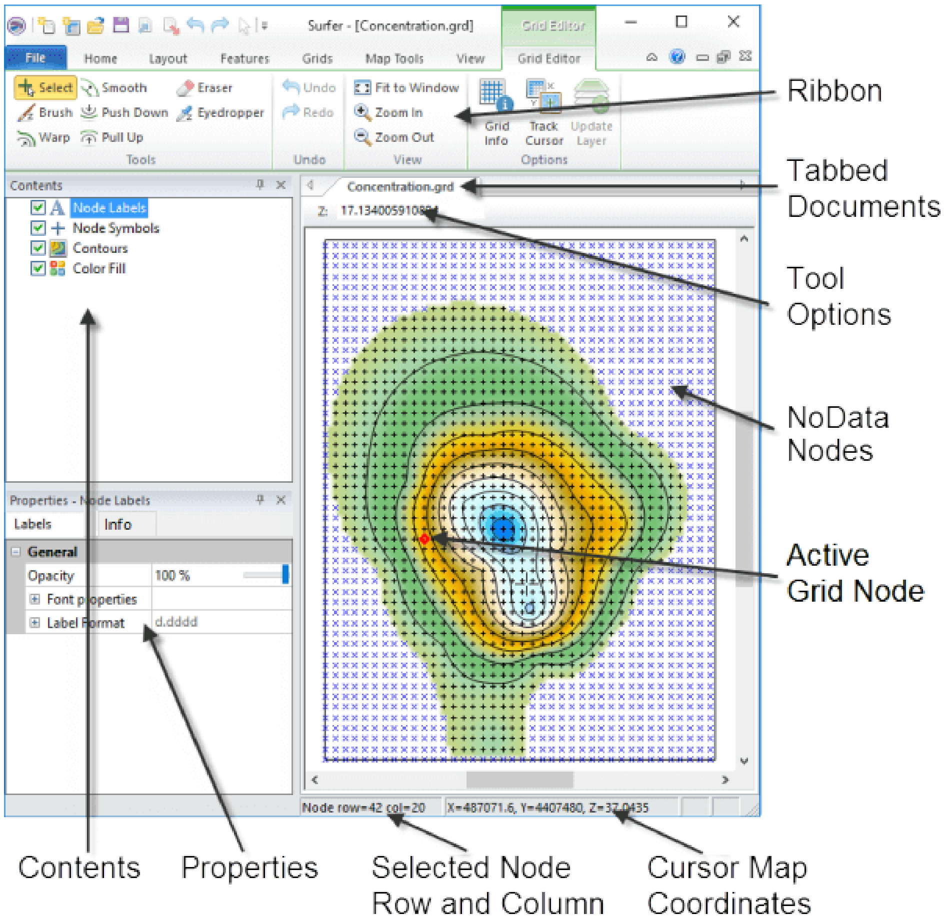
The grid editor contains various methods for editing the grid Z values. Editing the grid Z values will change the appearance of any grid-based maps. For example, the grid editor can be used to edit contours on a contour map or change the surface in a 3D surface map.

Each grid node is indicated with a black "+" in the grid editor window by default. Each NoData grid node is indicated with a blue "x" by default. The active node is highlighted with a red diamond. To move between grid nodes, press the arrow keys, or click a node with the **Select** tool active to make it the active node. The grid editor also includes contours, node labels, and a color fill. If the grid editor was opened by editing a layer in a map, any base and post layers are included for context as well. The grid appearance is controlled by the items in the **Contents** window and the properties displayed in the **Properties** window.

Note the **Undo** command does not undo changes in the **Properties** window in the grid editor.

Grid Editor Window

The following image and table explain the purpose of the grid editor window components.



*This is the **Surfer** grid editor with the **Contents** and **Properties** windows on the left and grid editor window on the right.*

Component	Function
Ribbon	The ribbon contains the **Grid Editor** commands.
Contents	Toggle the display of the *Node Labels*, *Node Symbols*, *Contours*, *Context Layers*, and *Color Fill* with the **Contents** window.
Properties	Edit *Node Labels*, *Node Symbols*, *Contours*, *Context Layers*, and *Color Fill* **Labels** properties and view **Info** properties in the **Properties** window.
Tabbed Documents	Plot windows, worksheet windows, and grid editor windows are displayed as tabbed documents.
Tool Options	The tool options bar contains the *Z value box*, *Brush size*, *Density*, and/or *Pressure* depending on the selected tool mode.
Active Node	The node that is currently selected. The active node is highlighted with a red diamond.
Grid Node	Each grid node is indicated with a black "+" in the grid editor window by default. NoData nodes are indicated with a blue "x".
Status Bar	The status bar includes information about the selected property, active node grid coordinates, and cursor map coordinates.

Using the Grid Editor

The grid editor can be used on existing map layers or on grid files without first creating a map.

To edit a map layer's grid:

1. Select the map layer created from a grid file to edit in the plot document **Contents** window. Only the grid for this map layer will be edited even when multiple layers, such as contour or color relief, use the same grid file.
2. Click **Map Tools | Edit Layer | Grid** in the plot window. The grid file is opened and is represented by a filled contour map. The location of each grid node in the file is marked with a black "+". NoData nodes are marked with a blue "x".
3. Use the **Grid Editor | Tools** commands to make the desired adjustments to the grid.
4. When you are done editing the grid, click the **Grid Editor | Options | Update Layer** command to update the map layer in the plot document with your grid.
5. Click the plot document tab to view the changes to the map layer. If you wish to revert the changes to the map layer, click the **Undo** command while viewing the plot window. If you are satisfied with the changes to the map layer, you may wish to save the edited grid to a file.
6. If you wish to save your edits to a file, click **File | Save | Save As** to create a new grid file. Click **File | Save** to overwrite the existing grid file. It is necessary to save your edits to a file with **Save** or **Save As** if you wish to update all layers in your map to use the edited grid.
7. To close the grid editor window, click the **File | Close** command or click the X in the grid editor document tab. To view an existing window and keep the grid editor window open, click on another document tab.

To edit a grid file:

1. Click the **Grids | Editor | Grid Editor** command and select the grid file in the **Open Grid** dialog. The grid file is opened and is represented by a filled contour map. The location of each grid node in the file is marked with a black "+". NoData nodes are marked with a blue "x".
2. Use the **Grid Editor | Tools** commands to make the desired adjustments to the grid.
3. When you are done editing the grid, click **File | Save | Save As** to create a new grid file. Click **File | Save** to overwrite the existing grid file. It is necessary to save your edited grid to a file with **Save** or **Save As** if you wish to create map layers with the grid.
4. To close the grid editor window, click the **File | Close** command or click the X in the grid editor document tab. To view an existing window and keep the grid editor window open, click on another document tab.

File Types

Surfer uses four basic file types: data, grid, base map, and **Surfer** .SRF files.

Data Files

Various types of data files are used to produce grid files, point cloud maps, and drillhole maps or to post data points on a map. These files are generally referred to as XYZ data files or data files throughout the help. Data can be read from various file types, including XLSX, CSV, and TXT. Most data files contain numeric XY location coordinates and optional Z values. The Z values contain the variable to be modeled, such as elevation, concentration, rainfall, or similar types of values.

XYZ data files contain raw data that **Surfer** interprets to produce a grid file. To create a grid file, you must start with an XYZ data file. XYZ data files are organized in column and row format. Surfer requires the X, Y, and Z data to be in three separate columns.

Grid Files

Grid files, also known as raster files, produce several different types of grid-based maps, are used to perform grid calculations, and to carry out grid operations. Grid files are a regularly spaced rectangular array of Z values in columns and rows. Grid files can be created in **Surfer** using the **Home | Grid Data | Grid Data** command or can be imported from a wide variety of sources such as WCS servers or other applications. Supported grid file formats include GRD, ASC, and ADF.

Base Map Files

Base map files contain XY location data such as aerial photography, state boundaries, rivers, or point locations. Base map files can be used to create layers overlaid on other map types, or to specify the limits for assigning NoData values, faults, breaklines, or slice calculations. Base map files can be created from a wide variety of vector and image formats. Base map files may be referred to as vector data files, raster data files, and images or image files in the help, depending on the type of data in the base map file. Supported base map file formats include SHP, DXF, JPG.

Surfer Files

Surfer *.SRF* files preserve all the objects and object settings contained in a plot window. These files are called **Surfer** *.SRF* files throughout this documentation **Surfer** can save *.SRF* files back to Surfer 11, but cannot save to *.SRF* files in versions older than that. For example, the Surfer 15 Document *.SRF* file type can be opened in Surfer 15, but does not contain features that are in later **Surfer** versions. The **.SRFfile* format (introduced in **Surfer** 16) provides ongoing backward compatibility.

Gridding Overview

A grid, also known as a raster in other software products, is a rectangular or cuboid region comprised of evenly spaced rows and columns. The intersection of a row and column is called a grid node. Rows contain grid nodes with the same Y coordinate. Columns contain grid nodes with the same X coordinate. The grid node value for 2D grids is the Z coordinate. 3D grids contain multiple stacked rectangular slices at fixed Z coordinates and the grid node value is the C coordinate. 3D grids can be created from XYZC point data or drillhole data.

Contour maps, color relief maps, grid values maps, peaks and depressions maps, watershed maps, vector maps, viewshed maps, 3D surfaces, and 3D wireframes all require grids for their creation in Surfer. In addition to creating grid files, **Surfer** can also open grid files created in other software packages. For a list of supported grid file formats, refer to the **File Format Chart**.

What is Gridding?

Gridding is the process of taking irregularly or regularly spaced XYZ or XYZC data and generating a regularly spaced grid of values at each grid node by interpolating or extrapolating the data values.

Gridding Methods

Gridding the data produces a regularly spaced, rectangular array of grid nodes, with a calculated value at each node, from regularly or irregularly spaced data. The term "irregularly spaced" means that the distance between data points varies in the X or Y direction, or both. Irregularly spaced data often has many holes where data are missing. Gridding calculates the values for grid nodes where data exists, and can also calculate values for grid nodes in the holes where no data exists, by extrapolating or interpolating the values in the data. The gridding method determines the mathematical algorithms used to compute the value at each grid node. Each method results in a different representation of your data. It is advantageous to test each method with a typical data set to determine the gridding method that provides you with the most satisfying interpretation of your data.

When your XYZ data is regularly spaced, meaning the distance between data points does not change in the X and Y directions, you may produce a grid file that uses the Z values directly and does not interpolate values for the grid nodes. See the *Producing a grid file from a regular array of XYZ data* help topic for more information.

General Gridding Options

Each gridding method has its own set of gridding options. Some of the options are the same or similar for the different gridding methods, while other options are specific to particular gridding methods. Some options that are available to multiple gridding methods include: *Search*, *Anisotropy*, *Breaklines*, and *Faults*.

Grid Data

Grid files are necessary in **Surfer** to create grid-based map types. Data files are typically randomly spaced points, and this data must be converted into an evenly spaced grid before using many of **Surfer's** features. Grid files are produced from XYZ, XYZC, or drillhole data using the **Home | Grid Data | Grid Data** command, the  button, or the **Grids | New Grid | Grid Data** command. With this command, you can specify the parameters for the particular gridding method and the extents of the grid. The gridding methods define the way in which the data are interpolated when producing a grid file.

Data files should be arranged with all X data in one column, all Y data in another column, and all Z data in a third column. If gridding XYZC data, all C data should be in a fourth column. Each data column can be any column in the data file and in any order. The columns are selected on the **Select Data** page of the **Grid Data** dialog. If gridding drillhole data, the data must be imported into the **Drillhole Manager**.

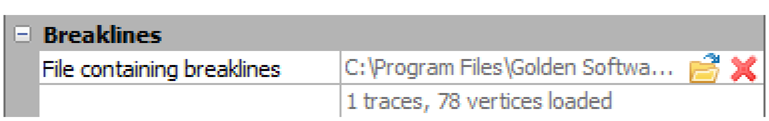
The default gridding parameters will generate a grid file that represents your data well under most circumstances. The Kriging gridding method with a linear variogram is the selected default gridding method for XYZ data because it gives good results for most XYZ data sets.

Breaklines

Breaklines are used when gridding to show discontinuity in the grid. A breakline is a three-dimensional boundary file that defines a line with X, Y, and Z values at each vertex. When the gridding algorithm sees a breakline, it calculates the Z value of the nearest point along the breakline, and uses that value in combination with nearby data points to calculate the grid node value. **Surfer** uses linear interpolation to determine the values between breakline vertices when gridding. Unlike faults, breaklines are not barriers to information flow, and the gridding algorithm can cross the breakline to use a point on the other side of the breakline. If a point lies on the breakline, the value of the breakline takes precedence over the point. Breakline applications include defining streamlines, ridges, and other breaks in the slope.

Using Breaklines when Gridding

The breaklines options are displayed in the *Breaklines* section of the **Grid Data** dialog **Options** page when the selected interpolation method supports breaklines.



The Breaklines section is displayed when an interpolation method supports breaklines.

Click the button in the *File containing breaklines* field to select the blanking file BLN containing the breaklines. In the **Open** dialog, specify the blanking file and click **Open**. The blanking file will be displayed in the *File containing breaklines* field. The number of traces and the number of total vertices are displayed under the file name. Delete the file name to exclude the breaklines from the interpolation process. Breaklines must contain 3 columns: X, Y, and Z. If the Z column is missing, the .BLN file cannot be used as a breakline.

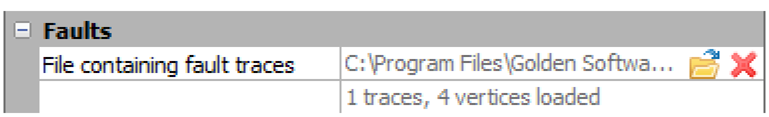
Faults

Faults are used to show discontinuity when gridding, similar to *breaklines*. A fault is a two-dimensional boundary file defining a line acting as a barrier to information flow when gridding. When gridding a data set, data on one side of a fault is not directly used when calculating grid node values on the other side of the fault.

If the fault line is a closed polygon, the gridding algorithm will grid the data on the side of the polygon where the data are located. If the fault line is not a closed polygon, the gridding algorithm can search around the end of the fault to see a point on the other side of the fault, but this longer distance reduces the weight of the point in interpolating the grid node value. If a point lies directly on the fault line, random round-off error determines which side of the fault captures the point.

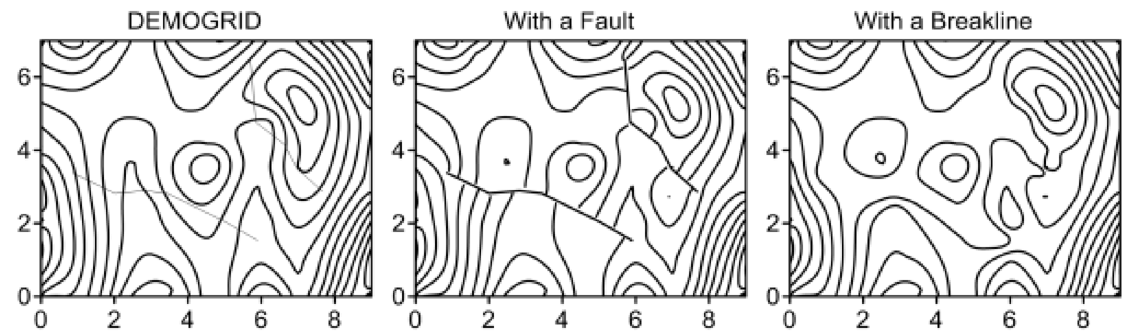
Using Faults when Gridding

The faults options are displayed in the *Faults* section of the **Grid Data** dialog **Options** page when the selected interpolation method supports faults.



The Faults section is displayed when an interpolation method supports faults.

Click the button next to *File containing fault traces* to select the blanking file BLN containing the fault traces. In the **Open** dialog, specify the blanking file and click *Open*. The blanking file will be displayed in the *File containing fault traces* field. The number of traces and the number of total vertices are displayed under the file name. Delete the file name to exclude the fault traces from the interpolation process.



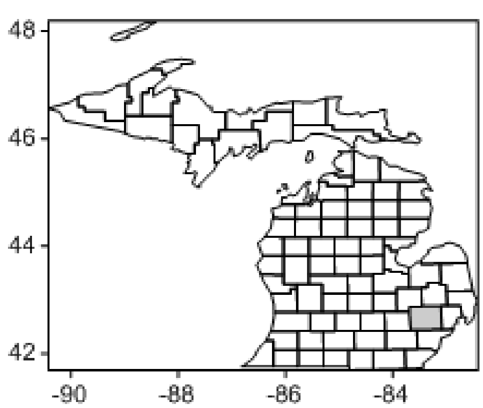
The map on the left is created from demogrid.dat *using default gridding settings. The center map is created with two fault lines. The right map is created with breaklines.*

Grids Tab Commands

There are many ways to manipulate grid files in **Surfer**. The **Grids** ribbon contains commands used to assign the NoData value, convert, create, extract, filter, mosaic, slice, smooth, and transform grid files. In addition, volume calculations, variogram generation, calculus operations, cross section creation, and residual calculations can be performed using the commands on the **Grids** ribbon. Click on the **Grids** tab to access the commands on the ribbon.

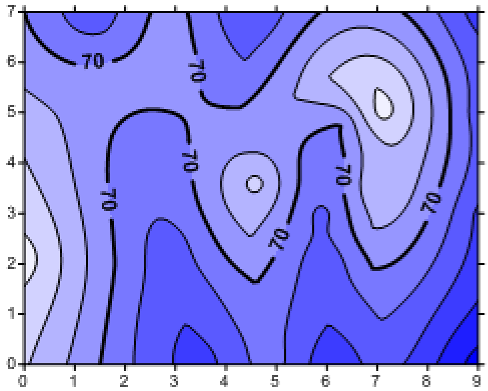
Map Types

Several different map types can be created, modified, and displayed with **Surfer**. These map types include base, contour, post, classed post, 3D surface, 3D wireframe, color relief, grid values, drillhole, peaks and depressions, point cloud, watershed, viewshed, 1-grid vector, and 2-grid vector maps. A brief description and example of each map is listed below.



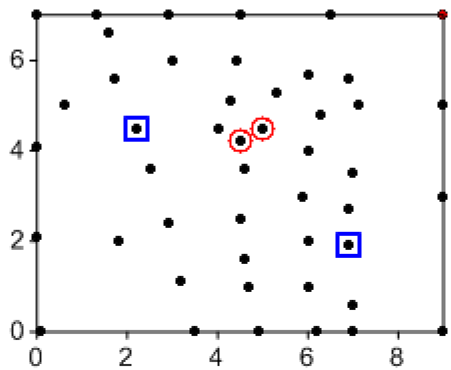
Base Map

Base maps display boundaries on a map and can contain polygons, polylines, 3D polygons, 3D polylines, 3D polymesh objects, points, text, images, or metafiles. Base maps can be overlaid with other map layers to provide details such as roads, buildings, streams, city locations, areas of no data, and so on. Base maps can be produced from vector files, images, download from online XYZ Tiles mapping servers, and data files. Individual base map objects can be edited, moved, reshaped, or deleted. Symbology can be added to a base map to communicate statistical information about the map features. Empty base maps can be created and used for drawing objects on other maps. Raster (image) and vector base maps can be downloaded from online WMS, OSM, WCS and WFS mapping servers.



Contour Map

Contour maps are two-dimensional representations of three-dimensional data. Contours define lines of equal Z values across the map extents. The shape of the surface is shown by the contour lines. Contour maps can display the contour lines and colors or patterns between the contour lines. Contours can be linearly or logarithmically spaced, or a custom spacing can be set between each set of lines.

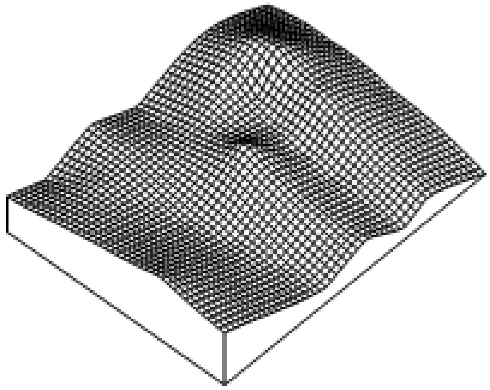


Post Map

Post maps and classed post maps show data locations on a map. You can customize the symbols and text associated with each data location on the map. Each location can have multiple labels. Classed post maps allow you to specify classes and change symbol properties for each class. Classes can be saved and loaded for future maps.

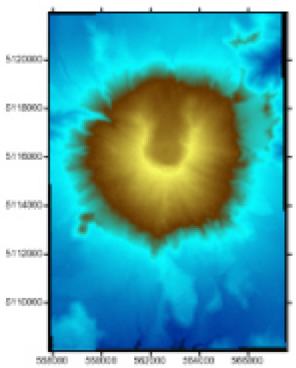
3D Surface Map

3D surface maps are color three-dimensional representations of a grid file. The colors, lighting, overlays, and mesh can be altered on a surface. Multiple 3D surface maps can be layered to create a block diagram.



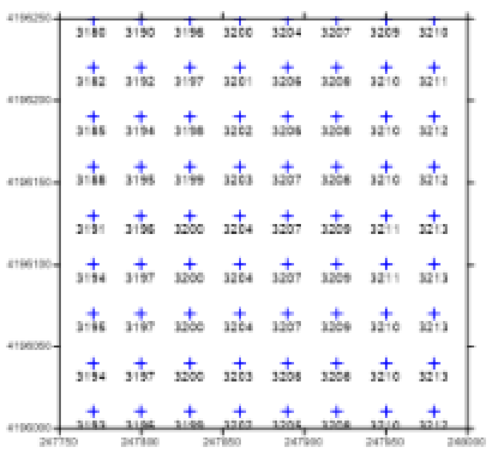
3D Wireframe Map

3D wireframe maps are three-dimensional representations of a grid file. Wireframes are created by connecting Z values along lines of constant X and Y.



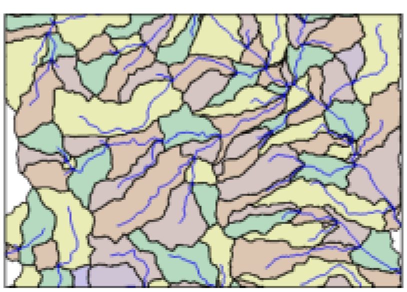
Color Relief Map

Color relief maps are raster images based on grid files. Color relief maps assign colors based on Z values from a grid file. NoData regions on the color relief map are shown as a separate color or as a transparent fill. Pixels can be interpolated to create a smooth image. Hill shading or reflectance shading can be applied to the color relief map to enhance its depth and appearance.



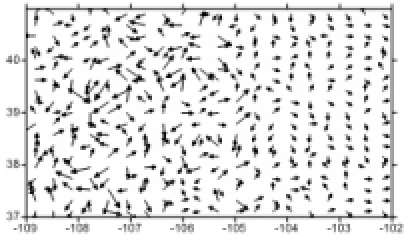
Grid Values Map

Grid values maps show symbols labels at grid node locations across the map. The density of the labels and symbols is controlled in the X and Y directions independently. Symbol color can vary by value across a colormap, and symbols and labels can be displayed for only a specific range of values. Grid lines can be added to the map.



Watershed Map

Watershed maps display the direction that water flows across the grid. The watershed map breaks the grid into drainage basins and streams. Colors can be assigned to the basins and line properties can be associated with the streams. In addition, depressions can be removed by filling the depression.

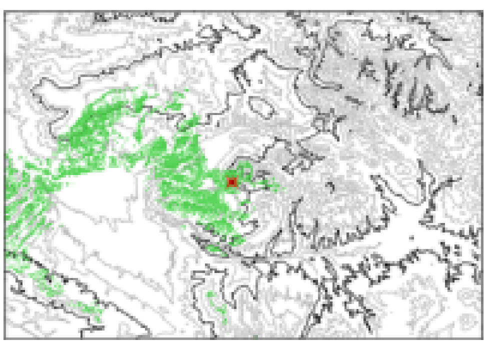


Vector Map

1-grid and 2-grid vector maps display direction and magnitude data using individually oriented arrows. At any grid node on the map, the arrow points in the downhill direction of the steepest descent and the arrow length is proportional to the slope magnitude. Vector maps can be created using information in one grid file (i.e. a numerically computed gradient) or two different grid files (i.e. each grid giving a component of the vectors).

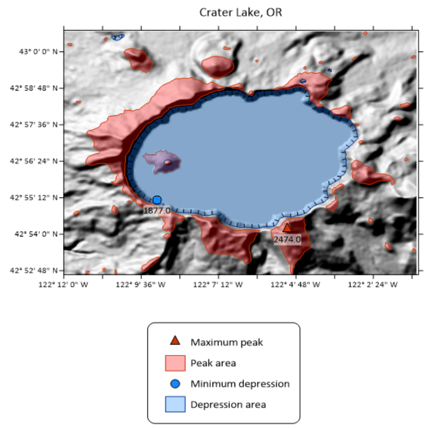
Point Cloud Map

Point cloud maps display LAS/LAZ data as points at XY locations. LAS/LAZ data can be combined from multiple files and filtered with various criteria when creating a point cloud map. Color is assigned to the points by elevation, intensity, return number, or classification. Surfer includes commands for modifying, classifying, and exporting points in a point cloud layer. A grid can be created from the point cloud layer. Point cloud layers are displayed in the 3D View as three-dimensional points.



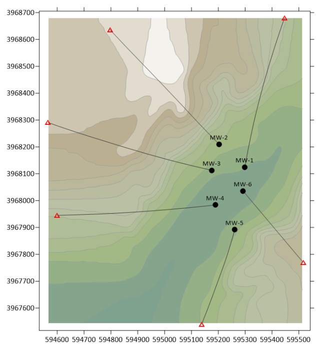
Viewshed Layer

Viewshed layers highlight the regions of a map that are visible (or invisible) from a transmitter location. The transmitter, receiver, and obstruction height above the surface can be specified. The viewshed analysis radius and angle can also be specified. Viewsheds can be added to any 2D grid based map. A viewshed can also be added to a 3D surface map that is displayed with no tilt (90 degrees) and in the orthographic view.



Peaks and Depressions Map

Volumes of surface water and ground water are informed by topographic data, Karst topography, and geographic data, which are captured in Surfer grid files and mapped in peaks and depression maps. Boundaries can be drawn around peaks where water flows from and depressions which capture water to create unique areas for statistical analysis.



Drillhole Map

A drillhole map can be created from collars, survey, intervals, and point data. The 2D drillhole layer shows the location, deviation, and path of each hole, core, or well. The drillhole map can also be viewed in 3D. Separate symbols can be defined to create a legend of the drillholes by hole id or any other attribute in the data.

Base Symbology

Vector base maps can include symbology. Symbology applies line, fill, and/or symbol properties to features in the base layer depending on an attribute value. The symbology can be included in a legend. The type of symbology and the layer's appearance are controlled in the **Symbology** dialog. The symbology types in **Surfer** are:

- *Unique Values* - Line, fill, and/or symbol properties are specified for unique values in the attribute field.
- *Unclassed Colors* - Colors from a color spectrum are applied to the features by numeric attribute value.
- *Unclassed Symbols* - Symbols are added for each polygon feature and scaled proportionally by numeric attribute value, or point features are scaled by numeric attribute value. *Unclassed Symbols* symbology is not applied to polylines.
- *Classed Colors* - Colors are applied to the features by classifying numeric attribute values.
- *Classed Symbols* - Symbols are added for each polygon feature and classified by a numeric attribute value, or point features are classified by a numeric attribute value. *Classed Symbols* symbology is not applied to polylines.
- *Pie Chart* - Attributes in the base layer are added as *Pie Chart* symbols with classified pie slices.

A symbology can be added to a base (vector) layer by clicking *Edit Symbology* in the **Properties** window **General** page. Select the symbology type, specify the attribute field for the symbology, and then specify the various line, fill, and/or symbol properties for the symbology in the **Symbology** dialog. Click *OK* or *Apply* to apply the symbology to the base layer.

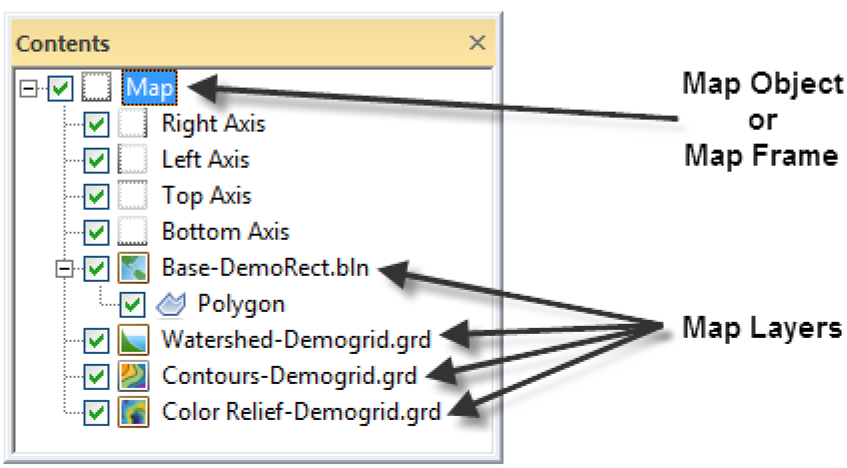
To apply symbology, the features in the base (vector) layer must have at least one attribute field. Any of the five symbology types can be applied to an attribute field that contains numeric data. *Unique Values* symbology can be applied to text or numeric data. Add or edit attribute data in the base layer with the Attribute Table.

Map Layers

A map layer is a single map type contained in a larger map object. The map layer may be a contour layer, a post layer, a base layer, or any other layer type that **Surfer** can create. The larger map object contains all of the individual map layers and axes used to create the entire map. Map layers can be created as separate maps or added to a single map object.

It is possible to combine several maps created from related data to create one map object with multiple map layers. You can add any combination and number of contour, base, post, color relief, grid values, point cloud, drillhole, vector, watershed, viewshed, or 3D surface layers to a single map. However, a map can contain only one 3D wireframe layer, and the wireframe cannot be combined with 3D surface, color relief or base(raster) layers.

There are multiple ways to overlay map layers in **Surfer**. If you have multiple maps and wish to move only one layer, you can drag a map layer from one map object to another map object in the **Contents** window. If you wish to combine all the layers from multiple maps, you can select all of the maps and use the **Map Tools | Map Tools | Overlay Maps** command. This moves all of the map layers to a single map object. If you have already created a map and need to add map layers to it, you can select the map and use one of the **Home | Add to Map | Layer** commands to add a map layer to the existing map. Grid-based map layers can be changed to other layer types by selecting the object in the **Contents** window and using the **Map Tools | Layer Tools | Convert Layer** command.



This one map object contains four map layers. There is a base layer, watershed layer, contour layer, and a color relief layer.

Coordinate Systems

A coordinate system is method of defining how a file's point locations display on a map. Different types of coordinate systems exist that control how the coordinates are shown on the map. In **Surfer**, a map can be unreferenced in local coordinates, referenced to a geographic latitude and longitude coordinate system, or referenced to a known projection and datum. Each data set, grid, map layer, and the map frame can have an associated coordinate system. All coordinate systems for individual layers are converted “on the fly” to the map’s target coordinate system. This allows maps with different coordinate systems to be easily combined in **Surfer**.

A local coordinate system generally is considered unreferenced. A local system has a location that begins numbering at an arbitrary location and increments numbers equidistant in the X and Y directions from this location. This is frequently referred to as a *Cartesian coordinate system*. The distance units can be specified for an unreferenced local system in the **Assign Coordinate System** dialog.

A *Geographic* coordinate system uses a spherical surface to define locations on the earth. Geographic coordinate systems are commonly called unprojected lat/long. **Surfer** has several predefined geographic coordinate systems available. Each system has a different datum. The same latitude and longitude value will plot in different locations depending on the datum.

A *Projected* coordinate system consists of a projection and a datum. Each projection distorts some portion of the map, based on the ellipsoid and datum specified. Coordinates can be lat/long, meters, feet, or other units. Different projections cause different types of distortion. It is recommended that you do not use projected coordinate systems if you do not need to convert between coordinate systems or if all your data are in the same coordinate system.

Source Coordinate System Properties

Maps can be created from data, grids, or base map files in any coordinate system. The *Source Coordinate System* is the coordinate system for the original data, grid, or base map used to create a map layer. Each map layer can reference a different projection and datum. If some map layers are using a different source coordinate system than what you want the map to display, the map layer is converted to the map's *Target Coordinate System*.

3D surface maps and wireframe maps do not have an associated coordinate system and cannot be converted to a different coordinate system. When a layer with a coordinate system is overlaid onto either a surface or wireframe map, the layer's coordinate system is removed and the layers are displayed in Cartesian coordinates.

Target Coordinate System Properties

Maps can be displayed in any coordinate system. The map is displayed in the coordinate system defined as the *Target Coordinate System*. When a map layer uses a different *Source Coordinate System* than the map's *Target Coordinate System*, the map layer is converted to the map's *Target Coordinate System*.

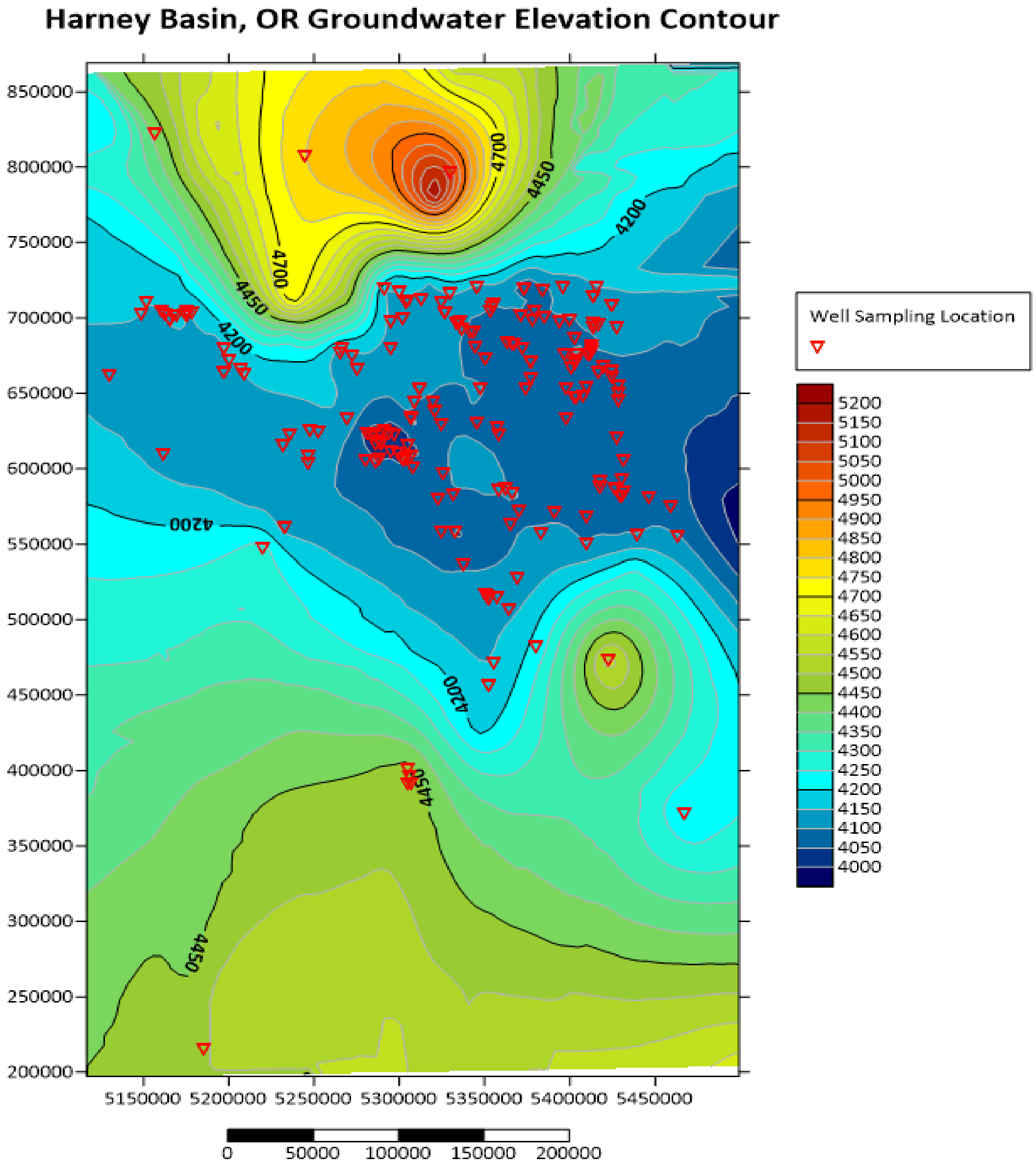
The standard procedure for creating maps in a specific coordinate system is as follows:

1. Create the map by clicking on the appropriate **Home | New Map** command.
2. In the **Open Grid(s)** dialog, select the file to open and click *Open*.
3. In the **Contents** window, click on the map layer to select it.
4. In the **Properties** window, click on the **Coordinate System** page.
5. If the *Coordinate system* is not correct, click the *Set* button next to *Coordinate System*. The **Assign Coordinate System** dialog opens. This is the initial coordinate system for the map layer, i.e. the coordinate system for the source data. Select the correct coordinate system in the dialog. When finished making changes, click *OK*.
6. To change the target coordinate system for the map, click on the *Map* object in the **Contents** window. In the **Properties** window, click on the **Coordinate System** tab. This is the coordinate system in which you want the map to display.
7. Click on the *Change* button next to *Coordinate System* to set the desired target coordinate system. When finished, click *OK*.
8. All of the map layers are converted on the fly to the target coordinate system. The entire map is now displayed in the desired coordinate system.

Surfer does not require a map coordinate system be defined. Maps can be created from unreferenced data, grid, and map layers. As long as all map layers have the same X and Y ranges, coordinate systems do not need to be specified. If you do not specify a source coordinate system for each map layer, it is highly recommended that you do not change the target coordinate system. Changes to the target coordinate system for the map can cause the unreferenced map layers to appear incorrectly or to not appear.

Tutorial

The **Surfer** tutorial will introduce you to the software by walking you through the creation of the groundwater contour map illustrated below.



*Final groundwater contour map created using the **Surfer** tutorial*

To get the most out of your **Surfer** experience, we highly recommend completing the entire tutorial which should take about an hour. After you have completed the tutorial, you will have all the tools needed to create maps in **Surfer** using your own data.

The tutorial can be accessed in the program by clicking the ? button and navigating to the *Tutorial* book or by clicking *Tutorials* in the **Welcome to Surfer** dialog.

The last page of the tutorial contains resources to continue your journey and learn more about **Surfer's** advanced features.

Tutorial Overview

The tutorial will cover the following topics:

Getting Started	Open **Surfer**, create a new plot window, and learn about the user interface
	Import data into **Surfer** and learn how to format it for best performance
	Create a grid file and contour map from irregularly spaced well data
Changing Map Properties	Adjust the appearance of the contour map
Adding Context Layers	Add map layers, a legend, and map scale to the contour map
	Adjust the map coordinates so that all map units are in feet
Viewing Maps in 3D	View the map in the 3D view and show 3D vector points
Sharing Your Work	Export the map in various file formats and save the project
	Learn about additional **Surfer** features that may be helpful in your work

Reading the Documentation

Various font styles are used throughout the **Surfer** quick start guide and online help.

- **Bold** text indicates commands, dialog names, tab names, window names, and page names.
- *Italic* text indicates items within a dialog or window such as section names, options, field names, and buttons. For example, the **Save As** dialog contains a *Save as type* field.
- Commands appear as **Home | New Map | Contour**. This means, "click or scroll to the **Home** tab at the top of the application window, then click on the **Contour** command within the **New Map** command group." The first word is always the menu or ribbon tab name, followed by the command group, and finally the command name within the menu list or on the ribbon.

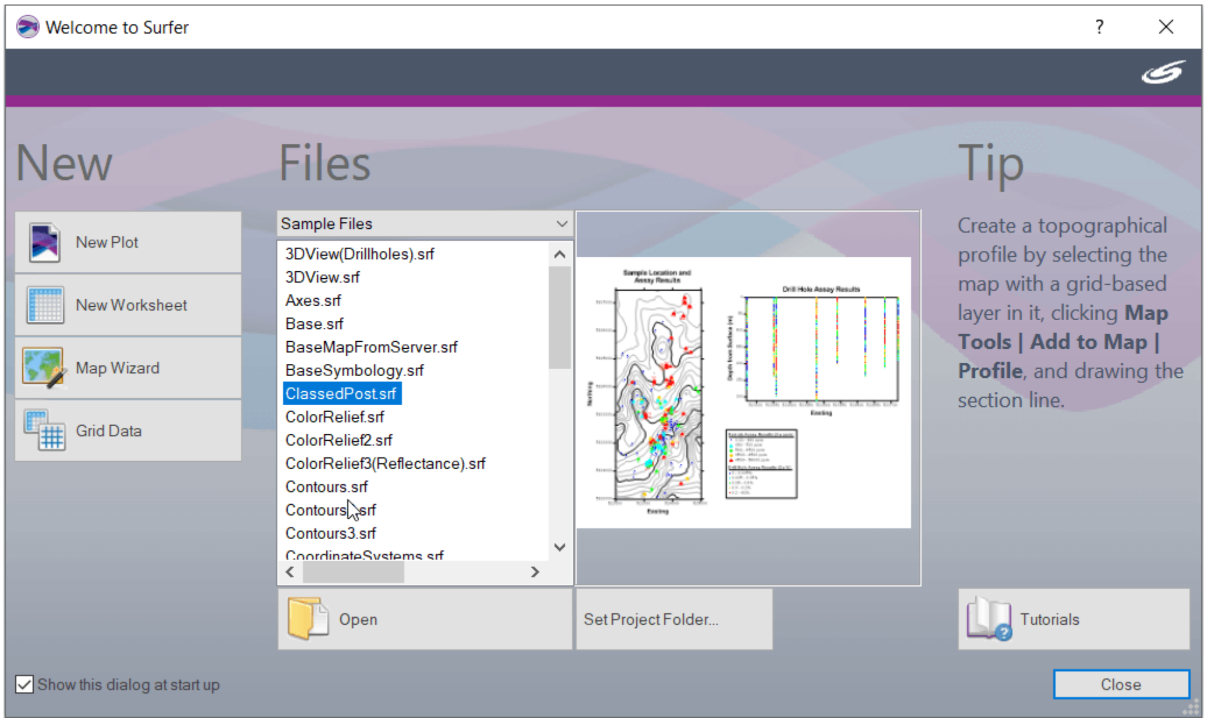
Sample File Location

The sample files used in the tutorial lessons are located in the **Surfer** Samples folder. The Samples folder is located by default at C:\Program Files\Golden Software\Surfer\Samples.

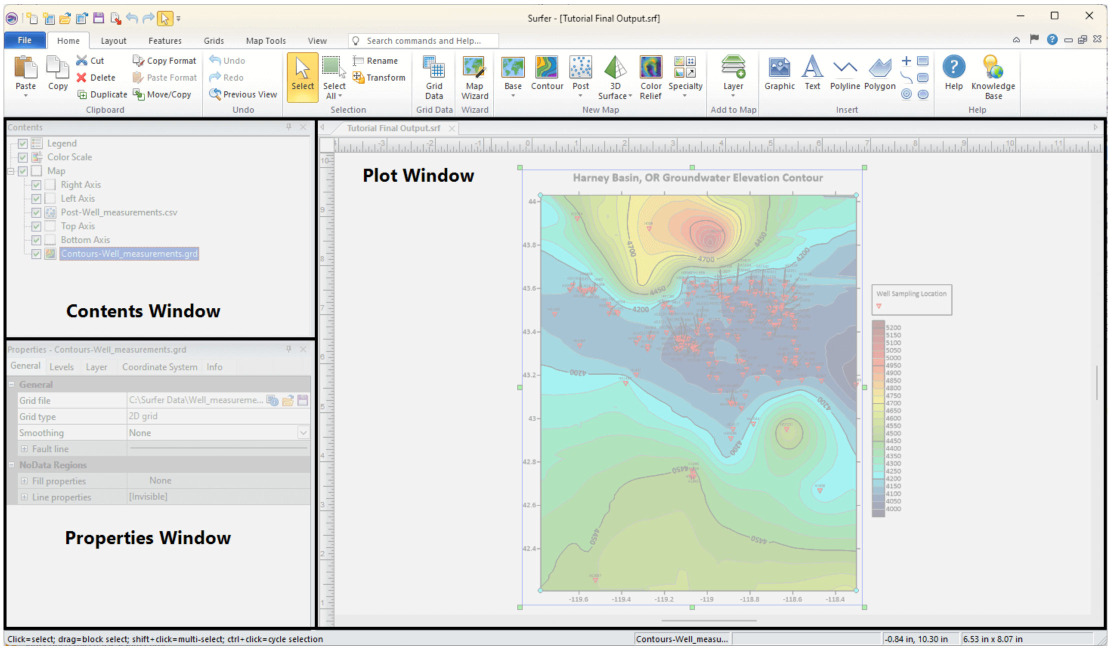
Getting Started

Before we dive into the map making process it is important to understand how information is organized and used in **Surfer**.

The **Welcome to Surfer** dialog is displayed each time you start **Surfer**. The **Welcome to Surfer** dialog provides immediate access to the New Plot, New Worksheet, Map Wizard, and Grid Data commands; sample files, recent files, and project files; as well as the tutorial.



The most important things to understand about **Surfer's** user interface are plot documents, the **Contents** window, and the **Properties** window.



- The **Plot** window or Plot document is the main component of the **Surfer** user interface. Each Plot document is a new **Surfer** project and is saved to its own SRF file. Multiple Plot windows can be open at once. Data files can also be opened in a **Worksheet** window. Each open Plot and Worksheet document will be displayed as a tab just below the ribbon.
- The **Contents** window displays a hierarchical list in tree view of all the objects in the current document. These objects can be selected, added, removed, rearranged, or edited.
- The **Properties** window contains all of the available properties for the selected object grouped into pages of related properties. When multiple objects are selected, their shared properties are displayed. Changes made in the **Properties** window are reflected immediately in the current document.

In summary, the **Plot** document houses your Surfer project. Each object in the project can be selected and arranged in the **Contents** window and once selected, the object properties can be adjusted in the **Properties** window.

Now that we have a basic understanding of the user interface, let's get started on our map.

1. If you do not already have **Surfer** opened, open it by:

- double-clicking the **Surfer** icon in the desktop, or
- selecting **Surfer** in the Start menu, or
- searching for **Surfer** in the Task Bar search field.

2. Click *New Plot* in the **Welcome to Surfer** dialog.

In **Surfer**, it is common to begin a project with just the dataset. In the next lesson we will detail how to import and format that data to ensure the smoothest **Surfer** experience possible.

Adding Context Layers

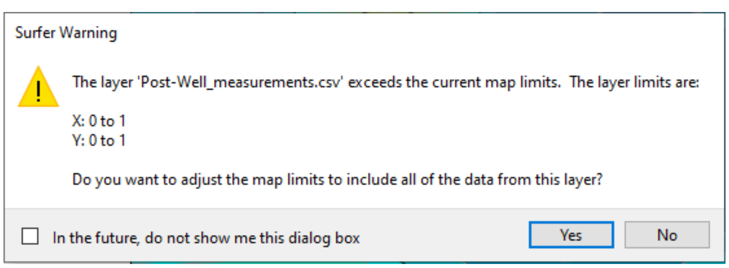
It's time to tell the full story of the site! Reference layers such as aerial imagery, point data for marker or well locations, or vector files containing site plans, give additional context for our groundwater level contours.

For this exercise, we'll add the well sampling locations as a post map layer. Post maps utilize the XY location to post a symbol for each point in the dataset you define. The *Well_measurements.xlsx* dataset contains the XY coordinates for each of our well sampling locations.

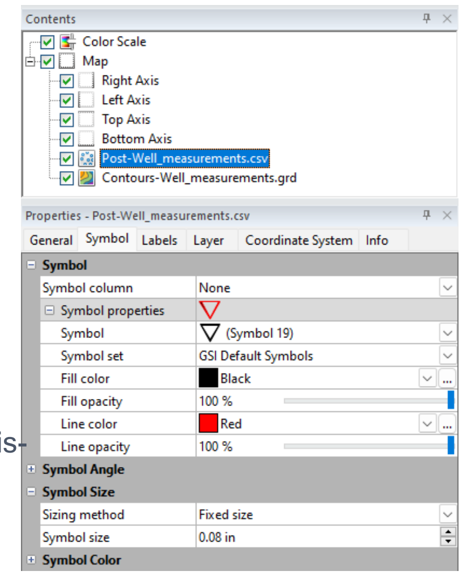
1. Click the *Map* object in the **Contents** window.
2. Click **Home | Add to Map | Layer | Post**.
3. Select the *Well_measurements.xlsx* file and click *Open*.
4. Click *OK* in the **XLSX Import Options** dialog.

   If you completed the Data Best Practices lesson and still have the worksheet opened, you can skip to step 8!

5. Click *No* on the warning stating that the layer exceeds the current map limits.



Surfer defaults to using the AB columns for the XY coordinates. If you recall, the *Well_ measurements.xlsx* dataset uses the C column for X and the B column for Y. By clicking No on the warning dialog, we avoided updating the map limits to these incorrect coordinates when adding the Post layer.



6. Click the newly created *Post* layer in the **Contents** window.

7. Click the **General** tab in the **Properties** window.

8. In the *Worksheet Columns* section,

    a. Click in the *X coordinates* field and select *Column C: Longitude*

    b. Click in the *Y coordinates* field and select *Column B: Latitude*

Next we will change the map properties to improve the visibility of each well location.

9. Click the **Symbol** tab in the **Properties** window.

10. Click the + next to *Symbol Properties* to expand the options, if needed.

11. Click in the *Symbol* field and select the unfilled downward triangle (Symbol 19).

12. Click in the *Line color* field and select *Red*.

13. In the *Symbol size* field use the up/down arrows to make the symbols larger or smaller.

As our final finishing touches let's add a Legend and a Scale Bar so it's clear what these red triangles represent and how far apart they are.

14. Click **Map Tools | Add to Map | Scale** in the ribbon.

15. Click and drag the *Map Scale* to the desired location on the map.

    Note: The scale bar and map units will be adjusted in the next lesson.

16. Click **Map Tools | Add to Map | Legend** in the ribbon.

17. Click the *Legend* in the **Contents** window, if needed.

18. On the **General** tab in the **Properties** window, click in the *Type* field and select *Square*.

19. Add a title to your legend by entering "*Well Sample Locations*" in the *Title Text* field and then press ENTER.

> The **Text Editor** dialog makes it easy to add specialized formatting including special characters and mathematical equations.

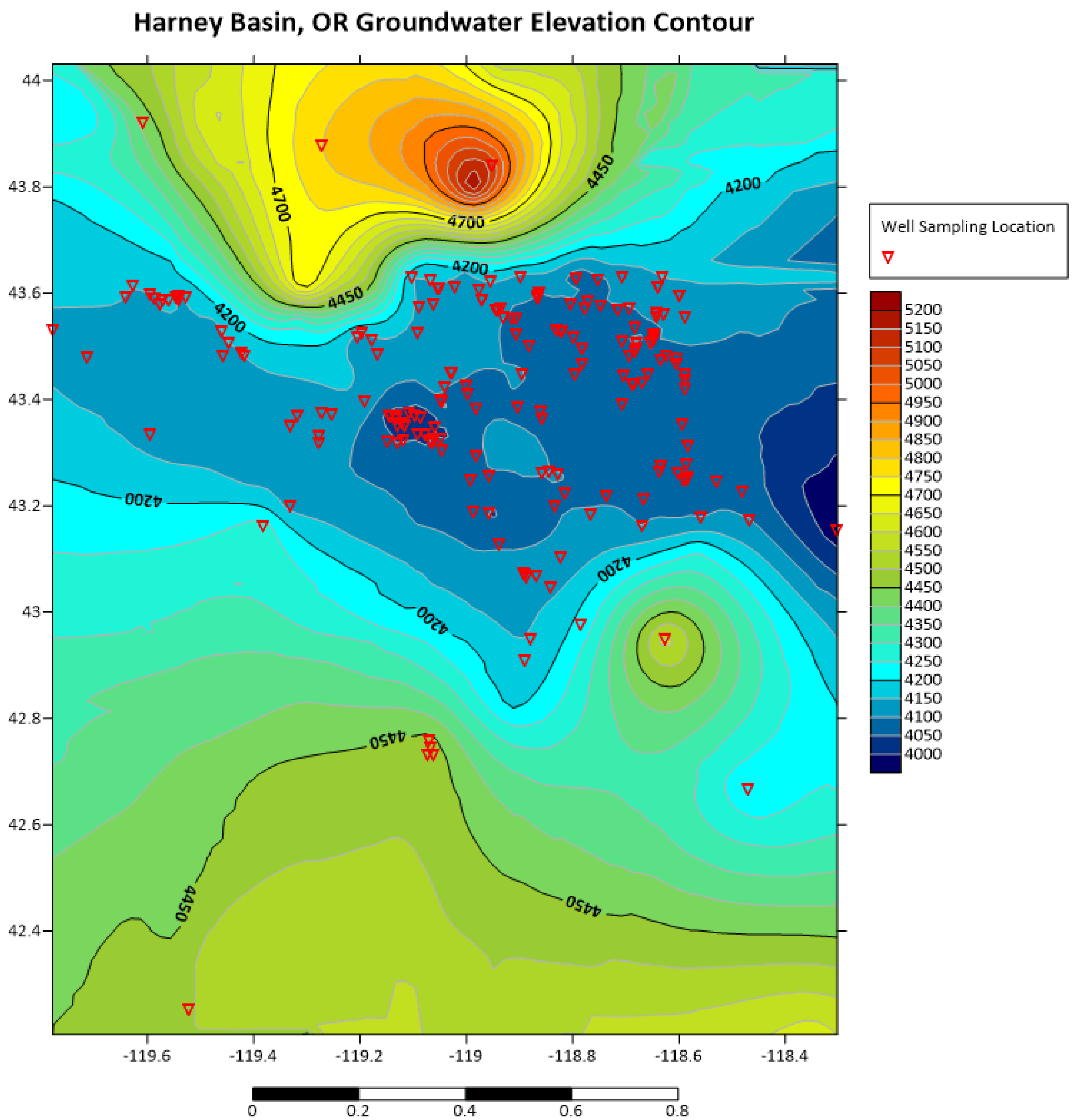
You'll notice the legend includes both the symbol as well as a data value. Let's remove the data value as that information is not relevant.

20. Click the **Layers** tab in the **Properties** window

21. In the *Template* field, change *symbol**value* to just *symbol.*

22. Click and drag the legend to your desired location in correspondence to the map.

The map should now look like the image below:



You can add as many layers to your map as needed to provide relevant context for your audience. Additional map layers commonly include a site plan, government boundaries (DXF, SHP, etc.), and aerial imagery (PNG, JPG, TIFF, etc.) added as base layers.

To add a site plan or imagery, click **Home | Add to Map | Layer | Base** and then load your image or site plans. If your imagery does not have associated coordinates, the process to add the layer requires a few more steps as it must first be georeferenced.

Common image file types such as .JPG or .PNG are less likely to have an associated coordinate system, but thankfully it's easy to georeference these files directly in **Surfer**.

The final step to finish the map before presentation is to change the map coordinate system so that the scale is in linear units.

Changing Map Properties

The look of your final map impacts the quality of your presentations and therefore how well the story of your data is understood by your audience. There are two primary ways to change how the map looks in **Surfer**: by changing the source data or by changing the properties.

In this lesson, we will focus on customizing the contour map properties.

1. In the **Contents** window, click the *Contours-Well_measurements.grd* map layer.

   Once selected, all of the available contour layer settings will appear in the **Properties** window. These include the option to add a fill, add a color scale, change the contour interval, or add/edit labels, to name a few.

2. Click the **Levels** tab in the **Properties** window.

3. In the *General* section, check the box next to *Color scale*.

4. In the *Filled Contours* section, check the box next to *Fill contours*.

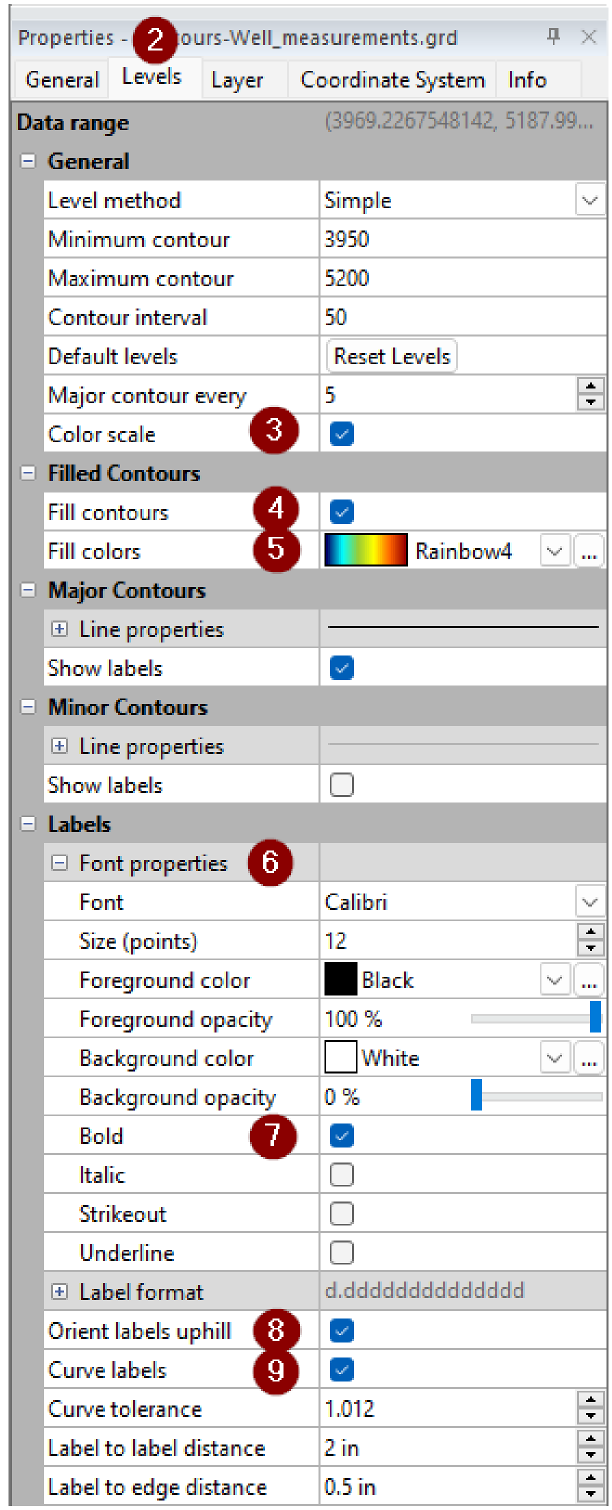
5. Use the *Fill colors* dropdown and change the color from *GrayScale* to *Rainbow4*.

6. In the *Labels* section click the + next to *Font properties* to expand the options.

7. Check the box next to *Bold*.

8. Check the box next to *Orient labels* uphill.

9. Check the box next to *Curve labels*.



These settings are just one combination of the infinite options available to you!

If you desire more control over your contour customizations, you can define specific contour layers and customize them individually with the Advanced level method.

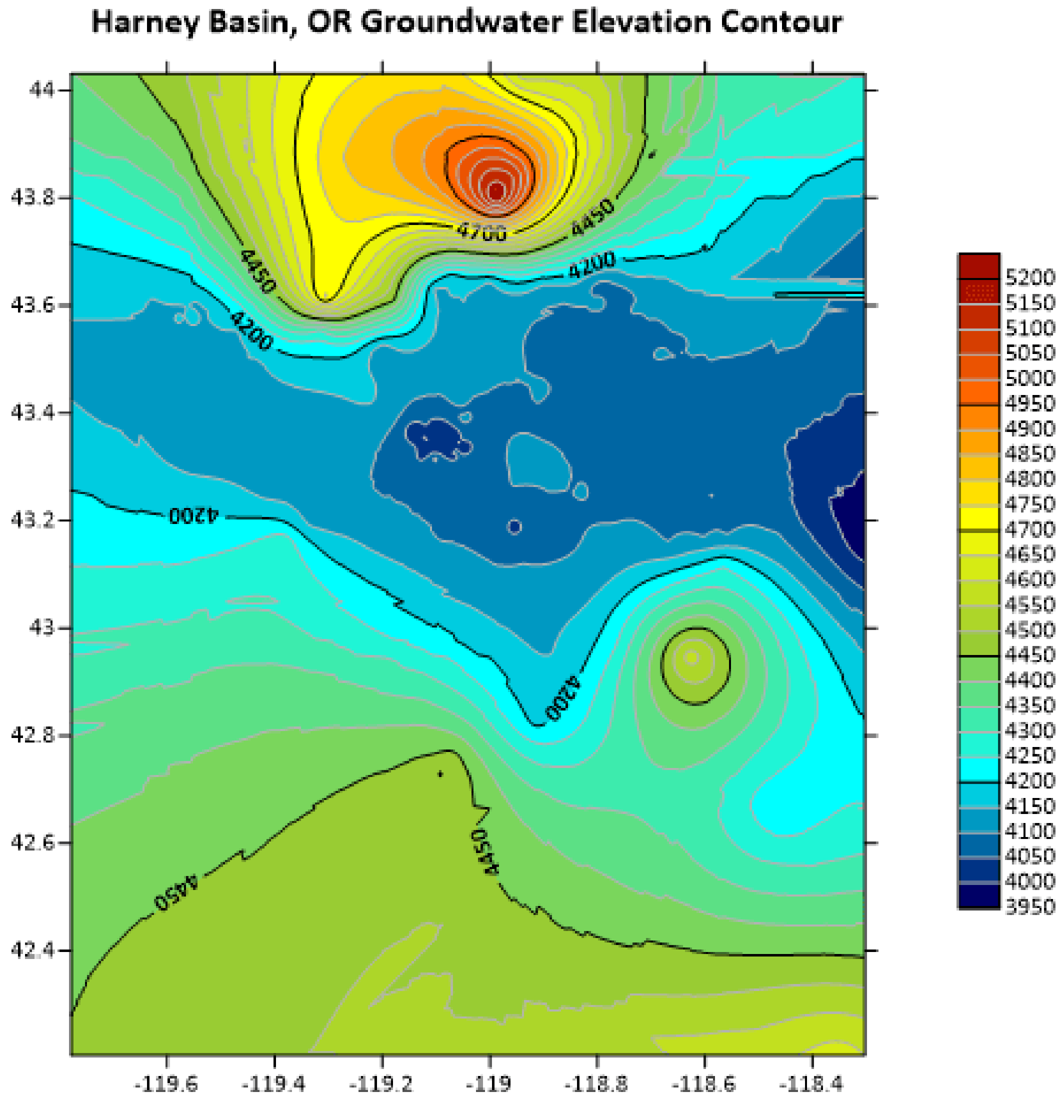
> You can make your own custom color schemes with the **Colormap Editor** by clicking the ellipses (...) next to the drop-down.

Most of the properties used to impact the look and feel of a map will belong to individual map layers like the contour layer above. However, one key map feature is best added via the axis properties: the map title! You could also simply insert text but using the axis properties ensures the title is always centered over the map.

To add a title to your map:

1. Click the *Top Axis* in the **Contents** window to select it.
2. Click the **General** tab in the **Properties** window.
3. In the *Title text* field, enter *Harney Basin, OR Groundwater Elevation Contour* and press ENTER.
4. Click the + next to *Font properties* to expand the section.
5. Click the up/down arrows to change the *Size (points*) to *16*
6. Check the box next to *Bold*.

After completing the steps above your contour map will look like the below map.



We have completed the basic process of gridding data, creating a map and adjusting the contour properties. Next we'll add context to further explain the data being illustrated by the map.

Viewing Maps in 3D

The **3D View window** can help provide clarity when examining at complex information. This is especially useful when sharing results with an audience that isn't used to interpreting 3D information from a 2D map.

To explore your finished map in 3D:

1. Click the *Map* in the **Contents** window to select it.

2. Click **Map Tools | View | 3D View**

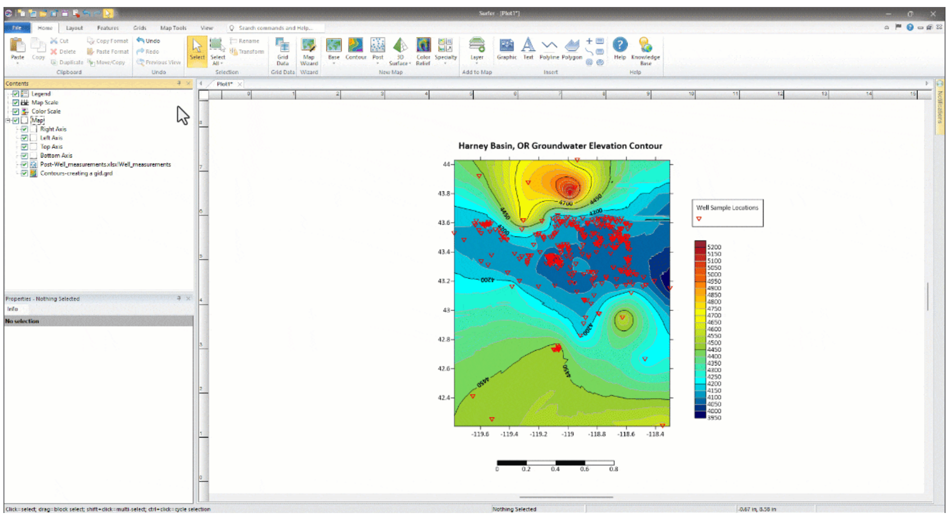
By default, **Surfer** will create a 2D Grid Surface from each grid file used in the map; a Vector Data object from each contour, post, vector base, and drillhole layer; and a 3D Point Cloud from each point cloud layer. Every layer in the map frame can be overlaid on each 2D Grid Surface.

The first thing we'll do is tell **Surfer** which data column should be used to position the points in the 3D model.

3. In the **Contents** window, click the *Post-Well_measurements.xlsx* layer under *Vector Data* to select it.

4. Click the **Z Coordinate** tab in the **Properties** window.

5. Click in the *Z coordinates* field and select *Water-level elevation, in feet*.



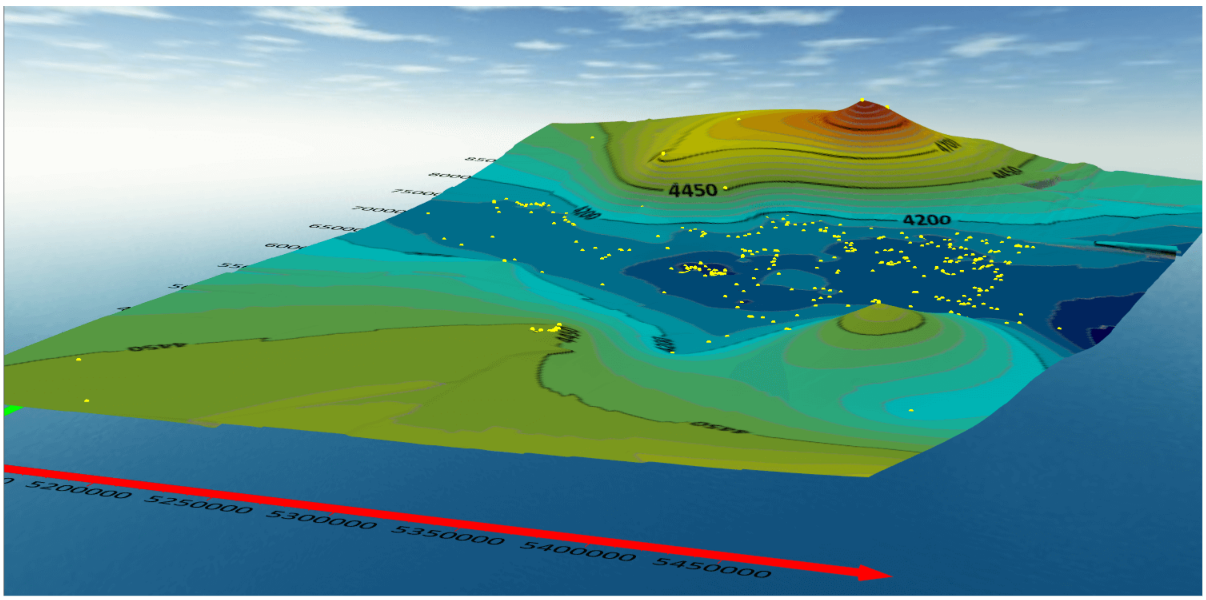
*Click the **Map Tools | View | 3D View** command to view a map in 3D. Use the mouse to zoom in and out and reposition the 3D image.*

Now that all of the data from our map is being modeled accurately, we can adjust some of the 3D View properties.

6. Click *Environment* in the **Contents** window.
7. Click the **General** tab in the **Properties** window.
8. Set the *Vertical exaggeration* to 50.

A vertical exaggeration of 1 will provide a true representation when the X, Y and Z coordinates all use the same units of measurement as is true in this case. We're choosing to exaggerate the Z values because the groundwater basin being modeled here is relatively flat and we want to be able to see the areas of elevation and depression clearly.

9. Click the **Lighting** tab in the **Properties** window
10. Click in the *Location* field and select *Fixed*.
11. Select the *2D Grid Surfaces* in the **Contents** window.
12. In the **Properties** window, set the *Surface quality* to 100 by using the slider or by typing *100*. The lower the surface quality the more likely it is vector objects can appear to intersect the surface, even in places they should not. If your PC's performance becomes slow, reduce the *Surface quality* until acceptable speeds are restored.
13. Select the *Well_meansurements.grd* surface in the **Contents** window.
14. In the *Textures to Display* section of the **Properties** window, clear the *Post-Well_measurement.csv* option.



Use the 3D View to explore for meaning in your data.

With **Surfer's** 3D View you can add even more information to your models to ensure every audience can understand your results. For example, a map like this might benefit from the addition of a ground level surface to better illustrate the depth of the water relative to the ground. We could also add a drillhole map to illustrate the depth of water relative to the depth of each well. Seismic data slices could also be added to illustrate how the subsurface geology is impacting groundwater levels.

The final step in our map making journey will be to share these results.

Sharing Your Work

The final and arguably most important step of creating models is sharing your work with stakeholders.

Surfer offers wide variety of export file formats including image files, PDF, 3D PDF, TIFF, DXF, and SHP. This makes it easy to insert figures into presentations or other software programs based on your final deliverable requirements.

Since we already have the 3D View open, let's create a 3D PDF first.

1. Click the **3D View | Output | Export 3D** command.
2. In the **Export 3D** dialog, set the *Save as type* to *3D PDF (Vector)*.
3. Specify a location and name for the file, e.g. your Documents folder. The Samples folder will be displayed by default, but most users cannot save to the Samples folder.
4. Click *Save*.
5. Review the export options in the **Export Options** dialog, and click *OK*.

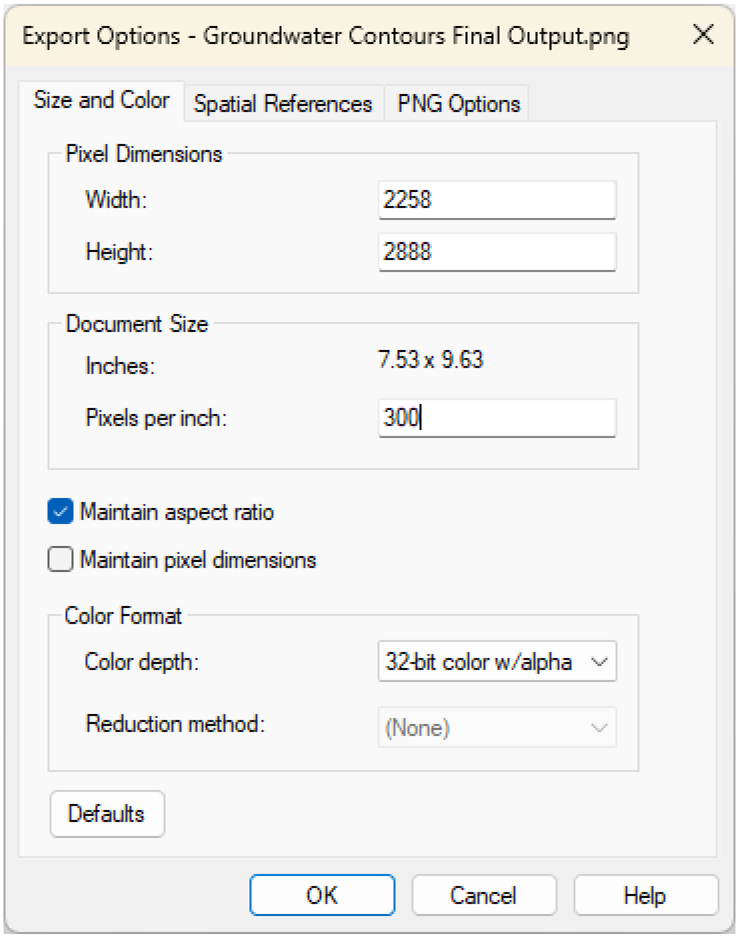
This 3D PDF can be easily shared with anyone. The PDF can be opened directly in Adobe Acrobat Viewer where the user can zoom, pan, and rotate the model.

You can tell Adobe to always allow playing of 3D content by following the instructions on their help page here: https://helpx.adobe.com/acrobat/using/enable-3d-content-pdf.html

If you're using your maps to generate reports and publications, you'll primarily be exporting images. Let's export an PNG of the finished map for easy inclusion in a Word document or other publication.

1. Switch back to the Plot Document window by clicking the *Plot1:1* tab.
2. Click the **File | Export** command.
3. Set the *Save as type* to PNG.
4. Specify a path and file name for the PNG file.
5. Click *Save*.
6. Review the options in the **Export Options** dialog and click *OK*.

The default options generate an image file that matches the size of everything visible in the Plot Document window.



> The easiest way to increase image quality is to increase the *Pixels per inch* option. Some publications recommend a resolution of 300 pixels per inch for journal-quality images. The higher the image quality, the larger the file size.

If you'll be using some of your **Surfer** data in other programs, it may be beneficial to export individual map layers to separate files. For example, you may need to save your contours as a DXF or SHP.

1. Click *Contours-Well_measurements.grd* in the **Contents** window to select it.
2. Click **File | Export**.
3. In the **Export** dialog check the box next to *Selected objects only*.
4. Set the *Save as type* to *DXF AutoCAD DXF Drawing*.
5. Specify a path and file name for the DXF file.
6. Click *Save*.

7. In the **Export Options** dialog, ensure that the *Scaling source* is set to *Map* and not *Page Units*.

> If the *Scaling source* is set to *Paper space (page units)*, the coordinate information you assigned will not be saved. This can cause problems when you try to use the file in other programs. Therefore, we almost always recommend setting the *Scaling source* to *Map* instead of *Paper space (page units)*.

8. Click the **DXF Options** tab.
9. Uncheck the boxes next to *All lines same style* and *All text as areas*.
10. Click *OK* to export only the selected map layer as your chosen file type.

With the ability to export any part of your map, you can now share the final output with clients in the format that best meets their needs.

Congratulations! You have created a finished map and exported it for presentation to your stakeholders. If you wish, save the tutorial map by clicking the **File | Save** command and experiment with this workflow using your own data.

Now that you're familiar with **Surfer's** basic functionality, let's see where you can go next....

Getting Help

Within **Surfer**, the help file is opened by clicking the **Home | Help | Help** command or the *Help* button in the upper right corner of the ribbon. You can also quickly search the *Help* by typing a term in the **Search commands and Help** box above the ribbon and clicking *Search help file* in the results. Alternatively, press F1 at any time to open the *Help*.

Context-Sensitive Help

To obtain context-sensitive help about dialogs or highlighted commands:

- Find the function of commands by hovering the cursor over the command and press Fn and F1.
- Click the ? button, the *Help* button, or press F1 in dialogs to open the help topic pertaining to that dialog.
- Press SHIFT + F1 on your keyboard, then click a command or screen region to view information regarding that item.

Internet Help Resources

There are several Internet help resources:

- Use the **File | Feedback** commands to send an **Information Request**, **Problem Report**, or **Suggestion** by email.
- Use the **File | Online** commands to access additional help, including the Golden Software home page, Surfer product page, and **Surfer** Knowledge Base.
- Search goldensoftware.com/products/surfer to find upcoming webinars, read the Golden Software Blog, and download the latest **Surfer** *Quick Start Guide*.
- From support.goldensoftware.com download new versions of **Surfer**, access **Surfer** Knowledge Base articles and recordings of webinars and training videos, and with active maintenance submit a request for support.
- The web help can be viewed by navigating to surferhelp.goldensoftware.com.

Technical Support

Golden Software's technical support is free to registered users of Golden Software products. Our technical support staff is trained to help you find answers to your questions quickly and accurately. We are happy to answer all of your questions about any of our products, both before and after your purchase. We also welcome suggestions for improvements to our software and encourage you to contact us with any ideas you may have for adding new features and capabilities to our programs.

When contacting us with your question please have the following information available:

- Your **Surfer** product key or support code
- Your **Surfer** version number, found in **File | About Surfer**
- The operating system you are using (Windows 10, 11 or higher)
- The steps taken to produce your problem
- The exact wording of the first error message that appears (if any)

If you cannot find the answer to your question in online help, the quick start guide, or on our web page FAQs or Knowledge Base, please do not hesitate to contact us:

Phone: 303-279-1021

Email: surfersupport@goldensoftware.com

Web: www.goldensoftware.com

Mail: Golden Software, LLC, PO BOX 281, Golden, Colorado, 80402-0281, USA

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