surfer® 12

Powerful Contouring, Gridding & 3D Surface Mapping

Quick Start Guide
Golden Software, Inc.

Surfer® Registration Information

Your **Surfer** serial number is located on the CD cover or in the email download instructions, depending on how you purchased **Surfer**.

Register your **Surfer** serial number online at www.GoldenSoftware.com. Or, complete the *Registration Form.PDF*, located in the main directory of the installation CD. Return the *Registration Form.PDF* by mail or fax. This information will not be redistributed.
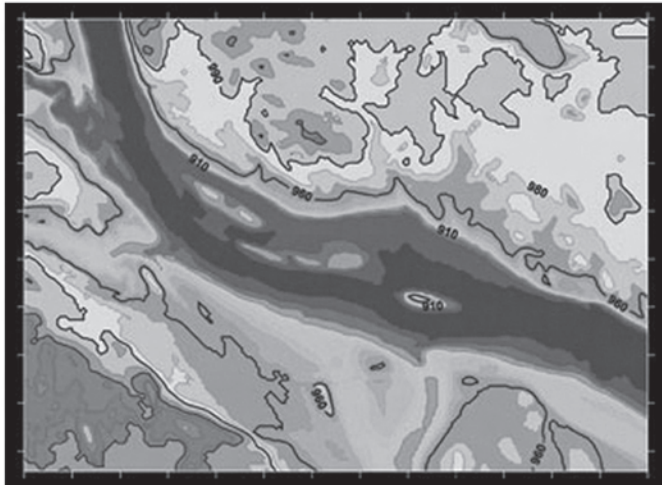
Registration entitles you to free technical support, free minor updates, and upgrade pricing on future **Surfer** releases. The serial number is required when you run **Surfer** the first time, contact technical support, or purchase **Surfer** upgrades.

For future reference, write your serial number on the line below.

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Surfer®   Quick Start Guide

Powerful Contouring, Gridding, and 3D Surface Mapping

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Introduction to Surfer

Welcome to **Surfer**, a powerful gridding, contouring, and surface mapping program for scientists, engineers, educators, or anyone who needs to generate maps quickly and easily.

Surfer is a grid-based mapping program that interpolates irregularly spaced XYZ 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, vector, image, shaded relief, watershed, 3D surface, and 3D wireframe maps. Maps can be displayed and enhanced in **Surfer**, allowing you to produce the map that best represents your data. Images of your area can be downloaded from a variety of online sources, multiple map layers can be added customizing the map display, and maps can be annotated with text, allowing every map you create to be the most informative publication quality map available.

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 gather information about your gridded data. Surface area, projected planar area, and volumetric calculations can be performed quickly in **Surfer**. Cross sectional profiles can be created by drawing a line on a map and viewing or exporting the result.

The grid files can be edited, combined, filtered, sliced, queried, and mathematically transformed. For example, an isopach map showing the difference between two surfaces can be created from two separate grid files. You will need the original surface grid file and the surface grid file after a volume of material was removed. Use the **Grid | Math** command to subtract the two surfaces to create an isopach map. The resulting map displays the amount of material that has been removed in all areas.

The **Scripter™** program, included with **Surfer**, is useful in creating, editing, and running script files that automate **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 of **Surfer 12** are summarized:

- Online at: www.GoldenSoftware.com/products/surfer#what-s-new

- In the program: click **Help | Contents** and click on the *New Features* page in the *Introduction* book

Who Uses Surfer?

People from many different 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 minimum system requirements for **Surfer** are:

- Windows XP SP2 or SP3, Vista, 7, 8 (excluding RT), and higher
- 512MB RAM minimum for simple data sets, 1GB RAM recommended
- At least 500 MB of free hard disk space
- 1024 x 768 or higher monitor resolution with a minimum 16-bit color depth

Installation Directions

Installing **Surfer** requires logging onto the computer with an account that has Administrator rights. Golden Software does not recommend installing **Surfer 12** over any previous versions of **Surfer**. **Surfer 12** can coexist with older versions (i.e. **Surfer 11**) as long as both versions are installed in different directories. By default, the program installation directories are different. For detailed installation directions, see the Readme.rtf file.

Installing Surfer

To install **Surfer** from a CD:

1. Insert the **Surfer** CD into the CD-ROM drive. The install program automatically begins on most computers. If the installation does not begin automatically, double-click on the Autorun.exe file located on the **Surfer** CD.
2. Choose *Install* **Surfer** from the **Surfer Auto Setup** dialog to begin the installation.

To install **Surfer** from a download:

1. Download **Surfer** according to the emailed directions you received.
2. Double-click on the downloaded file to begin the installation process.

Updating Surfer

To update **Surfer**, open the program and click the **Help | Check for Update** command. The Internet Update program will check Golden Software's servers for any free updates. If there is an update for your version of **Surfer** (i.e. **Surfer** 12.0 to **Surfer** 12.1), you will be prompted to download the update.

Uninstalling Surfer

Windows XP: To uninstall **Surfer**, go to the Control Panel and double-click *Add/ Remove Programs*. Select **Surfer 12** from the list of installed applications. Click the *Remove* button to uninstall **Surfer 12**.

Windows Vista: To uninstall **Surfer** when using the *Regular Control Panel Home*, click the *Uninstall a program* link. Select **Surfer 12** from the list of installed applications. Click the *Uninstall* button to uninstall **Surfer 12**.

To uninstall **Surfer** when using the *Classic View Control Panel,* double-click *Programs and Features*. Select **Surfer 12** from the list of installed applications. Click the *Uninstall* button to uninstall **Surfer 12**.

Windows 7: To uninstall **Surfer** go to the Windows Control Panel and click the *Uninstall a program* link. Select **Surfer 12** from the list of installed applications. Click the *Uninstall* button to uninstall **Surfer 12**.

Windows 8: From the *Start* screen, right-click the **Surfer 12** tile and click the *Uninstall* button at the bottom of the screen. Alternatively, right-click anywhere on the *Start* screen and click *All apps* at the bottom of the screen. Right-click the **Surfer 12** tile and click *Uninstall* at the bottom of the screen.

A Note about the Documentation

The **Surfer** documentation includes this quick start guide and the online help. Use the **Help | Contents** command in the program to access the detailed online help. Information about each command and feature of **Surfer** is included in the online help. In the event the information you need cannot be located in the online help, other sources of **Surfer** help include our support forum, knowledge base, FAQs, newsletters, blog, and contacting our technical support engineers.

You can purchase the full PDF user's guide that includes all of the documentation for the program. This PDF user's guide can be printed by the user, if desired. The guide can be purchased on the Golden Software website at www.GoldenSoftware.com.

Various font styles are used throughout the **Surfer** documentation. **Bold** text indicates menu commands, dialog names, window names, and page names. *Italic* text indicates items within a manager or dialog such as group names, options, and field names. For example, the **Save As** dialog contains a *Save as type* drop-down list. Bold and italic text occasionally may be used for emphasis.

In addition, menu commands appear as **File | Open**. This means, "click the **File** menu at the top of the **Surfer** window and click the **Open** command on the **File** menu list." The first word is the menu name, followed by the command within the menu list.

Three-Minute Tour

We have included several example files so that you can quickly see some of **Surfer's** capabilities. Only a few example files are discussed here, and these examples do not include all of **Surfer's** many map types and features. The **Object Manager** is a good source of information as to what is included in each file.

Example Surfer Files

To view the example **Surfer** files:

1. Open **Surfer**.

2. Click the **File | Open** command.

3. Click on an .SRF file located in the Samples folder. By default, the **Surfer** Samples folder is located in C:\Program Files\Golden Software\Surfer 12\ Samples.

4. Click *Open* and the file opens.
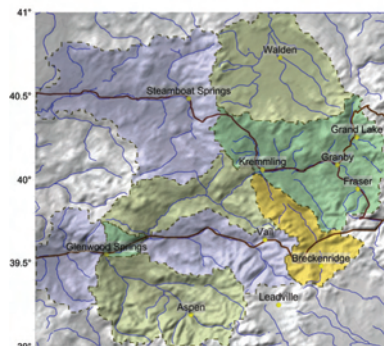
The Watershed.srf shows a map with multiple overlaid layers.

Watershed.srf

The watershed sample file contains a map with multiple map layers, including a post, multiple base, a contour, a 3D surface, and a watershed layer. The map highlights the **Surfer** calculated watersheds of the Colorado Rocky Mountain area.

Axes.srf

The axes sample file contains a contour layer and image map layer created from the same grid file. The Y axis is reversed and the X axis displays dates.
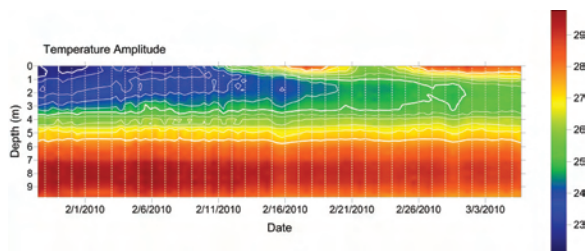
The Axes.srf file shows a contour layer overlaid onto an image map layer.

Using Surfer

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

1. Create a XYZ data file. This file can be created in a **Surfer** worksheet window or outside of **Surfer** (using an ASCII text editor or Excel, for example).

2. Create a grid .GRD file from the XYZ data file using the **Grid | Data** command.

3. To create a map, click the **Map | New** command, select a map type, and use the grid file from step two. Grid-based maps include contour, image, shaded relief, vector, watershed, 3D wireframe, and 3D surface maps.

4. Click on the map to display the map properties in the **Property Manager** where you can customize the map to fit your needs.

5. Click the **File | Save** command to save the project as a **Surfer** .SRF file which contains all of the information needed to recreate the map.

Using Scripter

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**. You can do practically everything with a script that you can do manually with the mouse or from your keyboard. 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* help book in the online help for more information about **Scripter**. We have included several example scripts so that you can quickly see some of **Scripter's** capabilities.

Example Scripter Files

To run a sample script:

1. Open **Scripter** by navigating to the installation folder, C:\Program Files\Golden Software\Surfer 12\Scripter. Double-click on the Scripter.exe application file.

2. Click the **File | Open** command.

3. Select a sample script .BAS file in the C:\Program Files\Golden Software\Surfer 12\Samples\Scripts folder.

4. Click *Open* and the script file opens.

5. Click the **Script | Run** command and the script is executed.

6. Most sample scripts will open **Surfer** and display a map in the plot window.

Surfer User Interface

Surfer contains three document window types: the plot window, worksheet window, and grid node editor window. Maps are displayed and created in the plot window. The worksheet window displays, edits, transforms, and saves data in a tabular format. The grid node editor window displays and edits Z values for the selected grid. The **Surfer** user interface layout consists of the title bar, menu bar, toolbars, tabbed windows, **Object Manager**, **Property Manager**, and status bar.
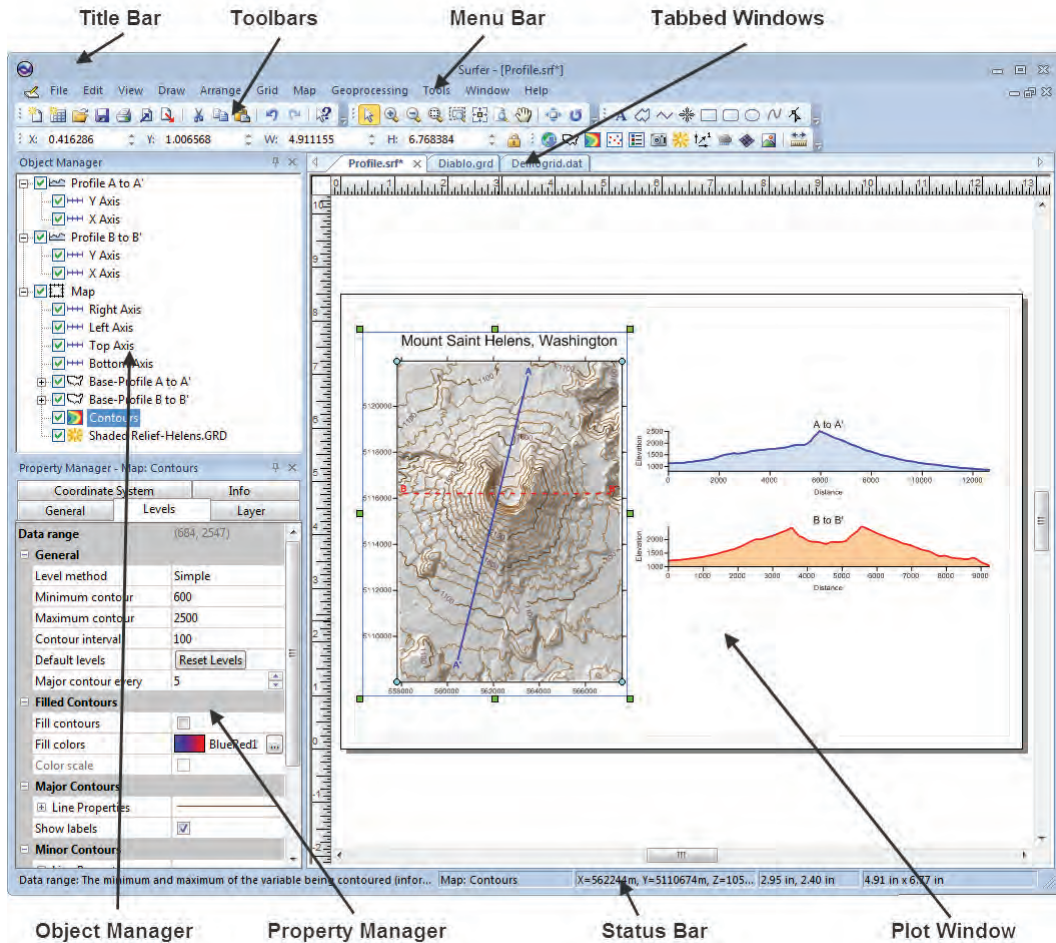
*This is the **Surfer** window with the **Object Manager** and **Property Manager** on the left side. The plot window, where the maps are displayed, is tabbed with a grid node editor window and a worksheet window. The toolbars and menu are displayed at the top and the status bar is displayed at the bottom.*

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 since it was last saved.
Menu Bar	The menu bar contains the commands used to run **Surfer**.
Toolbars	The toolbars contain **Surfer** tool buttons, which are shortcuts to menu commands. Move the cursor over each button to display a tool tip describing the command. Toolbars can be customized with the **Tools	Customize** command. Toolbars can be docked or floating.
Tabbed Windows	Multiple plot windows, worksheet windows, and grid windows can be displayed as tabs. Click on the tab to display that window.
Object Manager	The **Object Manager** contains a hierarchical list of the objects in a **Surfer** plot window. These objects can be selected, added, arranged, edited, and renamed in the **Object Manager**. The **Object Manager** is initially docked on the left side above the **Property Manager**. Changes made in the **Object Manager** are immediately reflected in the plot window. The **Object Manager** can be dragged and placed at any location on the screen.
Property Manager	The **Property Manager** allows you to edit any of the properties of a selected object. Multiple objects can be edited at the same time by selecting all of the objects and changing the shared properties. Changes made in the **Property Manager** are immediately reflected in the plot window.
Status Bar	The status bar displays information about the 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, the cursor page coordinates, and the dimensions of the selected object. The status bar also indicates the progress of a procedure, such as gridding. The percent of completion and time remaining are displayed.

Changing the Window Layout

The windows, toolbars, managers, and menu bar display in a docked view by default; however, they can also be displayed as floating windows. The visibility, size, and position of each item may also be changed. Refer to the *Changing the Windows Layout* topic in the online help for more information on layout options.

Displaying Managers

Click the appropriate **View | Managers** command to display the various managers. A check mark indicates the manager is visible. No check mark indicates the manager is hidden.

Auto-Hiding Managers

You can increase the view window space by minimizing the managers. To hide the manager, click the ⬛ button in the upper right corner of the manager when the manager is docked. When the manager is hidden, place the cursor directly over the tab to display the manager again. Click the ⬛ button to return the manager to a docked position.

Docking Managers

Surfer has a docking mechanism feature that allows for easy docking of managers. Left-click the title bar of a manager and drag it to a new location while holding down the left mouse button. The docking mechanism displays arrow indicators as you move the manager around the screen. 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 manager to be docked in the specified location.

The docking mechanism has docking indicators.

Customizing Toolbars and Buttons

You may customize **Surfer's** toolbars and menus by clicking the **Tools | Customize** command. This is useful to create custom toolbars, rearrange menus, menu commands, and toolbar buttons. You can display image, text, or image and text depending on your preference. You can also create a new button appearance for a command.

Plot Window

A plot window is the area used for creating and modifying grid files and for creating all types of maps. When you first start **Surfer**, you are presented with an empty plot window. Multiple plot windows can be open at one time. Tabs can be used to easily

move between multiple plot windows. If you need to change the display of tabs click the **Tools | Options** command. Select *User Interface* on the left side of the dialog. Set the *MDI tab style* on the right side. Setting this value to *None* turns the display of tabs off.

Menu Commands

The menus contain commands that allow you to add, edit, and control the objects on the plot window page. See the *Introduction* help book in the online help for the *Plot Window Commands* help book that detail the various plot window menu commands.

Toolbars

Toolbars display buttons that represent menu commands for easier access. Use the **View | Toolbars** commands to show or hide a toolbar. A check mark is displayed next to visible toolbars. Hold the cursor over any button on the toolbar to display the function of the button as a screen tip. A more detailed description is displayed in the status bar at the bottom of the window.

Status Bar

The status bar is located at the bottom of the window. Use the **View | Status Bar** command to show or hide the status bar. The status bar displays information about the current command or activity in **Surfer**. The status bar is divided into five sections. The left section displays information about the selected command or item in the **Property Manager**. The second section shows the selected object name. 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.

Object Manager

The **Object Manager** contains a hierarchical list of all objects in the plot window. The objects can be selected, arranged, moved, renamed, or deleted in the **Object Manager**. Changes made in the **Object Manager** are reflected in the plot window, and vice versa.

Each item in the **Object Manager** list consists of an icon indicating the object type, a text label for the object, and a check box. A ☑ indicates that the object is visible. A ☐ indicates that the object is not visible. Click the check box to change the visibility of the item. Invisible objects do not appear in the plot window and do not appear on printed output.
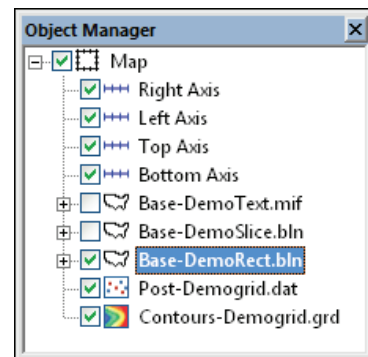
*The **Object Manager** contains a hierarchical list of the objects in the **Surfer** plot window.*

If an object contains sub-objects, a ⊞ or ⊟ button displays to the left of the object name. Click on the ⊞ or ⊟ button to expand or collapse the list. For example, a map object contains a map type, such as a contour layer, and normally four axes. The *Map* can contain many other objects. To expand the *Map* tree to see the axes and map layers, click on the ⊞ button next to *Map*. To collapse the *Map* tree, click on the ⊟ button next to *Map*.

Click on the object name to select an object and display its properties in the **Property Manager**. The selection handles in the plot window change to indicate the selected item and the status bar displays the name of the selected object. To select multiple objects in the **Object Manager**, hold down the CTRL key and click on each object.

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

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 cursor 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. For example, a 3D surface map layer cannot be moved to a map that contains a 3D wireframe layer but can be moved into a map that only contains a contour map layer. In addition to dragging objects in the **Object Manager**, the order can be changed with the **Arrange | Order Objects** commands.

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 choose **Map | Break Apart Layer**.

Property Manager

The **Property Manager** allows you to edit the properties of an object, such as a contour map or axis. The **Property Manager** contains a list of all properties for the selected object. The **Property Manager** can be left open so that the properties of the selected object are always visible. When the **Property Manager** is hidden or closed, double-clicking on an object opens the **Property Manager** with the properties for the selected object displayed. Information about the object properties is located in the online help.

Features with multiple options appear with a ⊞ or ⊟ to the left of the name. Click

on the ⊞ or ⊟ to expand or collapse the list. For example, click on a contour layer to select it. In the **Property Manager**, click on the **Levels** tab. Click the ⊞ next to *Filled Contours* and you see three options: *Fill contours, Fill colors,* and *Color scale*.

To change a property, click on the property's value next to the property name. Select a new property from the pop up box, scroll to a new number using the ⬍ buttons, select a new value using the ⬤━━┣ , select a new value from the drop-down list or palette, or type a property value. For example, a polyline has a **Line** page that contains a *Line Properties* section which contains *Style*, *Color*, *Opacity*, and *Width* properties. Changing the *Color* requires clicking on the current color and selecting a new color from the color palette. Changing the *Opacity* requires highlighting the existing percentage 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 are editable when multiple objects are selected. For example, you can left-click on a polyline in the **Object Manager**. 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 was selected, are not available as the polyline does not have fill properties.

*The **Property Manager** is used to change properties of the selected object. Each tab controls different properties of the object.*

Occasionally, some properties are dependent on other selections. For example, a polygon has **Line** and **Fill** tabs in the **Property Manager**. On the **Fill** tab, a *Pattern Offset* section is only available when an image fill type is selected as the *Pattern*.

Objects in the plot window automatically update after you select an item from a palette, press ENTER, or click somewhere else in the **Property Manager**.

When working with the **Property Manager**, the up and down ARROW keys move up and down in the **Property Manager** 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.

Use the **Tools | Options** command to change the default settings. Default settings for rulers, drawing grid, line, fill, font, symbol, label format can be set from the **Options** dialog. If the *Show Property Manager info area* is checked on the **Tools | Options | User Interface** page, a short help statement for each selected command will appear in the **Property Manager**.

Worksheet Window

The worksheet window opens a data file for editing. Data can be altered, transformed, sorted, or filtered. In addition, data can be assigned a coordinate system. The components of the worksheet window are displayed below.
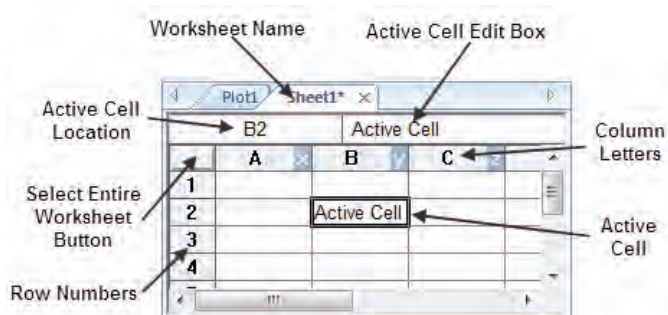
The components of the worksheet window shown above are described in the table below.

Component Name	Component Function
Column Letters	The column letters identify a column of the worksheet.
Row Numbers	The row numbers identify a row of the worksheet.
Active Cell	The active cell is highlighted with a bold outline. It is the cell that 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 is indicated with the column letter and row number (i.e. B2).
Active Cell Edit Box	The box displaying the data or text contained in the active cell is shown in the active cell edit box. Data typed into an empty cell appears in both the edit box and the active cell.
Worksheet Name	The data file name of the worksheet or the worksheet number prior to saving is displayed on the tab.
Select Entire Worksheet Button	This button selects all cells in the worksheet.

Grid Node Editor

The grid node editor opens a grid file for editing. Nodes display with a black "+", blanked nodes with a blue "x", and the active node is highlighted with a red diamond. Labels can be displayed at each grid node by clicking the **Options | Show Labels** command. To move between nodes, press the ARROW keys, or click a node to make it active. The active node XY map coordinates and grid coordinates are displayed at the top of the window. You can enter a new Z value for the node in the edit box. You can save the edited grid file with the same name or a different name.
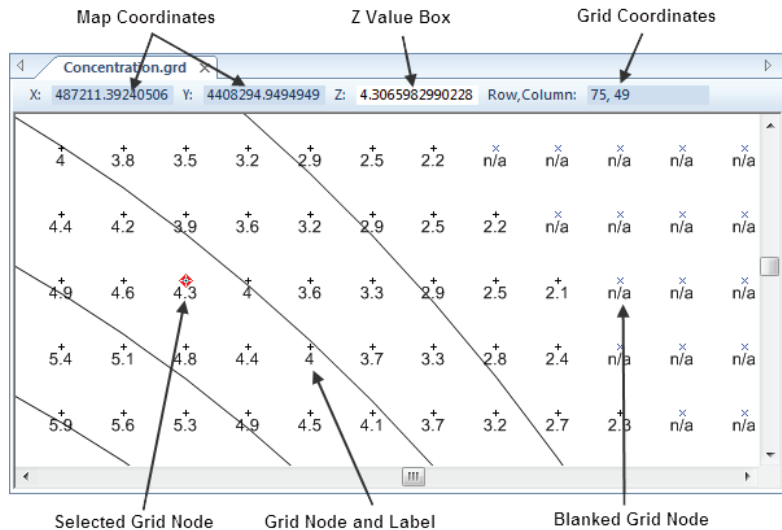
The grid node editor window allows Z values in a grid file to be changed or blanked. Individual nodes can be selected and altered.

File Types

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

Data Files

Data files are used to produce grid files, post data points on a map, or generate a residuals log. These files are generally referred to as *XYZ data files* or *data files* throughout the help. Data can be read from various file types. 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 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 **Grid | Data** command or can be imported from a wide variety of sources.

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 blanking, faults, breaklines, or slice calculations. Base map files can be created from a wide variety of vector and image formats.

Surfer Files

Surfer .SRF files preserve all the objects and object settings contained in a plot window. Maps, grid files, base map files, and data files are all included in the .SRF.

Gridding

Gridding is the process of taking irregularly spaced XYZ data and generating a Z value at each grid node by interpolating or extrapolating the data values. In addition to gridding data, **Surfer** can also use a variety of other grid files directly. For a list of these, refer to the online help.

A grid is a rectangular 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. Contour, image, shaded relief, vector, watershed, 3D surface, and 3D wireframe maps all require grids in **Surfer**.

Grid Menu Commands

There are many ways to manipulate grid files in **Surfer**. The **Grid** menu contains commands used to blank, 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 under the **Grid** menu.

Creating a Grid File

Click the **Grid | Data** command to grid data in **Surfer**. 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 XYZ data are interpolated when producing a grid file.

Gridding Methods

Gridding the data produces a regularly spaced, rectangular array of Z values from irregularly spaced XYZ data. The term *irregularly spaced* means that the points follow no particular pattern over the extent of the map, so there are many *holes* where data are missing. Gridding fills in these holes by extrapolating or interpolating Z values at those locations where no data exists. The gridding method determines the mathematical algorithms used to compute the Z 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.

Grid Line Geometry

The grid line geometry defines the grid limits and grid density. Grid limits are the *Minimum* and *Maximum* X and Y coordinates for the grid. Grid density is defined by the *# of Nodes* in the X and Y direction of the grid. The grid limits and the number of lines define the *Spacing*, the distance in data units between adjacent grid nodes. The intersection of the X line with the Y line is referred to as a grid node.

Surfer automatically computes reasonable values based on the minimum and maximum X and Y values of the XYZ data file. The number of nodes is determined by the direction that covers the greater extent. By default, the larger distance is assigned 100 grid nodes. The number of grid nodes in the other direction is computed so that the grid line *Spacing* in the two directions are approximately the same. Any of the items in the *Grid Line Geometry* section can be altered.

Grid Line Geometry	Minimum	Maximum	Spacing	# of Nodes
X Direction:	0	10	2.5	5
Y Direction:	0	25	6.25	5

Set the Grid Line Geometry *values to control the grid extents and grid density by entering the appropriate values. This grid will have a different spacing in the X and Y directions.*

Convex Hull

If the grid should not interpolate areas outside the data, check the *Blank grid outside convex hull of data* option. Leave the box unchecked to extrapolate the data to the minimum and maximum grid extents.

The *Inflate convex hull by* option expands or contracts the convex hull. When set to zero, the boundary connects the outside data points exactly. When set to a positive

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value, the area blanked is moved outside the convex hull boundary by the number of map units specified. When set to a negative value, the area blanked is moved inside the convex hull boundary by the number of map units specified. Values are in horizontal (X) map units. When the value is set to too high of a positive value, the contours will extend all the way to the minimum and maximum X and Y limits of the grid. When the value is set to too low of a negative value, the entire grid will be blanked, resulting in no grid file being created.

Z Transform

The *Z Transform* option changes how the Z values are gridded. *Linear* uses the Z values in the worksheet for gridding. No transformation is applied to the Z values. The *Log, save as log* takes the log (base 10) of the Z values and uses the log value for gridding. The grid is then saved with the log (base 10) values. The *Log, save as linear* takes the log (base 10) of the Z values and uses the log value for gridding. The grid is then converted back to the linear Z values by taking the antilog of the gridded results. The grid is then saved with the linear values.
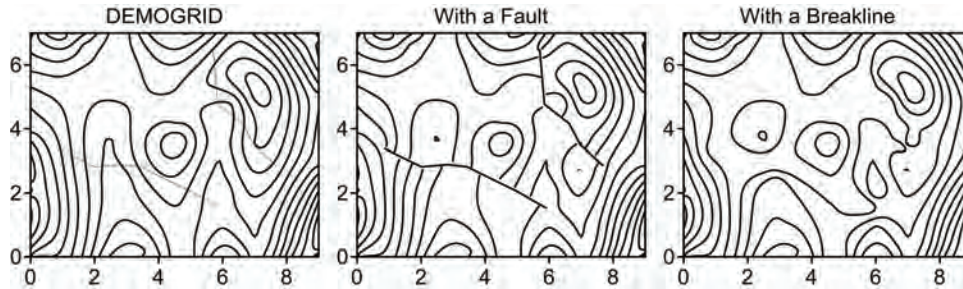
Breaklines

Breaklines are used when gridding to show discontinuity in the grid. A breakline is a three-dimensional .BLN 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. 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. The following gridding methods support breaklines: *Inverse Distance to a Power, Kriging, Minimum Curvature, Nearest Neighbor, Radial Basis Function, Moving Average, Data Metrics,* and *Local Polynomial*.

Faults

Faults are used to show discontinuity when gridding, similar to breaklines. A fault is a two-dimensional boundary file in .BLN format that defines a line with X and Y values at each vertex. Faults do not contain Z values. And, unlike a breakline, faults are barriers to information flow. Data on one side of a fault is not 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 is located. If the fault is not a closed polygon, gridding 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.

The following gridding methods support faults: *Inverse Distance to a Power, Minimum Curvature, Nearest Neighbor,* and *Data Metrics*.

All three maps were gridded with the Minimum Curvature *gridding method. The lines on the far left image were used as a fault and breakline in the other two images. Note the contours stop at the fault line and cross the location where the breakline would be.*

Map Types

Several different map types can be created, modified, and displayed with **Surfer**. These map types include base, contour, post, classed post, image, shaded relief, vector, watershed, 3D surface, and 3D wireframe maps. A description and example of each map is listed below.

Base Map

Base maps display boundaries on a map and can contain areas, curves, 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 several file formats. Individual base map objects can be edited, moved, reshaped, or deleted. Blank base maps can be created and used for drawing objects on other maps. Base maps can be downloaded from online mapping servers.
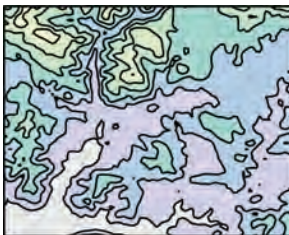
Contour Map

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.

Image Map

Image maps are raster images based on grid files. Image maps assign colors based on Z values from a grid file. Blanked regions on the image map are shown as a separate color or as a transparent fill. Pixels can be interpolated to create a smooth image.
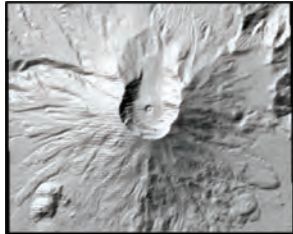
Shaded Relief Map

Shaded relief maps are raster images based on grid files. Shaded relief maps assign colors based on slope orientation relative to a light source. **Surfer** determines the orientation of each grid cell and calculates reflectance of a point light source on the grid surface. The light source can be thought of as the sun shining on a topographic surface.
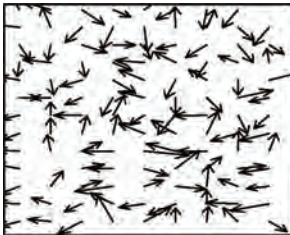
Vector Map

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).
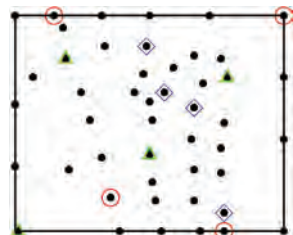
Post Map

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.
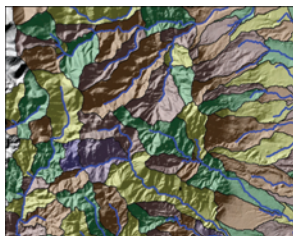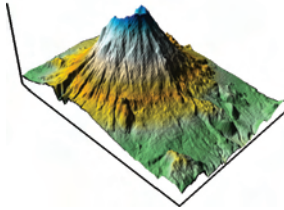
Classed Post Map

Classed post maps allow you to specify classes and change symbol properties for each class. Classes can be saved and loaded for future maps.

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.

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.
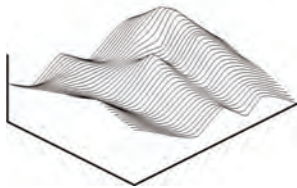
3D Wireframe Map

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.

Map Layers

Maps can be combined to create one map object with multiple layers. The **Map | Add** command adds a map layer to the selected map. Most combinations of map types can be combined. You can add any combination of contour, base, post, image, shaded relief, vector, watershed, or 3D surface maps. You can add any combination of contour, base, post, vector, and watershed maps with 3D wireframe maps.

A *Map* uses a single set of X, Y, and Z axes. Individual map layers are positioned according to the map layer's coordinate system. If two or more map layers have the exact same X and Y values, the two layers will occupy the same map space. If two layers cover adjacent X and Y areas, the two layers will overlay next to each other in the correct relative position. Layered maps become a single *Map* object and are moved and scaled together. The opacity of each map layer can be adjusted individually to make a layer transparent or semi-transparent.
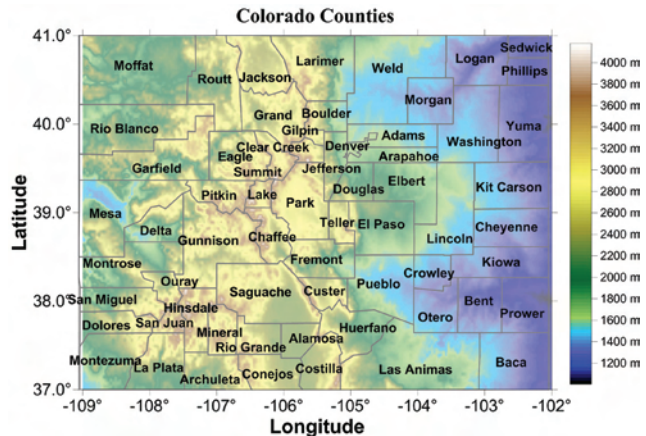
This map has multiple map layers that share axes. The map object controls the limits and scale. The individual map layers display the state and county boundaries, the county labels, and the image map showing elevation.

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Refer to the *Introduction to Map Layers* topic in the online help for additional information about map layers.

Coordinate Systems

A coordinate system is a 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 in local coordinates, in a geographic latitude and longitude system, or in 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* is considered unreferenced by **Surfer**. A local system has a location that begins numbering at an arbitrary location and increments numbers from this location. Most maps are created in local coordinate systems. In these cases, you can ignore the options on the **Coordinate System** tab in the **Property Manager**, as long as all map layers contain the same X and Y coordinates.

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 - Map Layer

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 data, grid, or base map file used to create the map layer. Each map layer can reference a different projection and datum. When a map layer has a source coordinate system different than what you want the map to display, the map is converted to the map's *Target Coordinate System*.

3D surface maps and wireframe maps do not have a coordinate system associated with them. When a map with a coordinate system is overlaid onto either of these map types, the map coordinate system is removed and the maps are displayed in the Cartesian coordinates.

Target Coordinate System - Map

Maps can be displayed in any coordinate system. The map is displayed in the coordinate system defined as the *Target Coordinate System*. A coordinate system normally has a defined projection and datum. 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 map's *Target Coordinate System* is the coordinate system in which you want to display your map.

Using Coordinate Systems with Multiple Map Layers

The standard procedure for creating maps in a specific coordinate system are:

1. Create the map by clicking on the appropriate **Map | New** command.

2. Click on the map layer to select it. In the **Property Manager**, click on the **Coordinate System** tab.

3. If the *Coordinate System* is not correct, click the *Set* button next to *Coordinate System*. The **Assign Coordinate System** dialog opens.

4. Make any changes in the dialog. This is the initial coordinate system for the map layer. When finished making changes, click *OK*.

5. To change the coordinate system for the entire map, click on the *Map* object in the **Object Manager**. In the **Property Manager**, click on the **Coordinate System** tab.

6. If the *Coordinate System* is not the desired output system, click on the *Change* button next to *Coordinate System* to set the desired target coordinate system. When finished, click *OK*.

7. All of the map layers are converted on the fly to the target coordinate system. The entire map is now displayed in the desired target system.

Surfer does not require a map projection be defined. Maps can be created from unreferenced data, grid, and map layers in local coordinate systems. 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 for the map. Changes to the target coordinate system for the map can cause the unreferenced map layers to appear incorrectly or to not appear.

Tutorial

The tutorial is designed to introduce basic **Surfer** features and should take less than an hour to complete. After you have completed the tutorial, you will have the skills needed to create maps in **Surfer** using your own data. The tutorial can be accessed in the program using the **Help | Tutorial** command.

Tutorial Lesson Overview

The following is an overview of lessons included in the tutorial.

- *Lesson 1 - Viewing and Creating Data* opens and edits an existing data file and creates a new data file.
- *Lesson 2 - Creating a Grid File* creates a grid file, the basis for most map types in **Surfer**.
- *Lesson 3 - Creating a Contour Map* creates and edits a contour map.
- *Lesson 4 - Modifying an Axis* edits the axis tick labels and axis title.
- *Lesson 5 - Posting Data Points and Working with Map Layers* adds a post map layer, displaying data points on the contour map. Both maps share the same axes, limits, and scaling.
- *Lesson 6 - Creating a Profile* shows how to create a profile line on the contour map and automatically display the profile.
- *Lesson 7 - Saving a Map* shows how to save the **Surfer** project.
- *Lesson 8 - Creating a 3D Surface Map* creates and edits a 3D surface map.
- *Lesson 9 - Adding Transparency, Color Scales, and Titles* changes the transparency of objects, adds a color scale, and add a map title.
- *Lesson 10 - Creating Maps from Different Coordinate Systems* loads multiple map layers from different coordinate systems and changes the final target coordinate system.

The lessons should be completed in order; however, they do not need to be completed at the same time. Advanced lessons are available in **Surfer** by clicking **Help | Tutorial**. The advanced lessons are optional, but we encourage you to read through them to provide additional detailed knowledge about **Surfer's** features.

Using the Tutorial with the Demo Version

Some **Surfer** features are disabled in the demo version, which means that some steps, such as lesson 7, cannot be completed by users running the demo version. This is noted in the tutorial lessons.

Starting Surfer

To begin a **Surfer** session:

1. Navigate to the installation folder, which is C:\Program Files\Golden Software\ Surfer 12, by default.

2. Double-click on the Surfer.exe application file.

3. A new empty plot window opens in **Surfer**. This is the work area where you can produce grid files, maps, and modify grids.

If this is the first time that you have opened **Surfer**, you will be prompted for your serial number. Your serial number is located on the CD cover, or in the email download instructions, depending on how you purchased **Surfer**.
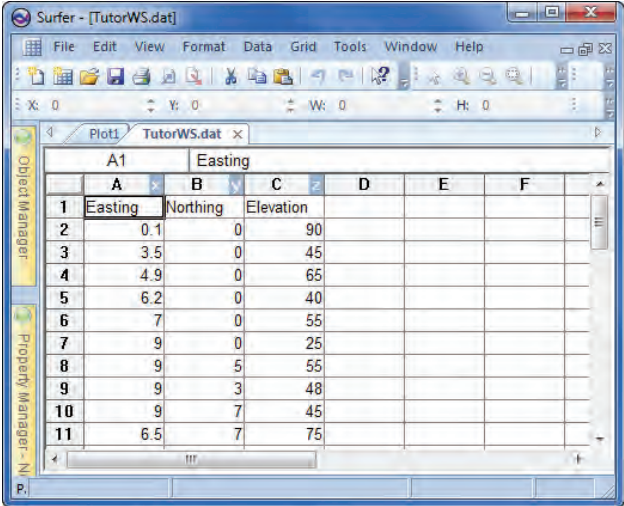
Lesson 1 - Viewing and Creating Data

An XYZ data file is a file containing at least three columns of data values. The first two columns are the X and Y coordinates for the data points. The third column is the Z value assigned to the XY point. Frequently, the X, Y, and Z data are stored in columns A, B, and C, respectively, though this is not required. Data files can contain header information, labels, point identifiers, filter information, and multiple columns of additional data.

Opening an Existing Data File

To look at an example of an XYZ data file, you can open any sample data file in a worksheet window.

1. Click the **File | Open** command, click the button, or press CTRL+O on the keyboard. The **Open** dialog displays.

2. If you are not in the Samples folder, browse to it. The Samples directory is located at C:\Program Files\Golden Software\Surfer 12\Samples, by default. In the list of files, click *TutorWS.dat*.
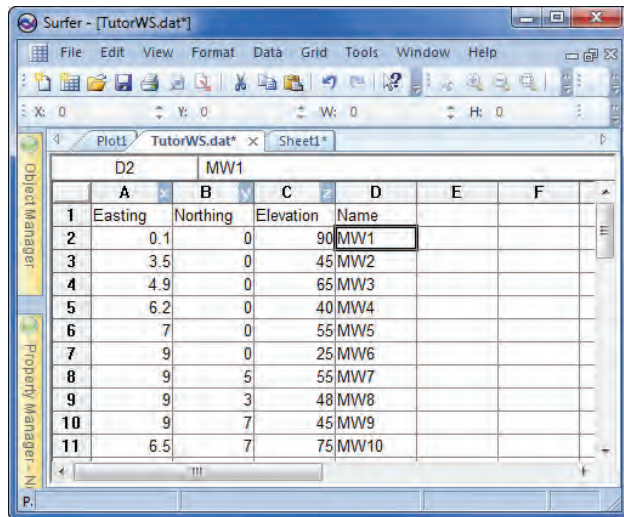

The data is displayed in a worksheet window. Note that each variable, X, Y, and Z, is in a separate column. Row 1 is a description of what the column contains.

3. Click *Open* to display the file in the worksheet window.

Notice that the X coordinate (Easting) is in column A, the Y coordinate (Northing) is in column B, and the Z value (Elevation) is in column C. Although it is not required, row 1 contains header text, which is helpful in identifying which column contains which data. When a header row exists, the information in the header row is used in the **Property Manager** when selecting worksheet columns.

Adding New Data

To edit any value, click in the cell to select it. Type information and the existing value is overwritten. Data can be transformed, sorted, or filtered in this window. New columns can be added. For instance, an *ID* column can be added which labels each row with a unique identifier. To do this:

1. Click in cell D1.

2. Type the text *Name*.

3. Click in cell D2.

4. Click the **Data | Transform** command.

5. In the **Transform** dialog, set the *Transform with* to *Column variables*.

6. Set the *Transform equation* to *D = "MW" + ITOA(ROW() - 1)*. This equation will use a prefix of "MW" before a number. The number is the row number minus 1 for each row. The ITOA function converts the *ROW() -1* number to text.

The new column contains a unique identifier for each row. This can be used for labels later in the tutorial.

7. Set the *First row* to 2.

8. Set the *Last row* to 48 (the last row in the worksheet).

9. Leave the *Empty cells, Text cells,* and *Number cells* set to the defaults.

10. Click *OK* and each row will have a unique identifier.

11. After making changes to the worksheet, save the file by clicking the **File | Save** command. Note that the data cannot be saved in the demo version.

Creating a New Data File

The **Surfer** worksheet can also be used to create a new data file. Use these steps to open a new worksheet window and begin entering data.

1. Click the **File | New | Worksheet** command, click the button, or press

CTRL+W on the keyboard. A new empty worksheet window is displayed.

2. Data are entered into the active cell of the worksheet. The active cell is selected by clicking on the cell or by using the arrow keys to move between cells. When a cell is active, enter a value or text, and the information is displayed in both the active cell and the active cell edit box.

3. To preserve the typed data in the active cell, move to a new cell by clicking a new cell with the mouse, pressing one of the arrow keys, or pressing ENTER. Press the ESC key to cancel without entering the data.

Refer to the *Worksheet Window* section on page 12 of this guide for additional information about the various parts of the worksheet window.

Saving the Data File

When all of the data has been entered, the data can be saved in a variety of formats. Note that the data cannot be saved in the demo version.

1. Click the **File | Save** command, click the 💾 button, or press CTRL+S on the keyboard. The **Save As** dialog is displayed if the data was not previously saved.

2. In the *Save as type* list, choose the *DAT Data (*.dat)* option.

3. Type the name of the file into the *File name* box.

4. Click the *Save* button and the **Data Export Options** dialog opens.

5. Accept the defaults in the **Data Export Options** dialog and click *OK*.

6. The file is saved in the Data .DAT format with the file name you specified. The name of the data file appears in the title bar and on the worksheet tab.

Lesson 2 - Creating a Grid File

Grid files are required to produce a grid-based map. Grid-based maps include contour, image, shaded relief, vector, watershed, 3D wireframe, and 3D surface map layers. Grid files are created using the **Grid | Data** command. The **Grid | Data** command requires data in three columns: one column containing X data, one column containing Y data, and one column containing Z data. We will use the *TutorWS.dat* sample file with this lesson.

1. If you have the worksheet window open, click the **Window** | **Plot1** command, or click on the *Plot1* tab. Alternatively, you can create a new plot window with the **File | New | Plot** command.

2. In the plot window, click the **Grid | Data** command.
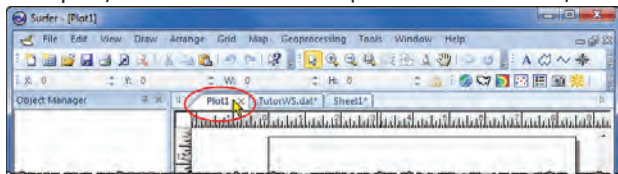
Click on the Plot1 *tab to select the plot window.*

3. In the **Open Data** dialog, click the *TutorWS.dat* Samples file in the *Open worksheets* section of the dialog by clicking once on the file name. The name appears in the *File name* box below the list of data files.

4. Click *Open*.

5. The **Grid Data** dialog is displayed, allowing you to control the gridding parameters and preferences. Take a moment to look over the various options in the dialog. Do not make any changes at this time, as the default parameters create an acceptable grid file.

    *   The *Data Columns* section is used to specify the columns containing the X, Y, and Z values in the data file.

    *   The *Filter Data* button is used to filter your data set.

    *   The *View Data* button is used to see a worksheet preview of your data.

    *   The *Statistics* button is used to open a statistics report for your data.

    *   The *Grid Report* option is used to create a report with statistical information about the grid file created.

    *   The *Gridding Method* option is used to specify the interpolation gridding method.

    *   The *Advanced Options* button is used to specify advanced settings for the selected *Gridding Method*.
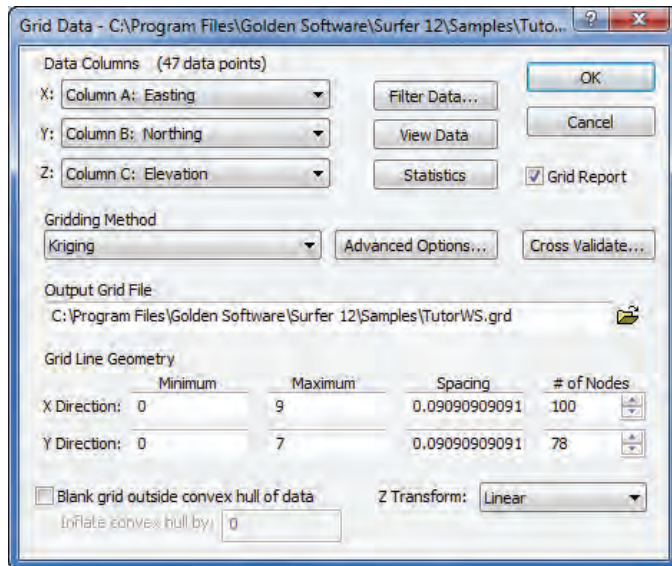
*The **Grid Data** dialog controls the options for gridding a data set. Set the options in the dialog and click* OK. *If the* Grid Report *box is checked, a report window will appear with information about the gridding process.*

    *   The *Cross Validate* button is used to assess the quality of the gridding method.

    *   The *Output Grid File* displays the path and file name for the grid file.

    *   The *Grid Line Geometry* section is used to specify the XY grid limits, grid spacing, and number of grid nodes (also referred to as rows and columns).

    *   The *Blank grid outside convex hull of data* automatically blanks any locations that are outside the data area. When checked, the *Inflate convex hull by* option is available. This allows the area to be gridded to be expanded or contracted beyond the data locations by the value specified.

- The *Z Transform* controls whether the actual Z value or the log (base 10) of the Z value is gridded and how the Z value is stored in the grid file.

6. Click *OK*. In the status bar at the bottom of the window, a display indicates the progress of the gridding procedure. By accepting the defaults, the grid file uses the same path and file name as the data file, but the grid file has a .GRD extension.

7. By default, a **Surfer** dialog appears after gridding the data with the full path and file name of the grid file that was created. Click *OK* to close the dialog.

8. If *Grid Report* was checked, a detailed gridding report is displayed. You can minimize or close this report.

Lesson 3 - Creating a Contour Map

A contour map is a plot of three values. The first two dimensions are the X and Y coordinates. Changing the X and Y coordinates changes the size or limits of the map. The third dimension is the Z value, represented by lines of equal value on the map. The shape of the surface is shown by the contour lines.

Contour maps are used for a variety of applications. You can contour any Z value of data. If you have multiple Z values for your X, Y values, you can create multiple contour maps. For example, you could create a contour map for X, Y, Z (elevation) to show the topography of your study area. You could then create a contour map for X, Y, Z (concentration) to show the concentration values across your study area. The Z value could be temperature, concentration, frequency, or any other numeric column of data.

The **Map | New | Contour Map** command creates a contour map based on a grid file. This lesson will create a contour map from the .GRD file created in *Lesson 2 - Creating a Grid File*.

1. Click the **Map | New | Contour Map** command or click the button.

2. The **Open Grid** dialog is displayed. Select the *TutorWS.grd* file created in *Lesson 2 - Creating a Grid File* by clicking once on its name. The file name is entered in the *File name* box.

3. Click *Open* and the map is created using the default contour map properties.

4. If you want the contour map to fill the window, click the **View | Fit to Window** command, click the button, or press CTRL+D on the keyboard. Alternatively, if you have a wheel mouse, roll the wheel forward to zoom in on the contour map. Click and hold the wheel button straight down while you move the mouse to pan around the screen.

Changing Contour Levels

After you create a contour map, you can easily modify any of the map features. For example, you might want to change the contour levels displayed on the map. To change the contour levels:

1. Place the cursor inside the limits of the contour map and click once. Or, click on the *Contours-TutorWS.grd* object in the **Object Manager**. When the contour layer is selected, the contour properties are displayed in the **Property Manager**.

2. In the **Property Manager**, click the **Levels** tab to display the contour line properties for the map. In this example, the contour levels begin at the Z value = 20. This is displayed next to *Minimum contour*. The *Maximum contour* level is Z = 105.

3. To change the contour range, click in the box next to *Minimum contour* or *Maximum contour*. Highlight the existing value and type a new value. The *Data range* of the grid file is displayed at the top of the **Levels** page, making selecting an appropriate range easier. For best results, select values for *Minimum contour* and *Maximum contour* that are in or near this *Data range*.

4. The *Contour interval*, or the frequency of contour lines, is five. This means that a contour line will be displayed every five Z units. We should see contour lines at 20, 25, 30, 35, etc. up to 105. Click in the *Contour interval* box, highlight the 5, and type the value 10.

5. Press ENTER on the keyboard. The map automatically updates to show contour lines every 10 Z units.
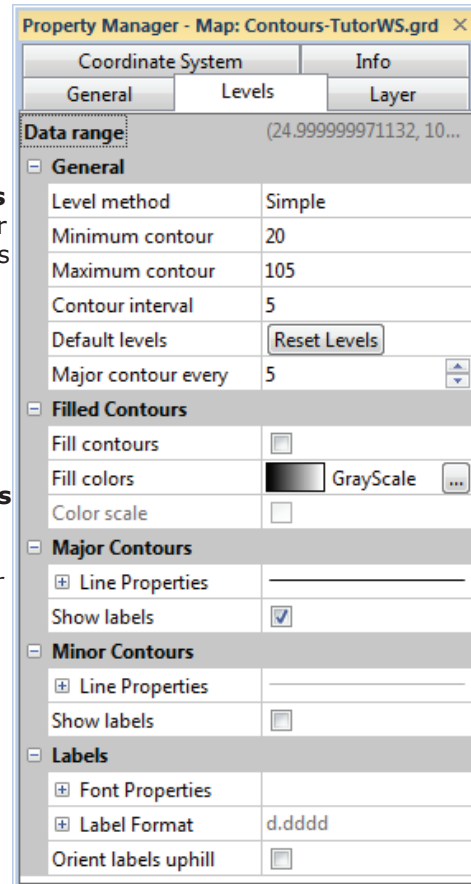
Set the contour level options on the **Levels** *page in the* **Property Manager**.

Changing Contour Line Properties

You can set any of the options in the list on the **Levels** page to customize the contour map. The *Major contour every* value allows the setting of two different line styles, the major and minor contour lines, for the contour map. By default, the major contour lines are black and labeled and the minor contour lines are gray and unlabeled. The number of minor contour lines and the line properties for both the major and minor contour lines can be changed.

1. Highlight the number in the box next to *Major contour every* and type in a new value of 3.

2. Press ENTER on the keyboard and every third line is a major contour line.

3. Click the ⊞ next to *Major Contours*, if it is not already open.

4. Click the ⊞ next to *Line Properties* in the *Major Contours* section. The major line properties appear.

5. Click the *Black* color box next to *Color*. Select another color, such as *Red*, from the list. The map automatically updates.
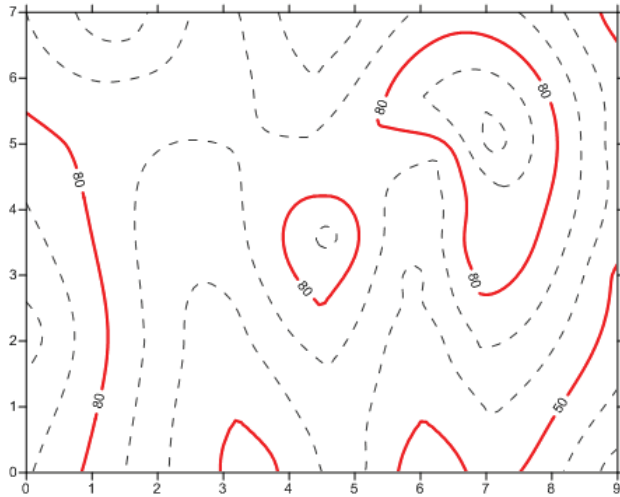
The major contour lines appear in a heavier solid line.

6. Click the ▲▼ next to *Width* and increase the value to 0.030 inches. Thick red lines now appear at the major contours.

7. Click the ⊞ next to *Minor Contours*, if it is not already open.

8. Click the ⊞ next to *Line Properties* in the *Minor Contours* section. The minor line properties appear.

9. Click the *30% Black* color box next to *Color*. Select another color, such as *80% Black*, from the list.

10. Click in the box next to *Style* and select a dashed line from the list. Dashed gray lines now appear at the minor contours.

Changing Contour Fill Properties

Color fill can be assigned to fill between contour lines. To display contour fill and change the contour fill color:

1. Click once on the contour map to select it. The contour map properties are shown in the **Property Manager**.

2. Click on the **Levels** tab in the **Property Manager**.

3. Click the ⊞ next to *Filled Contours*, if it is not already open.

4. Check the box next to *Fill contours*. The contour map automatically updates to display the default grayscale color fill between contours.

5. The color fill can be changed to assign a gradational color spectrum between two colors, or by selecting one of the preset color spectrums. To change the colors to one of the preset color spectrums, click the color bar next to *Fill colors*. A list

of colormaps appear. Click one of the preset colormaps, such as *Rainbow*, and the map automatically updates to display the new colors.

6. If only a minimum and maximum color are desired, click the ⬚ button next to the colormap beside *Fill colors*. The **Colormap** dialog appears.

7. The **Colormap** dialog allows you to select colors to assign to specific Z values. Click the colormap next to *Presets*. Select *GrayScale* from the list.

8. Click on the left node ⬚ below the color spectrum. This selects the minimum color node.
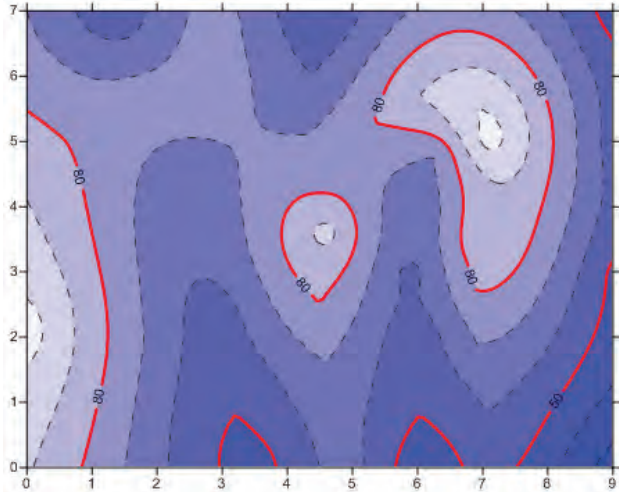
*The contour map is filled with a blue to white colormap after adjustments are made in the **Colormap** dialog.*

9. Click on the color button next to *Color* and select the color *Blue* in the color list. The color scale now ranges from *Blue* to *White*. Alternatively, you could select an existing color spectrum from the *Presets* list, or a custom colormap by clicking the *Load* button.

10. If you would like the color fill to be transparent, change the *Opacity* value by clicking and dragging the slider next to *Opacity*.

11. Click *OK* and the contour map is redrawn with the blue to white color fill.

Setting Advanced Contour Level Properties

Contour map level properties can be set in the *Simple* manner, like was shown previously. Or, you can change more advanced items, such as displaying contours on a logarithmic scale using the *Logarithmic* method or each contour line individually controlled by using the *Advanced* method. To set advanced contour level properties for all levels:

1. Click once on the contour map to select it.

2. In the **Property Manager**, click on the **Levels** tab.

3. Change the *Level method* by clicking on the word *Simple* next to *Level method* and selecting *Advanced* from the list.

4. Click the *Edit Levels* button next to *Contour levels* to open the **Levels for Map** dialog.

5. Click on the column header buttons to make bulk changes at regular intervals.

This provides a way to emphasize contours.
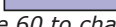
6. Click on the *Label* button. The **Labels** dialog opens.

7. Change the *First* value to 2, the *Set* value to 1, and the *Skip* value to 2.
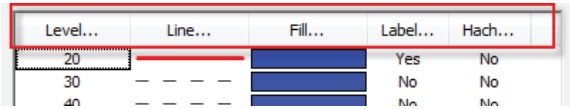
Click on one of the column header buttons to make bulk changes.

- The *First* value tells **Surfer** which contour line to first change. This will set the label for the second contour line (Z=30).

- The *Set* value tells **Surfer** how many contour lines to set with this style. This says to set one line with the label format.

- The *Skip* value tells **Surfer** how many lines to skip before setting the next contour line. This says to skip the next two contour lines. So, the Z=40 and Z=50 contours are not set.

- The next contour line Z = 60 uses the label format. Z=70 and Z=80 are skipped. Z=90 is set. Z=100 is skipped.

8. Click the *Font* button. The **Font Properties** dialog opens.

9. Set the *Size (points)* to 12.

10. Set the *Foreground color and opacity* color to *White*.

11. Click *OK*.

12. Click *OK* in the **Labels** dialog. Notice how the label status is changed in the **Levels for Map** dialog.

13. Click on the *Hach* button. The **Hachures** dialog opens.

14. Set the *First* to 1, the *Set* to 1, and the *Skip* to 0. This will set all contour lines to show the hachure setting.

15. Check the *Hachure Closed Contours Only* box, if it is not already checked.

16. Change the *Direction* to *Uphill.*

17. Click *OK*. This changes all of the items under *Hach* to *Yes*. All closed contours will have hachure marks.

18. Click *OK* and the bulk changes are made to the contour map.

To set advanced contour level properties for individual levels:

1. Click once on the contour map to select it.

2. In the **Property Manager**, click on the **Levels** tab.

3. Make sure that the *Level method* is set to *Advanced*.

4. Click the *Edit Levels* button next to *Contour levels* to open the **Levels for Map** dialog.

5. In the **Levels for Map** dialog, you can double-click an individual Z value in the list underneath the *Level* button to change the Z value for that particular contour

level. Let's double-click on the number 60.

6. In the **Z Level** dialog, highlight the value 60 and type 65.

40	– – – –		No	Yes
50	———		No	Yes
60			Yes	Yes
70	– – – –		No	Yes
80	———		No	Yes

Double-click the 60 to change the Z value for this contour line.

7. Click *OK* and the contour line changes to 65.

8. You can also double-click the line style for an individual level to modify the line properties for the selected level. This provides a way to emphasize individual contour levels on the map. Double-click on the line style next to the 70.

9. In the **Line Properties** dialog, change the *Style* to a solid line by clicking on the existing dashed line and selecting the *Solid* line from the list.

10. Click *OK*.

11. Let's add a single contour line halfway between two existing values. Click on the number 65 under the *Level* column.

12. Click the *Add* button. The value 57.5 is added between the 50 and the 65.

13. Click *OK* and the individual settings are made to the contour map.

Adding, Deleting, and Moving Contour Labels

Contour label locations can be changed on an individual basis. Labels can be added, deleted, or moved. To add, delete, and move contour labels:

1. Click the **Map | Edit Contour Labels** command or right-click on the contour map and select *Edit Contour Labels*. The cursor changes to ➤ to indicate that you are in edit mode. Contour labels have rectangular boxes around them in edit mode.

2. To delete a label, click on the label and press the DELETE key on the keyboard. For example, left-click on one of the center 65 labels and press the DELETE key on your keyboard.

3. To add a label, press and hold the CTRL key on the keyboard. The cursor changes to ➤+ to indicate you are able to add a new label. Left-click the location on the contour line where you want the new label to be located. Add several contour labels by clicking on the contour lines.

4. To move a contour label, left-click on the label, hold down the left mouse button, and drag the label. Release the left mouse button to complete the label movement.

5. To duplicate a label, hold the CTRL key on the keyboard while holding the left mouse button on an existing label. Drag the label to a new location along the line.

6. To exit the *Edit Contour Labels* mode, press the ESC key.

Lesson 4 - Modifying an Axis

Every contour map is created with four map axes: the bottom, right, top, and left axes. 3D maps have an additional Z axis. Additional X, Y, or Z axes can be added to a map with the **Map | Add** command. You can control the display of each axis independently of the other axes on the map. In this example, we will change the axis label spacing and add an axis title.

Adding an Axis Title

To add an axis title to an axis:

1. Move the cursor over one of the axis tick labels on the bottom X axis and left-click the mouse. In the status bar at the bottom of the plot window, the words "Map: Bottom Axis" are displayed. The *Bottom Axis* object is selected in the **Object Manager**. This indicates that you have selected the bottom axis of the map. Additionally, blue circle handles appear at each end of the axis, and green square handles appear surrounding the entire map. This indicates that the axis is a "sub-object" of the entire map.

2. The bottom axis properties are displayed in the **Property Manager**. Click on the **General** tab.

3. Click the ⊞ next to *Title* to open the *Title* section, if it is not already open.

4. Click in the box next to *Title text*. Type *Bottom Axis* and press the ENTER key on the keyboard. This places a title on the selected axis. Alternatively, click the Σ button. Type the text in the **Text Editor** and click *OK*.

5. If you cannot see the axis title, click the **View | Zoom | Selected** command. The map automatically increases its size to fill the plot window.

Changing the Tick Label Properties

All properties of the axis are editable, including the tick label format and frequency. To change the axis tick labels:

1. In the **Property Manager**, click on the **Scaling** tab to display the axis scaling options.

2. In the *Major interval* box, highlight the value 1 and type the value 1.5.

3. Press ENTER on the keyboard and the spacing automatically updates on the map axis to show 1.5 units between tick marks.

4. Click on the **General** tab in the **Property Manager**.
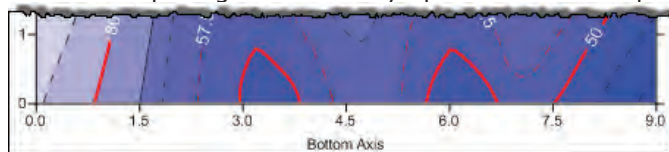
5. Click the ⊞ next to *Labels*, if it is not already open.

Change the axis tick mark and label properties or add an axis title to display your map exactly the way you want.

6. Click the ⊞ next to *Label Format* to open the *Label Format* section.

7. In the *Label Format* section, click on the existing option for *Type* and select *Fixed* from the list.

8. Highlight the existing value next to *Decimal digits* and type the value 1.

9. Press ENTER on the keyboard. This indicates that only one digit follows the decimal point for the axis tick labels.

10. The map is updated immediately after every change, showing the axis tick spacing, labels, and the axis title.

Lesson 5 - Posting Data Points and Working with Layers

Post maps are created by placing symbols representing data points at the X, Y data point locations on a map. Posting data points on a map can be useful in determining the distribution of data points, as well as placing data or text information at specific points on the map. Data files contain the X, Y coordinates used to position the points on the map. Data files can also contain the labels associated with each point.

Map layers allow you to add multiple maps to an existing map to create one map object displaying a variety of map types. The map uses a single set of axes and the map layers are positioned according to the target coordinate system. For example, if you have a contour map of weather data created, you can add a post map layer displaying the location and station names of each data collection station.

When a new post map is created with **Map | New | Post Map** it is independent of any other maps in the current plot window. When the two maps are displayed, two sets of axes are also displayed, one set for each map. When you select a map and click the **Map | Add** command, a new map layer can be added to the selected map.

If two maps already existed, a map layer can be dragged to a different map object in the **Object Manager**. Alternatively, select both maps and click the **Map | Overlay Maps** command. All selected map layers are moved to a single map object.

Adding a Post Map Layer

If you have not already completed *Lesson 1 - Viewing and Creating Data*, do so now. This lesson adds a worksheet column that is used for the post map labels.

1. Click once on *Contours-TutorWS.grd* layer in the **Object Manager** to select it.

2. Click the **Map | Add | Post Layer** command, or right-click on the contour map and select **Add | Post Layer**.

3. In the **Open Data** dialog, select *TutorWS.dat* from the *Open worksheets* section. If the *TutorWS.dat* file is not already open, select it from the *Samples* folder.

4.   Click *Open*.

The post map layer is added to the contour map. Notice in the **Object Manager** that the post map layer has been added to the *Map*. The two map layers now share the same set of axes. Changes made to the map properties will affect both the contour map layer and the post map layer.

Editing the Post Map

Once you have created a post map layer, you can customize the post map properties. Symbols in a post map can all be the same or can be selected with a worksheet column. Symbol sizes can all be the same or have proportional sizes. Symbol colors can all be the same or have color based on a column. To change the post map properties:

1.   Click on the *Post-TutorWS.dat* layer in the **Object Manager** or in the plot window.
2.   In the **Property Manager**, click on the **Symbol** tab.
3.   Click the ⊞ next to *Symbol*, if it is not already open.
4.   Click the ⊞ next to *Marker Properties* to open the *Marker Properties* section.
5.   Next to the *Symbol*, click on the existing symbol. Click on the filled diamond symbol (*Symbol set*: GSI Default Symbols, Number: 6) in the list.
6.   Next to *Fill color*, click on the existing color. In the list, select the *Cyan* color. The symbol is now cyan on the inside and black on the outside.
7.   *Fill opacity* and *Line opacity* can be adjusted to create semi-transparent symbols by dragging the ⟼ next to *Fill opacity* or *Line opacity*, if desired.
8.   Click the ⊞ next to *Symbol Size*.
9.   Highlight the value next to the *Symbol size* option and type 0.09 in.
10. Press ENTER on the keyboard. The symbols update with the new symbol size.
11. Click the ⊞ next to *Symbol Color*.
12. To change the symbol colors based on a worksheet value, click on the *None* next to the *Color column* option and select *Column C: Elevation*.
13. Verify that the *Color method* is set to *Numeric via colormap*.
14. Click the colormap next to the *Symbol colors* and select the desired colormap, such as *Terrain*.

If the post map is not visible, ensure that the post layer is on top of the contour layer in the **Object Manager**. The order the layers are listed in a map object is the order the map layers are drawn in the plot window. To move a map layer, left-click and drag up or down in the map object. Alternatively, select the map layer and use the **Arrange | Order Objects** command or right-click and select *Order Objects*.

Adding Labels to the Post Map

You can add labels to the data points on post maps and classed post maps. Multiple labels can be added to display all of the information desired in the map. To add labels:

1. Click on the *Post-TutorWS.dat* layer in the **Object Manager** to select it.

2. In the **Property Manager**, click on the **Labels** tab.

3. Click the ⊞ next to *Label Set 1*, if the section is not already open.

4. Next to *Worksheet column*, click the word *None* and select *Column C: Elevation* from the list.

5. For the *Position relative to symbol* option, click on the existing option and select *Below* from the list.

6. Click the *Add* button next to the *Add label set* option to add a second label to the post map.

7. Next to *Worksheet column*, click the word *None* and select *Column D: Name* from the list.

8. For the *Position relative to symbol* option, click on the existing option and select *Above* from the list.

9. Click the ⊞ next to *Font Properties* to open the *Font Properties* section.

Customize the post map by adding multiple labels with different properties.

10. Change the *Background opacity* to *33%*. This places a slightly white box around the names.

Moving Individual Post Map Labels

You can move individual labels of post maps and classed post maps with the **Map | Edit Post Labels** command. A customizable leader line is automatically added from the data point label to the symbol. To move individual labels:

1. Select the *Post-TutorWS.dat* layer in the **Object Manager**.

2. Click the **Map | Edit Post Labels** command or right-click on the selected map and select *Edit Post Labels*. The cursor will change to ⊕ to indicate you are now in post label editing mode.

3. Left-click on a label, hold the left mouse button down, and drag the label to a new

location. With the left mouse button held down, the arrow keyboard keys can be used to nudge the label location. Release the left mouse button to place the label in the new location. A leader line will be added from the point location to the new label location by default. The leader line visibility and line properties are controlled on the **Labels** page in the **Property Manager** when the post map is selected.

4. Press the ESC key to exit the post label editing mode.

Lesson 6 - Creating a Profile

The ability to slice a grid file in **Surfer** to create a file of data points along a specified line of section is a very powerful tool. The sliced data can be visually displayed as a profile in **Surfer**, or multiple profiles can be combined to display a cross section. Sometimes, a simpler process is desired because the data is not the end result. If being able to visually see the profile on the map and on a graph is the desire, the **Map | Add | Profile** command provides an excellent quick method. To start off, you must first have a grid file of your surface data. The profile line will be drawn directly on the map. To create the profile:

1. Click once on the contour map layer to select it.

2. Click the **Map | Add | Profile** command. The cursor changes to ┼ to indicate that you are in the drawing mode.

3. Click inside the contour map near the (0,4) and (9,4) coordinate locations. The exact coordinates of the cursor are displayed in the status bar for reference.

4. After the second point has been clicked, a line connects the points. Press ENTER on the keyboard to end drawing mode.

5. Click the **View | Fit to Window** command to see the entire map and profile.

The base map layer is automatically added to the contour map layer and the profile graph is automatically created. The properties can be edited by clicking on the *Profile 1* object in the **Object Manager**.
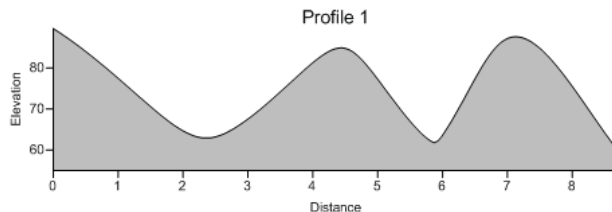
The profile graph showing the elevation change across the drawn line is automatically created when the line is completed.

Lesson 7 - Saving a Map

When you have completed the map in the plot window, you can save the map to a **Surfer** .SRF file. **Surfer** .SRF files contain all the information necessary to reproduce the project. When you save a map as a .SRF file, all the scaling, formatting, and map properties are preserved in the file. An asterisk (*) next to the file name in the title bar and plot window tab indicates the file has been modified and the modifications have not yet been saved.

If you are using the demo version of **Surfer** you will not be able to save or export the map. Please proceed to *Lesson 8 - Creating a 3D Surface Map*.

To save a map:

1. Click the **File | Save** command or click the ⊟ button. The **Save As** dialog is displayed because the map has not been previously saved. Set the *Save in* directory to any directory on your computer.

2. In the *File name* box, type *TutorWS*.

3. Make sure that the *Save as type* is set to *Surfer Document (*.srf)*.

4. Click *Save* and the file is saved to the current directory with a .SRF extension. The saved map remains open and the title bar changes to reflect the name change. There is no longer an asterisk next to the file name.

If desired, the *Save as type* can be set to *Surfer 11 Document (*.srf)*, if the file is to be shared with users using **Surfer 11**. After selecting the **Surfer 11** format, click *Yes* in the dialog. Any **Surfer 12** specific features are lost when saving to the **Surfer 11** format.

Lesson 8 - Creating a 3D Surface Map

Surfaces are three-dimensional shaded renderings of a grid file. Surfaces provide an impressive visual interpretation of data. Surfaces can be layered with other surfaces, so that the surfaces will intersect with each other. Surfaces can also have layers of other map types, excluding 3D wireframes. Surfaces allow you to generate an elevation model of your area of interest and add data on the top of the surface. You can control the color, lighting, overlay blending, and wire mesh grid of a 3D surface.

Creating a 3D Surface Map

We are going to use the same grid file you used to create the tutorial contour map. The 3D surface map will provide a new perspective to the contour map you have already created. Although we are going to create this map in a new plot window, the surface map could easily be added to the existing plot window.

1. Click the **File | New | Plot** command or click the 🗋 button to open a new plot document.

2. Click the **Map | New | 3D Surface** command or click the 🖼 button.

3. In the **Open Grid** dialog, select the grid file *TutorWS.grd* from the list of files. The *TutorWS.grd*, created in *Lesson 2 - Creating a Grid File*, is located in **Surfer's** Samples folder. By default, the Samples folder is located in C:\Program Files\

Golden Software\Surfer 12\Samples.

4. Click *Open* and the 3D surface is created using the default settings.

Adding a Mesh

Mesh lines can be applied to surfaces. 3D surface maps have more capability than 3D wireframe maps because surfaces can be combined with more map types and can change the map limits. Adding mesh lines to a 3D surface map simulates a 3D wireframe map. To add a surface mesh:

1. Click once on *3D Surface-TutorWS.grd* in the **Object Manager** to select the surface map layer.
2. In the **Property Manager**, click the **Mesh** tab.
3. Check the box next to the *Draw lines* option in both the *Lines of Constant X* and *Lines of Constant Y* sections.
4. Change the *Frequency* in both the *Lines of Constant X* section and *Lines of Constant Y* section to five. The mesh is displayed on the 3D surface.

Changing the 3D Surface Layer Colors

Changing color schemes on 3D surfaces is similar to changing colors on other map types such as image maps or contour maps. You can load previously defined color schemes or create your own color schemes. To change the surface material color:

1. Click on *3D Surface-TutorWS.grd* in the **Object Manager** to select it.
2. In the **Property Manager**, click on the **General** tab.
3. Click the ⊞ next to *Material Color* to open the section, if it is not already open.
4. Click the colormap next to *Upper*. In the list, select one of the predefined colormaps, such as *Rainbow*. The color range automatically updates.
5. If you wish to define your own colors, click the ⋯ button to the right of the selected colormap. The **Colormap** dialog opens.
6. In the **Colormap** dialog, select a predefined colormap from the *Presets* list. The *Presets* list contains a variety of predefined color schemes. Alternatively, you can click the *Load* button and select a custom color spectrum .CLR file. The ColorScales folder,
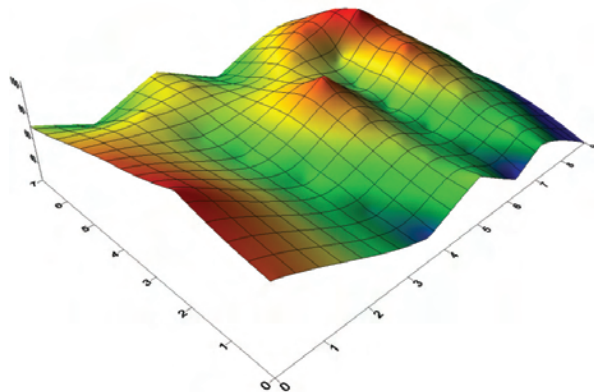
This is a 3D surface map with a mesh displayed at a frequency of five. The 3D surface map is using the preset Rainbow *color spectrum.*

located in the **Surfer** installation directory, contains many sample .CLR files.

7. The *Rainbow* preset has six nodes that range from purple to red. You can add, remove, apply opacity, customize the nodes, or accept the default selections. To reverse the color order, click the *Reverse* button.

8. Click *OK* in the **Colormap** dialog to update the surface map properties with your color changes.

You can continue to experiment with the colors by selecting other color spectrums from the *Upper* list. Or, click the ⋯ button to the right of the colormap and make changes in the **Colormap** dialog. You can experiment with selecting custom node locations and colors.

Adding a Map Layer

You can add additional map layers to the 3D surface with the **Map | Add** commands. When multiple 3D surfaces of differing elevations are added, the surfaces can intersect and overlap each other. If a surface map is added to another surface map with the **Map | Add | Surface Layer** command and the two maps are adjacent to each other in the X or Y direction, the surfaces are drawn side-by-side. In this example, we will add a planar layer to the surface you just created.

1. Click on *3D Surface-TutorWS.grd* layer in the **Object Manager**.

2. Click the **Map | Add | 3D Surface Layer** command, or right-click the surface map and select *Add | 3D Surface Layer*.

3. In the **Open Grid** dialog, select the planar grid, *TutorPl.grd* from **Surfer's** Samples directory.

4. Click *Open* and the new surface map layer is added using the default settings.

5. Click on the *3D Surface-TutorPl. grd* surface map layer in the **Object Manager**.

6. In the **Property Manager**, click on the **General** tab.

7. Click on the color next to *Upper*. Select *Rainbow* in the list to match the *3D Surface-TutorWS. grd* color fill.
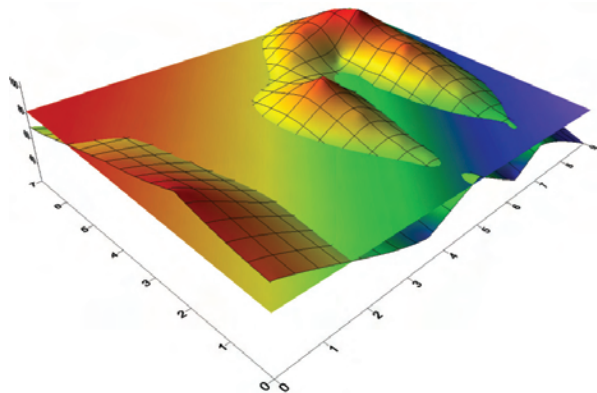
Here the two surface map layers are overlaid. Depending on the Z values of the grid files, the two surfaces can intersect, as this example shows.

Lesson 9 - Adding Transparency, Color Scales, and Titles

The opacity of a map, image, text, line, fill, symbol, or entire layer can be customized in **Surfer**. *Opacity* is the amount that you can see through an object or that light can pass through an object. An object can be made semi-transparent by adjusting the opacity value. Reducing the opacity of an object allows the ability to see through the object to other objects. 0% *Opacity* means that the object is invisible. 100% *Opacity* means that the object is fully opaque. Setting the opacity is useful when creating a semi-transparent map layer. For example, you may want to display a semi-transparent contour map layer over a satellite image base map layer so that both map layers can be seen. Being able to set the *Opacity* of entire layers is especially useful when you have multiple layers with filled objects and you need to see all of the layers.

Creating a Filled Contour Map

To create a contour map:

1. Click the **File | New | Plot** command or the ![button] button to create a new plot window.
2. Click the **Map | New | Contour Map** command.
3. Select the grid file *TutorWS.grd* from the list of files in the **Open Grid** dialog. The *TutorWS.grd*, created in *Lesson 2 - Creating a Grid File*, is located in **Surfer's** Samples folder.
4. Click *Open*. The map is created using the default settings.
5. Click on the contour map layer to select it.
6. In the **Property Manager**, click on the **Levels** tab.
7. Set the *Level method* to *Simple*, if it is not already *Simple*.
8. Click the ⊞ next to *Filled Contours* to open the *Filled Contours* section, if it is not already open.
9. Check the box next to *Fill contours* to fill the contours with the default color scale.

Applying Opacity

You can adjust the *Opacity* value of a map layer, or of individual fill, text, lines, or symbols when the appropriate object is selected. The properties are displayed in the **Property Manager**. To add transparency to a contour map:

1. Click on the contour map layer to select it.
2. Click on the **Levels** tab in the **Property Manager**.
3. Click the color bar next to *Fill colors*. Select *Rainbow* from the list.
4. Click on the **Layer** tab.
5. Highlight the existing 100% value next to the *Opacity* option and type 43.

6. Press ENTER on the keyboard and the opacity for the entire layer is decreased to 43%.

Adding and Editing a Color Scale Bar

Color scales are legends that show the fill colors. Color scales are available for contour, 3D wireframe, 3D surface, image, and vector maps. The color scale displays the colors assigned to levels in a filled contour map or 3D wireframe, the colors used in an image map or 3D surface, and the fill assigned to vector symbols. To add a color scale and text description to the contour map:

1. Click on the contour map layer to select it.
2. Click on the **Levels** tab in the **Property Manager**.
3. Click the ⊞ next to *Filled Contours* to open the *Filled Contours* section, if it is not already open.
4. Check the box next to *Color scale*. A default color scale is created. A new *Color Scale* object is added to the **Object Manager**.
5. Click on the color scale bar in the **Object Manager** to select the color scale.
6. In the **Property Manager**, click on the **General** tab.
7. You may wish to change the *Opacity* to 43% to match the contour map.
8. To add a title to the color scale bar, click the **Draw | Text** command or click the ![A] button.
9. Click to the left of the scale bar in the plot window. The **Text Editor** opens.
10. In the **Text Editor**, type the text *Elevation (Meters)*.
11. Click *OK*.
12. Press the ESC key on the keyboard to exit the text drawing mode.
13. Click on the *Text* object in the **Object Manager** to select the new text object.
14. Click the **Arrange | Rotate** command.
15. In the **Rotate** dialog, highlight the *0* and type *90* in the *Counterclockwise rotation in Degrees* box.
16. Click *OK*.
17. Click and drag the text box to position it next to the color scale.
18. Select the color scale and the text in the **Object Manager** by selecting the first object, holding the CTRL key, and selecting the second object.
19. Once only those two objects are selected, click the **Arrange | Group** command to create a *Group* object. Items in a grouped object can be individually edited, but they are moved together. To move the items individually, use the **Arrange | Enter Group** command.

Adding a Shaded Relief Map Layer

Adding a shaded relief map layer to the existing semi-transparent map will help display the elevation behind the contour fill. To add a shaded relief map layer:

1. Click on *Contours-TutorWS.grd* in the **Object Manager** to select the contour layer.

2. Click the **Map | Add | Shaded Relief Layer** command.

3. In the **Open Grid** dialog, select the file *TutorWS.grd*.

4. Click *Open*. A shaded relief layer is added to the map object in the **Object Manager**. Notice how the shadows of the shaded relief layer help distinguish the topography of the grid file.

Adding a Map Title

Adding a title to a map is a great way to stay organized and create publication quality maps. To add a title to the tutorial map:

1. Click on the *Top Axis* in the **Object Manager** to select it.

2. In the **Property Manager**, click on the **General** tab.

3. Click the ⊞ next to *Title*, if the section is not already open.

4. In the box next to *Title text*, click the **Σ** button to open the **Text Editor**.

5. Type *Tutorial Map* and press the ENTER key on the keyboard.

6. On the second line, we will use a dynamic predefined instruction to insert the current date. Click the 1/1-AM button.

7. In the **Insert Date/Time** dialog, select the desired date format. For instance, select *mm/dd/yy*.

8. Click *Insert*.

9. Highlight the date in the **Text Editor**.

10. Click the **B** button to make the highlighted text bold.

11. Change the *Size (points)* to 14. The size is located immediately to the right of the font name.

12. Click *OK* to close the **Text Editor**. The map updates to display the map title.
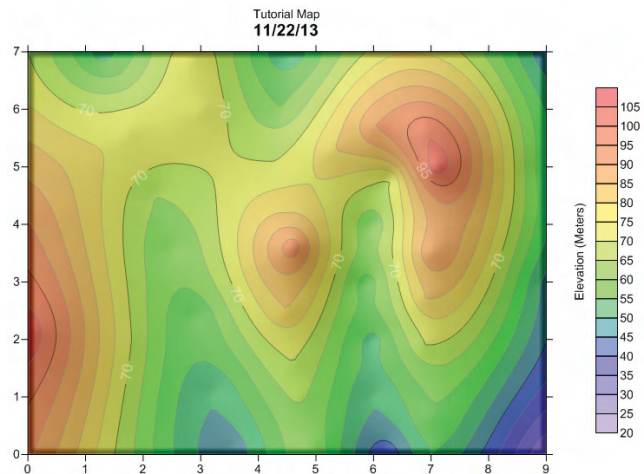
The map contains semi-transparent filled contours on a shaded relief layer. A color scale and title were added next to the map.

Lesson 10 - Creating Maps from Different Coordinate Systems

Map layers from different coordinate systems can be created in the same map object. **Surfer** converts the source coordinate system for each map layer to the target coordinate system for the entire map. The axes display the target coordinate system.

Creating the First Map

1. Click the **File | New | Plot** command or the [image] button to create a new plot.

2. Click the **Map | New | Contour Map** command or the [image] button to create the first map layer, a new contour map.

3. In the **Open Grid** dialog, click the *Diablo.grd* file in the **Surfer** Samples directory.

4. Click *Open*.

5. Click the *Contours-Diablo.grd* in the **Object Manager** to select the contour layer.

6. In the **Property Manager**, click on the **Coordinate System** tab. Note that the contour layer was imported with a coordinate system already specified. This map layer is in *State Plane 1927 - California III (Meters)*, as shown in the *Name* field.

Creating a New Map and Assigning a Coordinate System

Maps can be created without predefined coordinate systems and assigned the correct coordinate system in the map properties.

1. Click the **Map | New | Post Map** command or the [image] button to create a post map. This creates a new map with separate axes.

2. In the **Open Data** dialog, click the *Diablo Example.dat* file in the **Surfer** Samples directory.

3. Click *Open*.

4. Click on the *Map* that contains the post map. Drag it in the plot window so that the two maps are side by side. Note that the axes on the two maps have very different coordinates.

5. Click on *Post-Diablo Example.dat* in the **Object Manager** to select the post layer.

6. In the **Property Manager**, click on the **Coordinate System** tab. Note that the post map does not have a predefined coordinate system.

7. Click the *Set* button to define the coordinate system for the post map. Since we know this coordinate system, we can set it.

8. In the **Assign Coordinate System** dialog, click the ⊞ next to *Predefined* to open the *Predefined* section.

9. Click the ⊞ next to *Projected Systems* to open the *Projected Systems* section.

10. Click the ⊞ next to *UTM* to open the *UTM* section.

11. Click the ⊞ next to *North America* to open the *North America* section.

12. Click on the *North America NAD27 UTM Zone 10N* to select it.

13. Click *OK*. On the **Coordinate System** tab, the post layer shows a defined coordinate system next to *Name*.

14. In the **Object Manager,** click and drag the *Post-Diablo Example.dat* layer into the *Map* object that contains the *Contours-Diablo.grd* layer. The two map layers are now overlaid. You can see the posted symbols are located on the contour lines, despite the different coordinate systems.

Setting the Target Coordinate System

The target coordinate system is the system displayed on the map axes. Once the map layer is defined, the target coordinate system can be changed to any desired coordinate system. To change the target coordinate system:

1. Click on the *Map* object in the **Object Manager**.

2. In the **Property Manager**, click on the **Coordinate System** tab.

3. Click the *Change* button.

4. In the **Assign Coordinate System** dialog, click the ⊞ next to *Predefined* to open the *Predefined* section.

5. Click the ⊞ next to *Geographic (lat/lon)* to open the *Geographic (lat/lon)* section.

6. Click on *World Geodetic System 1984* to select it.

7. Click *OK*. On the **Coordinate System** tab, the map now has a different coordinate system than either of the map layers. Notice that the axes are now showing latitude and longitude values, as well.

Downloading an Online Base Map Layer

New layers with any coordinate system can be added to the map.

1. With the *Map* selected, click the **Map | Add | Base Layer from Server** or the

   ![button] button to download an image base map from a web mapping server.

2. In the **Download Online Maps** dialog, click the ▷ next to *Imagery*.

3. Click the ▷ next to the *NAIP Color Imagery for US* server name.

4. Click on the *Orthoimagery/USGS_EDC_Ortho_NAIP* layer.

5. Notice the *Specify Latitude/Longitude Extents* is selected with the boundaries of the selected *Map*.

6. In the *Select Image Resolution to Download* section, drag the slider to the right to increase the image resolution. The farther to the right the slider is located, the better the resolution and the larger the image. Clicking on one of the lines in the middle toward the left side of the slider downloads a map of sufficient quality that

is smaller in size.

7. Click *OK* and the base layer downloads. The base layer is automatically placed behind the contour and post layers.

8. Click on the *Base - Orthoimagery/USGS_EDC_Ortho_NAIP* layer in the **Object Manager** to select the new base layer.

9. In the **Property Manager**, click on the **Coordinate System** tab. Note that the base layer was imported with a coordinate system already specified. This map layer is in *World Geodetic System 1984*, as shown in the *Name* field.
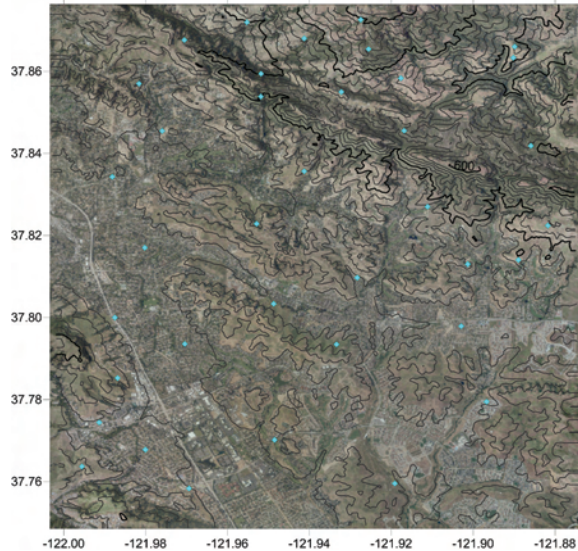
The final map displays three overlaid map layers, each in a different source coordinate system. The map axes display the target coordinate system.

Printing the Online Help

The online help topics may be printed. You can print a single topic, a section of the table of contents, or all topics in the table of contents. Open the online help by clicking the **Help | Contents** command in the **Surfer** window.

To print one topic, click the topic you wish to print and click the [Print] button. If the **Contents** page is open in the help navigation pane, the **Print Topics** dialog appears. Select *Print the selected topic* and click *OK*.

To print one book, the *Tutorial* for example, click the **Contents** tab on the left side of the help window. Click on the book you want to print, such as the *Tutorial* book to select the book. Click the [Print] button. In the **Print Topics** dialog, select *Print the selected heading and all subtopics* and click *OK*. All the topics included in the book are printed.

To print all of the topics in the help file table of contents, select the top-level book in the help book, **Surfer 12**. Click the [Print] button. In the **Print Topics** dialog, select *Print the selected heading and all subtopics* and click *OK*. All the topics included in the online help table of contents are printed.

WARNING: Printing the entire help file takes hundreds of letter-sized sheets of paper and is very time consuming to print. There is no table of contents or index printed with the file.

You can purchase the full PDF user's guide that includes all of the documentation for the program. This PDF user's guide can be printed by the user, if desired. The guide can be purchased on the Golden Software website at www.GoldenSoftware.com.

Getting Help

The quick start guide is a quick way to learn the basics in **Surfer**. There are also other sources of help with **Surfer**.

Extensive information about **Surfer** is located in the online help. To access the online help, choose the **Help | Contents** command. You can navigate help using the **Contents**, **Index**, **Search**, and **Favorites** pages in the navigation pane to the left of the topic page.

Surfer also contains context-sensitive help. Highlight a menu command, window region, or dialog, press the F1 key, and help is displayed for the highlighted item. You may also access context-sensitive help by pressing SHIFT+F1 or clicking on the ⬛ button on the toolbar. Then, click on a menu command, toolbar button, or screen region to view information specific to that item. The help window opens with information about the selected item. In most dialogs, click the ⬛ button in the dialog title bar or click the *Help* button to obtain help for that dialog.

Internet Resources

There are several Internet help resources.

- Direct links to the Golden Software home page (www.GoldenSoftware.com), the **Surfer** product page, frequently asked questions, and the knowledge base are available by clicking **Help | Golden Software on the Web**.
- The **Help | Feedback** commands send a problem report, suggestion, or information request by email directly to **Surfer** technical support.
- Click the *Forums* button in the online help to post a question or comment to our public support forums.
- Click the *Knowledge Base* button in the online help to search for an answer in our frequently updated knowledge base.
- Browse newsletter articles on our website at www.GoldenSoftware.com/newsletter.
- Browse FAQs at www.GoldenSoftware.com/products/surfer#faqs.

- Watch training videos and past webinars at www.GoldenSoftware.com/products/surfer#training-videos.
- Read through our blog items at www.GoldenSoftware.com/blog.

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.

Technical support is available Monday through Friday 8:00 AM to 5:00 PM Mountain Time, excluding major United States holidays. We respond to email, phone, and fax technical questions within one business day. When contacting us with your question, have the following information available:

- Your **Surfer** serial number (located on the CD shipping cover or in **Help | About Surfer**)
- Your **Surfer** version number, found in **Help | About Surfer**
- The operating system you are using (i.e. Windows XP, Vista, 7, 8, or higher)
- Whether you are using a 32-bit or 64-bit **Surfer** program and operating system

If you encounter problems with **Surfer**, you are welcome to send an email message to Golden Software using the **Help | Feedback | Problem Report** command. This message is delivered directly to SurferSupport@GoldenSoftware.com. Report the steps you perform when the problem occurs and include the full text of any error messages that are displayed. You are welcome to attach a .ZIP file (10 MB maximum) containing the .SRF file and other files that illustrate the problem or contact technical support if you have very large zipped attachments to send.

Contact Information

Telephone: 303-279-1021

Fax: 303-279-0909

Email: SurferSupport@GoldenSoftware.com

Web: www.GoldenSoftware.com (includes FAQs, knowledge base, support forum, training videos, newsletters, blogs, downloads, and more!)

Mail: Golden Software, Inc., 809 14th Street, Golden, Colorado 80401-1866, USA

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Before calling, please check the following available resources as your question may already be answered.

Registration: Register online at www.GoldenSoftware.com or fax or mail the *Registration Form.PDF*, located in the main directory on the CD
Knowledge Base: www.GoldenSoftware.com/activekb or in the **Surfer** program using the **Help | Golden Software on the Web | Knowledge Base** command
Forums: www.GoldenSoftware.com/forum or in the **Surfer** program using the **Help | Contents** command and click on Forums
Frequently Asked Questions: In the **Surfer** program using the **Help | Golden Software on the Web | Frequently Asked Questions** command
Tutorial: Complete the tutorial section in this quick start guide or in the **Surfer** program using the **Help | Tutorial** command
Online Help: In the **Surfer** program using the **Help | Contents** command
Support Videos: www.GoldenSoftware.com

Business Hours

Technical Support:

Monday through Friday, 8:00 AM - 5:00 PM, Mountain Time

Product Sales:

Online orders available 24 hours, 7 days a week with 2 business hour delivery

Golden Software Contact Information

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