MicroMODEL Tutorial

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1) **Prior to Running MicroModel**

1.1. First Steps

In your C:\ drive, create a folder with the title MicroMODEL. Within this MicroMODEL folder create a folder with the title of the project. In the example used in the tutorial, the file reference for the project is F:\Projects\MMdemo\. Save all files created for the project from external programs (such as *collar* and *assay* files created in Excel and the AutoCAD DXF *topo* file) to this folder before opening MicroMODEL.

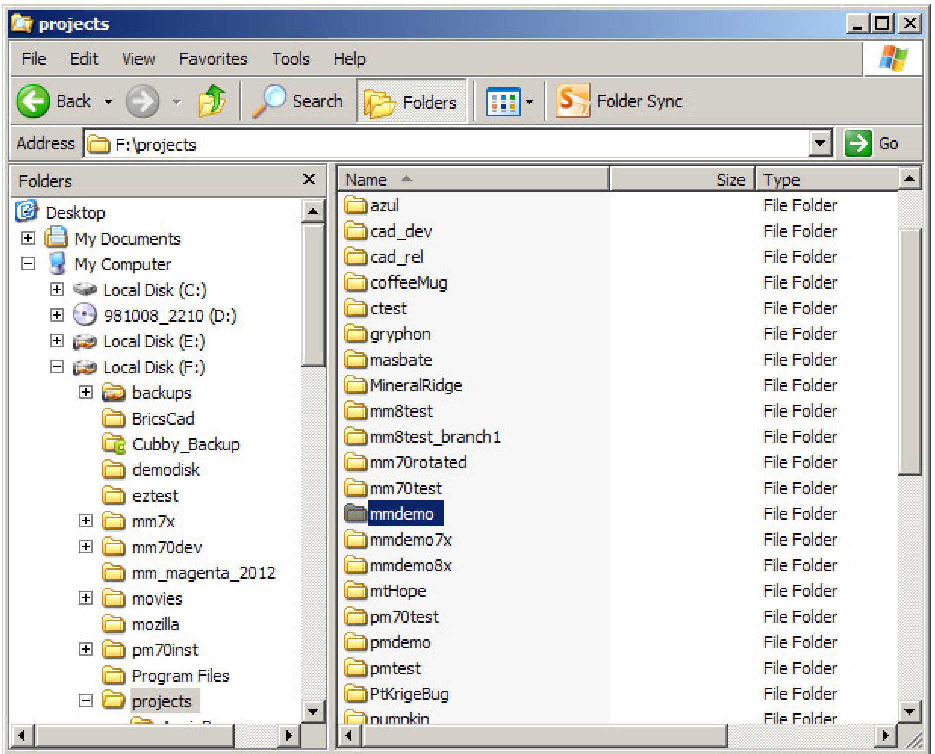


Figure 1 Screenshot of Windows Explorer showing Randall Project File

1.2. Preparing Drillhole Files

The drillhole data can either exist in a single Excel spreadsheet, with separate sheets for collar, survey, assay and optional lithology, or can be arranged in separate plain text files: *collar*, *survey*, *assay, and optional lithology*. The plain text files can be comma separated (*.csv), tab delimited (*.txt), or space delimited (*.prn).

- The *collar* file (Recommended name: *COLLAR*.csv) contains information on the drillhole collars.
- The *survey* file (Recommended name: *SURVEY*.csv) contains information on any downhole surveys done on the drillholes, if any, such as hole deviation.
- The *assay* file (Recommended name: *ASSAY*.csv) contains the assayed data, such as Au, Ag, Cu values and so forth.

- The *lithology* file (Recommended name: LITHOLOGY.csv) contains lithology, oxidation state, alteration, etc.

Microsoft Excel is the most efficient tool to develop these files in. The column headers that should be used for each file are listed below.

COLLAR FILE

- **DHNAME** - Drillhole name

Drillhole names can be up to twelve characters long. If your drillhole names are longer than twelve characters, then they need to be truncated in some way so that the maximum length is twelve characters. If you need to truncate names, be sure that the truncated versions remain unique for each drillhole. Use the same names as listed in the actual drillhole database. The drillhole names that will be used in all three files to identify the drillholes *MUST* be the same.

- **NORTHING** - Collar Northing
- **EASTING** - Collar Easting
- **ELEVATION** - Collar Elevation
- **AZIMUTH** – Dip Direction at Collar
- **DIP** – Dip Angle at Collar

Make sure the northing and easting are not switched!

At this point, verify a few drillholes against a topographic or regional map. **Time spent verifying and developing good input spreadsheets will save time during the modeling process**.

Dhname	Northing	Easting	Elevation	Azimuth	Dip
DH15	5143	4667	3400	0	90
DH16	4931	4566	3480	0	90
DH17	4941	4807	3489	200	60
DH18	4944	4817	3489	120	60
DH19	5034	4751	3467	185	58
DH20	5234	4855	3422	182.5	60
DH21	5163	4271	3407	102	62
DH22	5313	4308	3316	145	60
DH23	5416	4409	3276	295	60
DH24	5436	4181	3259	133	60
DH33	5559	4515	3282	173	60
DH34	5398	4874	3410	0	90

Figure 2 Collar File in Excel

Survey File

- **DHNAME** - Drillhole name

- **DEPTH** - Depth in hole of the survey point
- **AZIMUTH** - Hole azimuth at the survey point (The azimuth should be a value between 0 and 360)
- **DIP** - Drillhole dip at the survey point (value between 90 and 0)

The following figure illustrates how the numbers must be input.

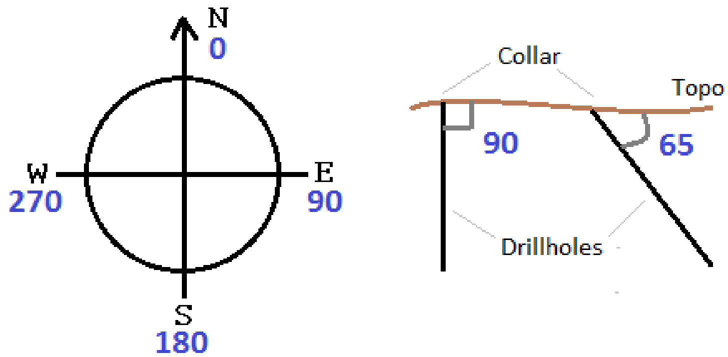
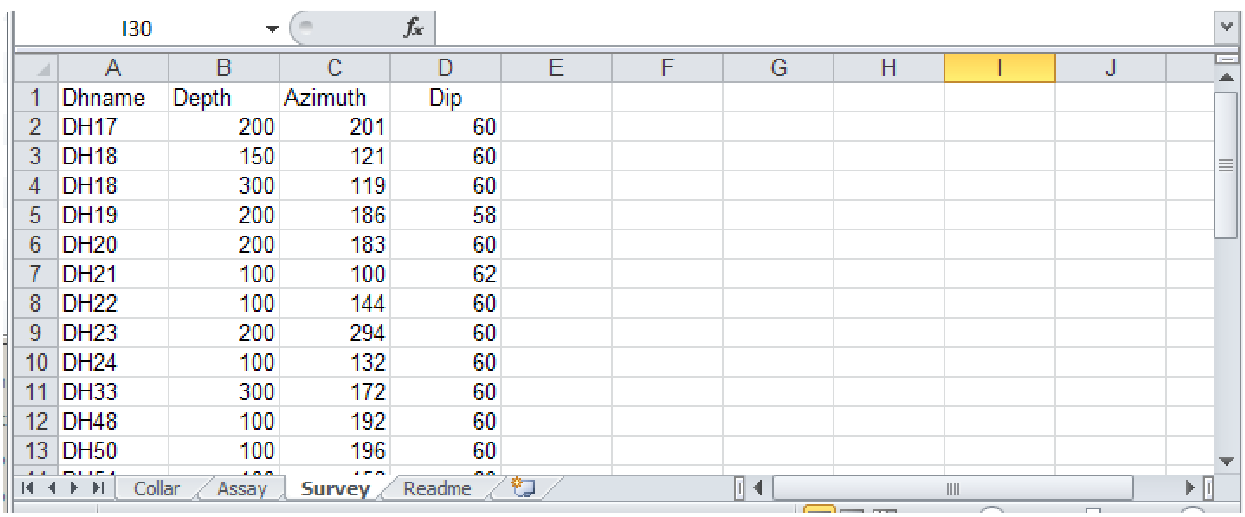


Figure 3 Azimuths and Dips

Use positive values for the dip. Otherwise, the program will think that the data set contains underground drillholes that go up, into the roof of a tunnel, for example. In that case, use negative dips for these vertically rising holes. **Please note that if your database has been constructed using the convention that negative dip angles are downward, you do not have to change them. There is a switch that can be chosen for the program that reads the drillhole data to accommodate this convention.**

All drillholes should have a survey value at DEPTH = 0. The collar azimuth and dip could be used, as well as any other downhole survey values.



	A	B	C	D
1	Dhname	Depth	Azimuth	Dip
2	DH17	200	201	60
3	DH18	150	121	60
4	DH18	300	119	60
5	DH19	200	186	58
6	DH20	200	183	60
7	DH21	100	100	62
8	DH22	100	144	60
9	DH23	200	294	60
10	DH24	100	132	60
11	DH33	300	172	60
12	DH48	100	192	60
13	DH50	100	196	60

Figure 4 Example of a Drillhole Survey File in Excel

If the drillhole doesn't have an azimuth and dip, and if it can be assumed to be a vertical hole, use an azimuth of 0 and a dip of 90.

Assay File

- **DHNAME** - Drillhole name
- **FROM** - Beginning of assay interval
- **TO** - End of assay interval

It is recommend that there be no gaps in the FROM-TO range. If there is no assay value or lithology just leave those cells blank, but the intervals should still exist. Note that there is a checkbox for the drillhole input program that will insert missing values for data if there are gaps in the assay interval values, so it is not absolutely necessary to insert missing intervals.

- **ROCK** - Lithology of the sample

The lithology should be listed as a single, simple label. It is possible to use an alphanumeric label (ie.: *ss* for *sandstone*, *bas* for *basalt*, etc), but it will be simpler later on to use numeric labels and keep a key of them in a separate spreadsheet. All numerical rock codes should be between 1 and 9999. DO NOT use 0 as a rock code. MicroMODEL uses 0 codes to indicate blocks of air during modeling.

Please note that MicroMODEL will accommodate text data using what is called a data dictionary, if you do not desire to make changes to text entries in your spreadsheet or CSV files. This is the recommended procedure. The data dictionary will allow you to plot drillhole sections showing the original text values, based on the data dictionary file that is created.

If you choose to perform the translations yourself, prior to loading into MicroMODEL, then use the V-Lookup feature in Excel.

<u>V-Lookup</u>

Create a file called RockCode to use as legend for the numerical lithology code in the assay file. If it does not already exist, copy the values from the ROCK column into a new spreadsheet. Highlight the column and use the "Remove Duplicates" tool to get a list of unique values. Define these values and save the RockCode file into the project folder.

To create a numerical rock code, take the alphabetical codes and follow the instructions in the previous paragraph. In the second column, assign values 1 through N to each value. In ASSAY.csv, move the alphabetical rock codes to last column. In the ROCK column, use the VLOOKUP formula to assign the proper numerical values to the now empty column. Spot check the values in the ROCK column to make sure the command worked correctly. When loading the sheet, just ignore the last column.

- **ASSAYS** - Assays should be assigned simple, descriptive headers. Examples are: AuPPM for gold, Cu% for percentage of copper, or Pb% for percentage of lead. Whatever system is chosen to name the assay headers, remain consistent to it.

	A	B	C	D	E
1	Dhname	From	To	Rock	Au Opt
2	DH15	0	5	99	0.022
3	DH15	5	10	99	0.062
4	DH15	10	15	3	0.137
5	DH15	15	20	3	0.079
6	DH15	20	25	3	0.026
7	DH15	25	30	3	0.005
8	DH15	30	35	3	0.003
9	DH15	35	40	2	0.005
10	DH15	40	45	2	0.003
11	DH15	45	50	2	0.002
12	DH15	50	55	2	0.001
13	DH15	55	60	2	0.003

Figure 5 Example Assay Data Set in Excel

Example:

If a particular assay interval has not been assayed, then leave the unassayed cells blank.

The only time 0 is used is to indicate a barren assay, however, for statistical reasons it is better to enter ½ of the detection limit for these intervals, rather than zero. Values of zero must necessarily be ignored in lognormal statistics calculations, while the ½ detection limit values remain valid. There is not right way to choose, as different projects and companies have their own systems. Best judgment should be applied in this situation.

To check if all intervals are properly assigned, you can create a temporary column in the spreadsheet. Use the formula "=TO1-FROM2". This subtracts the FROM value from the pervious TO Value. The only place this test column should NOT equal zero is at the end of one hole and the beginning of another hole. If any other non-zero values exist, investigate and correct any problems. This column can be deleted after the interval values are verified.

This is also the time to spot check assays against the original certificates and the lithology codes against the original logs to validate them. Also, check that the maximum depth listed in the collar file matches the last "TO" depth in the assay file.

It is best to store the COLLARS.csv, SURVEY.csv, ASSAY.csv, and RockCode files in the project folder, however, they can exist somewhere else if desired. MicroMODEL can look anywhere on your system for input files

Comment: Do not use "MISSING" or some other alpha-numeric indicator to show missing values, barren values, or values below detection limit. Barren assay values should be represented as 0. Assay values below detection limits should be handled as explained above. Missing values in the rock or assay columns should be left blank. All intervals should be listed regardless of whether or not values are missing.

1.3. Preparing DXF Files

DXF Files are used by MicroModel for importing topography surfaces, solids wireframes, and other features such as property boundaries.

To import the topography from digitized contour data, make sure that all the relevant contour lines are on layers separate from extraneous data (such as road indicators or other infrastructure), and that the contours are either lines, polylines, or lwpolylines. When loading the topo information, it is possible to pick and choose the necessary layers. Just make sure the contour data is consolidated on a few layers and independent of any other entity types.

1.4. Help

If you have questions about a particular input item for a program, navigate to the field you have questions about, and then click on the Help button, located in the lower right hand corner of the screen. In most cases, a small help dialog will appear which should explain what MicroMODEL is looking for. If you do not get a popup help, please make a note of the program and field and send a short note to Martin and Associates so that this oversight can be corrected.

2) Data Entry

1.5. Enter Project Information

1.6. Block Model limits

(Video 1)

(Data Entry – 3 Enter Project Information)

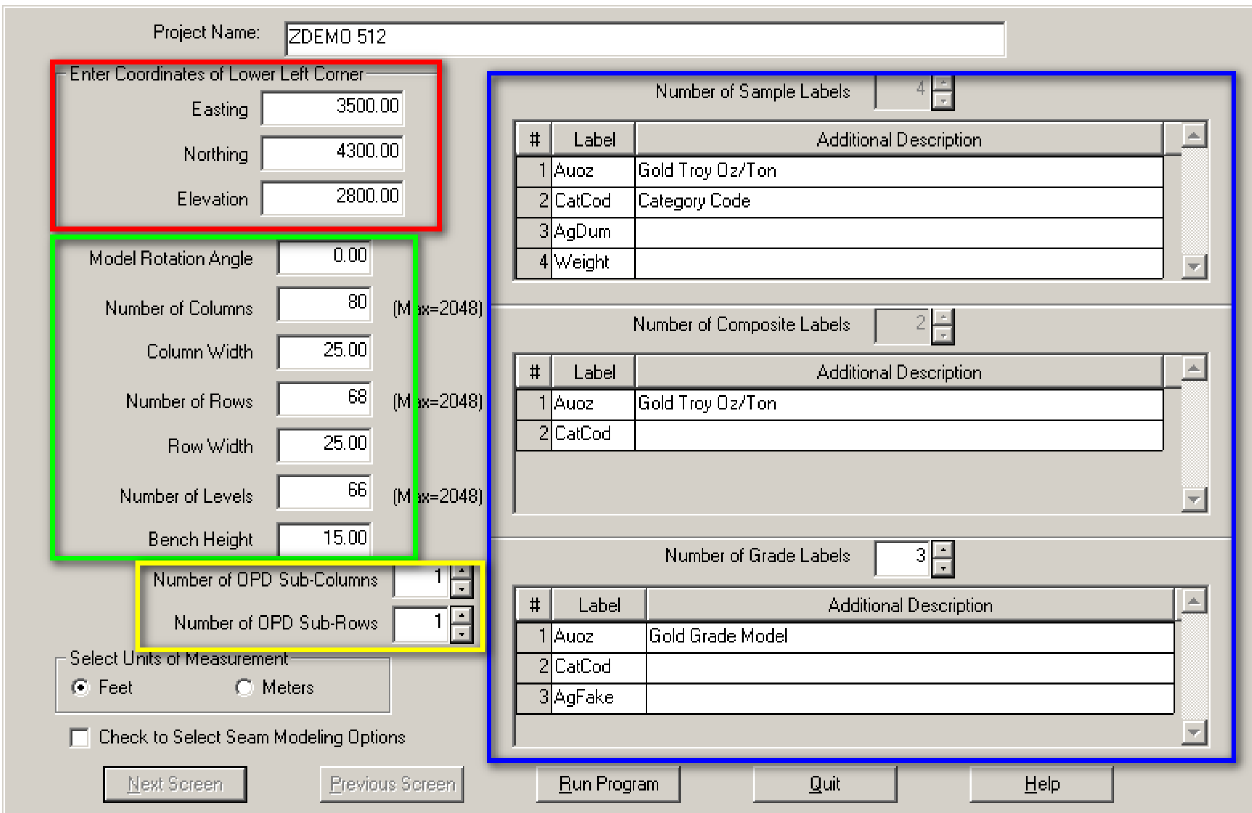


Figure 6 Project Information Entry Dialog Box

1) Enter coordinates of bottom Southwest corner (**Red**)

If the drill hole data is not yet inserted into the project (most of the cases, in the beginning of a project), the user must check minimum and maximum values of collar data (location and depth) so that the input values in this part of the project can be set.

If you are not sure what the final project limits will be, it is OK to start with the minimum and maximum easting and northing values for the DH data. Then, as the project evolves, it is advisable to extend the block model limits, pushing the border out a distance equal to the depth of the deepest drillhole, from a boundary line drawn around the outermost drillholes in the project.

To estimate the appropriate limits to use:

- Lowest elevation-longest drillhole (**Grey**)
- Min and max collar values (**Red**)
- 45 degree angle from that point (**Blue**)
- (Do this both in the E-W and N-S directions)

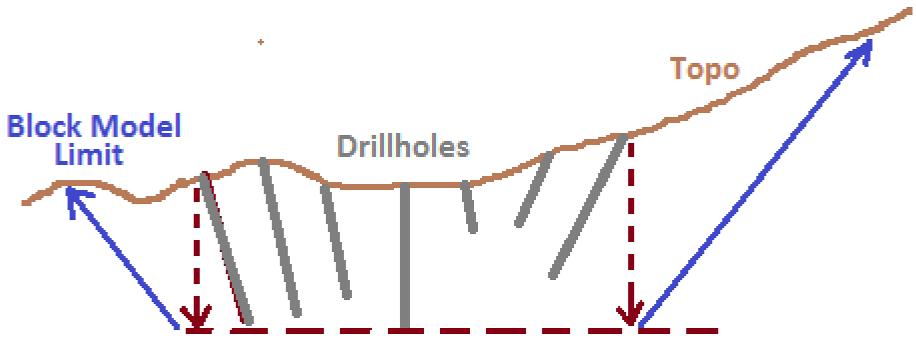


Figure 7 Block Model Limits

2) Number and Size of Blocks (**Green**)

After the left bottom south-west corner is chosen, and total block size is defined, the user has to choose the number and size of your blocks will define the actual size of the map, corresponding the total size as:

- Number of Columns x Column Width = East-West extent of the model area,
- Number of Rows x Row Width = North-South extent of the model area.
- Number of Levels x Bench Height = Z-axis extent of the model area.
    - Column x Rows x Height = Block size

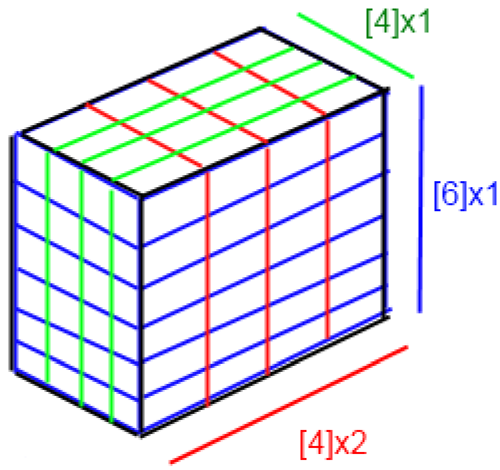


Figure 8 Number of Blocks in Each Dimension

Important note: The *Bench Height* choice refers to expected bench height for pit design. Example: if we are planning on a high output production mine with large equipment, taller bench heights would be used. This value will impact the design later on. The rule of thumb is to create a block width equal to the drill hole spacing divided by 4 or 5.

The next figure is an example of possible blocks. Blocks should match equipment selection size. If the blocks were too small for the backhoes, there would be no way to selectively mine ore and waste. If the blocks were too big, there would be no reach for a backhoe, and another shovel might be chosen.

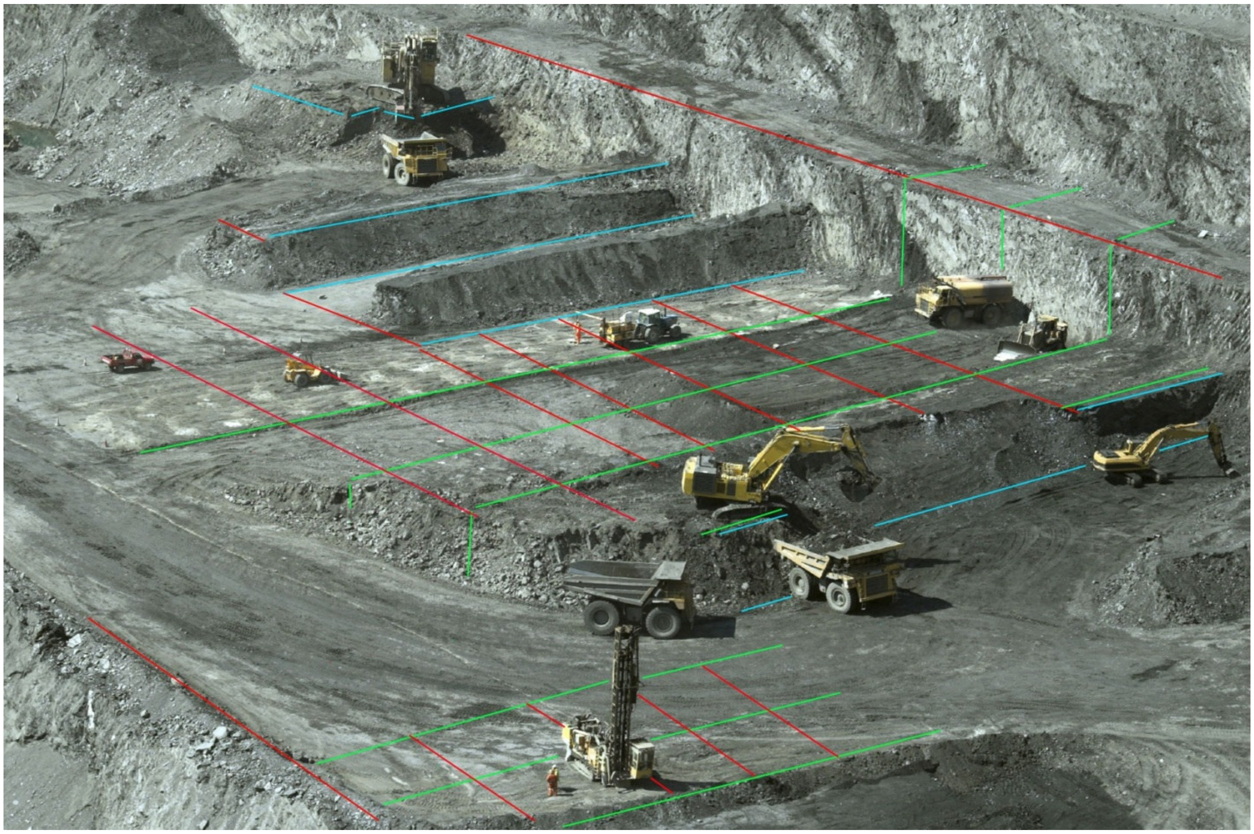


Figure 9 Block Model Boundaries Superimposed onto Typical Open Pit Mine Operation

There are some cases where a Model Rotation Angle is needed, such as on narrow veins, but it is not generally recommended. (Rule of thumb: If less than 30 degrees rotation is not needed, do not do it)

3) Labeling (**Blue**)

Labels are used later in the modeling process. Create a label for all relevant data from your database that will impact your modeling, such as Auppm, Cu%, Oxide%, Sulfide presence and so forth. In the label description, include a detailed statement about what the label describes and the label category. (ie Label: Cu% Description: Percentage of copper present-Sample). Later steps will use these labels, but will not display the detailed description for the label. By providing a detailed description for each label, you make it easier for somebody else that has to work on the project later on. Labels in MM are roughly equivalent to fields in Microsoft Access.

If the Sample and Composite Labels are already loaded or calculated, the number of labels will be greyed out, and it will not be possible to change from this screen. When this is the case, you must add or delete labels by accessing the Database Editing Menu under Data Entry (for sample labels), or the Database Editing Menu under Composite (for composite labels). There is a choice in the Database Editing Submenu that allows you to delete the current sample and composite DH database files. Use this option to begin the modeling process again from scratch.

4) OPD Sub-grid values (yellow)

The NUMBER OF OPD SUB-COLUMNS and NUMBER OF OPD SUB-ROWS will, in most cases, be set to 1 and 1 respectively. These options allow the user to calculate open pit reserves and resources with a higher degree of accuracy when needed.

In most cases, the accuracy of the calculations for resources and reserves in MicroMODEL is more than sufficient for pre-feasibility or feasibility level studies without the use of the sub-column/sub-row option. However, there may be some situations where the user needs additional accuracy in these calculations. An example would be short term mine planning calculations where the production target is on the order of ten blocks worth of material or less. For these situations, the user can divide each block in the model into sub-rows and sub-columns. Up to 10 sub-rows and 10 sub-columns can be used. When OPD sub-blocking is enabled, the block in/ block out calculations in OPD are based on the centroid of each sub-grid square, rather than on the centroid of the entire model block. Once a user has set the OPD sub-column and sub-row values, they should not be changed. If the user must change the values, then the user should delete all sub-gridded topography surfaces (P2xx). Also, delete the mined out file (OPDMINED).

- **[Run Program]**

3) Topography

Several methods are available for taking topographic information that is in a different format and transforming it for use by MicroModel. We can add topography from a DXF contour file, digitize it, or we can extract topography from a DXF TIN surface.

1.7.Adding Topography:

[File] – [DXF Conversion Utilities] – [TOPO LINE CONVERSION]

You may click on the HELP button to view the following text:

1) Enter optional answer set name.

2) Enter DXF input file (Access Directory to access your files).

3) Enter output file name (Access Directory to access your files).

4) Check "Check Here to Override Z Value and Insert Layer Number" if your DXF file uses the layer name to convey the Elevation Values.

5) Check Use Filter Box to filter data.

6) If, for some reason, your topo data is located in Section BLOCKS of the DXF file instead of the normal section ENTITIES, then check "my data is in section BLOCKS".

7) Select type of Entity to convert. If you do not know what kind of data is contained in your DXF file, press the "Scan DXF File" button in the lower right corner. The Scan function will list which layers in the DXF file contain which type of data. After scanning, you may simply "blank out" any layer you do not want to convert.

8) Press the "Convert DXF File (RUN)" button to begin the conversion process. The program only converts one type of data at a time (LINE,POLYLINE,LWPOLYLINE).

9) View the contents of print file "DXF2PCNT.PRN" to see which contours were converted, and what the minimum and maximum extents of these contours are.

Answer Set Name – Can be changed, and it is strongly recommended to change the name to something meaningful to the project. There is more information on Answer set names in the appendix.

Select Name of AutoCAD DXF Input File – Browse it by clicking on the bar under “Select Name of AutoCAD DXF Input File”.

Output file can be changed (“Select Name of MicroMODEL Poly.CNT style Output File”), but it is not advised. POLY.CNT is the standard name for the MicroMODEL digitized topography file.

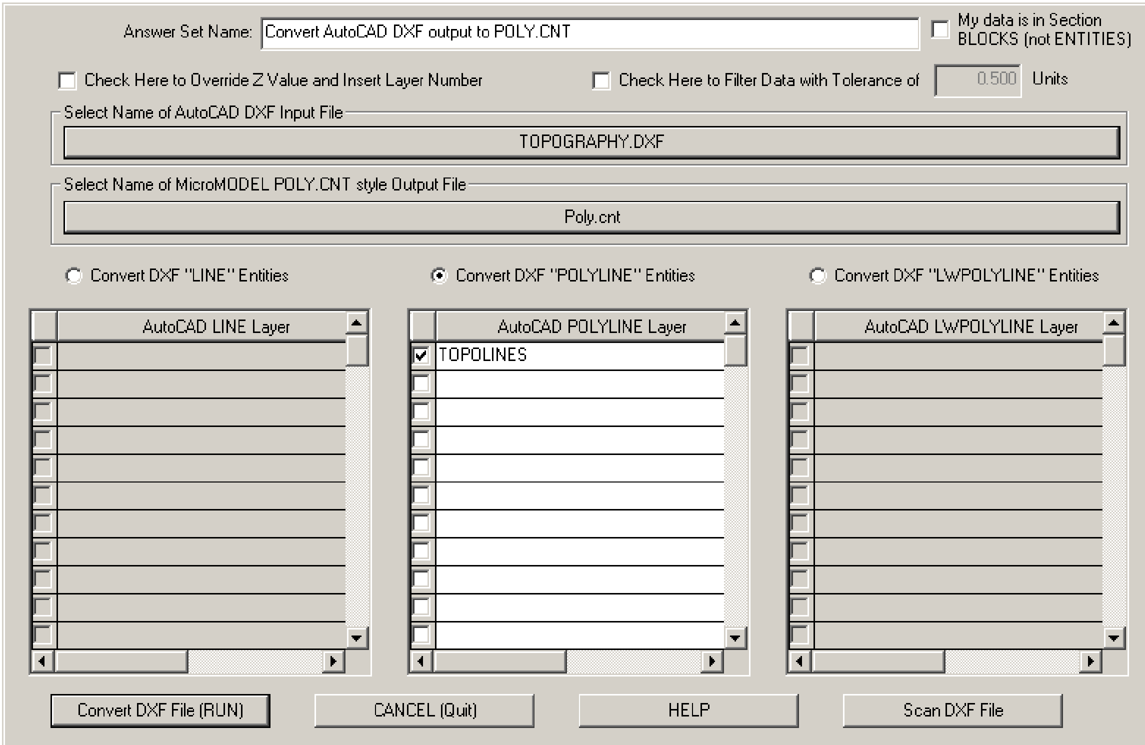


Figure 10 Import DXF to MicroModel Dialog Box

The next step is to choose the correct layers from the AutoCAD file. [Scan DXF File] can be used to scan the file and show the contained line types and layer names. Figure 9 shows what the scan option returns.

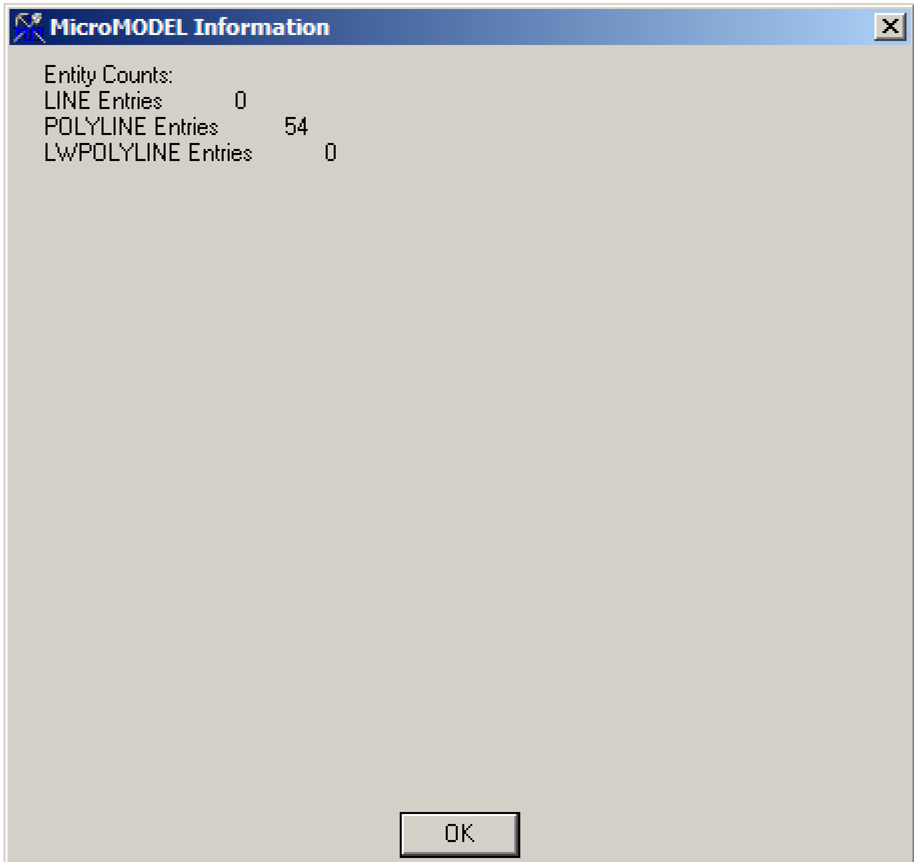


Figure 11 Line/Polyline/Lwpolyline Count

The program will count the different types of lines (LINE / POLYLINE / LWPOLYLINE) and the user will be able to choose which line type contains the topography via the radio buttons directly beneath the POLY.CNT style file name. Unnecessary layers can be deleted by unchecking the check box next to the layer name. Check each layer you want to include, and uncheck those you do not want to include.

[Convert DXF File (RUN)

After you have chosen the desired entity type and layer(s), press the Convert DXF File (RUN) button to complete the conversion. You should review the output file that is created by the conversion program. It lists the elevation of each entity that is converted along with the number of discrete points that were extracted for that entity. Compare the view of the DXF file in your CAD program with a plot of the converted digitized data in MicroMODEL:

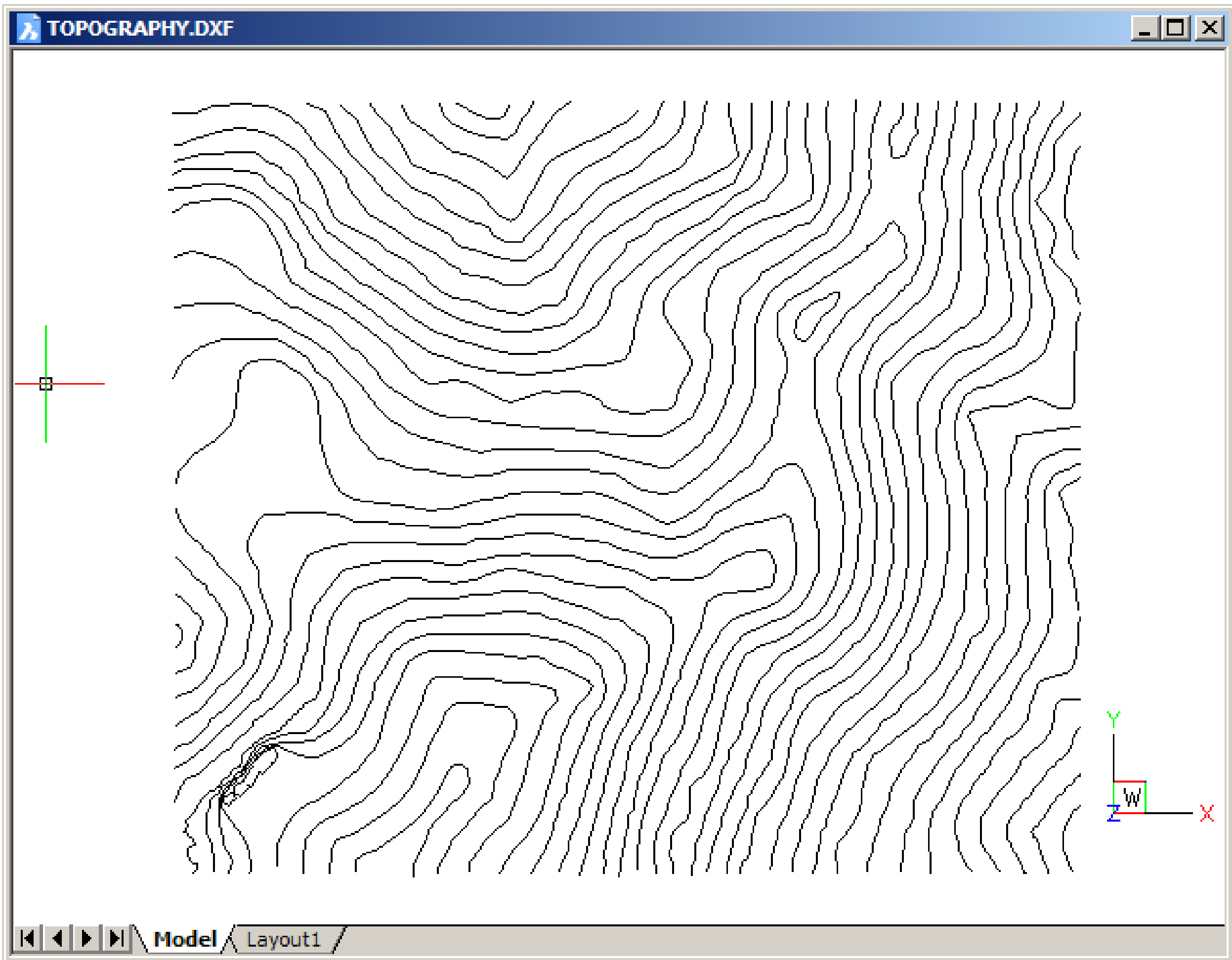


Figure 12 View of Topography.DXF in CAD program

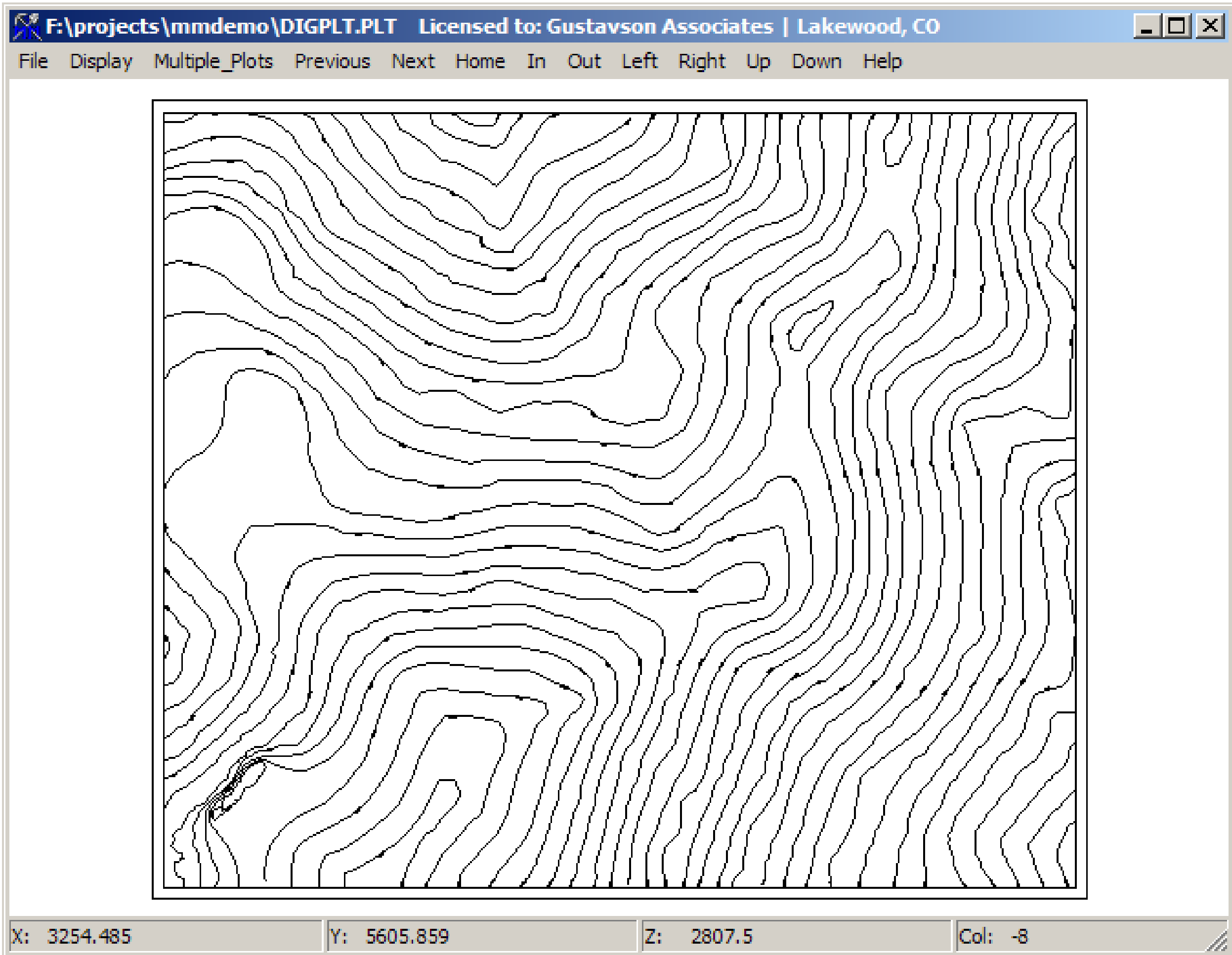


Figure 13 View of Converted Topography (POLY.CNT) in MicroMODEL

[File] – [DXF Conversion Utilities] – [Triangulated]

Convert AutoCAD DXF 3DFace to T200

Instead of Topo Lines, some .DXF files may come already as triangulated topography. In this case, we use a different conversion tool. Here is a view of file SURF3D.DXF in a CAD program:

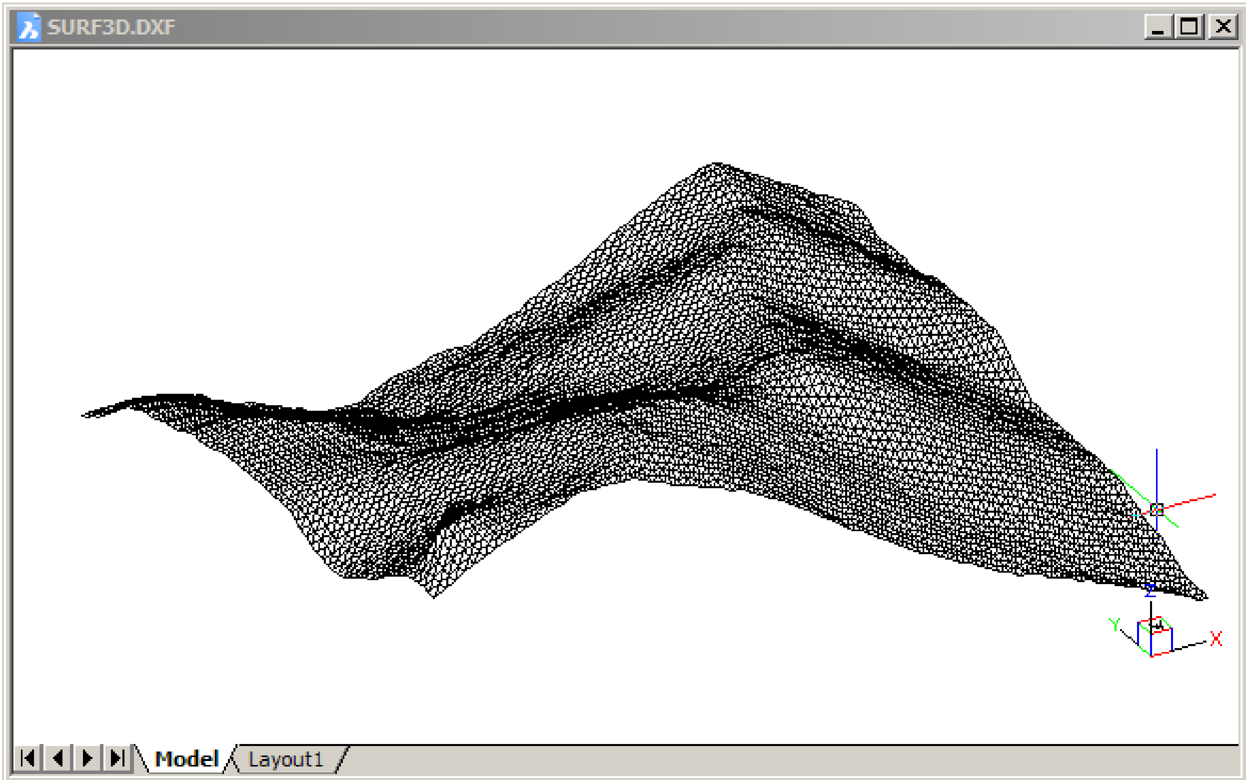


Figure 14 View of 3-D TIN Surface in CAD Program

Input the file [Enter Name of AutoCAD DXF Input File].

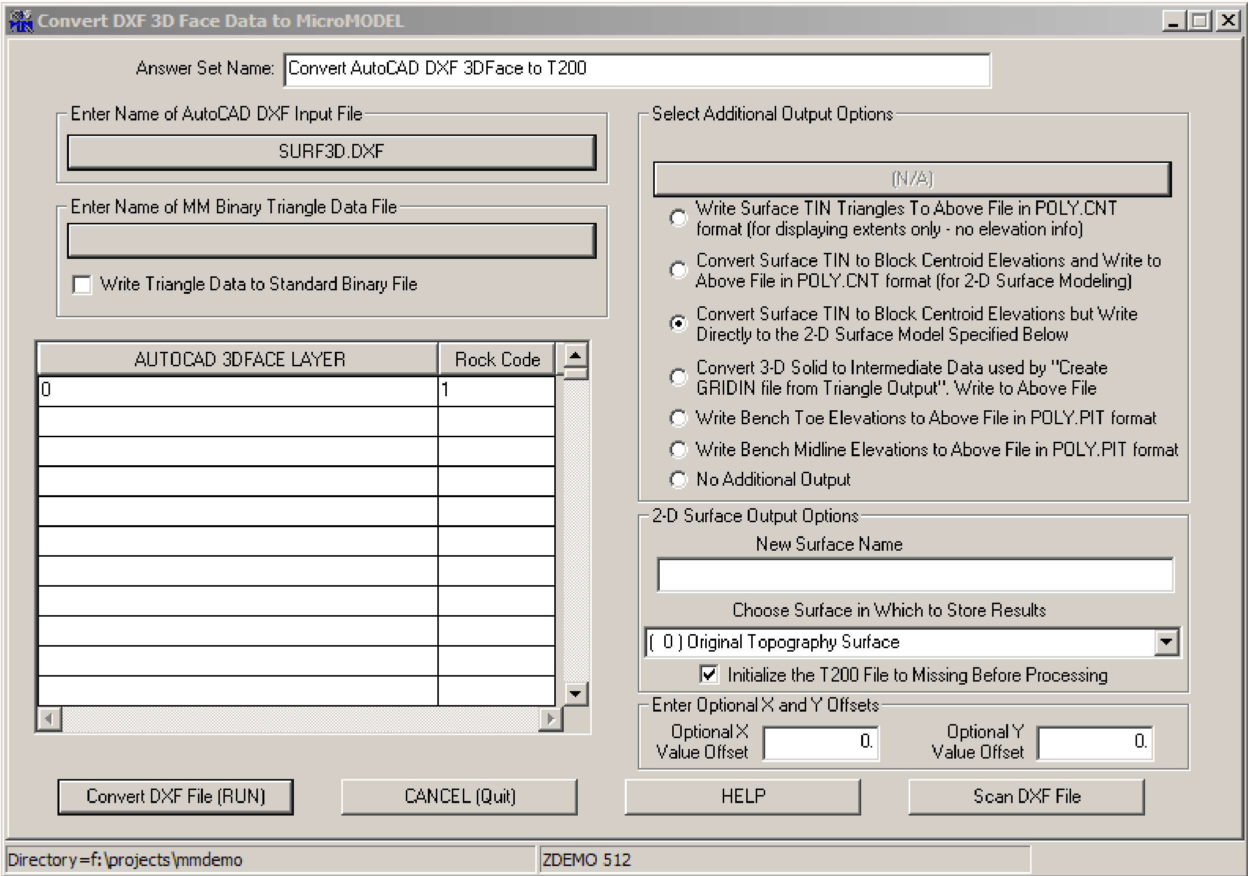


Figure 15 Input Screen to Convert TIN to T200 Surface

Now click [Convert Surface TIN (Triangulated Irregular Network) to Block Centroid Elevations but Write Directly to the 2D Surface Model Specified Below] Just like the previous DXF conversion tool, you must choose one or more layers in the TIN file that will be converted. In almost all cases, there will only be one layer, and it is usually layer 0. The rock code that is shown in the second column is ignored by the TIN converter. Unless you are converting a different TIN model than the current topography, you should specify surface (0) Original Topography Surface from the drop down menu “Choose Surface in Which to Store Results.”

[Convert DXF File (RUN)]

When you have entered the necessary input responses, click on Convert DXF File (RUN) to generate the MicroMODEL surface grid. To check the results, generate a contour map of the newly created topo grid. Refer to the section on Surface – Graphical Display. Here is what the two input screens should look like:

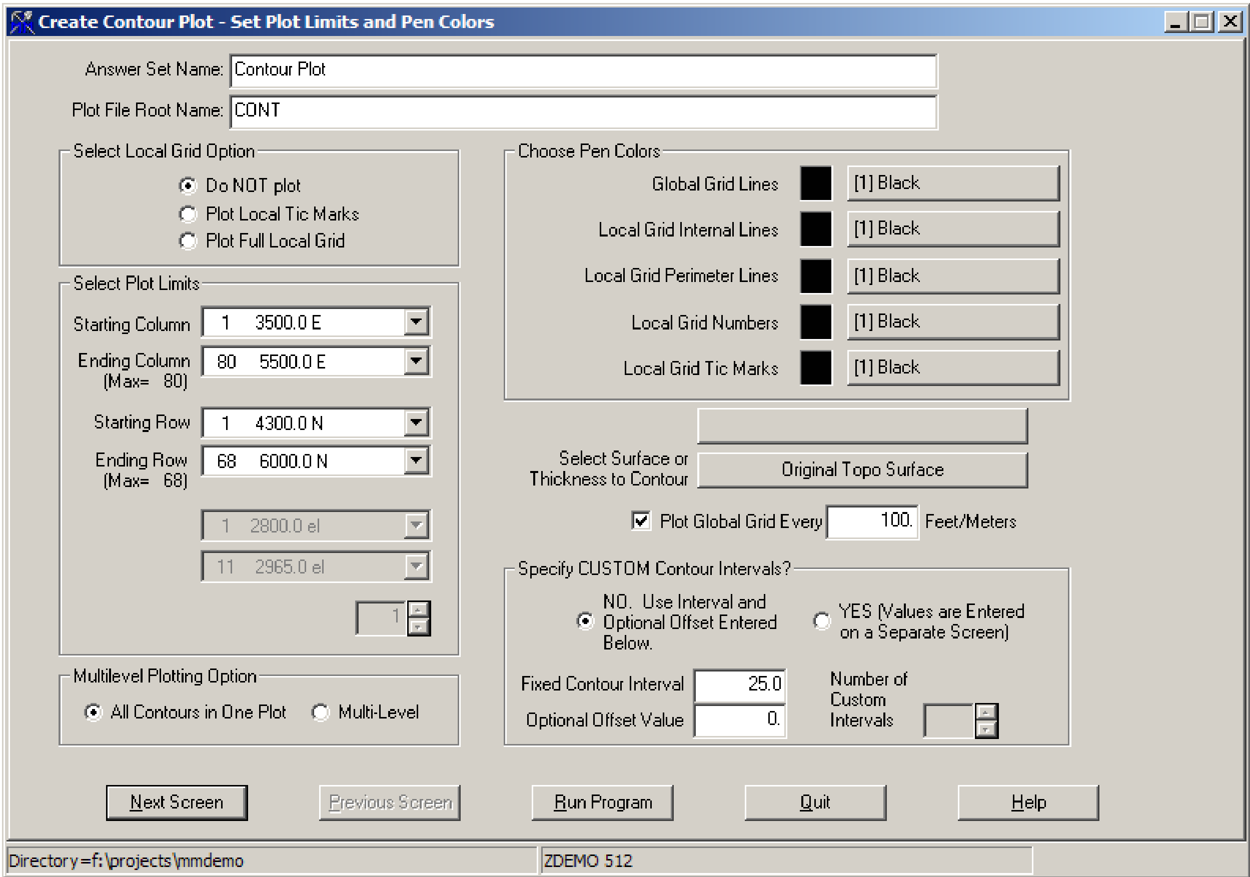


Figure 16 Input Screen 1 for Displaying Contour of Topography

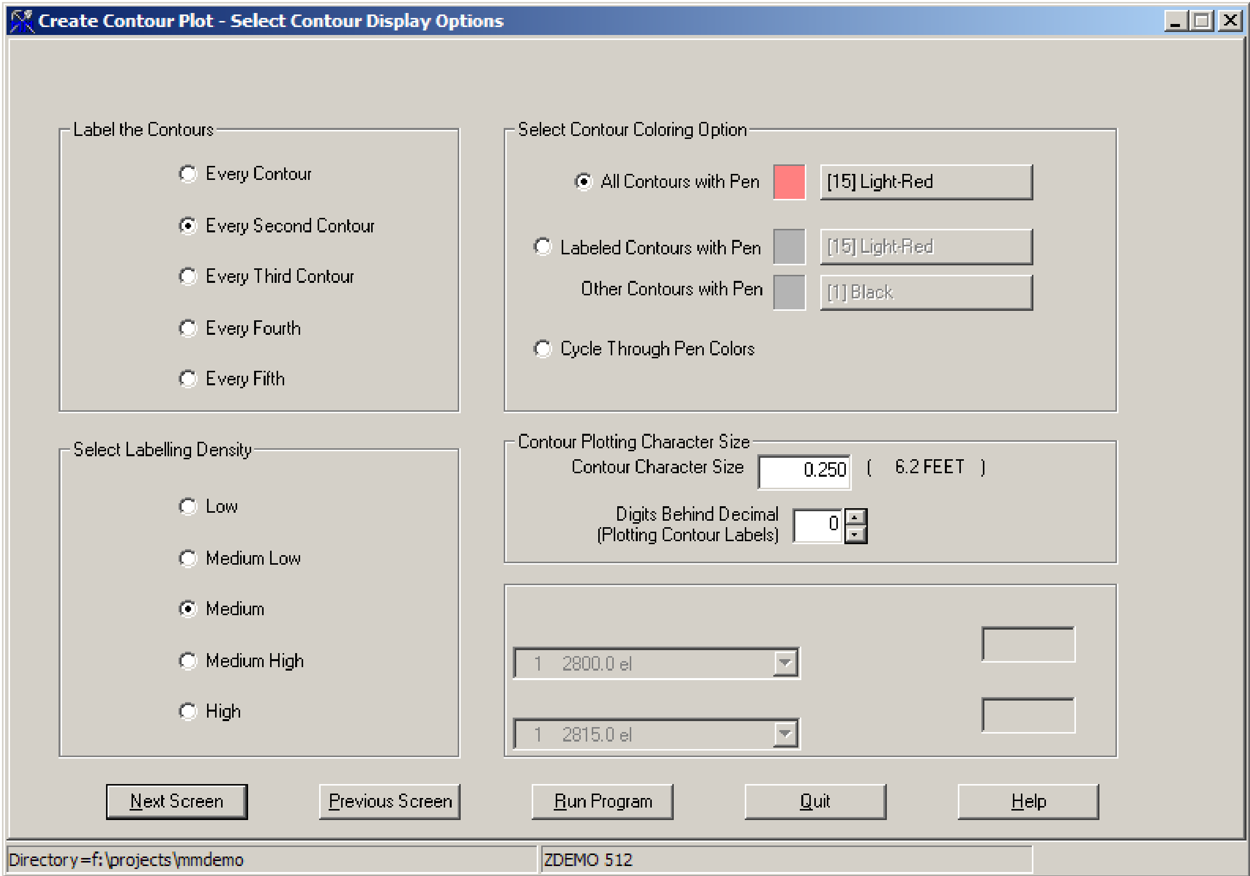


Figure 17 Input Screen 2 for Displaying Contour of Topography

Here is what the resulting contour map looks like:

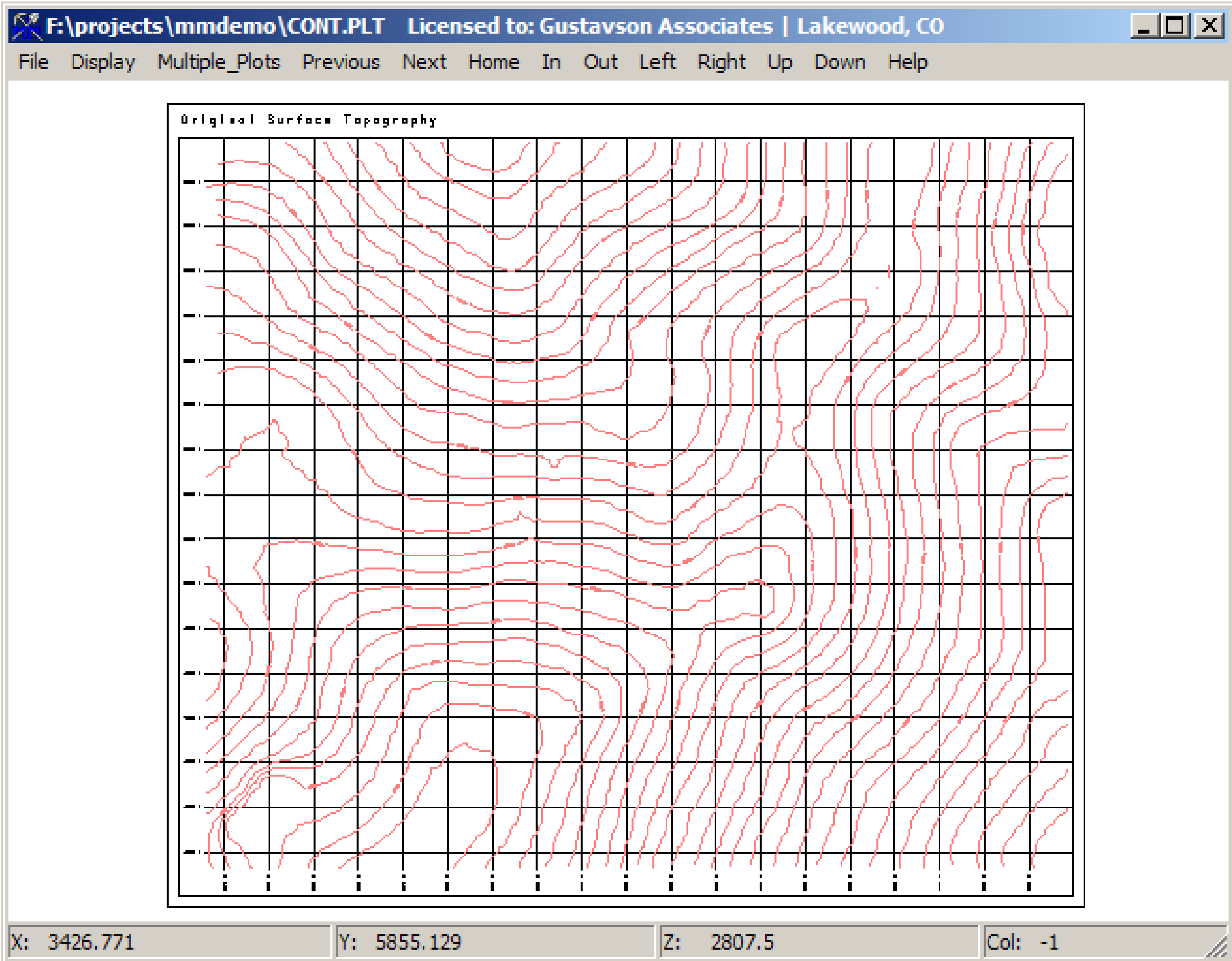
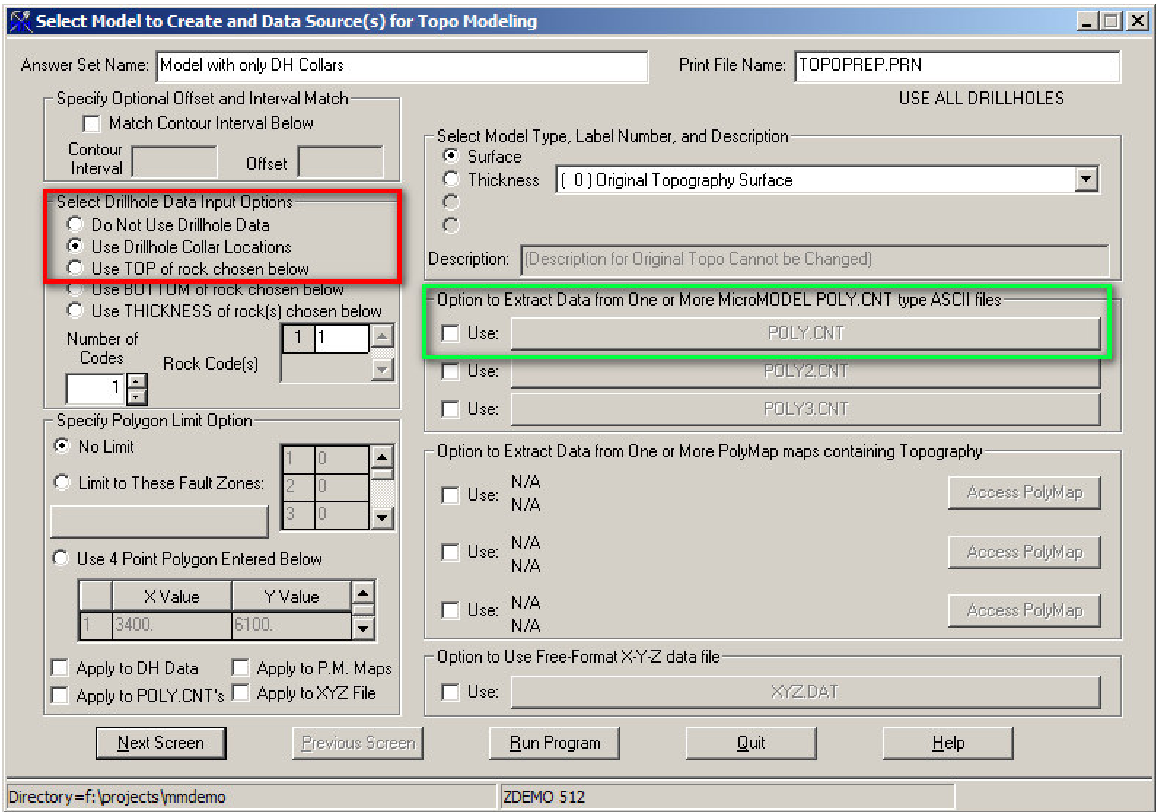


Figure 18 Contour Plot of Topography Grid

[Using Drillhole Data to Create Topo]

[Surface/Seam]-[Prepare Surface or Thickness Data]

This is a simple procedure that should be used only if more detailed topography information is unavailable. This is rarely the case, except for grass roots projects in remote locations that have not been surveyed. Preparing the Surface using drillhole collar locations will be the first step, and later you can follow the tutorial to 1.9 – Display Prepared Surface and so forth (Prepare-Presort-Modeling) to create it. In the dialog below, we have set the radio button "Use Drillhole Collar Locations"(red) and we have unchecked the "Use:" check box next to the first POLY.CNT file.(green)


Select Model to Create and Data Source(s) for Topo Modeling
Answer Set Name: Model with only DH Collars
Print File Name: TOPOPREP.PRN
USE ALL DRILLHOLES
Specify Optional Offset and Interval Match
Match Contour Interval Below
Contour Interval
Offset
Select Drillhole Data Input Options
Do Not Use Drillhole Data
Use Drillhole Collar Locations
Use TOP of rock chosen below
Use BOTTOM of rock chosen below
Use THICKNESS of rock(s) chosen below
Number of Codes
Rock Code(s)
Specify Polygon Limit Option
No Limit
Limit to These Fault Zones:
Use 4 Point Polygon Entered Below
X Value
Y Value
3400.
6100.
Apply to DH Data
Apply to P.M. Maps
Apply to POLY.CNT's
Apply to XYZ File
Select Model Type, Label Number, and Description
Surface
Thickness
(0) Original Topography Surface
Description: (Description for Original Topo Cannot be Changed)
Option to Extract Data from One or More MicroMODEL POLY.CNT type ASCII files
Use: POLY.CNT
Use: POLY2.CNT
Use: POLY3.CNT
Option to Extract Data from One or More PolyMap maps containing Topography
Use: N/A N/A
Access PolyMap
Use: N/A N/A
Access PolyMap
Use: N/A N/A
Access PolyMap
Option to Use Free-Format X-Y-Z data file
Use: XYZ.DAT
Next Screen
Previous Screen
Run Program
Quit
Help
Directory=f:\projects\mmdemo
ZDEMO 512

1.8. Prepare Surface or Thickness Data

If there is no TIN DXF model available to convert directly to the MicroMODEL surface topography grid, then the surface grid needs to be modeled via a three step process. The user must prepare the data points, presort the data, and then model the topo cells. For this example, we will use the data points that have been stored in Poly.cnt as the source of data. Run Surface > Prepare Surface or Thickness Data.

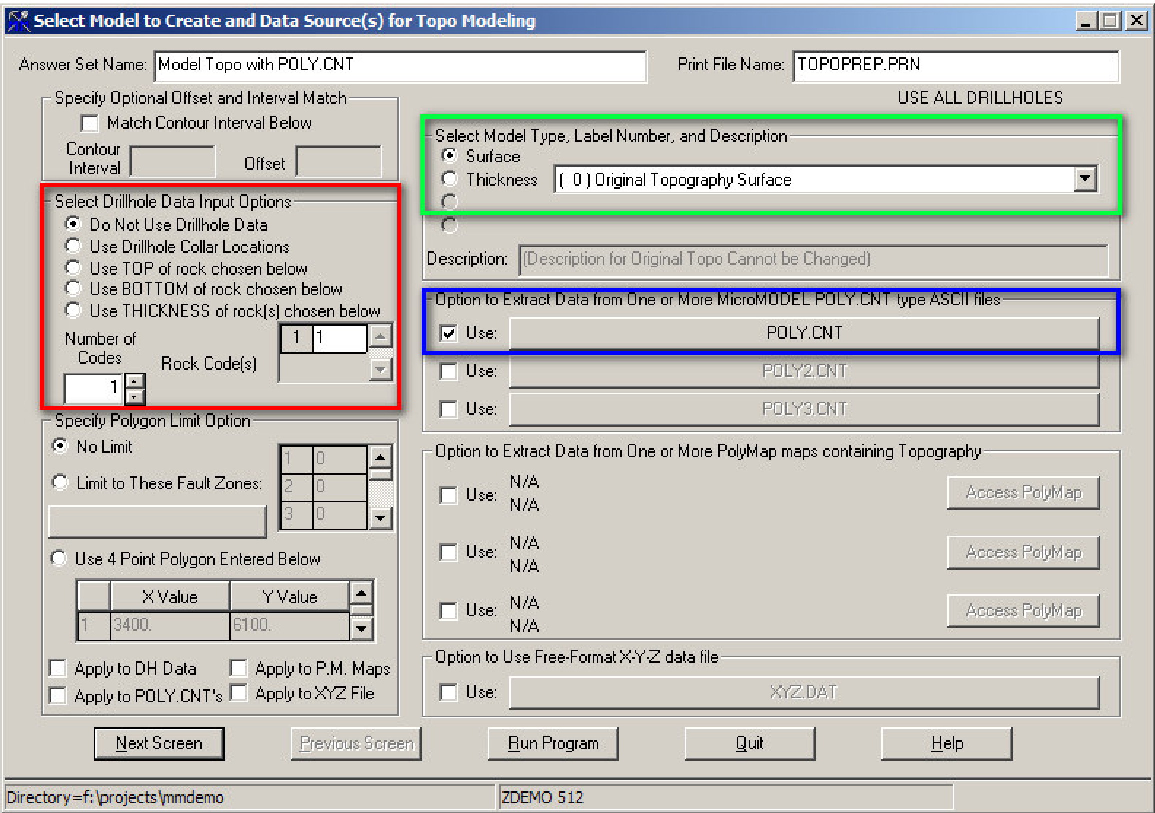


Figure 19 Prepare Surface of Thickness Data Dialog Box

1) Make sure that Do Not Use Drillhole Data is selected.(red)
2) Prepare data for Surface 0 – Original Topography Surface.(green)
3) Data will be extracted from file POLY.CNT.(blue)

- **[Run Program]**

1.9. Display Prepared Surface

(Video 11)

[Surface]-[5. Display Prepared Surface or Thickness Data Points]-[Select an Answer Set]

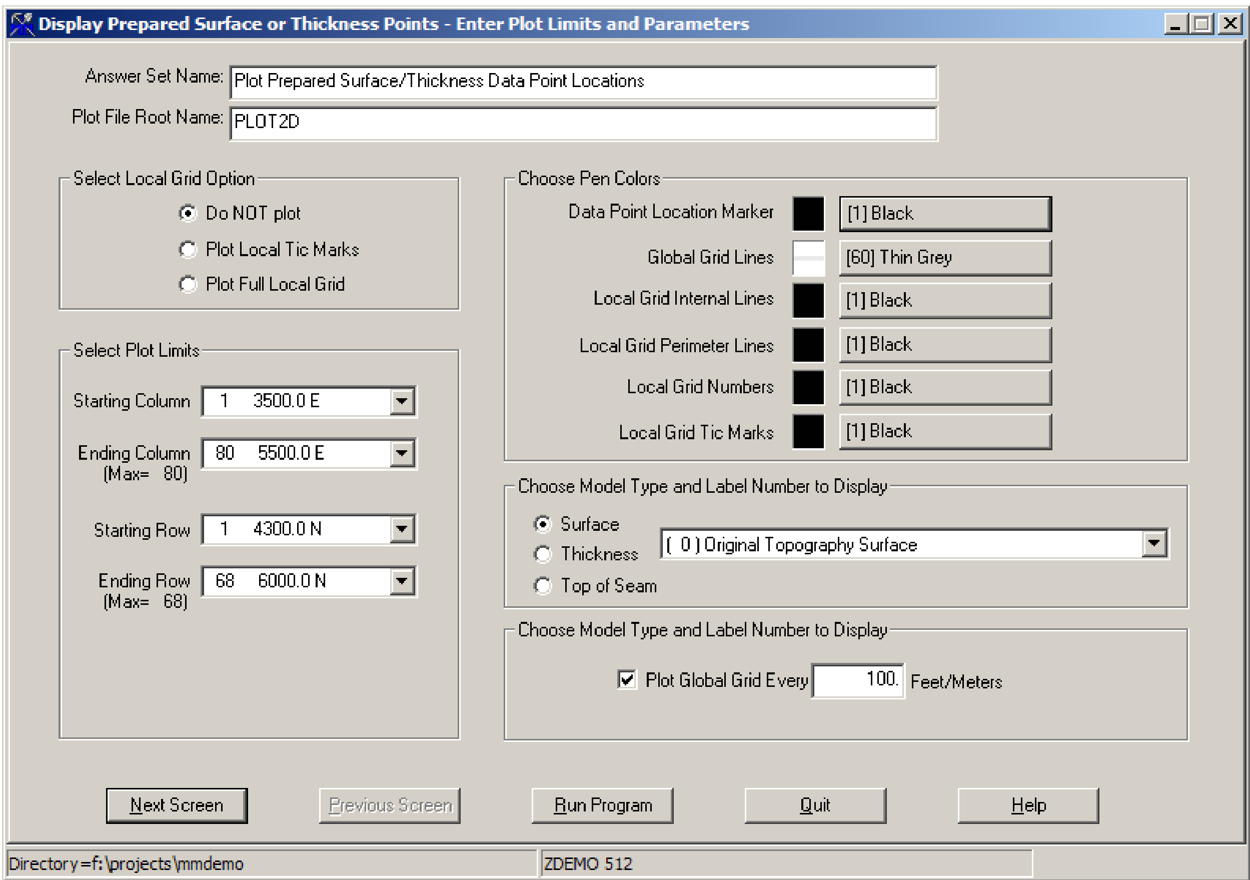


Figure 20 Display Prepared Surface or Thickness Data Dialog Box

The [Select Local Grid Option] will display grids related to the block size created in the first steps. DO NOT plot the local grids, as it will plot unnecessary grids for this moment.

For more references related to “Choose Pen Colors”, see the Appendix XXXX.

For more references related to “Title Blocks”, see the Appendix XXXX.

Observe the output from this program, and see how the data points they are dispersed. Blocks located in areas lacking any topo points require larger search distances in the modeling procedure, to ensure that they are assigned an elevation. From the picture below, we see that some areas have a higher point-density than others. The more homogeneous the points, the better, as well as high density being better than low density of points (but increasing processing time).

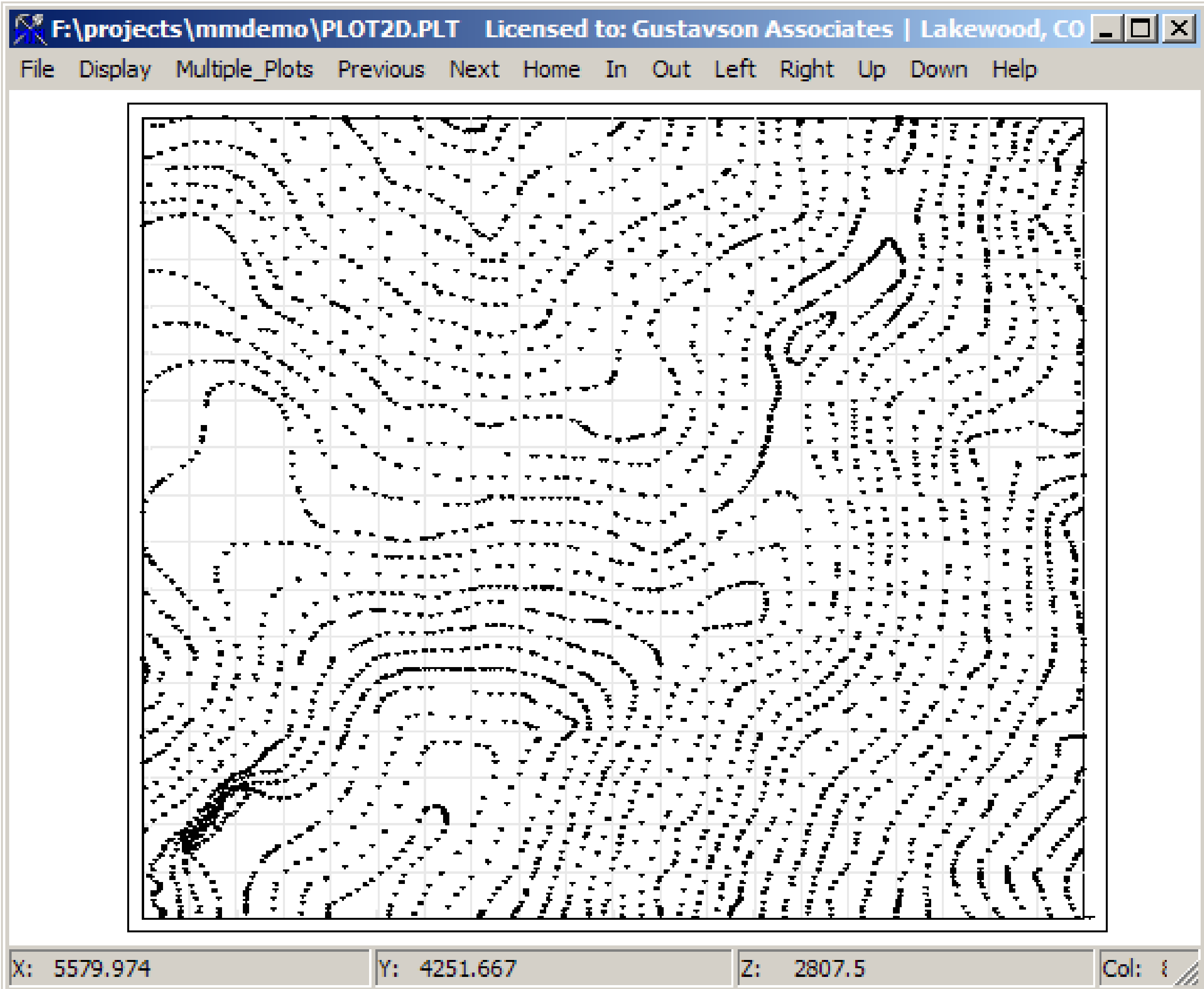


Figure 21 Display of Prepared Surface Data Points

1.10. Surface or Thickness Modeling Presort

(Video 12)

[Surface]-[7. Surface or Thickness Modeling Presort]-[Select an Answer Set]

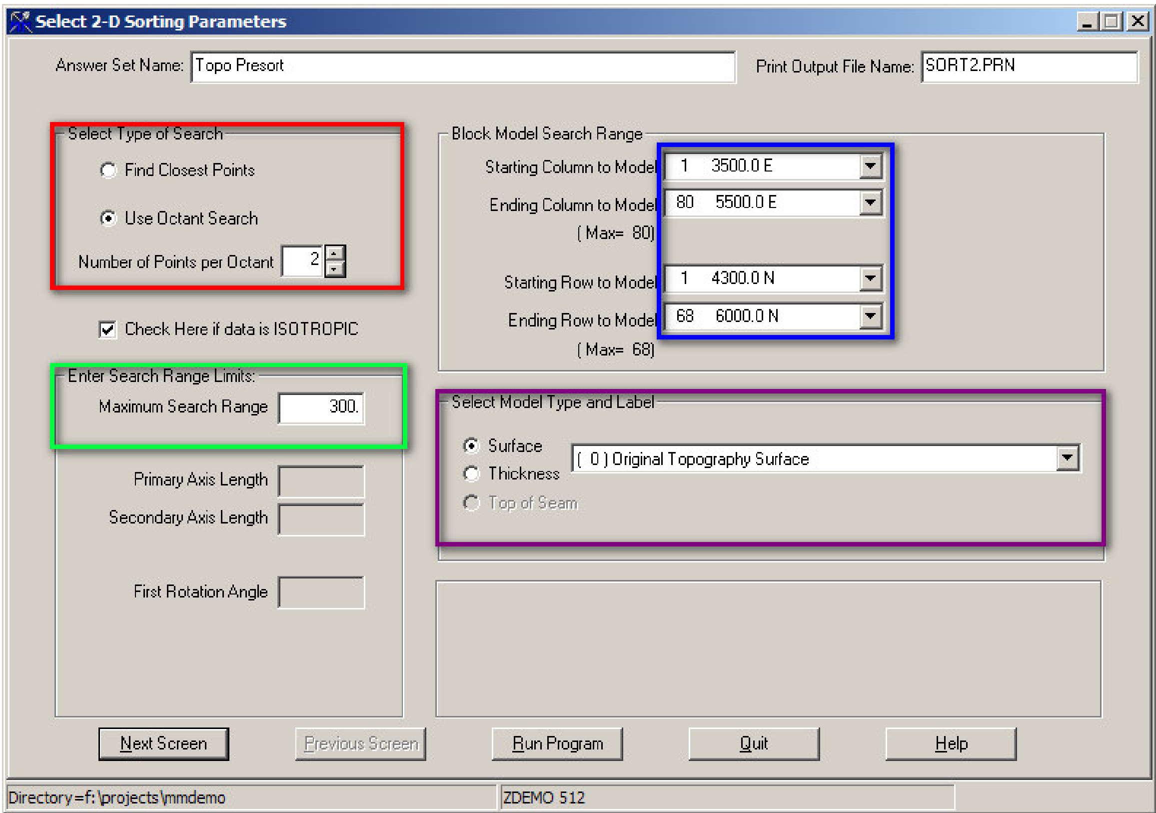


Figure 22 Surface Modeling Presort Dialog Box

1) Select Type of Search (**Red**)

- [Find closest Points] Works better when your topo data is extremely uniform.
- [Use Octant Search] Recommended, as most topo data sets have variable point density regions (as seen from the previous picture).
    - [Number of Points per Octant] 2-4, depending on data density. 2 points per octant means 16 points total for the algorithm to search for, which is adequate.

2) Enter Search Range Limits (**Green**)

Depending on the size of the topo map, and point density, use an adequate search. The object is to assign an elevation to all blocks. If in doubt, use a larger search. The larger search will take slightly longer. Observing the map of prepared surface points, there is a large flat area on the west side where a block could be as far as 150 feet from the closest data point. We choose twice this distance as our maximum search.

3) Block Model Search Range (**Blue**)

Make sure these values encompass all rows and columns.

4) Select Model Type and Label (**Purple**)

Make sure the sort is preparing data for “Original Topography Surface”.

➢ **[Run Program]**

1.11. Surface or Thickness Modeling

Following the topography presort, we continue with surface modeling.

[Surface]-[8. Surface or Thickness Modeling]-[Select an Answer Set]

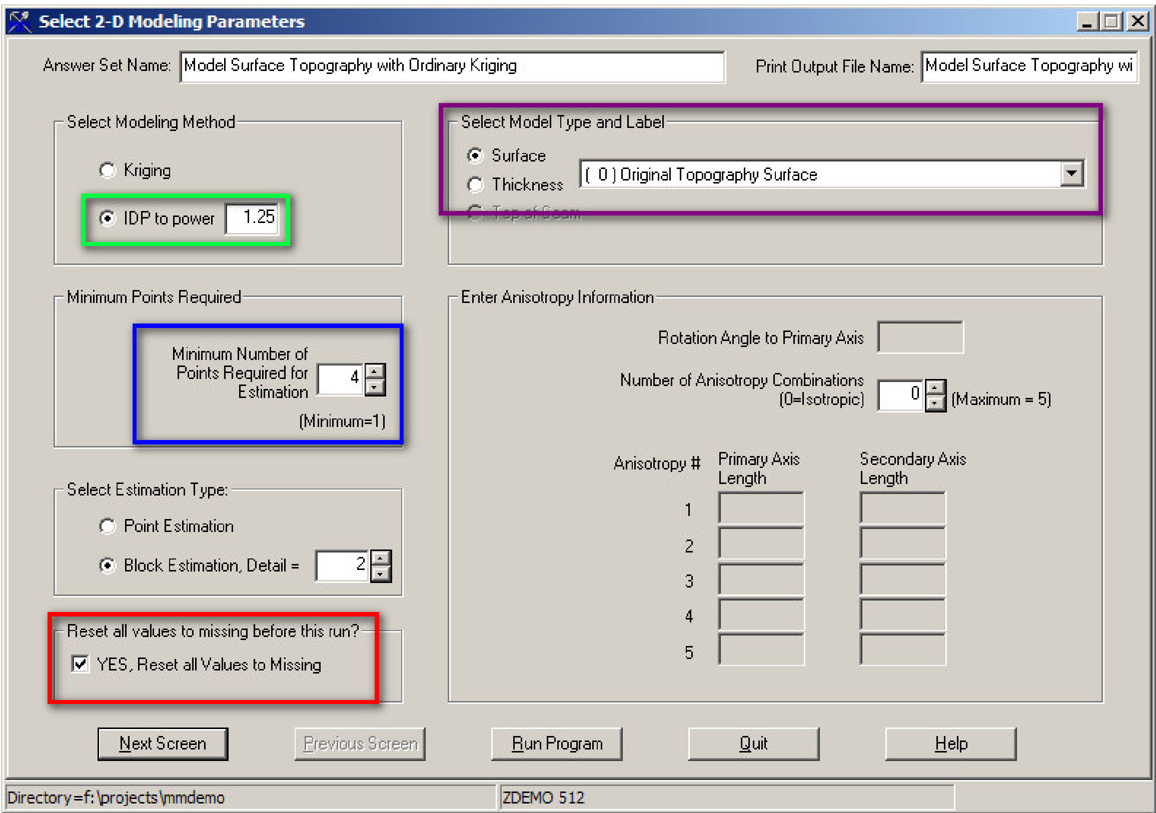


Figure 23 Surface or Thickness Modeling Dialog Box

1) Select Modeling Method (Green)

For topography, it is suggested to use IDP to power 1.25, and not Kriging, although just about any modeling technique will do a good job as long as the amount of data points is sufficient.

2) Minimum Points Required (**Blue**)

Four is recommended.

3) Reset all values to missing before this run? YES (Red**)**
4) Set the Model type and label to Surface – Original Topography Surface (Purple)

➢ **[Run Program]**

1.12. Contour Plot

Similar to **Error! Reference source not found.**, use the default (pre-filled) responses. In the plotting program, MicroModel allows the user to select surfaces. In the topography-contour program, the original Topography surface is already selected for the initial set of answers.

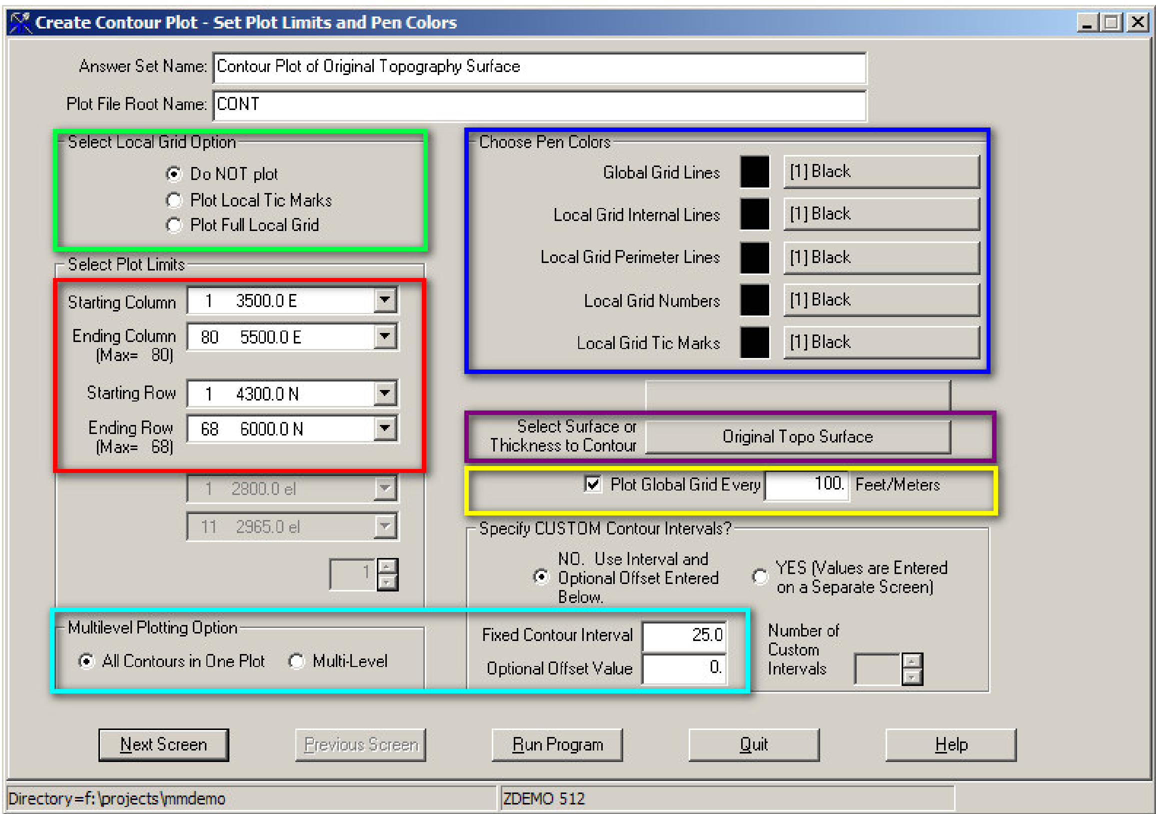


Figure 24 Contour Plot Input Screen

1) Local and Global Grids (**Green**)

When Plotting, MicroModel allows the user to plot (or not) local tic marks and grids. In most cases, the local grid option is not used.

2) Plot Limits (Red)

Select the starting and ending columns to display. In this example, we are displaying the entire model.

3) Contour Plotting Options (Cyan)

The radio button “All Contours in One Plot” is selected. Also, since our original digitized map of topography was prepared on 25 foot intervals, we have instructed MicroMODEL to display contours at this same interval.

4) Miscellaneous Pen Colors (Blue)

You can control the color of various grid lines with these entry fields. For this plot, all the lines and numbers will be displayed in black.

5) Select Surface to Contour (Purple)

We want to check the Original Topographic Surface.

6) Plot Global Grid (Yellow)

We have opted to display a global grid at 100 foot intervals.

This is the second input screen.

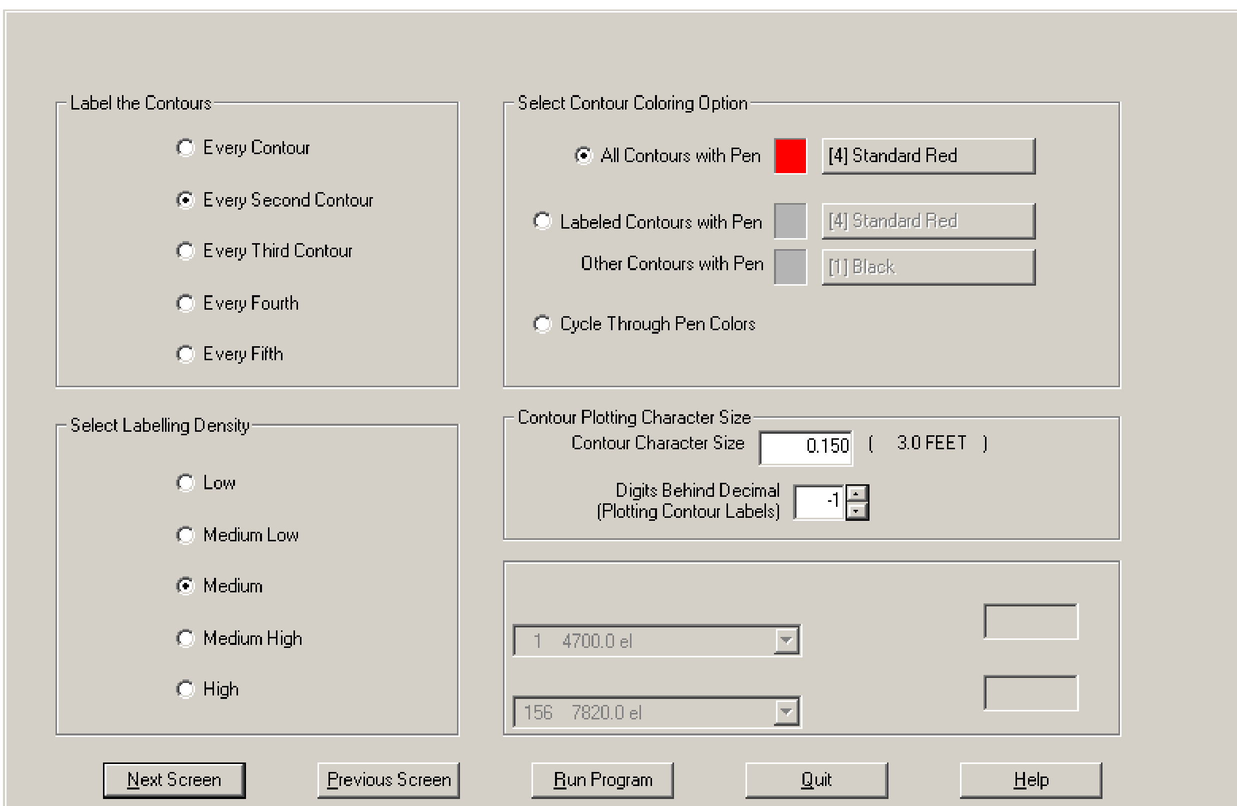


Figure 25 Contour Display Options

The user may change which contours are labeled, contour density, character size, and other options. Remember that the Help button on the bottom right corner gives more information on the input choices. In this screen, we have set the contour line color to red.

- **[Run Program]**

The displayed map will be as follows:

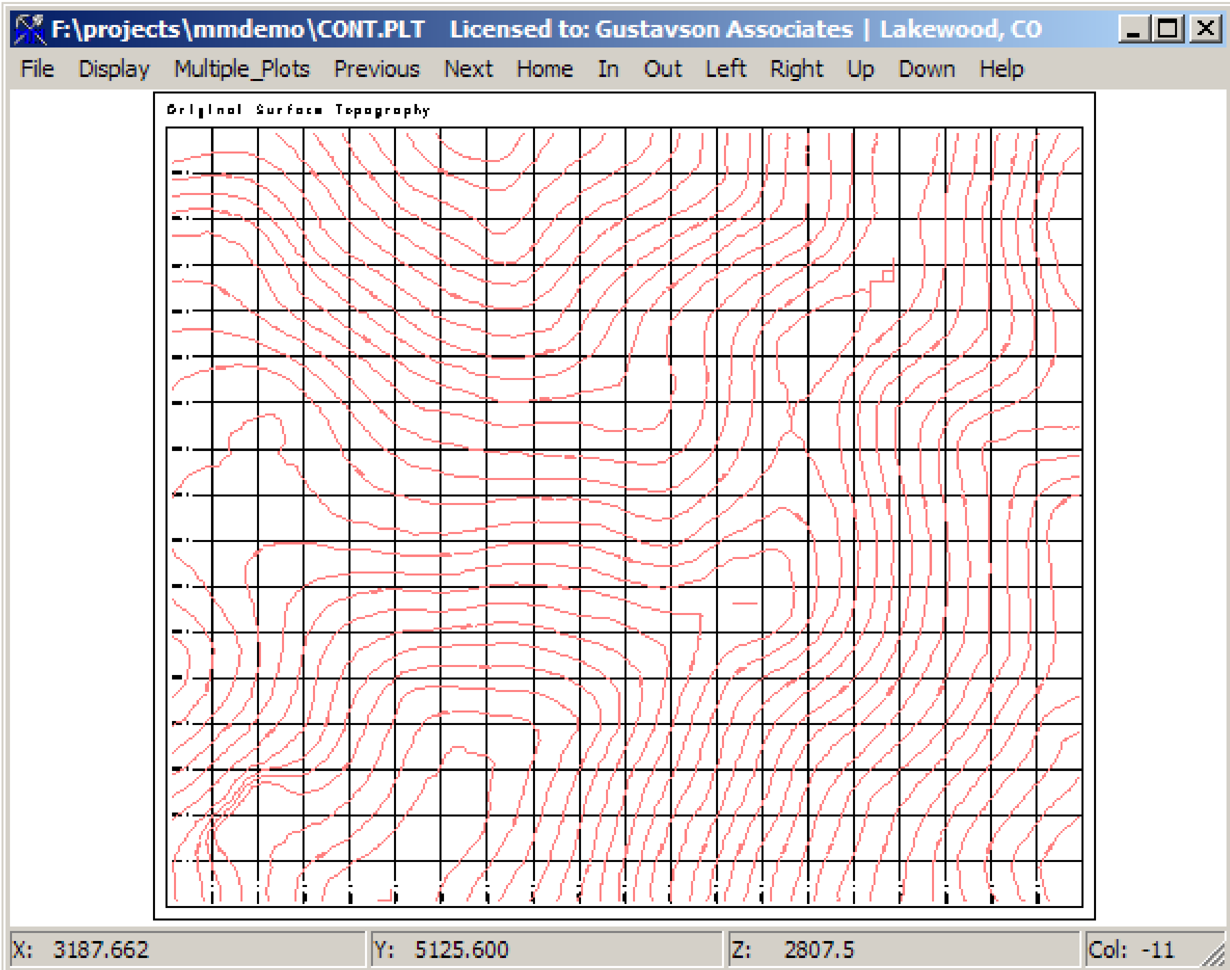


Figure 26 Contour Plot of Modeled Topography

As a final check, use the combine plots program from File Manager to create a combined display of digitized topo data and contoured topo in one display. Here is the input screen.

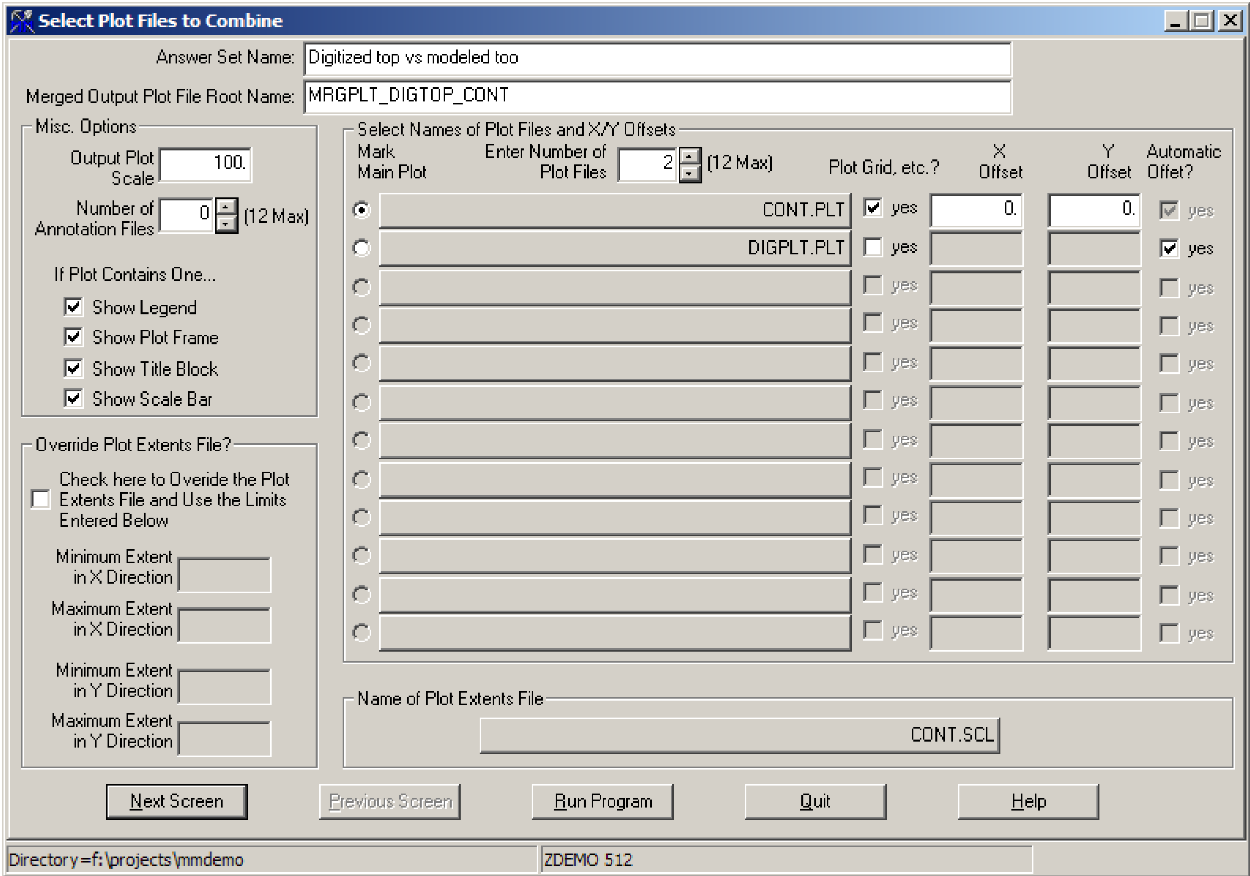


Figure 27 Create Combined Plot Input Screen

In this screen, we have opted to display two different plot files, CONT.PLT and DIGPLT.PLT. The resulting output is shown below.

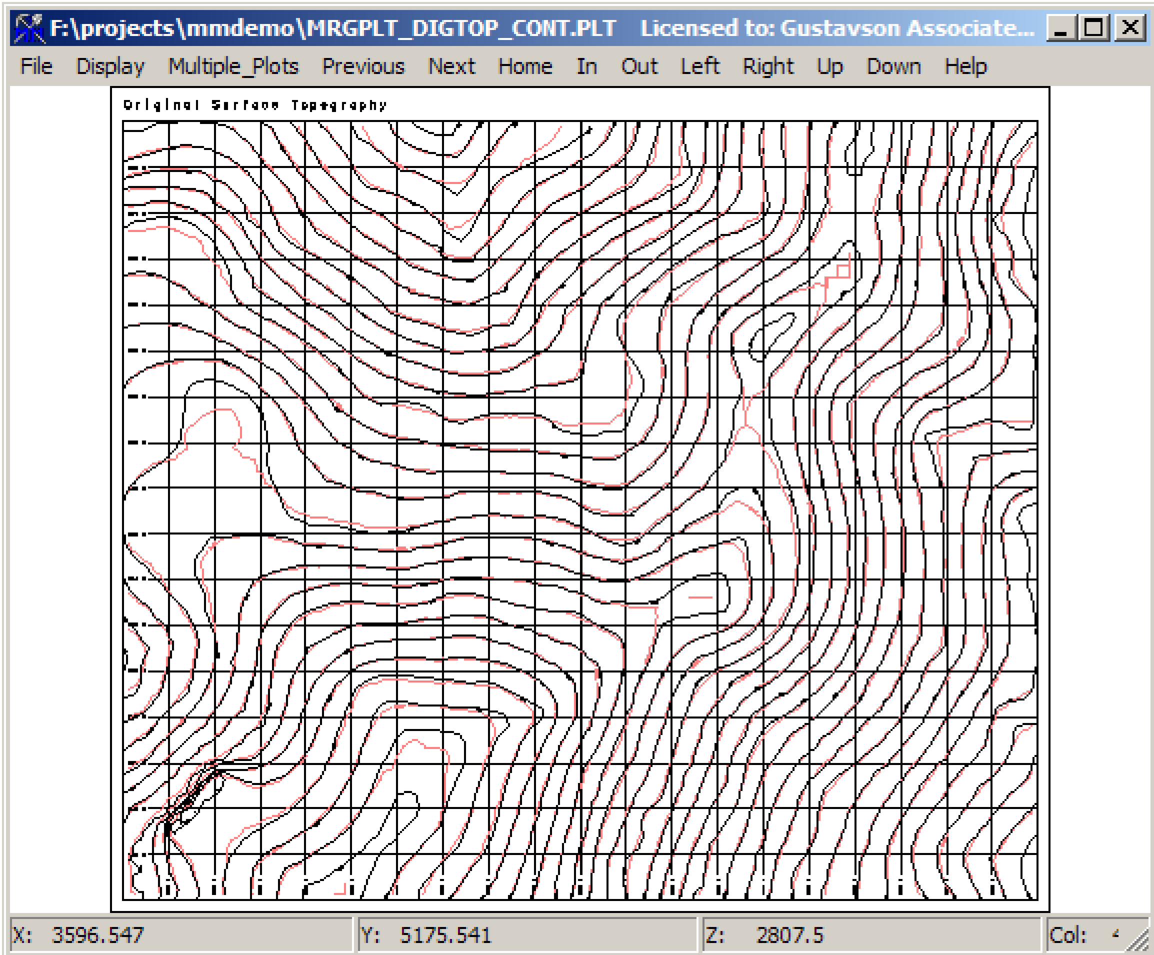


Figure 28 Combine Plot of Digitized Topography and Contoured Modeled Topography

The contoured topo (red lines) matches the digitized topography lines fairly well, except in areas with sparse data such as the western side flat area.

1.13. Create 3D Topo Surface Display

This choice, under the 3-D Display menu, will create a complete3-D topo surface as a further check of the modeled topography. Make sure the starting and ending columns and rows match the first and last columns and rows of the project area. Refer to the input screen below for the responses to enter.

To produce a DXF of the surface at the same time, check the box inside the red rectangle. The AutoCAD layer name (displaying 0 in the Figure) can be changed, and the file can be renamed by clicking on the bar.

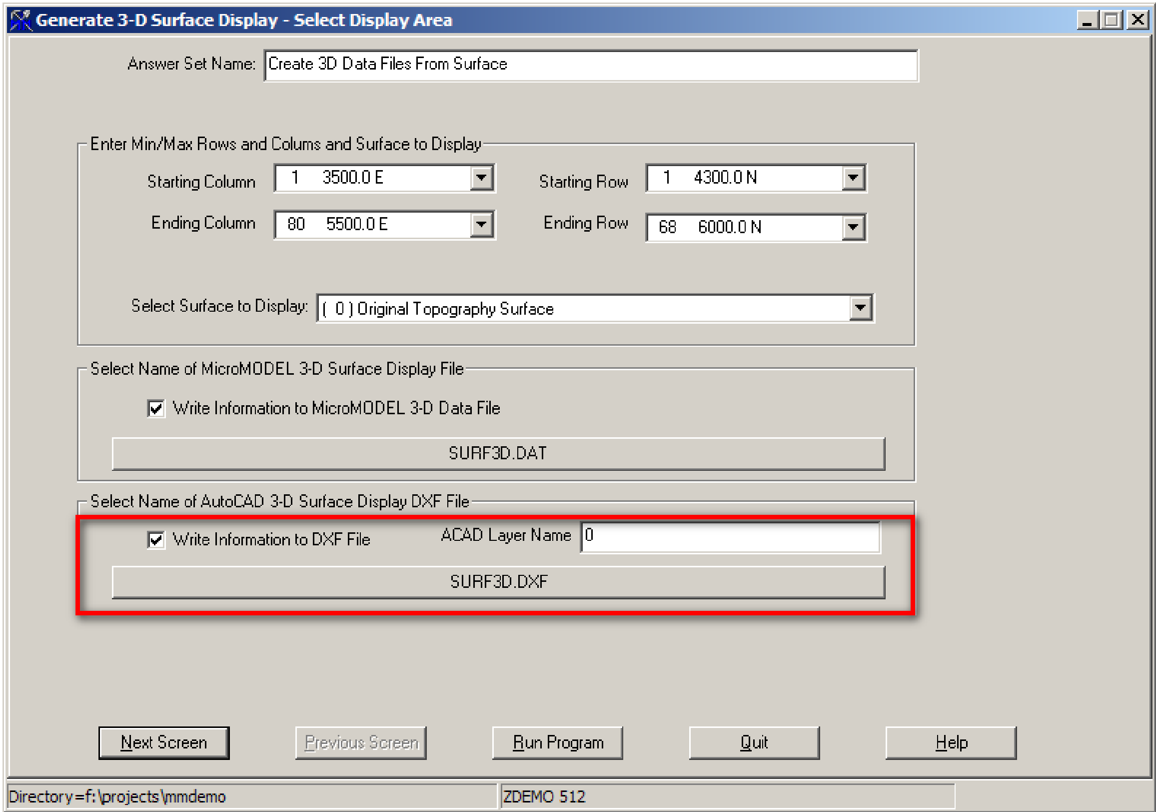


Figure 29 3D Surface Dialog Box

- **[Run Program]**

1.14. Display 3D Topo Surface

Once the 3-D surface file has been generated, it is displayed via the "Display 3D Data/ParaView File Conversion" program. Make sure the button next to "Normal Operation. Display Files with MicroMODEL Viewer" is selected. Do not change anything else on this page. The correct default screen is shown in below.

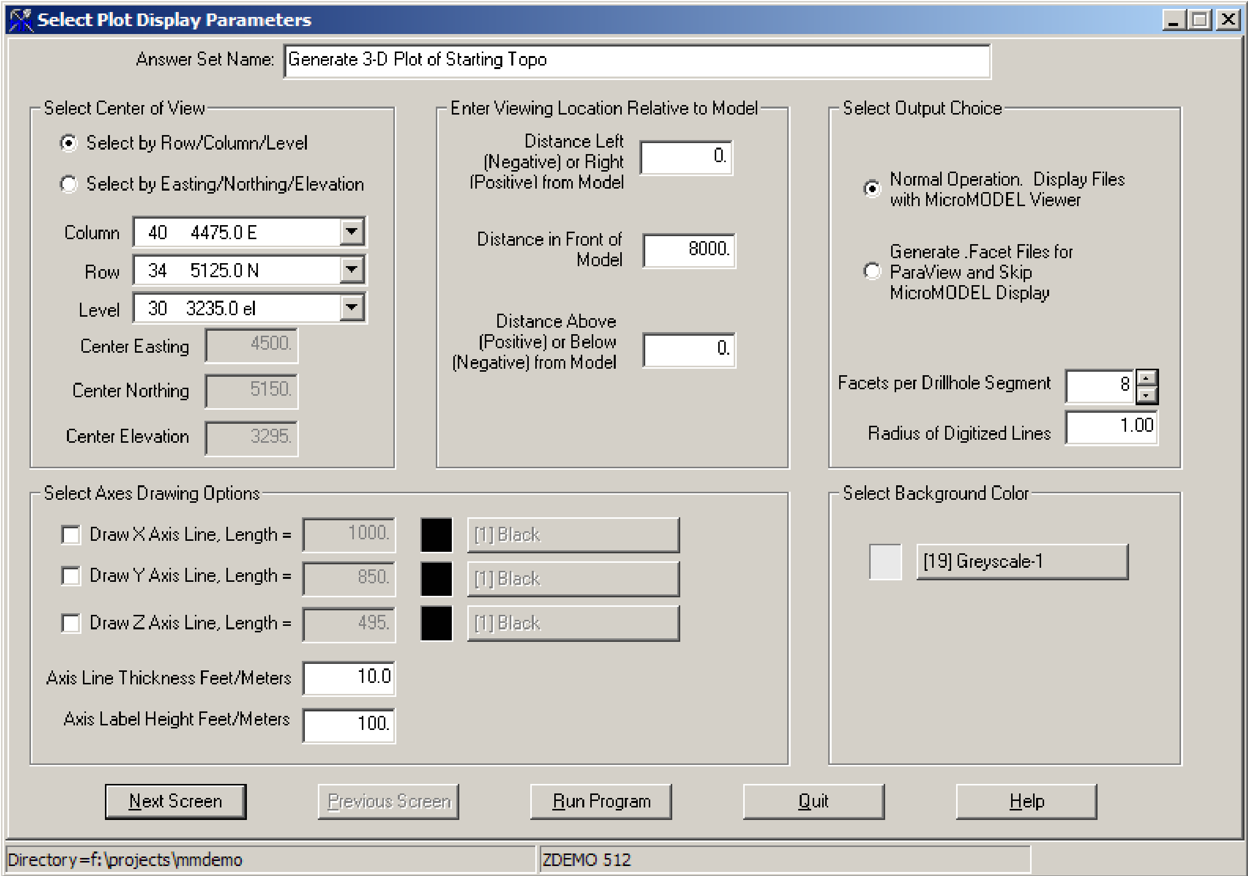


Figure 30 3D Display Dialog 1

- **[Next Screen]**

In the second input screen, choose a single 3-D file to display (SURF3D.DAT) and set the color of the surface (orange).

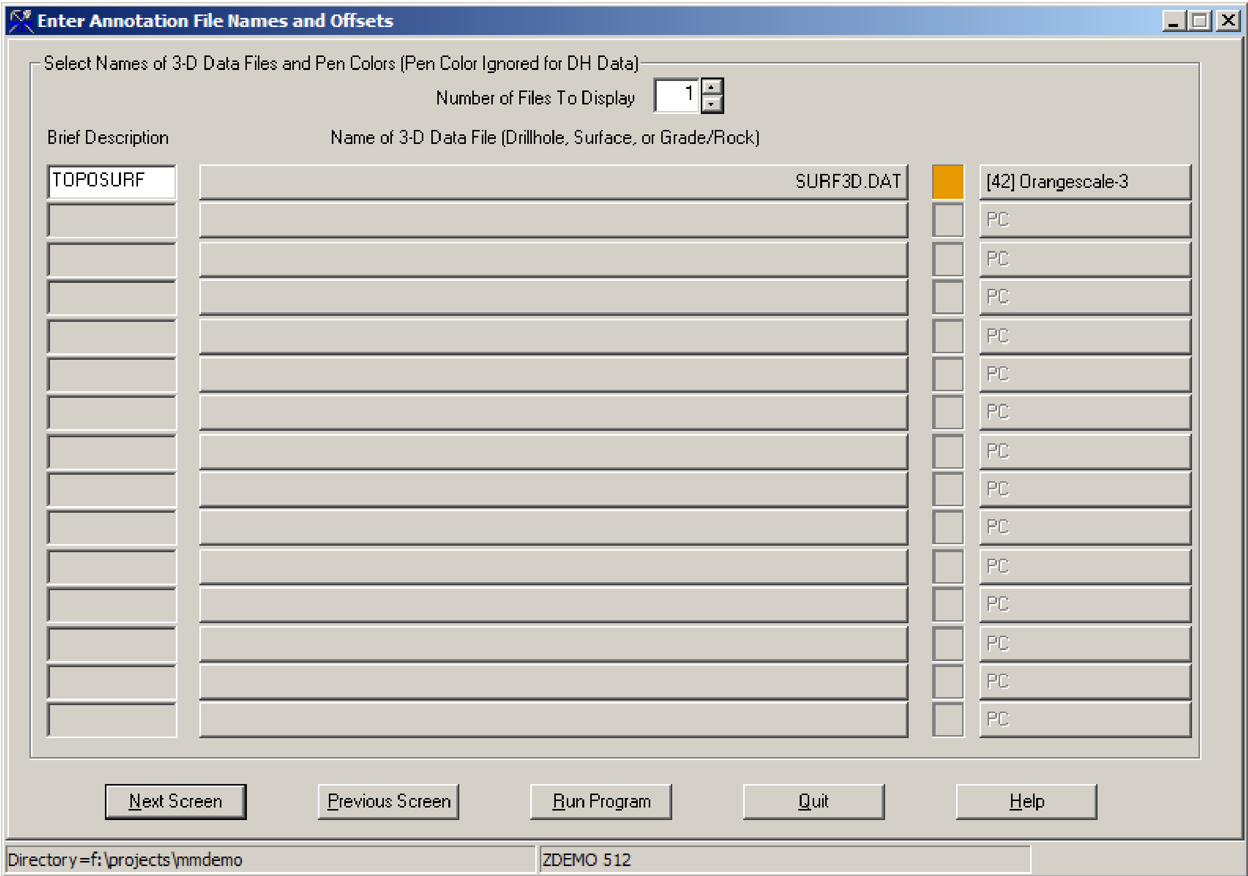


Figure 31 3D Display Dialog 2

- **[Run Program]**

Here is what the 3-D display looks like. Use Mouse click and drag or the arrow keys to rotate the view.

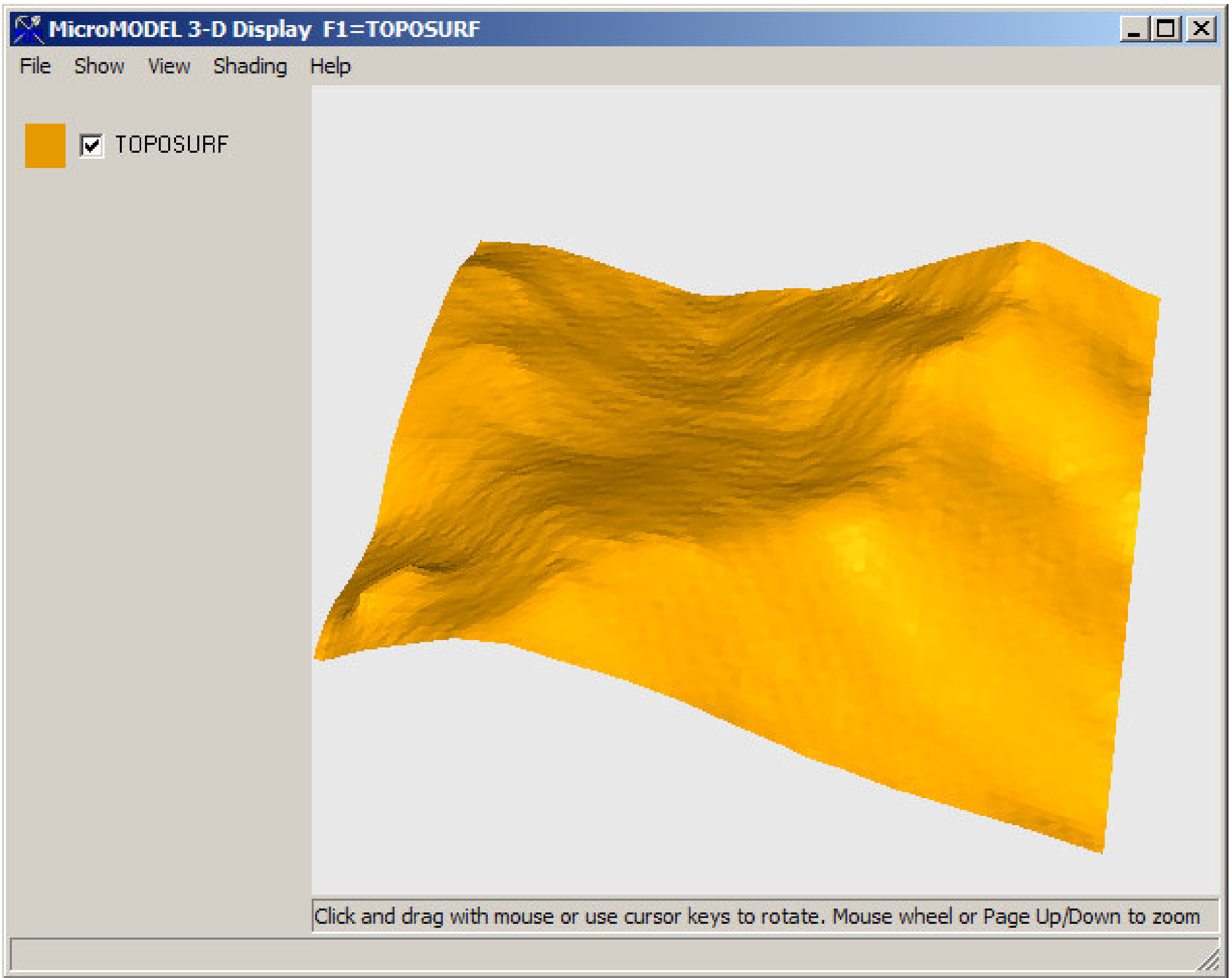


Figure 32 3D Surface in Viewer

4) Drill Hole Data

1.15. Adding Drill Hole Data

Comment/Tip: Make sure the pre-formatting of data as demonstrated in Section 1.2 was done correctly! This is essential. The following section demonstrates how to load drillhole data from a set of sheets that are part of a single Excel spreadsheet file.

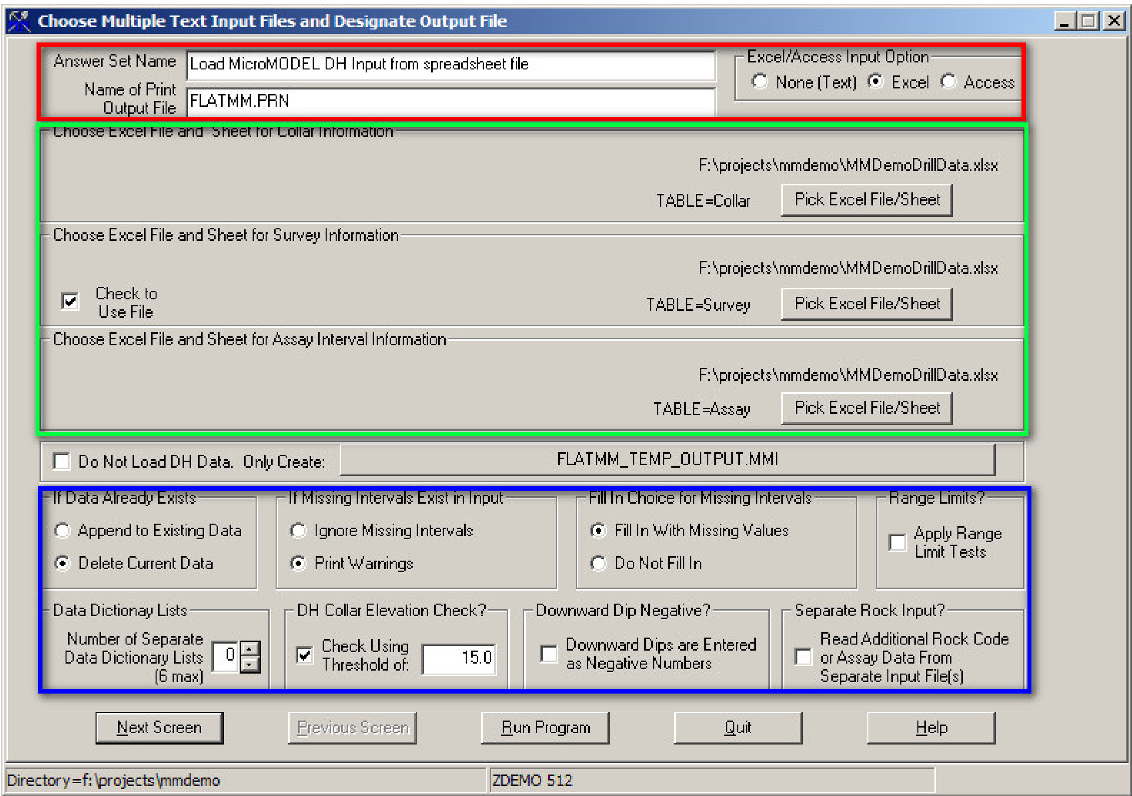


Figure 33 Drillhole Database Input Dialog 1

1) Enter the answer set name, specify the print file, and select the source of data. (**Red**) In this case, we are extracting data from Excel file(s).
2) Click on the "Pick Excel File/Sheet" button for each of the three file types (collar, surver, assay). Be sure to check the "Check to Use File" box for the survey information. You will be asked to select the excel spreadsheet file name, and the sheet to use. Note that, if necessary, the data can come from three separate excel files. If there is only one sheet in the excel file, you will not be prompted to choose the sheet.(**Green**)
3) In the blue rectangle, you must select miscellaneous input options. "Delete Current Data" is used in order to overwrite any current data. "Print warnings" will print warnings regarding missing intervals in the input data (recommended). It is recommended to fill in missing intervals with missing values. Range Limits can be specified, to apply sanity checks on the data values. If any of the input data is non-numeric, then one or more data dictionary Lists should be chosen. Drillhole collars can be checked against the current topo grid, provided that the starting

topography surface grid already exists. If your database was created with downward dips entered as negative numbers, check the downward dip negative box. Finally, if you have an additional files defining the rock code or other lithologic data, check the separate rock input box.

- **[Next Screen]**

On the Following Windows - Configure and Insert proper headings/columns/etc for the Collar/Survey/Assay Headers. The "Item Contained" column is a drop down menu of available items to match. If your column should be ignored, selected [IGNORE]. If the column of information contains all Text entries, such as the drillhole name column, set the Data Type to "Text". If the column contains a mix of numeric and text data, set the Data Type to "Mixed". Otherwise, for numeric data, the Data Type is "Numeric". If text or mixed data is contained in a column, then you must specify which Data Dictionary to use to decode the text entries and convert them to numbers.

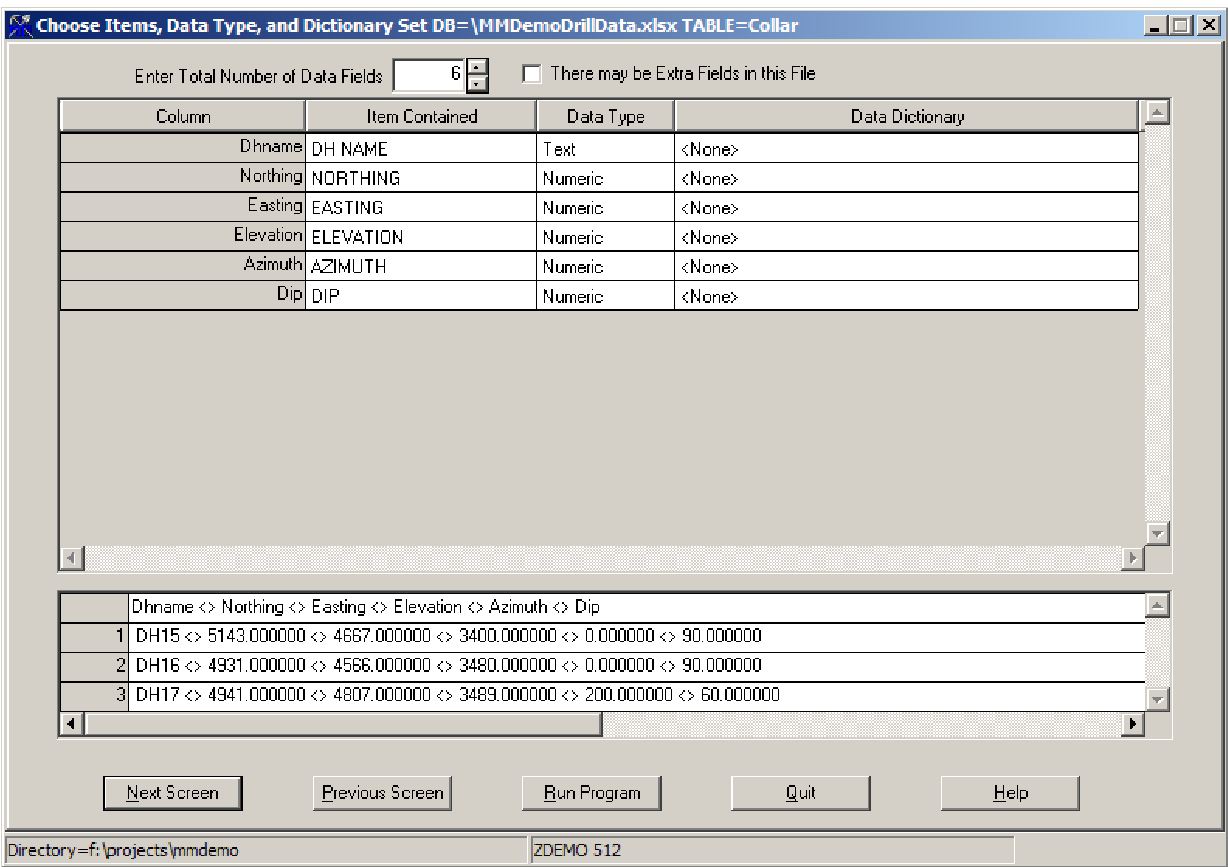


Figure 34 Collar File Field Parameters

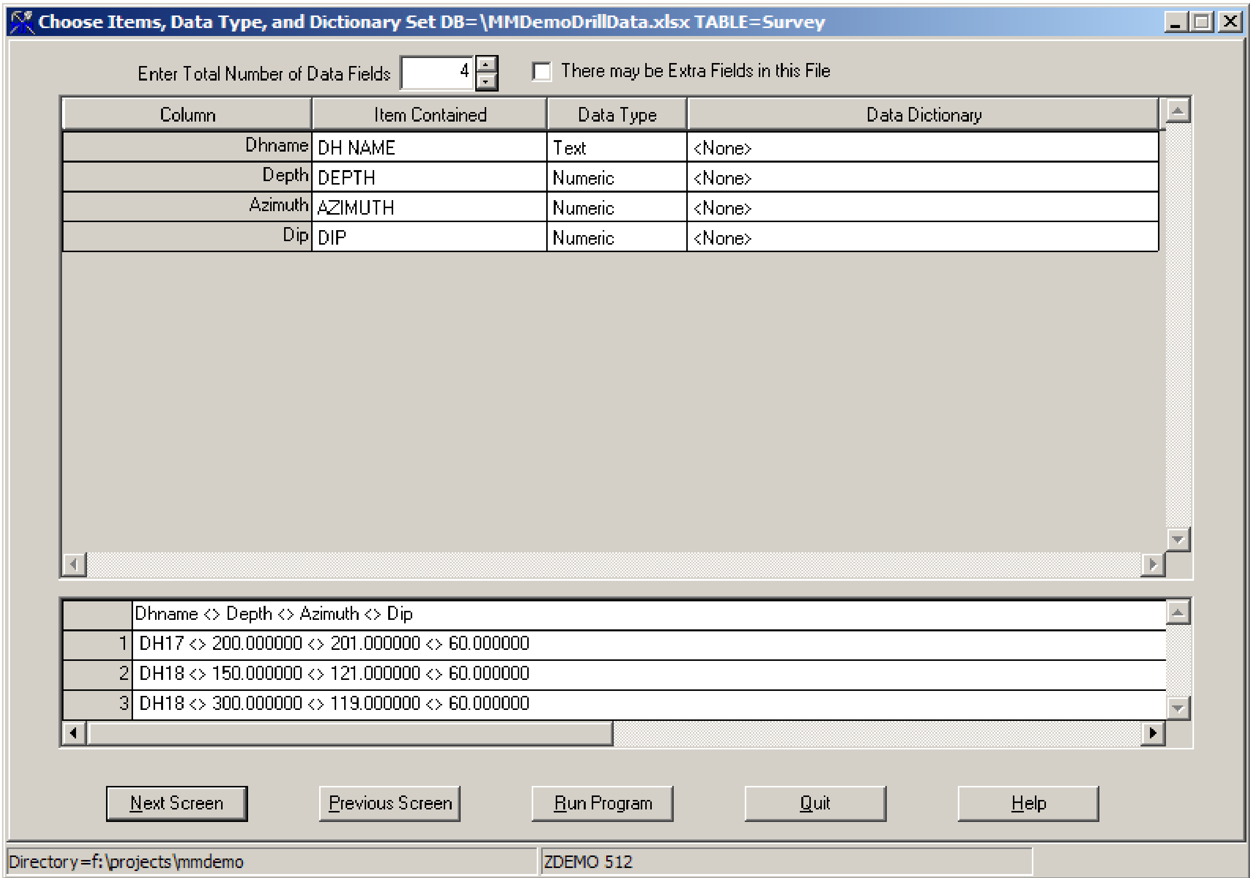


Figure 35 Survey File Field Parameters

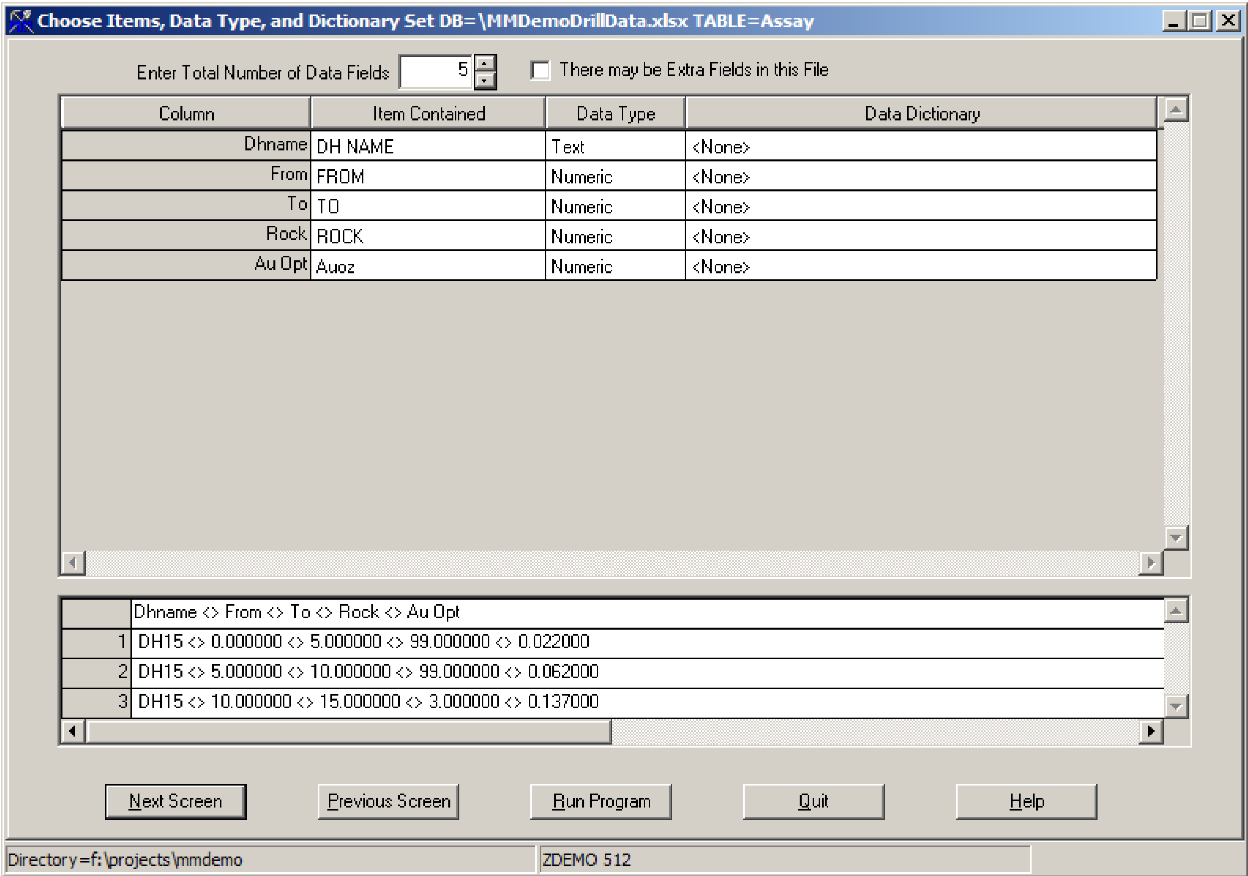


Figure 36 Assay File Field Parameters

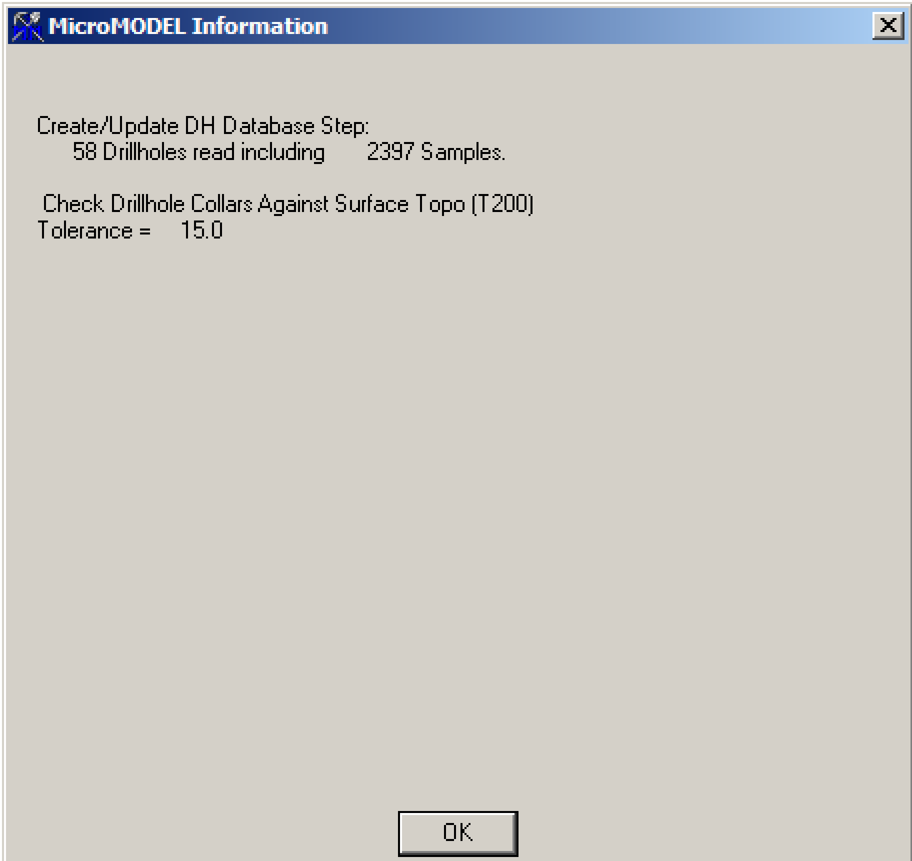


Figure 37 Load Drillhole Data Summary Screen

1.16. Printing Drillhole Data

Printing the drillhole database produces a text file of the database for review or for inclusion as part of a report. It is also a good way to check and see if your drillhole data loaded correctly by spot checking between the printed output and the original text file or spreadsheet.

The first screen allows you to refine / limit your results. The second screen allows you to define the Labels you want to print.

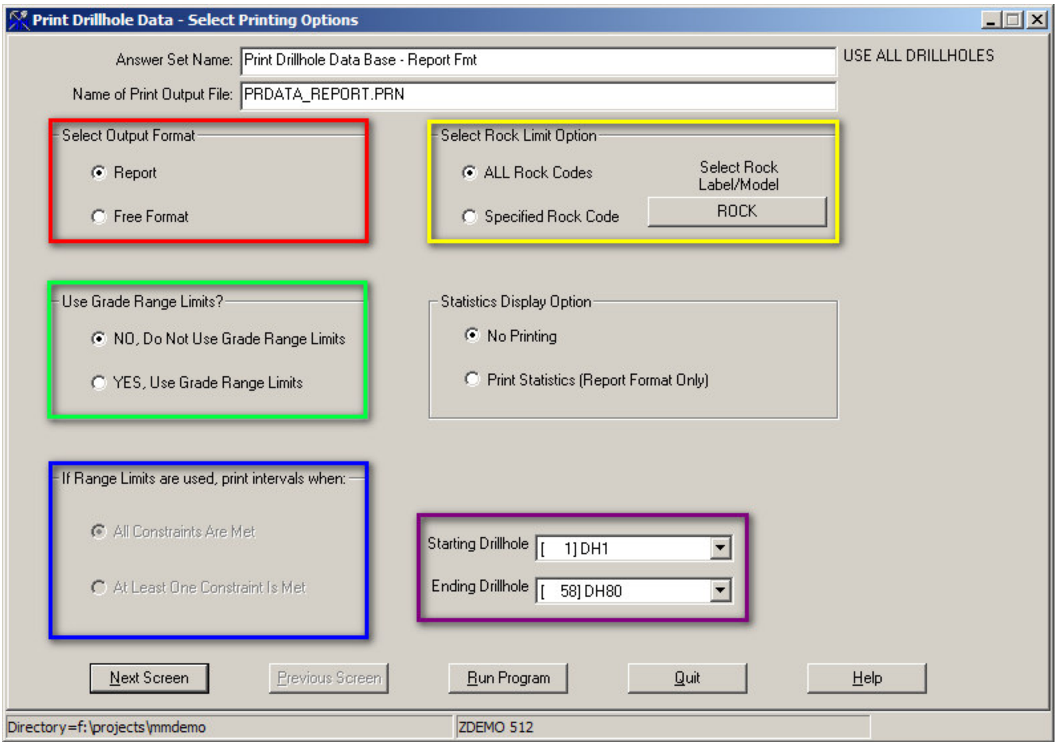


Figure 38 Print Drillhole Data First Input Screen

1) Select Report Format (**Red**)

Free format produces the text file that MicroMODEL use to use to store plain text data. This format is provided only to maintain compatibility with older versions of MicroMODEL, so this choice should always be Report Format.

2) Select Grade Range Limits (**Green**)

To print only drillhole assay intervals within a specific grade range (for example all non-barren, non-missing drillholes), use this option. To see all drillhole intervals, select “NO, Do Not Use Grade Range Limits”.

3) If Range Limits are used, print intervals when: (**Blue**)

To print all intervals, select “All Constraints Are Met”. If a grade range was applied to more than one value (ie Auppm>0.1 and Agppm>0.5),select “At Least One Constraint is Met” to see all drillholes that have Auppm>0.1 or Agppm>0.5. To see drillholes that have Auppm>0.1 AND Agppm>0.5 select “All Constraints Are Met”.

4) Select Rock Limit Option (**Yellow**)

To limit the drillholes by rock code, use “Specified Rock Code”. To see all drillholes, select “ALL Rock Codes”

5) Range of Drillholes (**Purple**)

To see all drillholes, select the first and last drillhole in the dropdown menus.

- **[Next Window]**

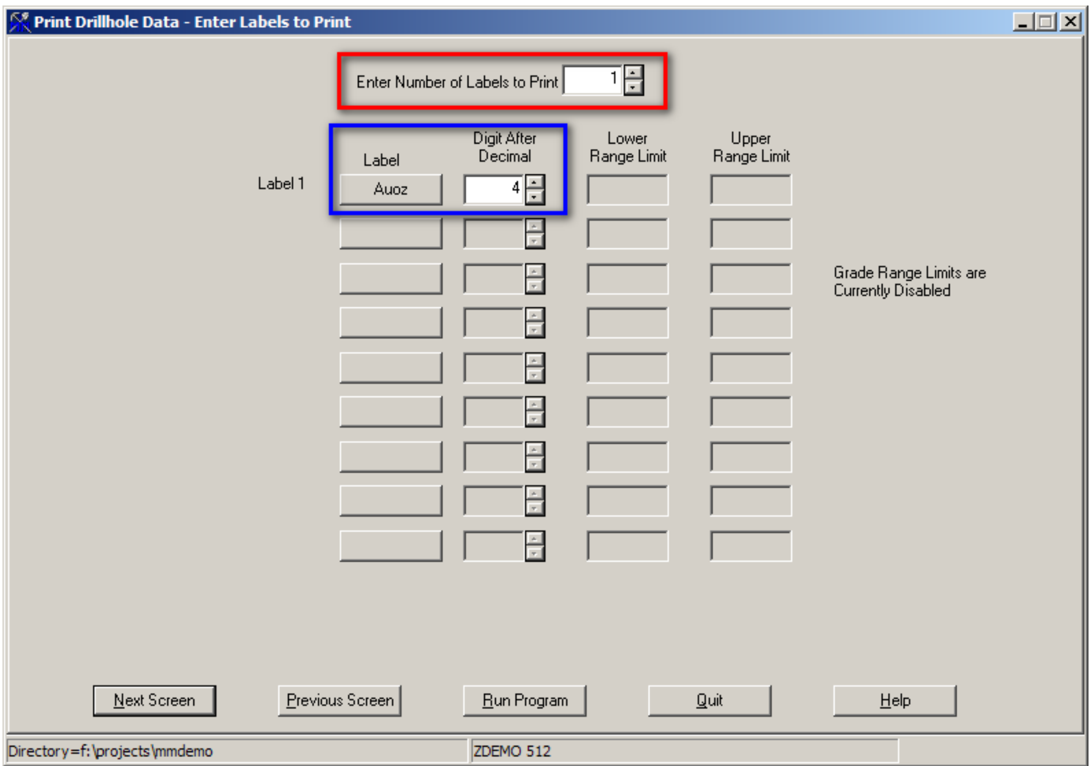


Figure 39 Print Drillhole Data First Second Screen

1) Enter Number of Labels to Print (**Red**)

Use the arrows to set the number of labeled grades you wish to print.

2) Set the Labels and Digits After Decimal (**Blue**)

To see a list of labels click on the grey box and select the labels in the order you want them to appear following the from, to, and rock code.

Set the number of decimal places that need to be printed for each label. Setting this box to -1 will show the whole number only (i.e. 32). 0 will show the whole number with a period after it (i.e. 32.).

- **[Next Screen]**

3) Leave all options in this dialog box unchecked.

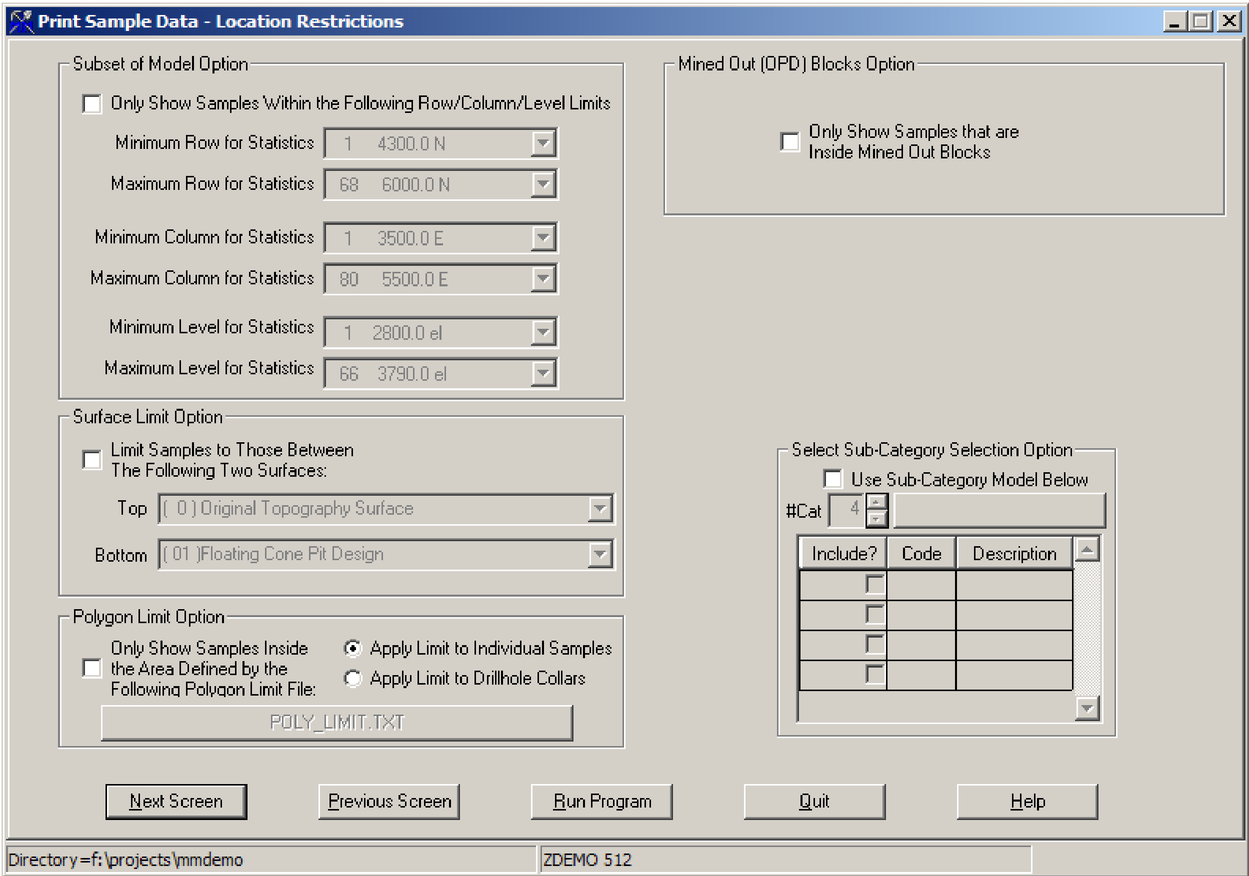


Figure 40 Print Drillhole Data Third Input Screen

- **[Run Program]**

4) Click Open to see text file output.

1.17. Plotting Drillhole Data

This program displays drillhole collars and projections in plan view.

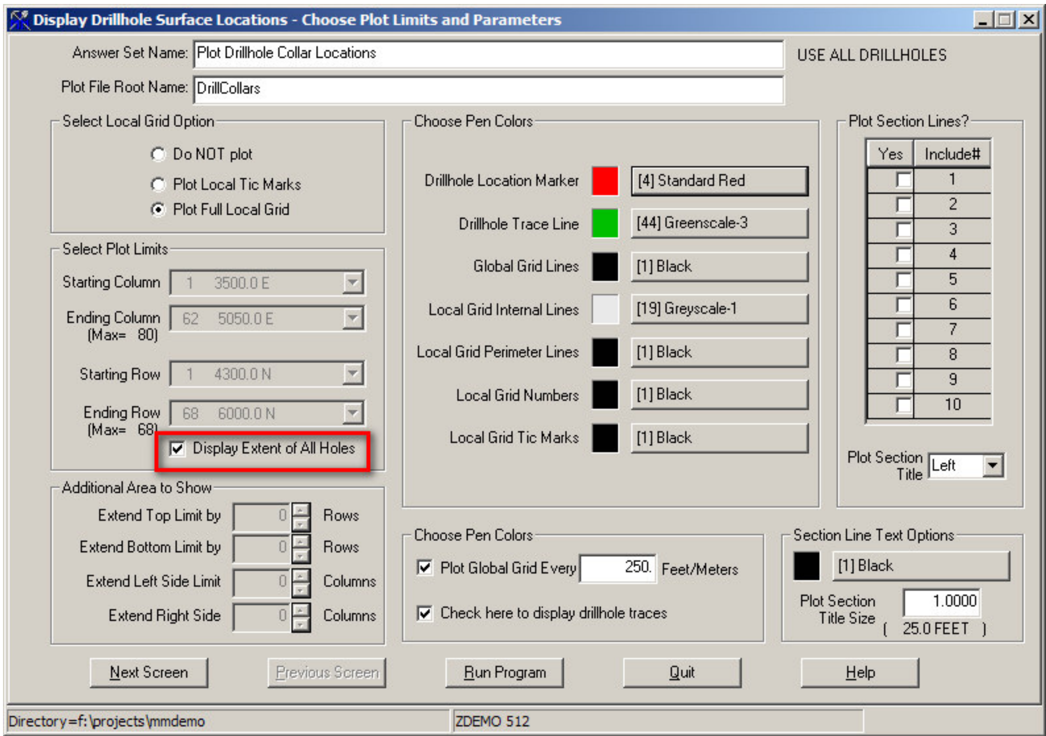


Figure 41 Plot Drill Hole Surface Locations Dialog 1

1) Display Extent of All Holes (**Red**)

This option plots all the collars in the drill hole database, even if the collar is outside the limits of the project. This is a good check to ensure that your drillholes are all accounted for in the project area. In Figure 44 Drillhole Collar Map with DH-1 wrong Easting Entered, DH-1 is out of the project area. The easting of the hole was entered as 2573 instead of the correct value of 4573. When using this option, it is recommended that you turn off the Global Grid option (uncheck the "Plot Global Grid Every" checkbox). If you have a drillhole in your database with incorrect collar coordinates, which places the drillhole a long ways from the project, then you will create a plot that includes thousands of local grid lines which obscure everything else.

Also, if a drillhole is a long ways outside the normal project limits, the "good" holes will all plot in a very small portion of the display. The errant drillhole will usually be in an opposite corner of the plot, or right on an edge of the plot. Identify this hole and correct the drillhole collar northing and easting.

2) Select Check here to display drillhole traces

The drillhole traces show in plan view the path of the drillhole based on the downhole surveys and collar azimuths and bearings.

As in the Plot Surface Contours dialog box, the Choose Pen Colors allows you to change the various colors of the plot items.

➢ **[Next Screen]**

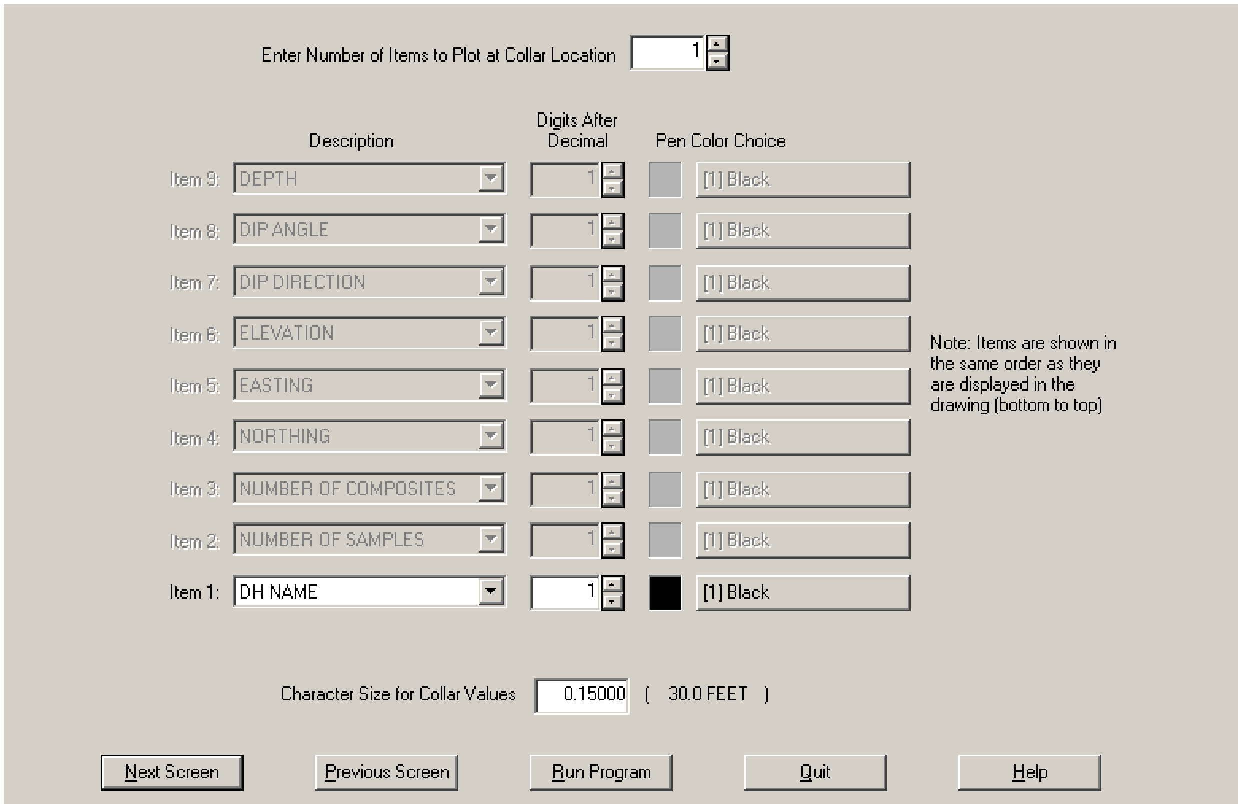


Figure 42 Plot Drill Hole Surface Locations Dialog 2

The second dialog box, shown in Figure 42, offers a variety of options to plot hole specific data at the collar location and the ability to adjust the text size for collar values. To keep the plot from becoming to busy, it is recommended to only plot drillhole names (DH NAME).

➢ **[Run Program]**

The option to add a title block will appear. Click through the first answer set. On the screen shown in Figure 43, make sure the box indicated by the Red arrow is unchecked.

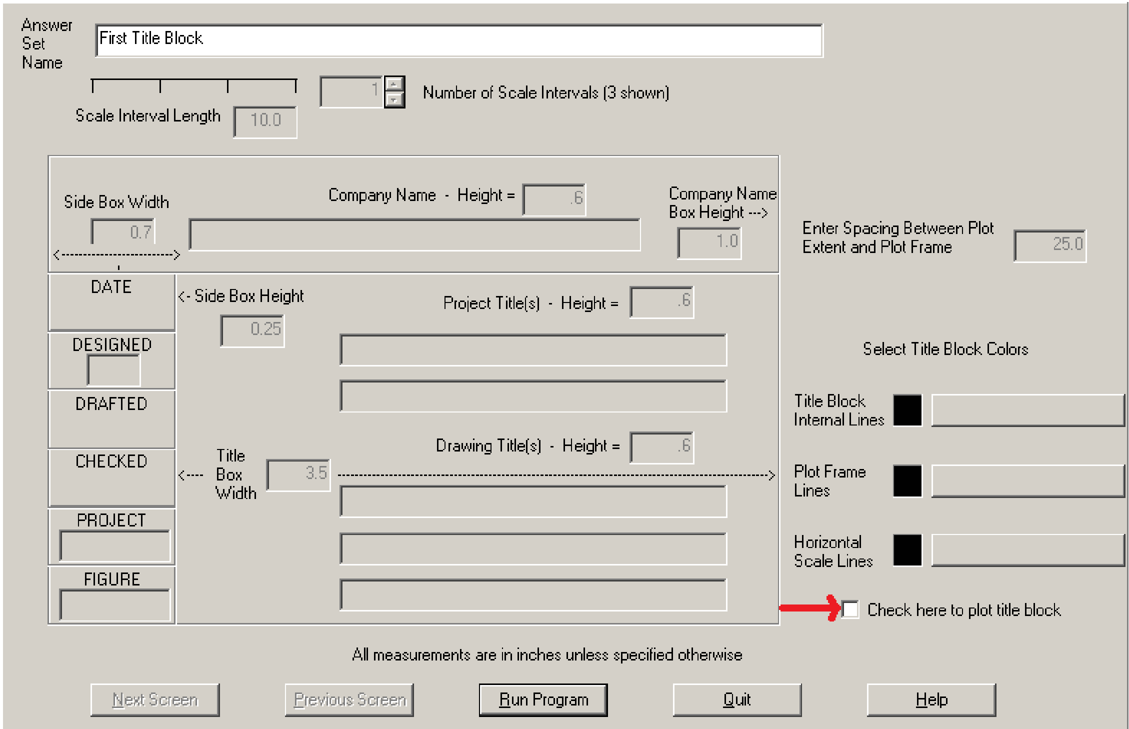


Figure 43 Title Box Dialog

- **[Run Program]**

The surface drill hole plot produces a plot like the one below.

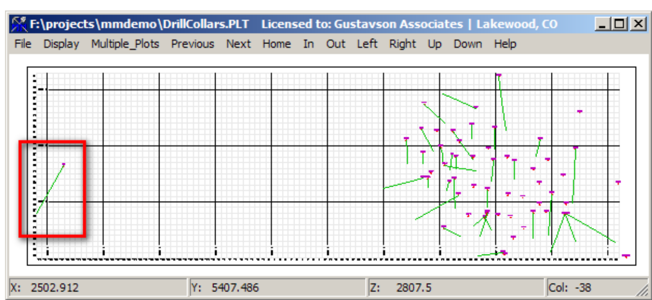


Figure 44 Drillhole Collar Map with DH-1 wrong Easting Entered

After Fixing the easting of drillhole DH-1, we rerun the collar plot program with the “Display Extent of all Holes” unchecked. The result is shown below.

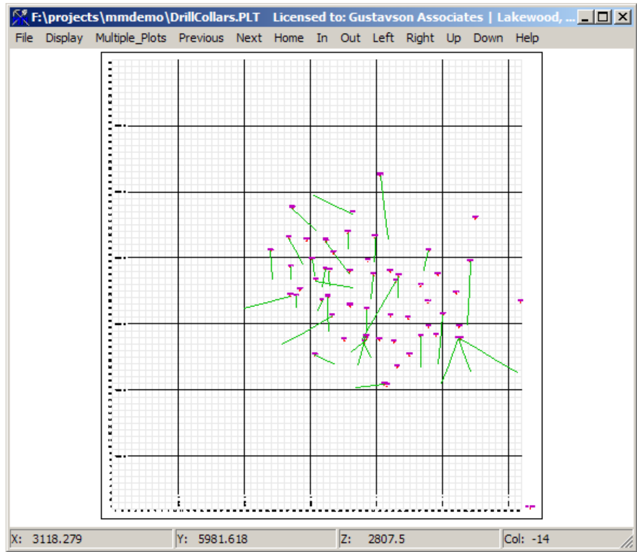


Figure 45 Surface Plot of Drillholes with Traces

5) <u>Composite Values</u>

Note that the composite menu shares many of the same features as the Data Entry Menu.

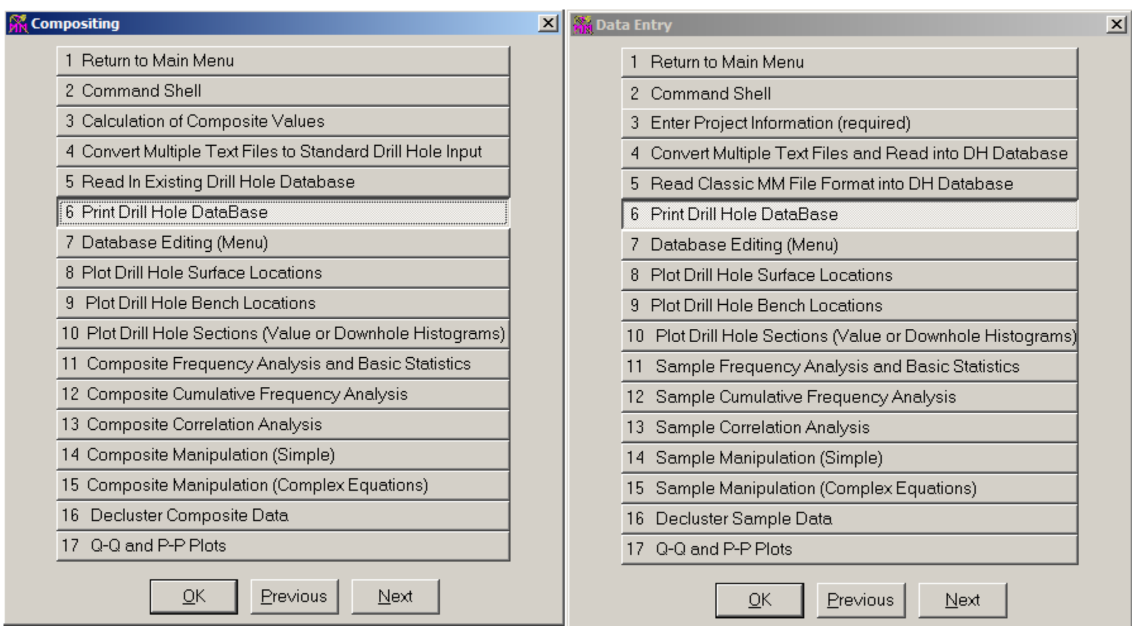


Figure 46 Data vs. Composite Features Dialog

This means that many procedures involving composited data are similar to the data entry procedures. In fact, many procedures in MicroModel are similar to others that appear in different tabs and programs.

1.18. Calculate Composite Values

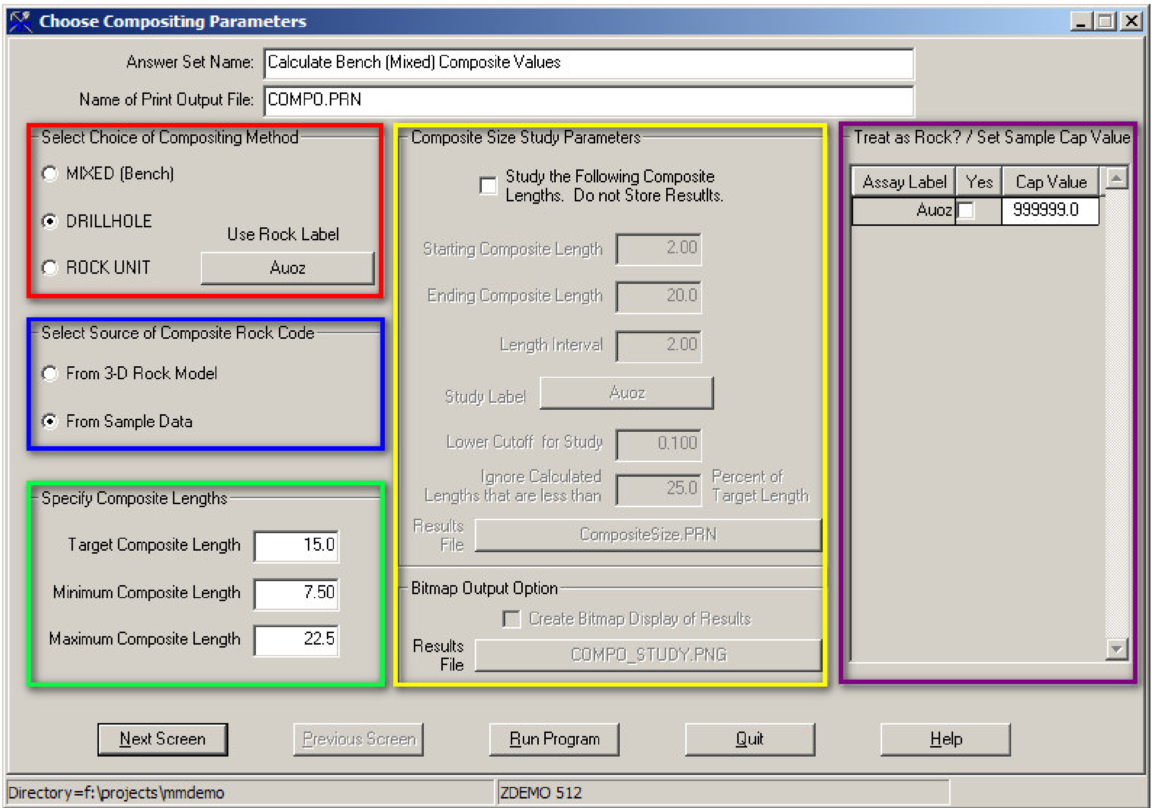


Figure 47 Calculate Composites Dialog 1

1) Select Choice of Compositing Method (**Red**)
   - **Mixed (Bench)** - This is based on bench size with the target length for the composite being the same as the bench length. By selecting this option the Target Composite Length box (**Green**) will grey out. If unsure about the best method, this is the recommended option.

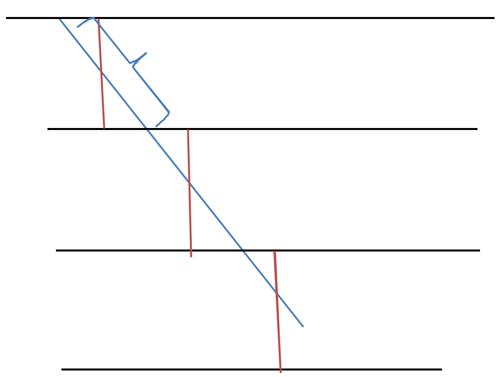


Figure 48 Mixed (Bench) Compositiing Diagram

   - **Drillhole** - This option just takes intervals from along the drill hole to make the composites. The Composite Size Study (Yellow) can help find dimensions to optimize the effectiveness of this option.

- **Rock Unit** - This option builds composites based on rock unit. It is most useful for strata bound deposits. By selecting this option the Target Composite Length box (**Green**) will grey out.

2) Select Source of Composite Rock Code(**Blue**)

Choose “From Sample Data” since the 3-D Rock Model doesn’t yet exist.

3) Specify Composite Lengths (**Green**)

- **Target Composite Length** - The ideal composite length. The program will calculate two composites. One composite with a length greater than the target, and one composite with a length less than the target. The program will take the one with the least variation from the target as the composite.
- **Minimum Composite Length** - The smallest length a composite can be. All shorter composites will be discarded by the program. A good value for minimum composite length is the assay sample size.
- **Maximum Composite Length** - No composite will be greater than this value.

4) Composite Size Study Parameters (**Yellow**)

If using Drillhole composites, run this function before deciding on the final length of the target composite. This function will produce a report that is contains statistics that can be helpful in choosing the target length. There is also a bitmap display showing the effect of composite length on the overall average grade, and variance of the composited data.

5) Treat as Rock?/Set Sample Cap Value (**Purple**)

Do not check any of the yes boxes. If there is a severe nugget effect, the sample value can be capped to reduce the impact here, to avoid any outliers.

➢ **[Run Program]**

1.19. Backmarking Composites from Wireframe

For our demo project, we are going to create a very simple model based on the ore zone wireframe. The wireframe was used to assign rock codes to the 3-D rock model. The wireframe can also be used to assign a code to samples or composites whose midpoints fall inside the wireframe.

To backmark composites, choose Backmark Samples/Composites from Wireframe in the Rock Modeling menu.

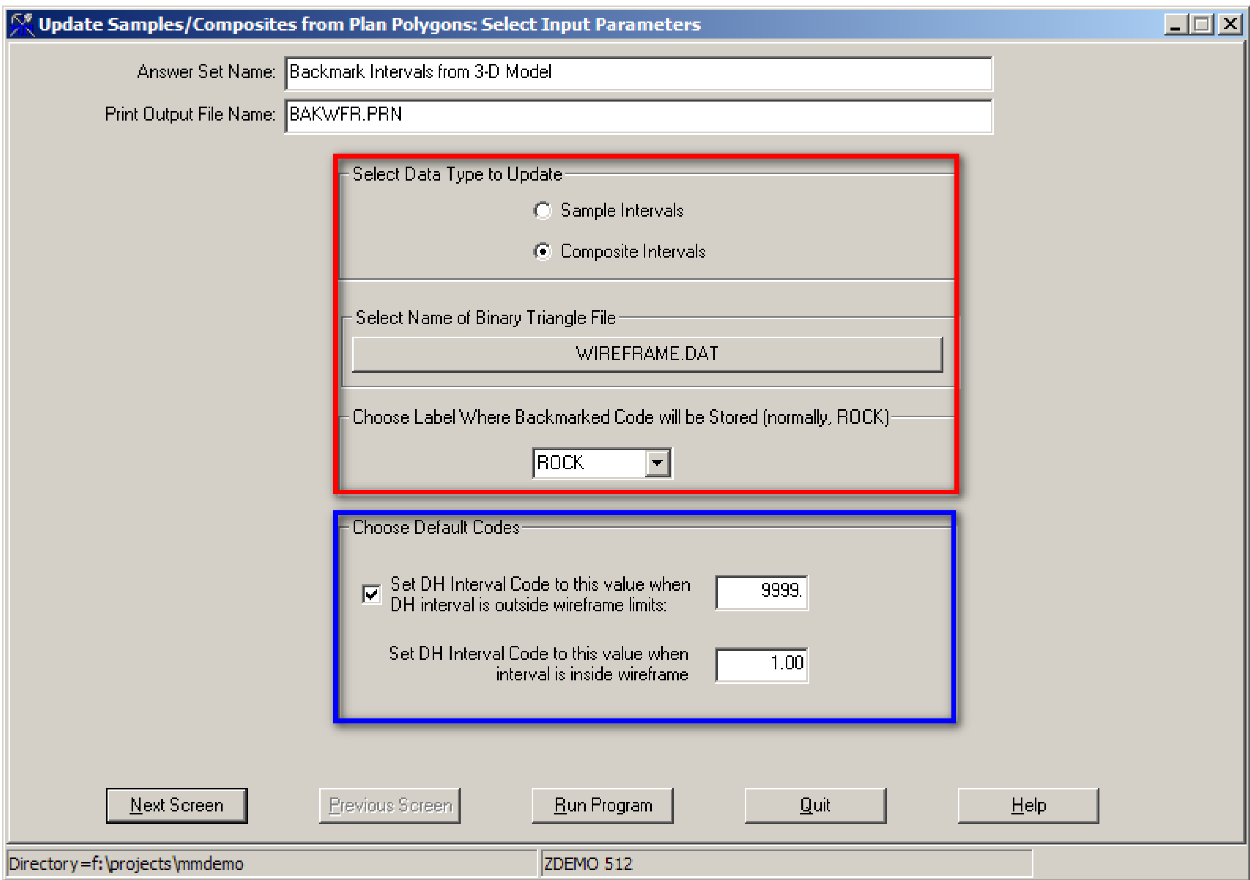


Figure 49 Backmark Composites from Wireframe Dialog

Select the type of data (composite intervals), the label where the code will be stored (ROCK), and the wireframe file (Wireframe.dat) in the red box. Select the code to assign to composites that fall outside of the wireframe, and the code to assign to composites inside the wireframe (blue).

After backmarking the composites, plot drillhole sections showing the composite rock code, overlay the drillhole sections on wireframe outline sections.

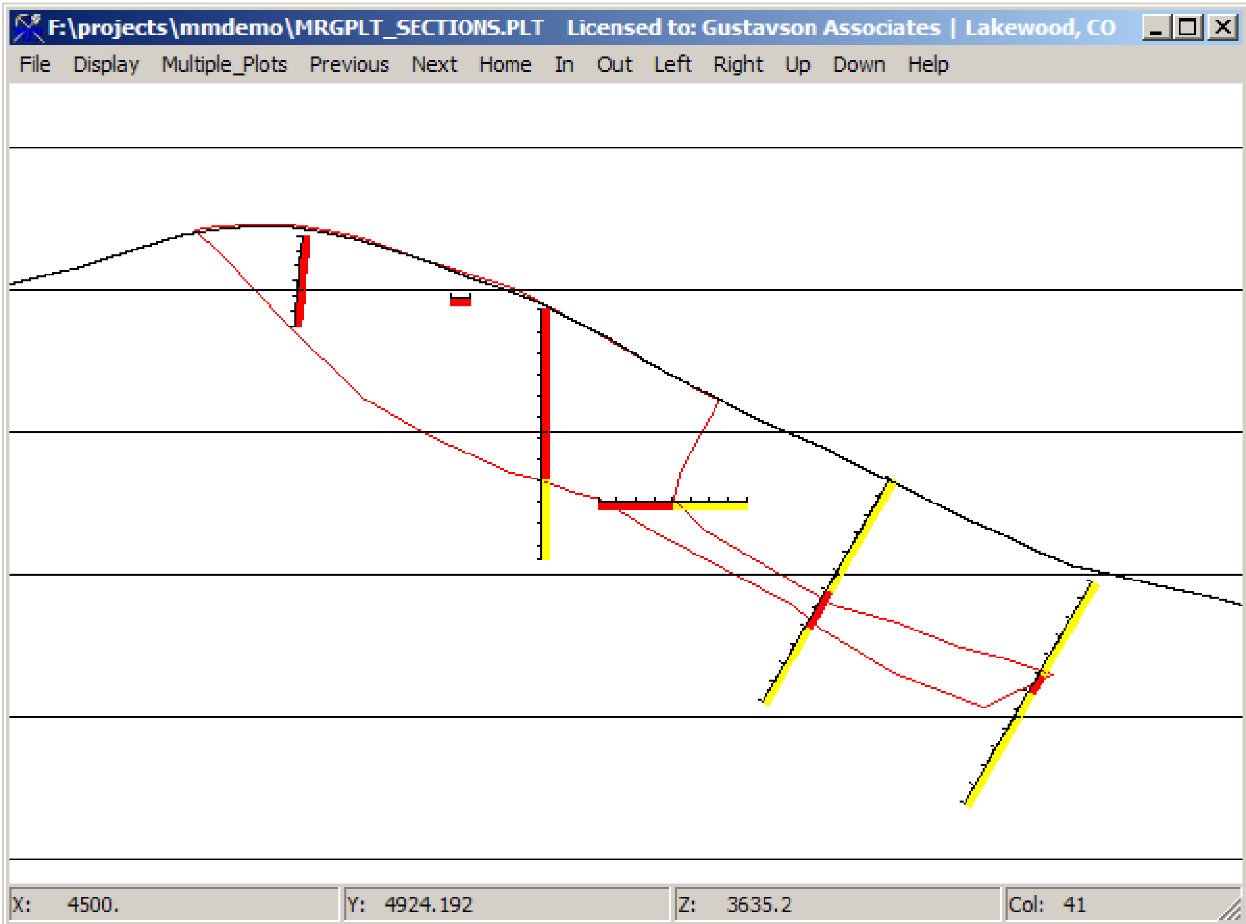


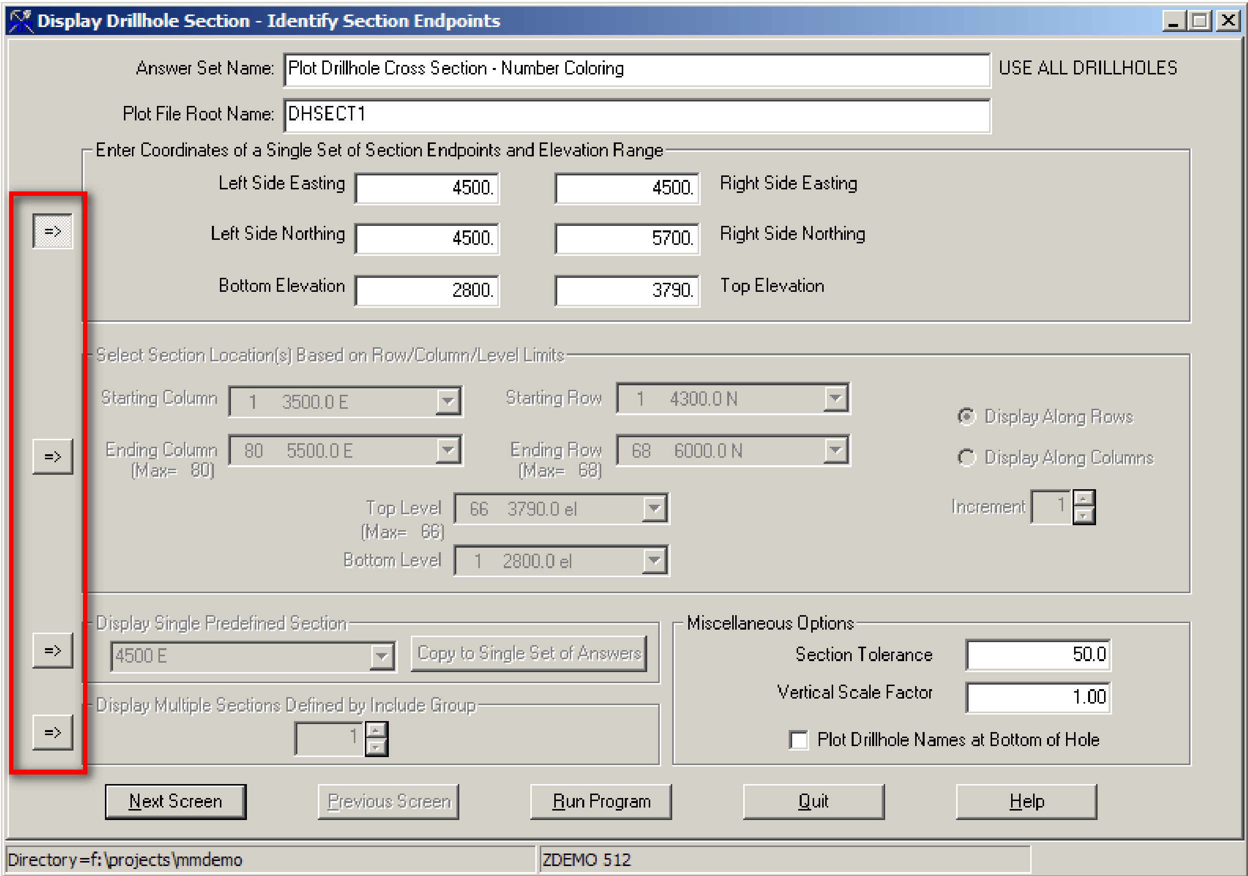
Figure 50 Display of Backmarked Composites and Wireframe Outline

The dark red colored composites are those backmarked from the wireframe, while the yellow intervals are outside the wireframe. The wireframe outline for the section is shown in lighter red.

6) Creating Cross Sections

There are several ways to create cross sections. This section discusses the display of sample or composite values.

Most section generation programs in MicroMODEL use the same four methods of selecting section endoints as is depicted in the input screen below.



The four pushbuttons along the left hand edge of the screen choose the method for which section endpoints, or multiple section endpoints, will be specified.

The top choice, which is selected in the screen above, allows the user to specify one set of section endpoints.

The second choice allows the user to generate one or more sections along rows or along columns, at a specified interval. This is probably the most useful method of specifying section locations as it allows the user to generate a number of sections through the deposit at equal intervals.

The third choice allows the user to select a single section from a list of predefined sections. The sections are predefined via the File Manager – Define Project Section Locations choice. The dropdown menu allows the user to choose which section to display.

The fourth choice allows the user to select an Include Group of sections that have been predefined in the File Manager. For example, a set of east-west sections could be defined as Include Group 1, and a set of north-south sections could be defined as Include Group 2, and so on.

1.20. Vertical Cross Sections along Rows or Columns

The following example details how to generate a section along rows in the deposit.

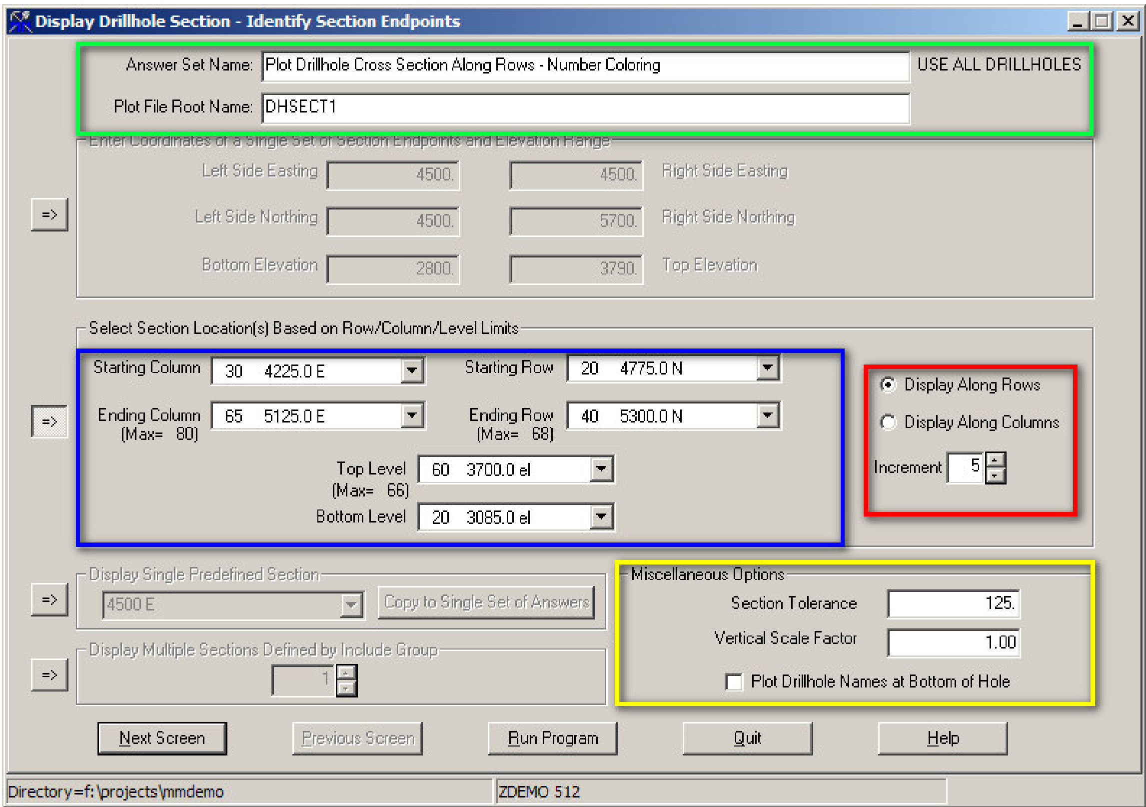


Figure 51 Cross Section Dialog Box 1

1) Answer Set Name and Plot Output Name(**Green**)

Use a descriptive name for the answer set so it can easily be referenced later if more copies of similarly configured cross-sections are needed. Specify the name of the plot file pair (name.PLT,name.SCL) that will contain the output from this run. If the output file name is left blank, then it defaults to "SECT".

2) Select Section Location(s) Based on Row/Column/Level Limits (**Blue**)

Select the second option down to use this method. Enter the limits of the sections from the drop down menus at each option. Note that we have clipped our view in both the column and level ranges. Since we are displaying along rows, at an increment of 5, we will be displaying sections at row 20, 25, 30, 35, and 40.

3) Orientation and Increment Box (**Red**)

- Select to make cross sections along rows or along columns.
- Select how many row/column increments between cross sections. In the example in Figure 51, a cross section will be generated every five rows.

4) Miscellaneous Options (**Yellow**)

- Section Tolerance sets the distance on either side of the cross-section centerline that drillhole data will be accepted. In the example in Figure 51, drillhole data 125 feet on either side of the cross section centerline will be included.
    - If uncertain about what value to use, use ½ of the distance between each section.
- Vertical Scale Factor controls vertical exaggeration. It is recommended to leave this at 1.
- Plot Drillhole Names at Bottom of Hole will show the drillhole name at both the top and bottom of the drillhole.

➢ **[Next Screen]**

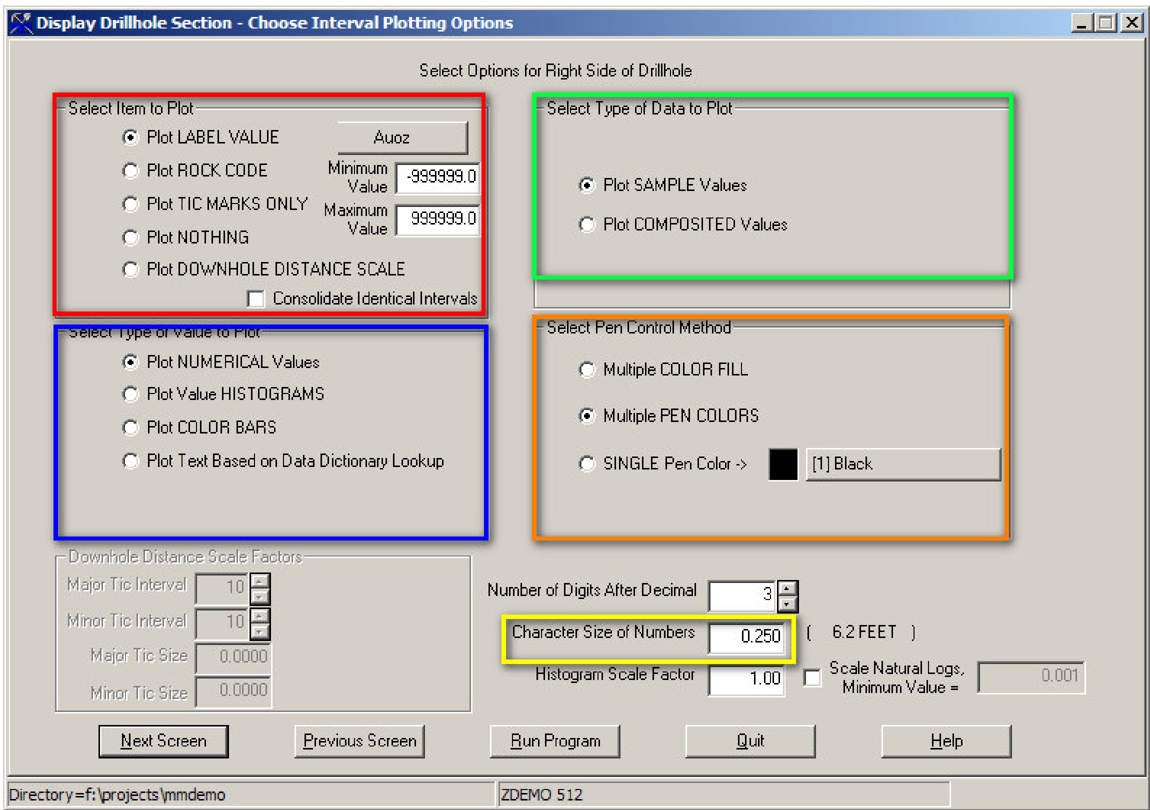


Figure 52 Cross Section Plot Dialog Box 2

This dialog box will select what will be plotted on the right side of the drillhole line in the cross section.

1) Select Item to Plot (**Red**)
    - **Plot LABEL VALUE** will display the assay values of the selected label in their position in the drillhole. Change the label to display by clicking on the raised, grey box.
    - **Plot ROCK CODE** will plot the lithological code for the intervals of the drillhole.
    - **Plot TIC MARKS ONLY** will plot tic marks for each interval, without displaying the label value.

- **Plot NOTHING** will grey out all the options following the Item to Plot and nothing will be plotted on the right side of the drillhole.
- **Plot DOWNHOLE DISTANCE SCALE** will plot major and minor tic marks down the hole, using parameters entered in the Downhole Distance Scale Factors group box.

The example uses Plot LABEL VALUE.

2) Select Type of Value to Plot (**Blue**)
    - **Plot NUMERICAL Values** will plot the numbers associated with the label.
    - **Plot Value HISTOGRAMS** will plot scaled histogram lengths of the values in the label along the drillhole. This option is mostly used for ore grades. The Histogram Scale Factor is used to calculate histogram bar lengths.
    - **Plot COLOR BARS** plots bars of a fixed width (as defined by Histogram Scale Factor field) along side the drillhole.The bars are color-coded based on label value ranges. (**Orange**).
    - **Plot Text Based on Data Dictionary Lookup** will replace numerical values with text values that are supplied in a data dictionary file.

This example uses Plot NUMERICAL Values.

3) Select Type of Data to Plot (**Green**)

To plot sample data, select **Plot SAMPLE** Values. To plot composite values use **Plot COMPOSITED** Values.

This example displays sample values.

4) Select Pen Control Method(**Orange**)
    - **Multiple COLOR FILL** puts a graded colored background on each interval.
    - **Multiple PEN COLORS** changes the color of the text based on a gradient.
    - **SINGLE Pen Color** plots all value text as one color.

This example uses Multiple PEN COLORS.

5) Character Size of Numbers (**Yellow**)

Adjust the size of the text the values will be displayed at to prevent overcrowding. Generally, 0.1 is a good scale value to begin with. This example uses 0.25.

- **[Next Screen]**

If the *Multiple Pen Colors* options was chosen in the Select Pen Control Method, a gradient setup screen will appear like the one in **Error! Reference source not found.**. Select a range and gradient like in Figure 53. This is an example gradient for plotting the gold grade.

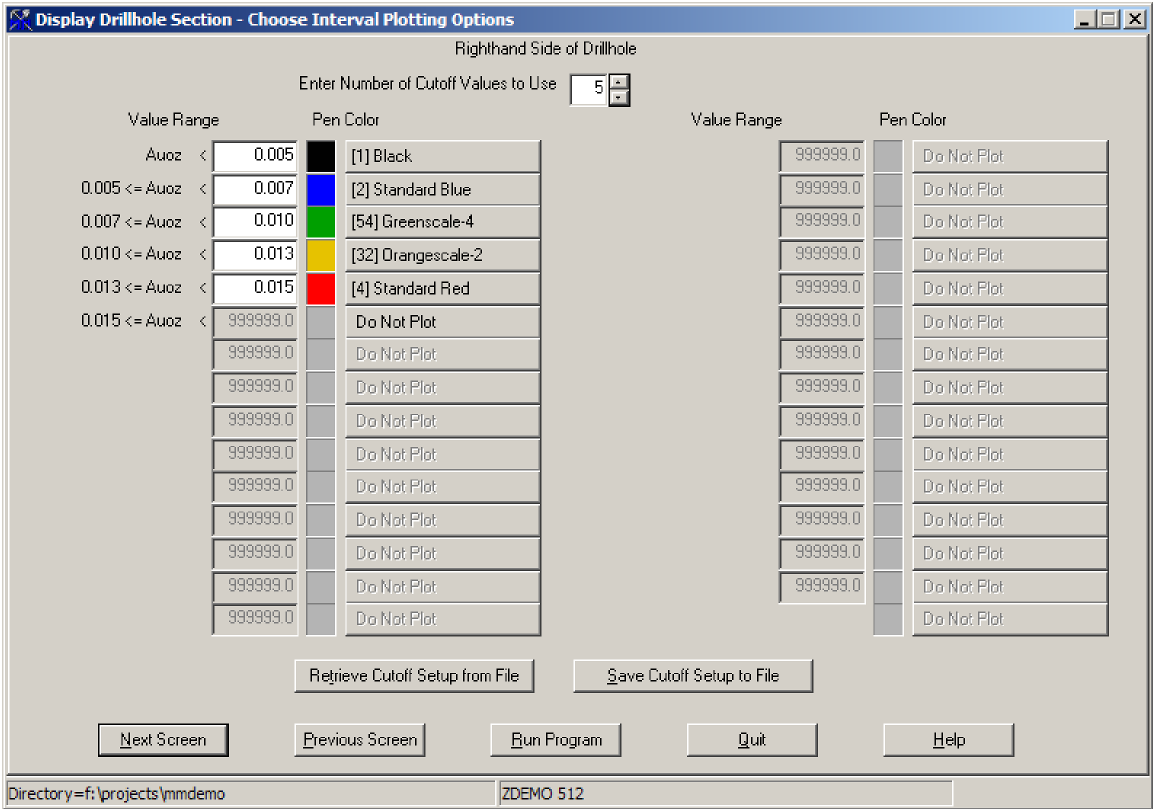


Figure 53 Auppm Color Gradient Example

If a single pen color was selected, this screen will not appear.

- **[Next Screen]**

A screen similar to the dialog box in Figure 52 will appear. This affects the plotting of the **LEFT SIDE OF THE DRILLHOLE**. For the example the Plot NOTHING option was selected in Select Item to Plot.

- **[Next Screen]**

This next dialog allows you to adjust the drillhole properties being printed. To keep the plot from becoming too busy, it is recommended to just print drillhole names and to leave this dialog at its defaults.

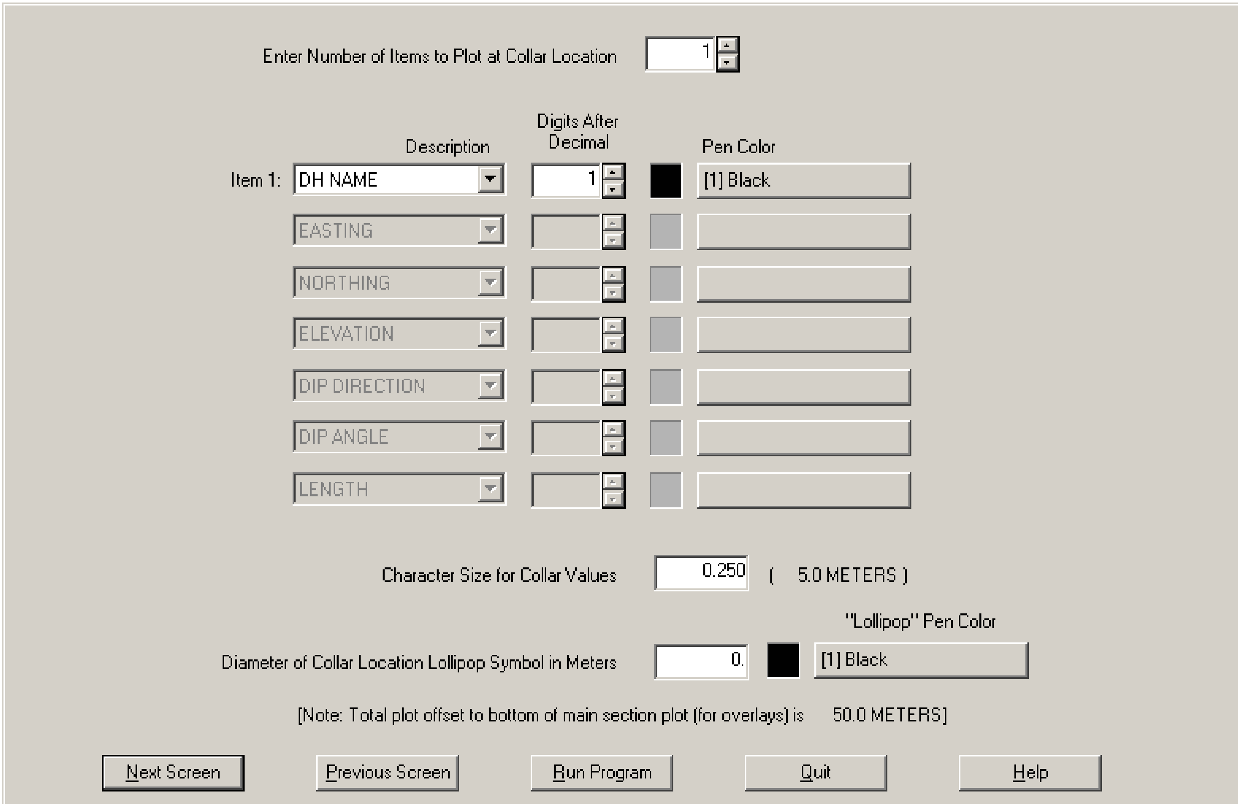


Figure 54 Cross Section Dialog Box 4

- **[Next Screen]**

It is recommended to leave this dialog at its default values.

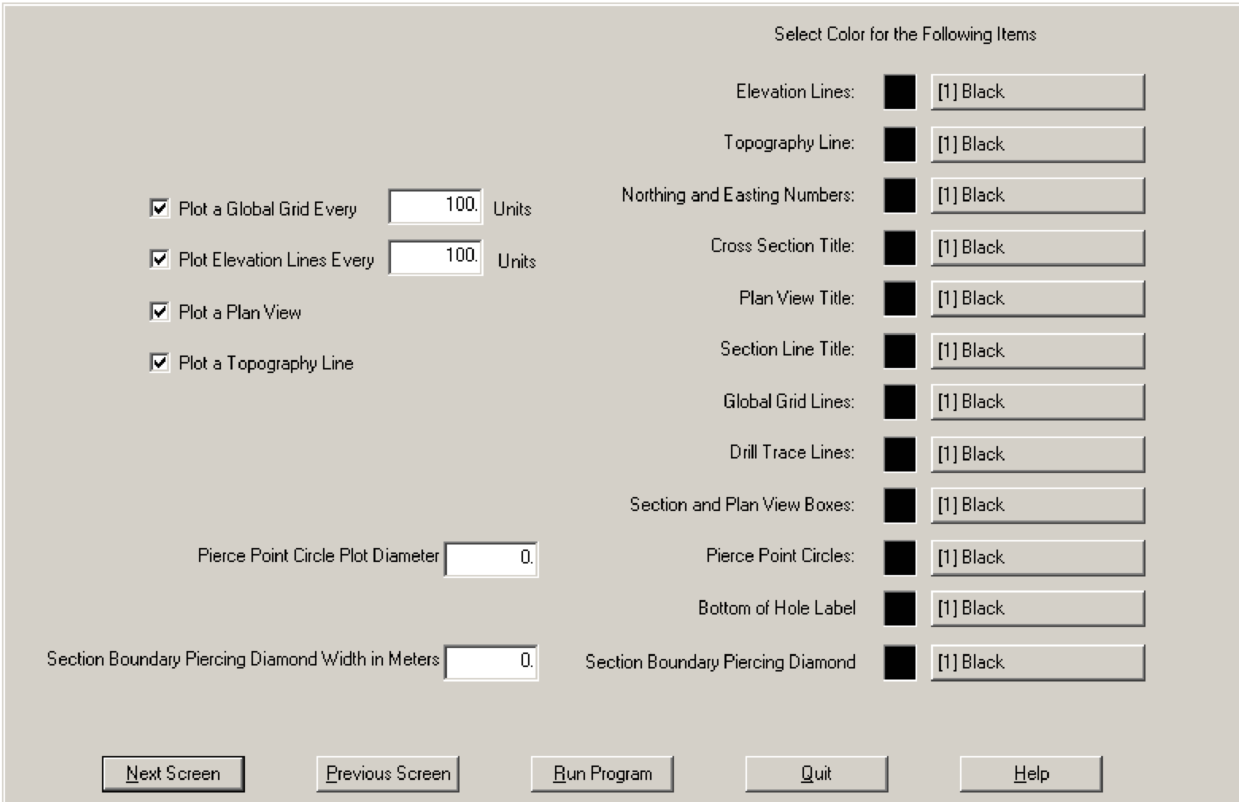


Figure 55 Cross Section Dialog Box 5

- **[Run Program]**

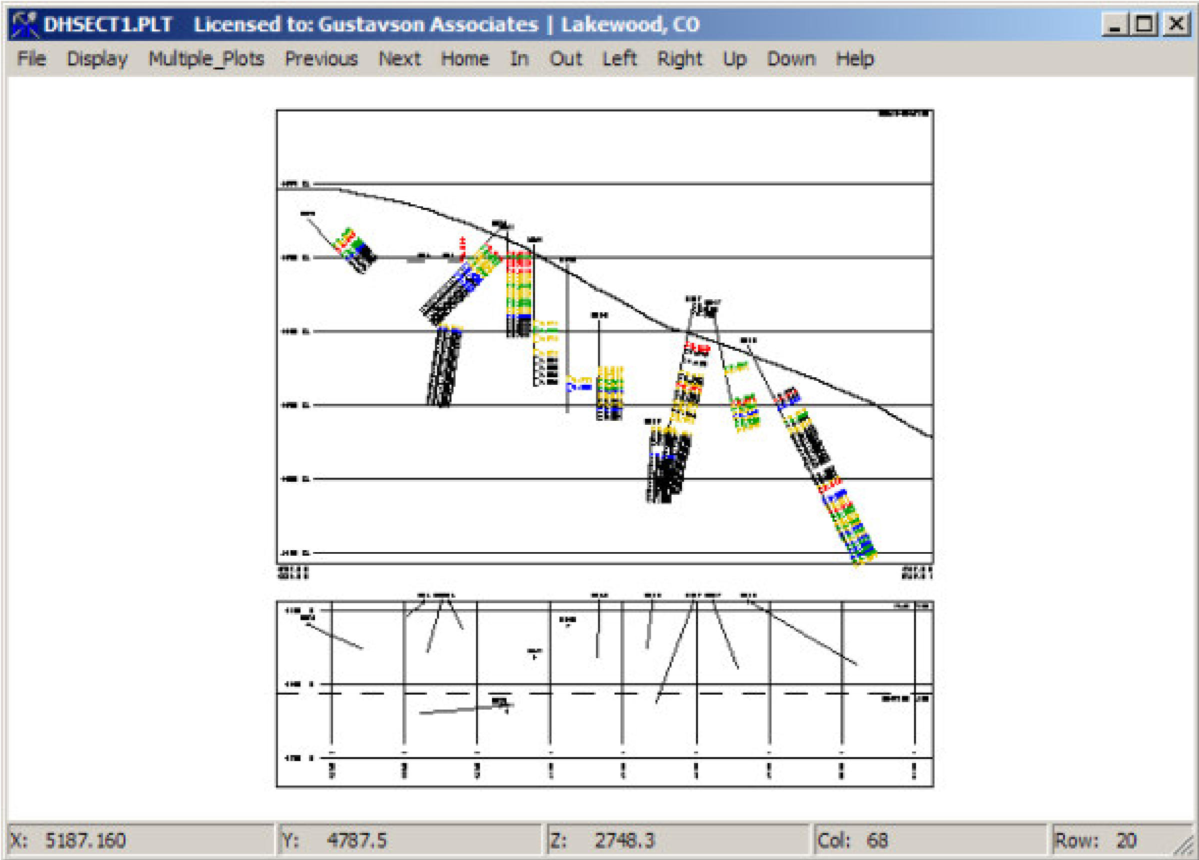


Figure 56 Example Cross Section at 52850 N

7) <u>Grade Thickness</u>

A grade thickness plot will show where the higher amounts of a metal are distributed in a deposit, at a given cutoff. Grade thickness units are (length x quantity). For our example, we will calculate the grade thickness in terms of feet-oz of gold. There are two output options for grade thickness plots: Contours and Cell Plot. Both have the same initialization process. (Video 41)

1.21. Calculate Grade Thickness

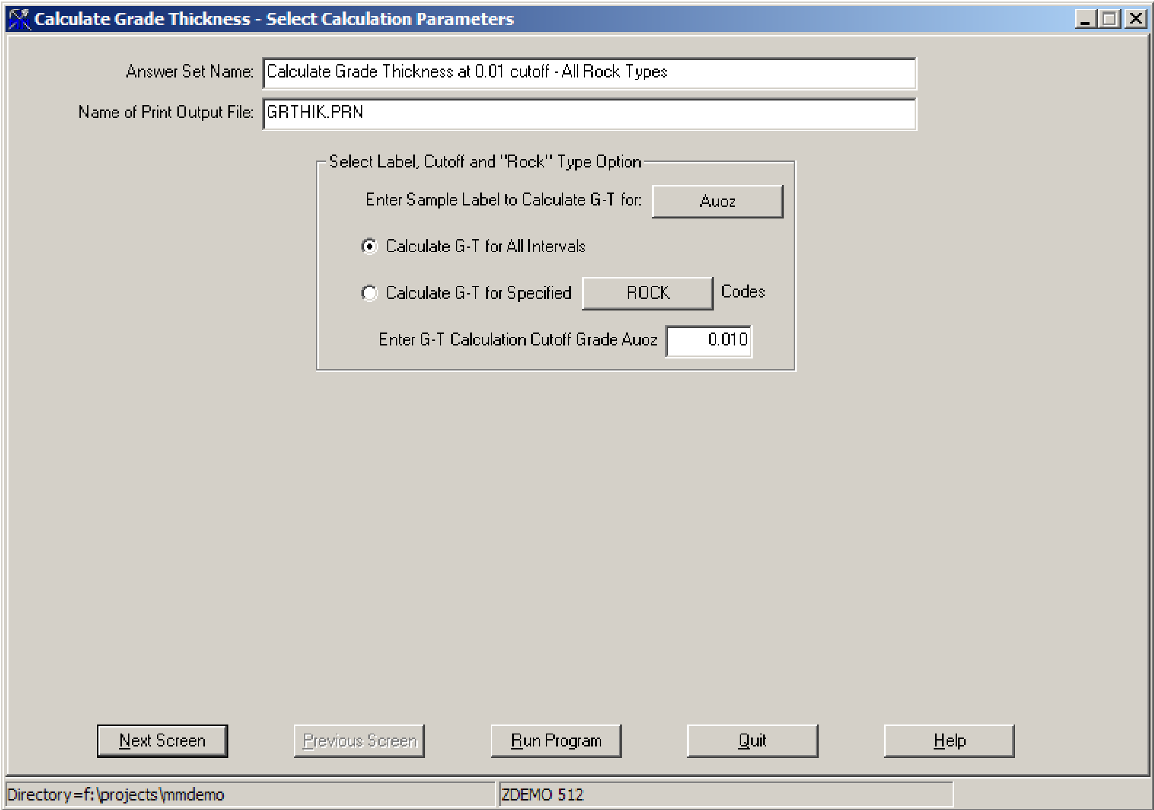


Figure 57 Calculate Grade Thickness Dialog Box

1) Select a Descriptive Name for the answer set

2) Select the label to use in calculating the G-T values. Note that only one type of GT model can exist in MicroMODEL. Multiple models can be created, but only one at a time is saved.

3) Select Calculate G-T for All Intervals

4) Set the Cutoff Grade

If the cutoff grade is not known, you may set this value to 0.

- **[Run Program]**

1.22. Grade Thickness Value Presort

[G-Thickness] – [5. Grade Thickness Value Presort] -[Select an Answer Set]

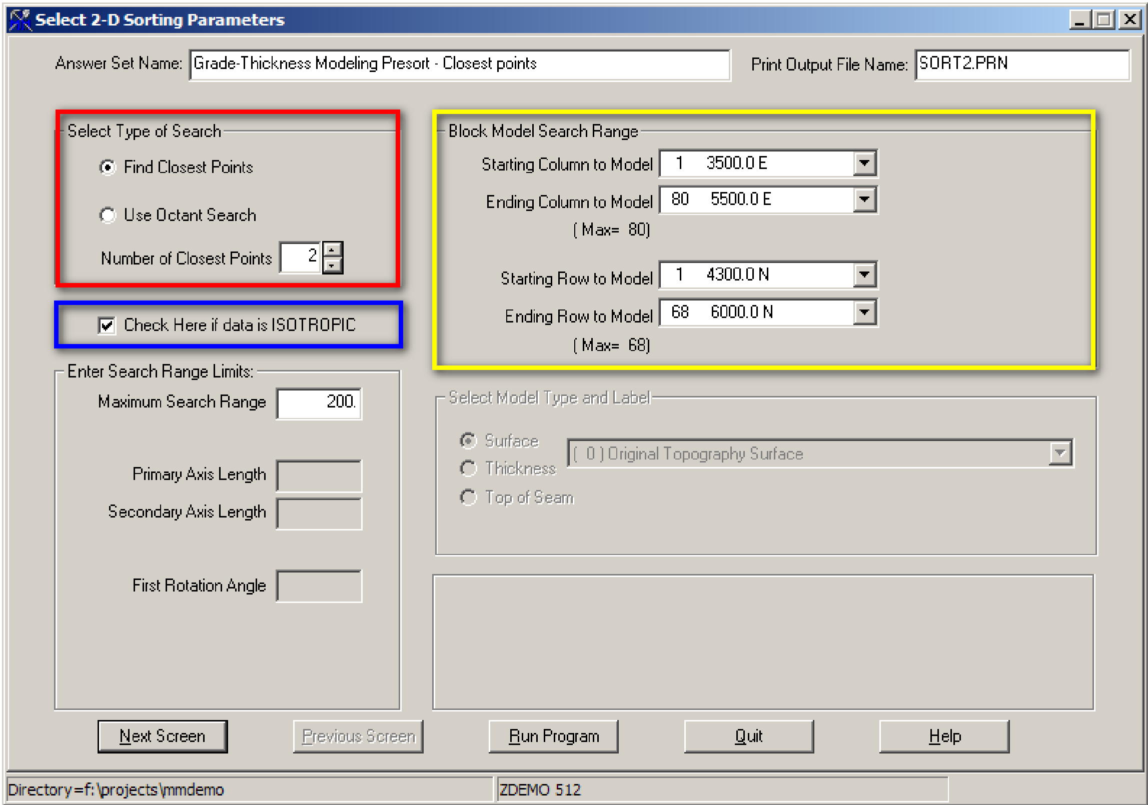


Figure 58 Grade-Thickness Modeling Presort Dialog Box

1) Select Type of Search (**Red**)

Always use an octant search with a minimum of two points.

2) Check Here if data ISOTROPIC (**Blue**)

This box should always be checked.

3) Block Model Search Range (**Yellow**)

Make sure this range encompasses the entire model area.

- **[Run Program]**

1.23. Grade Thickness Modeling

[G-Thickness] – [6. Grade Thickness Modeling] -[Select an Answer Set]

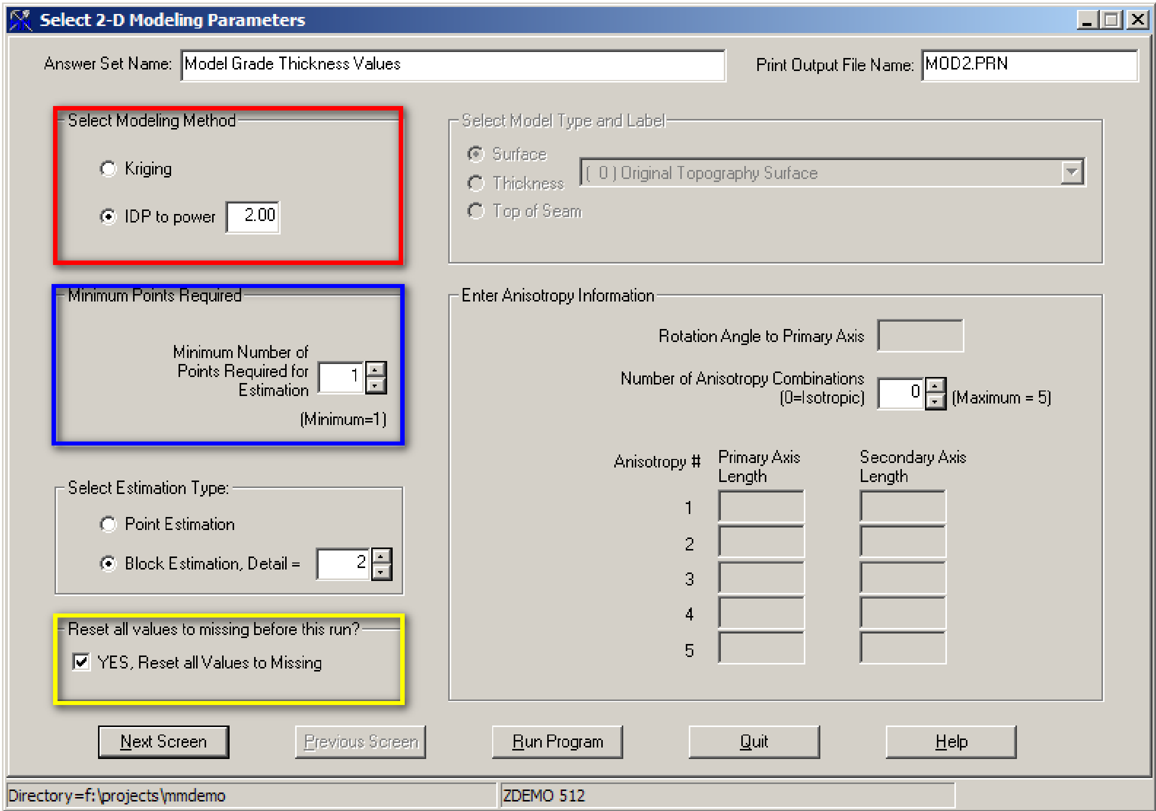


Figure 59 Grade Thickness Modeling Dialog Box

1) Select Modeling Method (**Red**)

Use IDP to the power of 2 for grade modeling.

2) Minimum Points Required (**Blue**)

At least one point is required in this example.

3) Reset all values to missing before this run? (**Yellow**)

Make sure this box is checked every time the grade thickness is modeled.

- **[Run Program]**

1.24. Grade Thickness Contours

[G-Thickness] – [7. Graphical Display of Grade Thickness (Menu)]-[4. Contour Grid Values] -[Select an Answer Set]

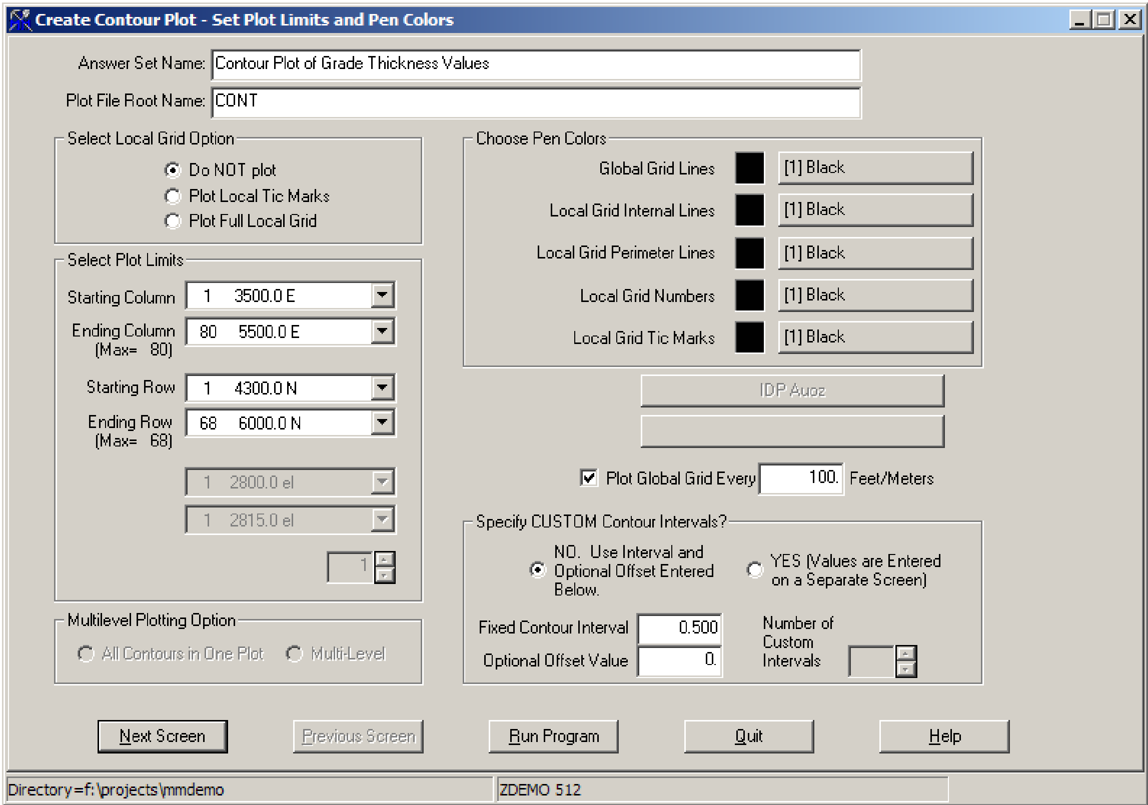


Figure 60 Contour Grade Thickness Dialog Box 1

Keep these values set to default like in Figure 60.

- **[Next Screen]**

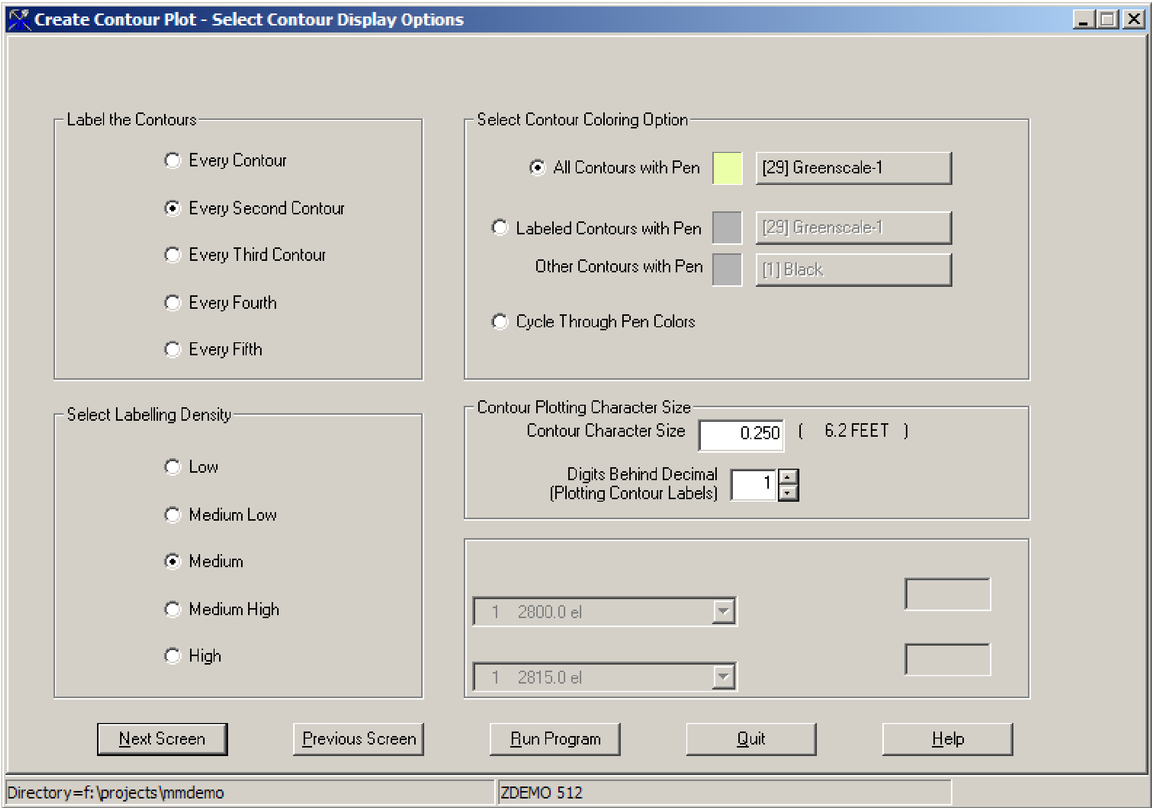


Figure 61 Contour Grade Thickness Dialog Box 2

Except for All Contours with Pen in Select Coloring Option, it is recommended to leave the settings in the second contour plotting box at their defaults. The light yellow pen color was chosen so that the contour lines will stand out against the darker cell colors of the cell plot, when displayed with the combine plot program.

- **[Run Program]**

1.25. Grade Thickness Cell Plot

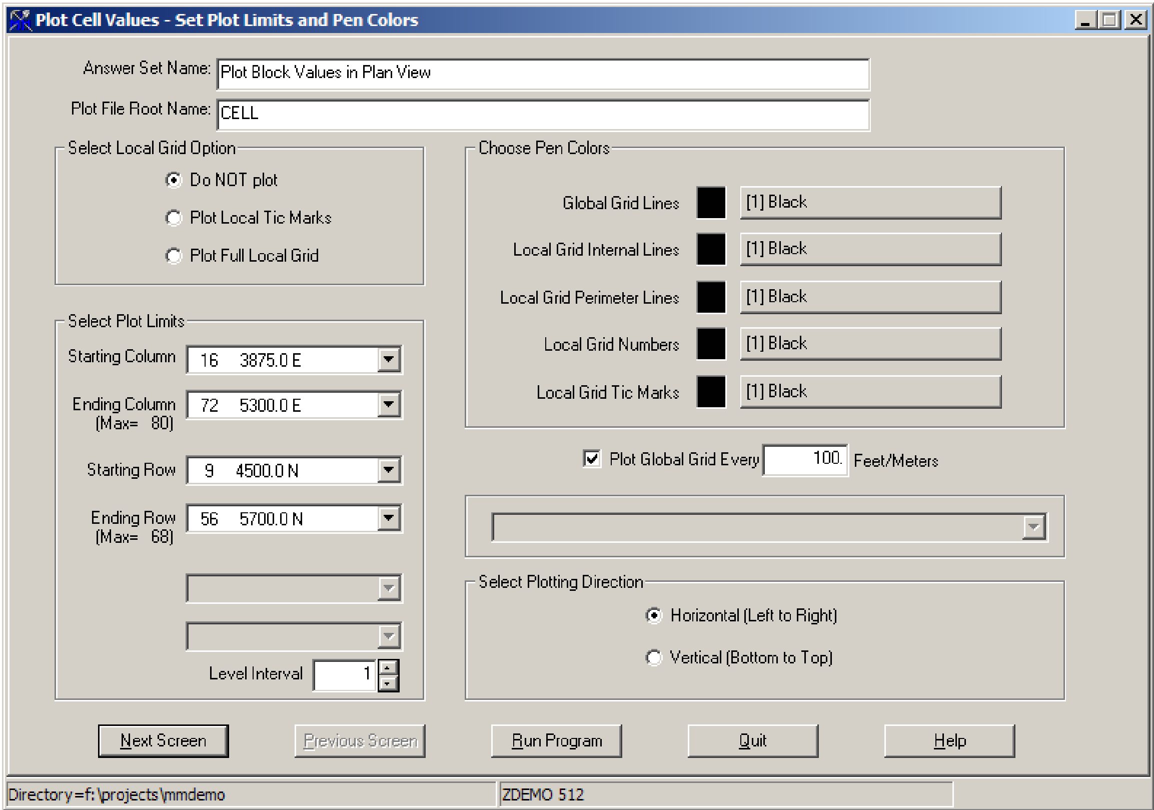


Figure 62 Cell Plot (Grade) Dialog Box 1

It is recommended to leave the values in the first dialog at default as seen in Figure 62.

- **[Next Screen]**

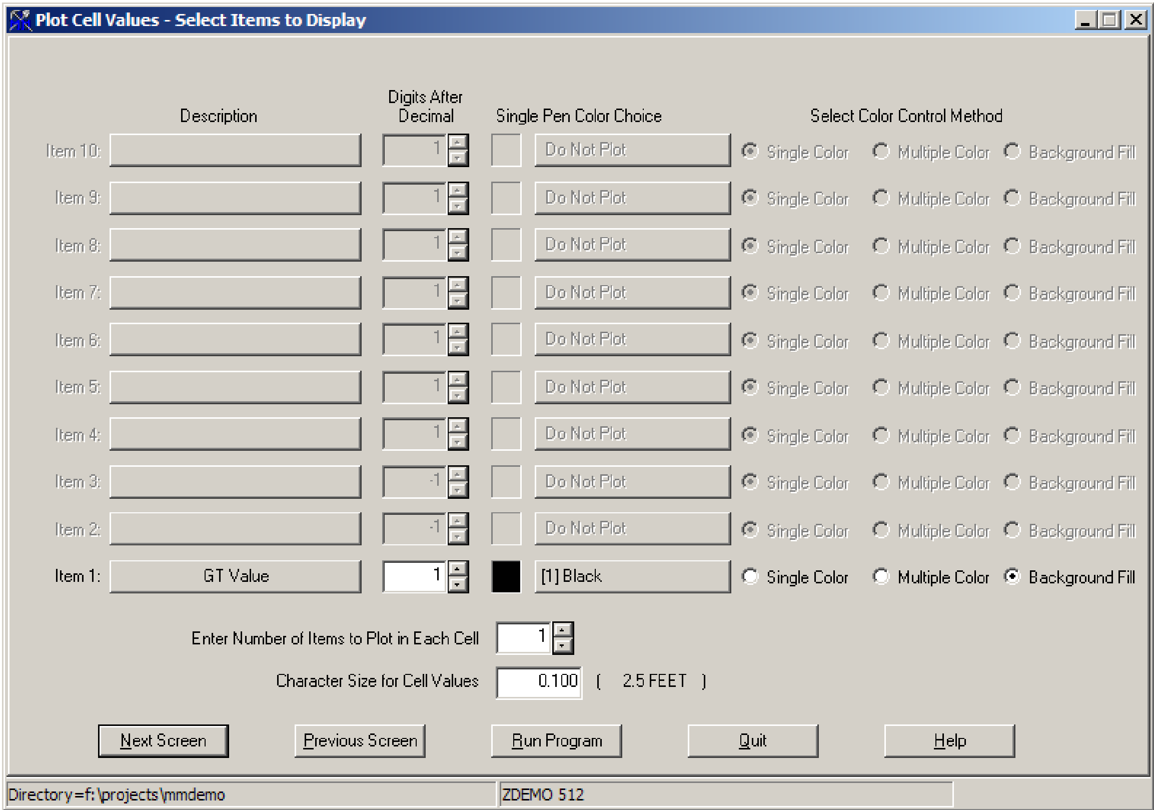


Figure 63 Cell Plot (Grade) Dialog Box 2

Leave everything at the default value but Select Color Control Method which should be set to Background Fill, as seen in Figure 63.

- **[Next Screen]**

Leave the next screen at its default values.

- **[Next Screen]**

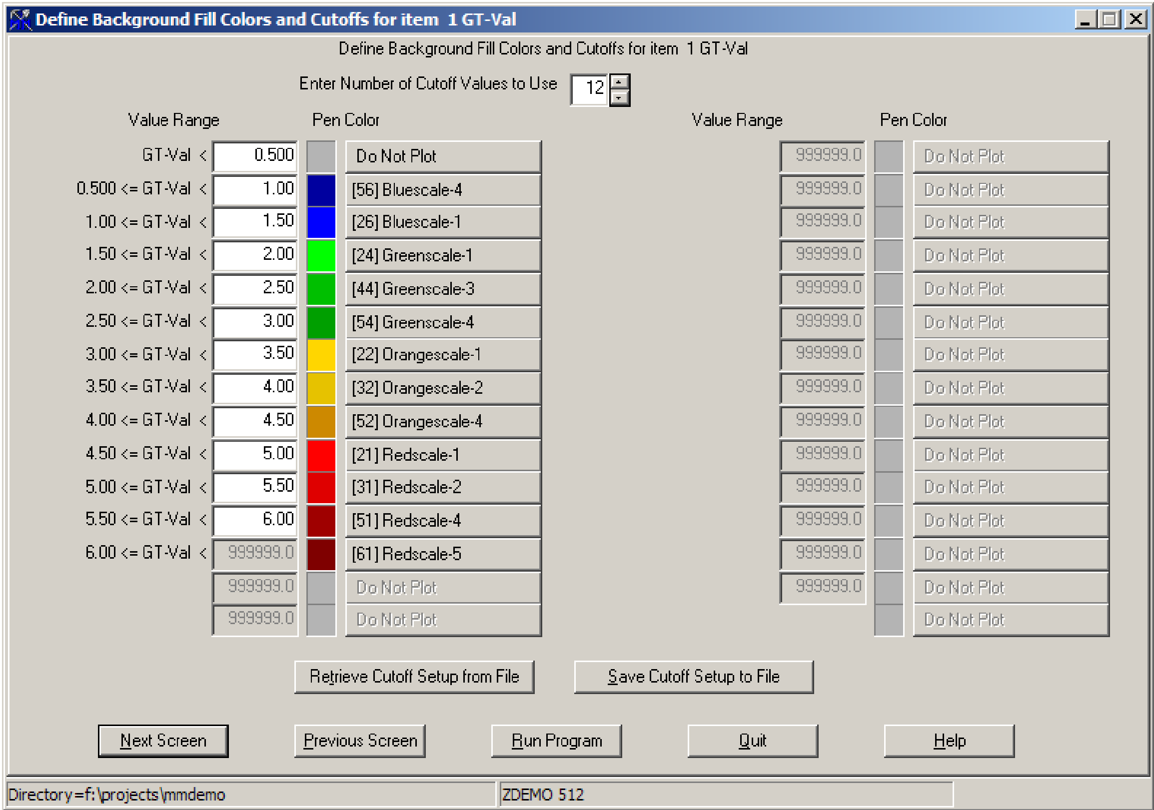


Figure 64 Cell Plot (Grade) Dialog Box 4

Build a gradient for the grade thickness like the one in Figure 64.

- **[Run Program]**

This cell view makes it easier to spot areas of high grade thickness for mine planning purposes. Right after creating both plots, use the Combine Plot function create an image like Figure 65.

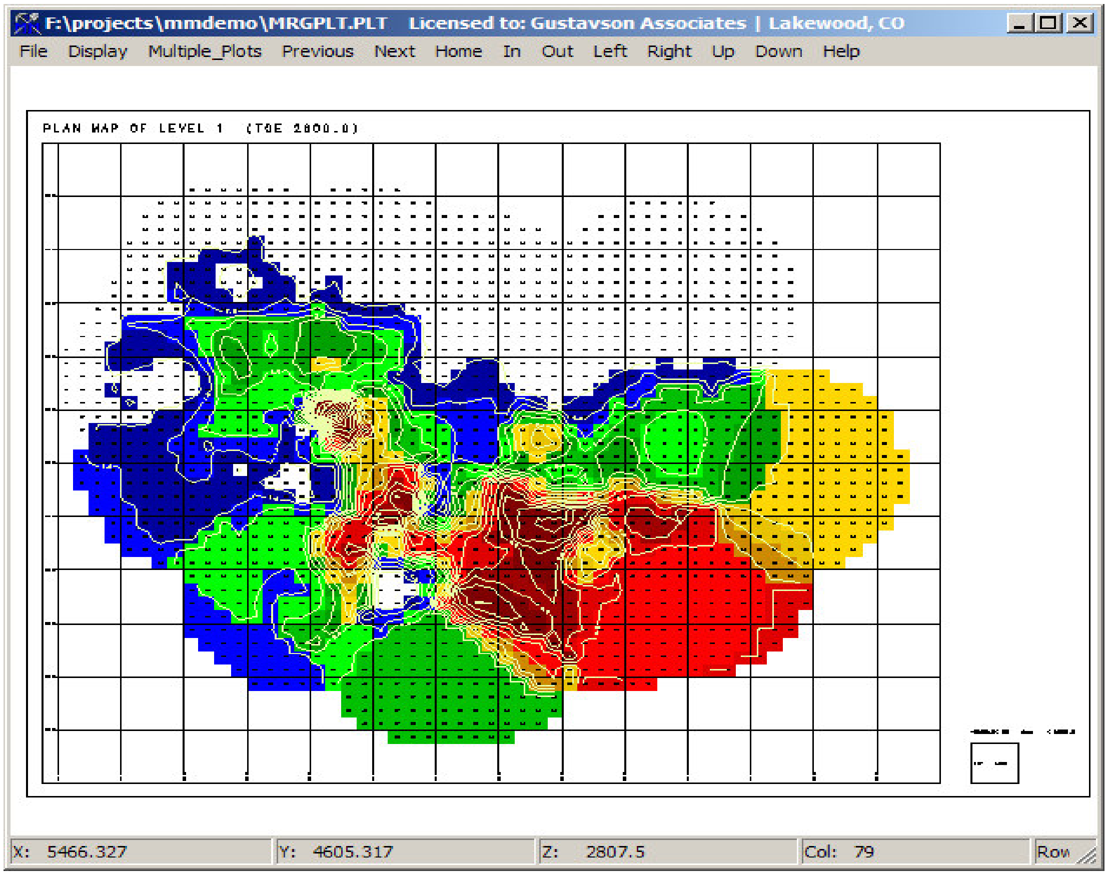


Figure 65 Cell Plot of Grade Thickness with Grade Thickness Superimposed Over It

1.26. Create a Combined Plot

[FileManager] – [6. Create a Combined Plot] -[Select an Answer Set]

This function overlays one plot on top of another as seen in Figure 49. To do this, the plots should be made in the same scale and view.

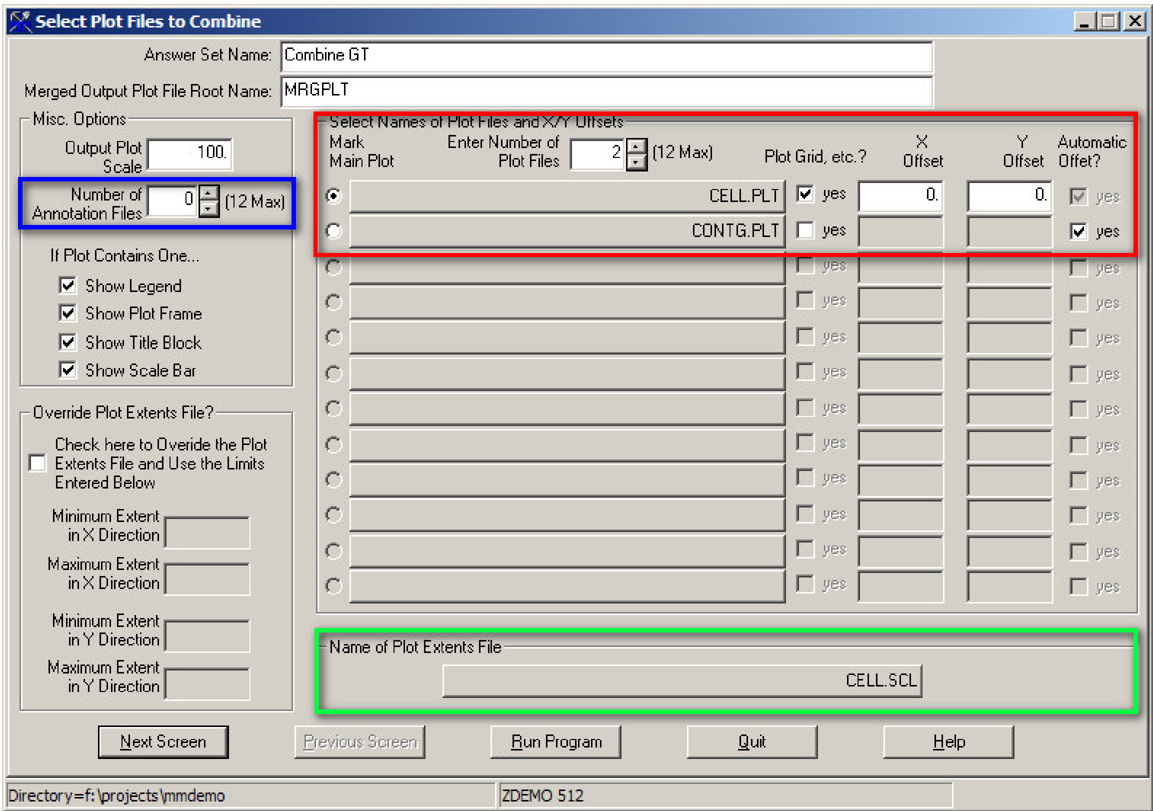


Figure 66 Combine Plot Dialog Box

1) Number of Annotation Files (**Blue**)

If you do not have any annotation files, set this value to zero. Annotation files are an easy way to add legend boxes, scale bars, north arrows, etc. to your plots. Some users prefer to export the plots to AutoCAD DXF, and then add the annotation using AutoCAD.

2) Select Names of Plot Files and X/Y Offsets (**Red**)

List the plots to be overlaid from bottom to top. The base plot should be listed first followed by the second plot and so on. The "Plot Grid, etc?" check box can be used to select/deselect display of any coordinate grids that are part of a plot. In most cases, you will choose to use automatic offsets. However, the manual offset feature can come in handy. For example, to display two plots side by side, use a manual offset in the X direction for the second plot that is equal to the width of the first plot.

3) Name of Plot Extents (**Green**)

Find the name of your base plot in the file by clicking on the grey box. Select your base plot name file ending in .SCL.

- **[Run Program]**

8) Statistics

There are several options for calculating sample, composite, and grade model statistics.

1.27. Calculate Sample Statistics

[Data Entry] – [11. Sample Frequency Analysis] -[Select an Answer Set]

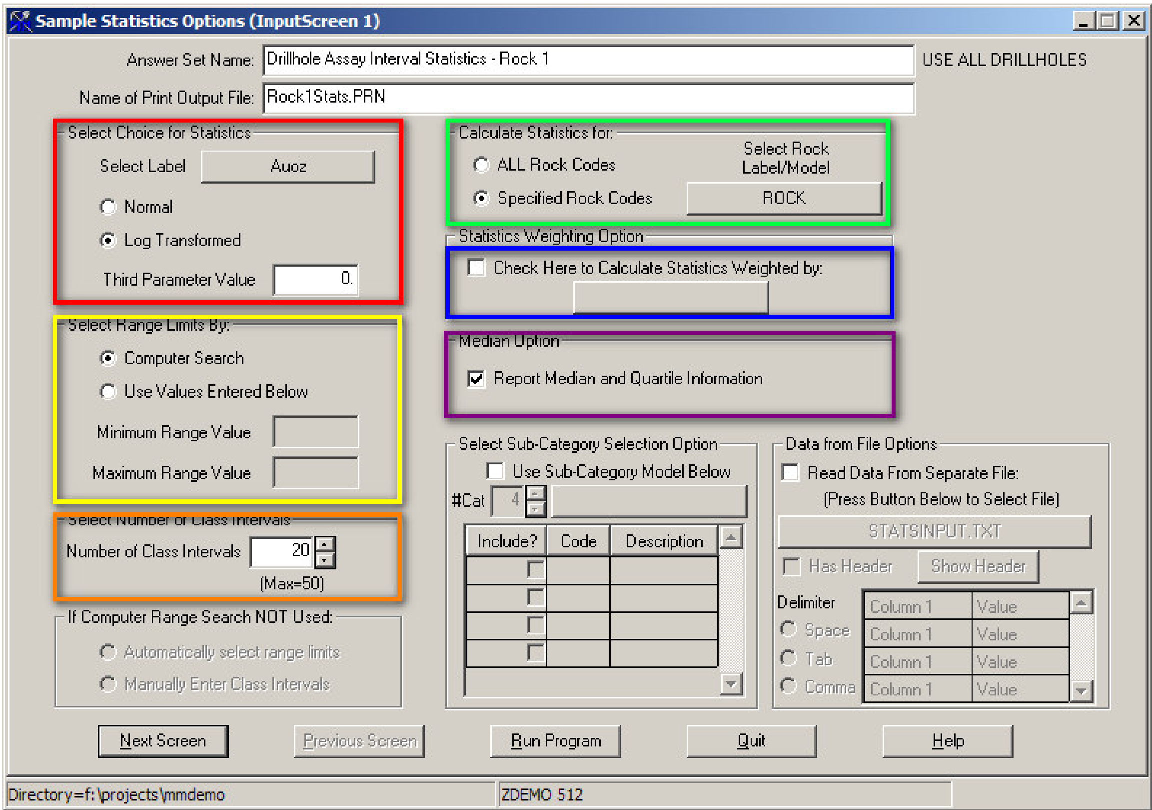


Figure 67 Sample Stastics Dialog Box 1

1) Select Choice for Statistics (**Red**)

The statistics can either be processed using normal or logarithmic statistics. It is most common to use logarithmic stats on base and precious metals. Normal statistics might be more appropriate for bulk deposits such as iron ore.

2) Select Range Limits (**Yellow**)

Select Computer Search to process all values. To calculate statistics above cut off grade only, select Use Values Entered Below and enter the cut off grade in the Minium Range Value box and change the Maximum Range Value box to the highest grade value of the samples. If Use Values Entered Below is selected, make sure that automatically select range limits is selected in the If Computer Range Search NOT Used options.

3) Select Number of Class Intervals (**Orange**)

This selects the number of intervals for the histogram. It is recommended to leave this at 20.

4) Calculate Statistics for (**Green**)

To calculate statistics for all rock types select ALL Rock Codes. In this example, we will be calculating statistics for one particular rock type (code 1), which is specified on a later input screen.

5) Statistics Weighing Option (**Blue**)

Checking this option will report weighted statistics in the statistics report. The drop down menus selects the label to use for the weight value. Weighting allows for the more accurate statistics based on some factor that makes the population different (greater length of core versus shorter lengths of core for example).

6) Median Option (**Purple**)

Select this option to get the median and quartile information. This is recommended.

- **[Next Screen]**

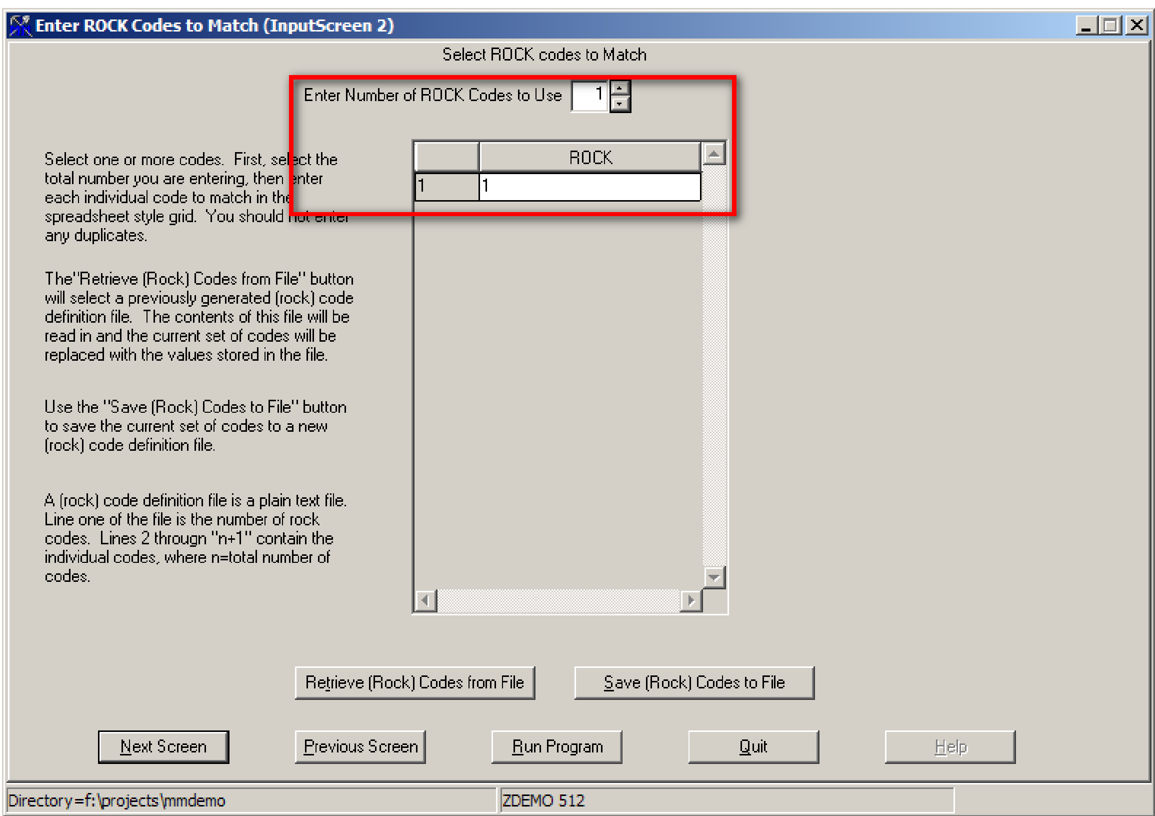


Figure 68 Sample Statistics Dialog Box 2

1) In the second screen, we specify that there is one rock code, and the individual code is 1.

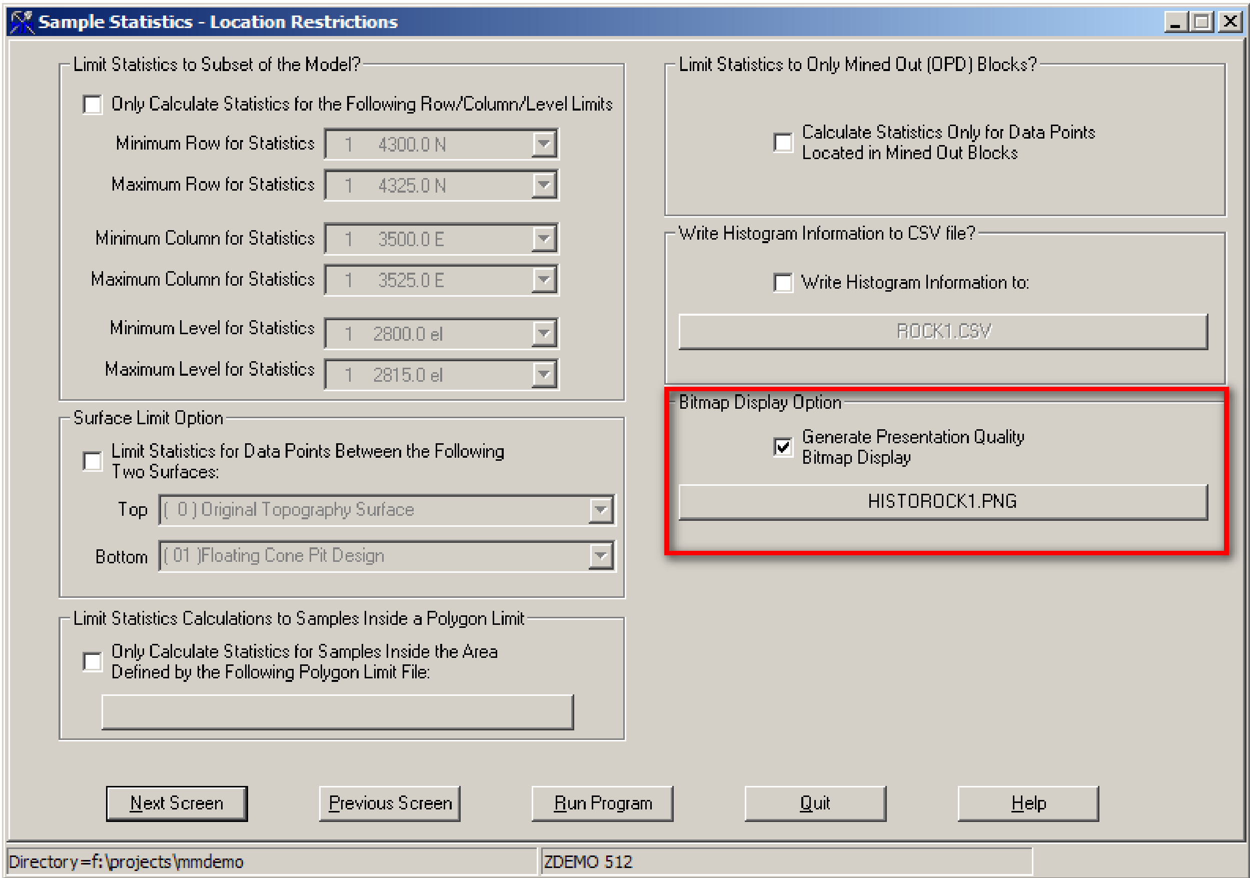


Figure 69 Sample Statistics Dialog 3 Choose Bitmap File

1) Bitmap Display Option (**Red**)

Check this box to produce a bitmap image of the histogram. Click on the file select button to name and save the file. In this case, we are creating HistoRock1.png.

- **[Run Program]**

After running, an image of the bitmap histogram will appear. When through viewing the histogram, close the window and the text editor will then display the printed output.

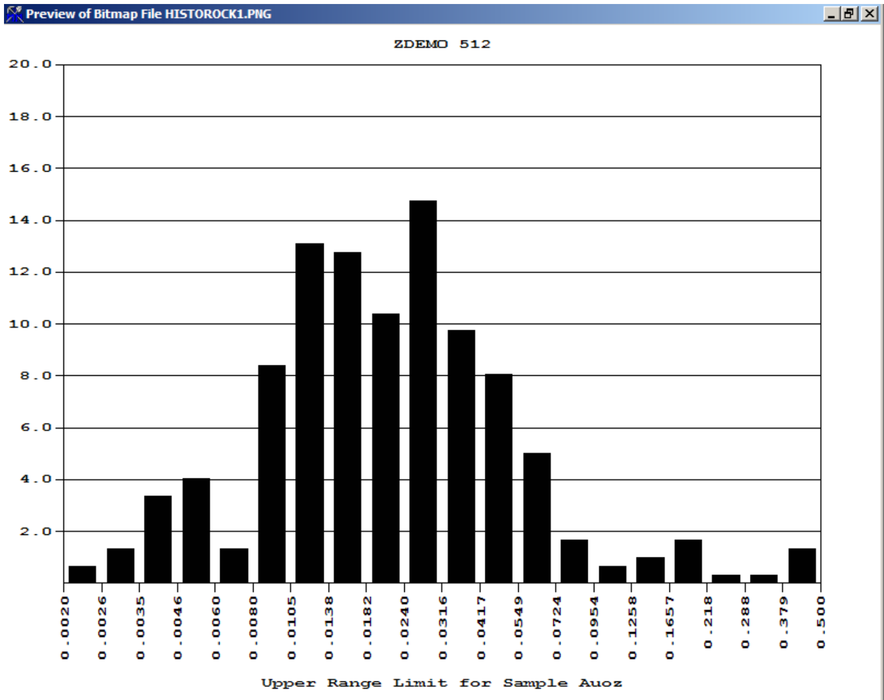


Figure 70 Histogram Image from Sample Statistics

```
NOTE: DH CLASS LIMITED TO THE FOLLOWING:

 1 = Diamond Drill Core
 2 = Rotary Drill Core
 3 = Other

NUMBER OF SAMPLE DRILLHOLES CURRENTLY USED     :      58
NUMBER OF SAMPLE ASSAY VALUES USED             :    2397
NUMBER OF COMPOSITE DRILLHOLES CURRENTLY USED  :      58
NUMBER OF COMPOSITE ASSAY VALUES USED          :     876

RUNTIME TITLE : Drillhole Assay Interval Statistics - Rock 1
PROJECT TITLE : ZDEMO 512

    DATA TYPE IS SAMPLE
    STATISTICS FOR LABEL : Auoz

    THIRD PARAMETER FOR LOG TRANSFORM =        0.000000
```

ROCK TYPE	SAMPLE COUNT MISSING	BELOW LIMITS	ABOVE LIMITS	INSIDE LIMITS	UNTRANSFORMED STATISTICS MINIMUM	MAXIMUM	MEAN	VARIANCE	STD. DEV.	COEF. OF VAR	LOG-TRANSFORMED STATS LOG MEAN	LOG VAR.	LOG STD.DEV	LOG-DERIVED MEAN	COEF. OF VAR.
1	4	1	0	298	0.00200	0.50000	0.03624	0.00376	0.06136	1.6930	-3.8524	0.8765	0.9362	0.0329	1.1842
ALL	4	1	0	298	0.00200	0.50000	0.03624	0.00376	0.06136	1.6930	-3.8524	0.8765	0.9362	0.0329	1.1842

ROCK TYPE	SAMPLE COUNT MISSING	BELOW LIMITS	ABOVE LIMITS	INSIDE LIMITS	MEDIAN STATISTICS MINIMUM	5TH PERCENTILE	25TH PERCENTILE	50TH PERCENTILE	75TH PERCENTILE	95TH PERCENTILE	99TH PERCENTILE	MAXIMUM
1	4	1	0	298	0.00200	0.00400	0.01200	0.02050	0.03675	0.10255	0.38175	0.50000
ALL	4	1	0	298	0.00200	0.00400	0.01200	0.02050	0.03675	0.10255	0.38175	0.50000

Figure 71 Image of Sample Statistics Printout

1.28. Add a New Label and Sample Decluster Tool

After initial drillhole data has been loaded into MicroMODEL, it is sometimes necessary to add new fields to the sample or composite database. The most common useage is to add a field for storing a metal equivalent. Another application might be to combine several lithology codes into a new, consolidated code. If the sample declustering tool is going to be run, then a new label for storing the declustering weight *MUST* be added before declustering. The input screen below shows how the declustering weight is added with the Database Editing > Add Labels choice.

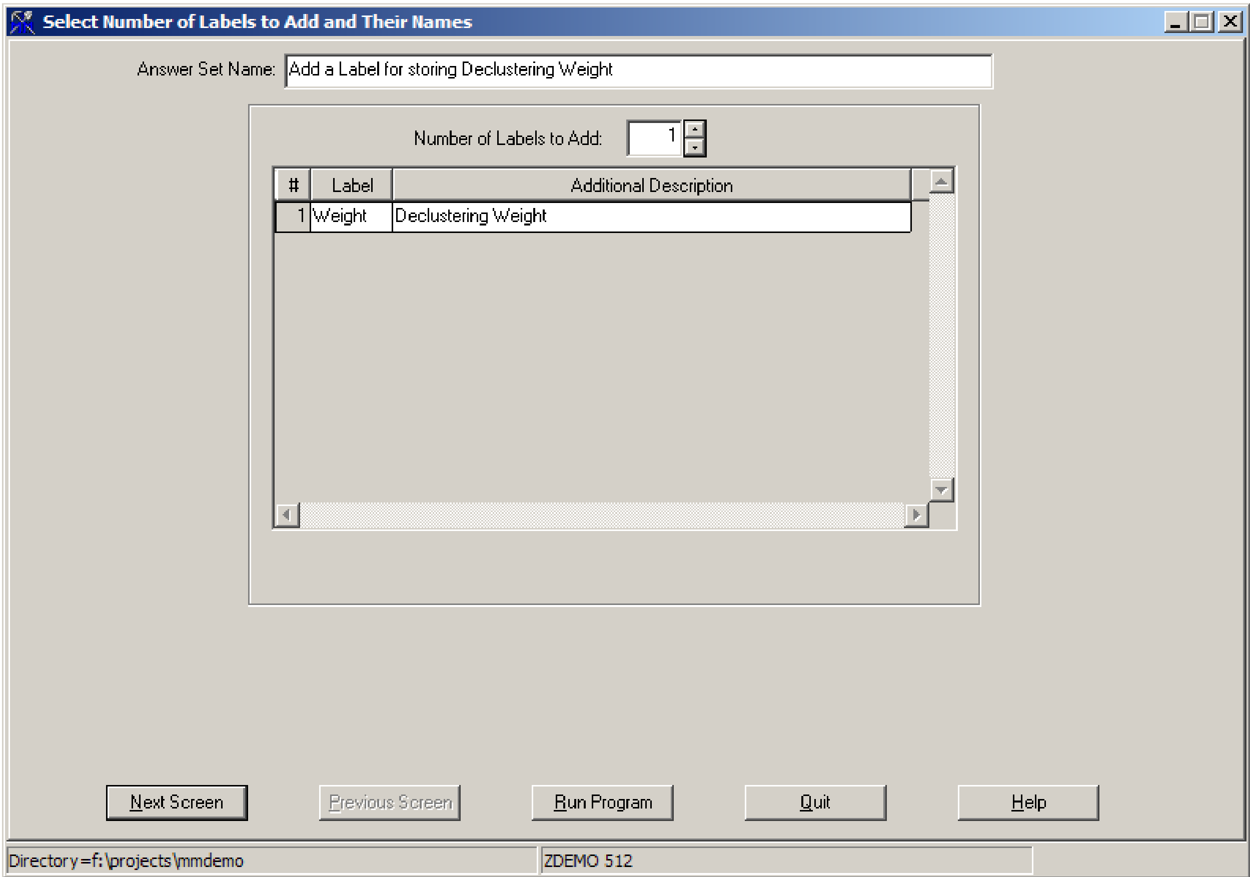


Figure 72Add Sample Label for Declustering Weight

The sample declustering analysis tool comes straight from the GSLIB program. It is used to determine the most likely sample mean for an irregularly spaced drilling grid. Here is a sample input screen from the declustering tool:

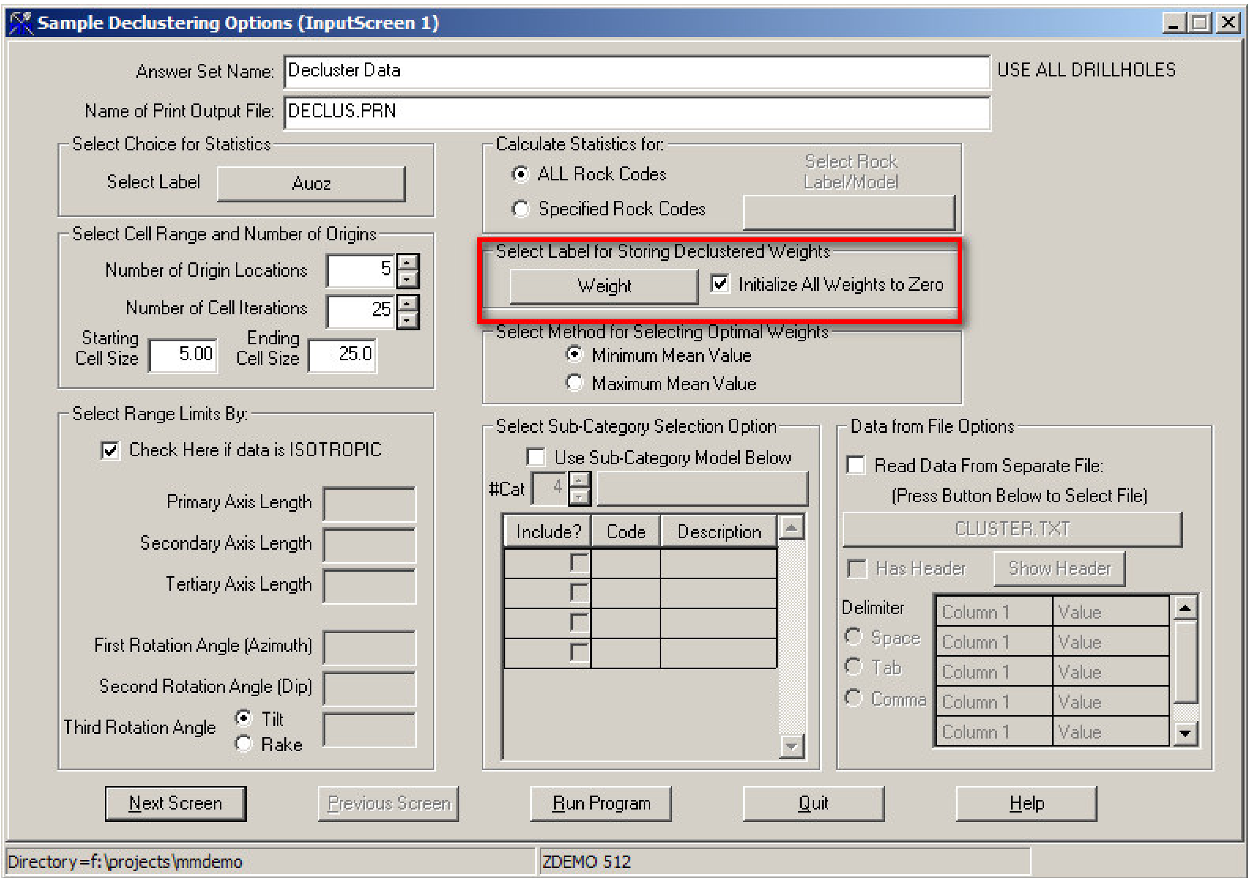


Figure 73 Sample Declustering Options

Note that it is VERY IMPORTANT to set the label for storing declustered weights to the newly added label “Weight”. It is very easy to accidently overwrite an input label, such as our AuOz label, with this program. The output generated by the program is shown below, compliments of Leland Stanford Junior University.

```
Decluster Data
DECLUS C Copyright (C) 1996
The Board of Trustees of the Leland Stanford
Junior University.  All rights reserved.

2
Cell Size
Declustered Mean

 There are      2393 data with:
   mean value              =      0.01633
   minimum and maximum     =      0.00000     0.50000
   size of data vol in X =    944.80005
   size of data vol in Y =   1428.65002
   size of data vol in Z =    293.00000

          0.000            0.01633
          5.000            0.01627
          5.833            0.01631
          6.667            0.01636
          7.500            0.01648
          8.333            0.01656
          9.167            0.01658
         10.000            0.01651
         10.833            0.01659
         11.667            0.01646
         12.500            0.01653
         13.333            0.01664
         14.167            0.01671
         15.000            0.01668
         15.833            0.01657
         16.667            0.01658
         17.500            0.01657
         18.333            0.01691
         19.167            0.01665
         20.000            0.01663
         20.833            0.01661
         21.667            0.01673
         22.500            0.01673
         23.333            0.01650
         24.167            0.01665
         25.000            0.01671
  BEST =>
          5.000            0.01627
```

Figure 74 Declustering Program Output

1.29. Sample Cumulative Frequency

You may create either a normal or logarithmic cumulative frequency plot with MicroMODEL. The data can be limited to one or more rock types, and can be further limited by a sub-category model. Data can be further limited by row/column/level limits, between two topography surfaces, or within a given polygon boundary.

MicroMODEL will produce a bitmap file, suitable for direct insertion to a report, as well as a standard plot file that can be viewed with the viewer program or converted to DXF output. Two or more cumulative frequency plots can be combined into a new bitmap or standard plot file.

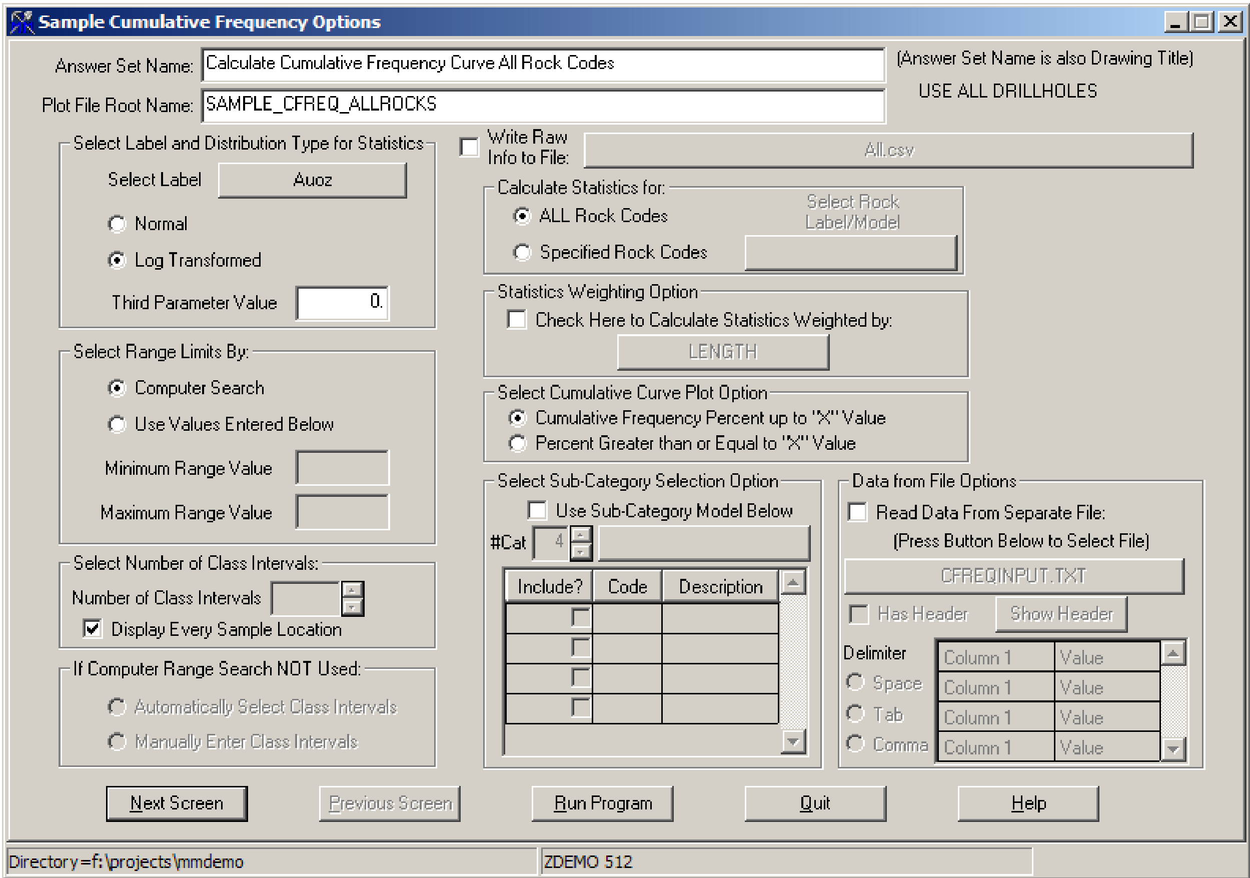


Figure 75 Sample Cumulative Frequency Plot Dialog 1

In the first input screen, the sample label, distribution type (normal/lognormal), and various other parameters are specified. Note that we are calculating the cumulative frequency for All Rock Codes.

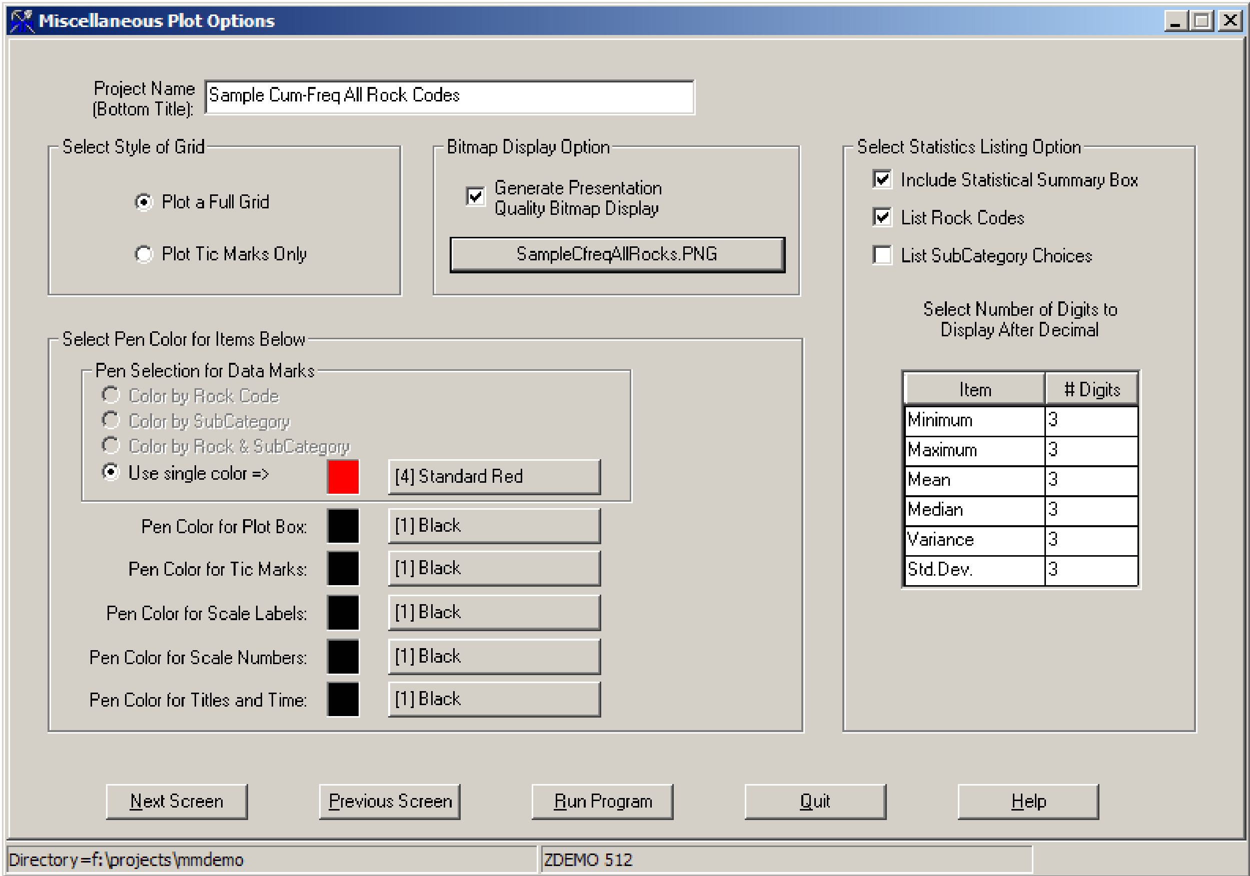


Figure 76 Sample Cumulative Frequency Plot Dialog 2

In the second input screen, we supply various responses that control the appearance of the cumulative frequency plot. We are displaying the data points in red. Note that the Bitmap Display Option has been checked, and we are saving the bitmapin file SampleCfreqAllRocks.PNG.

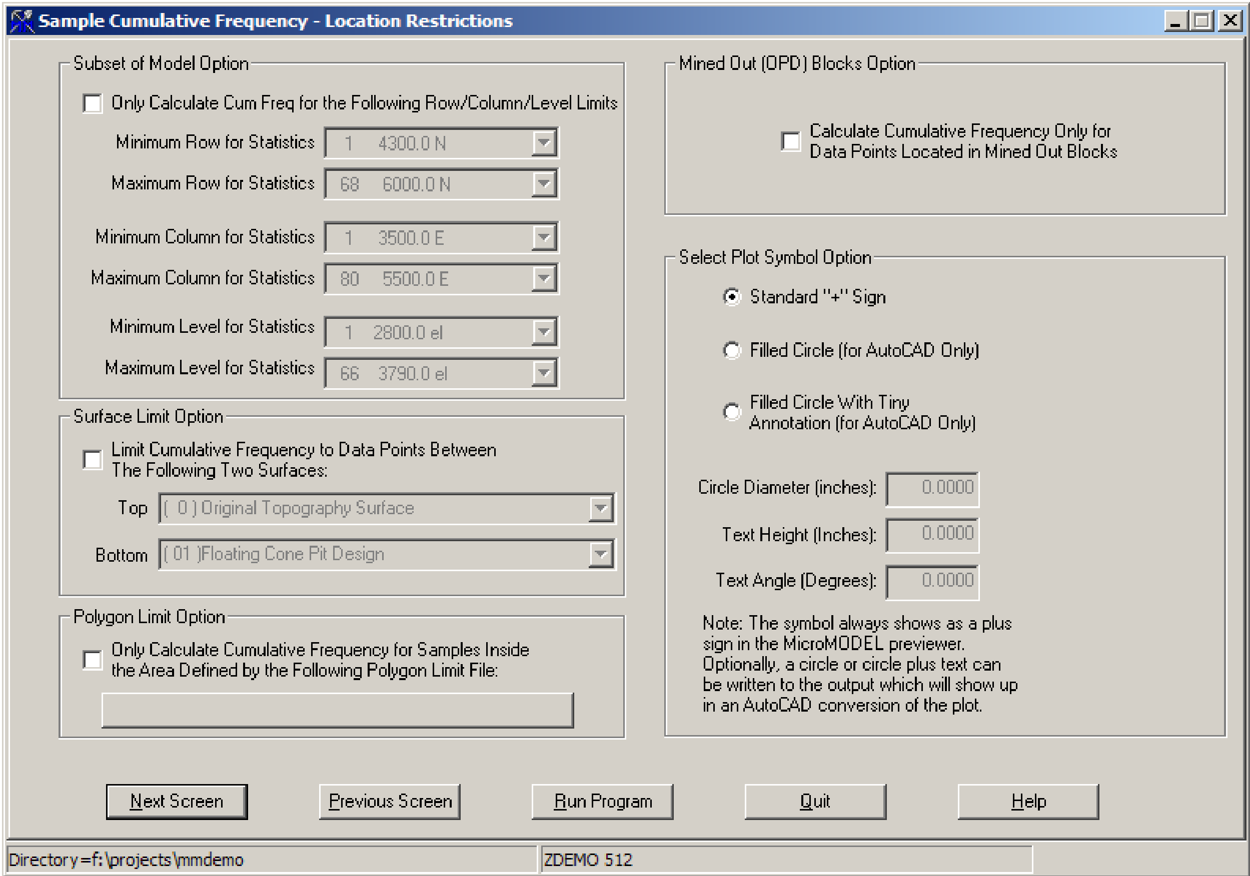
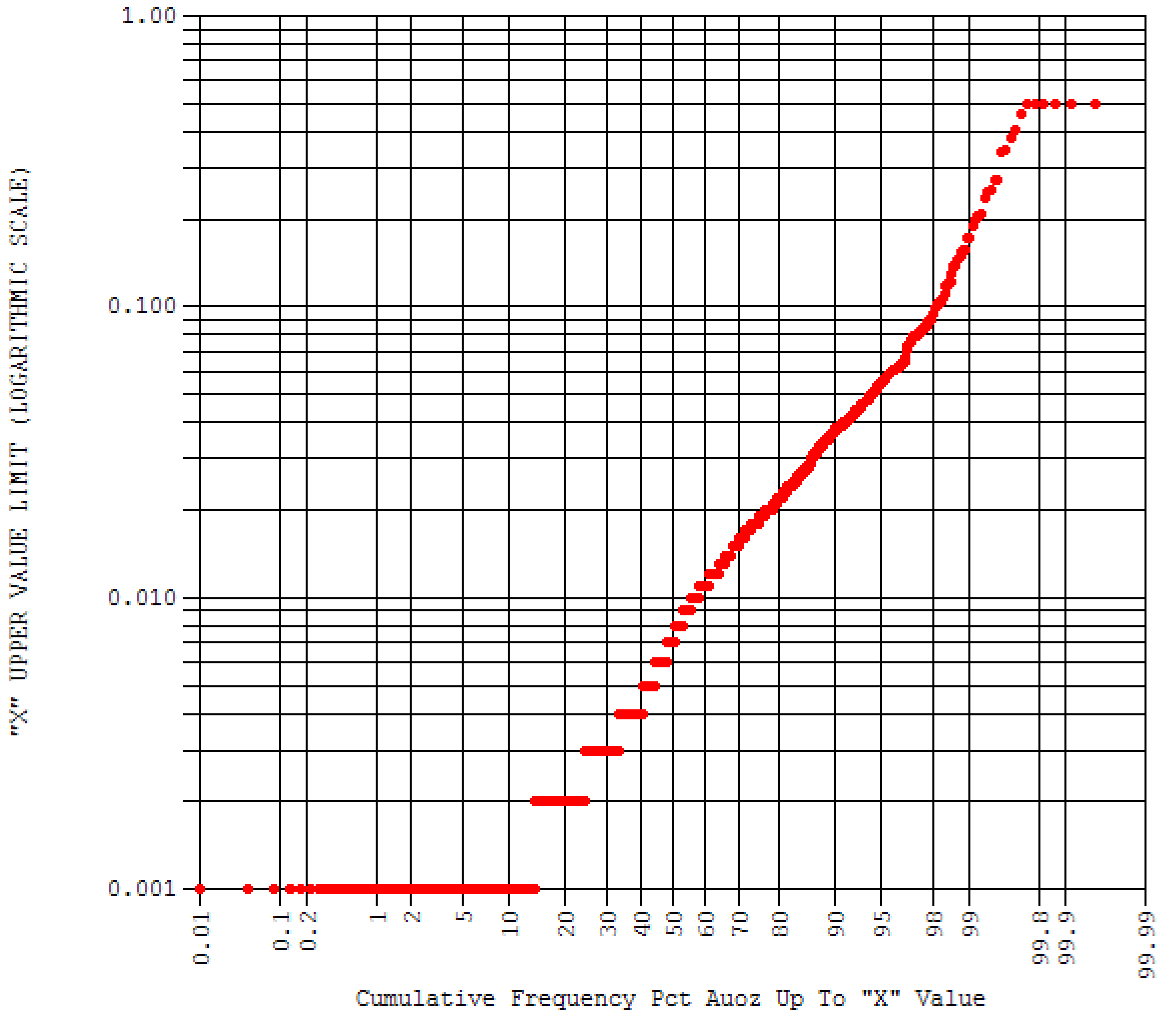


Figure 77 Sample Cumulative Frequency Plot Dialog 3

In the final input screen, the user can invoke various options that control where the data points come from for the cumulative frequency plot. There is also a plot symbol option. This option should always be set to the standard plus sign, unless you specifically want to use the special DXF symbol handling option.

The resulting cumulative frequency bitmap output is shown below.



Sample Cum-Freq All Rock Codes

Number of Samples:	2397	Minimum Value:	0.001
Number Missing:	4	Maximum Value:	0.500
Number Below Limits:	118		
Number Above Limits:	0	Mean Value:	0.017
Number in Range:	2275	Median Value:	0.007
		Variance:	0.002
		Standard Deviation:	0.039

Match ROCK Codes: (ALL)

Figure 78 Sample Cumulative Frequency Plot

Now, let's generate a combine display of the cumulate frequency curves for rock 1, rock 2, and rock 3. In order to generate such a display, we need to run the cumulative frequency program three different times, once for each rock type. We generate a simple CSV file containing a list of the data points for each rock type. After generating the three CSV files, we combine them together into a single display using Special Tools > Combine Multiple Cumulative Frequency Plots.

Here are the first and second input screens used to generate the CSV file for Rock code 1.

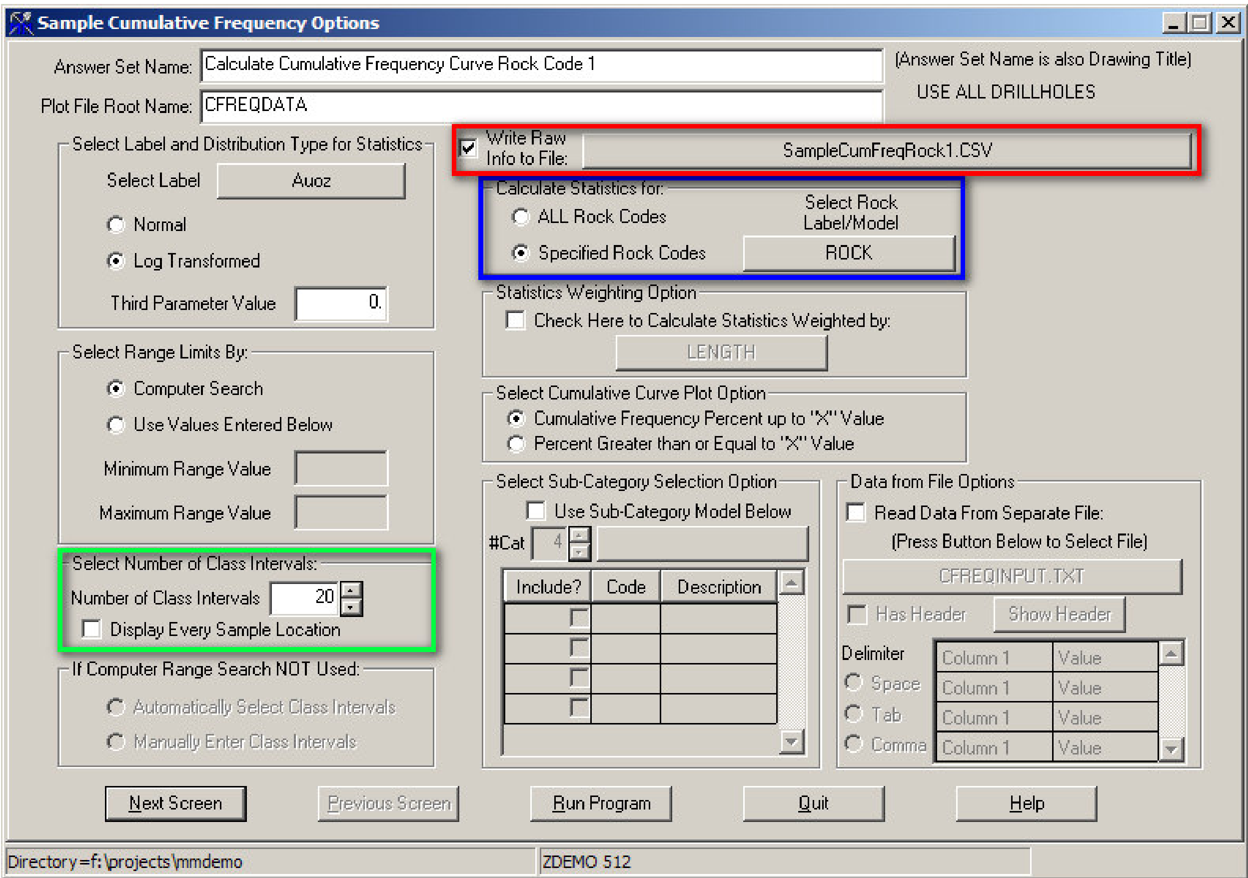


Figure 79 Generate Cumulative Frequency CSV File Dialog 1

In the first screen, we have asked to display 20 data points (green). We are writing the cumulative frequency data points to a text file called SampleCumFreqRock1.CSV (red). We are requesting that the cumulative frequency be calculated based on specified rock codes(blue).

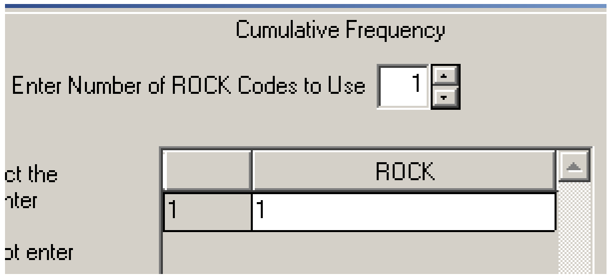


Figure 80 Generate Cumulative Frequency CSV File Dialog 2

We want to generate a cumulative frequency plot for rock code 1. In the second input screen, we select 1 ROCK Code to Use, and specify that this single code is ROCK 1. We run the cumulative frequency program and generate the raw data CSV file. This step is repeated for rock codes 2 and 3 so that we have three raw data files with which to generate our combined cumulative frequency display. Here are the input settings that we use:

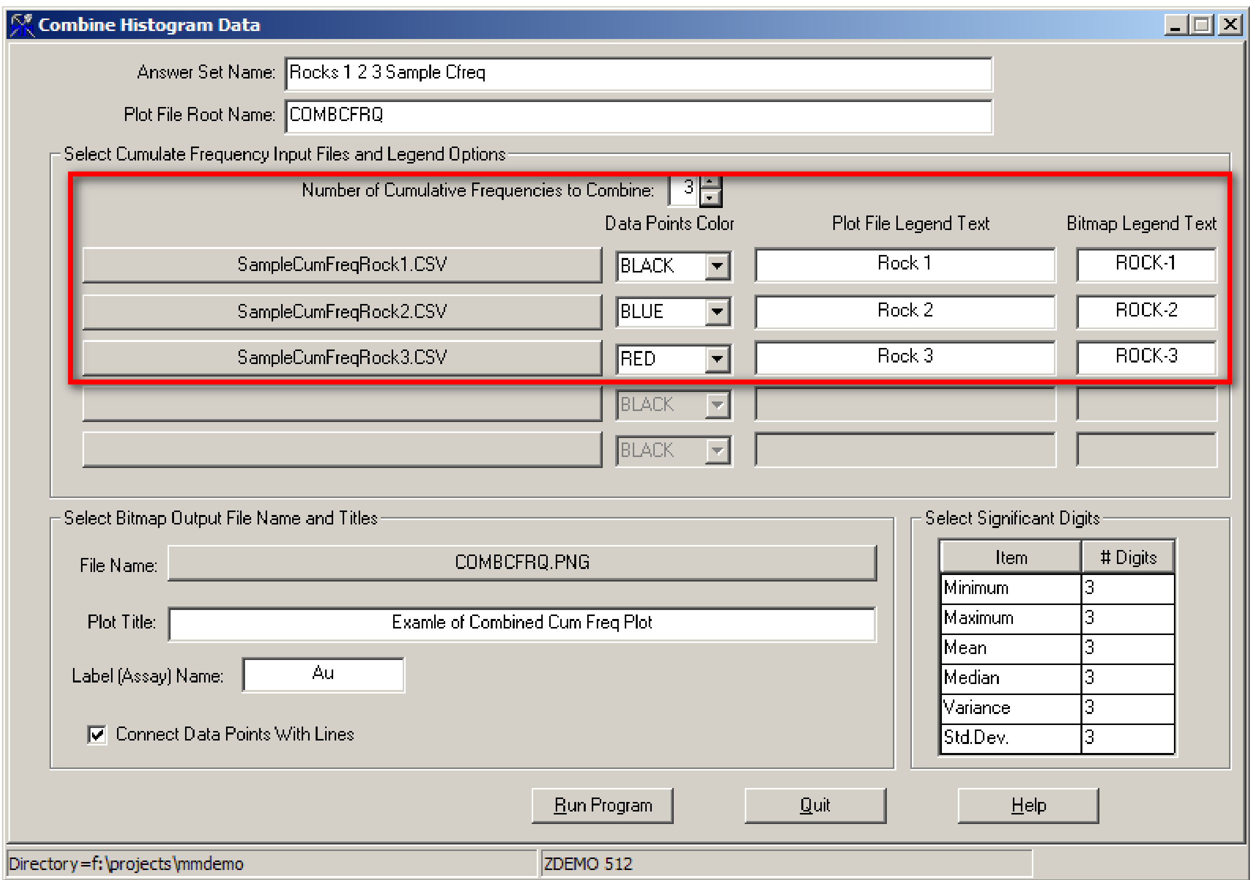
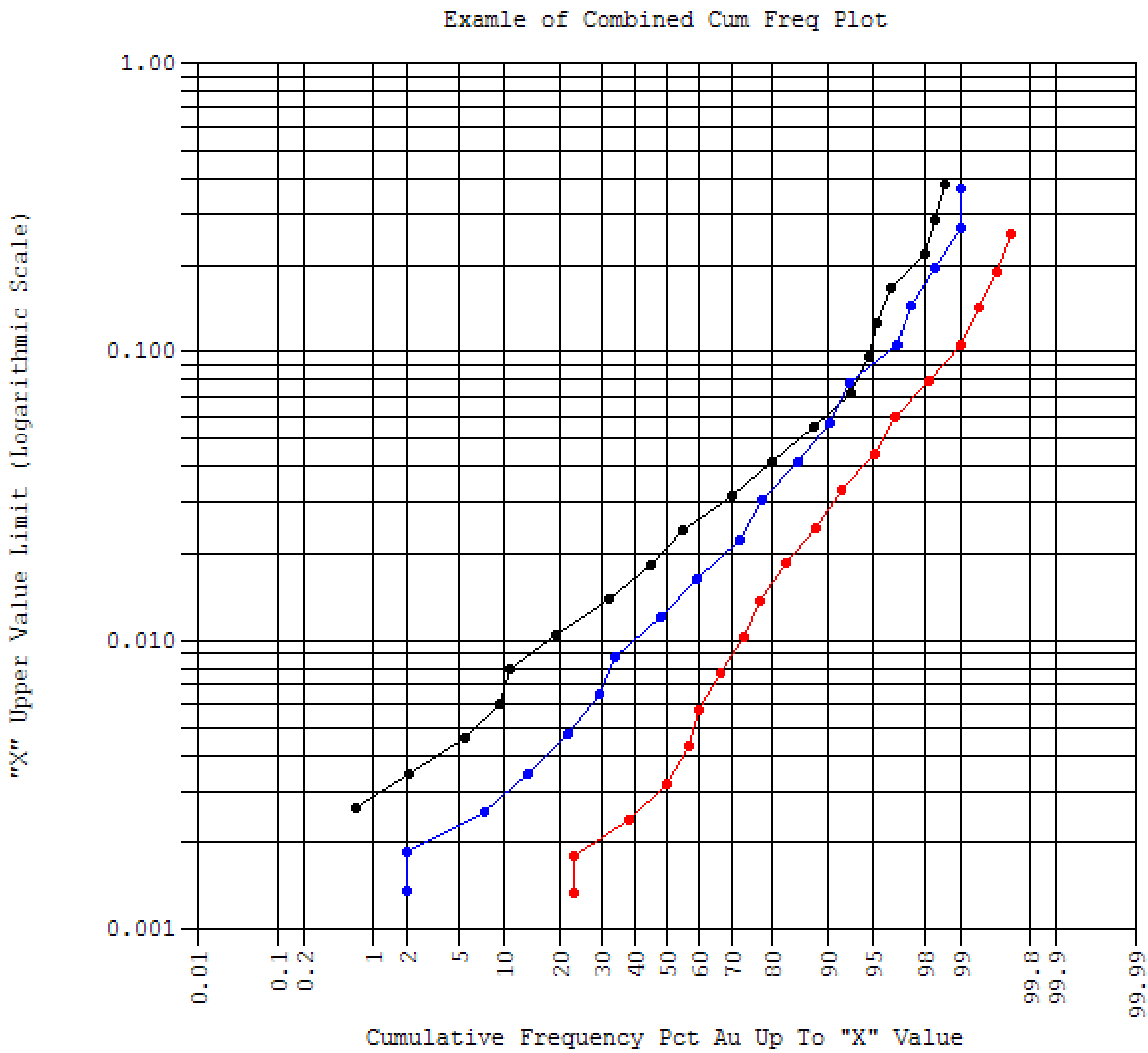


Figure 81 Combine Multiple Cumulative Frequencies Dialog 1

Note that we specify three input files, and select the files with the pushbuttons on the left. The data point color is selected from the dropdown color menu. Legends for both the traditional plot file and the bitmap file can be specified (red). The bitmap file that is created (COMBCFRQ.PNG) is shown below:



	ROCK-1	ROCK-2	ROCK-3
Number of Samples:	303	300	999
Number Missing:	4	0	0
Number Below Limits:	1	0	84
Number Above Limits:	0	0	0
Number in Range:	298	300	915
Minimum Value:	0.002	0.001	0.001
Maximum Value:	0.500	0.500	0.340
Mean Value:	0.036	0.027	0.012
Median Value:	0.021	0.013	0.004
Variance:	0.004	0.003	0.001
Standard Deviation:	0.061	0.057	0.025

Figure 82 Plot of Three Separate Cumulative Frequencies

1.30. Correlation

(Video 36)

1.31. Calculate Sample Statistics

[Composite] – [11. Composite Frequency Analysis and Basic Statistics] -[Select an Answer Set]

The method for finding the statistics for composites is the same as for samples.

9) Rock Model

1.32. Create Rock Model from Sample/Composite Data

Building a 3-D rock model allows you to see differences in geology, identify possible geologic structures, and find associations between grade and rock type. A rock model must be created in order to create grade models and use the open pit design (OPD) system.

Creating the rock model from sample/composite data is a quick way to generate a rough model of the geology. It is recommended that some other, more involved method be used to create a proper geology model. For example, digitizing the geology on regularly spaced sections should provide a “better” model of the geology.

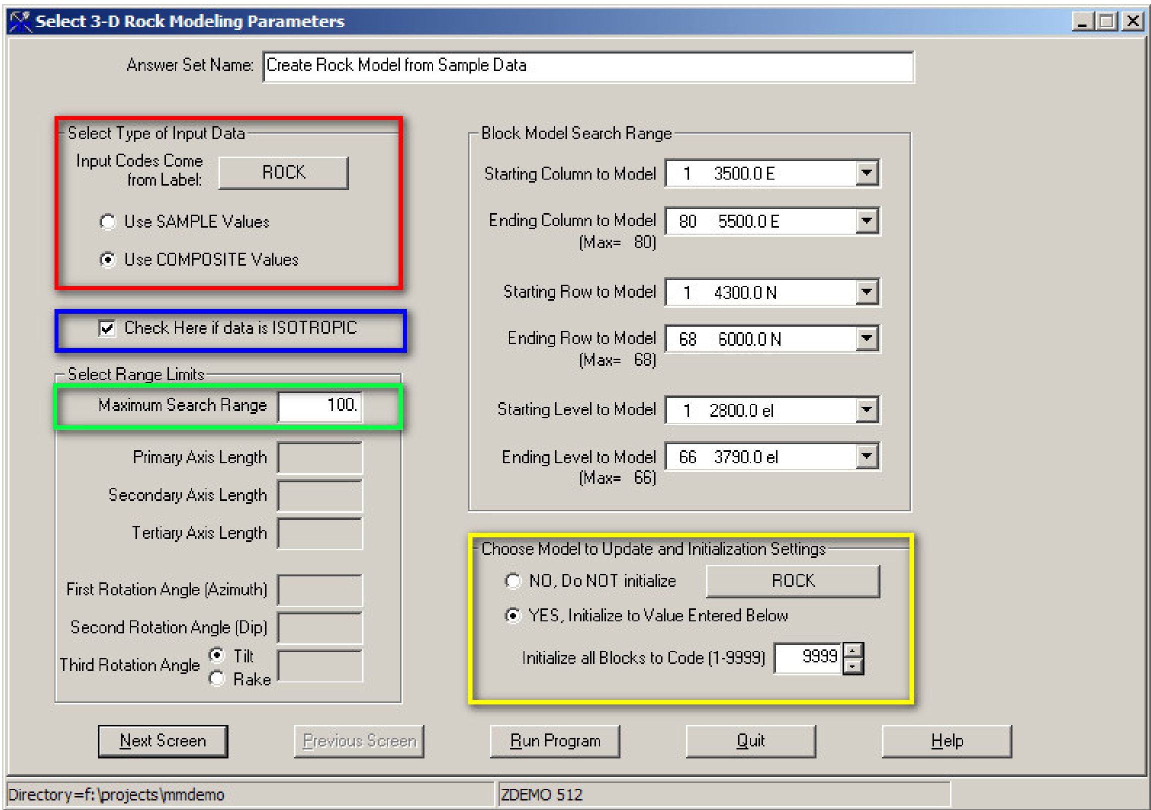


Figure 83 Create Rock Model Dialog Box 1

1) Input Codes Come From Label (**Red**)

Make sure the grey box is set to the Rock label. For this example, we have chosen composites as our source of data.

2) Check Here if data is ISOTROPIC (**Blue**)

Make sure this box is checked.

3) Maximum Search Range (**Green**)

This the maximum distance that is searched in assigning a rock code to each block. Depending on the size of the model and the density of the drillholes between 100 feet and 300 feet is recommended. For less dense and larger areas use a higher value.

4) Choose Model to Update and Initialization Settings (Yellow)

Select YES, Initialize to Value Entered Below. Initialize all blocks to 9999 to see which ones the model didn't code. All blocks that don't have any data in range will be coded 9999.

- **[Run Program]**

After the model is made , it is possible to make cross sections and plan view grids of the rock types. This can be useful for identifying structures and trends. Here is a cross section, showing each of the six rock types plus the background code in different colors:

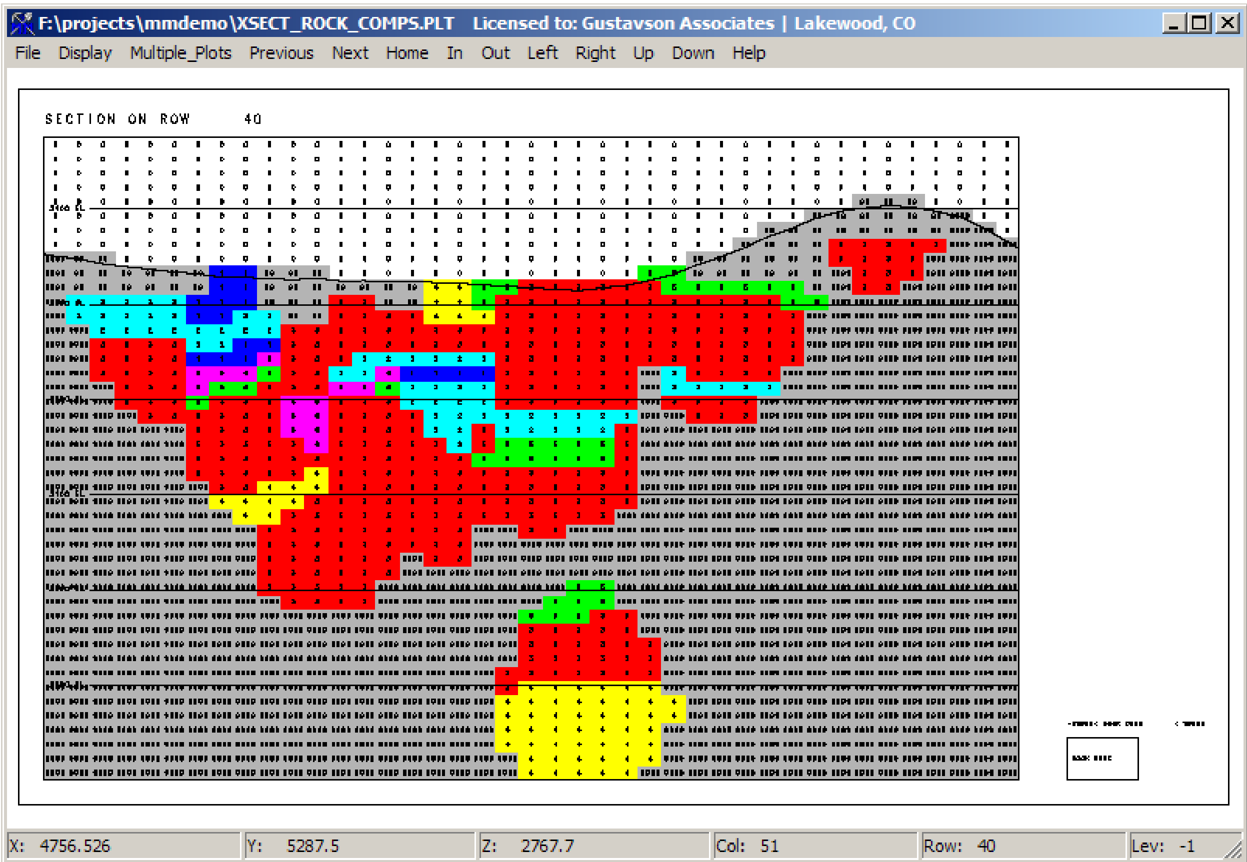


Figure 84 Plot of Rock Codes Modeled from Composite Data

1.33. Create Default Rock Model

In some instances, it may be necessary to build a “quick and dirty” homogenous rock model consisting of a single code. The way to do this is via the choice “Create/Update Rock Model from Plan Polygons”. This program would normally apply digitized polygon shapes to create a rock model, but it can also be used to initialize a simple rock model.

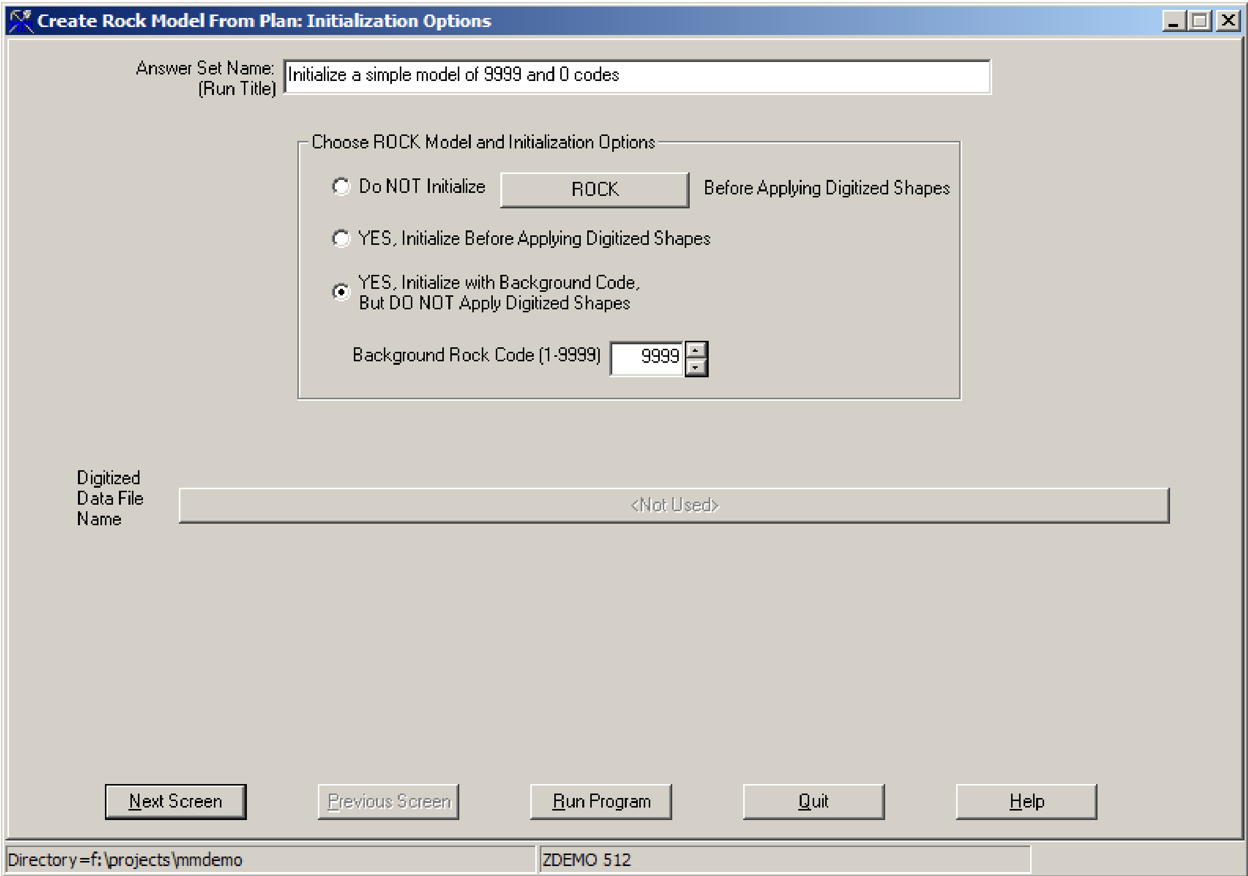


Figure 85 Create Default Rock Model Dialog 1

Select the responses shown in the above input screen and run the program. It will produce a simple rock model which consists of code 9999 for blocks that have any portion below the current topography grid (T200), and code 0 for blocks that are totally air. Here is what the simple rock model looks like in section view.

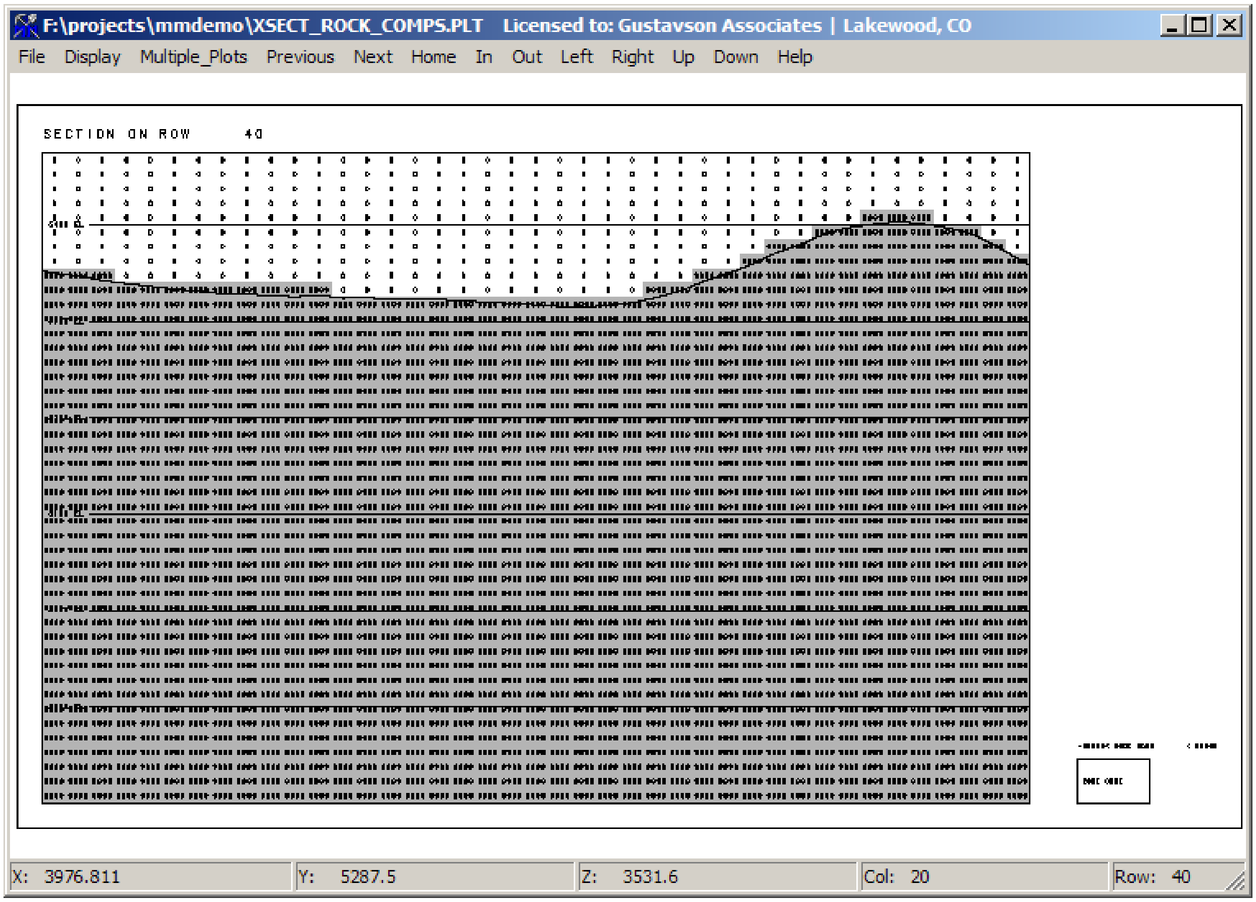


Figure 86 Display of Default Rock Model

1.33. Create Rock Model from Section Polygons

For a project that is in a more mature stage of development, the rock model should be better defined, either via plan view polygons, wireframe models, or section view polygons. For this example project, we have a set of ore zone polygons that have been drawn on each of four pre-defined sections. The input polygon file (POLY.RKS) was generated using the PolyMap Program. The ore zones are very simple, and consist of one or two contiguous zone on each section. The input parameters are as follows (Rock Modeling; Create/Update Rock Model from Section Polygons):

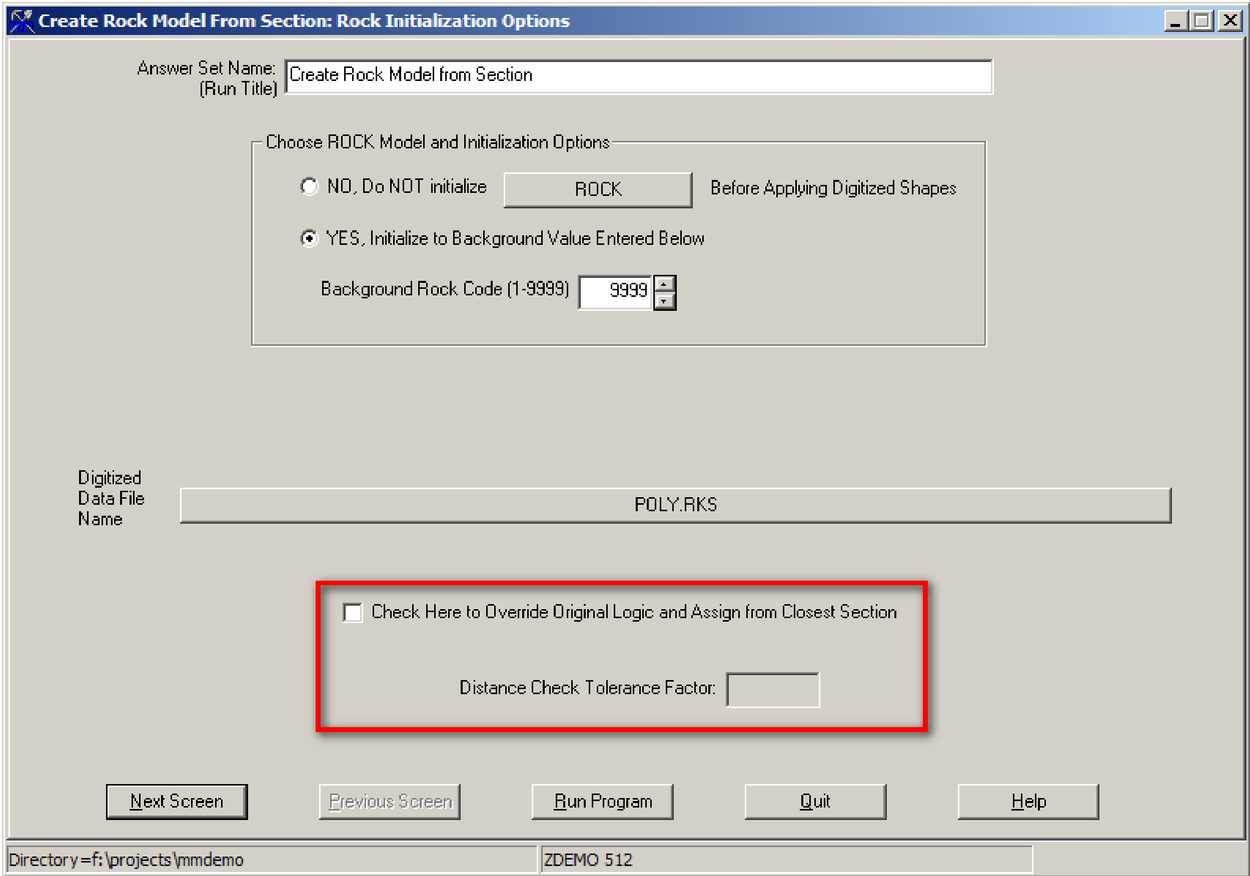


Figure 87 Create Rock Model from Section Polygons Dialog 1

The range of influence from each section behind/in-front has been specified in the Polymap program. The checkbox in the red box can be used to override the fixed values and force block assignment from the nearest section. This option is useful when the section spacing is irregular. For this example, the sections are 100 feet apart, so the distance of influence is +/- 50 feet in all cases.

After the assignment program has been run, use the plot angled section from the Rock Model graphical display to check the sections. We use the fourth method for endpoint selection, which displays all sections that are defined as part of include group 1. We color the rock code cyan for air blocks (rock code 0), red for ore zone blocks (rock code 1), and yellow for waste blocks (rock code 9999).

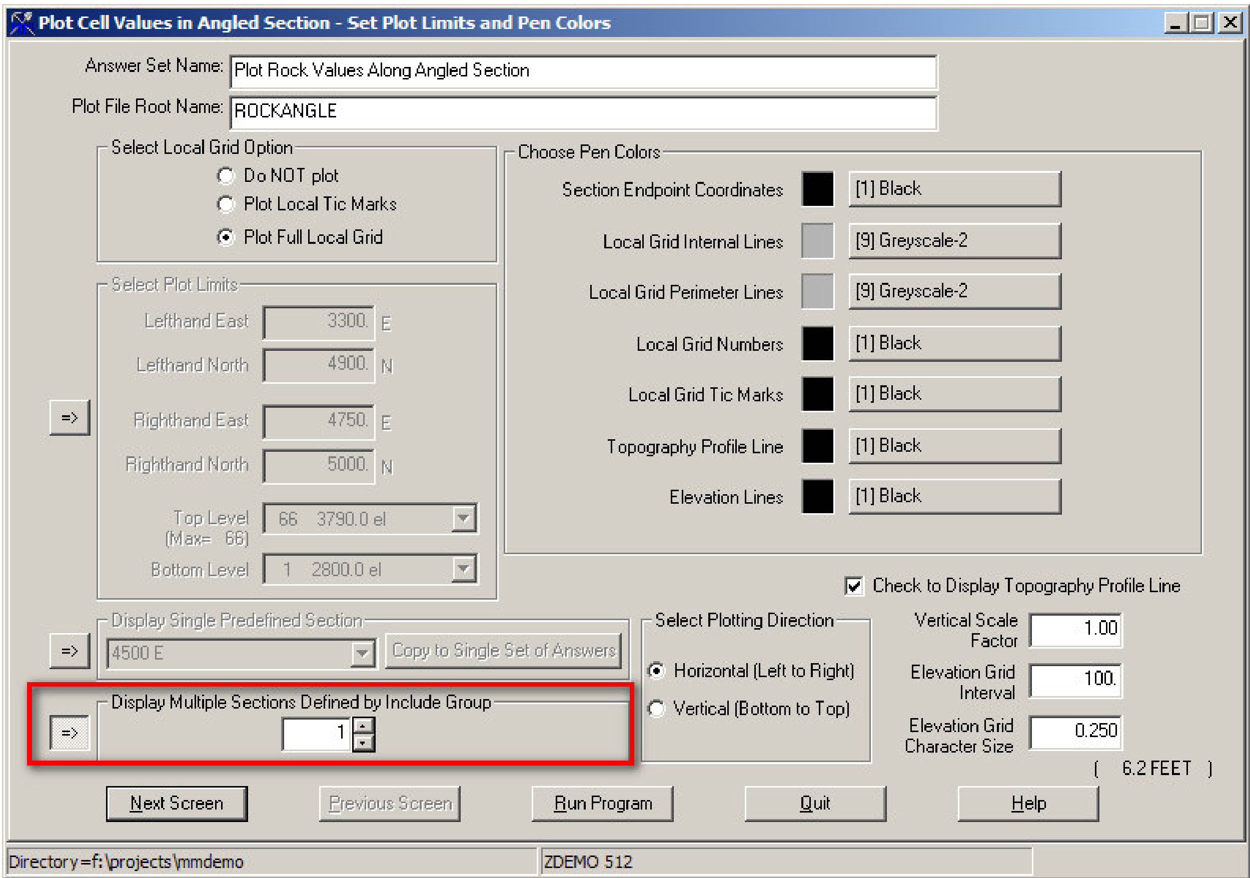


Figure 88 Plot Cell Values in Angled Section Dialog 1

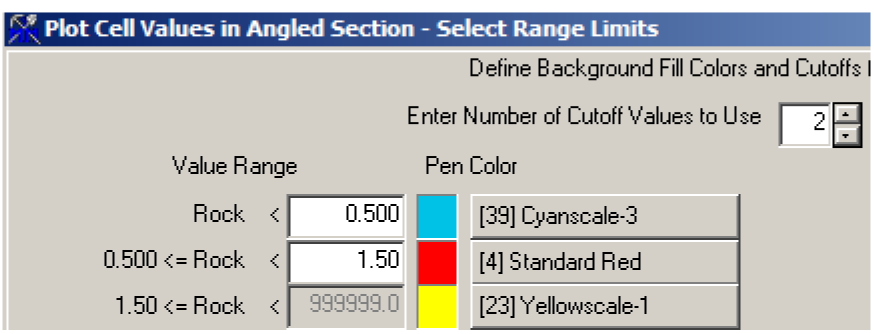


Figure 89 Create Ore Zone Rock Model Display

Here is what one of the four sections looks like:

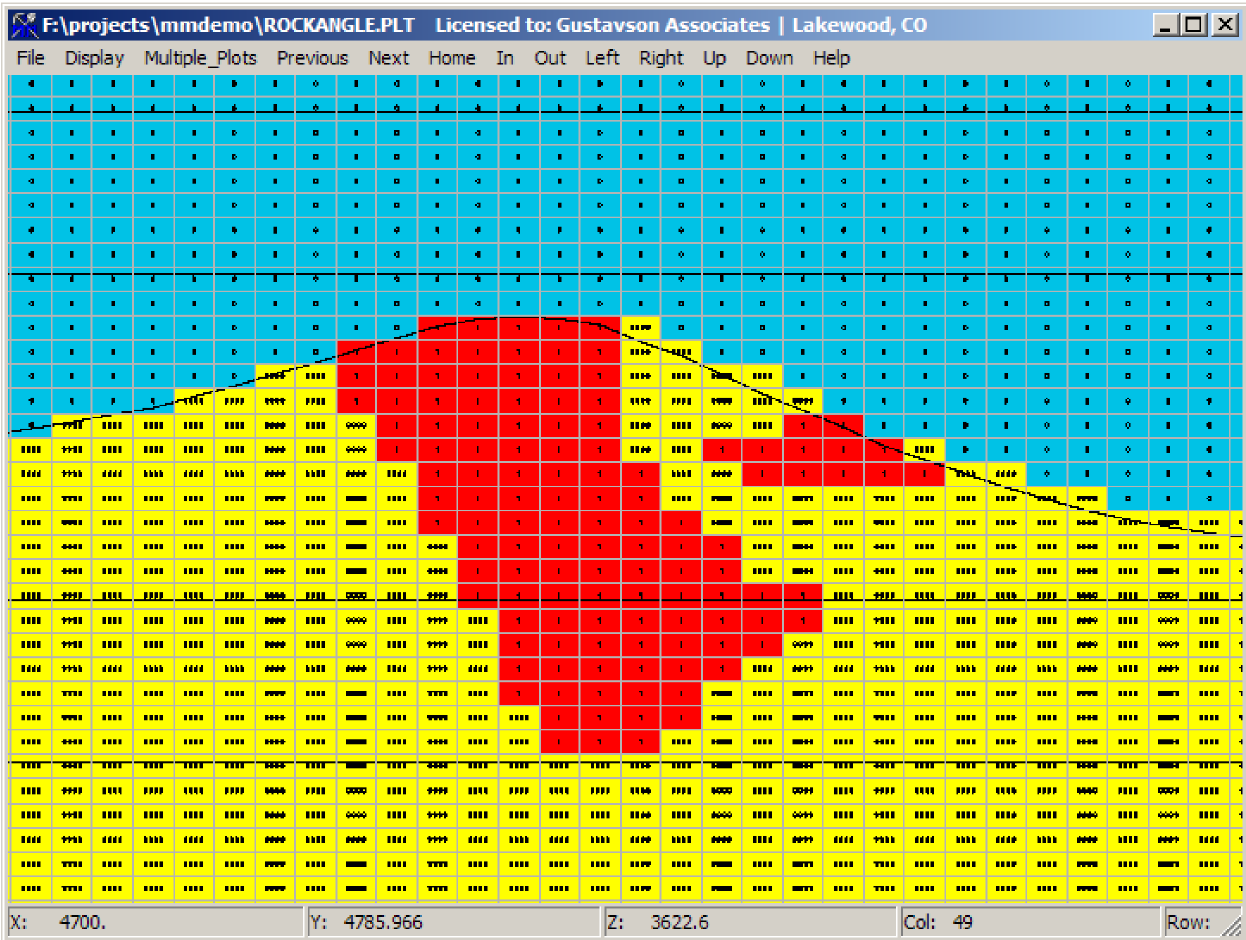


Figure 90 Plot of Rock Codes from Section Polygons

1.34. Create Rock Model from Wireframe

MicroMODEL can generate a rock model from a 3-D Wireframe. The wireframe needs to be in the form of an AutoCAD DXF file containing 3-D Face entities. Each solid in the DXF must be a closed solid. There can be multiple layers in the DXF. Each layer will be converted into a separate rock code.

The creation of a rock model from wireframe is a multistep process. First, the wireframe file is processed to form an intermediate work file containing column, row, elevation, and rock. This file is processed to create a block model coding file, consisting of column, row, level, and rock. That file is then read in to the input grid program to create/update the rock model.

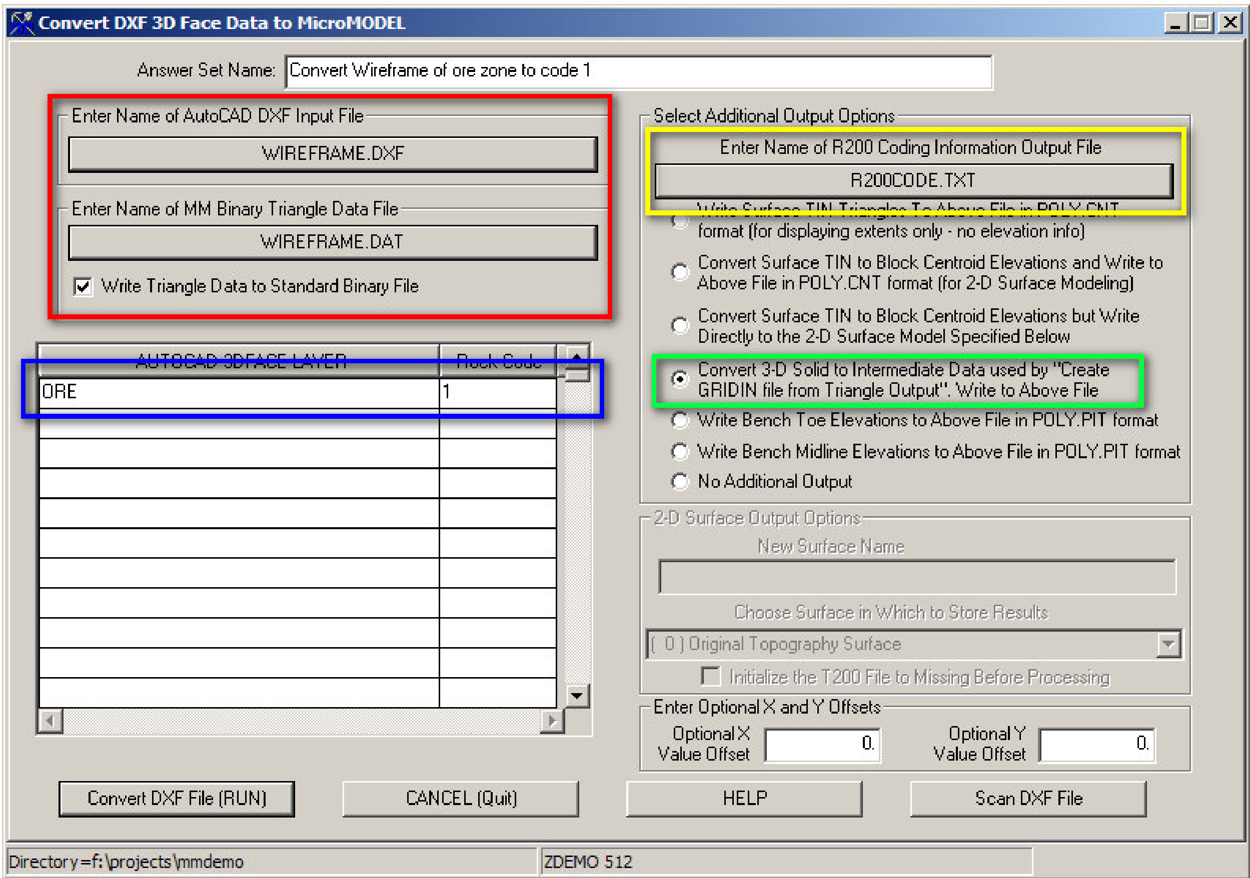


Figure 91 Create Rock Model From Wireframe DXF Dialog 1

From the File menu, choose DXF Conversion Utilities, Triangulated Model Conversion. Choose the wireframe DXF file to convert, and also the MicroMODEL binary data file to create (red). You may press the Scan DXF File button to find out which AutoCAD layer(s) are in the file. For each layer, enter the rock code to assign. Layers that are not to be converted should be deleted from the list (blue). We are converting the 3-D Solid to intermediate data that will be further processed. Choose the appropriate radio button (green). The name of the intermediate file is chosen with the top right pushbutton (yellow). It is suggested that the default name R200CODE.TXT be used here.

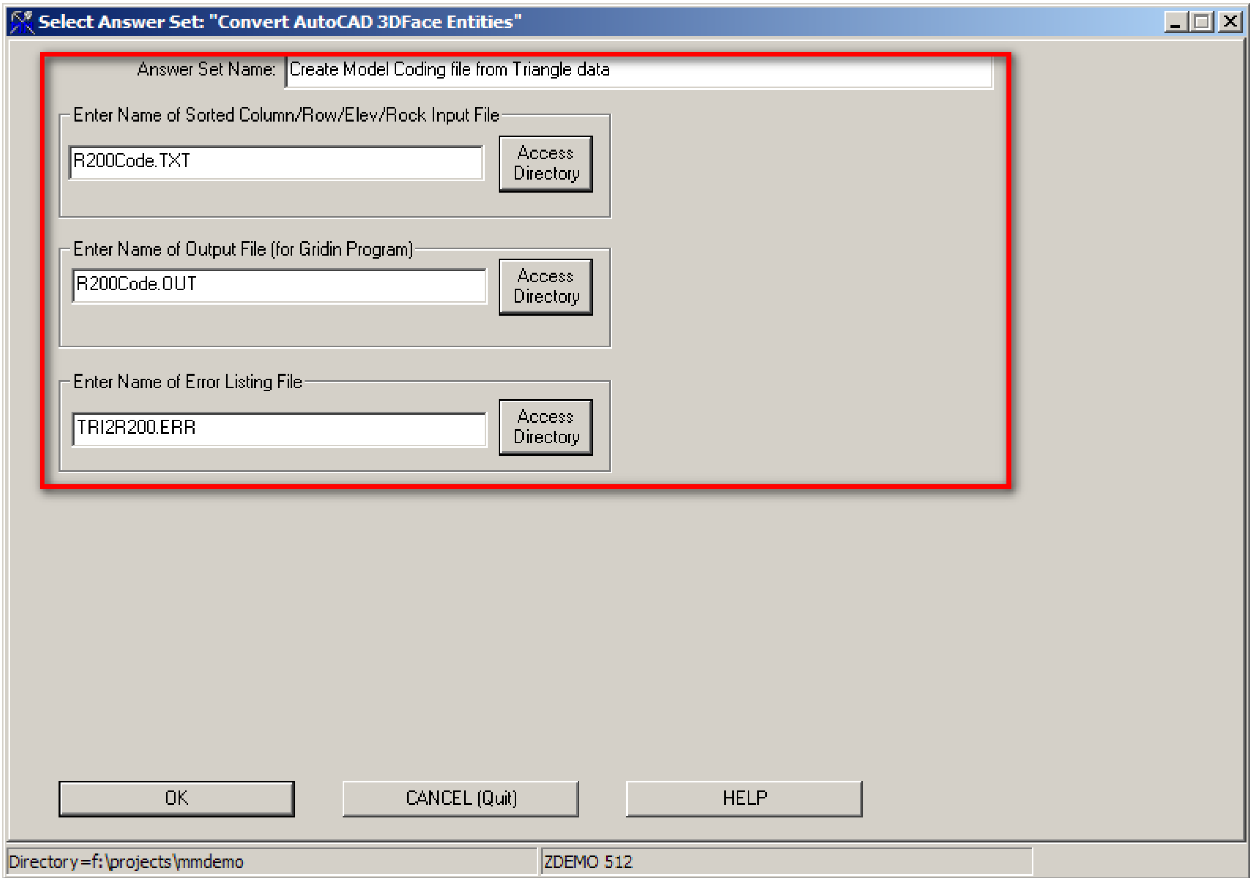


Figure 92Create Rock Model From Wireframe DXF Dialog 2

Now, from the File menu, choose DXF Conversion Utilities, Create Gridin File from Intermediate Data. The name of the file created from the previous step is entered in the top entry field. The output file that is created is entered in the middle entry field. It is suggested that the default name R200Code.Out be used. The error file is specified in the bottom entry field. If there are any problems with the converted wireframe data, they will be listed in the error file.

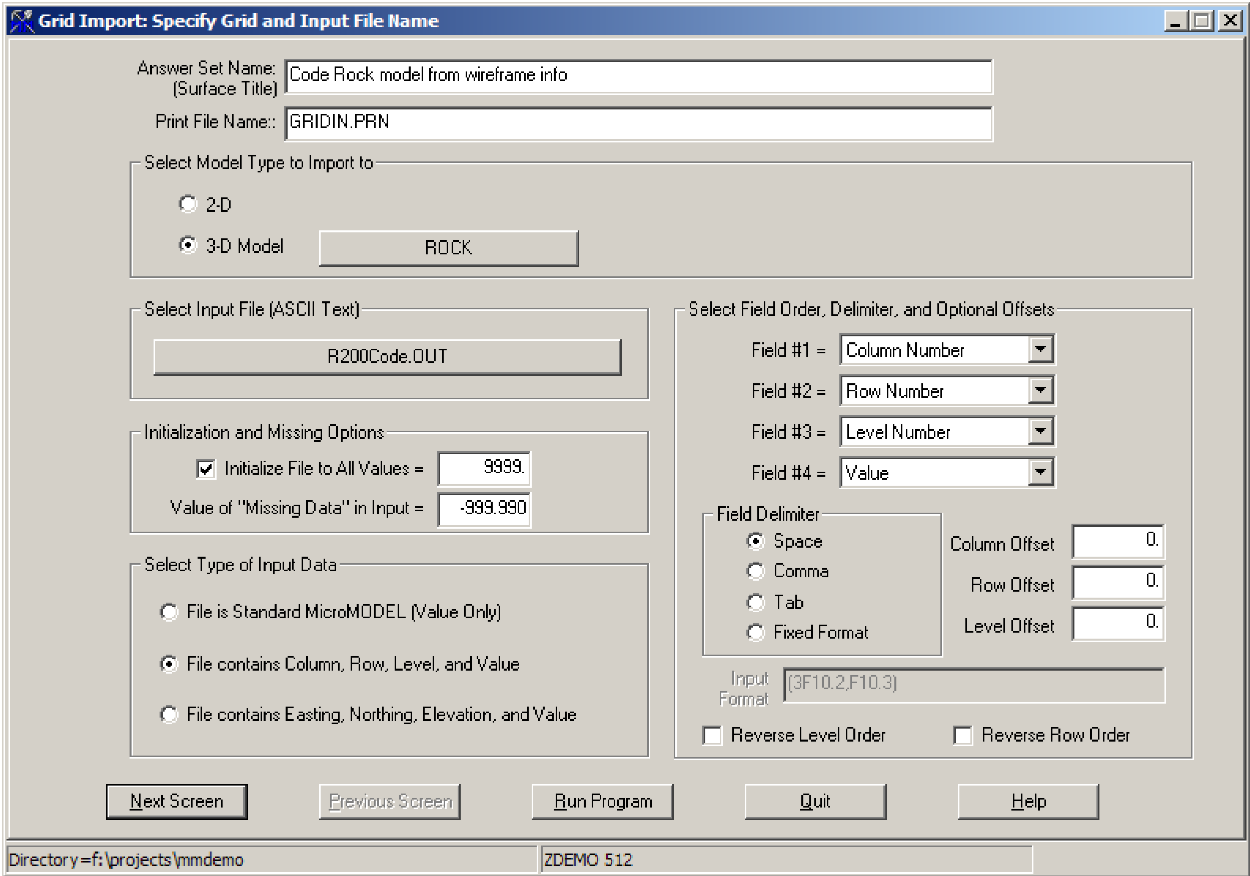


Figure 93 Import Rock Model from Wireframe Coding File Dialog 1

From the File Manager menu, choose Import from File to MicroMODEL Grid or Block Model. Use the input parameters as shown above to load the rock code values from the wireframe solid. Note that the rock model is initialized to a background code of 9999. The file generated from the previous step is space delimited, and the items in the file are column, row, level, and rock code. After the rock model has been updated, it needs to be adjusted so that all blocks that are completely above topography are set to zero. This is accomplished with the Adjust Rock Model Zero Values for New Topo Tool in the Special Tools Menu.

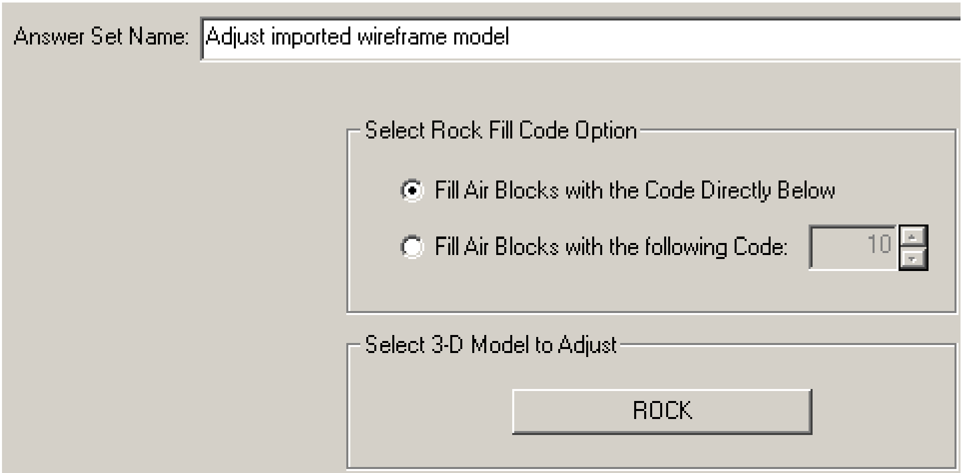


Figure 94 Adjust Rock Model Air Blocks Dialog

After the air blocks have been set to zero, we can check the rock model by plotting multiple cross sections or plan views. Here is a section plot of the rock model after it has been defined by the wireframe file.

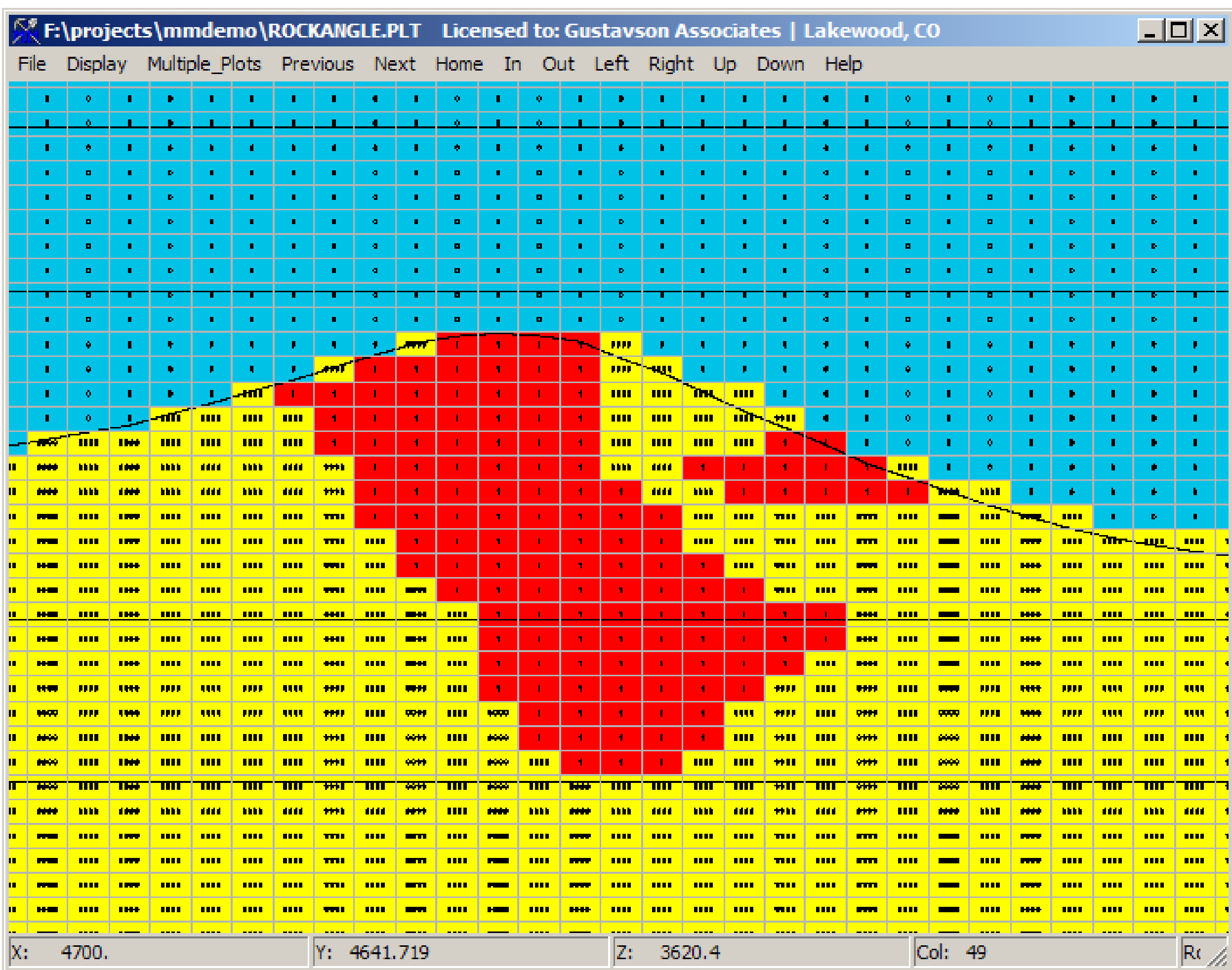


Figure 95 Plot of Rock Model Created from Wireframe

Here is a 3-D display showing the wireframe and the rock model that was generated from the wireframe.

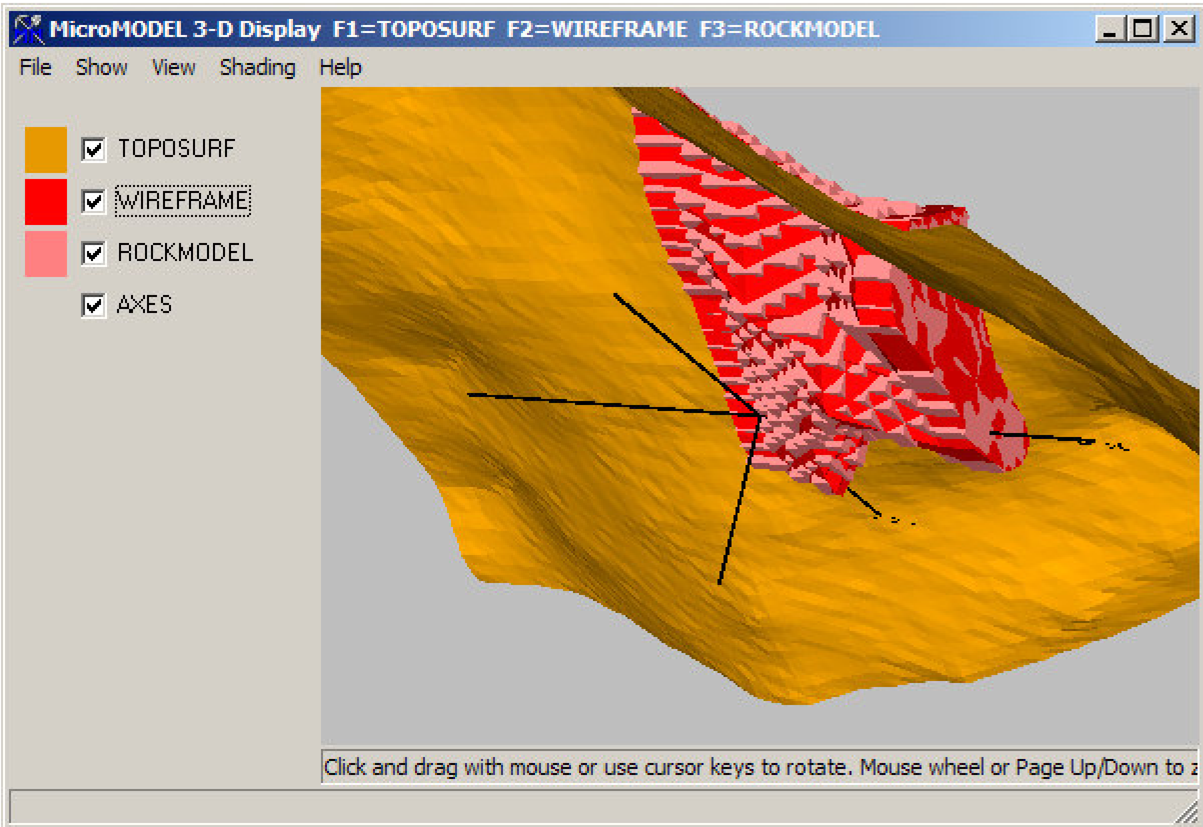


Figure 96 3-D Display of Surface, Wireframe, and Rock Model

10) Grade Modeling

(Video 41) Grade Thickness counts how many samples are higher than a cutoff in a certain vertical region. But there is a certain distortion if the drill hole is not vertical. The Polygonal Calculation Serves more as a presentation for clients, it is a handy way of showing where grades are.

1.35. Traditional Polygonal Reserve by Bench Calculation

Traditional Polygonal grade models can be calculated by bench. Bench composites must first be generated in order to calculate these grades. This is not the recommended method for a complete model, but it is adequate for a simple, test model. Generally, if a polygonal model such as this cannot be "mined" economically, then a more thoroughly evaluated, detailed model will not be economical. Bench

Polygon Grade Modeling is the traditional method that was used to hand calculate reserves, prior to the advent of computers and computer modeling techniques.

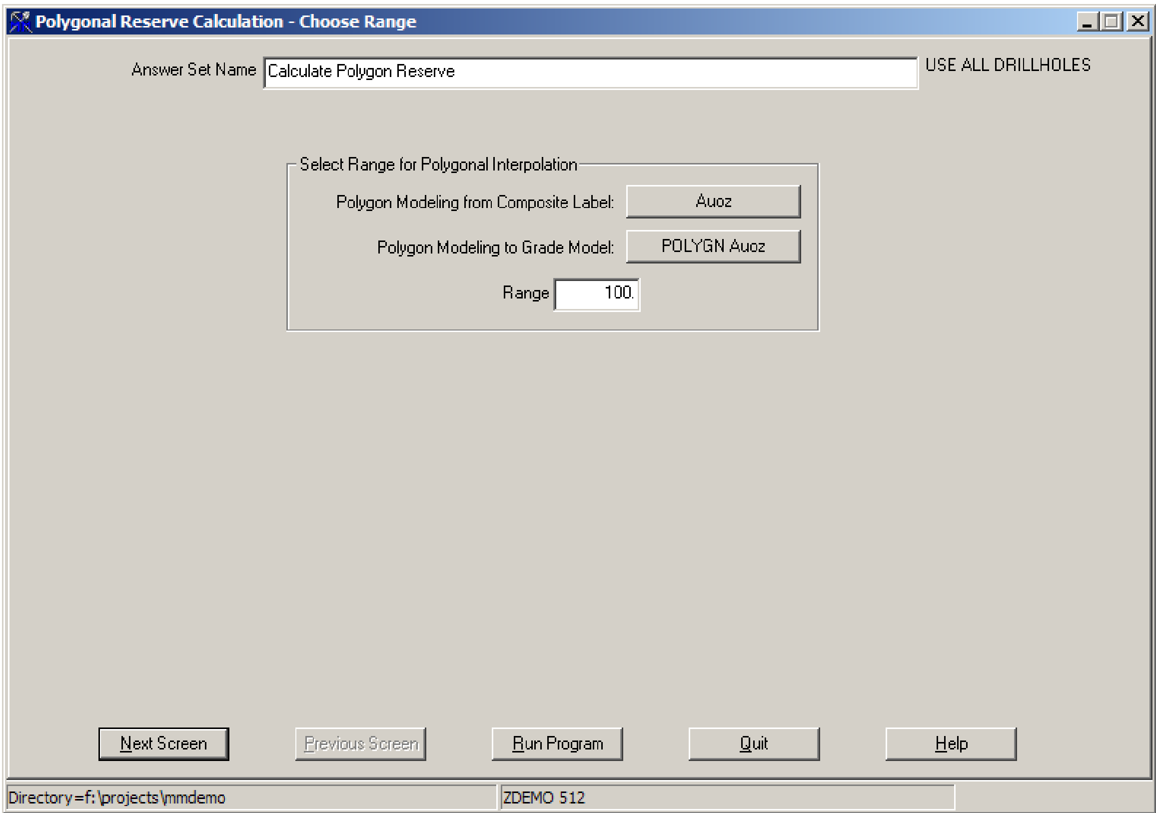


Figure 97 Polygonal Reserves Calculation Dialog Box

1) Make sure that the boxes for Polygon Modeling from Composite Label and Polygon Modeling to Grade Model boxes are set to the correct choice..
2) Select a reasonable range depending on drillhole density.

The larger the area and the lower the drillhole density the higher the range should be.

- **[Run Program]**

1.36. Polygonal Reserve Plots

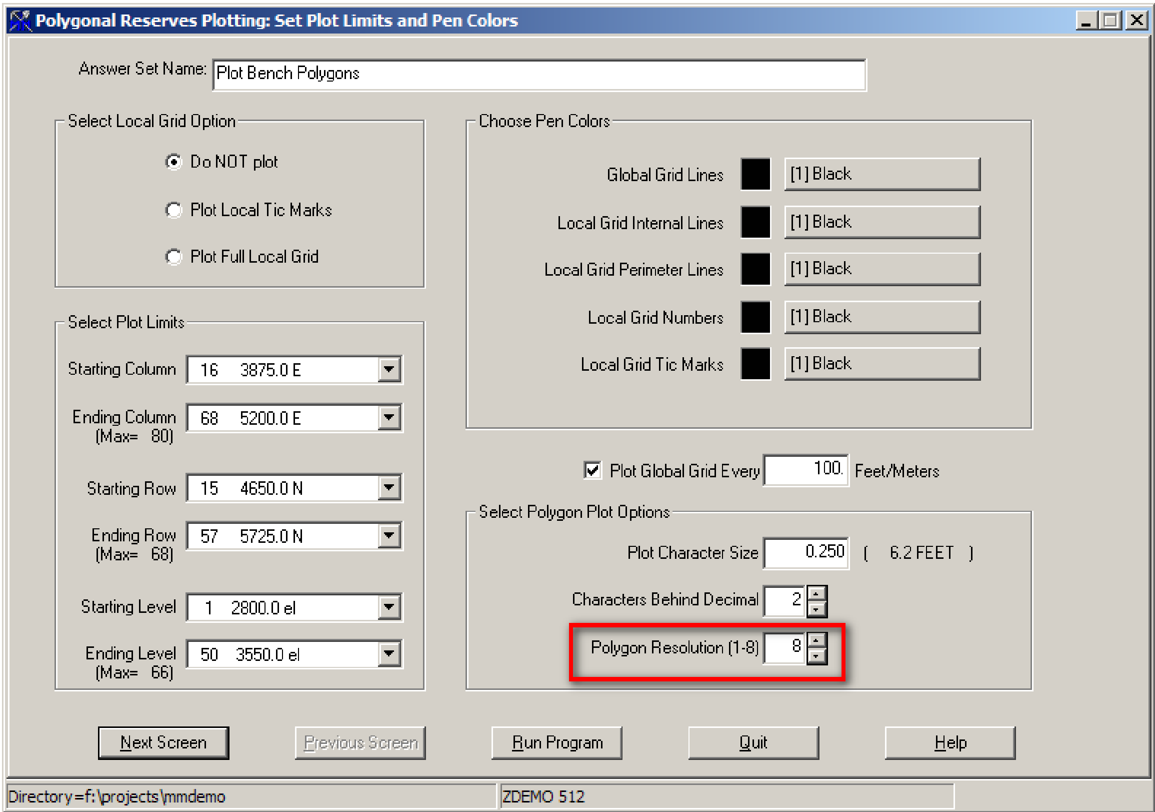


Figure 98 Polygon Reserve Plotting Dialog Box

1) Set row and column limits, if desired. Leave other items at defaults except set Polygon Resolution to 8. (**Red**)

Polygon Resolution sets the smoothness of the polygons. The smoother the polygons the longer the plots take the computer to process. 1 is the roughest setting, and 8 is the smoothest.

- **[Run Program]**

The final product is a plot at each level showing the drillhole name, polygon grade, and polygon area for each of the polygons that are generated. Figure 99 shows a polygon grade plot.

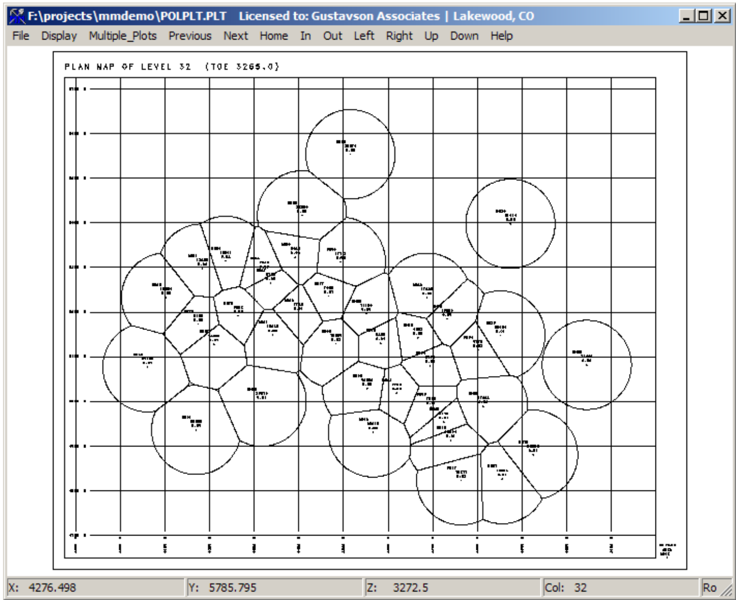


Figure 99 Polygon Grade Plot for Level 32 in Plan View

1.37. IDP Point Validation Presort

(Video 54, 55, 56) An Inverse Distance Power (IDP) model doesn't require a variogram. Using the power 2 is recommended for all models for which there is uncertainity about the rule of thumb.

[Grade] – [6. Point Validation Presort] -[Select an Answer Set]

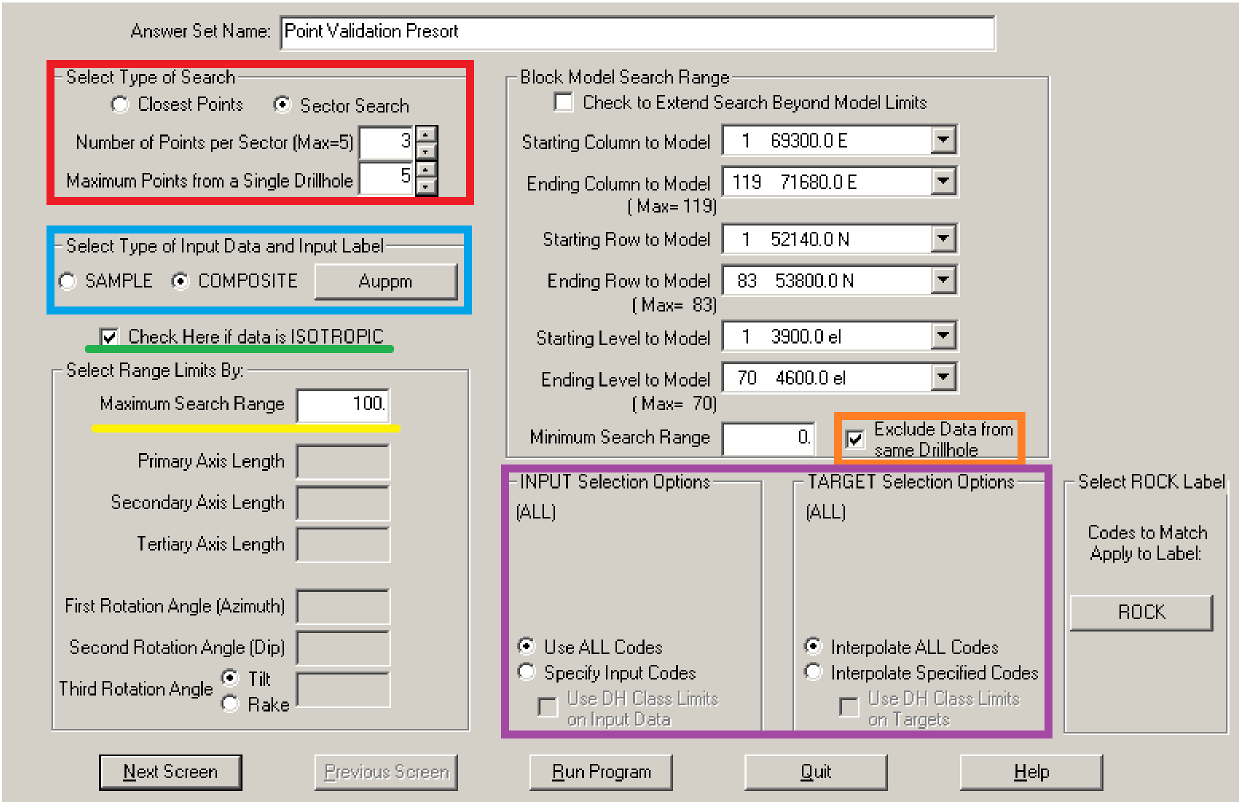


Figure 100 Point Validation Presort Dialog Box 1

1) Select Type of Search (**Red**)

Always set sector search. For this usage, Number of Points per Sector is suggested to be 3, and Maximum Points from a Single Drillhole is suggested to be 5.

2) Select Type of Input Data and Input Label (**Blue**)

It is highly recommended to always select the COMPSITE option. Make sure that the grey box displays the correct label. The label can be changed by clicking on the grey box.

3) Check Here if data is ISOTROPIC (**Green**)

Make sure this box is checked.

4) Maximum Search Range (**Yellow**)

Select a value between 100 and 300 based on the drillhole density and model area.

5) Exclude Data from same Drillhole (**Orange**)

Make sure this option is checked to prevent the search from drawing on sample from the same drillhole. This is considered to increase the accuracy of the model.

6) INPUT Selection Options and TARGET Selection Options (**Purple**)

Make sure both of these boxes are set to Use ALL Codes and Interpolate ALL Codes.

- **[Next Screen]**

Leave this dialog box at default (no boxes checked).

- **[Run Program]**

1.38. IDP Point Validation

After the data is sorted, it needs to be validated before attempting to model.

[Grade] – [7. Point Validation] -[Select an Answer Set]

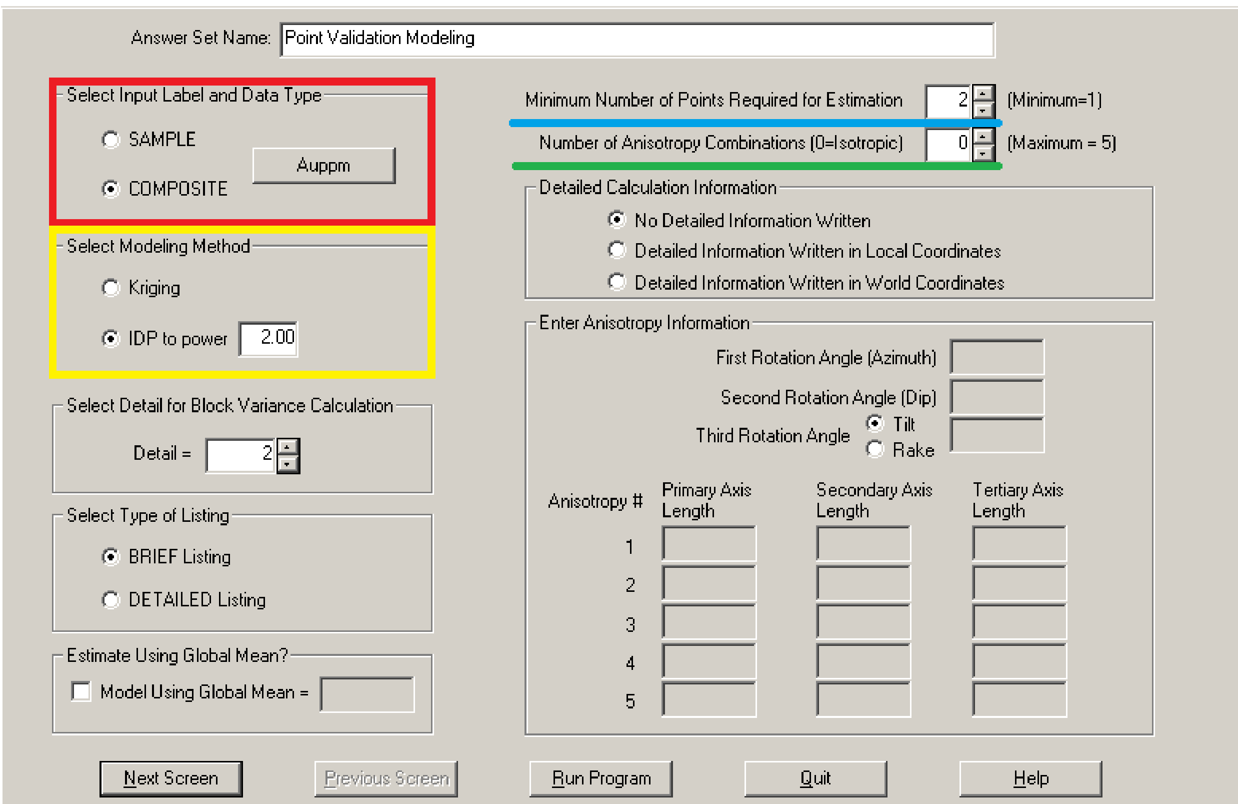


Figure 101 Point Validation Dialog Box 1

1) Select Input Label and Data Type (**Red**)

Select COMPOSITE. Verify the label in the grey box represents the resource to be modeled. To change the label, click on the grey box.

2) Select Modeling Method (Yellow)

Select IDP and set a power of 2 if uncertain of the rule of thumb.

3) Minimum Number of Points Required for Estimation (**Blue**)

Make sure the value is at least 2. If there is a high drillhole and assay density, increase the value accordingly.

4) Number of Anisotropy Combinations (0=Isotropic) (**Green**)

This should always be set to 0.

- **[Next Screen]**

Make sure this dialog box is set to default values (no boxes checked).

- **[Run Program]**

1.39. Grade Modeling Presort

(Video 57, 58, 59, 60, 61)

3-D Grade block modeling is similar to the Point Validation Presort. In Figure 102, only the difference between the Grade Model Presort and the Point Validation Presort have been highlighted. Assume all other options are the same as in Figure 100.

[Grade] – [8. Grade Modeling Presort] -[Select an Answer Set]

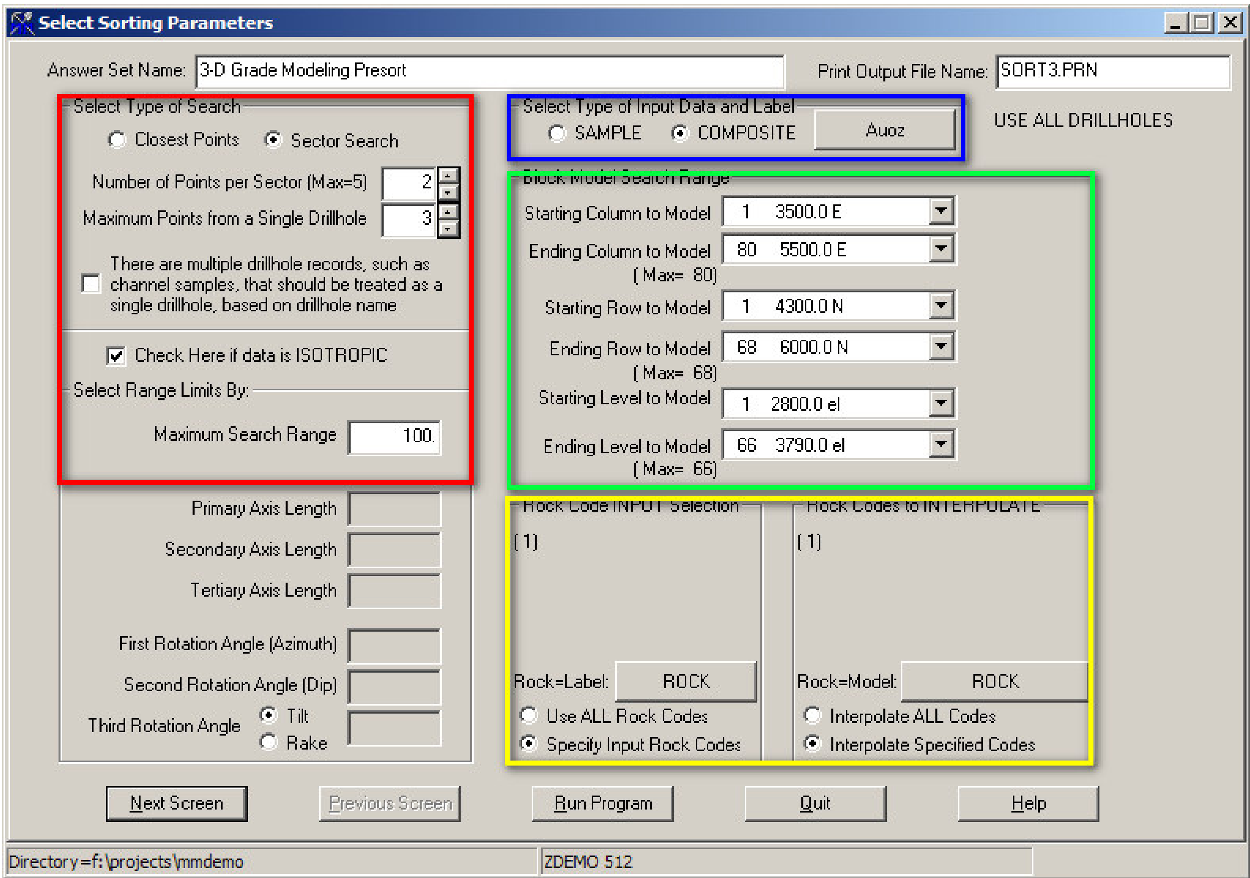


Figure 102 Grade Model Validation Presort Dialog Box 1

1) Choose the type of search. Sector Search is chosen here. It helps to decluster data. Two points per sector and a maximum of three points from each drillhole are selected. We do not have multiple drillhole records with the same name, so the multiple drillhole records box is left unchecked. For this exercise, we assume no preferential direction of grade trends (data is ISOTROPIC) (**Red**).
2) We are using composite values as our data points, and we want to model using label Auoz (blue).
3) We are modeling the entire range of columns, rows, and levels. If we wanted to, we could opt to presort for a subset of our model by changing these values (green).
4) We are limiting the data points that will be used in this modeling run to those that match specified composite rock codes. The input rock code label is ROCK. Note that the input screen is showing the currently selected codes here (1). The actual input screen for these codes appears later. We are only assigning grade values to those 3-D blocks that match certain codes in the rock model ROCK. Note that the input screen is showing the currently selected codes here (1) (Yellow).

- **[Next Screen]**

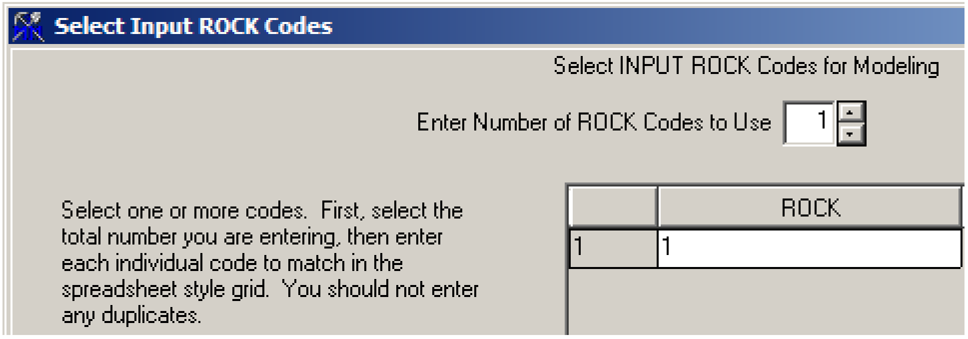


Figure 103 Grade Modeling Presort Dialog Box 2

In the second screen, we choose how many composite rock codes to use, and which codes. In this case, we are specifying a single code (1), which selects the composite intervals that were backmarked from our ore zone wireframe.

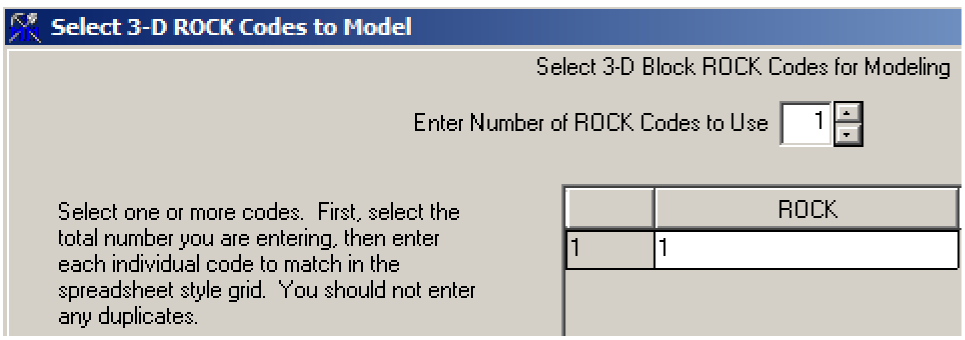


Figure 104 Grade Modeling Presort Dialog Box 3

In the third screen, we choose how many 3-D rock codes to use, and which codes. In this case, we are specifying a single code (1), which selecte the 3-D blocks that were backmarked from our ore zone wireframe.

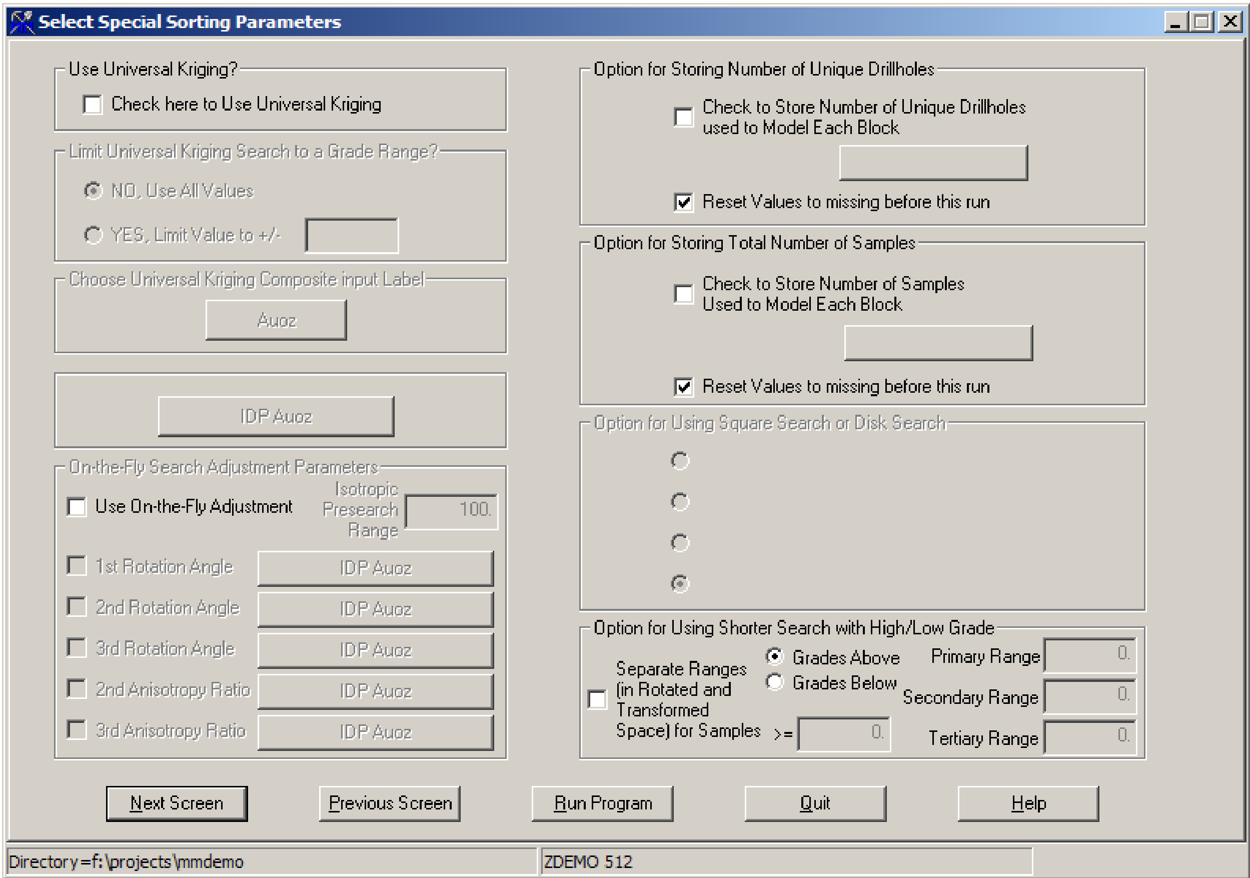


Figure 105 Grade Modeling Presort Dialog Box 4

The fourth screen contains fields for controlling various specialized options for presorting. For our simple example, we are not using any of these options.

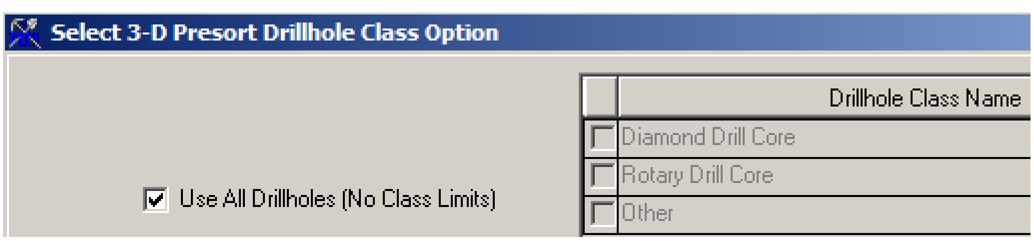


Figure 106 Grade Modeling Presort Dialog Box 5

The fifth input screen can be used to limit the source of data points to one or more drillhole classes. For our simple example, we are opting to use all drillhole data.

- **[Run Program]**

1.40. Grade Modeling

After we generate a set of presorted data, we calculate a block grade based on the data points. For our simple example, we will generate an inverse distance to second power model.

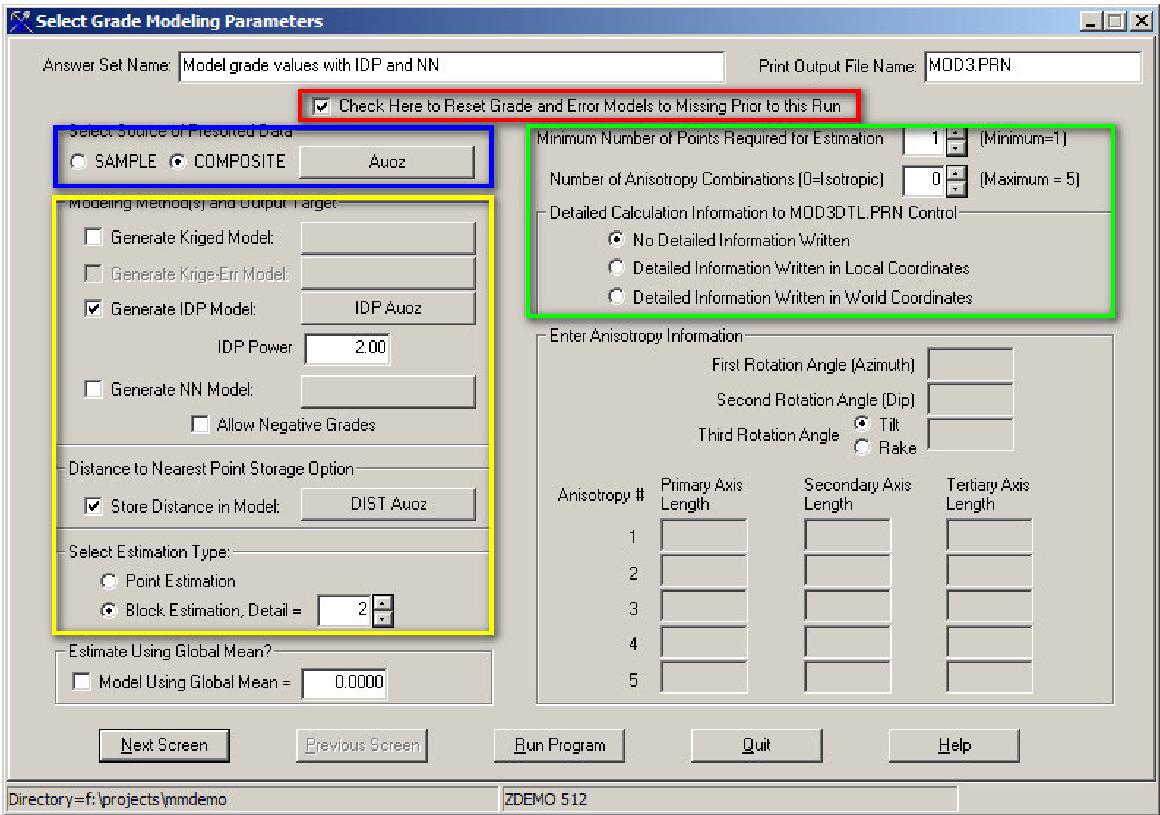


Figure 107 Grade Modeling Dialog Box 1

1) Reset Grade and Error Models to Missing Prior to this Run is checked. This insures that only blocks which meet our presort criteria will be assigned a grade. (**Red**)
2) The source of our data is composited Auoz (Blue).
3) We are only generating an IDP Model in this run. If we wanted to, we could also create a kriged model and nearest neighbor (NN) model at the same time, all in a single run. The IDP power is set at 2.0. We are also storing the distance to nearest point in the model type DIST for Auoz. Estimation type is set to block, with a level of detail of 2.(yellow).
4) We are assigning grade values to blocks, even when there is only a single sample found for it, but setting the minimum number of points required for estimation to 1. By specifying zero anisotropy combinations, we are invoking isotropic grade assignment. We are skipping the printing of detailed information. The detailed information is generally only used by geostatisticians who are interested in the specifics of how grades are being assigned.(green).

- **[Next Screen]**

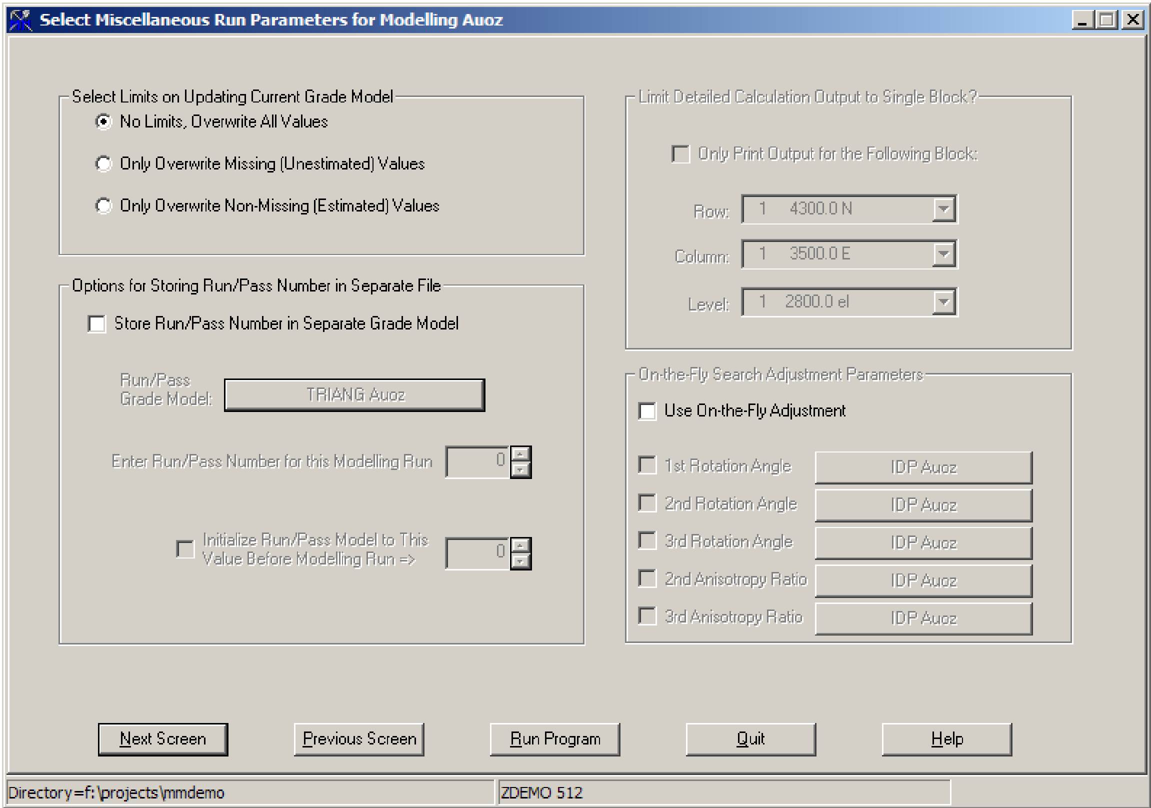


Figure 108 Modeling Grade Dialog Box 2

1) In the second screen, we choose no limits, overwrite all values.
   - **[Run Program]**

After modeling the grade of Auoz in our blocks, we can create cross section view of the grades. The following screen shot shows the inversed distance grades that were assigned, along with the rock code. Note that air blocks and blocks outside of the ore zone (Rock codes 0 and 9999) have not been assigned grades. Only the ore zone blocks (rock code 1) were assigned grades.

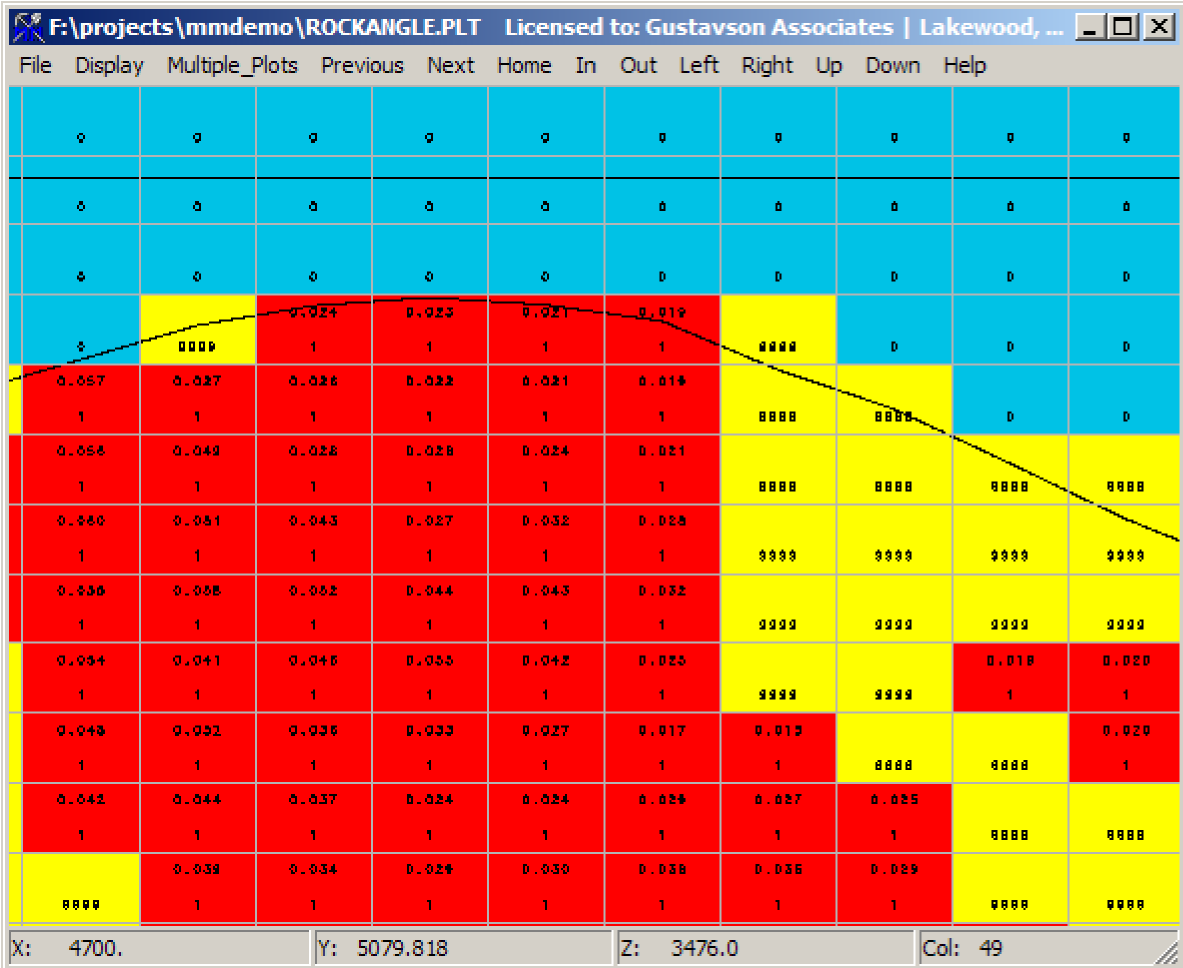


Figure 109 Section Plot of Modeled Gold Grades with Rock Codes

11) Swath Plot

A Swath Plot is a convenient tool for checking a grade model. A plot of sample or composite grade, block model grade, and block model tons can all be displayed in one or more bitmap files.

We will generate a set of bitmaps showing our inverse distance grade model along columns that roughly correspond to the four drillhole sections that were used to generate the ore zone wireframe.

From Special Tools, select Generate Swath Plot.

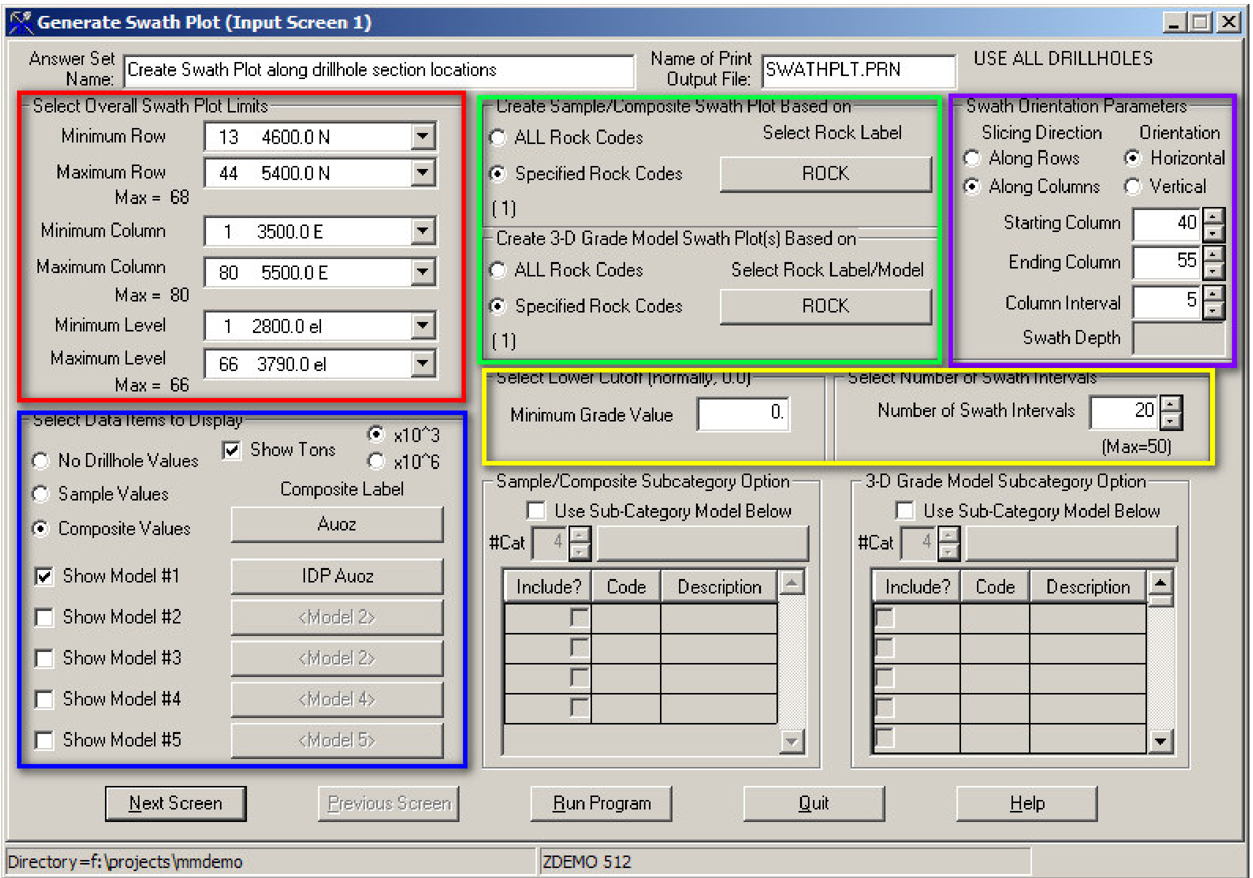


Figure 110 Swath Plot Dialog 1

1) A subset of the model can be used in generating the swath plot.(red)
2) Samples or Composites can be shown, along with tons and up to five different grade models.(blue)
3) A subset of rock codes for both the drillhole data and grade model data can be specified. In this case, we are using specified codes from the composites and specified codes from the 3-D ROCK model. In both instances, we are selecting a single code, 1, this choice occurs in input screens three and four.(green)

4) Swath orientation can be along rows or along columns. The swaths can be calculated horizontally, or vertically. The center of each swath region is controlled by the starting and ending row/column and the row/column interval.(purple)
5) Swath plots can be calculated above a given cutoff. The number of cells used in the swath calculation can be adjusted anywhere from one to fifty. Twenty cells will generally create a reasonable looking output.(yellow)

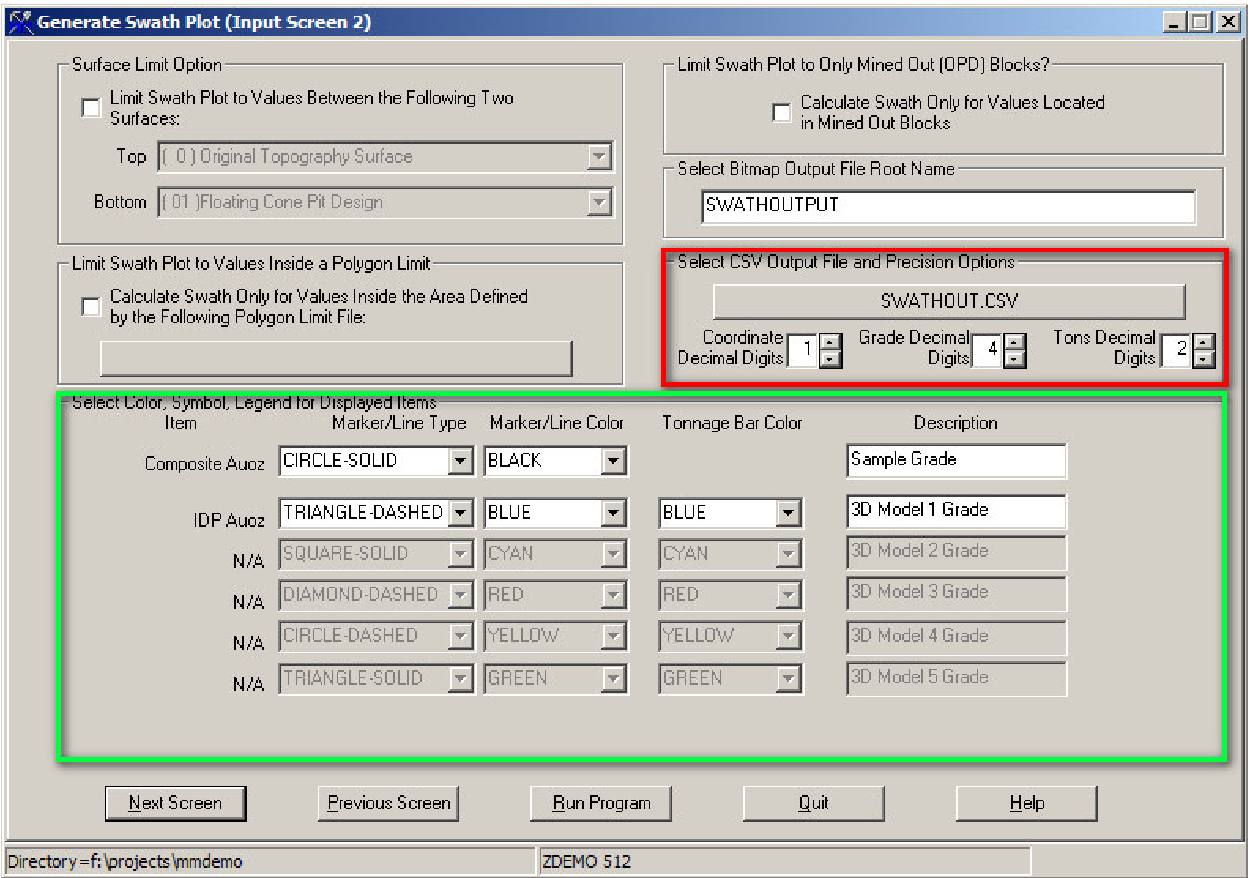


Figure 111 Swath Plot Dialog 2

1) The swath program will create an optional CSV output file, containing all of the data points used in creating the swath plot. This CSV file can be loaded into Excel, and Excel can be used to generate a chart based on the data values.(red)
2) Each item that is displayed in the swath plot can be controlled with various dropdown choices for marker/line type and Color. The description shows up in the swath plot legend.(green)

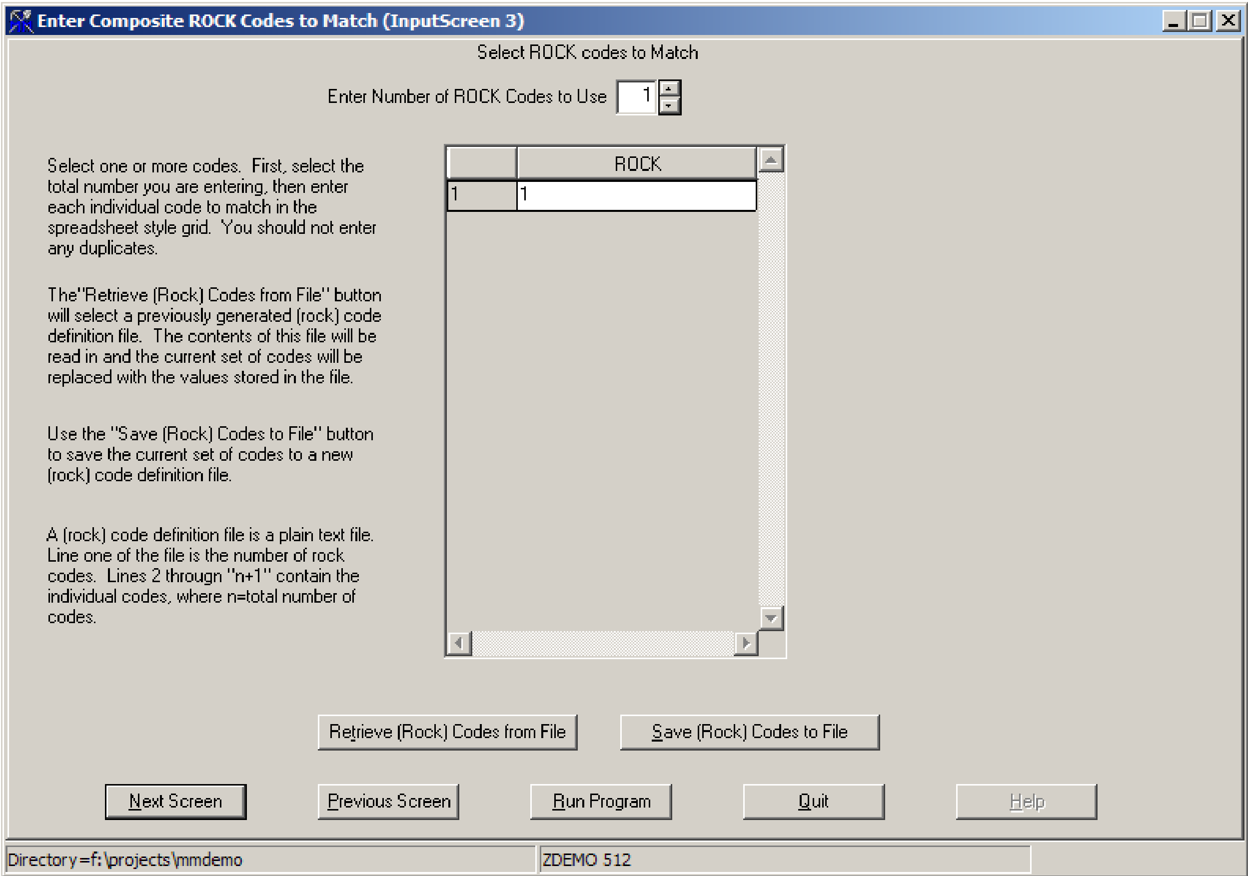


Figure 112 Swath Plot Dialog 3

1) Rock codes to match for the composite values are selected in this dialog.

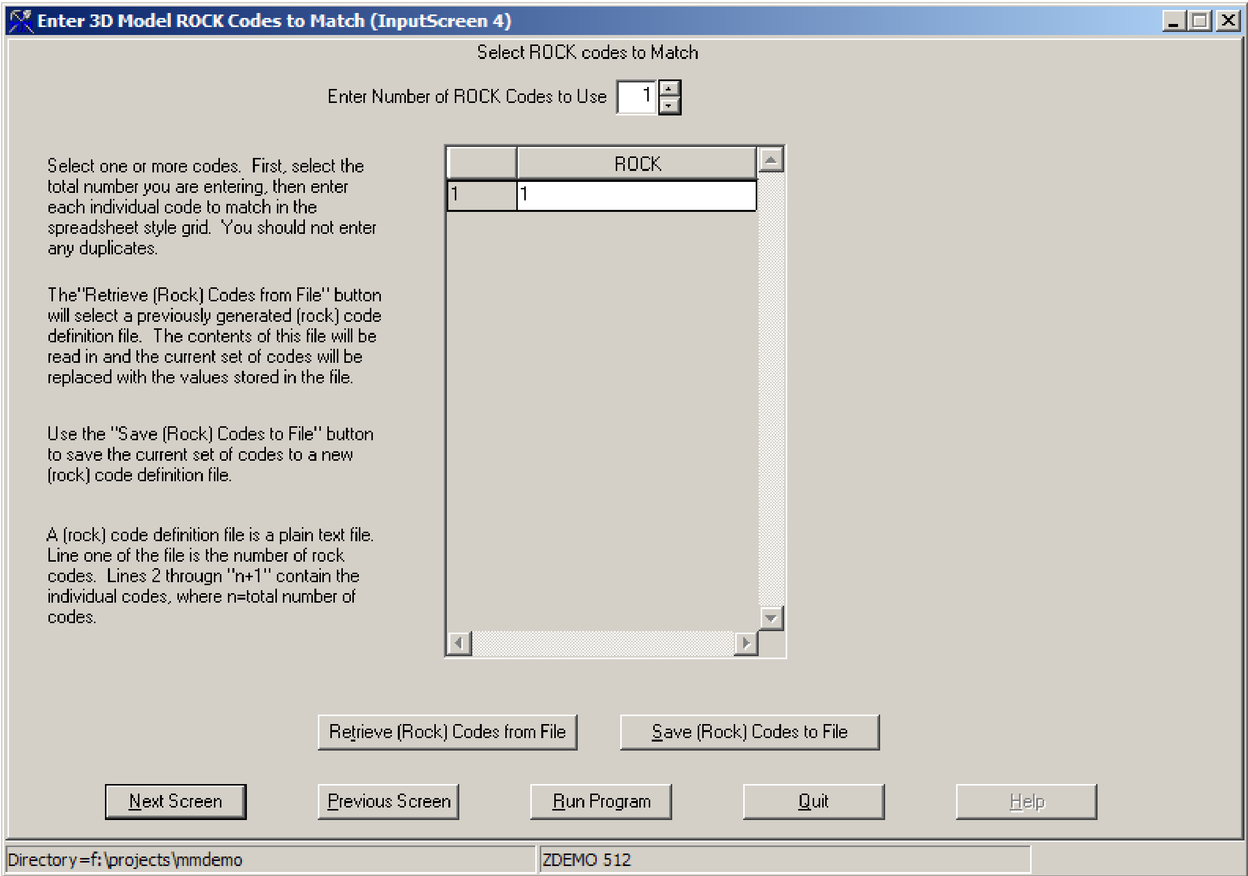


Figure 113 Swath Plot Dialog 4

1) Rock codes to match in the 3-D model values are selected in this dialog.

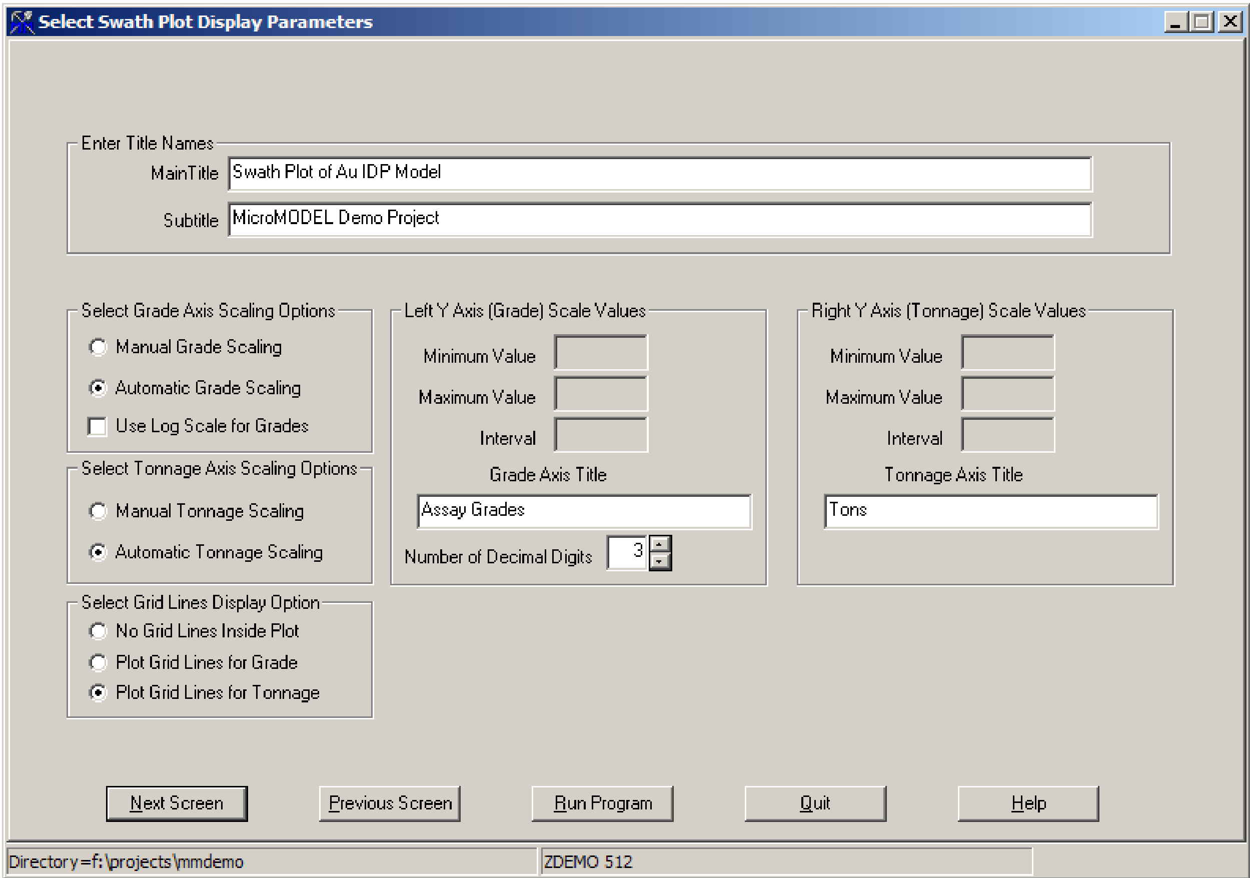


Figure 114 Swath Plot Dialog 5

1) This dialog allows the user to specify the main title and subtitle for the swath plots, along with various scaling options.

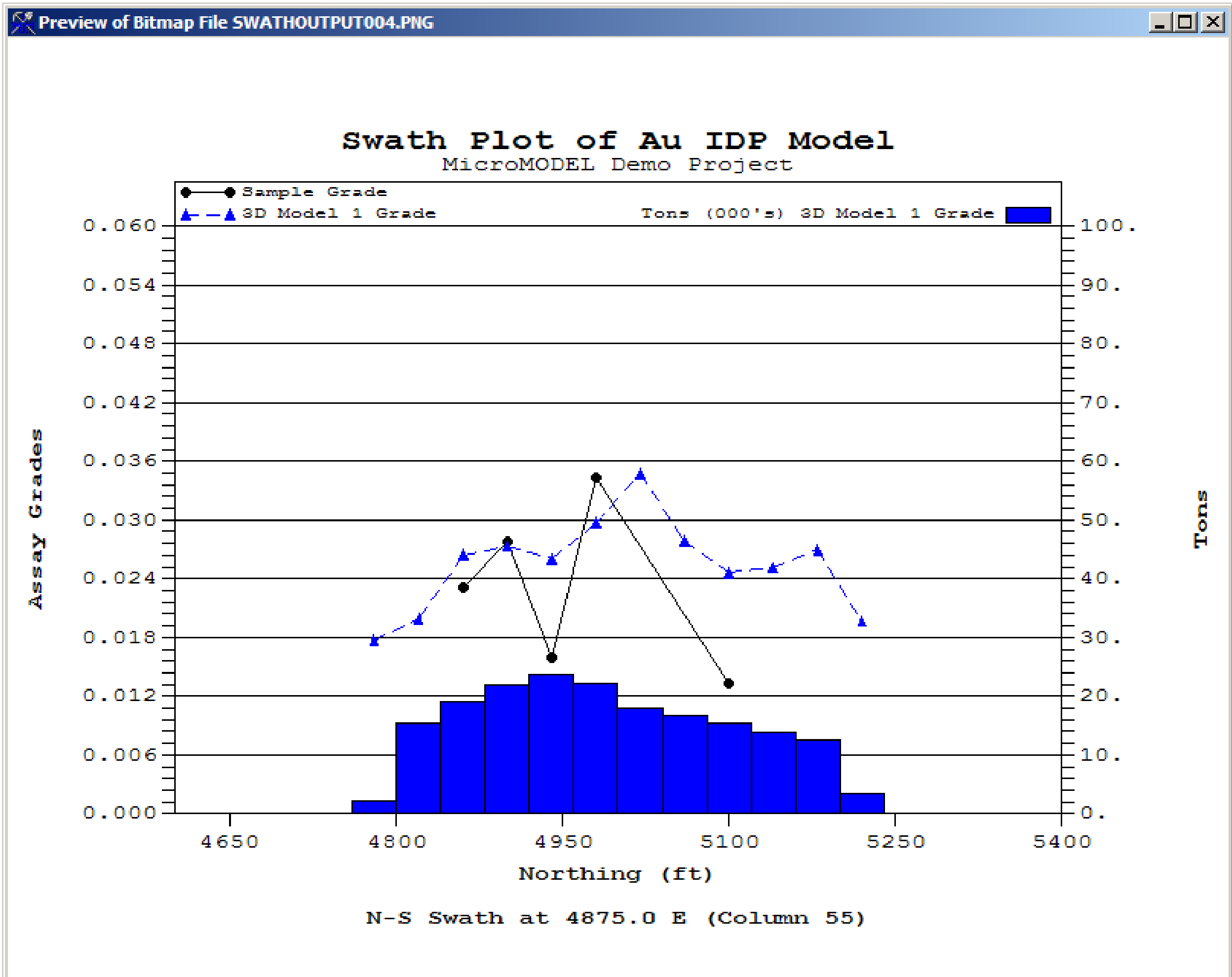


Figure 115Swath Plot Bitmap Output

1) This is one of the bitmap files generated by the swath plot program.

12) Pit Design

1.41. Initialize Pit Model

Before any resource, pit reserve, or cone reserve can be calculated, the OPD system needs to be initialized. The initialization step finds the number of unique codes in the user specified rock model, and a mined out indicator model is initialized.

Prior versions of MicroMODEL were inflexible in that the default rock model, R200, was always the model used by the OPD system to represent different material types. The current version of MicroMODEL removes that limitation, so any 3-D model can be used to represent the OPD material types, as long as the model consists of whole numbers in the range from 1 to 9999.

The starting surface grid, T200, must exist and cannot contain any unestimated values.

If there are multiple MicroMODEL project areas that have been modeled separately, but pits from the separate areas will be scheduled concurrently, then it may be necessary to override the automatic code tabulation and manually enter all possible rock codes (material types) that will be scheduled. In this case, use the “Manually Override Rock Code Tabulation” radio button.

The input screen for initializing the pit model is shown below:

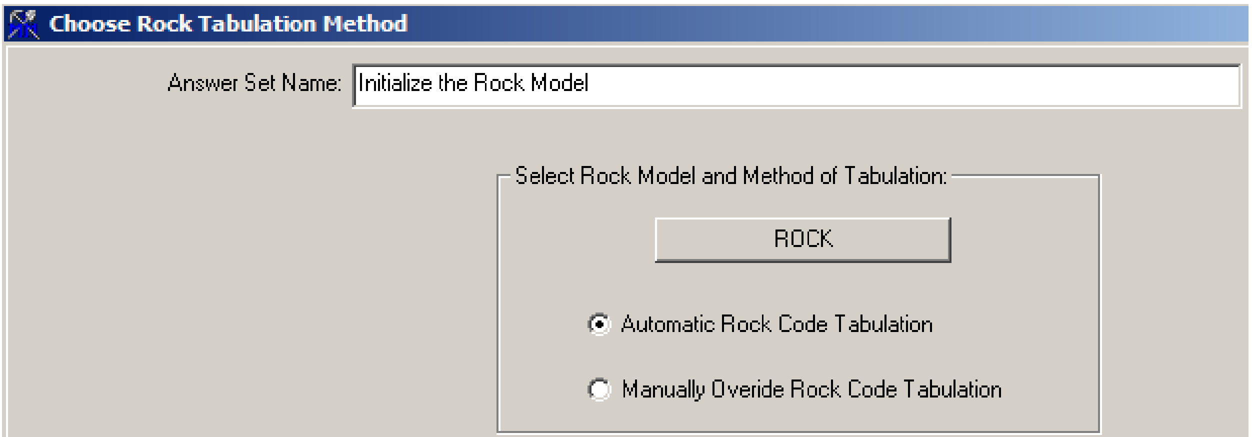
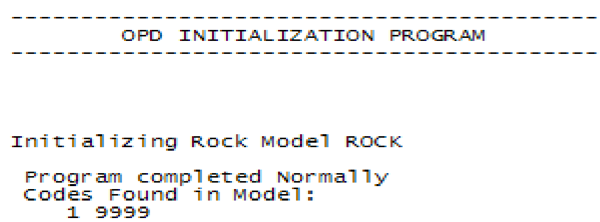


Figure 116 OPD Initialization with Automatic Rock Code Tabulation Dialog

Here is the resulting printout, showing that only codes 1 and 9999 exist (code zero is not counted)



```
-----------------------------------------
      OPD INITIALIZATION PROGRAM
-----------------------------------------


Initializing Rock Model ROCK

 Program completed Normally
 Codes Found in Model:
    1 9999
```

Figure 117 OPD Initialization Summary Information

(Video 64)

1.42. Enter Pit Generation Parameters

After initializing the OPD system, the pit generation parameters must be entered. The original version of MicroMODEL did not have the companion PolyMap program available for pit designs. The original pit expansion capabilities of MicroMODEL have been maintained, but are seldom used. In almost all cases, the user will have designed one or more open pits in PolyMap or AutoCAD. These pit designs will be evaluated in MicroMODEL.

In order to evaluate a pit or series of pits, it is necessary to know the bulk density of each 3-D block, the grade of the block, and what cutoff or cutoffs to use in the evaluation. MicroMODEL allows for a lowgrade cutoff and an oregrade cutoff to be used concurrently, in order to report two separate grade ranges of material. For example, having two separate cutoffs allows for the reporting of a run of mine (ROM) ore type along with a crushed heap leach ore type. If necessary, up to five different mill types can be reported, including both a low and high grade portion. The multiple mill process feature is not limited to ore, but can also be used to classify waste into acid and non-acid generating components.

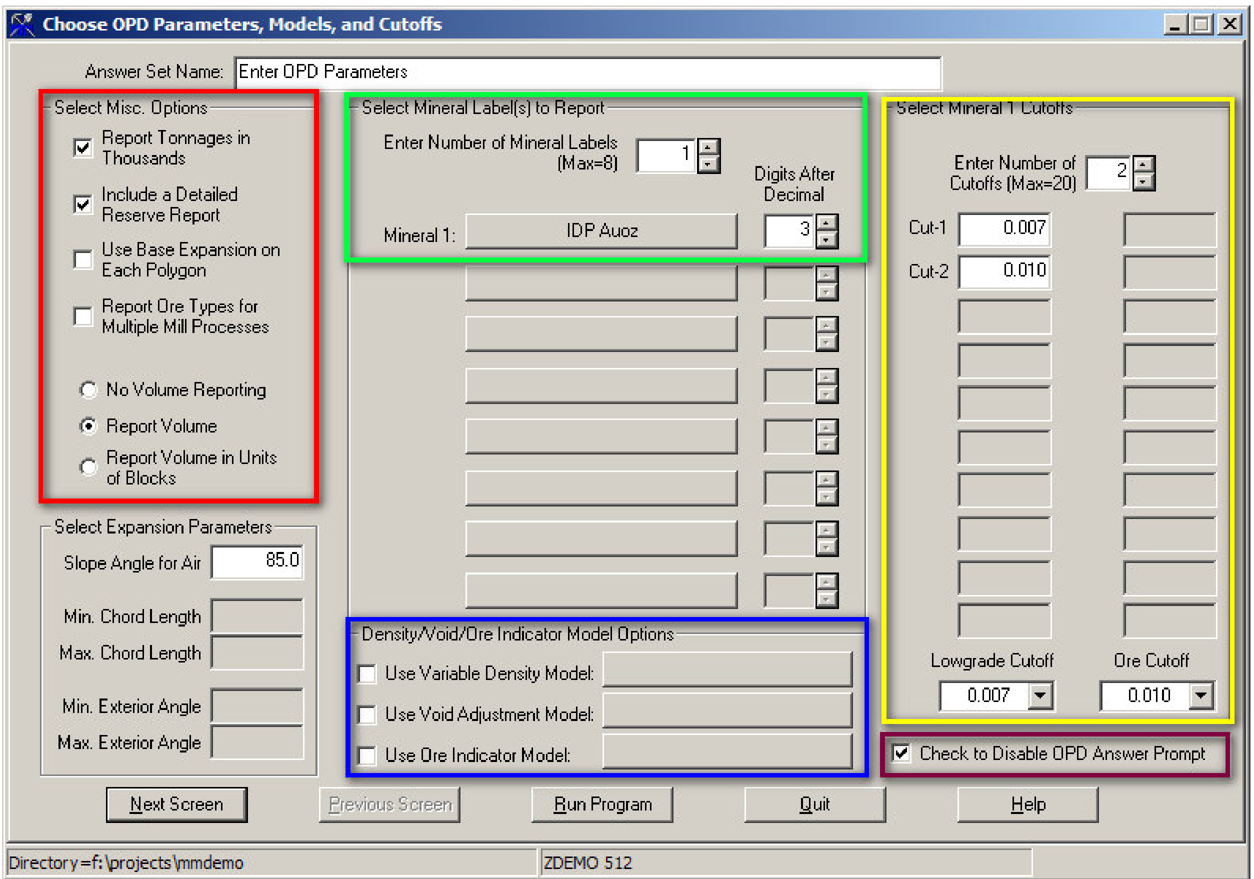


Figure 118 OPD Parameters Dialog 1

1) In the miscellaneous options, we choose to report tonnages in thousands. Unless you have a relatively small deposit, it is best to report in thousands. A detailed report gives the breakdown of all material types by bench. The volume reporting is optional. We are choosing to report volume in standard units, which will be Cu-yds/ton for our English Unit project.(red)
2) We only have one grade model, inverse distance Auoz. Three digits after the decimal are chosen to control the format of grade output.(green)
3) There are various Density/Void/Ore Indicator options available, but we are not using them.(blue)
4) Up to 20 different cutoffs can be entered. The cutoffs need to be in ascending order. We have chosen just two cutoffs. Note the the Lowgrade Cutoff and Ore Cutoff are different, which means that both a low grade material and ore material will be reported.(yellow)

5) The disable OPD answer prompt box is checked. When it is NOT checked, then any time a program is selected which accesses these parameters, a popup dialog box will appear, reminding us of the current OPD configuration.(purple)

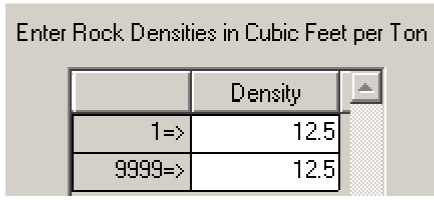


Figure 119 OPD Parameters Dialog 2

1) In the second input screen, we enter a density of 12.5 cubic feet per ton for both of our rock types.

1.43. Calculating a Resource

Although the module is labeled Pit Design, it is also used for calculating resources. A global resource is calculated by first creating a “cone” surface that represents the bottom of the model. Then, a resource is calculated for all blocks between the bottom of the model and the surface topography grid.

From the Money Matrix/Cone Miner Submenu, choose Create Cone for Doing Geologic Reserves.

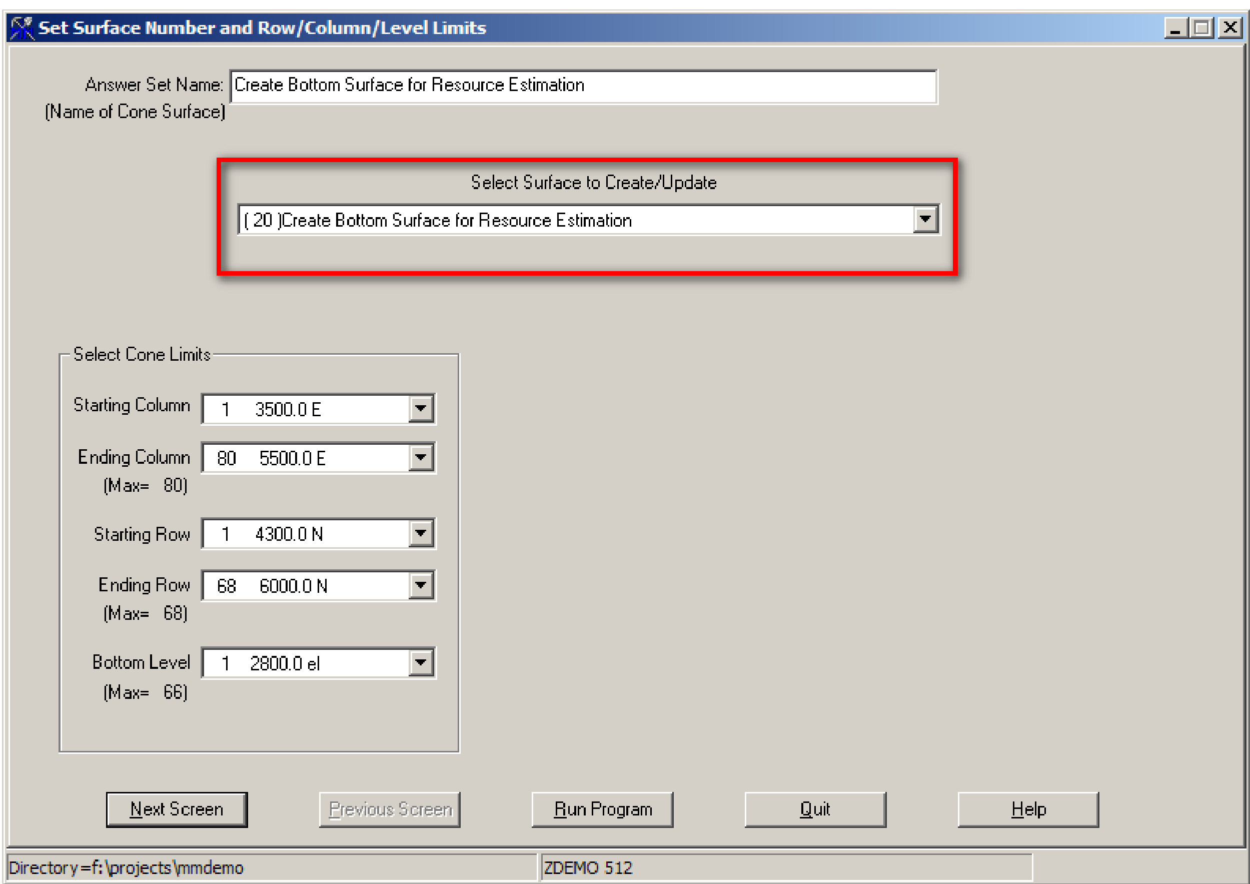


Figure 120 Create Cone Surface for Calculating a Resource Dialog 1

1) Select any unused surface between 1 and 99 (red). The default answer is surface 20. Note that the row and column limits are set to cover the entire model. A subset of the model can be reported by changing the row and column limits.

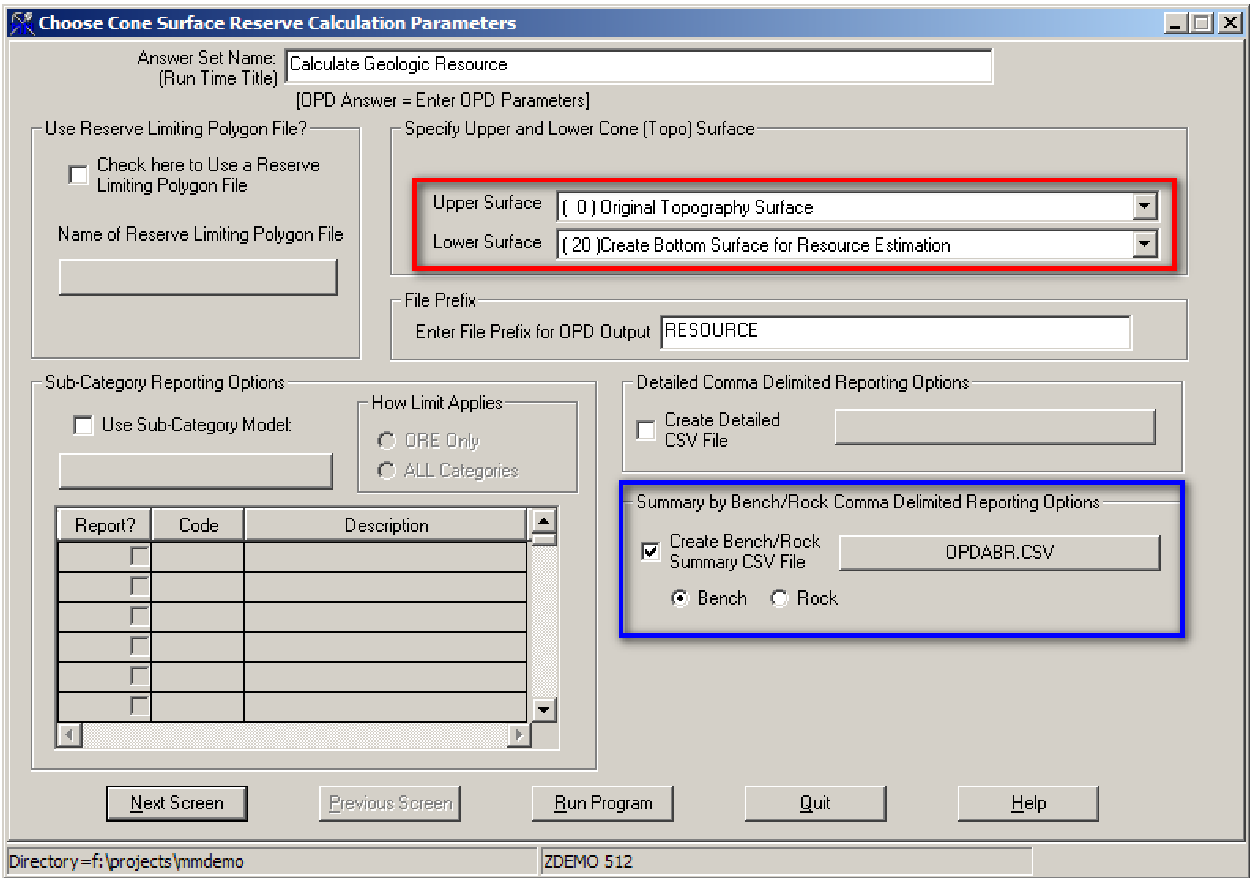


Figure 121 Calculate Resource using Cone Surfaces Dialog 1

1) Specify the upper and lower surfaces. We are calculating a resource between the original topography and the bottom of model surface we just created (red).
2) You may opt to create a CSV file that can be directly loaded into Excel by specifying the name of a Bench/Rock Summary file. The summary can be formatted either by bench or by rock. In most cases, we summarize by bench (blue).

1.44. Create Money Matrix

Prior to creating a money matrix, it is recommended that a new grade label be added to the project. Here is the screen in Data Entry > Enter Project Information. Change the number of grade labels from 1 to 2, and add the Au1100 label as shown.

Next, run the money matrix program.

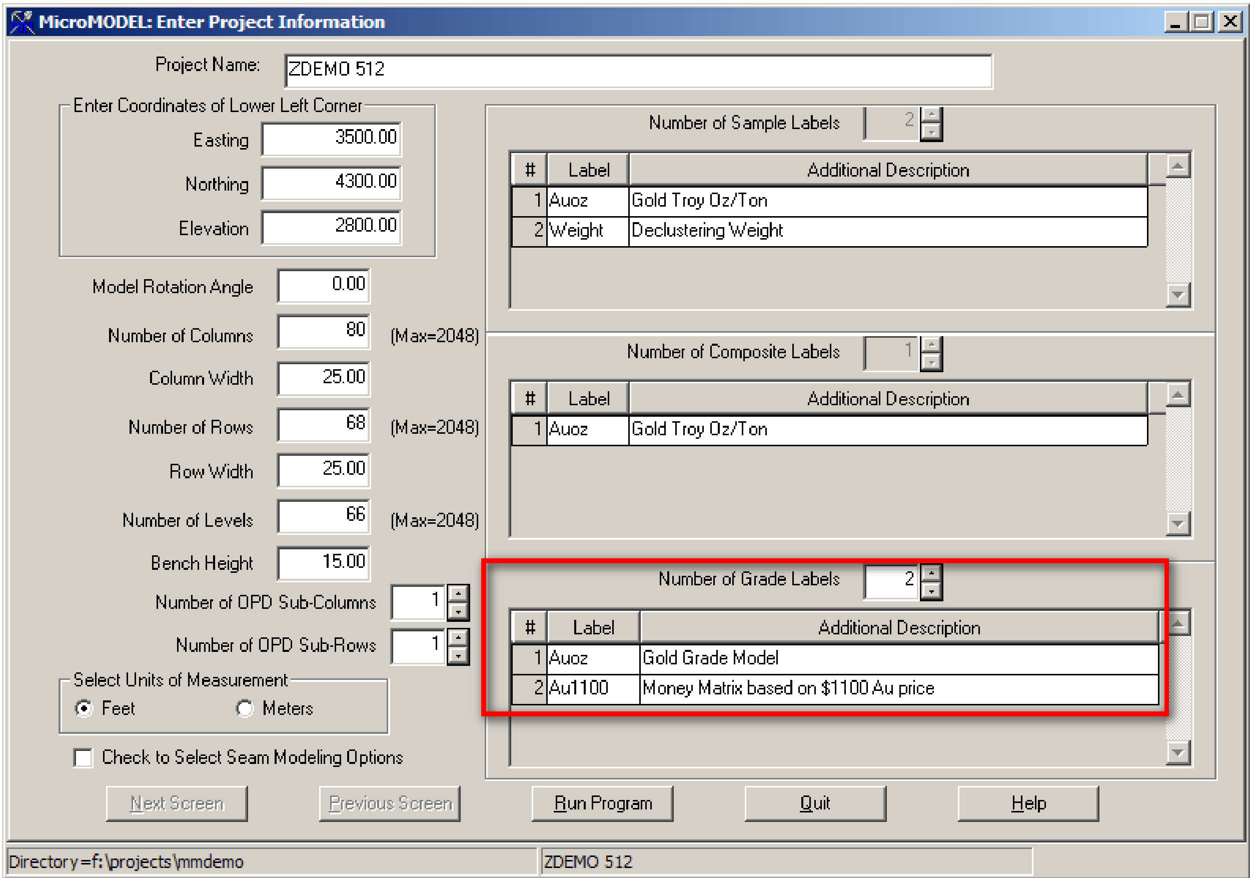


Figure 122 Add Grade Label for Storing Money Matrix Dialog

Our money matrix will be calculated based on these economic parameters:

Breakeven Cutoff Calculation		
Item	Heap Leach	ROM Leach
Mining Cost	2.40	2.40
Milling Cost	6.00	2.35
Recovery	0.80	0.65
Gold Price	1100	1100
NSR+Royalty	50	50
Net Gold Pay	1050	1050
Breakeven Au Grade	0.010	0.007

Figure 123 Economic Parameters for Money Matrix Calculations

This is a very simplistic model. MicroMODEL can handle more complicated scenarios, but this simple economic model has been chosen for our demonstration. The first money matrix input screen is shown below.

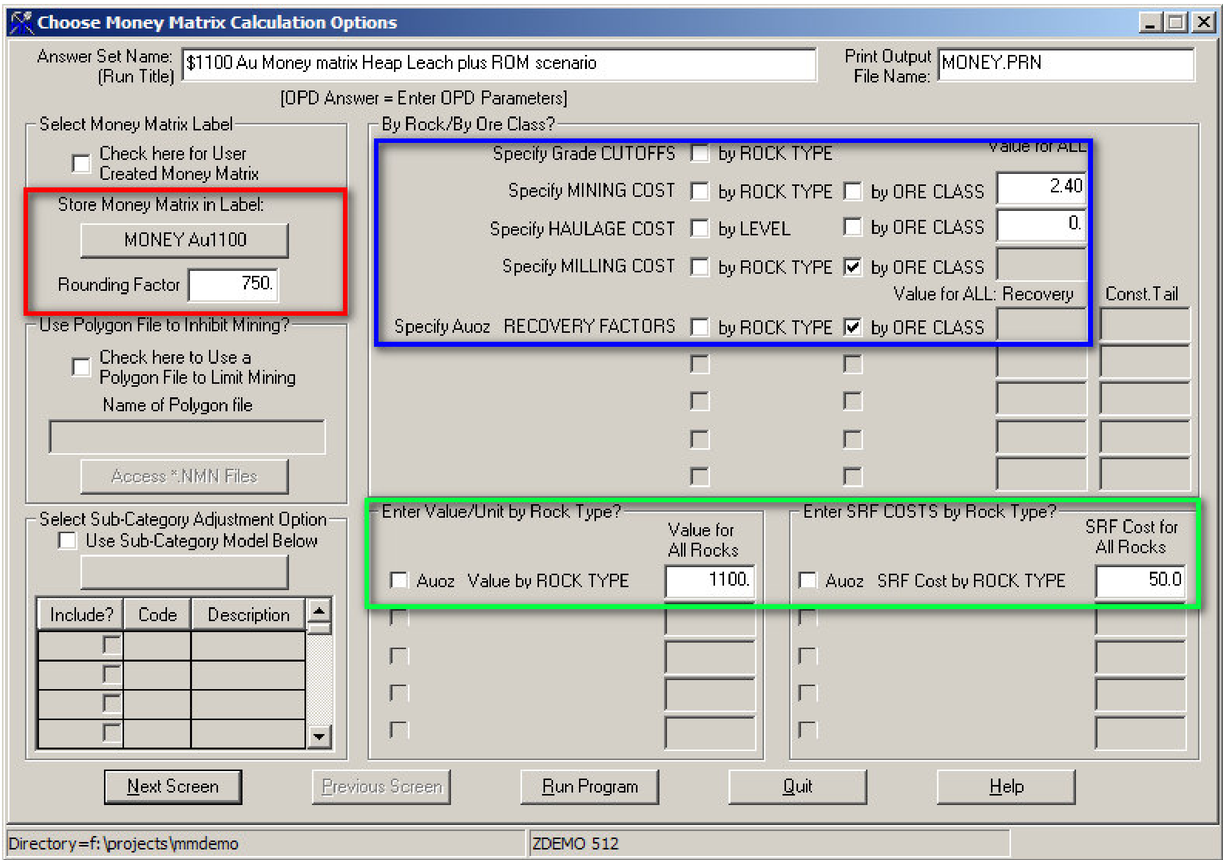


Figure 124 Money Matrix Calculation Dialog 1

1) Click on the" Store Money Matrix in Label" button and choose the Au1100 label. Change the short name to "MONEY" and the description to Money Matrix. The model selection dialog screen is shown below. The rounding factor of 750 converts the money matrix value calculated for the entire block into a value per ton, making it easier to check calculated values. This "trick" only works when the density factor is the same for all blocks, as it is in this case.(red)
2) The mining cost is the same for all rock types and ore classes and is entered as 2.40 per ton. We are not specifying additional haulage costs. Milling Cost and Recovery Factors are both entered by ore class, so the by ORE CLASS check box is selected for both of these items.(blue)
3) The gold value is entered as 1100 for all rock types. The royalty and SRF cost is entered as 50 for all rock types.(green)

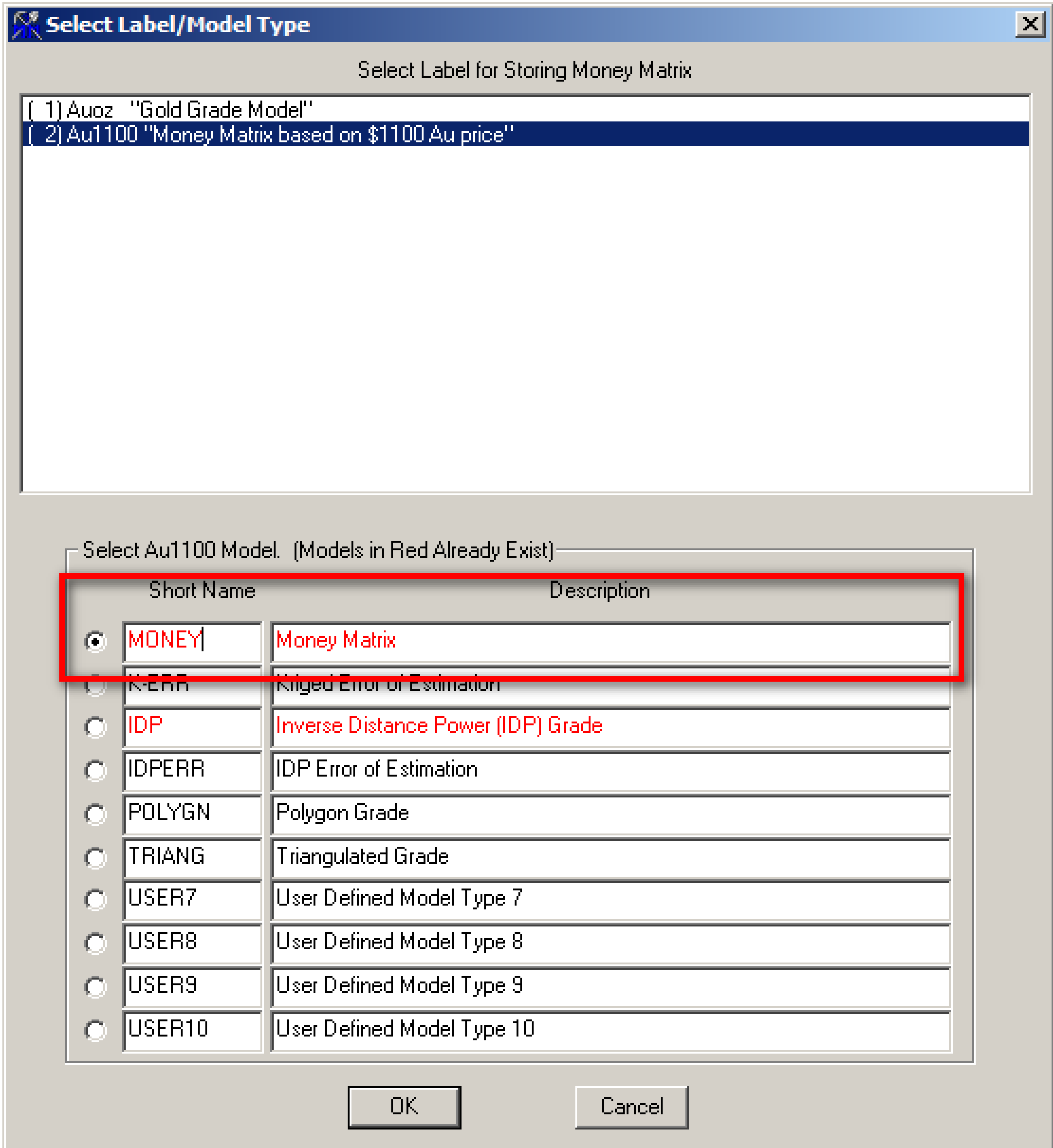


Figure 125 Selecting the Money Matrix Model and Changing Short Name and Description Dialog

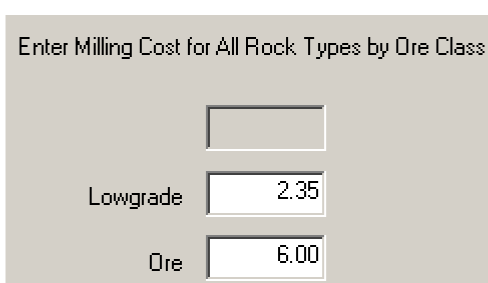


Figure 126 Money Matrix Calculation Dialog 2

In the second money input screen, we specify the milling cost for each of our ore types.

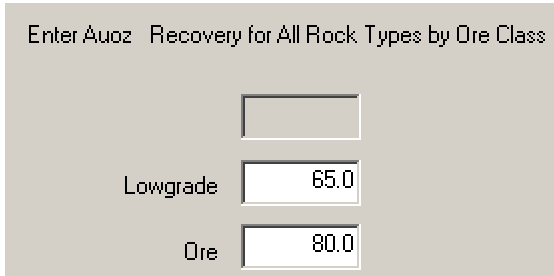


Figure 127 Money Matrix Calculation Dialog 3

In the third input screen, we enter the recovery factor for gold for both ore types. The recovery factor is entered as a percent (1 to 100). Here are the printed results of our money calculation. One important check is to be sure that the most negative block value (red)is the net value of the densest waste block. If the most negative value is more negative, then there is a problem with the cutoff that is entered.

```
Money Model Parameters:

  Lowgrade Cutoff =       0.007    Ore Cutoff =       0.010

  Mining Costs:

   ROCK     LOWGRADE      ORE        WASTE      TON(NES)/BLOCK     DENSITY

      1        2.40       2.40        2.40          750.00          12.500
   9999        2.40       2.40        2.40          750.00          12.500

Note: All haulage costs are set to 0.00

  Milling Costs:

   ROCK     LOWGRADE      ORE

      1      2.3500     6.0000
   9999      2.3500     6.0000

  Recovery and Value Parameters for Auoz    :

                  CONSTANT TAIL            PERCENT RCVY
   ROCK          LOWGRADE      ORE       LOWGRADE      ORE    UNIT VALUE   SRF COST

      1        0.00000     0.00000       65.0        80.0     1100.00       50.00
   9999        0.00000     0.00000       65.0        80.0     1100.00       50.00

  Money Values are stored in Model MONEY Au1100
    and are rounded by a factor of        750.
Cone Miner Parameters:

  Most negative block value:              -2.40

  Most positive block value:             125.68
```

Figure 128 Money Matrix Calculation Printout

1.45. Floating Cone Pit Design

(Video 66) – Money Matrix

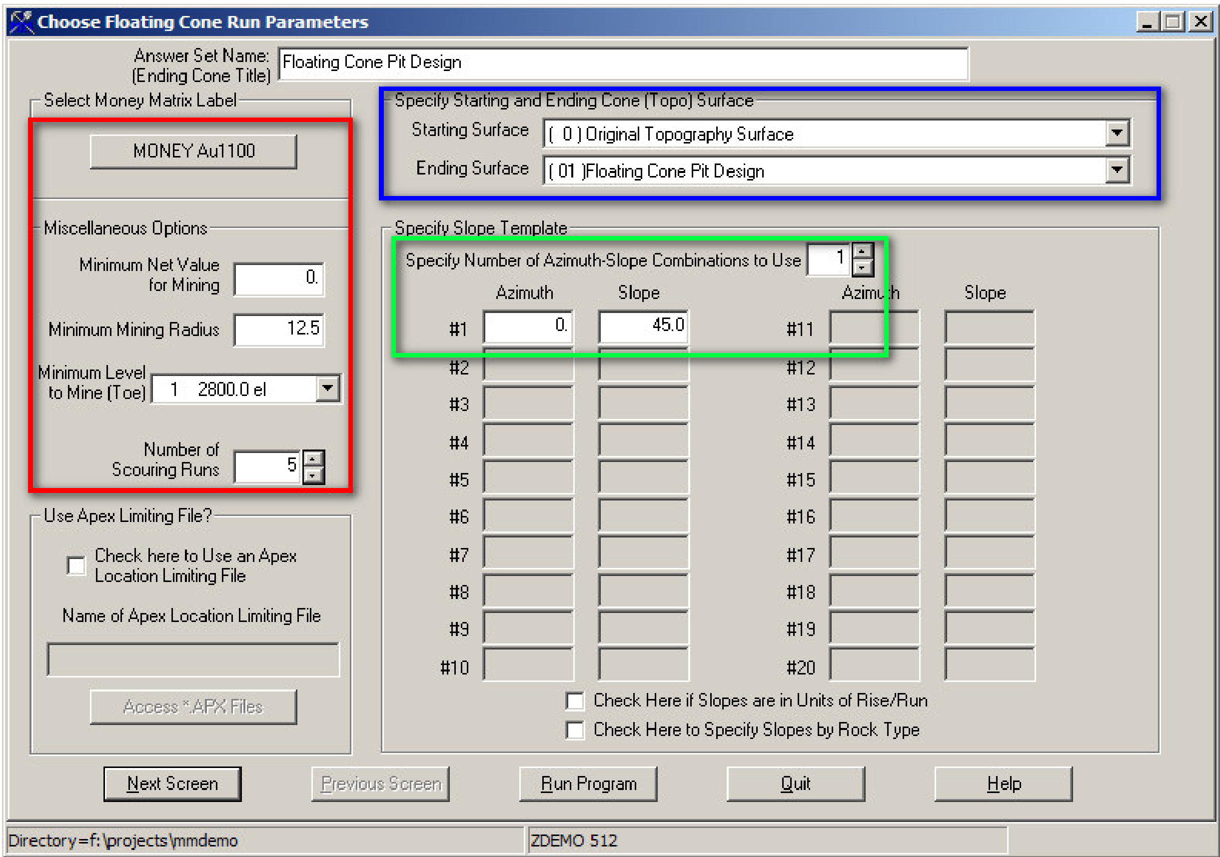


Figure 129 Floating Cone Design Dialog 1

1) Select the money matrix to use for this cone run. We are using the $1100 money matrix, stored in model MONEY Au1100. Set the miscellaneous options as shown.(red)
2) Select the starting and ending surface. We begin with current topography, and store the results in surface 1.(blue)
3) Set the slope to 45 degrees.(green)

After running the cone miner, create a contour plot of the surface just created:

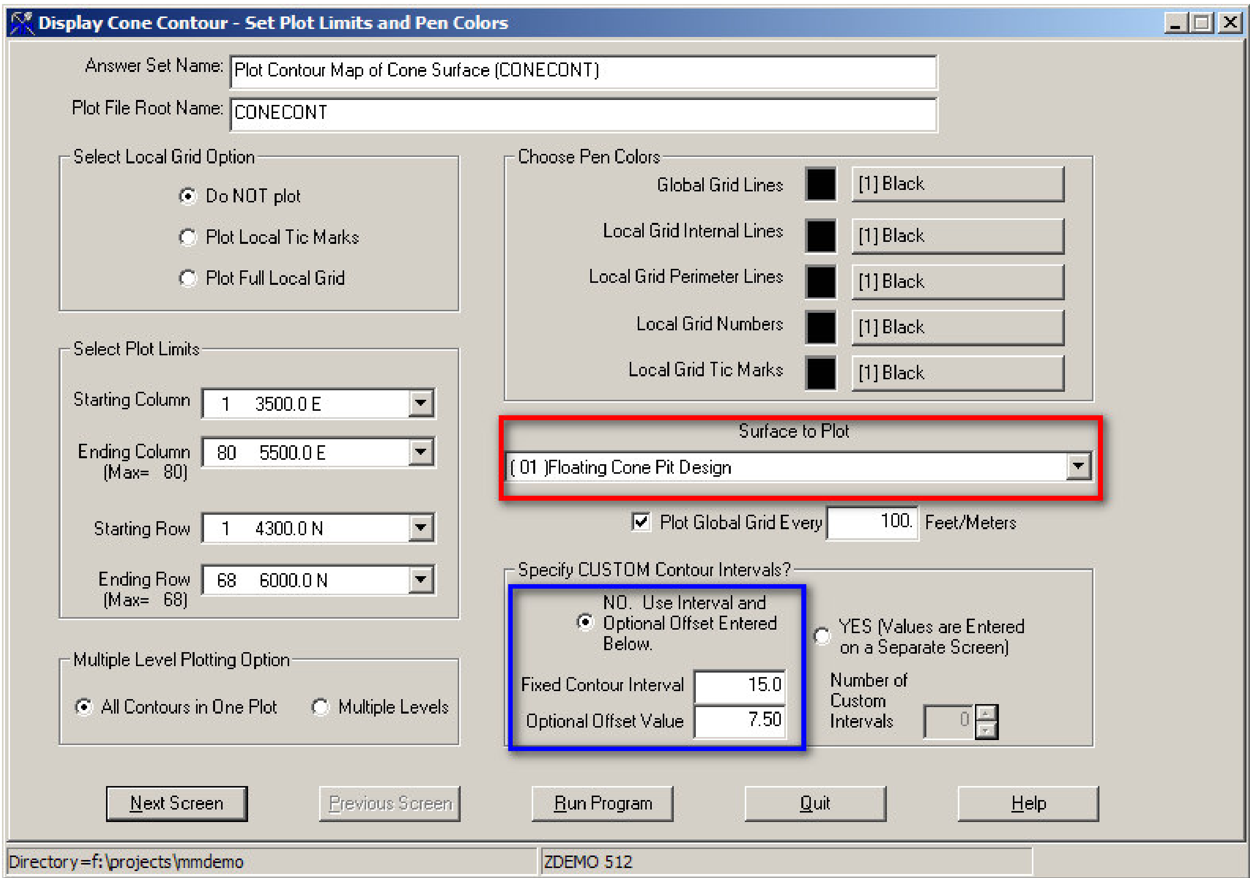


Figure 130 Create Contour Plot of Cone Pit Dialog 1

1) Choose the surface to contour. We select surface 1, which we just created with the cone mining program.(red)
2) Set contour control to fixed contour interval of 15 feet (the bench height) and add an offset of 7.5 feet, which is one-half the bench height to display mid-bench contours.(blue)

Here is a zoomed in view of the resulting contour plot:

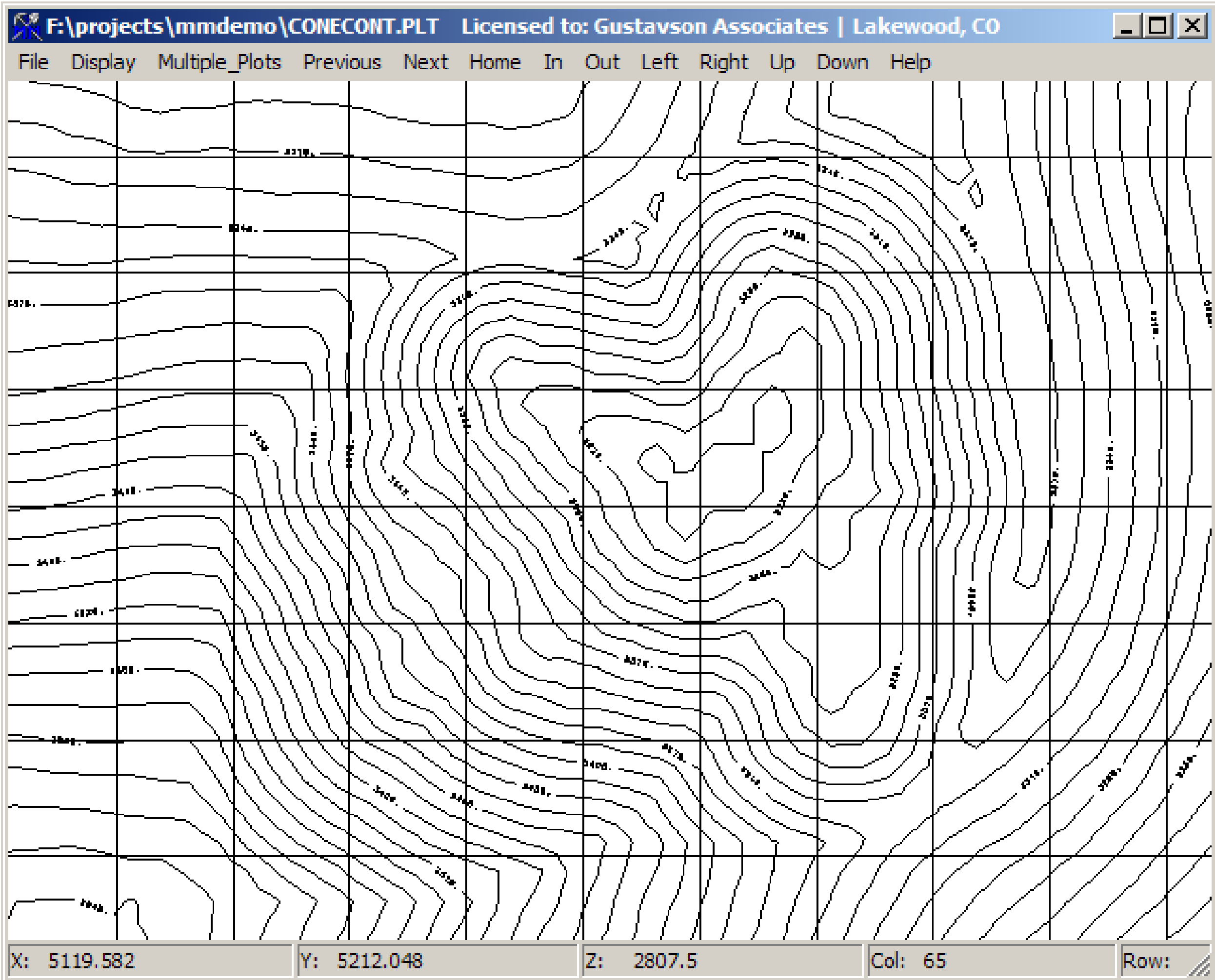


Figure 131 Plot of Cone Pit Contours

Calculate Cone Reserves (from Topo to Cone Limits).

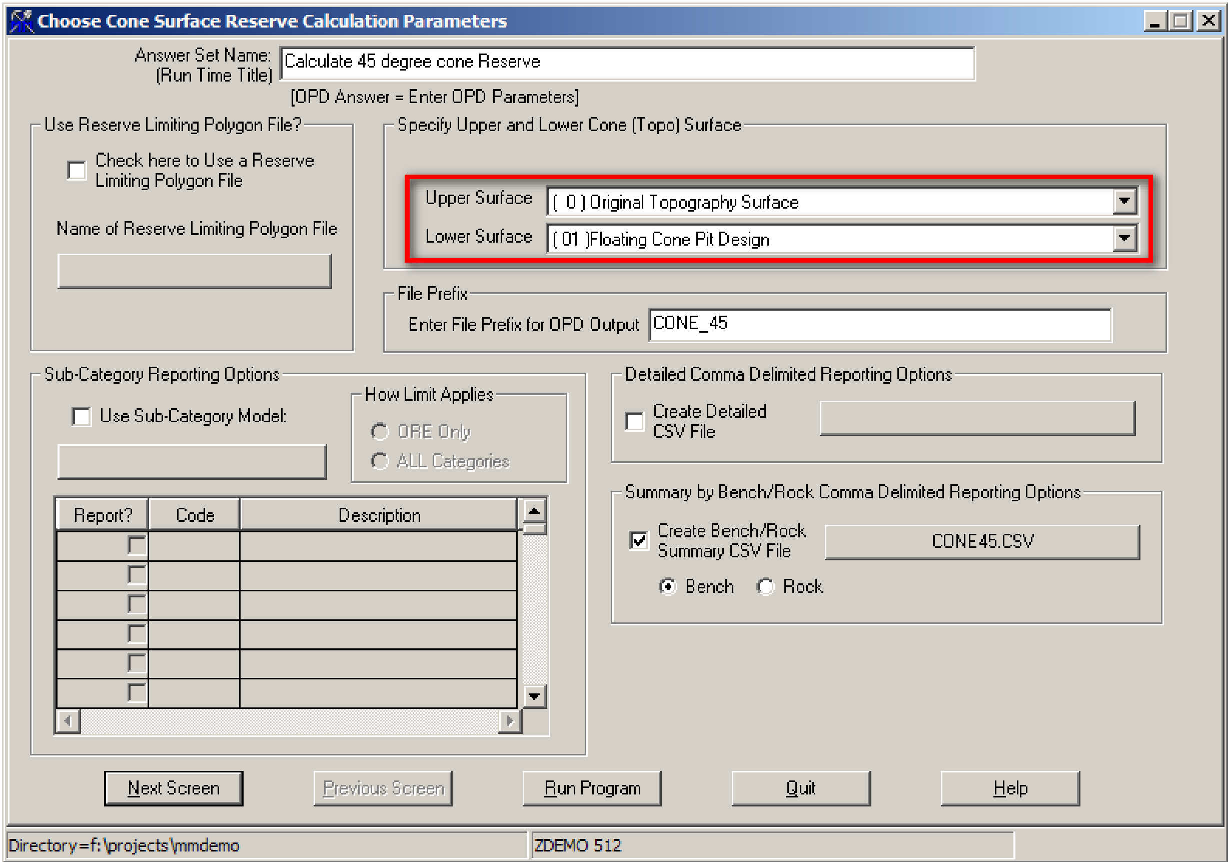


Figure 132 Calculate Cone Pit Reserves Dialog 1

1) Select the upper and lower surface that define the reserve volume.(red)

Here is a partial display of the reserve summary. The volume reporting was turned off prior to running the report:

Calculate 45 degree cone Reserve

SUM OF ALL ROCK TYPES
NOTE: Auoz WAS USED AS THE BASIS FOR CLASSIFYING
RESERVES BY CUTOFF GRADE
ALL VOLUMES AND TONNAGES ARE IN THOUSANDS

	ORE (>= 0.010 CUTOFF)		LOWGRD (0.007- 0.009)		WASTE	TOTAL	
BENCH LEVEL	TONNAGE TONS	Auoz IDP	TONNAGE TONS	Auoz IDP	TONNAGE TONS	TONNAGE TONS	STRIP RATIO
3610.0	0.	0.000	0.	0.000	3.	3.	99.99
3595.0	0.	0.000	0.	0.000	7.	7.	99.99
3580.0	0.	0.000	0.	0.000	13.	13.	99.99
3565.0	0.	0.000	0.	0.000	18.	18.	99.99
3550.0	0.	0.000	0.	0.000	23.	23.	99.99
3535.0	4.	0.033	1.	0.009	25.	29.	6.75
3520.0	10.	0.032	2.	0.009	24.	36.	2.61
3505.0	15.	0.032	3.	0.009	27.	45.	1.99
3490.0	27.	0.039	2.	0.008	29.	57.	1.16
3475.0	37.	0.045	2.	0.008	29.	69.	0.85
3460.0	63.	0.041	2.	0.008	39.	103.	0.64
3445.0	80.	0.039	2.	0.008	49.	131.	0.64
3430.0	90.	0.037	1.	0.009	65.	157.	0.74
3415.0	101.	0.038	1.	0.010	87.	188.	0.87
3400.0	103.	0.034	1.	0.009	116.	220.	1.14
3385.0	110.	0.030	0.	0.000	149.	259.	1.35
3370.0	112.	0.033	1.	0.007	154.	266.	1.38
3355.0	94.	0.035	0.	0.000	168.	262.	1.79
3340.0	90.	0.026	0.	0.000	156.	246.	1.74
3325.0	90.	0.024	2.	0.009	121.	213.	1.37
3310.0	93.	0.030	2.	0.008	88.	183.	0.97
3295.0	97.	0.036	1.	0.010	57.	154.	0.59
3280.0	91.	0.030	3.	0.009	33.	127.	0.40
3265.0	79.	0.020	3.	0.009	16.	98.	0.24
3250.0	59.	0.016	0.	0.007	10.	69.	0.16
3235.0	41.	0.017	0.	0.000	5.	46.	0.13
3220.0	22.	0.016	1.	0.010	3.	26.	0.18
3205.0	6.	0.012	2.	0.010	2.	9.	0.54
3190.0	0.	0.000	0.	0.000	0.	0.	99.99
TOTAL	1513.	0.031	30.	0.009	1515.	3057.	1.02

Figure 133 Printout of Cone Reserves

We generated a cone pit containing roughly 1.5 million tons of heap leach ore at an average grade of 0.031 opt, and 30 thousand tons of ROM at an average grade of 0.009 opt. The strip ratio for our pit is just over 1 to 1.

1.46. Find Maximum Dump/Pad Volume within Boundary Limit

The Pits choice Find Maximum Dump Volume Within Boundary allows the user to select an area within the project, and design a dump at a given slope angle and maximum elevation that will maximize volume, given these limitations.

The program requires a boundary file that is in the format of an RSV (reserve limiting) file. Since the boundary line should be a single polygon, the CNT file format will work as well. The following input screen shows the items of information that must be specified.

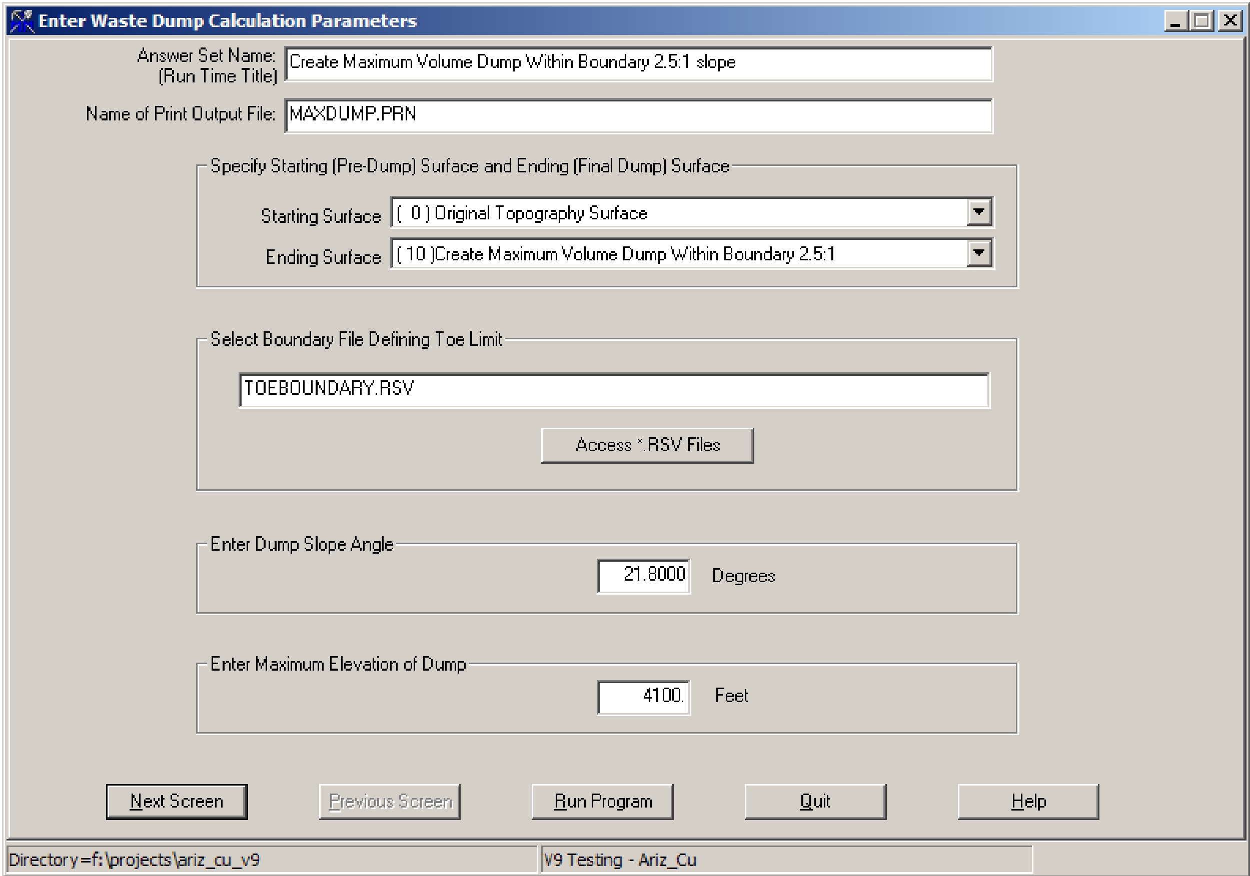


Figure 134 Find Maximum Dump Volume Dialog 1

Taking the surface that was generated, we create a 3-D view of the original surface, the maximum dump surface, and also show the approximate boundary line as projected to the original surface.

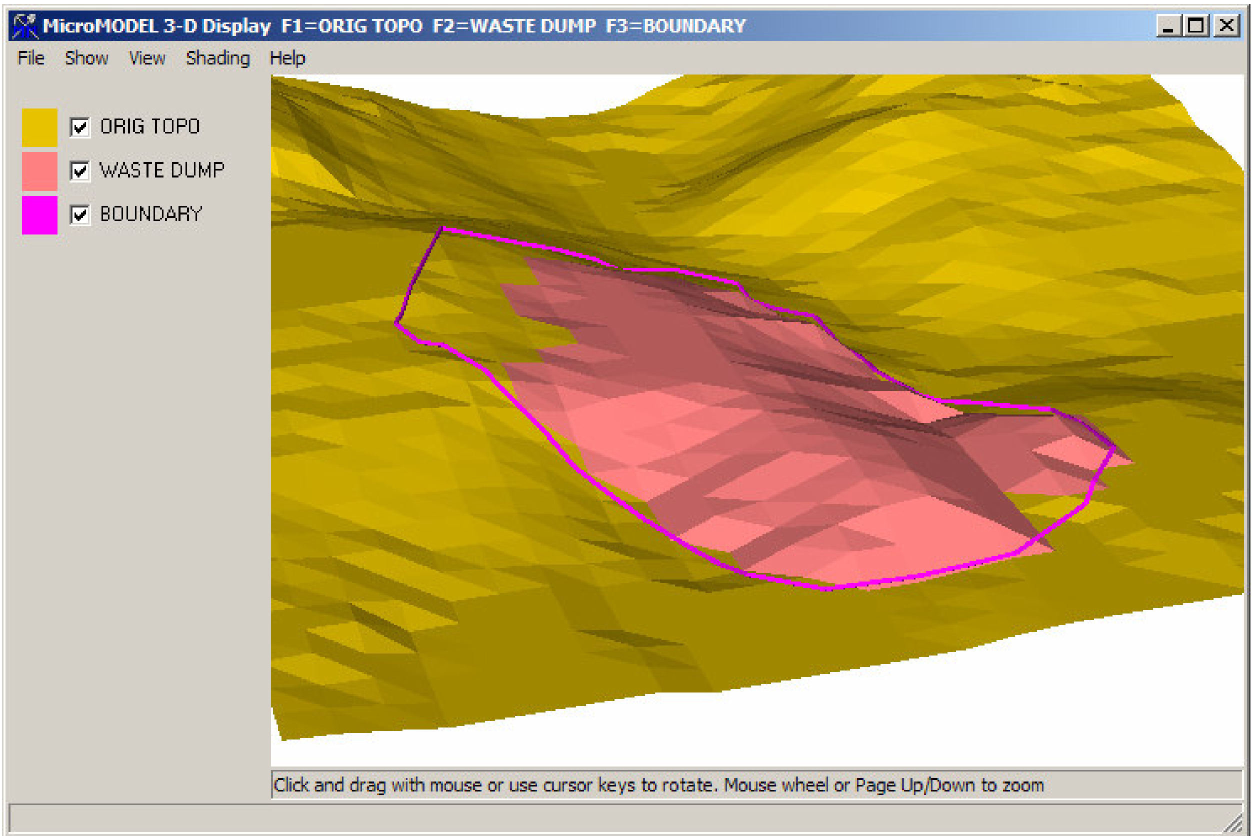


Figure 1353-D Display of Maximized Dump Surface