4 Import

4.3.14 Import Wells

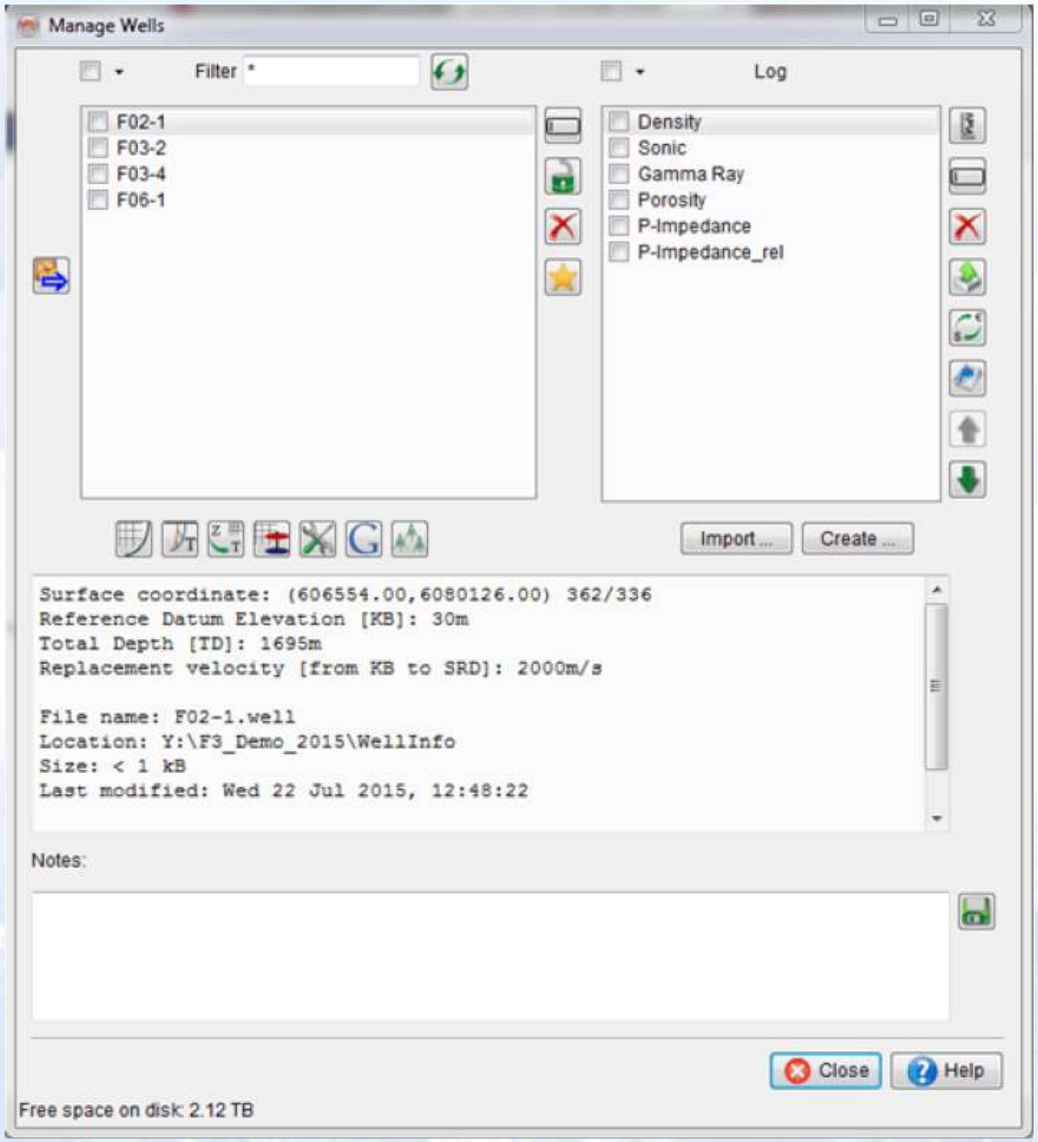
4.3.14 Import Wells

Well data in OpendTect is organized into four sub-categories: well tracks, well logs, markers (well tops) and time-depth models. Each category can be imported via *Survey* > *Import* > *Wells* menu:

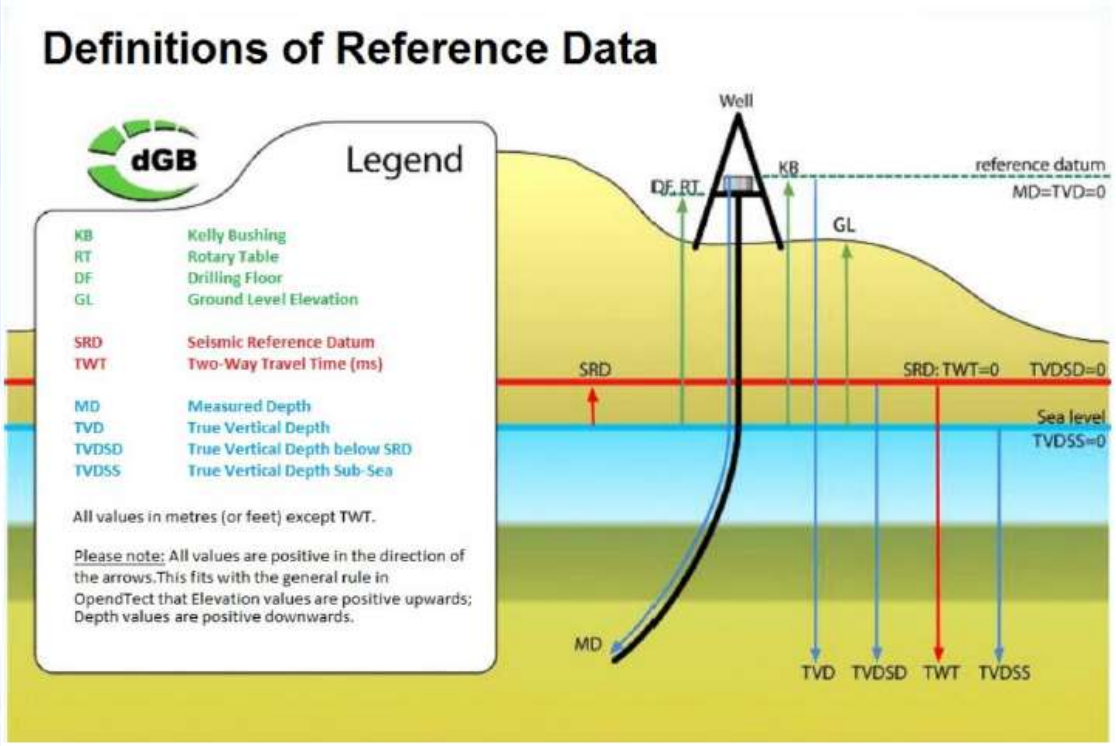
- *ASCII*: single well import.
- *Simple Multi-Well*: simple multi-well import of vertical wells.
- *Bulk*: multi-well import.
- *VSP (SEG-Y)*:import of zero-offset VSP data.

Alternatively, import (and editing) of well data is available from the *Manage Wells* window (*Survey* > *Manage* > *Manage Wells*):

- *Import* button in Well Track, Checkshot, Depth/Time Model and Markers editors allows to import these tables from ASCII files.
- *Import...* button below *Log* list allows to import well logs from LAS files.


Manage Wells
Filter *
Log
F02-1
F03-2
F03-4
F06-1
Density
Sonic
Gamma Ray
Porosity
P-Impedance
P-Impedance_rel
Import ...
Create ...
Surface coordinate: (606554.00,6080126.00) 362/336
Reference Datum Elevation [KB]: 30m
Total Depth [TD]: 1695m
Replacement velocity [from KB to SRD]: 2000m/s
File name: F02-1.well
Location: Y:\F3_Demo_2015\WellInfo
Size: < 1 kB
Last modified: Wed 22 Jul 2015, 12:48:22
Notes:
Close
Help
Free space on disk: 2.12 TB

Reference datums used in OpendTect are schematically shown in the figure below:



Well depths in OpendTect are always referenced using their Measured Depth (MD). The alignment with seismic data is done using well track data (deviation survey) and time-depth (and/or checkshot) data. The well track data provides the relation between lateral coordinates, True Vertical Depth Sub Sea (TVDSS) and MD values. The time-depth data provides the relation between MD and Two Way Times (TWT).

4.3.14.1 From ASCII Files

Single well import is available via *Survey* > *Import* > *Wells* > *ASCII* menu:

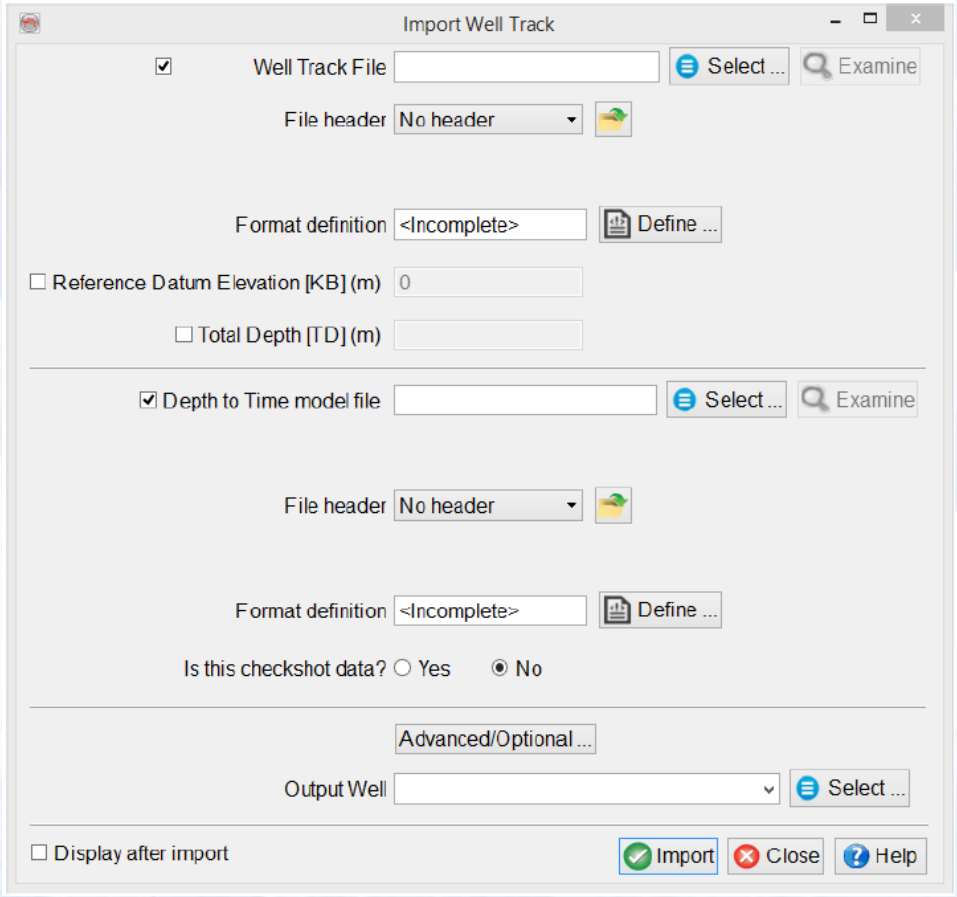
- *Track*: import of deviation survey and time-depth model (and/or checkshot data).
- *Logs*: import of well logs from LAS files.
- *Markers*: import of markers (well tops).

4.3.14.1.1 Track (井轨迹)

Well track (deviation survey) of a single well can be imported to OpendTect using a column sorted ASCII file or defined as vertical via *Survey* > *Import* > *Wells* > *ASCII* > *Track...* In time surveys, time-depth model must be either imported using column sorted ASCII file or temporarily defined as constant velocity at this step.

The well track is the core part of a well, it is required for the visualization of well data in depth and further loading of markers and logs. The well track determines the size of the usable and displayed well data. Any log or marker outside of the track Z range will neither be usable nor be displayed. On the other hand the well track is not limited to the survey Z range and can be loaded outside the survey box.

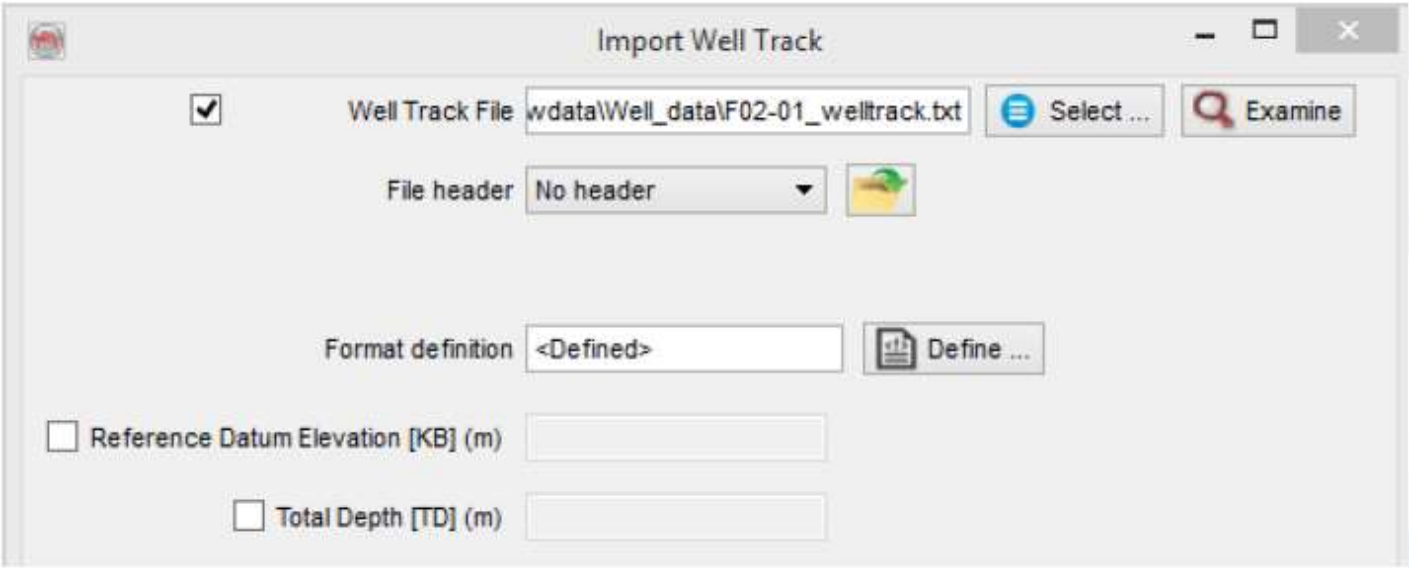
A time-depth model is another core piece of information which is required for visualization and use of well data in time.


Import Well Track
Well Track File
Select ...
Examine
File header
No header
Format definition
<Incomplete>
Define ...
Reference Datum Elevation [KB] (m)
0
Total Depth [TD] (m)
Depth to Time model file
Select ...
Examine
File header
No header
Format definition
<Incomplete>
Define ...
Is this checkshot data?
Yes
No
Advanced/Optional ...
Output Well
Select ...
Display after import
Import
Close
Help

Well Track

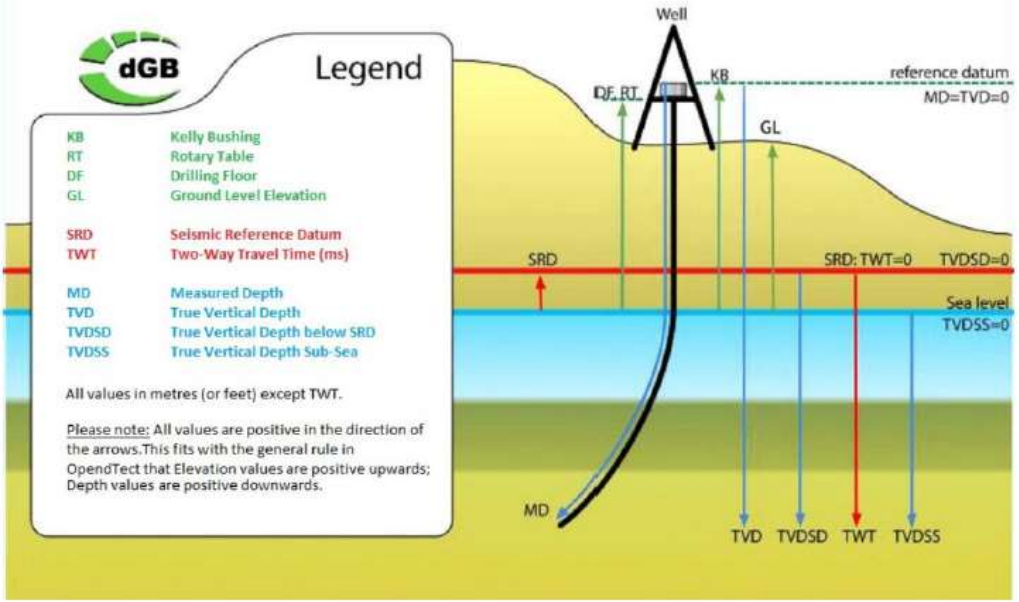
Well Track File

Checked box at the top of *Import Well Track* window allows to select an ASCII file containing a well track, vertical or deviated.



Reference datums used in OpendTect are schematically shown in the figure below (note that Measured Depth [MD] is always referenced from Kelly Bushing [KB]):

Definitions of Reference Data

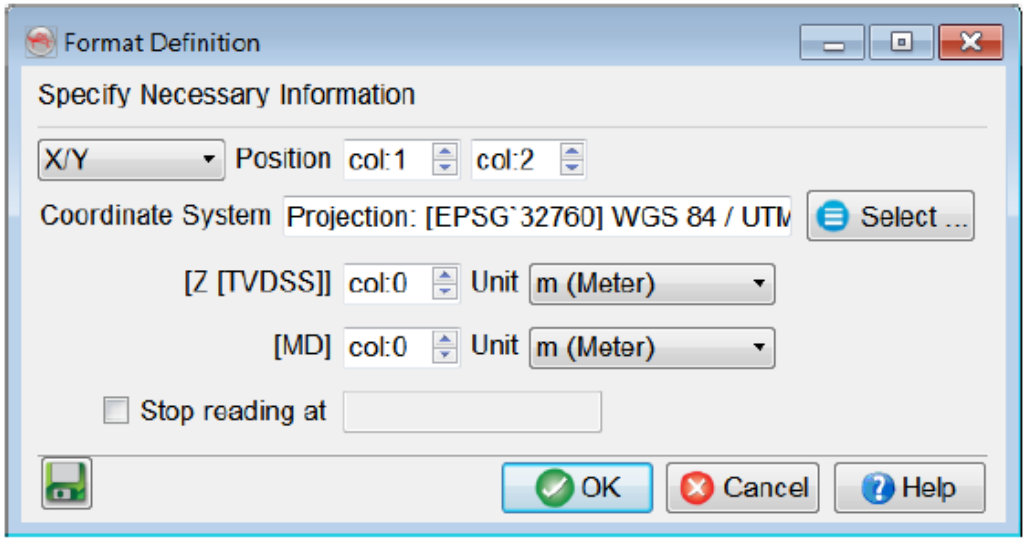


- *For a deviated well, the file must contain 4 columns: position information (X/Y or Inl/Crl), true vertical depth sub sea (TVDSS) and MD.*
- *For a vertical well, the file must contain at least 3 columns: position information(X/Y or Inl/Crl) and at least one depth column, TVDSS or MD (Reference Datum Elevation [KB] value must be specified in this case).*
- *The best way to ensure that the reference datum elevation is properly set is to have the deviation survey file starting at MD = 0 and TVDSS of KB. In the example below: KB elevation of a well is 34.1 m above MSL, i.e. in OpendTect TVDSS at KB is -34.1 m, which corresponds to MD=0.0 m:*

X	Y	Z (TVDSS)	MD
623255.98	6082586.87	-34.10	0.00
623255.98	6082586.87	0.00	34.10
623255.98	6082586.87	65.90	100
623255.84	6082591.69	440.86	475

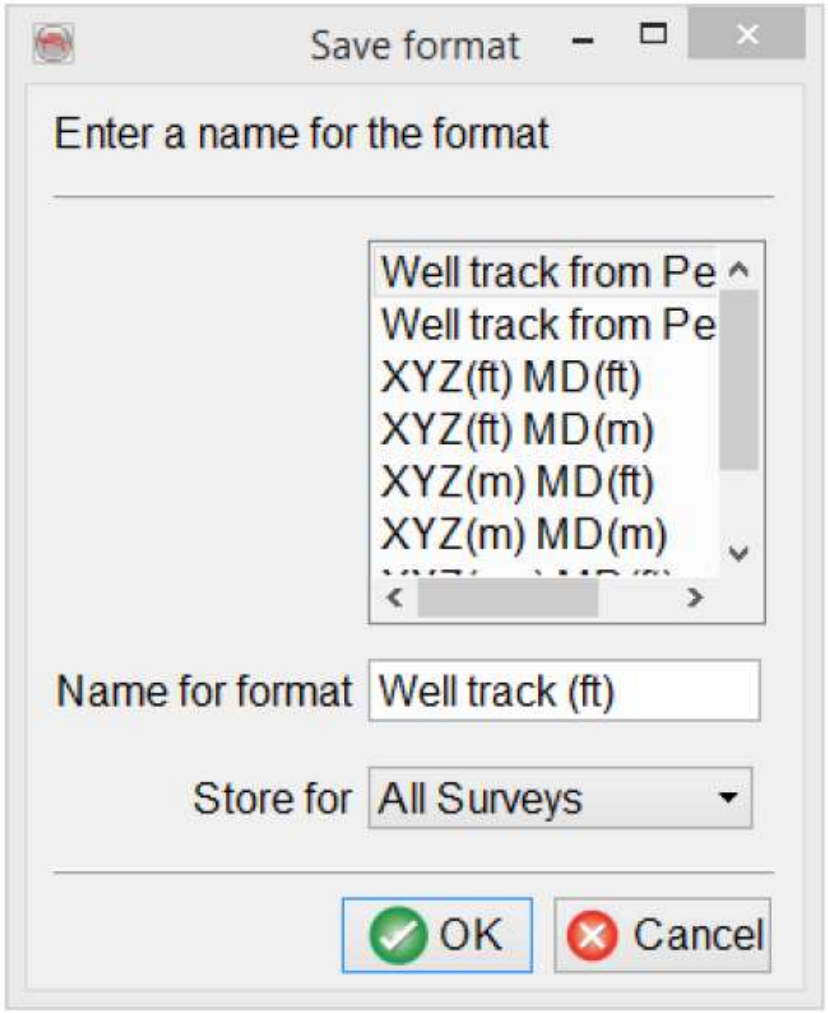
Format definition

Predefined and saved file formats are available by clicking on icon. Otherwise the format must be manually specified by clicking on *Define* button and selecting column numbers corresponding to position information (X/Y or Inl/Crl), Z and MD. If Coordinate Reference System (CRS) is defined for the survey, CRS conversion will be available in the import window.



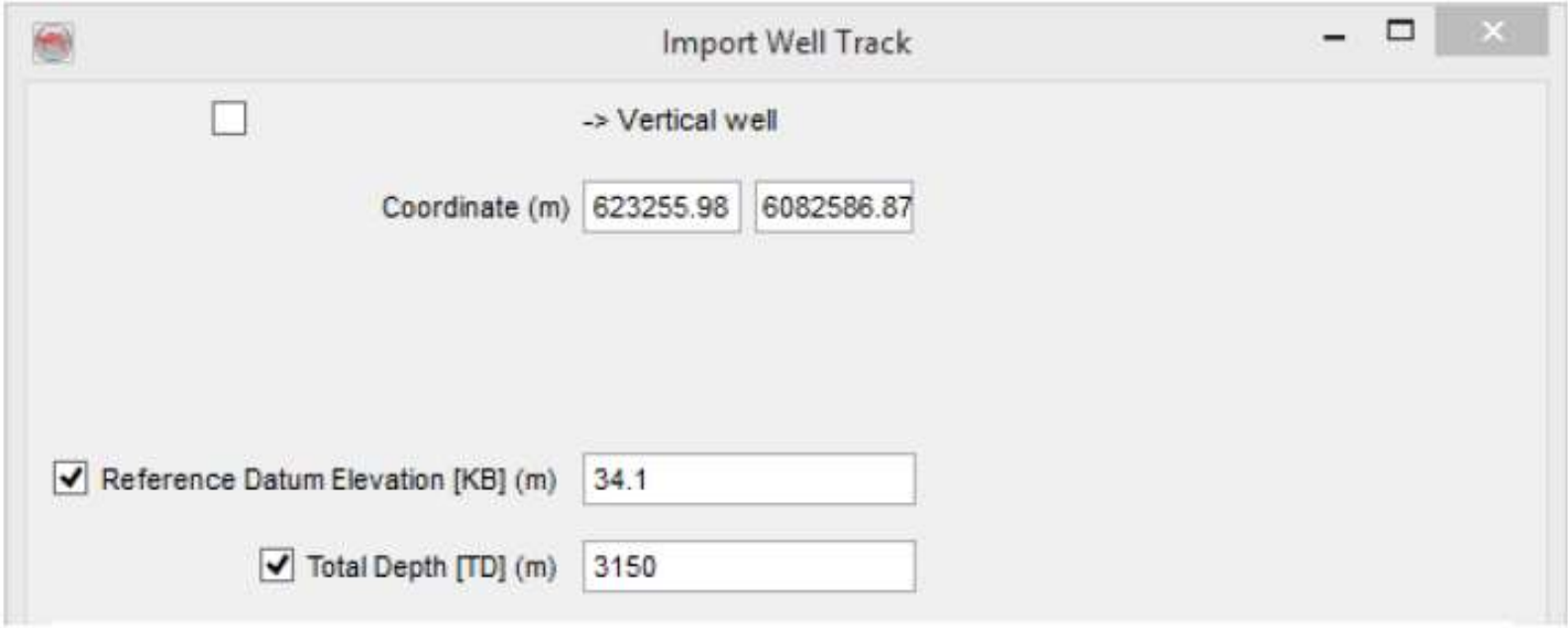
- *X* and *Y* are absolute coordinates (not relative to the surface coordinates) and must have same units as the OpendTect survey coordinates.
- *Z* is TVDSS, increasing downwards and equal to zero at sea level.
- For a vertical well, either *Z* or *MD* can be left unspecified (*col:0*). In this case *Reference Datum Elevation [KB]* value must be provided in the main *Import Well Track* window.

It is recommended to save the format definition for a later use and QC, by clicking on icon. The format can be stored at different levels (*All surveys*, *This survey only*, or *My user ID only*) depending on the usage.



Vertical well

Unchecked box at the top of *Import Well Track* window allows to create a vertical well by entering its surface coordinates, *Reference Datum Elevation [KB]* and *Total Depth [TD]*.



Time-Depth Model 时深转换模型

If checked *Depth to Time model file*, a file containing the time-depth relation model can be provided as an ASCII file containing depth as TVDSS, TVD-SRD or MD. If time-depth model is unavailable, the check box at the left of this field can be deselected and temporary model velocity value (m/s) should be provided.

Predefined and saved formats are again available by pressing the  icon. Otherwise the format must be manually specified. The *Define* button gives access to the *format definition* window.

You must specify in the format definition window the column where depths and times are located, and the type of data to be expected. Three types of depths are supported for loading a check-shot/time-depth curve from a file. The supported depths are: MD, TVDSS, TVD rel SRD. Time values can be either one-way or two-way traveltimes. Times (lines) that should not be read must all have the same numerical value, which is to be filled in as the *Undefined value*".

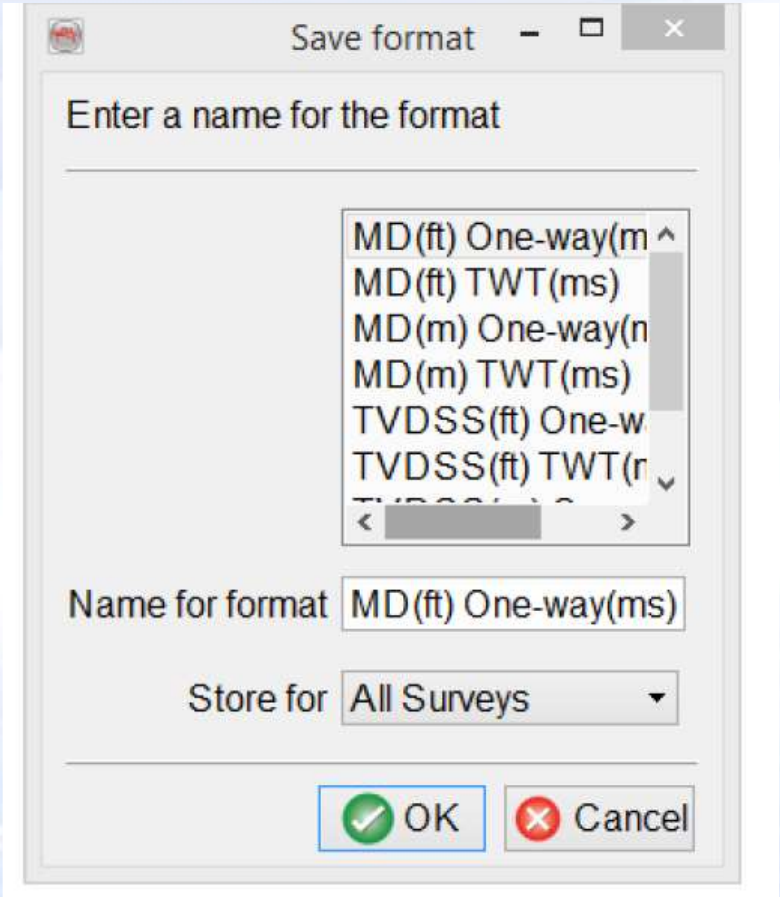
Time-depth models are always stored using measured depths and two-way travel times in seconds. Therefore any other input format will cause a conversion of the input data. Data loading can be stopped at a specific line by providing the adequate keyword.

It is mandatory that the time-depth model obeys the following requirement: TWT = 0.0 ms corresponds to TVDSS at SRD. The best way to ensure this is to have such line in the imported file. For example, if SRD is 1000.0 m above MSL, i.e. in OpendTect TVDSS at SRD is -1000.0 m, then the file should contain a line with the following TVDSS (m) - TWT (ms) pair: -1000.0 m - 0.0 ms.

It is highly recommended that the 2nd sample of the time-depth model corresponds to the start depth of your sonic log, unless the input is a measured checkshot survey.

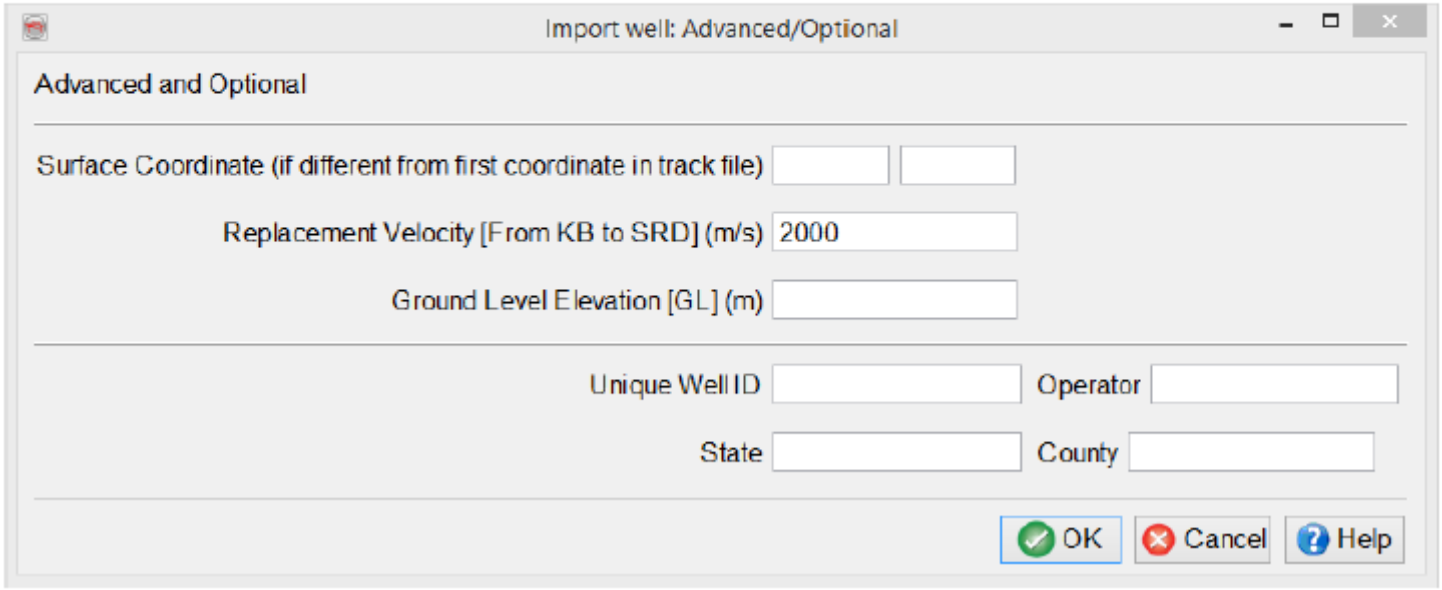
The Time-Depth model used during import can be either a checkshot model or a "normal" time depth curve. More information can be found in the well management chapter.

类似地，可以保存时深转换模型读取的设置：



Advanced/Optional

The *Advanced/Optional* button allows the user to provide optional parameters.

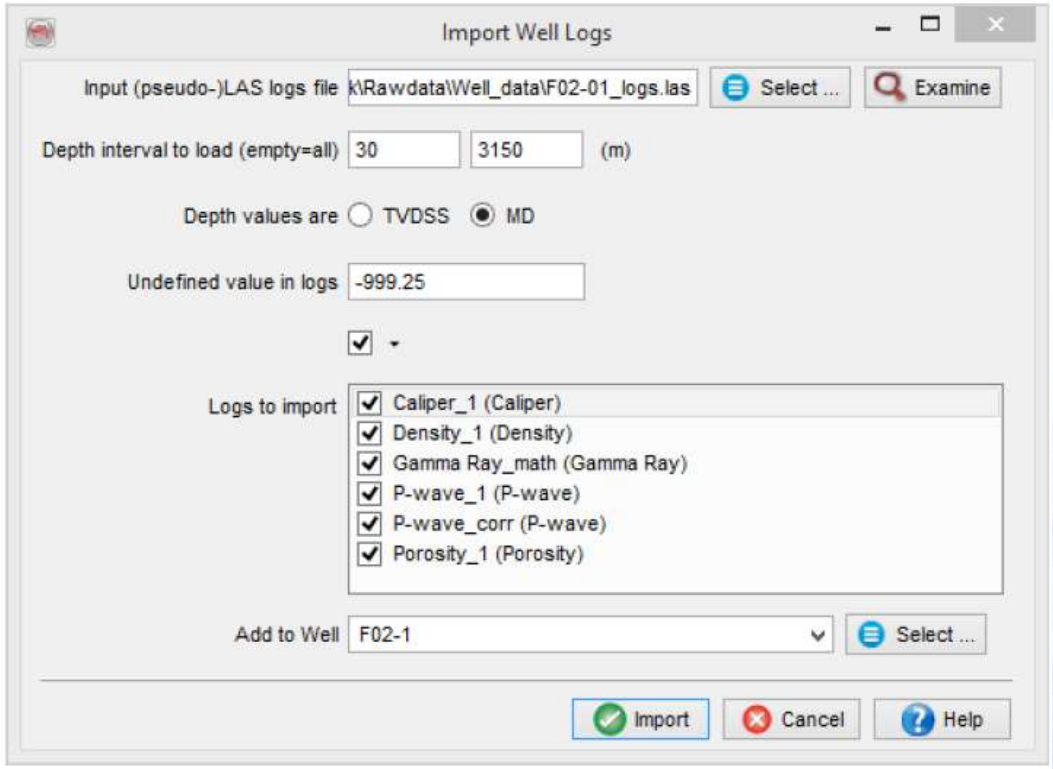


- **Surface Coordinate**: if provided, the coordinates written in the first line of the track file will be overruled.
- **Replacement Velocity**: interval velocity from KB to SRD.
- **Ground Level Elevation**: elevation of GL above MSL.
- **Unique Well ID**: unique well identifier which can be used during import of well logs and markers.
- **Operator**, **State** and **County**: text details about a well.

4.3.14.1.2 Logs 录井，LAS格式文件

Logs of a single well can be imported to OpendTect as LAS or pseudo-LAS file via *Survey* > *Import* > *Wells* > *ASCII* > *Logs...* The import of well logs requires the well track to be imported first.

Logs can also be imported or computed from the well manager.



Import Logs: The LAS file should contain depth values as MD or TVDSS. Alternatively, the log files can be pseudo-LAS, meaning LAS (with one line of data per depth value) with the header replaced by a one-line definition: "Depth Gamma Sonic" etc (without quotes). Log names should be separated by blank characters (space or tab). For both LAS and pseudo LAS, the following units can be recognized. The recognition process is case insensitive.

Once the file has been selected all recognized logs will be listed in the *Select logs* section. Only the highlighted logs will be imported. Be careful that two logs do not have the same name. The depth interval can be limited to a sub-range. The start depth, stop depth and step written in the LAS files are not used; instead the depths found on the same line as the amplitudes will be used.

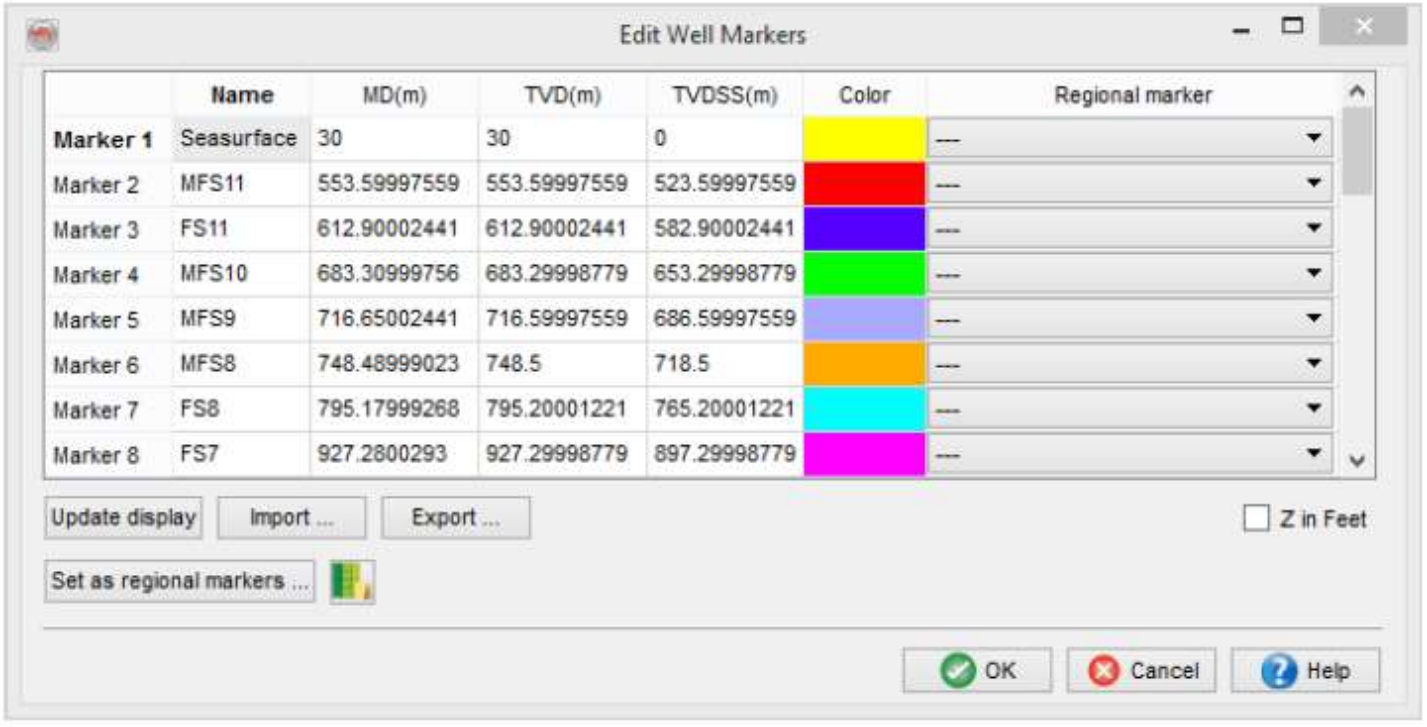
In pseudo LAS, units should follow directly behind the log name in parentheses, e.g. Depth(ft) Density(g/cc). Below are examples of text string that will match units:

- Time: *s, msec, µsec*
- Distance: *m, feet, f, ft, in*
- Density: *kg/m3, g/cc, g/c*
- Velocity: *m/s, ft/s, f/s, feet/s, km/s*
- Sonic: *s/m, us/ft, µsec/f, us/m, usec/m*
- Acoustic Impedance: *kg/m2s, kg/m2us, g/ft2s*
- Fraction (porosity, water saturation): *%, PU, or blank for unitless*
- Permeability: *k*
- Gamma Ray: *API*
- Electric Potential: *V*
- Resistance: *ohm*
- Compressibility: *1/Pa*
- Temperature: *K, deg.C, deg.F*
- Pressure: *Pa, bar*

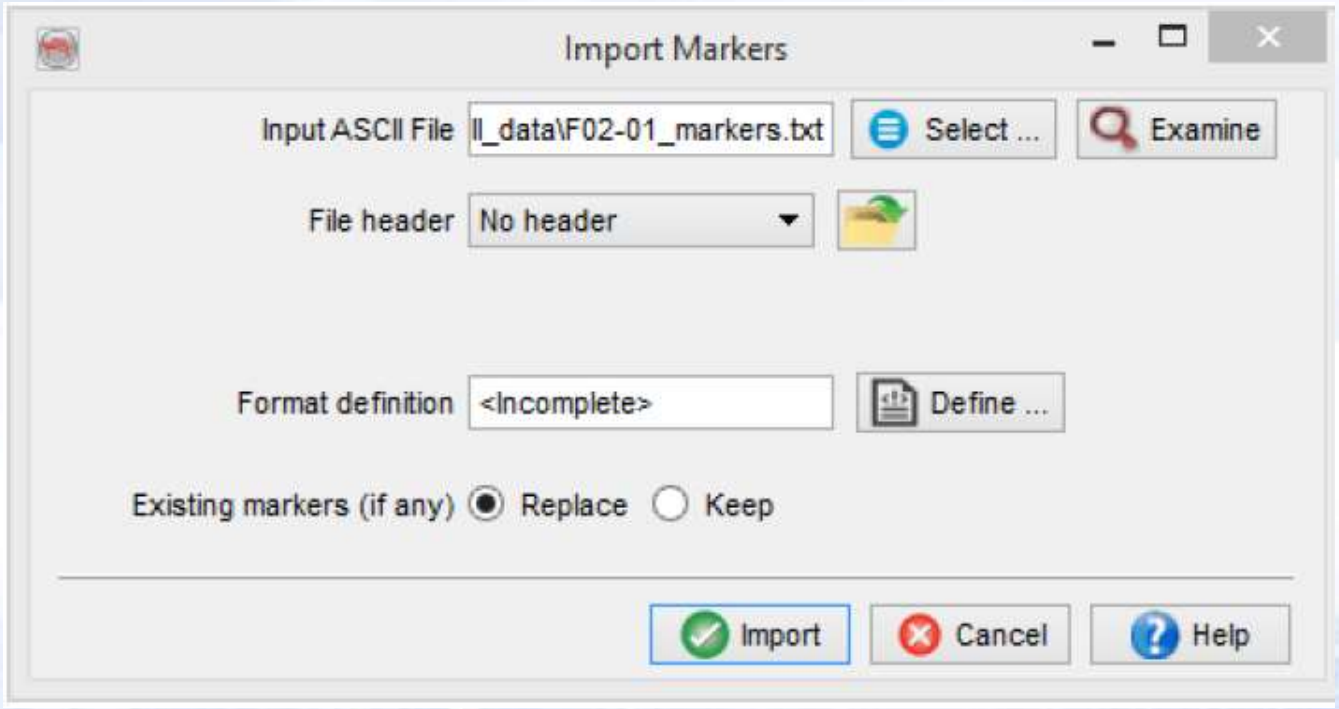
4.3.14.1.3 Markers

Markers of a single well can be imported to OpendTect as ASCII files via *Survey* > *Import* > *Wells* > *ASCII* > *Markers*...The import of markers requires the well track to be imported first.

Markers can be also imported from the well manager.



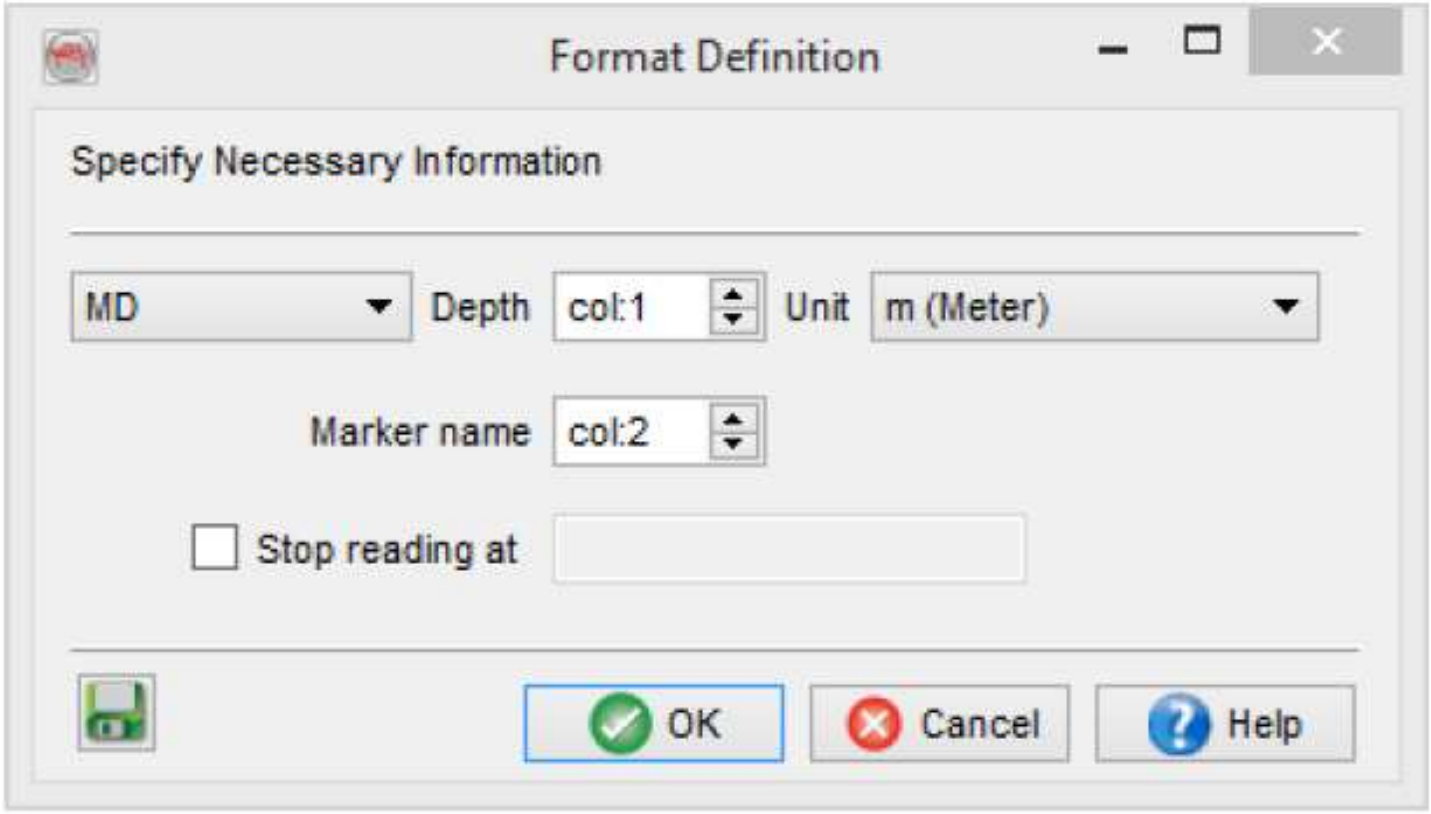
In the *Edit Well Markers* window click on *Import* button to display *Import Markers* window.



Input ASCII file should contain names of the markers and depth values as MD or TVDSS and can be displayed by pressing the *Examine* button.

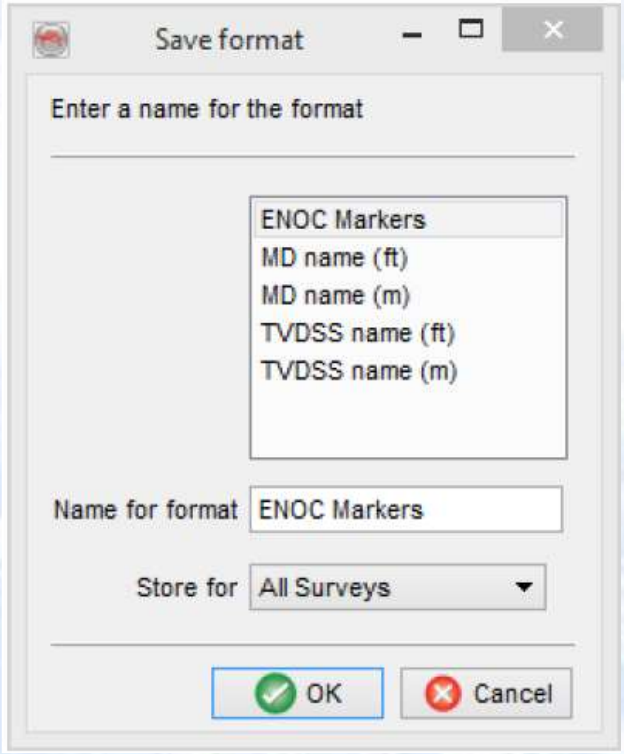
Format definition

Predefined and saved file formats are available by pressing the Open icon . Otherwise the format must be manually specified. The *Define* button gives access to the format definition window.



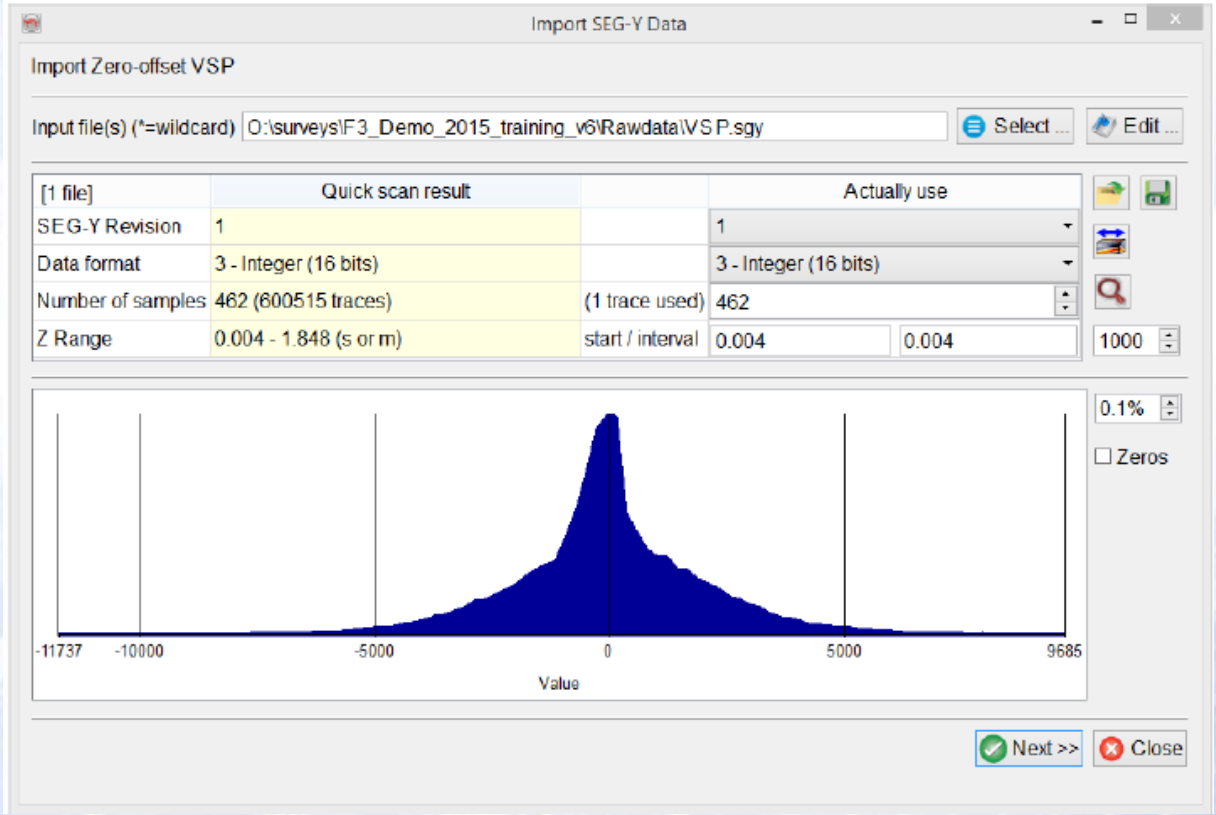
Column numbers of the marker name and depth should be specified. Please mind the spaces in the marker names that can break the fixed column format.

It is recommended to save the format definition for a later use and QC, by clicking on the Save icon  . In pop-up window, write the name of the format and store it. The format can be stored at different levels (All surveys, Current survey, Current OpendTect user level) depending on the usage. Press *Ok* when done.

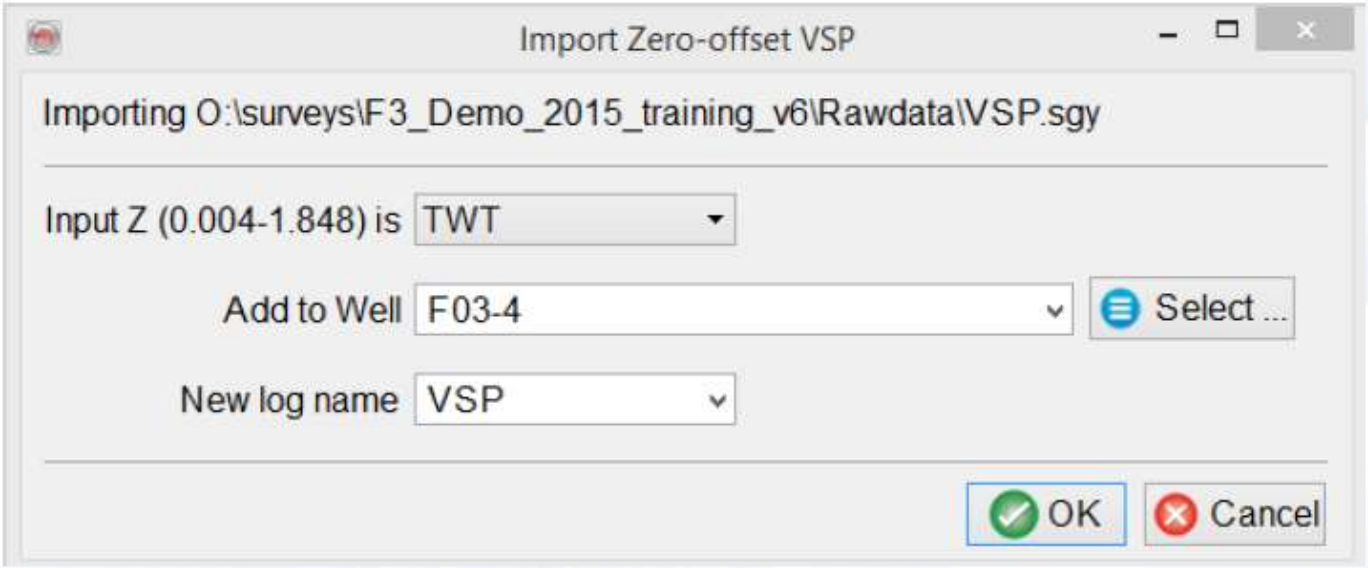


4.3.14.2 Import Zero-Offset VSP

A zero-offset VSP data can be imported for a selected well via *Survey* > *Import* > *Wells* > *VSP (SEG-Y)*... First browse and locate the input file. Then in the Import SEG-Y Data window check the quick scan results and press *Next* when done.



In the pop-up *Import Zero-offset VSP* window, select the type of input Z values (TWT, TVDSS or MD), select the well to which the VSP log should be added and press OK to import the log.



4.3.14.3 Import Well Locations

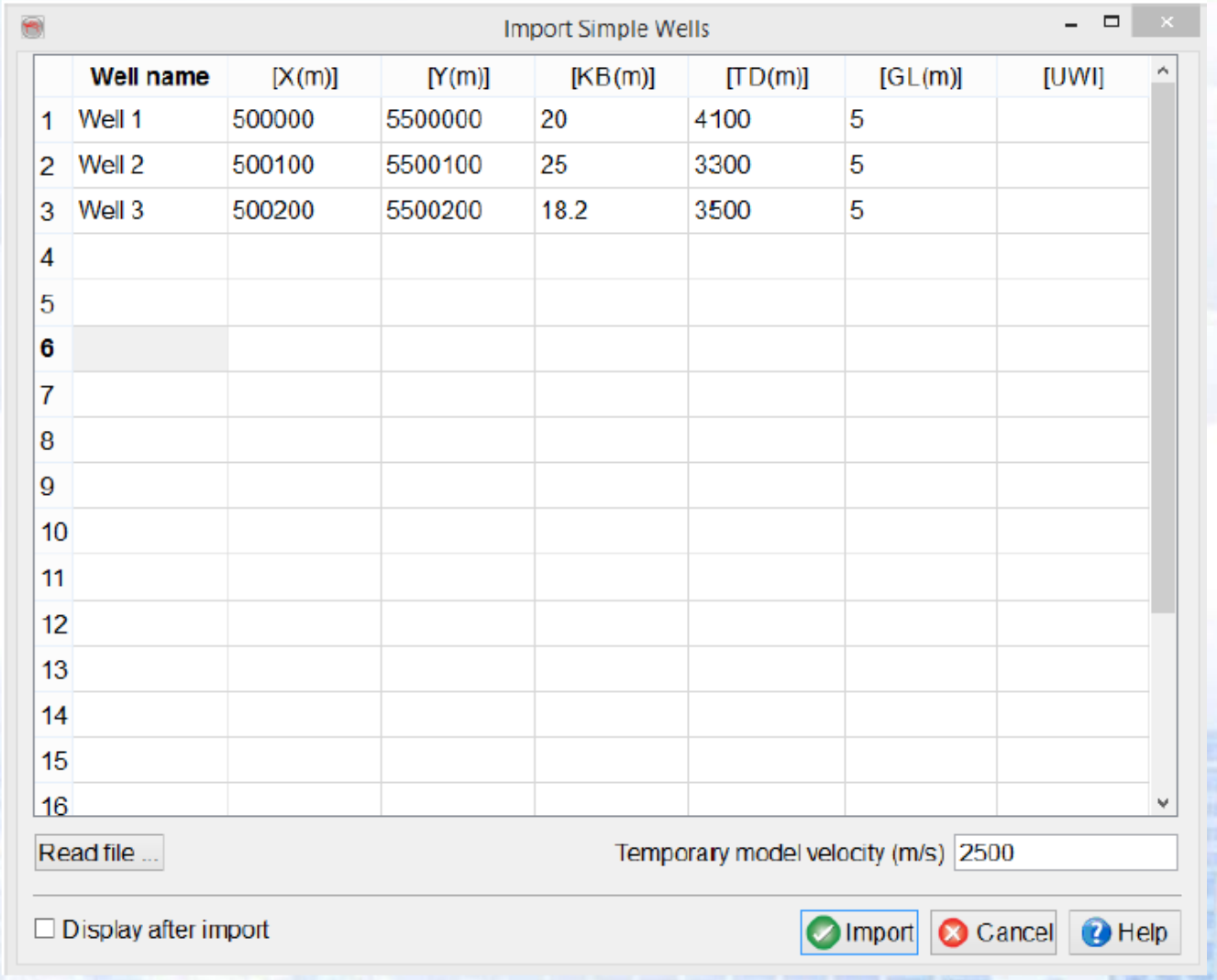
This utility window allows the quick creation of multiple vertical wells with a constant velocity as depth-time model provider. The table window below can either be filled manually or by reading a file.

The following parameters are mandatory:

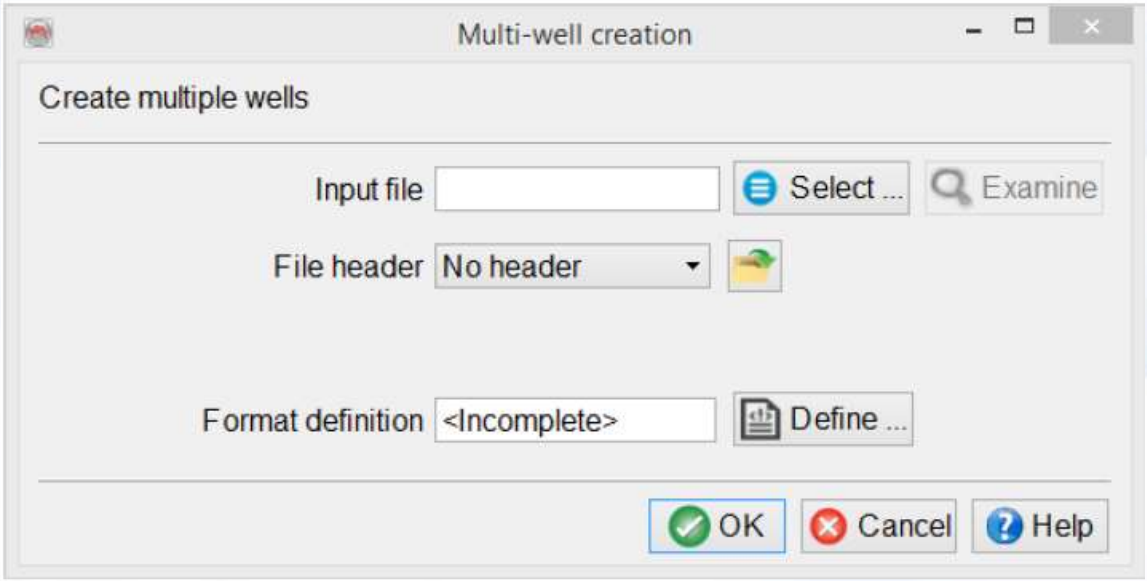
- Well name
- (Vertical) position along the X axis, in the same unit as the survey geometry.
- (Vertical) Position along the Y axis, in the same unit as the survey geometry.
- Reference datum elevation (KB or other): Altitude measured from sea level of the point MD = 0., positive upwards. Can be left to 0 if unknown.
- Total depth (TD): Largest measured depth in the well. This parameter is half optional; If not provided the well track is created such that it will reach the survey base.

The following parameters are optional:

- Seismic reference datum (SRD): Altitude measured from sea level of the point TWT = 0 ms, positive upwards.
- UWI (Unique well identifier): You can input any number, string or combination.

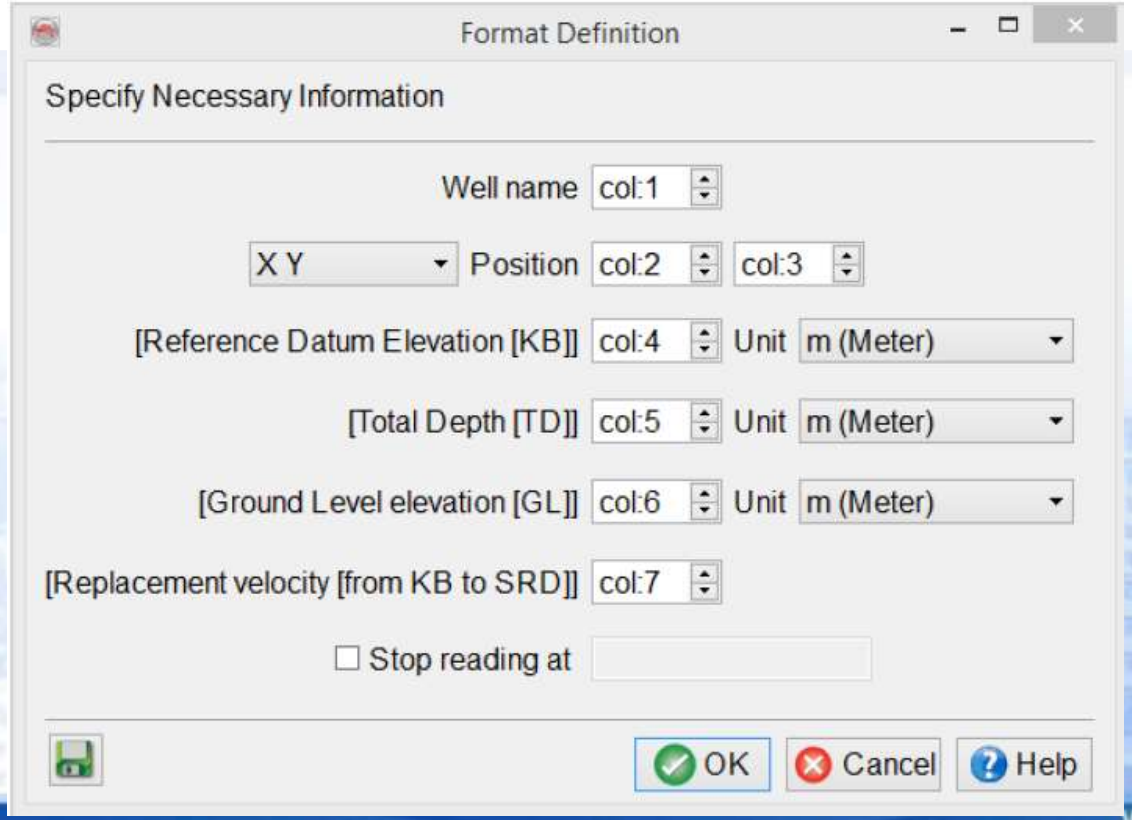

Import Simple Wells
Well name
[X(m)]
[Y(m)]
[KB(m)]
[TD(m)]
[GL(m)]
[UWI]
1 Well 1 500000 5500000 20 4100 5
2 Well 2 500100 5500100 25 3300 5
3 Well 3 500200 5500200 18.2 3500 5
4
5
6
7
8
9
10
11
12
13
14
15
16
Read file ...
Temporary model velocity (m/s) 2500
Display after import
Import
Cancel
Help

To read a file containing that information, press *Read file* and select the input ASCII file. One line in this file should correspond to one line in the output table.



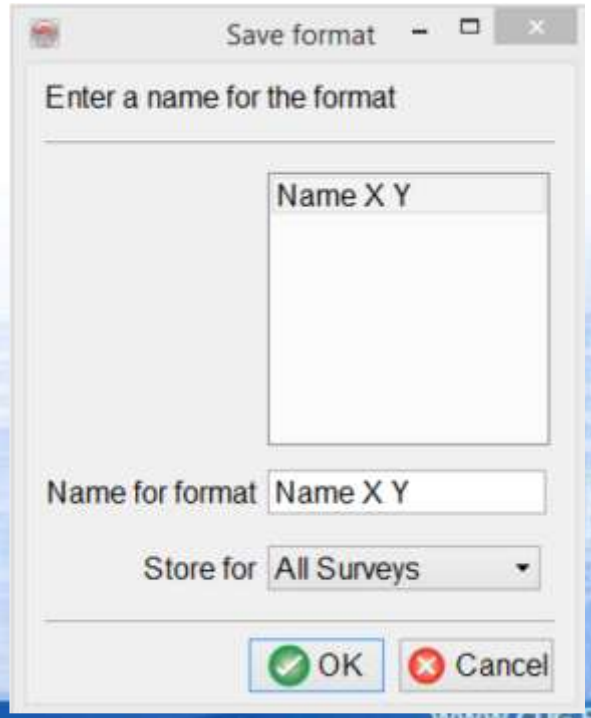
The main work is to specify the presence of a *file header* and the file *format definition*. The header, if present, can be of fixed length (number of lines), or delimited on its last line by a keyword.

Predefined and saved file formats are available by pressing the  icon. Otherwise the format must be manually specified. The *Define* button gives access to the format definition window.



You must specify in the format definition window the column numbers of the X and Y coordinates (absolute values, not relative to the surface coordinates), in the same unit as used when defining the OpendTect survey. Reference datum elevation and TD should also be provided, while the SRD and UWI are less frequently used. Please note that KB and SRD both increase upwards and are positive above sea level, whereas MD is a depth and increases downwards (MD is never negative).

It is recommended to save the format definition for a later use and QC, by clicking on the icon. In pop-up window, write the name of the format and store it. The format can be stored at different levels (All surveys, Current survey, Current OpendTect user level) depending on the usage.



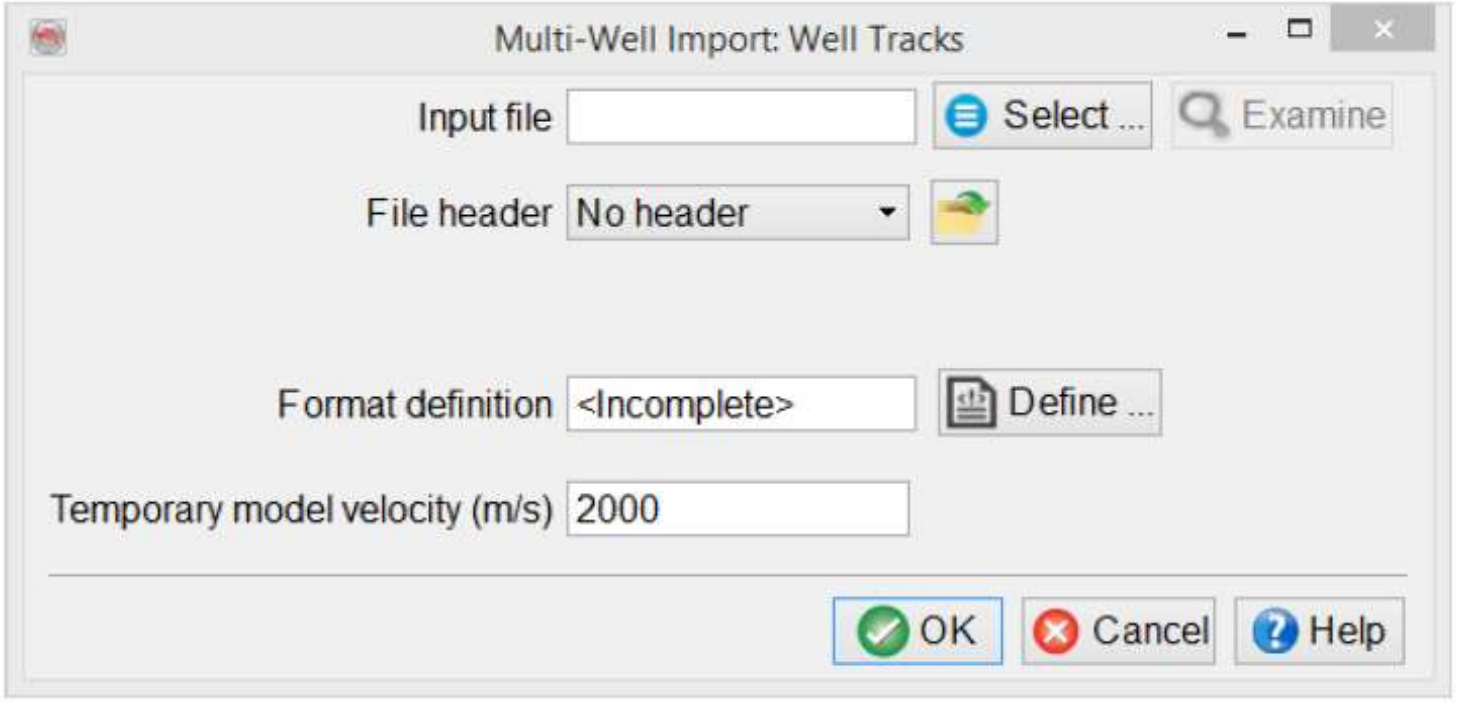
4.3.14.4 Bulk

The bulk import tool is available via *Survey* > *Import* > *Wells* > *Bulk* menu. It allows to import well tracks, time-depth models, logs and markers for different wells from one or several files. The data is matched against primarily the well name and, if available, against the Unique Well Identifier (UWI). This has the following implications:

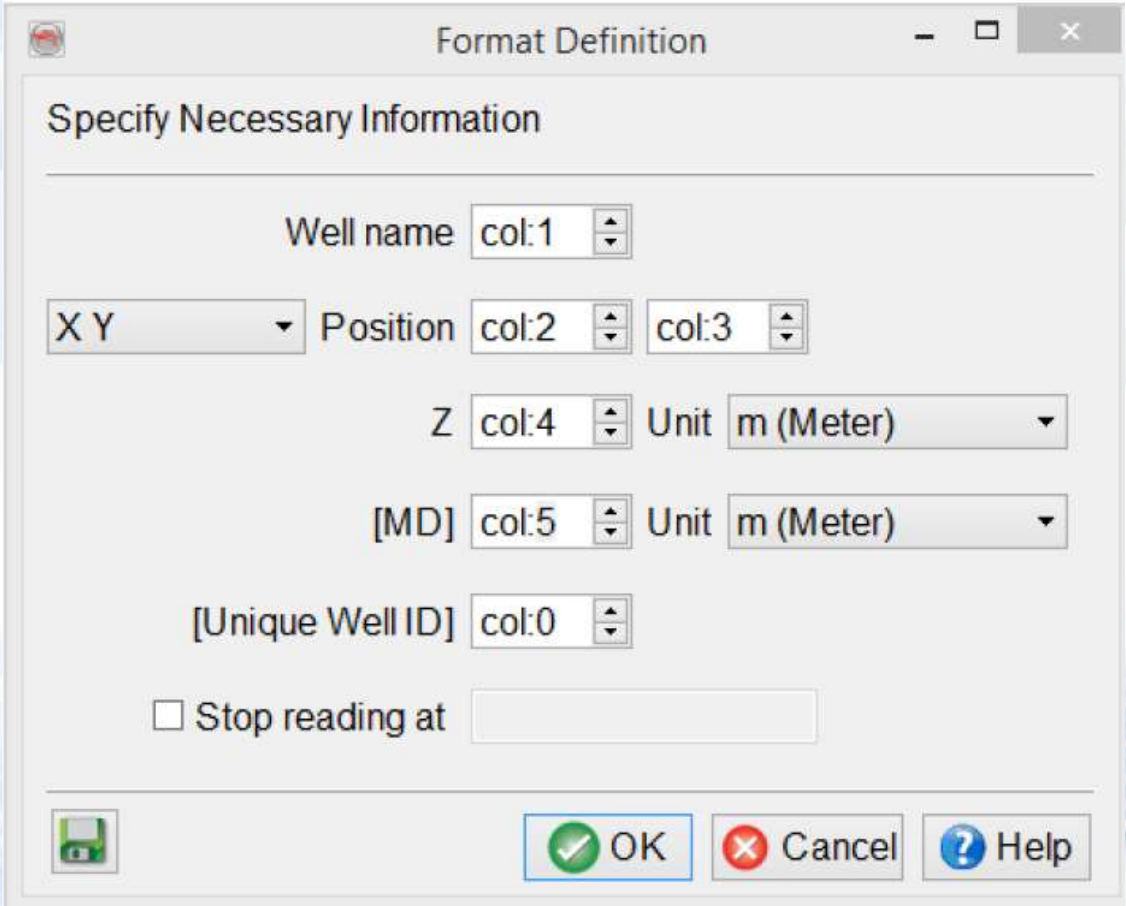
- The well name must appear on each line of the input file. If the well already exists, then the UWI must match the database. The same applies for the UWI if it is used in combination with the well name.
- The well name should not contain spaces, otherwise the matching with a given column number will not work as expected.

4.3.14.4.1 Bulk Well Track Import

Well tracks can be imported for several wells in bulk from a single ASCII file via *Survey* > *Import* > *Wells* > *Bulk* > *Track...* The specification for the input data is similar to the single well import.



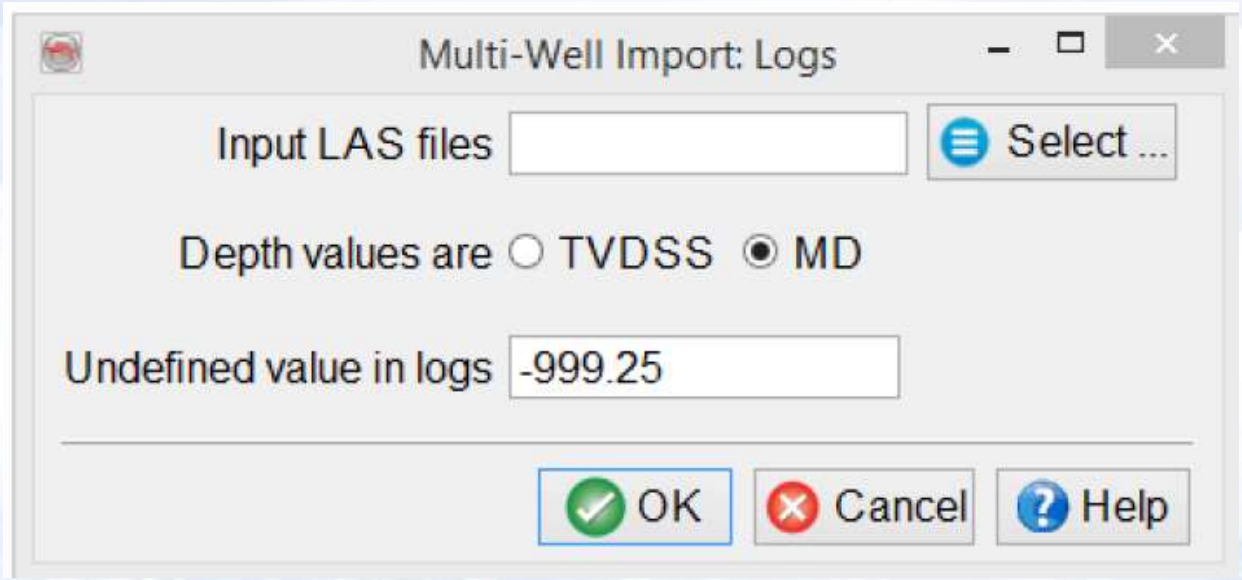
Click *Define*... to pop up the *Format Definition* dialog:



You will have the option to select either the well *Name* or *UWI* (Unique Well Identifier). And also to set depth as either *MD* or *TVDSS*. You may also toggle on the 'Stop reading at' choice and set a value here.

4.3.14.4.2 Bulk Well Log Import

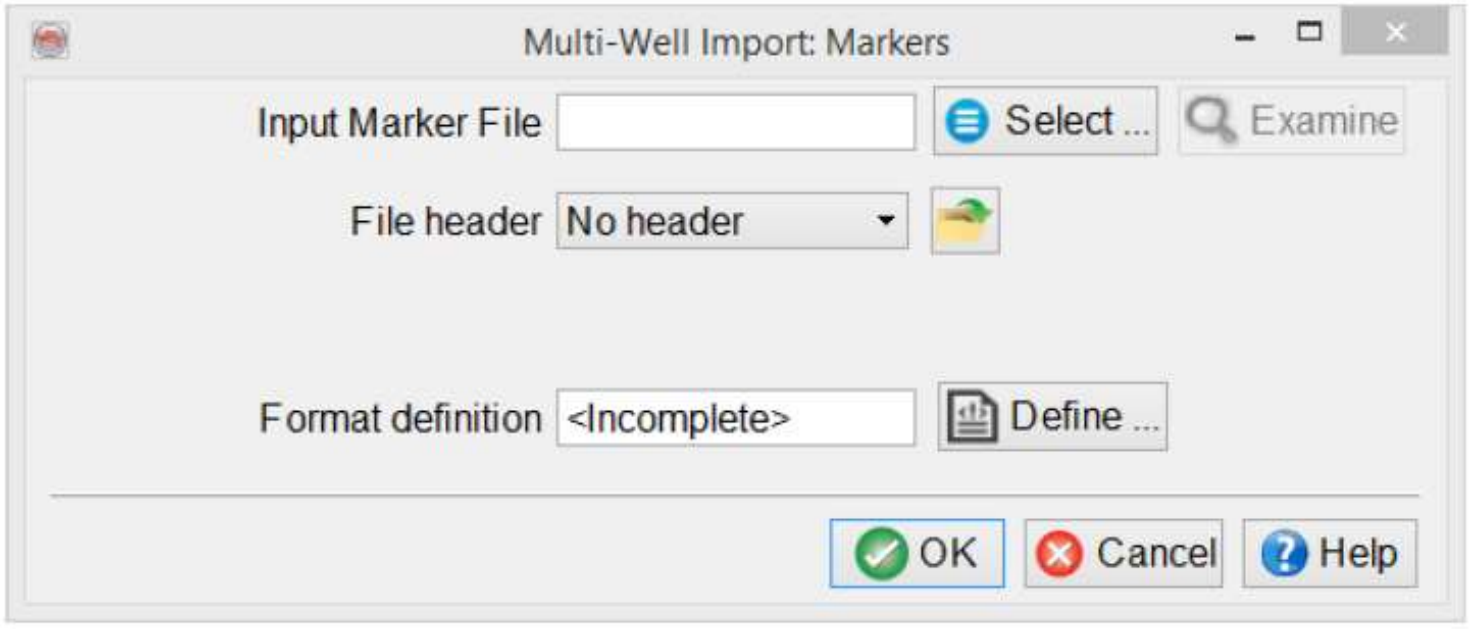
Several LAS files can be imported for different wells in bulk via *Survey* > *Import* > *Wells* > *Bulk* > *Logs...*



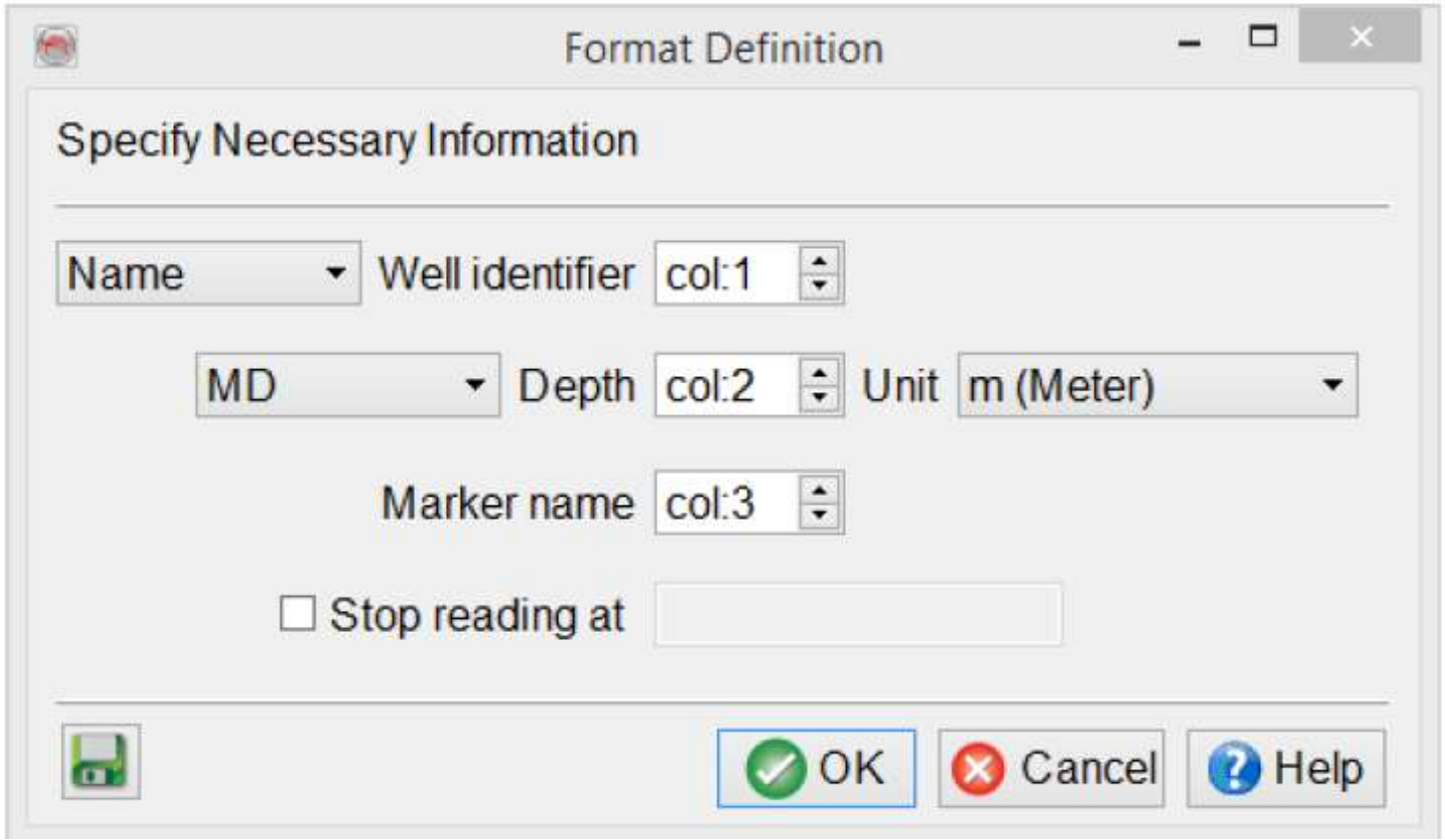
If the well name in the file does not match the current well database, it may be used to create a track and dummy time-depth model if necessary. Well tracks and time-depth models can be later imported from the well manager.

4.3.14.4.3 Bulk Well Marker Import

Markers can be imported for several wells in bulk from a single ASCII file via *Survey* > *Import* > *Wells* > *Bulk* > *Markers...*. The specification for the input data is similar to the single well import.



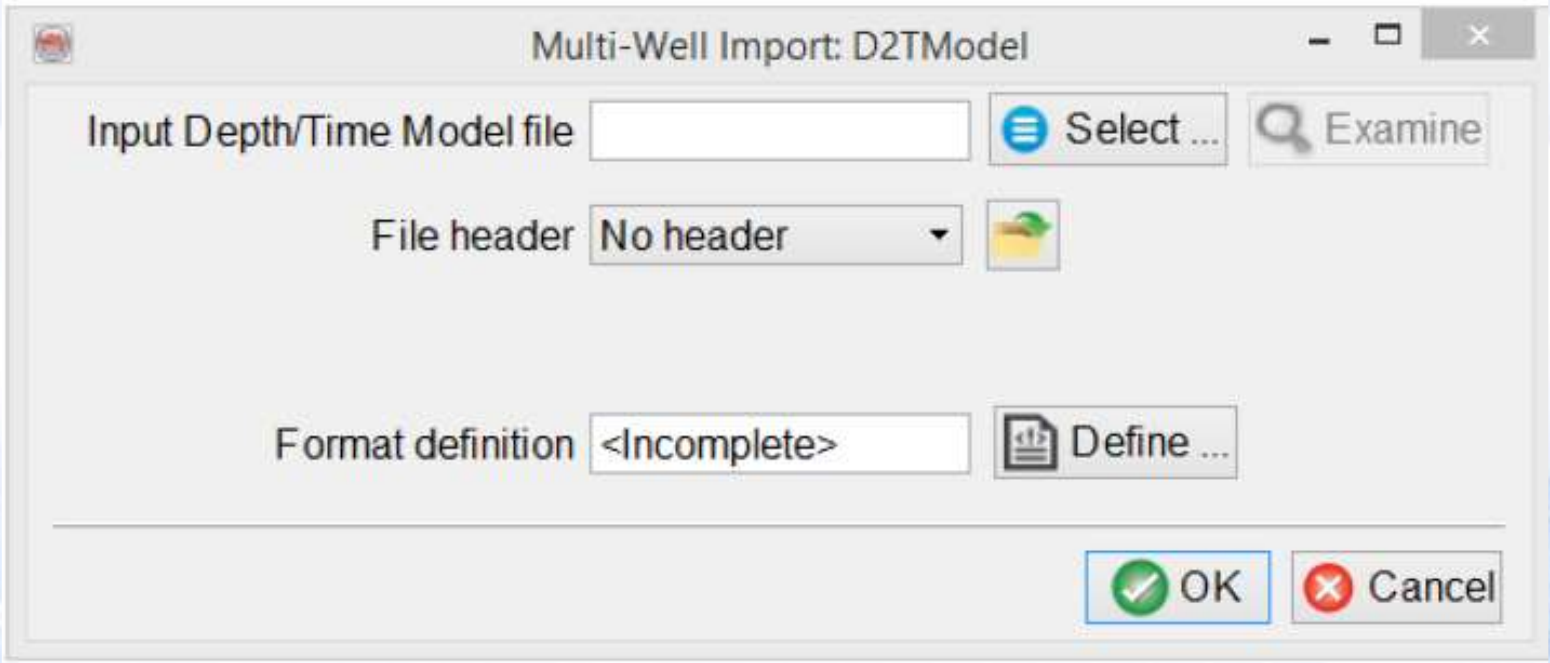
Click *Define...* to pop up the *Format Definition* dialog:



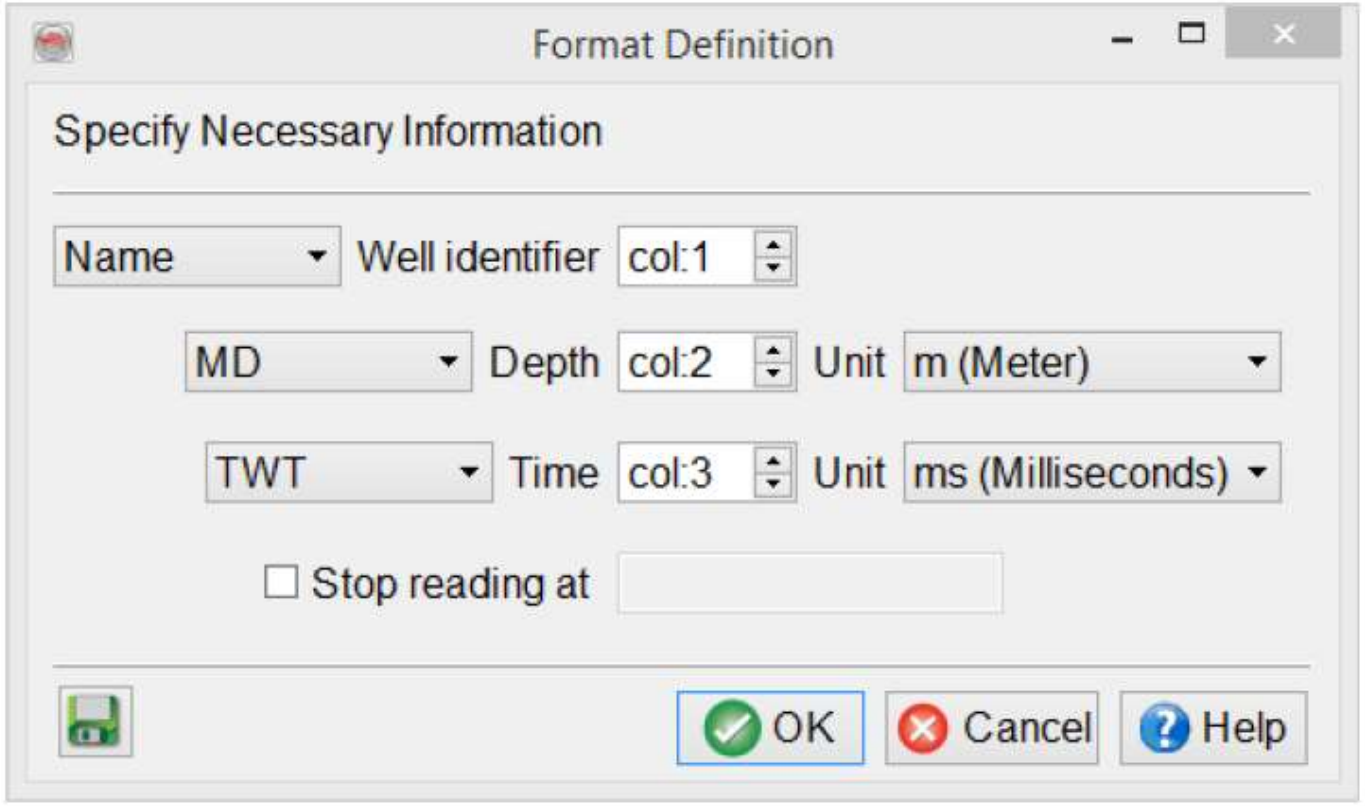
You will have the option to select either the well *Name* or *UWI* (Unique Well Identifier). And also to set depth as either *MD* or *TVDSS*. You may also toggle on the 'Stop reading at' choice and set a value here.

4.3.14.4.4 Bulk Well Time-Depth Model Import

Time-depth models can be imported for several wells in bulk from a single ASCII file via *Survey* > *Import* > *Wells* > *Bulk* > *Depth/Time model...* The specification for the input data is similar to the single well import.



Click *Define...* to pop up the *Format Definition* dialog:



You will have the option to select either the well *Name* or *UWI* (Unique Well Identifier). And also to set depth as either *MD* or *TVDSS*. You may also toggle on the 'Stop reading at' choice and set a value here.