SW_CANAL_2007

IRRIGATION CANAL DESIGN SOFTWARE
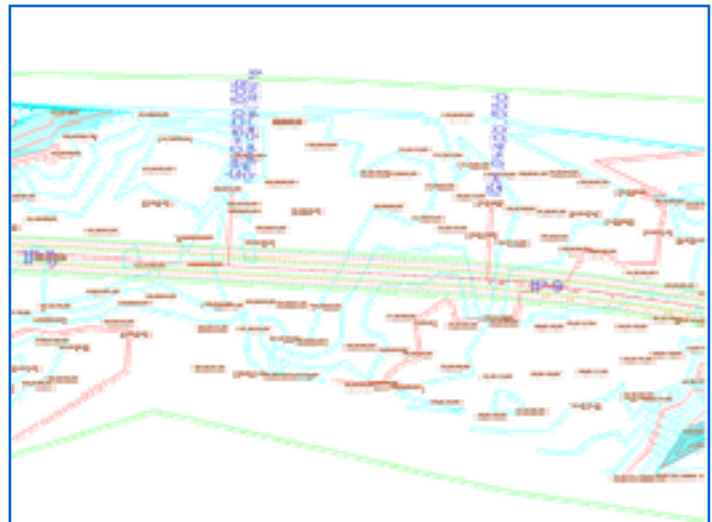
USER'S MANUAL

Table of Content

1.0   INTRODUCTION

SW_Canal_2007 is a software package for the new and existing canal design work developed by the SOFTWEL (P) Ltd. It is the upgrade of previous Software SW_CANAL_2004 and it has its own visual screen for plan, profile & cross-section and data sheet for data input. Earlier versions of SW_Canal have been successfully used in many irrigation projects in Nepal including the Sunsari Morang Irrigation Project, Mahakali Irrigation Project – Stage III, Phatepur Irrigation Project and Sikta Irrigation Project. Present version includes support for generation of Canal Plan, Profile and cross-section interactively.

SW_Canal_2007 runs in Windows platform (windows 98/2000/XP) and support AutoCAD version below 2007.

SW_Canal_2007 has inbuilt data input area from where data for plan, profile and cross-section can be supplied. In addition to this it has data import facility from where data can be imported from excel. Whole design process is included in the software itself with different tools to optimize the design. The software has the facility for exporting all drawing and data to AutoCAD and Excel.

2.0   INSTALLATION AND SOFTWARE INITIALIZATION

SOFTWEL: SW_CANAL is provided in a CD-ROM. Following instructions should be followed to install the program.

a) The CD-ROM contains the Directory SW_CANAL
b) Open this directory and run the **Setup Icon** (by double clicking)
c) Select directory of installation as "**C:\SOFTWEL** SW_CANAL" and follow the instructions from screen for proper installation.
d) *In older versions of WIN 95/98, the program may ask to restart the computer if so re-start the computer*
e) The program will automatically generate a shortcut in "Program" menu as ***SOFTWEL PROGRAMS***-> SW_CANAL

3.0 GETTING STARTED

The program can be started from
Start-->All Programs-->SW_CANAL_2007-->SW_CANAL_2007.exe

3.1 OPENING NEW PROJECT

For opening the new project Click File-->New and give the file location and name for saving the file.

There are two type of Canal Design Work namely, New Canal Design Work and Existing Canal Design Work.

New Canal Design Work:
New canal design work specifies for the canal design in totally new terrain.

Existing Canal Design Work:
Existing canal design work specifies for the canal design in previously existing canal. This design type is especially for canal rehabilitation process. This requires the elevation of existing canal bed and bank.

To select the design type, in the menu click as below;
File→New Canal Design Work or
File→Existing Canal Design Work.

3.2 OPENING THE EXISTING PROJECT

For opening the existing project Click File→Open and give the location and name of the file you want to open.

You can also open the file just by double clicking the file you want to open.
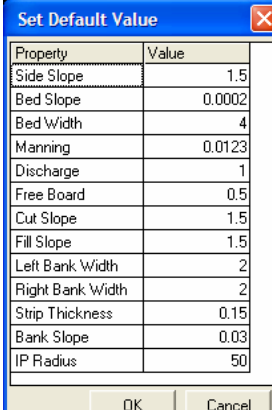
3.3 SAVING THE PROJECT

For saving the file Click File→Save to save the file or Click File→Save As to save the file in the new location

3.4 SETTING THE DEFAULT VALUE FOR THE PROJECT

The initial default value is initially set by the software itself. To give the new default value Click View→Set Default Value.
The 'Set Default Value' appears as shown in fig 3.1. Give the required value for the corresponding property.
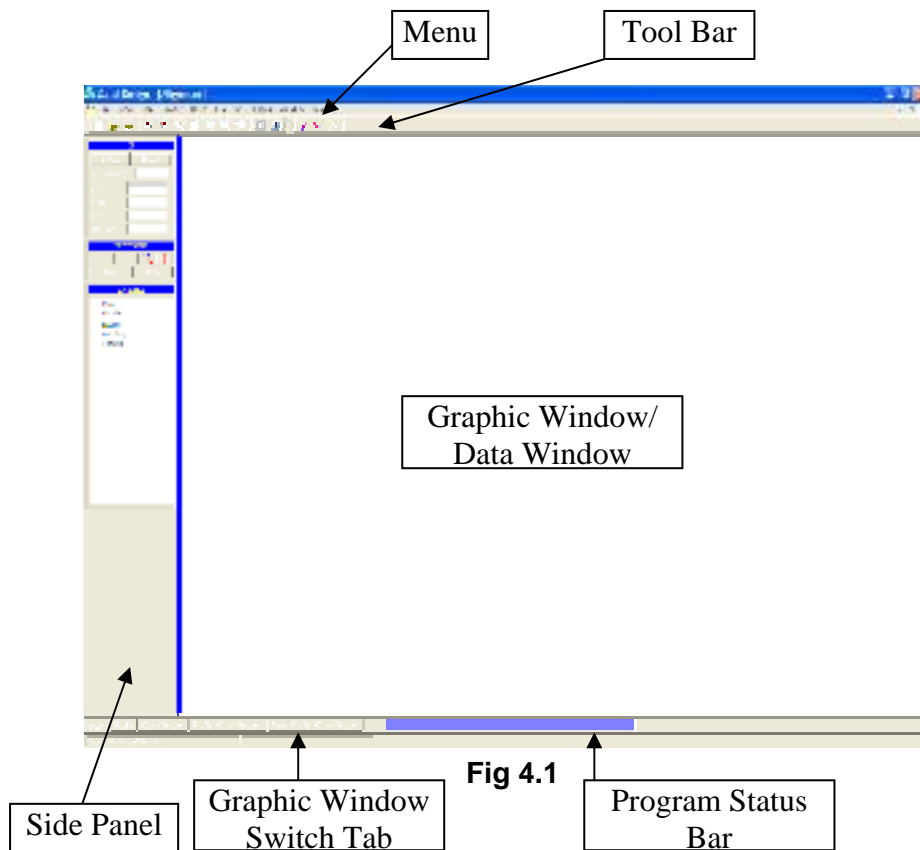

Set Default Value

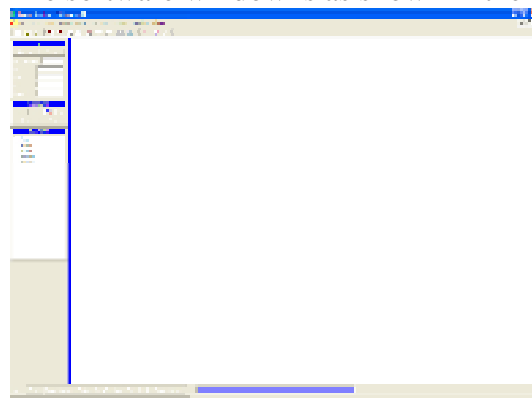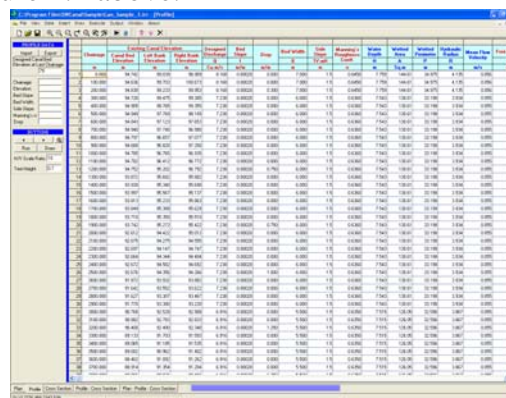| Property	Value
Side Slope	1.5
Bed Slope	0.0002
Bed Width	4
Manning	0.0123
Discharge	1
Free Board	0.5
Cut Slope	1.5
Fill Slope	1.5
Left Bank Width	2
Right Bank Width	2
Strip Thickness	0.15
Bank Slope	0.03
IP Radius	50

Fig 3.1

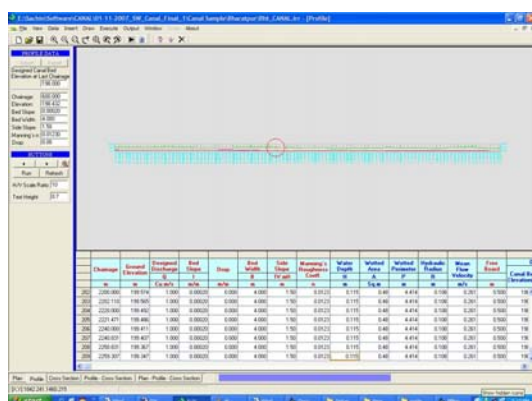## 4.0   SOFTWARE WINDOWS

Fig 4.1

The software window is as shown in the figure 4.1 above.

Fig 4.2 Graphic Window

Fig 4.3 Data Window

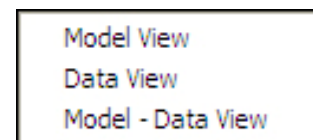**Fig 4.4 Both Graphic & Data Window**

Menu

File View Data Insert Draw Execute Output Window Cross About

Tool Bar

Graphic window switch tab and Program Status Bar

Plan | Profile | Cross Section | Profile - Cross Section | Plan - Profile - Cross Section

[X,Y] 702.000,-192.000

Click on the tab to switch between different graphic windows.

Switching between Graphic window and Data window
To switch between graphic window and data window right click on graphic window or data window area, a popup menu will appear as shown in the figure 4.5.

Model View
Data View
Model - Data View

Fig 4.5

Click Model view for graphic window (Fig 4.2).
Click Data View for Data window (Fig 4.3).
Click Modal – Data for both (Fig 4.4).

5.0   DATA INPUT

The software has the facility of handling two types of Survey data; Existing Plan, Profile and Cross-Section Data and Terrain Data.

5.1   EXISTING PLAN, PROFILE AND CROSS-SECTION DATA.

For this type of data input method, data required are;
Plan Data: (| S.N. | Easting | Northing | Radius |)
Profile Data: (| Chainage | Ground Elevation | Discharge | Canal Shape | Bed Slope | Menning's Coeff.)
Cross-Section: (| Chainage | Partial Dist. | Reduce Level |Remarks|)

There are two ways of inputting data. One is inputting data from Data Window where you can either type your data or you can copy and paste your data from Excel. The figure 5.1 shows data window for inputting plan data.

	IP Data				Horizontal Curve Data									
IP	Coordinate		Radius	IP	Coordinate		Dist.	WCB	Def Ang	Radius	Curve Data			Chainage
	Easting	Northing			X	Y					T	E	LC	BC
(No)	(m)	(m)	(m)	(No)	(m)	(m)	(m)	(Deg)	(Deg)	(m)	(m)	(m)	(m)	(m)

Fig 5.1

The column heading with red color text shows the data required to be given by user. The column heading with blue color text shows that the data is calculated by the software and need not be given by user.

The other method of inputting data is from menu 'Data' where you can import data, copy and paste data and as well as export those data. The figure 5.2 shows the dialog box to import profile data.

Fig 5.2

In order to import data from excel, select the range in excel sheet in which the no. of column is equal to the number of column in this dialog box. Then click 'import' button to import data. You can Export and Save data by clicking 'Export' and 'Save Button. Export button export data in '.csv' format. Save button save the imported data in the project.

Inputting Plan Data:
Inputting Plan Data from Data Window:

Fig 5.3

Inputting Plan data from menu
Data➔Alignment

Fig 5.4

Inputting Profile Data:
Inputting Profile Data from Data Window:

	Chainage	Ground Elevation	Designed Discharge	Bed Slope	Drop	Bed Width	Side Slope	Manning`s Roughness Coeff.	Water Depth	Wetted Area	Wetted Perimeter	Hydraulic Radius	Mean Flow Velocity	Free Board	Designed Canal Outp	
			Q	I		B	1V:mH		H	A	P	R			Canal Bed Elevation(m)	Water Surface Elevation(m)
	m	m	Cu.m/s	m/m	m/m	m	m	n	m	Sq.m	P	R	m/s	m		
1																
2																

Fig 5.5

Inputting Profile Data form menu:
Data→Profile

Fig 5.6

You cannot give ground elevation data in these tables. The ground elevation field is locked. This ground elevation at different chainage is given different table named Existing Ground Profile. Click in menu; Data>>Existing Ground profile.
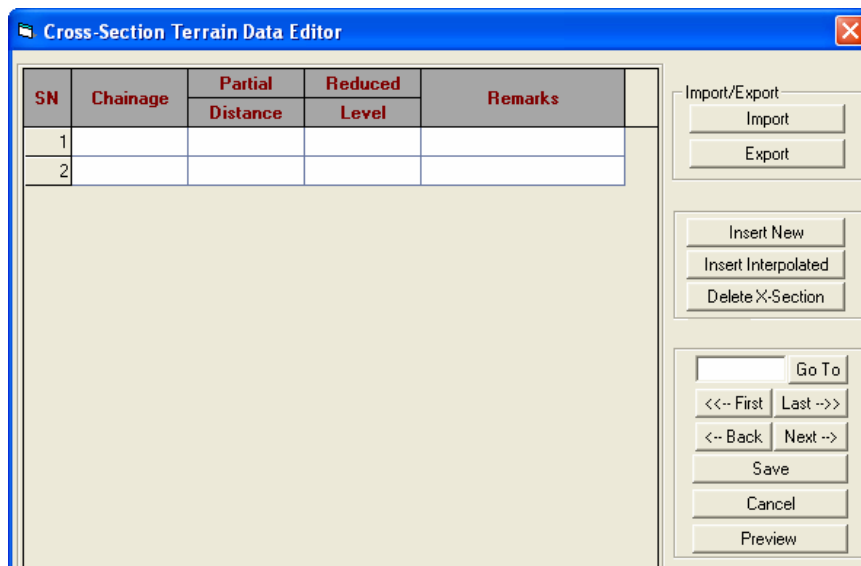

Fig 5.7

Inputting Cross-Section Data:
There is no Data Window for cross-section. The data must be given form menu.
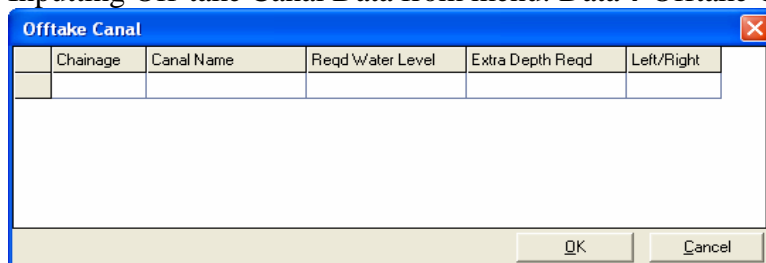
Inputting Cross-Section Data from menu:
Data→Cross-Section

Fig 5.8

Inputting other data:
You can similarly input other data like Offtake Canal Data, Soil Data, Canal Bank Data, Canal Berm Data, Canal Lining Data and Canal Stripping Data from menu.
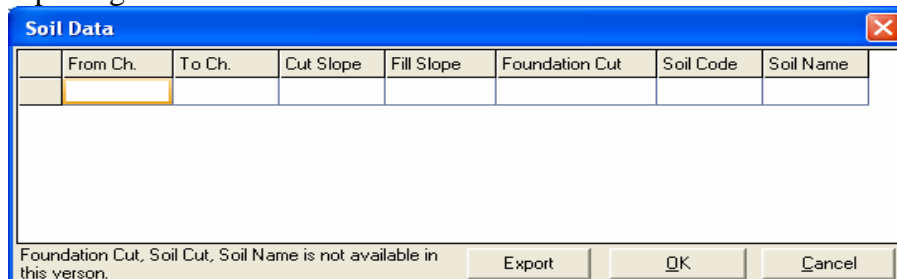
Inputting Off-take Canal Data from menu: Data→Offtake Canal

Fig 5.9

Inputting Soil Data from menu: Data→Soil Data

Fig 5.10

Inputting Bank Data from menu: Data→Canal Bank

Fig 5.11

Inputting Canal Stripping Data from menu: Data→Canal Stripping Data
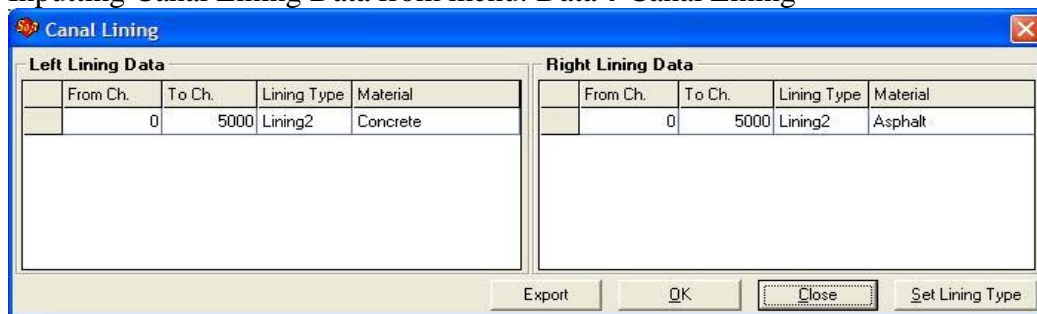
Fig 5.12

Inputting Canal Lining Data from menu: Data→Canal Lining

Fig 5.13

Inputting Canal Berm Data from menu: Data→Canal Berm

Fig 5.14

5.2 TERRAIN DATA

This mode requires terrain model data. This software needs terrain model data in the form of file with extension "*.dtm". This type of file is generated by SW_DTM application.

Working in this mode;
The first step in this design mode is to create the topographic map in AutoCAD. Run SW_DTM and export *.dtm file.

Now import the topographic map in AutoCAD to this canal software by clicking menu Insert→Detail from AutoCAD.
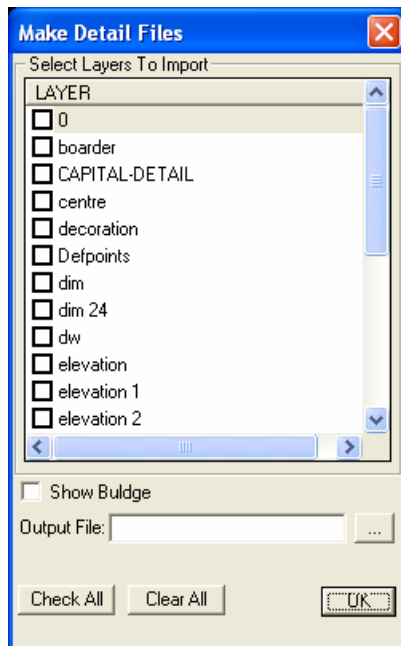
Select the ACAD layer to import into your canal project and then click OK.

Give the output *.det file location to be saved. If no name is given then the *.det file will be saved in the project file location. Now the imported detail file will be your base map for drawing alignment.

Fig 5.15

5.2.1 WORKING IN TERRAIN DATA MODE

Drawing Alignment:
Click in menu Draw→Alignment
On the Plan window draw alignment of the canal as you wish.

Editing Alignment:
You can move, insert and delete the IP (intersection Point) of the alignment.

To move IP, click the toolbar button [icon] and then select and drag the IP you want to move.

To insert a new IP, select IP after which you want to insert it. Then click the toolbar

[icon] button. And then click at the location where you want to insert the IP.

To delete an IP, select the IP you want to delete. Then click the toolbar [icon] button to delete that IP

5.2.2 EXTRACTING PROFILE AND CROSS-SECTION DATA

Click 'Execute→Extract Terrain Data' to extract profile and cross-section data. The dialog box as shown in figure 5.16 will appear.
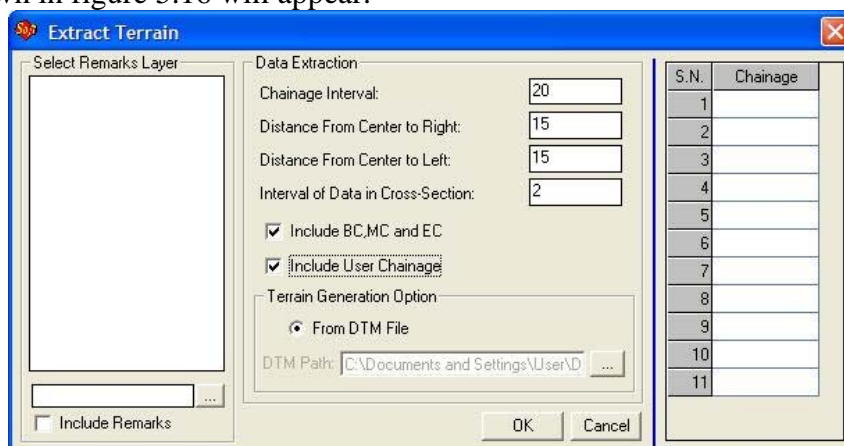
Fig 5.16

Give the required data. Check 'Include BC, MC and EC' to export data at these chainage. Check 'Include User Chainage' and give your chainages to export these chainage data. In the "Terrain Generation Option" give the path of DTM file that is exported from SW_DTM.

To import remarks, in 'Select Remark Layer', give the path of the AcadCAD drawing file from where the remarks are to be imported. It should be took in mind that the drawing file for importing remarks and file for exporting '*.dtm' file from SW_DTM should be same. Check the remarks layer in the list box for importing remarks.

Now Click 'OK' to extract terrain data. Wait for the software to complete exporting terrain data. Now check the data window of profile and cross-section whether plan and profile data is imported or not.

6.0 DESIGNING CANAL

6.1 SETTING DEFAULT OPTION

To set the default option click in menu View→Option
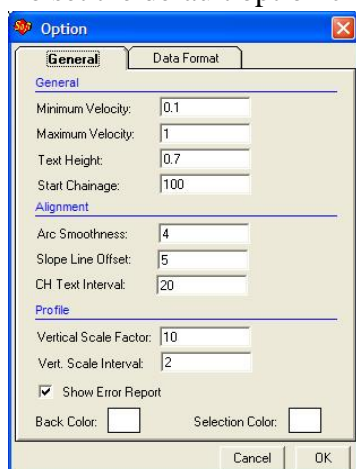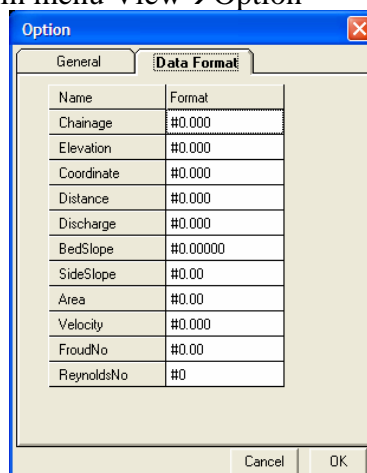
Fig 6.1   **Fig 6.2**

Vertical Scale Factor: It is the ratio of Horizontal Scale to Vertical. It is the scale factor to draw canal profile in Profile Window.

Vert. Scale interval: It is the interval of elevation text of vertical Scale in Profile Window.

Minimum/Maximum Velocity: Minimum velocity refers the non silting velocity and maximum velocity refers the non-scouring velocity. If the velocity for the section   calculated   by   the software in not within this velocity range then an error report will   generated   showing   velocity error.

Text Height: This is the height of text in alignment drawing.
Start Chainage: Start chainage of the alignment.
Arc Smoothness: Decreasing the arc smoothness value will increase the smoothness of the arc.
Slope Line Offset: This is the distance between two staking line.
CH Text Interval: This is the interval of chainage marking text in alignment drawing.
*Show Error Report:* Check it to show error report after execution
Back Color: Click color area to change the background color of graphic window
Selection Color: Click color area to change the selection rectangle color.

Data Format:
Change the decimal place for the corresponding property.

6.2   EXECUTING THE DESIGN

Start Chainage:
You must change the start chainage of the canal alignment initially. This value is given in the option dialog box.

Design Canal Bed Elevation at Last Chainage:
The design of Canal profile starts from the last chainage. So give the elevation of the design canal bed at the last chainage. This value is given in the text box present on the Side panel of Profile Window as shown in the figure 6.3.

Fig 6.3

Executing the whole design without updating x-section item from table data
Click in menu "Execute→Execute Design' to execute the whole design.

Executing the whole design updating all x-section item from table data
Click in menu "Execute→Execute & Update All Cross-Section' to execute the whole design.

Updating Canal Bank Item from Canal Bank Table
Click in menu "Execute→Update Canal Bank' to execute the whole design.

Updating Canal Berm Item from Canal Berm Table
Click in menu "Execute→Update Berm' to execute the whole design.

Updating Cut/Fill Slope Item from Soil Data Table
Click in menu "Execute→Update Cut/Fill Slope' to execute the whole design. Before this action check 'Update CutFill Lines Slope' in Option dialog box (Cross>>Utility>>Option).

Executing Plan Data
Click Run Button on Side Panel of Alignment Window to run the alignment data only. This will calculate whole circle bearing, Tangent length, Curve data and chainage of IP of the alignment.

Executing Profile Data
Click Run Button on Side Panel of Profile Window to run the profile data only. This will calculate different hydraulic parameter of the canal section.

6.3   EDITING THE INPUT DATA.

The data of the section that is active is shown in the side panel as shown in figure 6.4 and 6.5. You can change the value of the corresponding property data and press enter to execute the calculation.
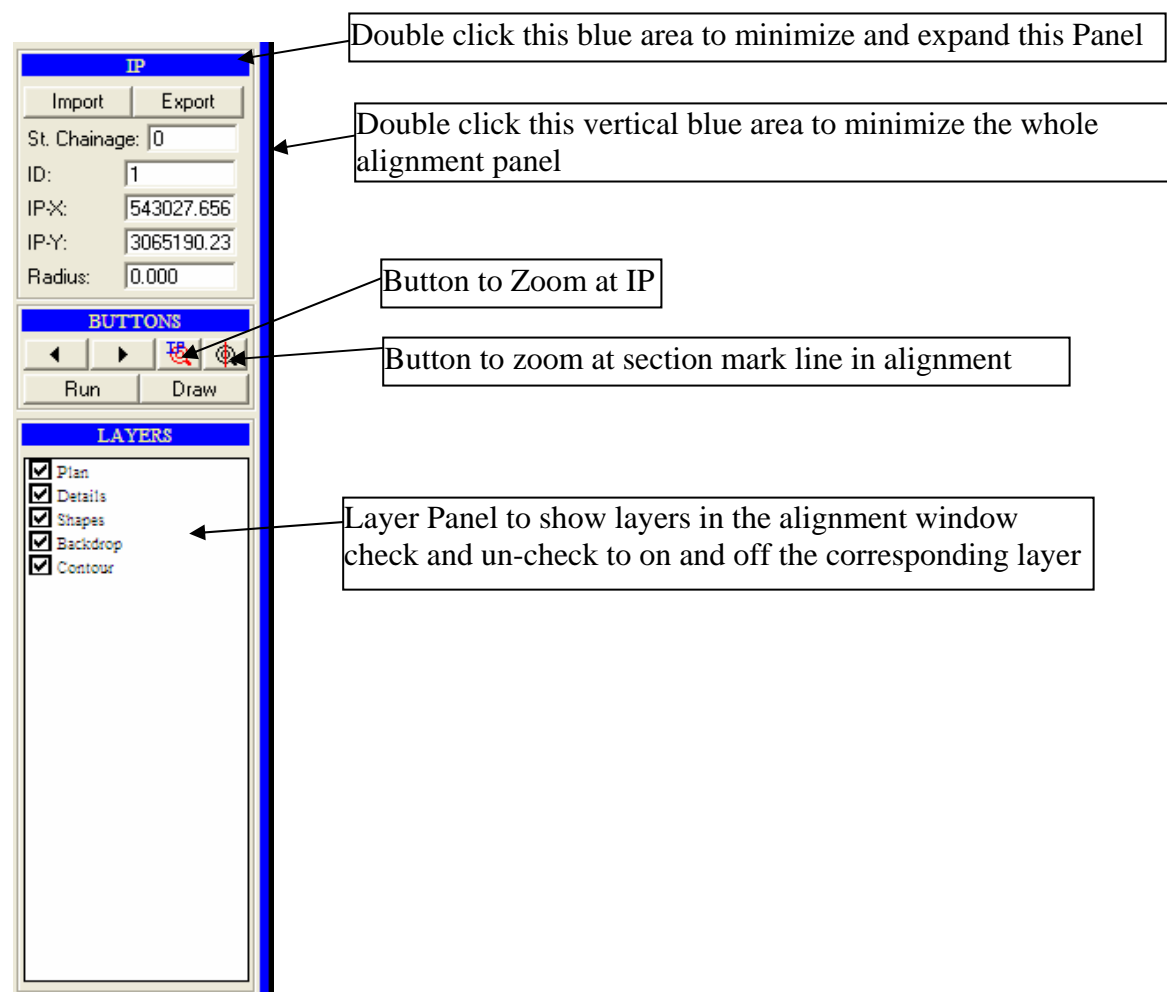
Fig 6.4 Side Panel in Alignment Window

Fig 6.5 Side Panel in Profile Window

6.4   INSERTING USER CHAINAGE

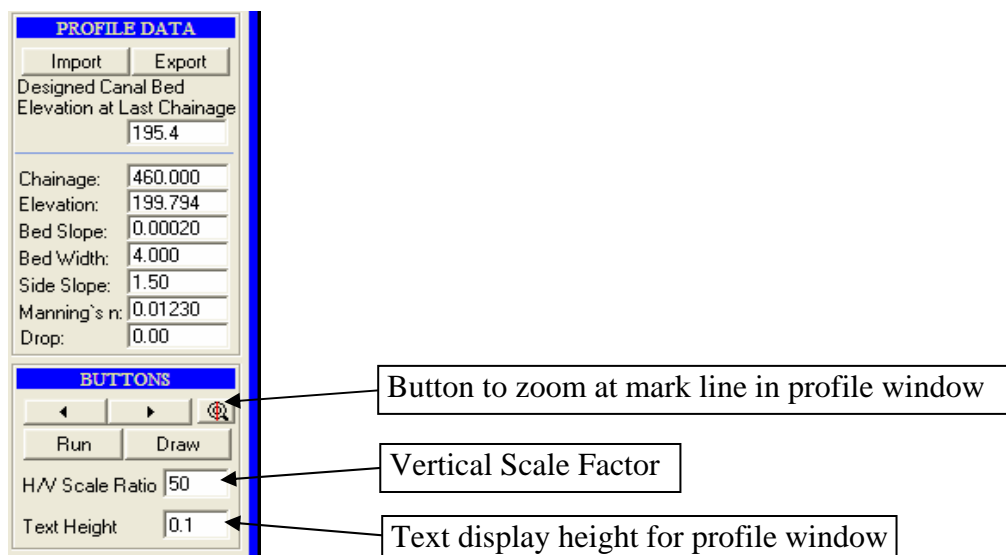You can insert user chainage while extracting terrain data. Just check Insert User Chainage in 'Extract Terrain Data' dialog box (fig 5.16) and give your chianage.

6.5   ADJUSTING CROSS ELEVATION

The ground elevation at the center of the cross-section must be same as that of profile. If there is mistake in this case then error message will be generated. Click 'Execute→Adjust Cross Elevation" to adjust the elevation in the cross-section. This will read the ground elevation from the profile and adjust that elevation in cross- section.
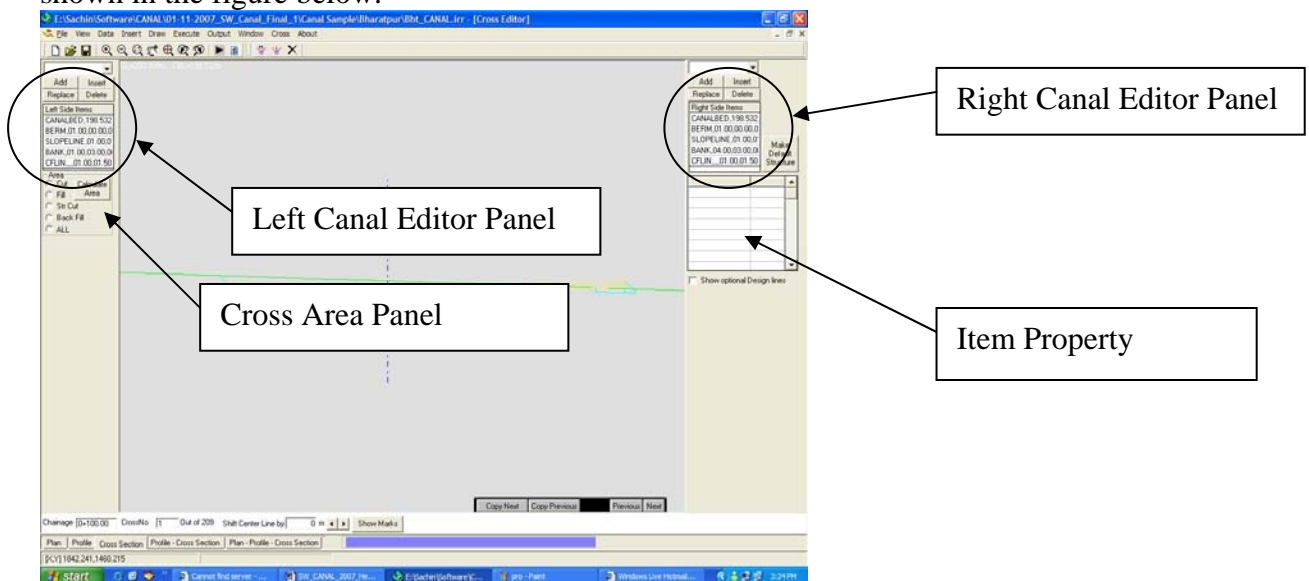
6.6   ERROR REPORT

Error Report is automatically generated after every execution of design. This report will help the user to trace the errors in the design. The error report window is shown in the figure below.
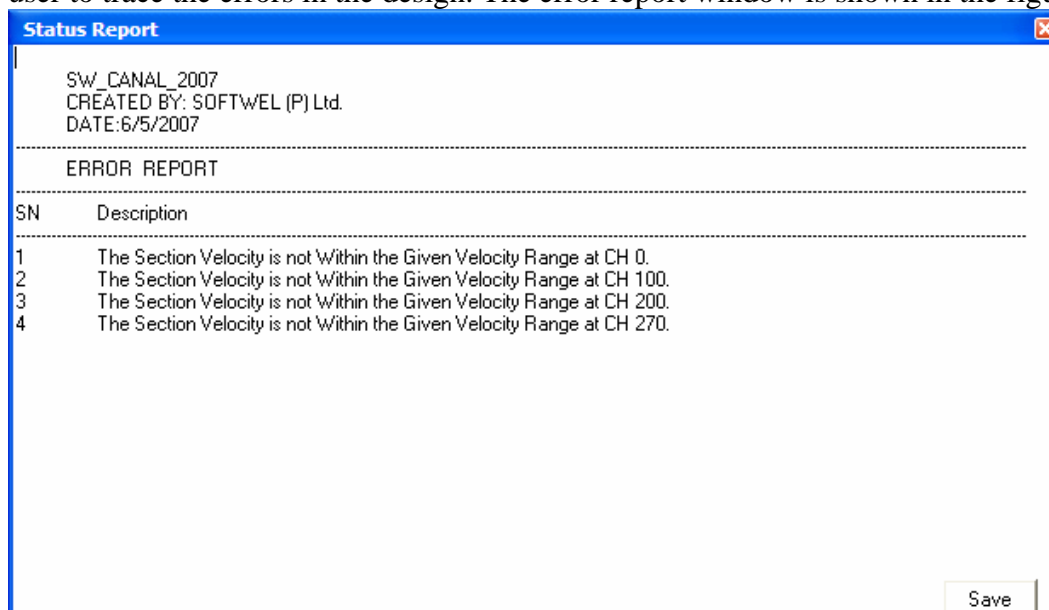
Fig 6.6

7.0   CROSS-EDITOR

Canal Structure can be added from cross-editor. The cross-editor or Cross-Section window is shown in the figure below.


Fig 7.1

You can add different type of structures/items to the left and right side of the canal. The lists of structures/items that can be added in the canal are;

1. CFLIN – Cut/Fill Line
2. BKFLO – Back Fill Line
3. BANK – Canal Bank
4. BERM – Canal Berm
5. DOWLA – Dowla
6. SLOPELINE – Slope Line
7. FLUSHLINE – Flush Line
8. DrainG – Drain Type G
9. DrainH – Drain Type H
10. MwRetA – Masonry Retaining Wall Type A
11. MwRetB – Masonry Retaining Wall Type B
12. GwRetA – Gabion Retaining Wall Type A
13. GwRetB – Gabion Retaining Wall Type B
14. MwBrtA – Masonry Breast Wall Type A
15. MwBrtB – Masonry Breast Wall Type B
16. GwBrtA – Gabion Breast Wall Type A
17. GwBrtB – Gabion Breast Wall Type B
18. DrRetA – Dry Retaining Wall Type A
19. DrRetB – Dry Retaining Wall Type B

You can view one cross-section at a time. You can view section at different chainage by clicking 'Next' or 'Previous' button located at the bottom of the cross-section window. Similarly you can copy the items of next and previous section by clicking 'Copy Next' and 'Copy Previous' button.
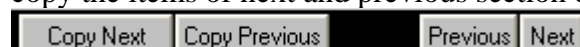
Fig 7.2

You can also go to certain chainage by just giving Chainage in 'change textbox' or giving Cross-section no in 'Crossno textbox' and pressing enter button.

Fig 7.3

Editing Structure Item:
On the left and right side of the cross-section window you can see an Editor Panel. There are 4 buttons for Adding, Inserting, Replacing and deleting the item on the combo box. Just below the buttons, you can see the list of Items that is on the left or right side of the canal.

In order to Add, Insert, Replace and Delete a Item, Select the Item, you want to change, in the list. Specify the Item you want to Add, Insert, Replace or delete in the combo box. Then just click the required button.

Changing the Item Property:
Select the Item from the Item list. Now you see the list of properties of that item on the right side of the cross-section window. The property list in grey color is non-editable while the others are editable. You can change the value of the property as required.

Viewing Cross-Section Area:
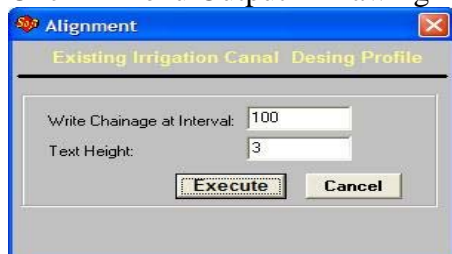Click 'Calculate Area' button to calculate the cross-section area of the current cross section.

8.0   REPORT OUTPUT

8.1   DRAWING OUTPUT
The Plan, Profile and Cross-Section drawing can be exported to AutoCAD.

Exporting Plan
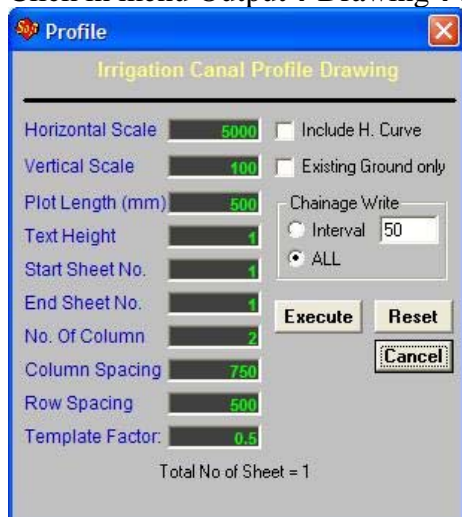Click in menu Output→Drawing→Alignment a dialog box as shown in figure 8.1 will appear.

Fig 8.1

Click Execute button to export alignment drawing into active AutoCAD file.

Exporting Profile
Click in menu Output→Drawing→Profile a dialog box as shown in figure 7.2 will appear.

Fig 8.2

Give all the required value and then click Execute button to export alignment drawing into active AutoCAD file.

Exporting Cross-Section
Click in menu Cross→Drawing→Draw All a dialog box as shown in fig 8.3 will appear.

Give all the required value and then click Execute button to export alignment drawing into active AutoCAD file.

Click in menu Cross→Drawing→Draw Current to draw the current cross-section.
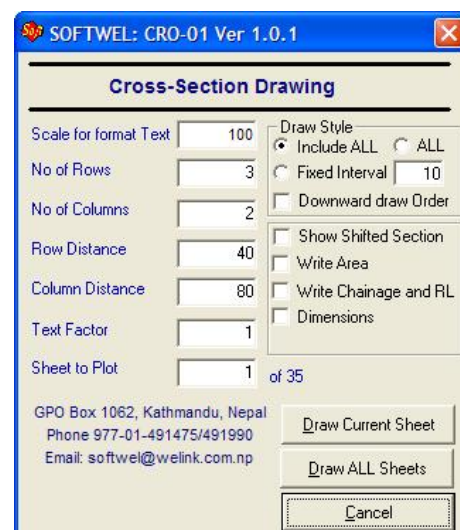
Fig 8.3

8.2   DATA OUTPUT

The Plan, Profile, Cross-Section and Quantity data can be exported to CSV format.

Exporting Plan Data
Click in menu Output→Data→Alignment and give the file location and name to   export alignment data in CSV format

Exporting Profile Data
Click in menu Output→Data→Profile and give the file location and name to export alignment data in CSV format

Exporting Cross-Section Data
Cross-Section data can only be exported from Cross-Section entry dialog box by clicking export button.

Exporting Quantity Data
Click in menu Cross-->Quantity Output and give the file location and name to export alignment data in CSV format

9.0   LAYER EDITOR

Click the menu 'View-->Layer Editor' to open the layer editor dialog box as shown in figure 8.1.
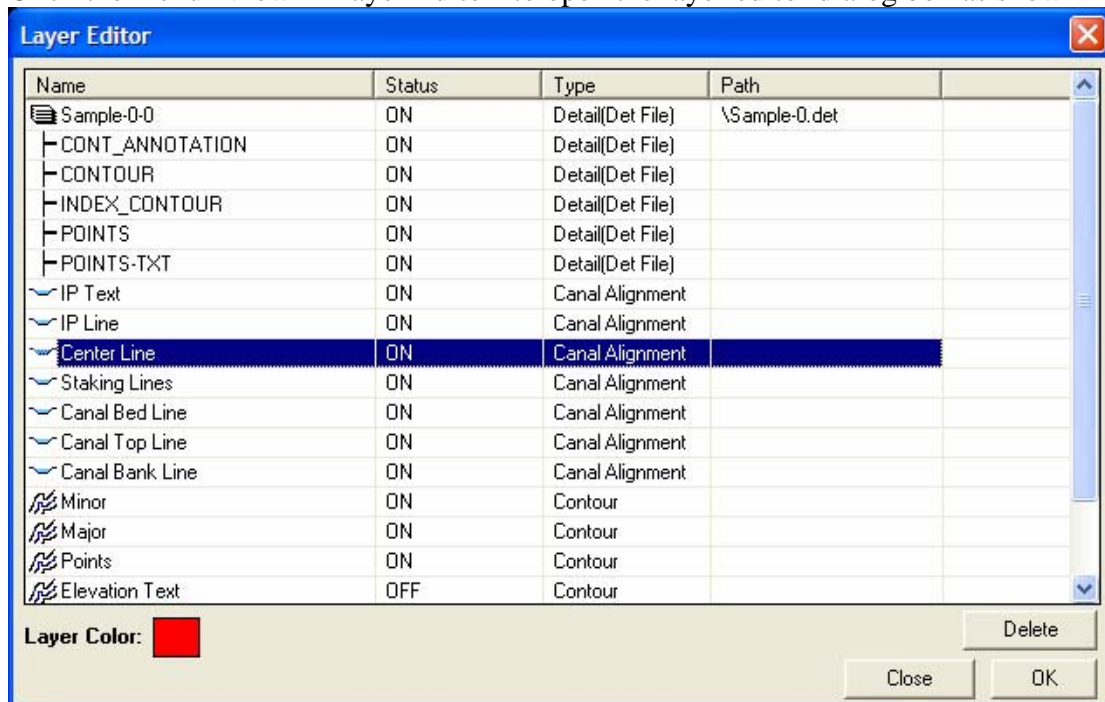
Fig 9.1

From layer editor you can change the color of the specified layer; you can load and delete the layer too.

10.0   EXAMPLE

Here is the example for designing New Irrigation Canal in terrain data mode. Data required for this mode is terrain data, i.e. dtm file of the topographic map generated by SW_DTM and the same topographic map in dwg format. Follow the following steps in sequence.

1.   Prepare topographic map in AutoCAD (e.g. PointData.dwg) and export the dtm file (e.g. Terrain.dtm) of the same from SW_DTM.
2.   Open new SW_CANAL application.
3.   Click menu 'File→Save Project' and give your File name and location to save the file.
4.   Click menu 'File→New Canal Design Work' for new canal design work.
5.   Set the project option by clicking 'View→Option' and set the value as;

   In General tab,
   Vertical Scale Factor=50
   Minimum Velocity=0.30m/sec
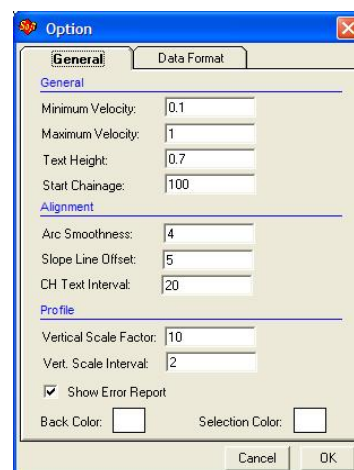   Maximum Velocity=0.65m/sec
   Arc Smoothness=5
   Slope line Offset=2
   Text Height=7
   Start Chainage=100

   And click ok.

6.   Set the default project value by clicking 'View→Set Default Value'

   Side Slope=1.5
   Bed Slope=0.0002
   Bed Width=4.0m
   Manning=0.0123
   Discharge=2.0m^3/sec
   Free board=0.5m
   Cut Slope=0.67
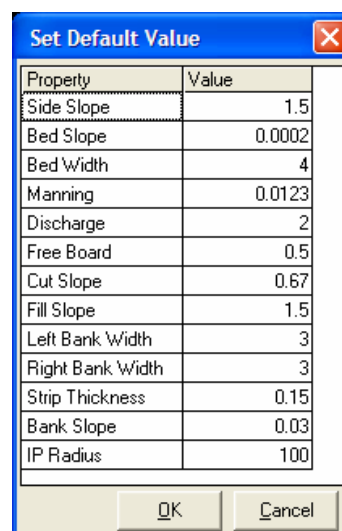   Fill Slope=1.5
   Left Bank Width=3.0m
   Right Bank Width=3.0m
   Strip Thickness=0.15m
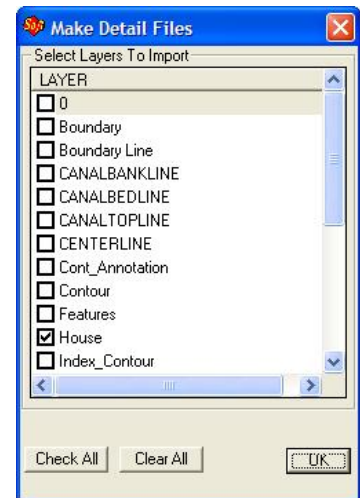   Bank Slope=0.03
   IP Radius=100m

7. Insert Detail file by clicking 'Insert→Detail from AutoCAD' and select the ACAD topographic map PointData.dwg and click 'Open'.

Select the layers to import into your project.
E.g. Alignment, Contour, Feature, House, Index Counter, Fence.
Now click 'OK' to import.

8. Click menu 'File→Save Project' to save the file
9. Click menu 'Draw→Alignment' to draw the Canal Alignment.

Right click to finish drawing alignment.

To append a new alignment, just start drawing new IP after the last IP of the previously drawn alignment.

To move IP, click the toolbar [M] button and then select and drag the IP you want to move.

To insert a new IP, select IP after which you want to insert it. Then click the toolbar button . And then click at the location where you want to insert the IP.

To delete an IP, select the IP you want to delete. Then click the toolbar button to delete that IP.

10. Click menu 'Execute→Extract Terrain Data' to extract profile and cross-section data of the alignment.

Give the value
for example as;
Chainage Interval=15m
Dist. From Cen. to Left=20m
Dist. From Cen to Right=20m
Interval of Data in X-sect. =4m

Check 'Include BC, MC and EC to export data at these chainages.
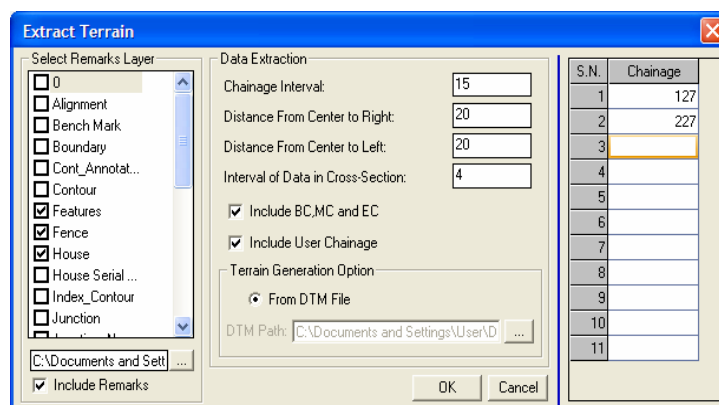
Check 'Include User Chainage' and look at the right side of the dialog box. Right the chainage list for which you want profile and cross-section data to be exported.

In Terrain generation option, click the file browse button to select the 'Terrain.dtm' file

In 'Select Remarks layer' click browse button to select 'PointData.dwg' file. Check the Layer (e.g. Feature, Fence, House etc) for which you want the layer to be imported. Check 'Include Remarks'.

Click 'OK' to accept extracting profile and cross-section data.

11. Now the input data is ready for you to design. Click Profile window tab and click 'View→Zoom Extent' or Zoom Extent ⊕ button to view the profile drawing.
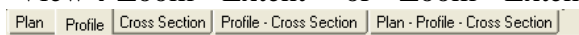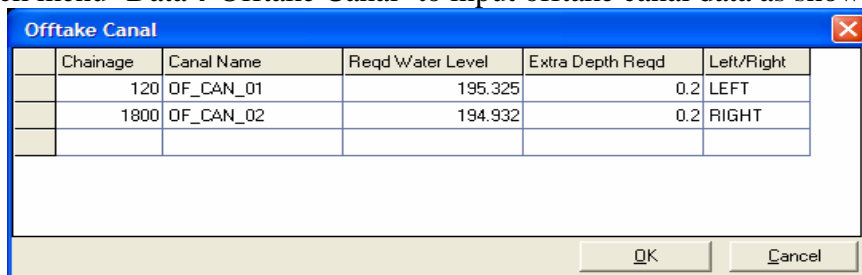
Similarly click Cross-Section Window tab and Zoom Extent button to view the cross-section drawing.

12. Initially the last design Canal Bed Elevation is the last ground elevation. So change the value to 195.4m on the Profile data Panel located at the left top corner of Profile Window and enter to execute.

13. Click menu 'Data→Offtake Canal' to input offtake canal data as shown in figure below.

	Chainage	Canal Name	Reqd Water Level	Extra Depth Reqd	Left/Right
	120	OF_CAN_01	195.325	0.2	LEFT
	1800	OF_CAN_02	194.932	0.2	RIGHT

14. Click menu 'Data➔Soil Data' to give soil cut slope and fill slope at different chainage as shown in the figure.

15. Click menu 'Data-->Canal Bank' to give the length of canal bank at different chainage as shown in figure.

16. Click menu 'Data➔Canal Stripping Data' to give the stripping thickness at different chainage as shown in figure.

17. Click menu 'Data➔Canal Lining' to give the canal lining at different chainage as shown in figure.

18. Click menu 'Data→Canal Berm' to give the canal berm at different chainage as shown in figure.

19. You can put drop at any chainage interactively. In order to put drop of 0.2m at chainage 1+275.00, in the Profile Window, right click to display the popup menu and select 'Show Scale' to display the scale bar. Write the chainage 1275.00 in the chainage text box on Profile Data Panel and then click enter to make it current.

Now click 'Zoom at Mark Link' Button [icon] located at Profile Data Panel to zoom the profile at that chainage.

Enter the value 0.2 in the drop text box located on Profile Data Panel and press enter to execute.
Similarly put drop at chainage 0+010.00

Similarly you can change Bed Slope, Bed Width, and Side Slope for that chainage. So change the bed width from CH 1+275 to CH 1+875.

20. Click Cross-Section Tab and zoom extent button [icon] to view the cross-section drawing.

21. As in profile window you can change the cross-section property for the given cross-section. See Cross-Editor section for learning how to work with each cross-section.

22. You can view the section area of the current section on 'Cross Area Panel'.

23. Click 'Execute→Execute Design' or click Execute button ▶ or press F5 to execute the whole design. Now the design is complete. You can view the whole canal alignment with staking lines in Alignment Window.

24. To export alignment drawing click in menu Output-->Drawing-->Alignment a dialog box as shown in figure will appear.
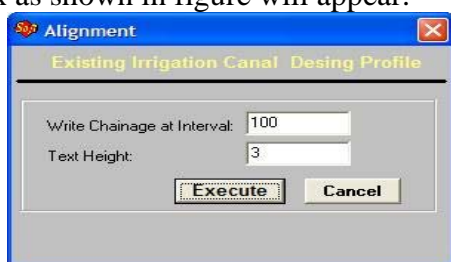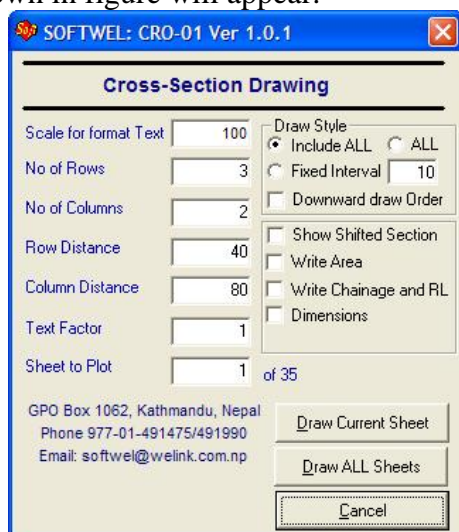

Fig 7.1

Click Execute button to export alignment drawing into active AutoCAD file.

25. To export profile drawing click in menu Output-->Drawing-->Profile a dialog box as shown in figure 7.2 will appear.

26. Give all the required value and then click Execute button to export alignment drawing into active AutoCAD file.

27. To export cross-section drawing click in menu Cross→Drawing→Draw All a dialog box as shown in figure will appear.

28. Give all the required value and then click Execute button to export alignment drawing into active AutoCAD file.

29. To export alignment data click in menu Output→Data→Alignment and give the file location and name to export alignment data in CSV format

30. To export profile data click in menu Output→Data→Profile and give the file location and name to export alignment data in CSV format

31. Cross-Section data can only be exported from Cross-Section entry dialog box by clicking export button.

32. To export quantity data click in menu Cross-->Quantity Output and give the file location and name to export alignment data in CSV format

   To design in existing data mode import data of Plan, Profile and Cross-Section from Data menu and follow the process from step 12