

# **CHAPTER THREE**

## ***Contaminant Ingress Model***

# Manual of Risk Assessment for Contaminant Intrusion into Water Distribution Systems

Chapter-1  
IRA-WDS: Overview



Chapter-2  
Data Preparation



Chapter-3  
Contaminant Ingress Model



Chapter-4  
Pipe Condition Assessment Model



Chapter-5  
Risk Assessment Model

# Chapter 3: Contaminant Ingress Model

## 3.1 Introduction

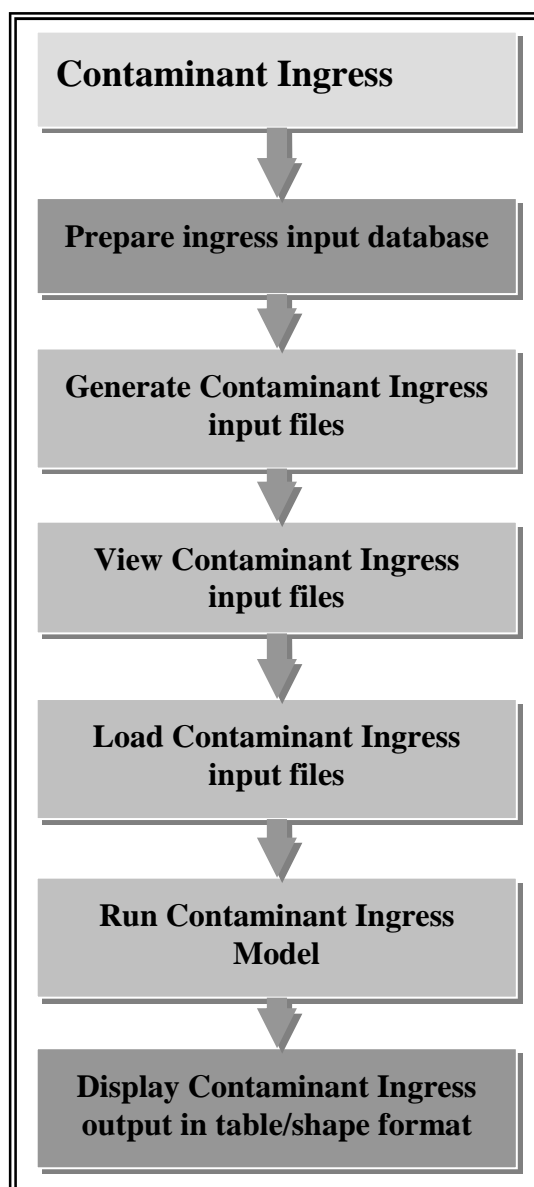
The ‘Contaminant Ingress’ menu contains several submenus. This chapter describes the use of these submenus and associated commands to run the Contaminant Ingress Model. Figure 3.1, below, shows the steps involved in executing this component of the software.

The following steps need to be performed to run the Contaminant Ingress Model:

- Adding the data (if not already done so)
- Rearranging the data (optional)
- Generating an input file
- Viewing Ingress input file (optional)
- Loading input file
- Running model
- Displaying output (optional)

The example files given in Table 3.1 are used for illustration purposes to describe the use of the Contaminant Ingress Model with the help of IRA-WDS.


Table 3.1. Example input files	
Themes	Filenames
Water distribution	wdstesttheme.shp
	wdstestnode.shp
Sewer	sewertesttheme.shp
	sewertestnode.shp
Canal	canaltesttheme.shp
	canaltestnode.shp
Foul water body	fwblink.shp
	fwbnode.shp
Soil type	soilbound.shp

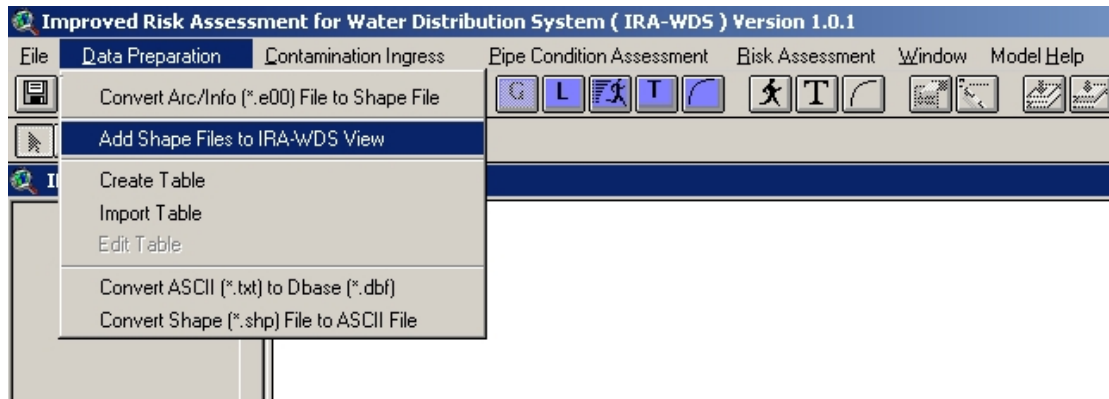


**Figure 3.1. Overview of Contaminant Ingress Model of IRA-WDS**

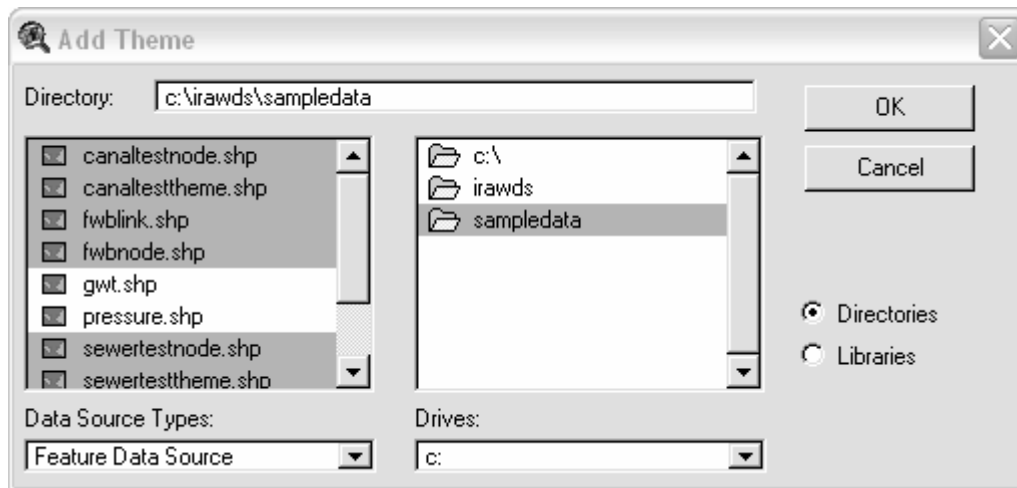
## **3.2 Shape files**

### **3.2.1 Adding shape files**

Adding shape files can be done by clicking on the Tool icon  which is just below the 'Data Preparation' menu or by clicking on the 'Data Preparation' menu and then clicking on the submenu 'Add Shape Files to IRA-WDS View', as shown in the screen below:

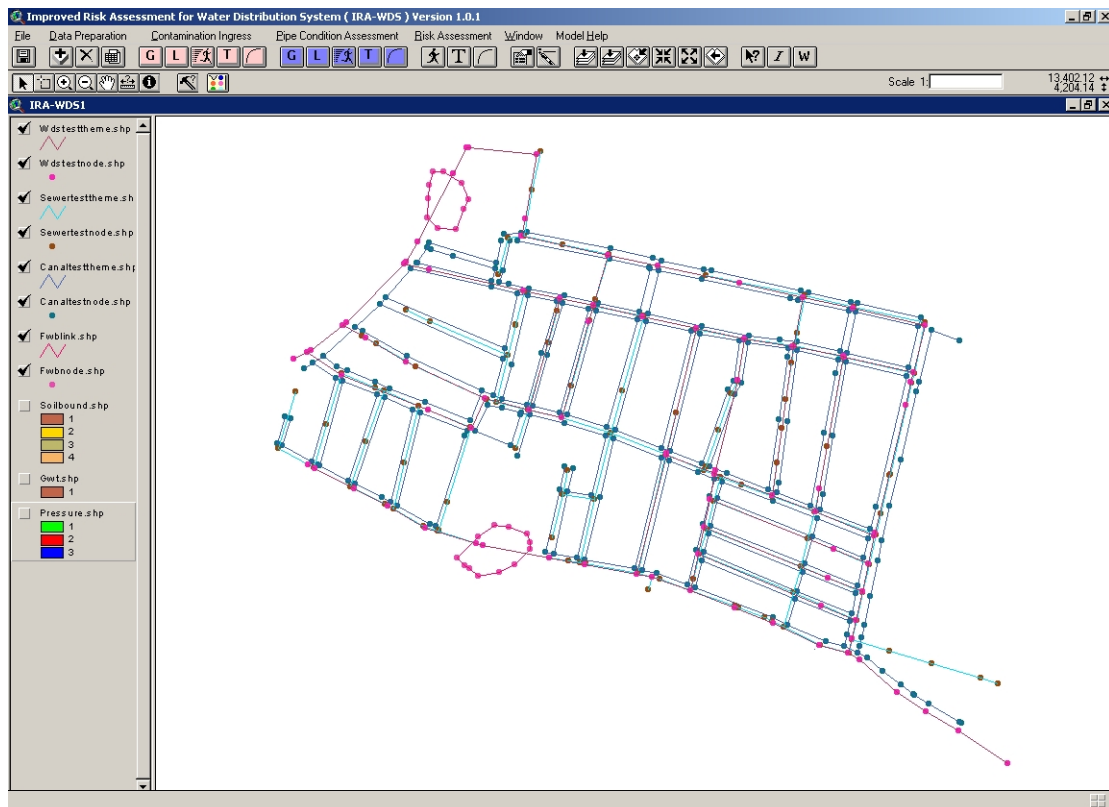


This opens the Add Theme form, as shown below, and the user is then required to select the desired files. At this stage, these files are those relating to: water distribution link and node; sewer pipe link and node; canal link and node; foul water bodies link and node; and soil polygon map.

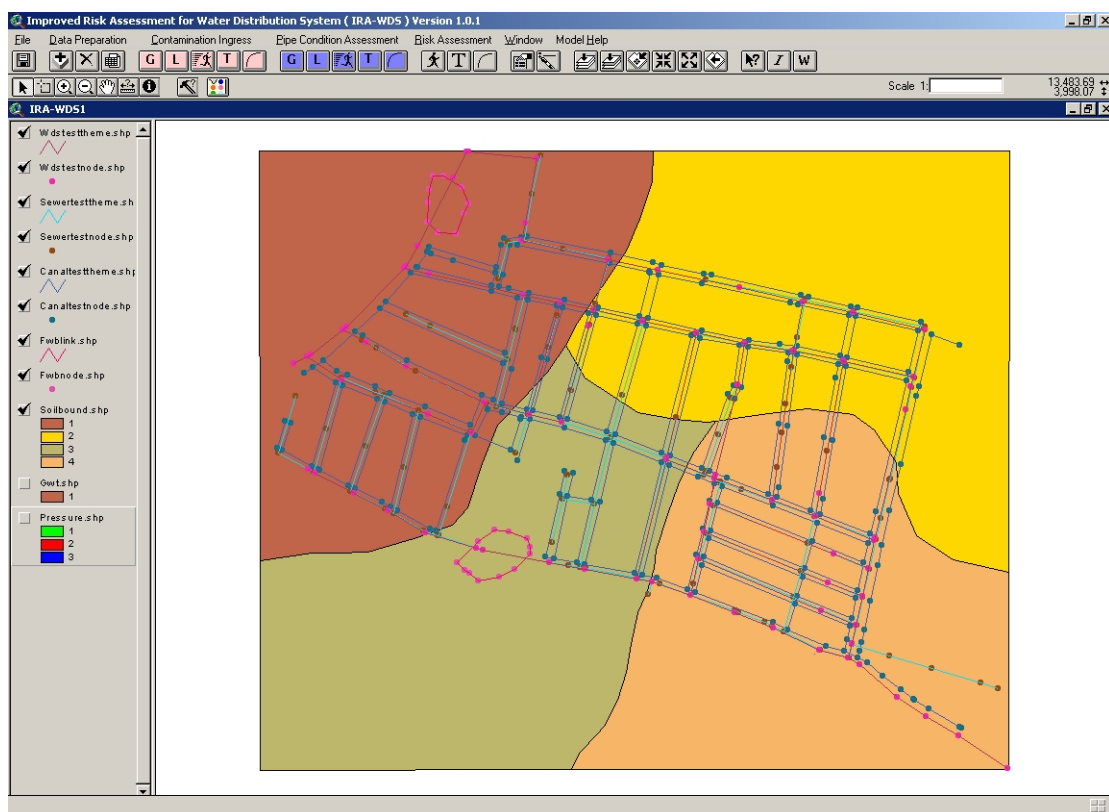


### 3.2.2 Rearranging shape files

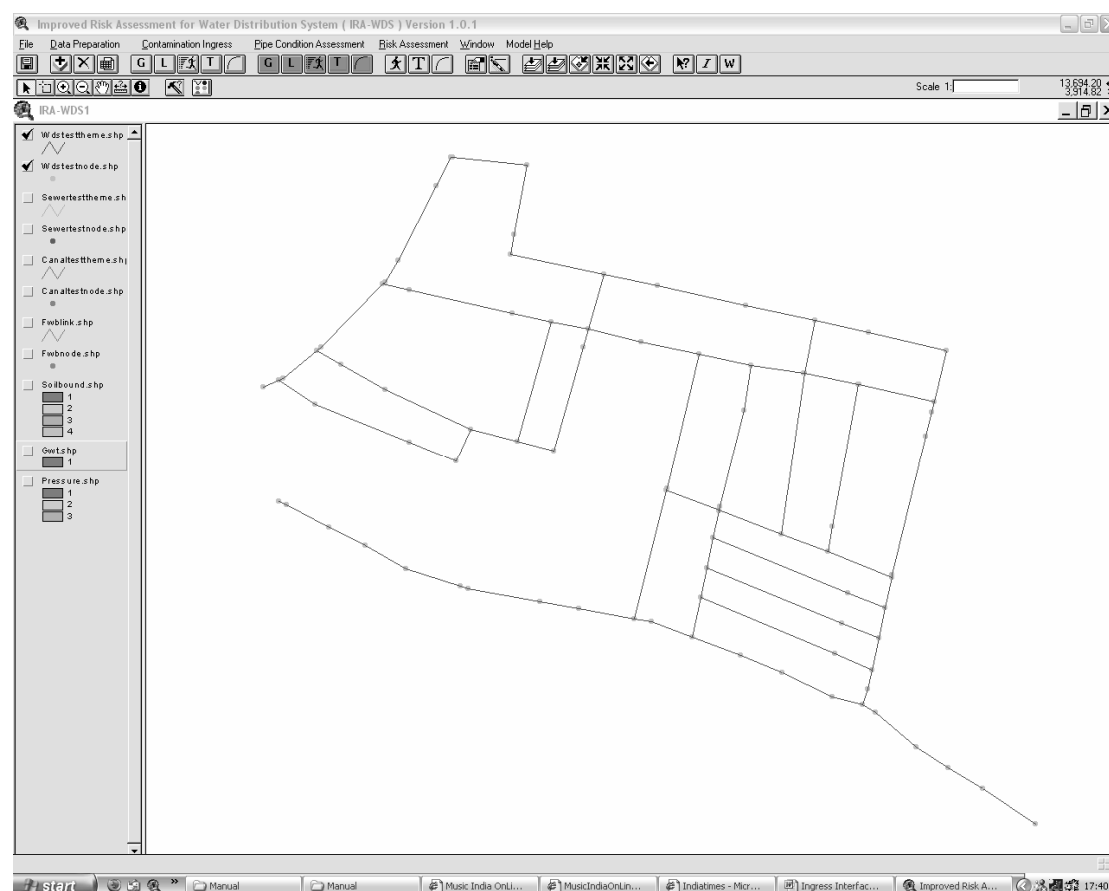
Once the data are added, these can be rearranged for viewing purposes. This can be done by selecting (☑) and/or omitting (☐) different themes (on the left hand side) and changing the preference order of different themes by dragging them above or below the other themes. For example, the view with only line and node themes is as below:



However, if a polygon theme such as soil is to be viewed with these themes, the user should select 'Soilbound.shp'. The view with line and node themes and different soil types is then as below:




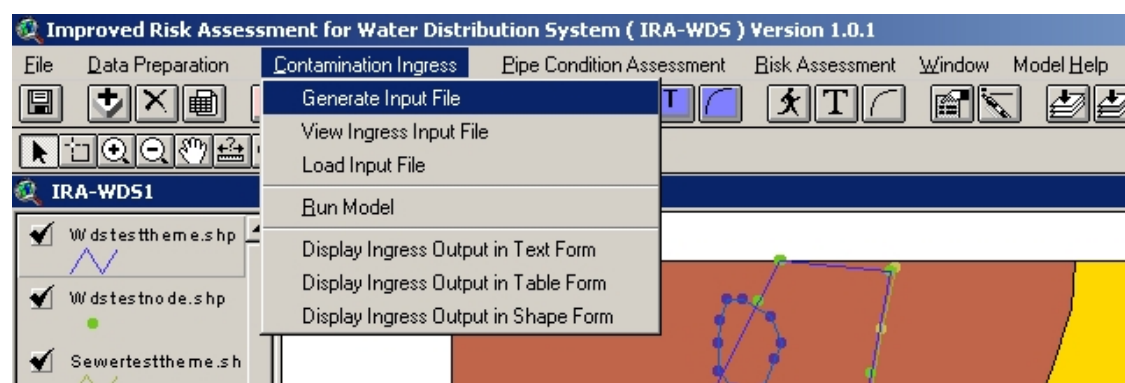
Similarly, if only the water distribution network theme is to be viewed, the user should select 'wdstesttheme.shp' and 'wdstestnode.shp', as shown below:



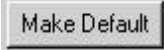


### 3.3 Generating an input file

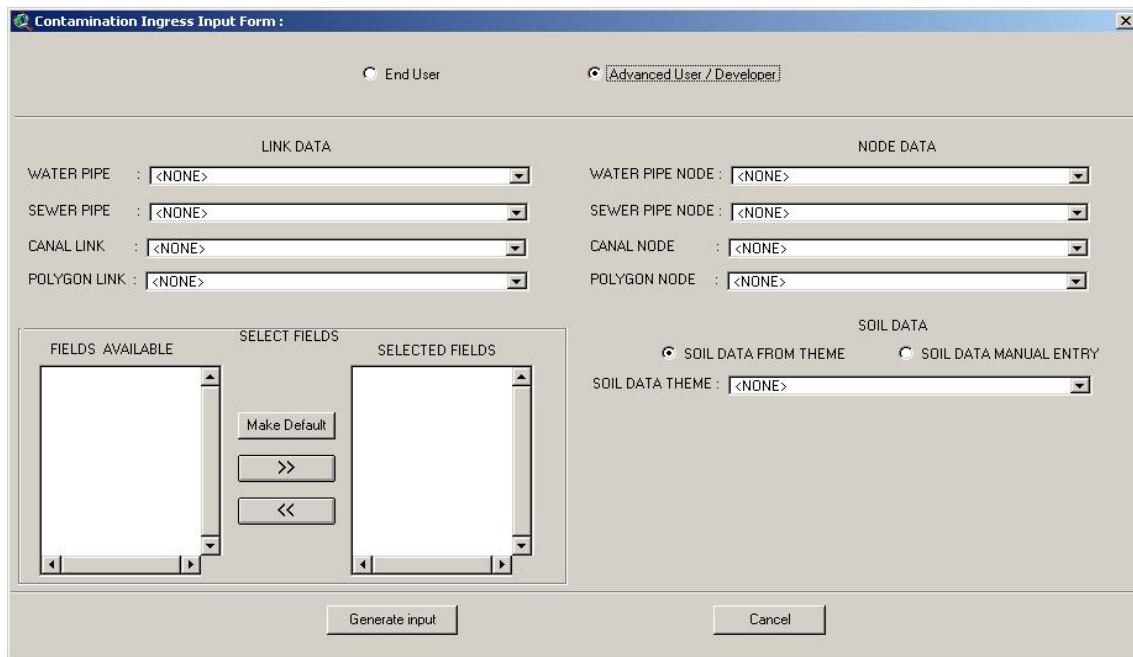
#### 3.3.1 Background to Contaminant Ingress Model input

An input file can be generated by clicking on the Tool icon  which is just below the 'Contamination Ingress' menu or by clicking on the 'Contamination Ingress' menu and then clicking on the submenu 'Generate Input File', as shown in the screen below:



The Contamination Ingress Input Form has two radio button options: **Advanced User** and **End User**.

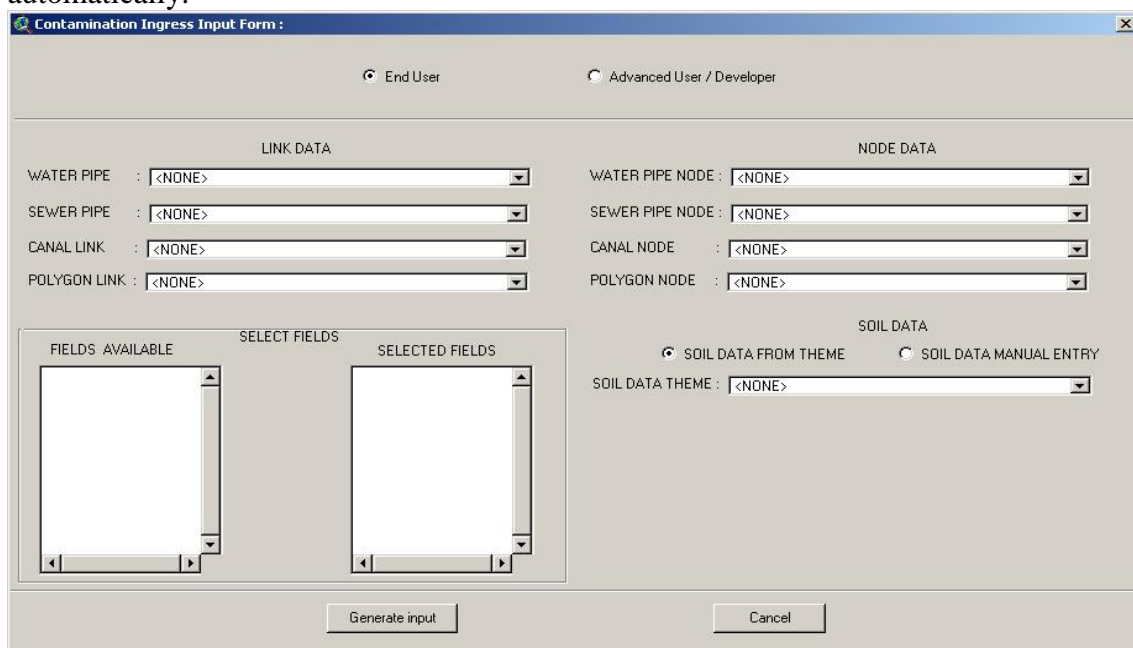
*Advanced users* can click on the radio button next to Advanced User/Developer, which allows the user to add or remove fields to or from the ‘SELECTED FIELDS’ list box. The user can click the  button to select the default field names. Advanced users can add fields to the ‘SELECTED FIELDS’ list box by selecting those fields in the ‘FIELDS AVAILABLE’ list box and then clicking on  button, or can remove fields from the ‘SELECTED FIELDS’ list box by selecting those fields in the ‘SELECTED FIELDS’ list and then clicking on  button.



The screenshot shows the 'Contamination Ingress Input Form' window. At the top, the 'Advanced User / Developer' radio button is selected. The form is divided into several sections:

- LINK DATA:** Four dropdown menus for 'WATER PIPE', 'SEWER PIPE', 'CANAL LINK', and 'POLYGON LINK', all currently set to '<NONE>'.
- NODE DATA:** Four dropdown menus for 'WATER PIPE NODE', 'SEWER PIPE NODE', 'CANAL NODE', and 'POLYGON NODE', all currently set to '<NONE>'.
- SOIL DATA:** Two radio buttons, 'SOIL DATA FROM THEME' (selected) and 'SOIL DATA MANUAL ENTRY'. Below them is a dropdown menu for 'SOIL DATA THEME' set to '<NONE>'.
- SELECT FIELDS:** A section with two list boxes: 'FIELDS AVAILABLE' and 'SELECTED FIELDS'. Between them are three buttons: 'Make Default', '>>', and '<<'.
- Buttons:** 'Generate input' and 'Cancel' buttons at the bottom.

*End users* are not provided with the option of adding or deleting fields to or from the ‘SELECTED FIELDS’ list box. With the End User option, the fields are selected automatically.



The screenshot shows the 'Contamination Ingress Input Form' window with the 'End User' radio button selected. The layout is identical to the previous screenshot, but the 'Advanced User / Developer' radio button is now unselected. The 'SELECT FIELDS' section is present but its functionality is restricted for end users.



### 3.3.2 Adding shape files

#### 3.3.2.1 Water and sewer distribution data

The themes added by the user in the IRA-WDS View need to be defined in terms of which theme represents what (that is, the user needs to define which theme represents water distribution system pipe/node theme, sewer pipe/node theme, canal link/node theme and foul water body (polygon) link/node theme). All polyline shape files in the IRA-WDS View are listed in each combo box placed under the 'LINK DATA' so that user can choose each respective theme from the list to represent WATER PIPE, SEWER PIPE, CANAL LINK and POLYGON LINK in the IRA-WDS View. All point shape files in the IRA-WDS View are listed in each combo box placed under the 'NODE DATA' so that user can choose each respective theme from the list to represent WATER PIPE NODE, SEWER PIPE NODE, CANAL NODE and POLYGON NODE in the IRA-WDS View.

The screenshot shows the 'Contamination Ingress Input Form' with the following sections:

- LINK DATA:** Four dropdown menus for WATER PIPE, SEWER PIPE, CANAL LINK, and POLYGON LINK, each with a shape file selected (e.g., 'Wdstesttheme.shp').
- NODE DATA:** Four dropdown menus for WATER PIPE NODE, SEWER PIPE NODE, CANAL NODE, and POLYGON NODE, each with a shape file selected (e.g., 'Wdstestnode.shp').
- SOIL DATA:** A radio button for 'SOIL D' is selected, followed by a 'SOIL DATA THEME' dropdown menu showing a list of shape files including '<NONE>', 'Wdstestnode.shp', 'Sewertestnode.shp', 'Canaltestnode.shp', and 'Fwbnode.shp'.
- FIELD SELECTION:** A section with three lists: 'FIELDS AVAILABLE' (Shape, Id, X\_coord, Y\_coord, Z\_coord, Polygon, Water\_dep, Soil\_id), 'SELECT FIELDS' (empty), and 'SELECTED FIELDS' (Id, X\_coord, Y\_coord, Z\_coord, Water\_dep, Soil\_id).
- Buttons:** 'Generate input' and 'Cancel' at the bottom.

#### 3.3.2.2 Soil data

SOIL DATA for Contamination Ingress can be defined either through the soil theme, through manual input or through the soil database built within IRA-WDS. All polygon shape files in the IRA-WDS View are listed in combo box placed under the 'SOIL DATA' so that user can choose each respective theme from the list to represent SOIL DATA THEME in the IRA-WDS View.

### 3.3.2.3 Soil data from theme

The figure below shows the user how to select soil data from the shape files.

The screenshot shows the 'Contamination Ingress Input Form' window. At the top, there are two radio buttons: 'End User' (selected) and 'Advanced User / Developer'. The form is divided into several sections:

- LINK DATA:** Four dropdown menus for 'WATER PIPE', 'SEWER PIPE', 'CANAL LINK', and 'POLYGON LINK', all showing shapefile names ending in '.shp'.
- NODE DATA:** Four dropdown menus for 'WATER PIPE NODE', 'SEWER PIPE NODE', 'CANAL NODE', and 'POLYGON NODE', also showing shapefile names.
- SELECT FIELDS:** Two list boxes. 'FIELDS AVAILABLE' contains: Shape, Area, Perimeter, Soilbound\_, Soil\_id, Soil\_type, Sat\_k, Sat\_mc. 'SELECTED FIELDS' contains: Soil\_id, Sat\_k, Sat\_mc, Ini\_mc, Bulk\_den, Koc, Air\_entry, Poresize.
- SOIL DATA:** Two radio buttons: 'SOIL DATA FROM THEME' (selected) and 'SOIL DATA MANUAL ENTRY'. Below is a dropdown menu for 'SOIL DATA THEME' with options: 'Soilbound.shp', '<NONE>', 'Soilbound.shp' (highlighted), and 'Gwt.shp'.

At the bottom are 'Generate input' and 'Cancel' buttons.

### 3.3.2.4 Soil data manual input

With the soil data manual entry option, the user inputs the soil data desired in a box provided before each soil parameter, as shown below:

The screenshot shows the 'Contamination Ingress Input Form' window with the 'SOIL DATA MANUAL ENTRY' option selected. The layout is similar to the previous screenshot, but with additional input fields:

- LINK DATA and NODE DATA:** Same as the previous screenshot.
- SELECT FIELDS:** Same as the previous screenshot.
- SOIL DATA:** The 'SOIL DATA MANUAL ENTRY' radio button is selected. Below it, there are several input fields and dropdown menus:
  - 'Soil Type' dropdown: '<User>' (selected).
  - 'Soil T' dropdown: '<User>' (selected).
  - 'Saturated HC (Ks, c' dropdown: 'Sand' (selected).
  - 'Loamy Sand' is also visible in the dropdown list.
  - 'Initial SMC (Qo, cm3/cm3)': empty text box.
  - 'Air Entry Head [he, cm)': empty text box.
  - 'Pore Size Index': empty text box.
  - 'Soil Characteristic Curve Coeff.': empty text box.
  - 'Fraction Organic Content (Foc)': empty text box.
  - 'Diffusion Coeff. (Dp, cm2/day)': empty text box.
  - 'Organic Carbon Coeff (Koc)': empty text box.
  - 'Liquid Phase Decay (LPD, per hr)': empty text box.

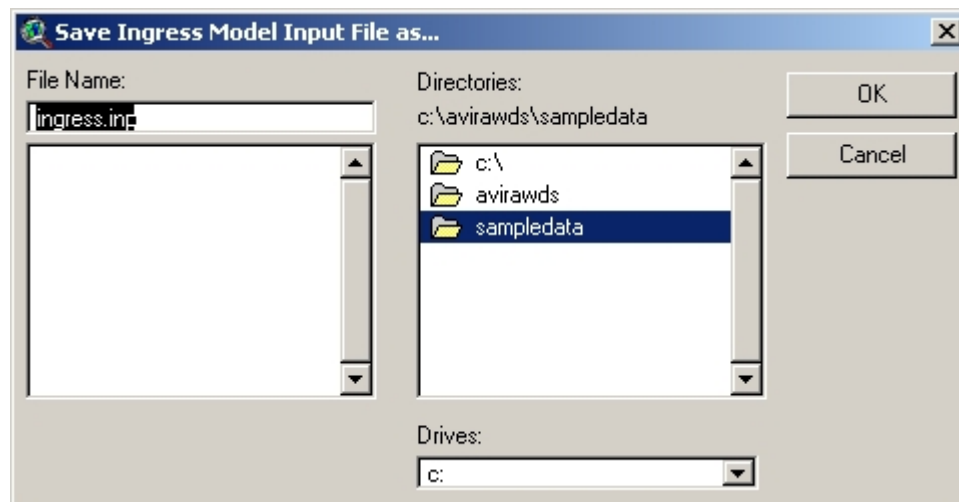
At the bottom are 'Generate input' and 'Cancel' buttons.

### 3.3.2.5 Soil data from database

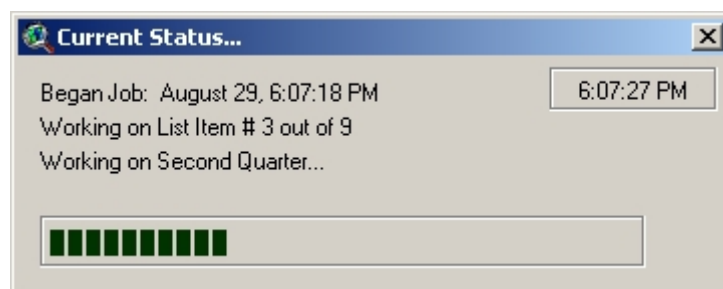
With the soil data from database option, the user chooses the soil type from the Soil Type menu, which consists of different soil properties. The user can also modify the soil properties by using the empty boxes next to some soil properties. The some soil properties depend on the interaction of different soils with contaminants (for example, fraction organic content). The user is required to input the values of these properties.

## 3.4 Generating the input file for the model

After completing the data definition, the next step is for the user to generate the input file to run the Contamination Ingress Model. The Contamination Ingress input file is generated by clicking on the 'Generate Input' button on the 'Contamination Ingress Input Form'. For example, if the soil theme is selected, a spatial analysis is performed by the program to identify the pipes and corresponding soil types in which they are buried; then the soil data is appended according to the node themes of the water distribution system, sewer system, canal and foul water body. Then the user opens the 'File Save' dialogue box to save the file with a user-defined name, as below:



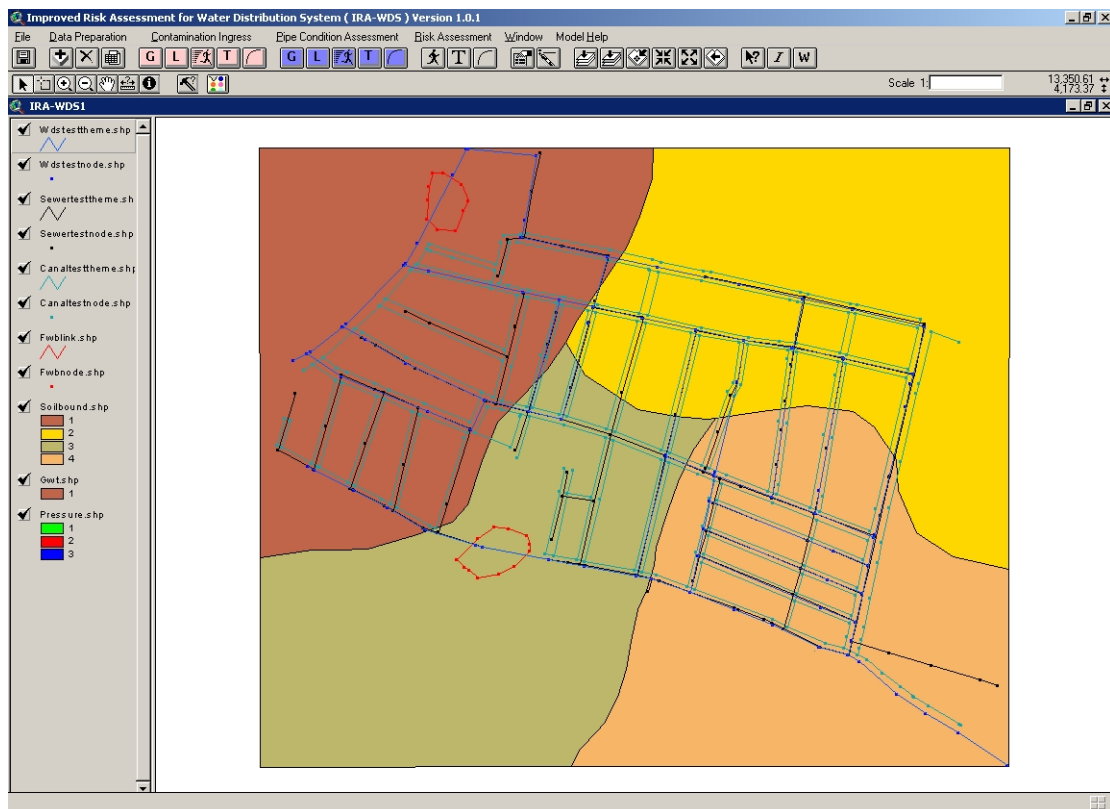
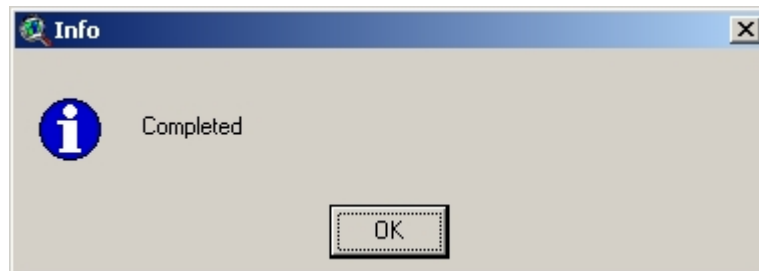
The data generation and writing progress is shown in the Progress Bar as below:




Before the completion of data writing, the model prompts an Input box asking for 'Time of Analysis' (See Appendix B) as shown on next page.



After successfully generating the input file, an Info Message box indicating task completion is displayed as shown below:



### 3.4.1 Viewing Ingress input file

The user can view the input file in the notepad by clicking on the  button and browsing the appropriate output file to view.

ingress - Notepad

File Edit Format Help

[POLYGON NODE 2]

Id	X_coord	Y_coord	Z_coord	water_depth	soil_ID
76	13289.500		4108.500	22.590	0.500 3
77	13300.500		4106.720	22.530	0.500 3
78	13314.000		4101.690	22.470	0.500 3
79	13277.300		4100.020	22.750	0.500 3
80	13316.600		4095.650	22.490	0.500 3
81	13316.200		4090.520	22.520	0.500 3
82	13261.800		4084.040	23.070	0.500 3
83	13305.100		4079.250	22.670	0.500 3
84	13267.400		4078.040	23.080	0.500 3
85	13271.000		4076.200	23.060	0.500 3
86	13293.300		4073.100	22.800	0.500 3
87	13277.500		4070.190	23.020	0.500 3

[SOIL DATA]

Soil_id	Sat_k	Sat_mc	Ini_mc	Bulk_den	KOC	Air_Entry	Poresize	Diff_coeff	FOC	Liq_de
1	29.590	0.430	0.047	1.650	1.000	7.020	1.670	1.000	0.007	1.000 0.07
2	14.360	0.410	0.057	1.600	2.000	9.580	1.270	2.000	0.006	2.000 1.02
3	4.212	0.410	0.064	1.500	3.000	17.700	0.892	3.000	0.007	3.000 1.23
4	1.163	0.390	0.101	1.450	4.000	26.200	0.479	4.000	0.002	4.000 1.56


[TIME]

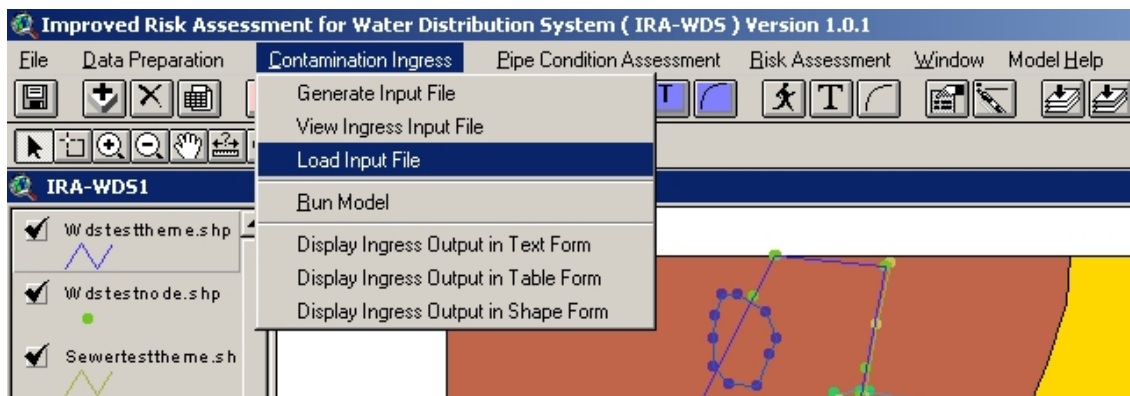
TIME

500

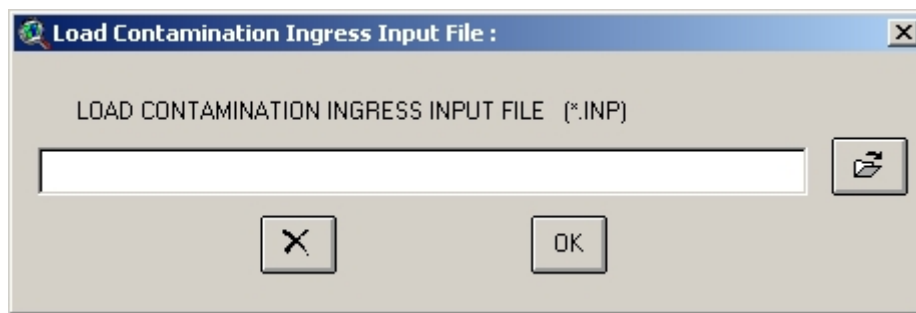
IRA-WDS data viewer


### 3.4.2 Loading input file

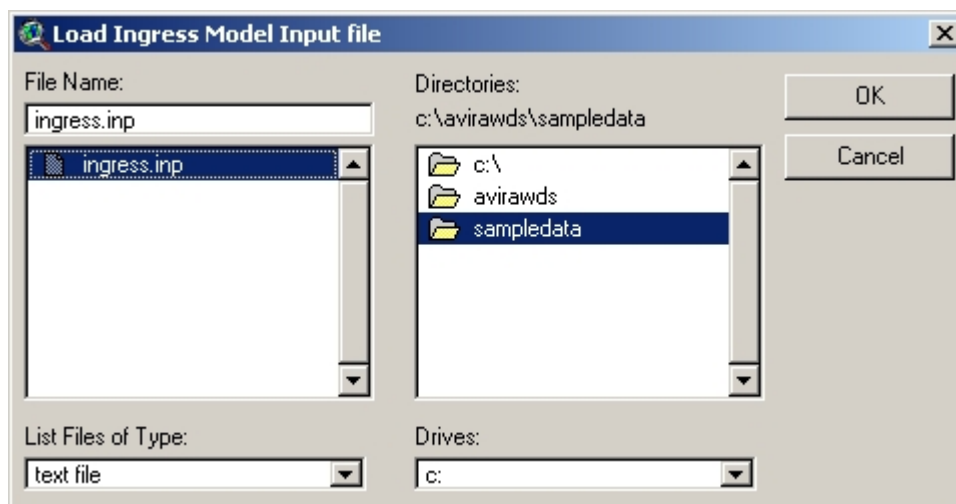
The input file to be used for running the Contaminant Ingress Model is loaded using tool  which is just below the 'Contamination Ingress' menu or by clicking on the 'Contamination Ingress' menu and then clicking on the submenu 'Load Input File', as shown on the screen below:



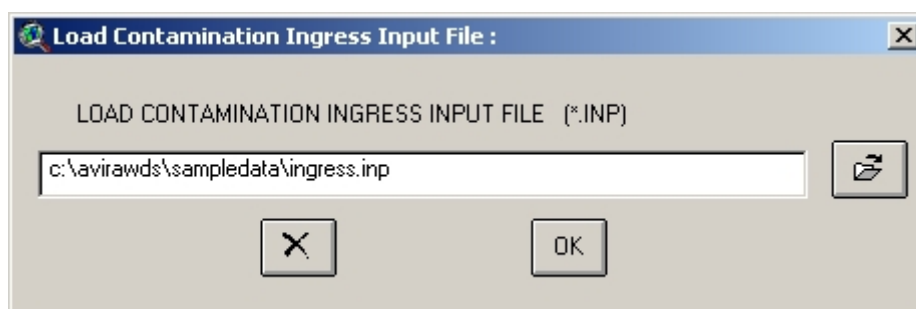
The 'Load Contamination Ingress Input File' dialogue box is as shown below:





The user can browse through the computer by clicking on the  button on the 'Load Contamination Ingress Input File' dialogue box. This opens the 'File Load' dialogue box, as shown below:




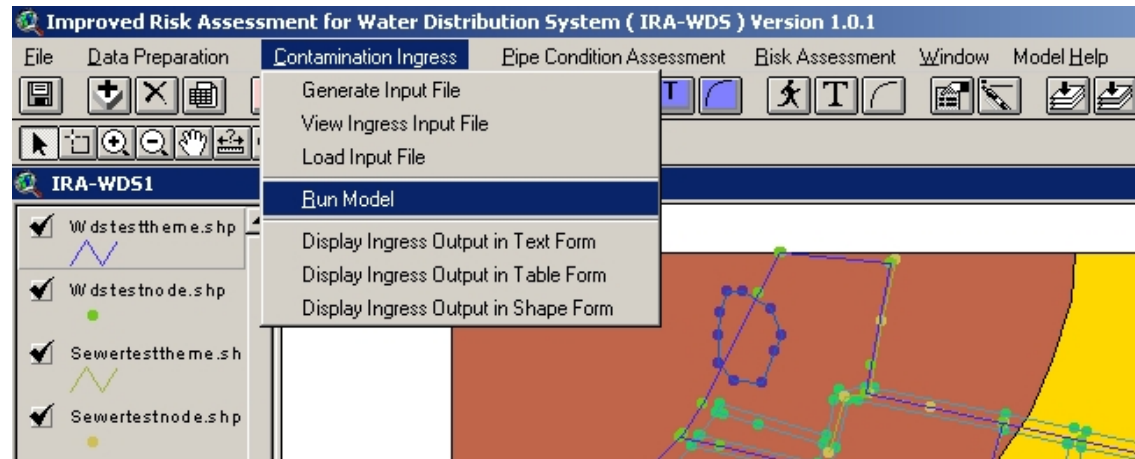
After the appropriate file has been selected, the user presses the 'OK' button on the 'Load Contamination Ingress Input File' dialogue box where the filename appears.



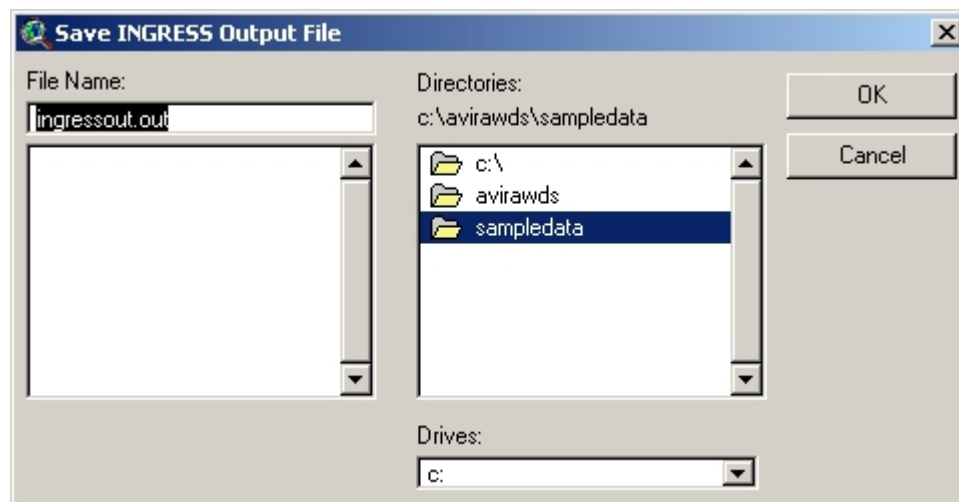
If the user wants to change the filename, he or she can do this by clicking the button , which clears the filename from the 'Load Contamination Ingress Input File' dialogue box. If user is sure of the input file selected, then the file can be loaded by clicking on the  button, which also closes 'Load Contamination Ingress Input File' dialogue box.

### 3.5 Running the Contaminant Ingress Model

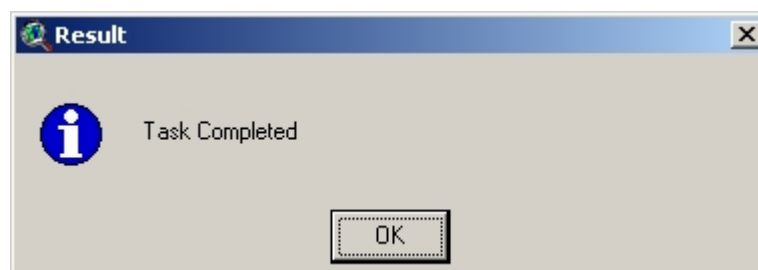
To run the model, the user clicks on the  button, which is just below the 'Contamination Ingress' menu or he or she clicks on the 'Contamination Ingress' menu and then clicks on the submenu 'Run Model', as shown on the screen below:



This opens the 'File Save' dialogue box for saving the Contamination Ingress Model output file as \*.out. Once the user types the appropriate name and clicks 'OK', then the outputs are generated as specified by the user.




The program then displays the 'Task Completed' Result Message Box, as shown below:

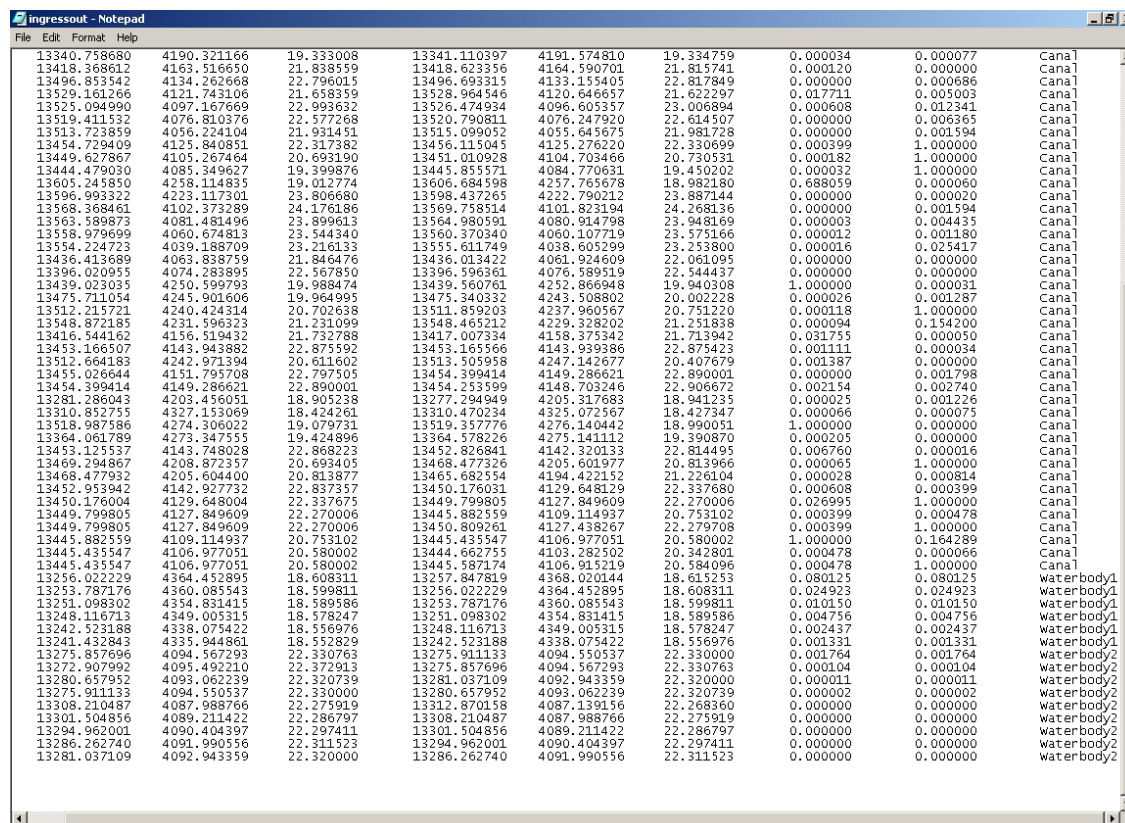
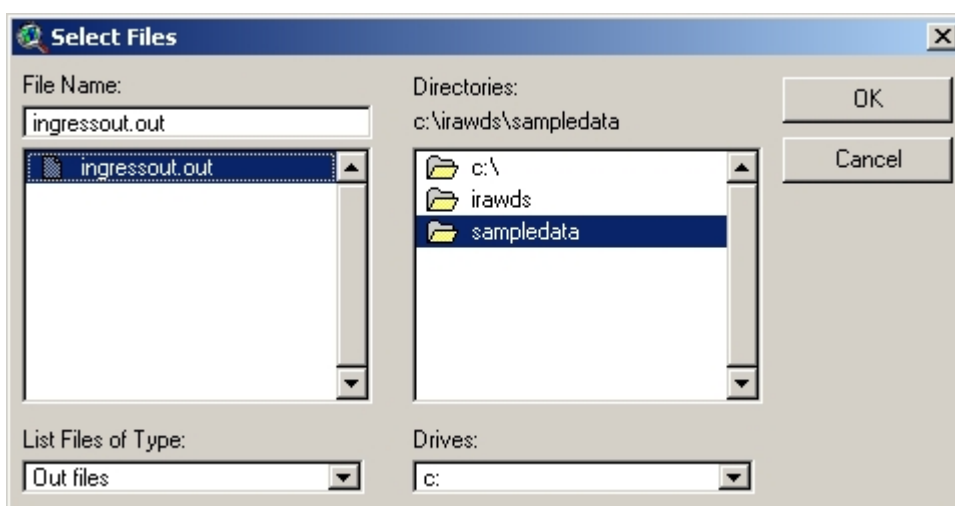


## 3.6 Displaying output

Outputs can be displayed in text, table and shape forms

### 3.6.1 Displaying Ingress output in text form

The user can view the output file in text form using the notepad by clicking on the  button or by selecting the Display Output in Text Form submenu from the Contaminant Ingress menu and browsing the appropriate output file to view.

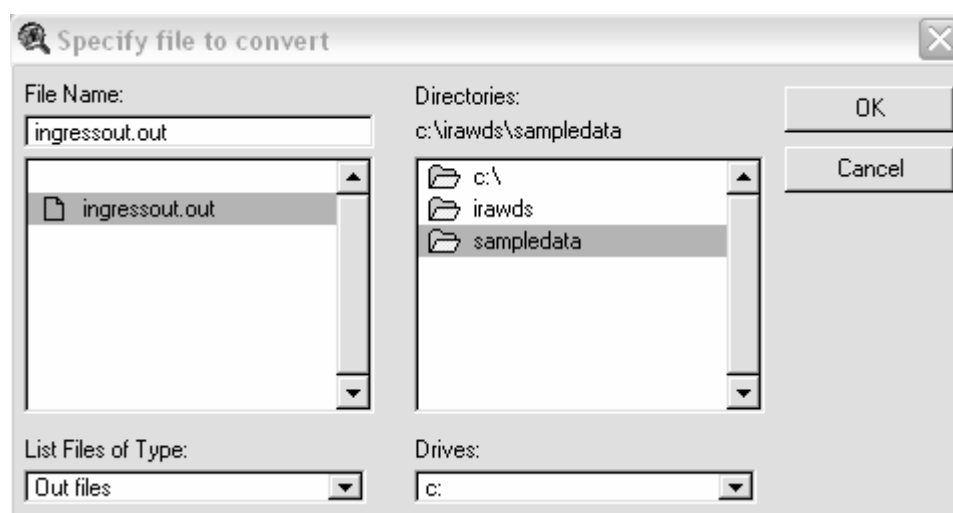


13340.758680	4190.321166	19.333008	13341.110397	4191.574810	19.334759	0.000034	0.000077	Canal
13418.368612	4163.516650	21.838559	13418.623356	4164.590701	21.815741	0.000120	0.000000	Canal
13496.853542	4134.262668	22.796015	13496.693315	4133.155405	22.817849	0.000000	0.000686	Canal
13529.161266	4121.743106	21.658359	13528.964546	4120.646657	21.622297	0.017711	0.005003	Canal
13525.094990	4097.167669	22.993632	13526.474934	4096.605357	23.006894	0.000608	0.012341	Canal
13510.411532	4076.810376	22.577268	13520.790811	4076.247920	22.614507	0.000000	0.006365	Canal
13513.723859	4056.224104	21.931451	13515.099052	4055.645675	21.981728	0.000000	0.001594	Canal
13454.729409	4125.840851	22.317382	13456.115045	4125.276220	22.330699	0.000399	1.000000	Canal
13449.627867	4105.267464	20.693190	13451.010928	4104.703466	20.730531	0.000182	1.000000	Canal
13444.479030	4085.349627	19.399876	13445.855571	4084.770631	19.450202	0.000032	1.000000	Canal
13605.245850	4258.114835	19.012774	13606.684598	4257.765678	18.982180	0.688059	0.000060	Canal
13596.993322	4223.117301	23.806680	13598.437265	4222.790212	23.887144	0.000000	0.000020	Canal
13568.368461	4102.373289	24.176186	13569.758514	4101.823194	24.268136	0.000000	0.001594	Canal
13563.589873	4081.481496	23.899613	13564.980591	4080.914798	23.948169	0.000003	0.004435	Canal
13558.979693	4060.674813	23.544340	13560.370347	4060.107719	23.575166	0.000012	0.001180	Canal
13554.224723	4039.188709	23.216133	13555.611749	4038.605299	23.253800	0.000016	0.025417	Canal
13436.413689	4063.838759	21.846476	13436.013422	4061.924609	22.061095	0.000000	0.000000	Canal
13396.020955	4074.283895	22.567850	13396.596361	4076.589519	22.544437	0.000000	0.000000	Canal
13439.023035	4250.599793	19.988474	13439.560761	4252.866948	19.940308	1.000000	0.000031	Canal
13475.711054	4245.901606	19.964995	13475.340332	4243.508802	20.002228	0.000026	0.001287	Canal
13512.215721	4240.424314	20.702638	13511.859203	4237.960567	20.751220	0.000118	1.000000	Canal
13548.872185	4231.596323	21.231099	13548.465212	4229.328202	21.251838	0.000094	0.154200	Canal
13416.544162	4156.519432	21.732788	13417.007334	4158.375342	21.713942	0.031755	0.000050	Canal
13453.166507	4143.943682	22.871592	13453.165366	4143.939386	22.875423	0.001111	0.000034	Canal
13512.684183	4242.971394	20.611602	13513.505958	4247.142677	20.407679	0.001387	0.000000	Canal
13455.026644	4151.795708	22.797505	13454.399414	4149.286621	22.890001	0.000000	0.001798	Canal
13454.399414	4149.286621	22.890001	13454.253599	4148.703246	22.906672	0.002154	0.002740	Canal
13281.286043	4203.456051	18.905238	13277.294949	4205.317683	18.941235	0.000025	0.001226	Canal
13310.852755	4327.133069	18.424261	13310.470234	4325.072567	18.427347	0.000066	0.000075	Canal
13518.987586	4274.306022	19.079731	13519.357776	4276.140442	18.990051	1.000000	0.000000	Canal
13364.061789	4273.347555	19.424896	13364.578226	4275.141112	19.390870	0.000205	0.000000	Canal
13453.125537	4143.748028	22.868223	13452.826841	4142.320133	22.814495	0.006760	0.000016	Canal
13469.294867	4208.872337	20.693405	13468.477326	4205.601977	20.813966	0.000065	1.000000	Canal
13468.477932	4205.604400	20.813877	13465.682554	4194.422152	21.226104	0.000028	0.000814	Canal
13452.953942	4142.927732	22.837357	13450.176031	4129.548129	22.337680	0.000608	0.000399	Canal
13450.176004	4129.648004	22.337675	13449.799805	4127.849609	22.270006	0.026995	1.000000	Canal
13449.799805	4127.849609	22.270006	13445.882559	4109.114937	20.753102	0.000399	0.000478	Canal
13449.799805	4127.849609	22.270006	13450.809261	4127.438267	22.279708	0.000399	1.000000	Canal
13445.882559	4109.114937	20.753102	13445.435547	4106.977051	20.580002	1.000000	0.164289	Canal
13445.435547	4106.977051	20.580002	13444.662755	4103.282502	20.342801	0.000478	0.000066	Canal
13445.435547	4106.977051	20.580002	13445.587174	4106.915219	20.584096	0.000478	1.000000	Canal
13256.022229	4364.452895	18.608311	13257.847819	4368.020144	18.615253	0.080125	0.080125	waterbody1
13253.787176	4360.085543	18.599811	13256.022229	4364.452895	18.608311	0.024923	0.024923	waterbody1
13251.098302	4354.831415	18.589586	13253.787176	4360.085543	18.599811	0.010150	0.010150	waterbody1
13248.116713	4349.003515	18.578247	13251.098302	4354.831415	18.589586	0.004756	0.004756	waterbody1
13242.523188	4338.075422	18.556976	13248.116713	4349.003515	18.578247	0.002437	0.002437	waterbody1
13241.432843	4335.944861	18.552829	13242.523188	4338.075422	18.556976	0.001331	0.001331	waterbody1
13275.857696	4094.567293	22.330763	13275.911133	4094.550537	22.330000	0.001764	0.001764	waterbody2
13272.907992	4095.492210	22.372913	13275.857696	4094.567293	22.330763	0.000104	0.000104	waterbody2
13280.657952	4093.062239	22.320739	13281.037109	4092.943359	22.320000	0.000011	0.000011	waterbody2
13275.911133	4094.550537	22.330000	13280.657952	4093.062239	22.320739	0.000002	0.000002	waterbody2
13308.210487	4087.988766	22.275919	13312.870158	4087.139156	22.268360	0.000000	0.000000	waterbody2
13301.504856	4089.211422	22.286797	13308.210487	4087.988766	22.275919	0.000000	0.000000	waterbody2
13294.962001	4090.404397	22.297411	13301.504856	4089.211422	22.286797	0.000000	0.000000	waterbody2
13286.262740	4089.211523	22.311523	13294.962001	4090.404397	22.297411	0.000000	0.000000	waterbody2
13281.037109	4092.943359	22.320000	13286.262740	4091.990556	22.311523	0.000000	0.000000	waterbody2




### 3.6.2 Displaying Ingress output in table form

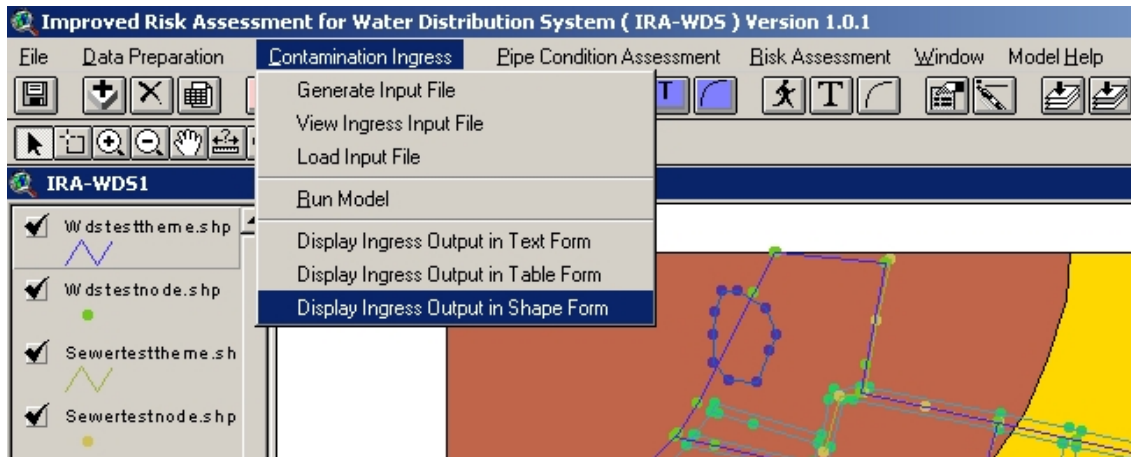
The user can view the output file in table form by selecting the Display Output in Table Form submenu from the Contaminant Ingress menu and specifying the appropriate output file to view by browsing as below:



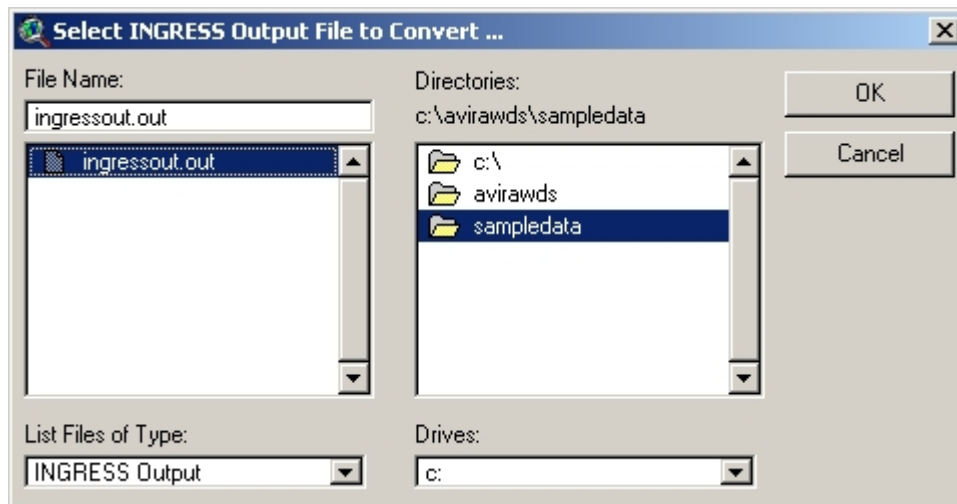
PipeID	StartX	StartY	StartZ	EndX	EndY	EndZ	StartConc	EndConc	Q
898	13529.700	4237.970	20.929	13547.300	4234.320	21.181	0.383	1.000	Sewer
884	13512.400	4241.870	20.665	13512.500	4242.250	20.647	1.000	0.000	Sewer
865	13609.600	4257.060	18.920	13610.100	4256.940	18.910	1.000	0.000	Sewer
914	13605.700	4238.720	21.605	13610.100	4256.940	18.910	1.000	0.000	Sewer
917	13175.500	4220.390	19.550	13175.700	4220.280	19.554	0.000	0.039	Sewer
808	13374.600	4309.420	18.739	13374.800	4309.380	18.737	1.000	0.000	Sewer
842	13520.100	4277.900	18.912	13520.500	4277.810	18.924	0.000	1.000	Sewer
1151	13559.000	4009.350	22.300	13559.000	4009.350	22.300	0.016	1.000	Canal
1151	13559.100	4009.290	22.302	13559.100	4009.290	22.302	0.000	0.046	Canal
1143	13553.600	4015.380	21.915	13554.100	4017.120	21.724	0.000	0.000	Canal
809	13230.400	4301.180	18.492	13228.800	4301.540	18.487	0.000	0.000	Canal
879	13184.300	4252.940	18.787	13182.900	4253.710	18.765	0.000	0.000	Canal
917	13157.900	4232.040	19.135	13159.300	4231.150	19.167	0.000	0.002	Canal
836	13373.500	4306.110	18.803	13373.900	4307.420	18.778	0.025	0.000	Canal
855	13362.600	4268.160	19.444	13362.900	4269.390	19.446	0.000	0.000	Canal
944	13337.900	4275.000	19.733	13337.600	4273.700	19.721	0.000	0.000	Canal
944	13316.200	4197.620	19.021	13315.900	4196.530	19.009	0.002	0.000	Canal
950	13340.800	4190.320	19.333	13341.100	4191.570	19.336	0.000	0.000	Canal
975	13418.400	4163.520	21.839	13418.600	4164.590	21.816	0.000	0.000	Canal
1016	13496.900	4134.260	22.796	13496.700	4133.160	22.818	0.000	0.001	Canal
1029	13529.200	4121.740	21.658	13529.000	4120.650	21.622	0.018	0.005	Canal
1064	13525.100	4097.170	22.994	13526.500	4096.610	23.007	0.001	0.012	Canal
1085	13519.400	4076.810	22.577	13520.800	4076.250	22.615	0.000	0.006	Canal
1107	13513.700	4056.220	21.932	13515.100	4055.650	21.982	0.000	0.002	Canal
1064	13454.700	4125.840	22.317	13456.100	4125.280	22.331	0.000	1.000	Canal
1085	13449.600	4105.270	20.693	13451.000	4104.700	20.730	0.000	1.000	Canal
1107	13444.500	4085.350	19.400	13445.900	4084.770	19.450	0.000	1.000	Canal
865	13605.200	4258.110	19.013	13606.700	4257.770	18.982	0.688	0.000	Canal
915	13597.000	4223.120	23.807	13598.400	4222.790	23.887	0.000	0.000	Canal
1047	13568.400	4102.370	24.176	13569.800	4101.820	24.268	0.000	0.002	Canal
1078	13563.600	4081.480	23.900	13565.000	4080.910	23.948	0.000	0.004	Canal
1100	13559.000	4060.670	23.544	13560.400	4060.110	23.575	0.000	0.001	Canal
1114	13554.200	4039.190	23.216	13555.600	4038.610	23.254	0.000	0.025	Canal
1097	13436.400	4063.840	21.846	13436.000	4061.920	22.061	0.000	0.000	Canal
1082	13396.000	4074.280	22.568	13396.600	4076.590	22.544	0.000	0.000	Canal
975	13439.000	4250.600	19.988	13439.600	4252.870	19.940	1.000	0.000	Canal
918	13475.700	4245.900	19.965	13475.300	4243.510	20.002	0.000	0.001	Canal
1016	13512.200	4240.420	20.703	13511.900	4237.960	20.751	0.000	1.000	Canal
1012	13548.900	4231.600	21.231	13548.500	4229.330	21.252	0.000	0.154	Canal
1082	13416.500	4156.520	21.733	13417.000	4158.380	21.714	0.032	0.000	Canal
1019	13453.200	4143.940	22.876	13453.200	4143.940	22.875	0.001	0.000	Canal
984	13512.700	4242.970	20.612	13513.500	4247.140	20.408	0.000	0.000	Canal
989	13455.000	4151.800	22.797	13454.400	4149.290	22.890	0.000	0.002	Canal
993	13454.400	4149.290	22.890	13454.300	4148.700	22.907	0.002	0.003	Canal
936	13281.300	4203.460	18.905	13277.300	4205.320	18.941	0.000	0.001	Canal

### 3.6.3 Displaying Ingress output in shape form

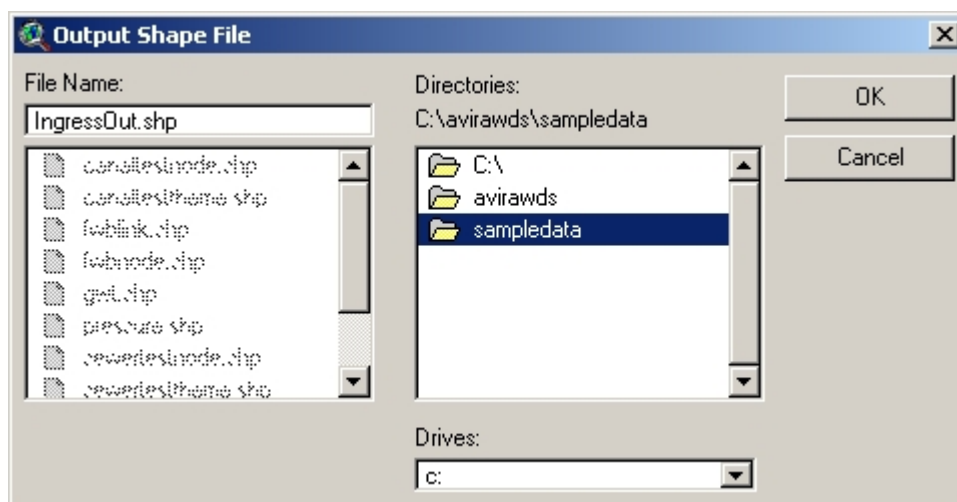
To view the Contamination Ingress Model output in shape file form click on the  button, which is just below the 'Contamination Ingress' menu or by clicking on the 'Contamination Ingress' menu and then clicking on the submenu 'Display Ingress Output in Shape Form', as shown in the screen below:



This opens the 'File Select' dialogue box for selecting the Contamination Ingress output file as \*.out, which has to be converted to shape file as shown below:



Once the user has selected the appropriate filename and clicked 'OK', this opens the 'File Save' dialogue box and asks the user to type in the output shape filename:



After typing or selecting the appropriate name, the user needs to click the 'OK' button, which then generates the shape file with information from the Contamination

Ingress output shape file and loads that file into the IRA-WDS data viewer with contamination legend as shown below:

