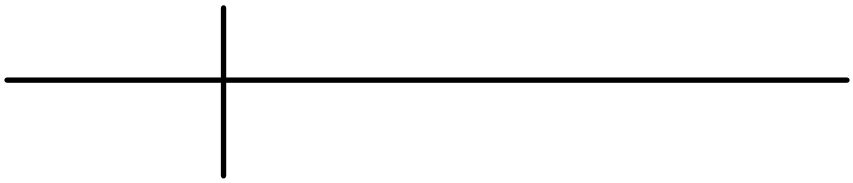
Quick Start Lessons



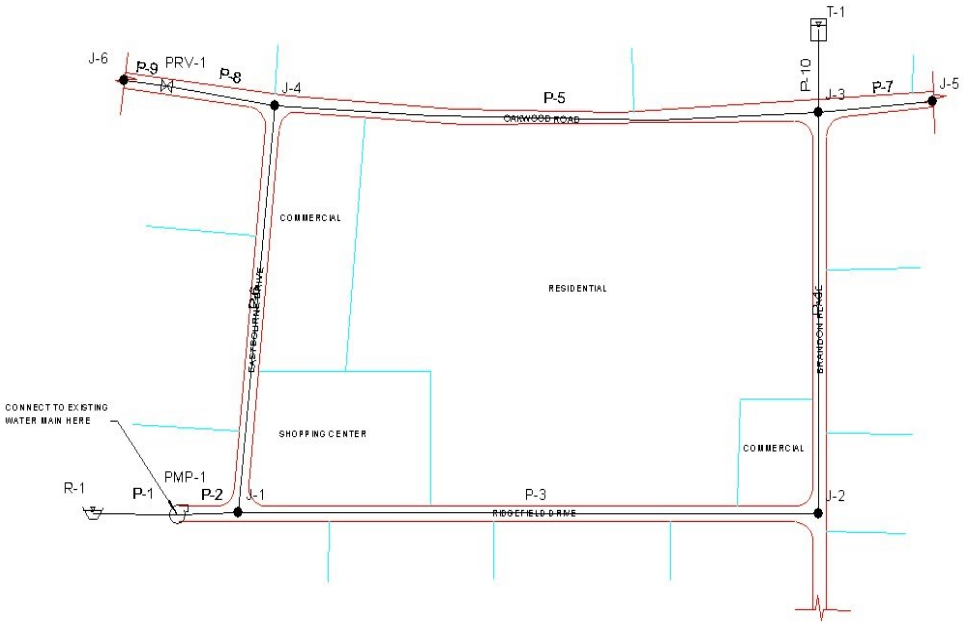
Building a Network and Performing a Steady-State Analysis

In constructing a distribution network for this lesson, you do not need to be concerned with assigning labels to pipes and nodes, because Bentley WaterCAD V8*i* will assign labels automatically. When creating a schematic drawing, pipe lengths are entered manually. In a scaled drawing, pipe lengths are automatically calculated from the position of the pipes' bends and start and stop nodes on the drawing pane.

In this network, the modeling of a reservoir connected to a pump simulates a connection to the main water distribution system. Simplifying the network in this way can approximate the pressures supplied to the system at the connection under a range of demands. This type of approximation is not always applicable, and care

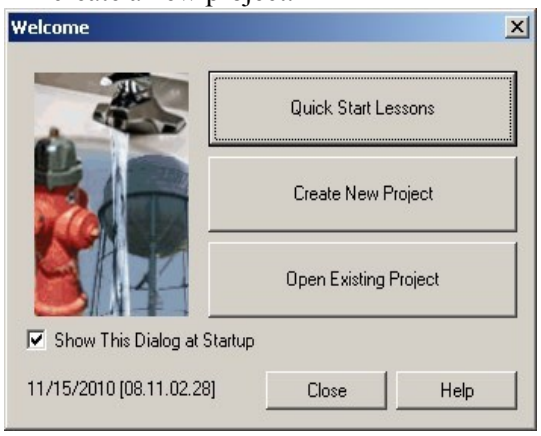
should be taken when modeling a network in this way. It is more accurate to trace the network back to the source.

In this lesson, you will create and analyze the network shown below. You will use a scaled background drawing for most of the network; however, four of the pipes are not to scale and will have user-defined lengths.

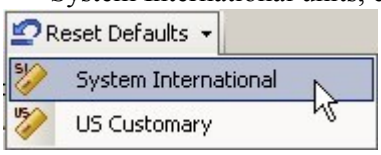


Step 1: Create a New Project File

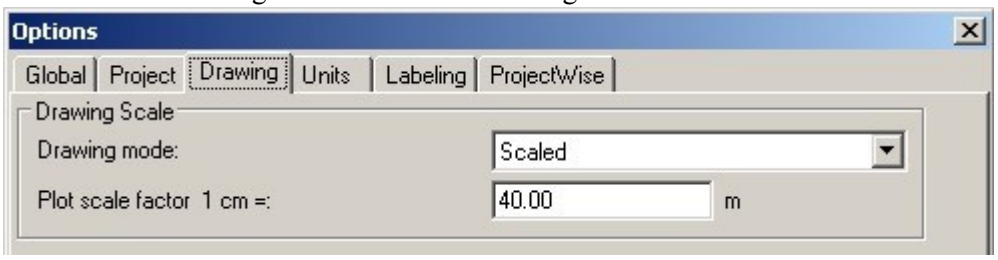
1. From the welcome dialog, click Create New Project and an untitled project opens. Or click File > New to create a new project.



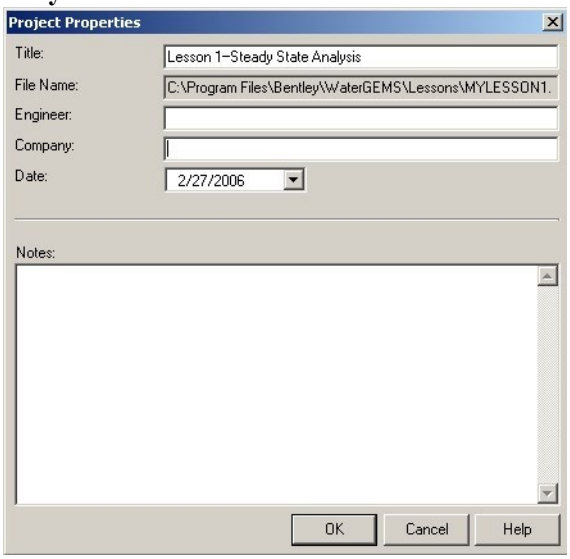
2. Click the Tools menu and select the Options command. Click the Units tab. Since you will be working in System International units, click the Reset Defaults button and select System International.



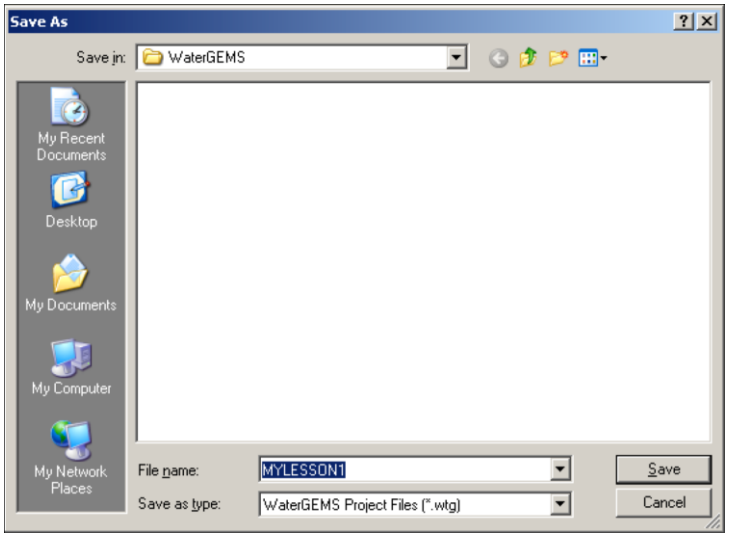
3. Verify that the Default Unit System for New Project is set to System International. If not, select from the menu.
4. Click the Drawing tab to make sure Drawing Mode is set to Scaled.



5. Set the Plot Scale Factor 1 cm = **40** m.
6. Click OK.
7. Set up the project. Choose File > Project Properties and name the project **Lesson 1—Steady State Analysis** and click OK.



8. Choose **File > Save as**. In the Save File As dialog box, browse to the **My Documents/Bentley/WaterGEMS** folder.



9. Enter the file name **MYLESSON1.WTG** for your project, and click **Save**.

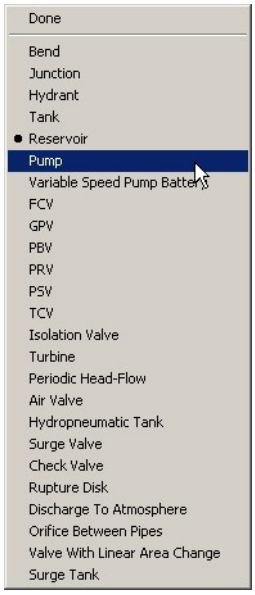
Step 2: Lay out the Network

1. Select Pipe  from the layout toolbar.

2. Move the cursor on the drawing pane and right click to select Reservoir from the menu or click  from the toolbar.

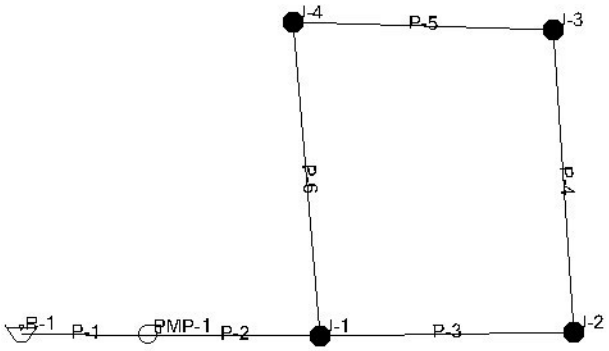
3. Click to place R-1.

4. Move the cursor to the location of pump P-1. Right-click and select Pump from the shortcut menu.

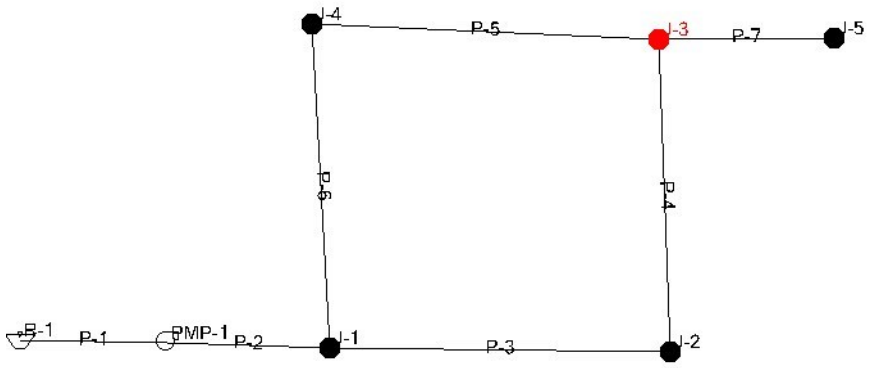


5. Click to place it.

6. Right click to select Junction from the menu and click to place J-1.
7. Click to place junctions J-2, J-3, and J-4.
8. Click on J-1 to finish.
9. Right-click and choose Done from the menu.



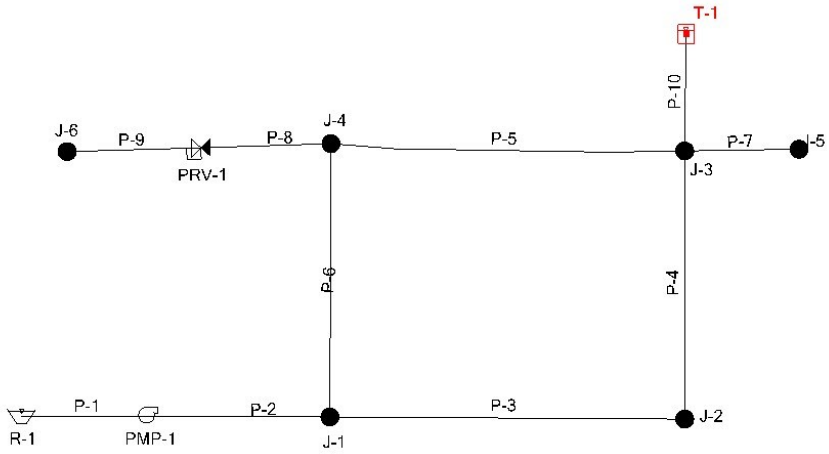
10. Create J-5.
    a. Select the **Pipe** layout tool again.
    b. Click junction J-3.
    c. Move the cursor to the location of J-5, and click to insert the element.
    d. Right-click and select **Done**.



11. Lay out junction **J-6** and the **PRV** by selecting the **Pipe** layout tool and placing the elements in their appropriate locations.

    Be sure to lay out the pipes in numerical order (P-7 through P-9), so that their labels correspond to the labels in the diagram. Right-click and select **Done** from the menu to terminate the Pipe Layout command.

12. Insert the tank, T-1, using the **Pipe** layout tool. Pipe **P-10** should connect the tank to the network if you laid out the elements in the correct order.



13. Save the network by clicking **Save** or choose File > Save.

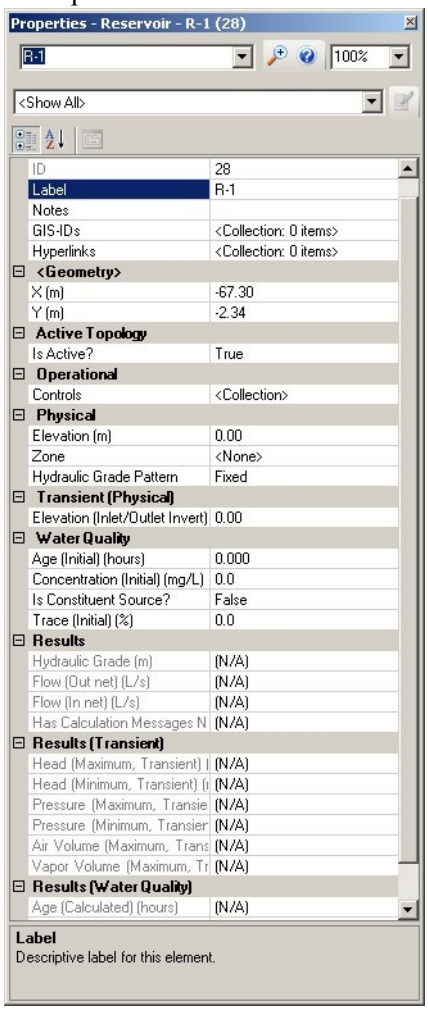
Step 3: Enter and modify data

- **Dialog Boxes**—You can use the Select tool and double-click an element to bring up its Properties editor.
- **FlexTables**—You can click FlexTables to bring up dynamic tables that allow you to edit and display the model data in a tabular format. You can edit the data as you would in a spreadsheet.
- **User Data Extensions**—The User Data Extensions feature (Tools menu > User Data Extensions) allows you to import and export element data directly from XML files.
- **Alternative Editors**—Alternatives are used to enter data for different "What If?" situations used in Scenario Management.

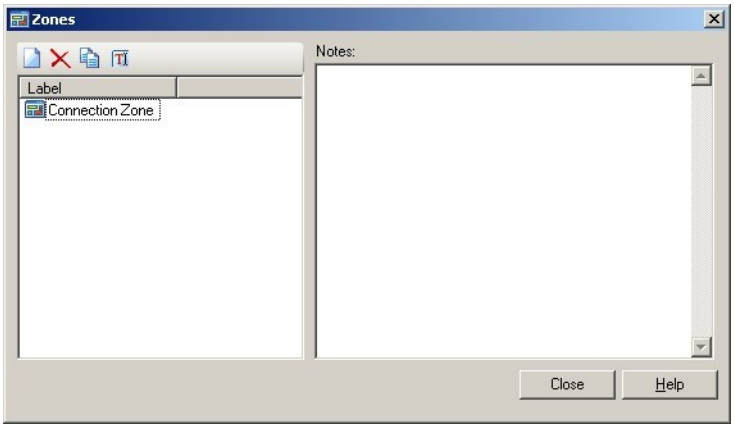
Entering Data through the Properties Editor

To access an element's property editor, double-click the element.

1. Open the **Reservoir Editor** for reservoir R-1.



2. Enter the Elevation as 198 (m).
3. Set Zone to **Connection Zone**.
   a. Click the **Zone** menu and select the **Edit Zones** command, which will open the **Zone Manager**.
   b. Click **New**  .
   c. Enter a label for the new pressure zone called Connection Zone.

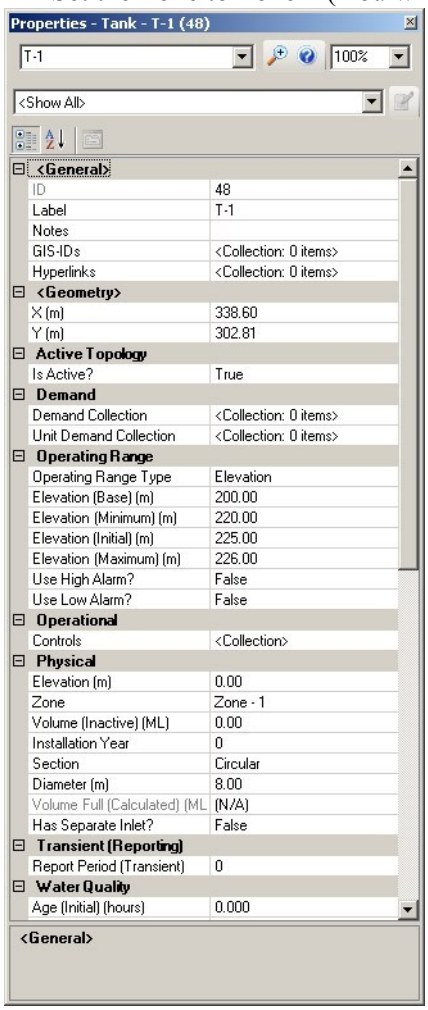


d. Click Close.

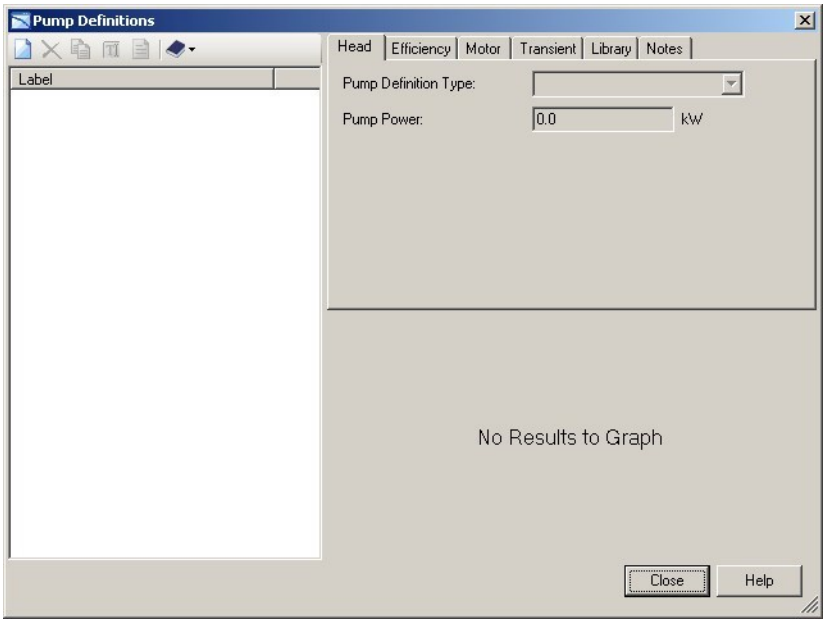
e. Select the zone you just created from the Zone menu.

4. Click tank **T-1** in the drawing to highlight it and enter the following:
Elevation (Base) = 200 m
Elevation (Minimum) = 220 m
Elevation (Initial) = 225 m
Elevation (Maximum) = 226 m
Diameter = 8 m

Section = Circular
Set the Zone to Zone 1 (You will need to create Zone-1 in the Zone Manager as described above.)



5. Click pump PMP-1 in the drawing to highlight it.
   a. Enter 193 (m) for the Elevation.
   b. Click in the Pump Definition field and click on Edit Pump Definitions from the drop-down list to open the Pump Definitions manager.

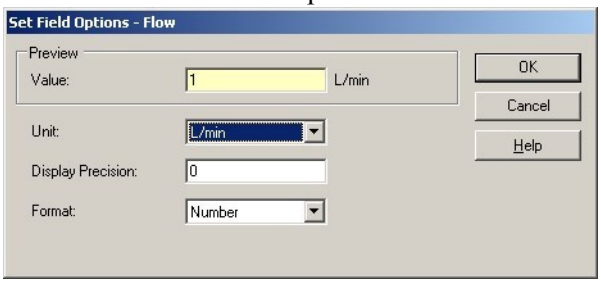


c. Click New to create a new pump definition.

d. Leave the default setting of Standard (3 Point) in the Pump Definition Type menu.

e. Right click on the Flow column and select the Units and Formatting command.

f. In the Set Field Options box set the Units to L/min.

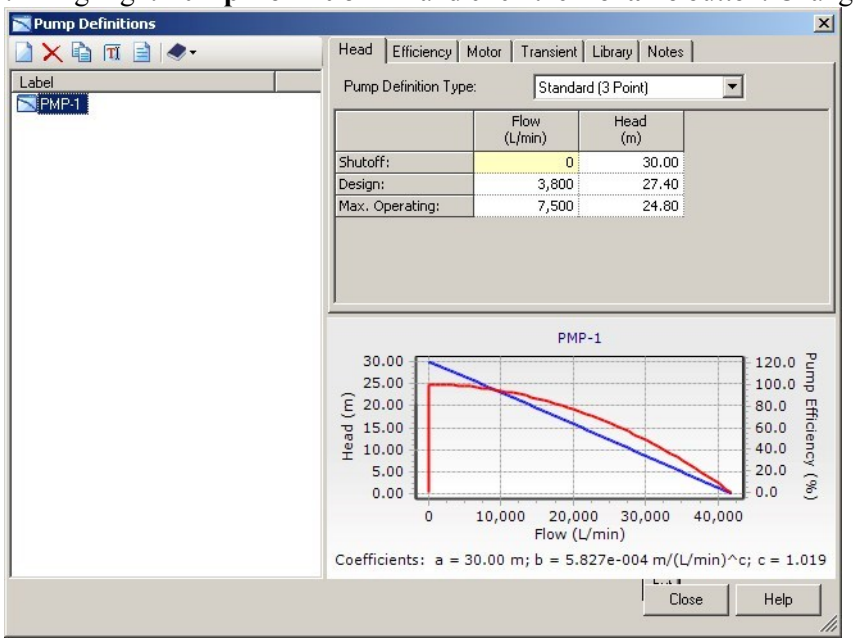


g. Click OK.

h. Enter the following information:

	Flow (L/min)	Head (m)
Shutoff:	0.00	30.00
Design:	3,800.00	27.40
Max. Operating:	7,500.00	24.80

i. Highlight **Pump Definition - 1** and click the **Rename** button. Change the name to **PMP-1**.

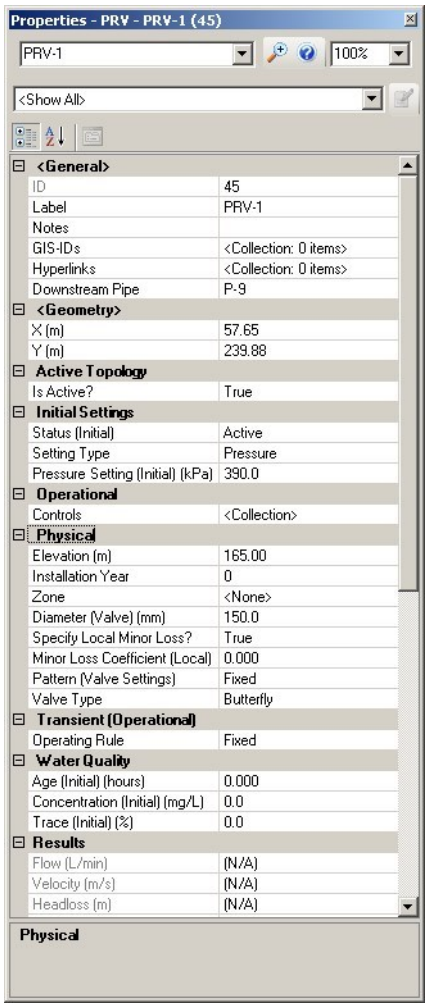


j. Click **Close**.

k. In the Properties editor, select **PMP-1** from the **Pump Definition** menu.

6. Highlight valve **PRV-1** in the drawing. Enter in the following data:
   Status (Initial) = Active
   Setting Type= Pressure
   Pressure Setting (Initial)= 390 kPa
   Elevation =165 m

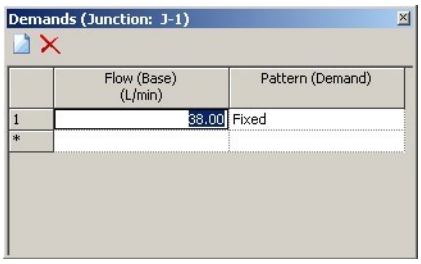
   Diameter (Valve) = 150 mm
   Create Zone-2 and set the valve's Zone field to Zone-2.



7. Enter the following data for each of the junctions. Leave all other fields set to their default values.

Junction	Elevation (m)	Zone	Demand (l/min)
J-1	184	Zone-1	38
J-2	185	Zone-1	31
J-3	184	Zone-1	34
J-4	183	Zone-1	38
J-5	185.5	Zone-1	350
J-6	165	Zone-2	356

In order to add the demand, click the ellipsis  in the Demand Collection field to open the Demand box, click New, and type in the value for Flow (L/min).



Specify user-defined lengths for pipes P-1, P-7, P-8, P-9 and P-10. a. Click pipe **P-1** to open the Pipe Editor.

b. Set **Has User Defined Length?** to **True**. Then, enter a value of **0.01 m** in the **Length (User Defined)** field.

Note that the default display precision will cause only "0" to be displayed. To change display precision, right click the column heading and select **Units and Formatting** to open the **Set Field Options** dialog; from here you can change the **Display Precision** to the desired value and click **OK**.

Since you are using the reservoir and pump to simulate the connection to the main distribution system, you want headloss through this pipe to be negligible. Therefore, the length is very small and the diameter will be large.

c. Enter **1000 mm** as the diameter of P-1.

Physical	
Zone	<None>
Diameter (mm)	1,000.0
Material	Ductile Iron
Hazen-Williams C	130.0
Has User Defined Length?	True
Length (User Defined) (m)	0.01
Has Check Valve?	False
Specify Local Minor Loss?	True
Minor Loss Coefficient (Local)	0.000
Installation Year	0

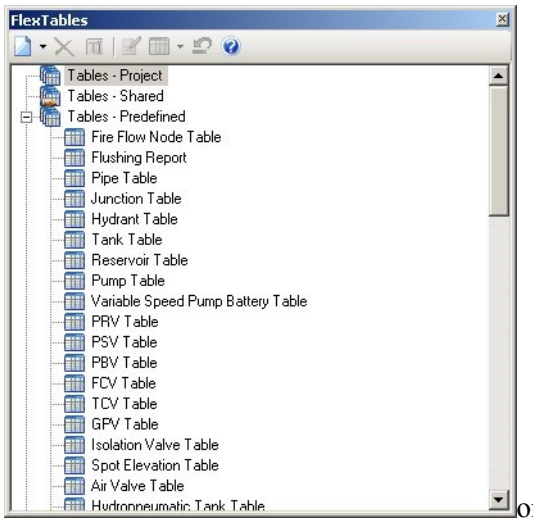
d. Change the lengths (but not the diameters) of pipes P-7 through P-10 using the following user-defined lengths: P7 = Length (User Defined): 400 m
P8 = Length (User Defined): 500 m
P9 = Length (User Defined): 31 m
P-10 = Length (User Defined): 100 m

e. Close the Properties editor.

Step 4: Entering Data through FlexTables

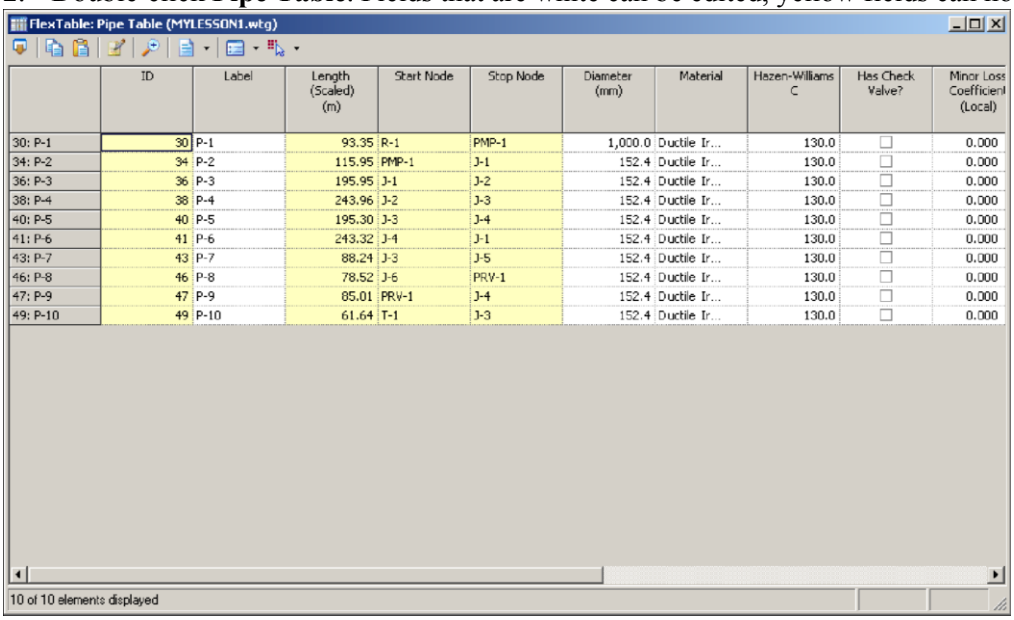
It is often more convenient to enter data for similar elements in tabular form, rather than to individually open the properties editor for an element, enter the data, and then select the next element. Using FlexTables, you can enter the data as you would enter data into a spreadsheet. **To use FlexTables**

1. Click FlexTables 



or choose View > FlexTables.

2. Double-click **Pipe Table**. Fields that are white can be edited, yellow fields can not.

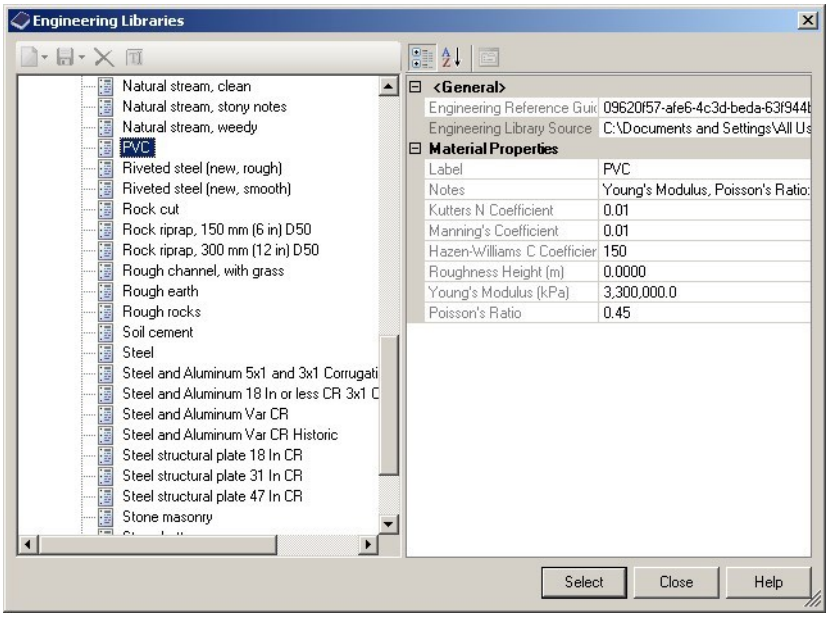


	ID	Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Has Check Valve?	Minor Loss Coefficient (Local)
30: P-1	30	P-1	93.35	R-1	PMP-1	1,000.0	Ductile Ir...	130.0	☐	0.000
34: P-2	34	P-2	115.95	PMP-1	J-1	152.4	Ductile Ir...	130.0	☐	0.000
36: P-3	36	P-3	195.95	J-1	J-2	152.4	Ductile Ir...	130.0	☐	0.000
38: P-4	38	P-4	243.96	J-2	J-3	152.4	Ductile Ir...	130.0	☐	0.000
40: P-5	40	P-5	195.30	J-3	J-4	152.4	Ductile Ir...	130.0	☐	0.000
41: P-6	41	P-6	243.32	J-4	J-1	152.4	Ductile Ir...	130.0	☐	0.000
43: P-7	43	P-7	88.24	J-3	J-5	152.4	Ductile Ir...	130.0	☐	0.000
46: P-8	46	P-8	78.52	J-6	PRV-1	152.4	Ductile Ir...	130.0	☐	0.000
47: P-9	47	P-9	85.01	PRV-1	J-4	152.4	Ductile Ir...	130.0	☐	0.000
49: P-10	49	P-10	61.64	T-1	J-3	152.4	Ductile Ir...	130.0	☐	0.000

3. For each of the pipes, enter the diameter and the pipe material as follows:

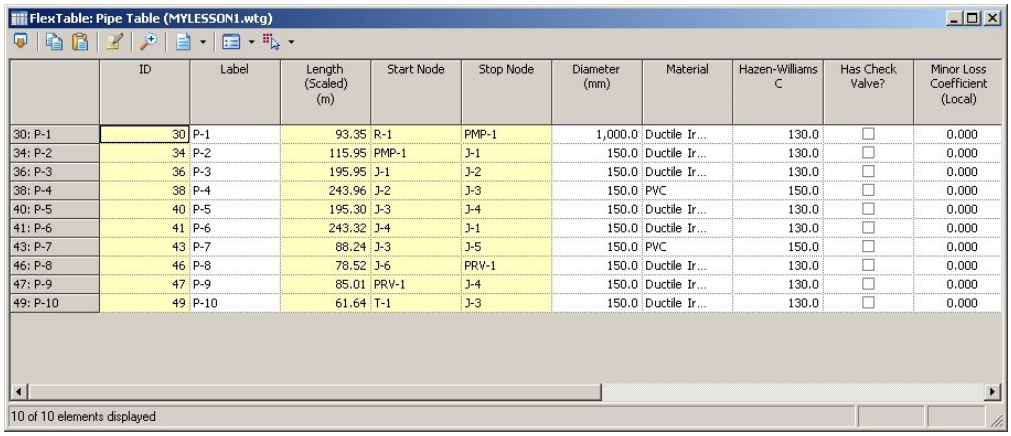
Pipe	Material	Diameter (mm)
P-1	Ductile Iron	1000
P-2	Ductile Iron	150
P-3	Ductile Iron	150
P-4	PVC	150
P-5	Ductile Iron	150
P-6	Ductile Iron	150
P-7	PVC	150
P-8	Ductile Iron	150
P-9	Ductile Iron	150
P-10	Ductile Iron	150

4. In order to enter the material type, click the ellipsis  to open the Engineering Libraries box. Click on Material Libraries > Material Libraries.xml and then click the appropriate material type and then click Select.



5. Notice that the C values for the pipes will be automatically assigned to preset values based on the material; however, these values could be modified if a different coefficient were required.

6. Leave the other data set to their default values. Click to exit the table when you are finished.



FlexTable: Pipe Table (MYLESSON1.wtg)

	ID	Label	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Has Check Valve?	Minor Loss Coefficient (Local)
30: P-1	30	P-1	93.35	R-1	PMP-1	1,000.0	Ductile Ir...	130.0	☐	0.000
34: P-2	34	P-2	115.95	PMP-1	J-1	150.0	Ductile Ir...	130.0	☐	0.000
36: P-3	36	P-3	195.95	J-1	J-2	150.0	Ductile Ir...	130.0	☐	0.000
38: P-4	38	P-4	243.96	J-2	J-3	150.0	PVC	150.0	☐	0.000
40: P-5	40	P-5	195.30	J-3	J-4	150.0	Ductile Ir...	130.0	☐	0.000
41: P-6	41	P-6	243.32	J-4	J-1	150.0	Ductile Ir...	130.0	☐	0.000
43: P-7	43	P-7	88.24	J-3	J-5	150.0	PVC	150.0	☐	0.000
46: P-8	46	P-8	78.52	J-6	PRV-1	150.0	Ductile Ir...	130.0	☐	0.000
47: P-9	47	P-9	85.01	PRV-1	J-4	150.0	Ductile Ir...	130.0	☐	0.000
49: P-10	49	P-10	61.64	T-1	J-3	150.0	Ductile Ir...	130.0	☐	0.000

10 of 10 elements displayed

Step 5: Run a Steady-State Analysis

1. Click  to open the **Calculation Options** manager.
2. Double-click **Base Calculation Options** under the **Steady-State/EPS Solver** heading to open the **Properties** editor. Make sure that the **Time Analysis Type** is set to **Steady State**.

Calculation Times	
Simulation Start Date	1/1/2000
Time Analysis Type	Steady State
Use simple controls during ste	True
Is EPS Snapshot?	False
Start Time	12:00:00 AM

   Close the **Properties** editor and the **Calculation Options** manager.

3. Click Compute  to analyze the model.
4. When calculations are completed, the Calculation Summary and User Notifications open.
5. A blue light is an informational message, a green light indicates no warnings or issues, a yellow light indicates warnings, and a red light indicates issues.
6. Click to close the Calculation Summary and User Notifications dialogs.
7. Click to Save  project.