

Chapter 8

Developing a Reservoir Network

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Chapter 8

Developing a Reservoir Network

A reservoir network represents a collection of watershed elements connected by routing reaches. Elements created in the Watershed Setup Module belong to specific watershed configurations, and when you create a reservoir network, it references one of those configurations.

The computation points defined for a configuration in the Watershed Setup Module automatically become junctions in the Reservoir Network Module. Your primary task in developing a reservoir network is to connect the junctions with routing reaches between junctions.

This chapter provides an overview of the Reservoir Network Module's screen components and describes the processes for creating a new reservoir network, opening an existing reservoir network, making a network editable, and adding routing reaches. ResSim also allows you to add additional elements to a reservoir network.

After you have established your reservoir network connectivity, you will need to edit Junction, Reach, and Diversion data (see Chapter 9), define and edit the Physical components of Reservoirs in your network (see Chapter 10), define Reservoir Operations data (see Chapter 11), define Reservoir Systems (see Chapter 12), and define Alternatives (see Chapter 13). These steps will prepare your reservoir network to run Simulations (see Chapter 14).

8.1 Recognizing Reservoir Network Screen Components

The **Reservoir Network Module** (Figure 8.1) provides the tools you will need to develop the connectivity of your reservoir network as well as enter and edit physical and operations data. What follows is a discussion of the components and features of the Reservoir Network Module.

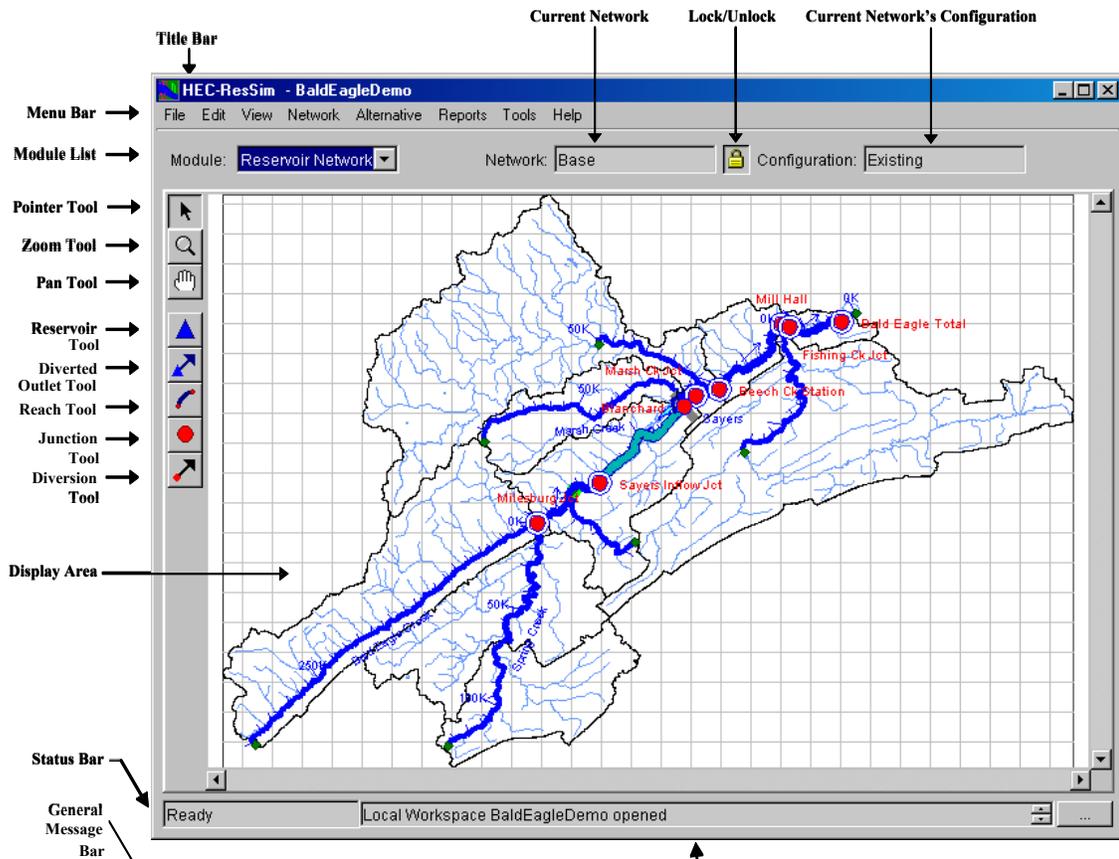


Figure 8.1 Reservoir Network Module Main Window

8.1.1 Menu Bar

The following is an overview of the Reservoir Network Module's Menu Bar tools, which allow you to create and edit the connectivity of your reservoir network. The tools specific to this module will be described in more detail in the context of particular tasks later in this chapter.

The **File** menu (Figure 8.2) allows you to **Open** an existing watershed, **Save** a watershed, **Save** the Display Area (Map), and **Exit** ResSim. Your most-recently-used watersheds are listed at the bottom of the File menu.



Figure 8.2 File Menu

The **Edit** menu (Figure 8.3) provides access to the ResSim editors for **Reservoirs**, **Reaches**, **Junctions**, **Diversions**, and **Reservoir Systems**. You must select the **Allow Network Editing** command to access the editors.

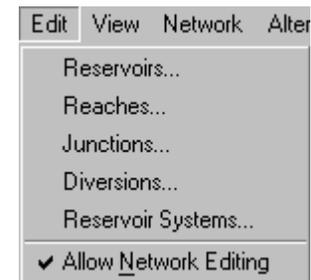


Figure 8.3 Edit Menu

In the **View** menu (Figure 8.4) select **Zoom to All** to restore your watershed map view to full size. **Layers** opens the Layer Selector dialog box. **Unit System** allows you to customize the display (view) settings for your watershed. If a dialog or editor window is open but inactive, **Restore Windows** brings the dialog or editor window to the front as the active window.



Figure 8.4 View Menu

The **Network** menu (Figure 8.5) is unique to the Reservoir Network Module. It allows you to create a **New** network, **Open** an existing network, **Save** a network or **Save As** a new network, or **Rename** a network. You can also **Update Network from Configuration** and **Delete Networks**.

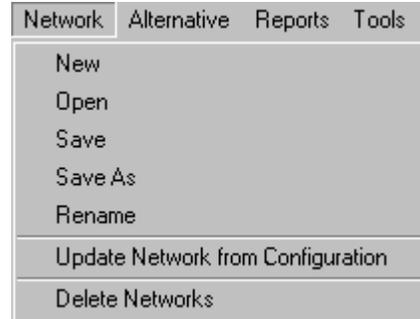


Figure 8.5 Network Menu

The **Alternative** menu (Figure 8.6), also available in the Simulation Module, provides access to the **Alternative Editor**.



Figure 8.6 Alternative Menu

The **Reports** menu (Figure 8.7) provides access to the **Reservoir List**, **Reach List**, **Junction List**, and **Diversion List**. Also, two **Advanced** reports are available: the **Network Summary** and the **Node List** reports.

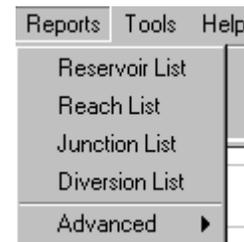


Figure 8.7 Reports Menu

As in the other modules, the **Tools** menu (Figure 8.8) provides access to **Hec-DssVue** and to **Scripts**. **Options** allows you specify Model Directories, Cache Directory, Compute Display, Debug Levels, General information (including whether to show a confirmation when exiting the program and whether to reload last watershed at startup of program), and Fonts. **Information** provides details about client, user, and watershed settings as well as server and system properties.

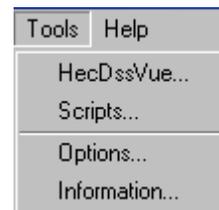


Figure 8.8 Tools Menu

The **Help** menu (Figure 8.9) displays information about the current version of ResSim. **About** indicates the version, revision and build numbers.

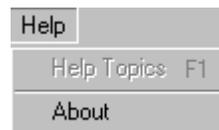


Figure 8.9 Help Menu

8.1.2 Network, Configuration, and Lock/Unlock

In the Reservoir Network Module, your current **Reservoir Network** and **Configuration**, along with the **Lock/Unlock** icon , are displayed below the Menu Bar and to the right of the Module List, as shown in Figure 8.10.



Figure 8.10 Network, Configuration, and Lock/Unlock

The **Configuration** indicates which configuration the current **Network** is based on. As will be described in Section 8.2, you select the Configuration when you setup the Network (using the **Network** menu).

The **Lock/Unlock** icon indicates whether or not the Network is locked and available for editing. You can lock and unlock the Network by clicking on the icon or by selecting or deselecting **Allow Editing** in the **Edit** menu.

8.1.3 Map (Mouse) Tools

The **Map (Mouse) Tools**, which appear in the toolbar on the left side of the ResSim screen, allow you to interact with objects in the map display. The Reservoir Network Module has three standard Map Tools and five network connectivity tools that allow you to establish the connectivity of your reservoir network.

Pointer Tool

Right-click with the Pointer Tool to select and access a shortcut menu for any schematic element within your map display. The Pointer Tool is available in all ResSim modules.

Zoom Tool

The Zoom Tool allows you to zoom in and out of the display area in all modules. To zoom in, hold the left mouse button down and outline the area you want to enlarge. To zoom out, click the right mouse button. Zooming out using the right click button zooms out by a factor of two, positioning the clicked location at the center of the screen. The Zoom Tool is available in all ResSim modules.

Pan Tool

After you have zoomed in with the Zoom Tool, you can use the Pan Tool to view watershed areas that fall outside of the ResSim window borders. The Pan Tool is available in all ResSim modules.

**Reservoir Tool**

With the Reservoir Tool, you can add reservoirs to your reservoir network. You can also edit reservoir properties, rename, and delete reservoirs using commands in the shortcut menu.

**Diverted Outlet Tool**

The Diverted Outlet Tool allows you to create a diverted outlet from a reservoir in your network. The shortcut menu for this tool provides access to the Reservoir Editor and also allows you to rename and delete a diverted outlet.

**Reach Tool**

Use the Reach Tool to draw routing reaches (from *upstream* to *downstream*) to connect the junctions on the stream alignment. You can also edit reach properties, rename, break, and delete reaches using commands in the shortcut menu.

**Junction Tool**

The Junction Tool allows you to manually insert junctions in your reservoir network. The shortcut menu for this tool allows you to edit junction properties, rename and delete junctions.

**Diversion Tool**

With the Diversion Tool you can add diversions to your reservoir network. You can also edit diversion properties, rename, delete, and disconnect outflow of diversion reaches using commands in the shortcut menu.

8.1.4 Display Area

In the Reservoir Network Module, the display area contains the reservoir network connectivity you construct, along with the map layers, stream alignment, reservoirs and computation points you have established in the Watershed Setup Module for the current network's configuration. Any other time-series icons, projects, and impact areas you established in the Watershed Setup Module will not appear.

Using the Map (Mouse) Tools to access shortcut menus, you can open data editors as well as rename and delete elements in your reservoir network directly from the display area.

8.2 Defining a Reservoir Network

With a stream alignment in place and one or more configurations defined, you can create a network of reservoirs and routing reaches. This process involves defining a new network and then adding routing reaches.

8.2.1 Creating a New Reservoir Network

When you create a new reservoir network, you are defining which elements will be included in your network by selecting the appropriate watershed configuration. Once you have created your network, you can add additional elements. Remember, however, that any additional elements you add will not be available for use in other networks. If you want the additional elements to be available for other networks, you will need to go back to the Watershed Setup Module and add the new elements to the appropriate configuration, then return to the Reservoir Network Module to create your reservoir network using the updated configuration (see Section 8.6, “Updating a Reservoir Network”).

To create a new reservoir network:

1. From the **Network** menu, select **New**. The **Create New Reservoir Network** dialog box will appear (Figure 8.11).

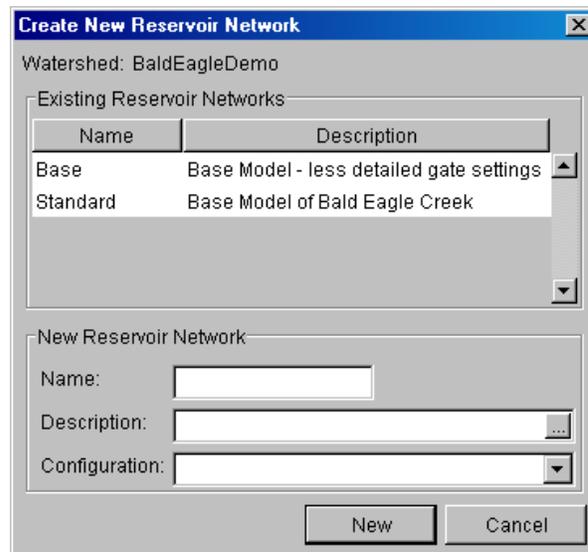


Figure 8.11 Create New Reservoir Network Dialog Box

2. Specify a **Name** for the network and enter a **Description**. You can click the **...** button to access a larger text field for your description.
3. From the **Configuration** list, choose the configuration on which this network will be based.
4. Click **New**.

The **Create New Reservoir Network** dialog box will close, and you will see the name of your new network and its configuration displayed below the Menu Bar, to the right of the Module List (see Section 8.1.2 above).

In the display area, ResSim will automatically create the reservoirs and computation points that were part of the selected configuration as elements in the new Reservoir Network. Reservoirs transfer directly, whereas computation points appear as Junctions.

8.2.2 Opening an Existing Reservoir Network

To open an existing Reservoir Network for editing:

1. From the **Network** menu, select **Open**. The **Open Reservoir Network** dialog box will appear (Figure 8.12).

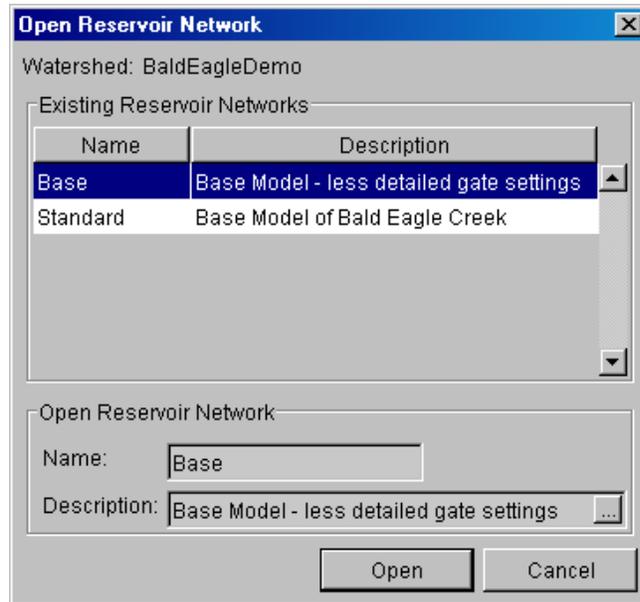


Figure 8.12 Open Reservoir Network Dialog Box

2. Select the **Reservoir Network** you want by clicking on it.
3. Click **Open**.

The Open Reservoir Network dialog box will close, and you will see the name of your network and its configuration displayed below the Menu Bar, to the right of the Module List (see Section 8.1.2 above).

8.3 Making the Network Editable

Before you can begin editing your reservoir network, you must ensure that the network is editable (“locked”). To do so, select **Allow Network**

Editing from the **Edit** menu or click the **Lock/Unlock** button .

8.4 Adding Routing Reaches

Routing reaches are elements that establish the connectivity of the reservoir network schematic. By adding a routing reach between two junctions, you can connect the reservoir network so that water will transverse through the routing reach from *upstream* to *downstream*.

8.4.1 Drawing Routing Reaches

Routing Reaches are drawn from *upstream* to *downstream*. You connect two adjacent junctions (typically, computation points added to the network's Configuration in the Watershed Setup Module) by drawing a routing reach.

To draw routing reaches:

1. Select the **Reach Tool** .
2. Point to the *upstream* junction at the upstream end of the reach.
3. Hold down the **CTRL** key and click on the junction to start the *upstream* end of the reach.
4. Release the **CTRL** key and move the mouse pointer along the stream alignment and click on the *downstream* junction.

Routing reaches automatically conform to the stream alignment. You can connect routing reaches to existing junctions; otherwise, if you begin and/or end a reach elsewhere on the stream alignment, ResSim will create new junctions at both/either end of the reach.

ResSim will automatically constrain a new reach between existing junctions (e.g., will not allow a reach to be drawn past an existing junction). If the reach appears to draw past a junction, then the junction is not on the stream you think it's on. This can occur if the computation point (that the junction is based on) is not initially placed on the appropriate stream. To solve this situation, go back to the Watershed Setup Module and revise the location of the computation point (you may need to delete and recreate the computation point to be on the appropriate stream). After saving your watershed configuration, change to the Reservoir Network Module and select **Update Network from Configuration** from the **Network** menu. See Section 8.6, "Updating a Reservoir Network", for additional information for updating networks.

Additionally, you may not connect tributaries to the middle of a reach; tributaries must connect to a junction.

8.4.2 Renaming Routing Reaches

ResSim automatically names routing reaches according to the names of the upstream and downstream junctions. To rename a reach component:

1. Select the **Reach Tool** .

2. Right-click on the routing reach to be renamed.

3. Select **Rename** from the shortcut menu. The **Rename Reach** dialog box will appear (Figure 8.13), allowing you to type in a new name.



Figure 8.13 Rename Reach Dialog Box

4. Type in the new name and optional description.

5. Click **OK** to close the Rename Reach dialog box.

The new name will now appear as a label in the map display.

8.4.3 Deleting Routing Reaches

To delete routing reaches:

1. Select the **Reach Tool** .

2. Right-click on the routing reach to be deleted.

3. Select **Delete** from the shortcut menu. A **Confirm Delete** dialog box will appear (Figure 8.14).

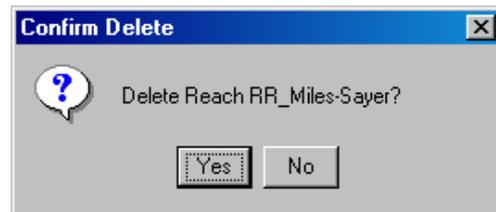


Figure 8.14 Confirm Delete Reach Dialog Box

4. Click **Yes** if you are sure about the deletion.

The routing reach will no longer appear in the map display.

8.5 Viewing Network Reports

In the Reservoir Network Module, the **Reports** menu allows you to access summary reports pertinent to the elements in your network. These reports summarize your reservoirs, routing reaches, junctions, and diversions. In addition, advanced reports of your network connectivity are also available.

8.5.1 Viewing the Reservoir List

The **Reservoir List** (Figure 8.15) displays the names and descriptions of all reservoirs in your network. For information about printing and exporting options available from the report's **Report** menu, see Appendix F.

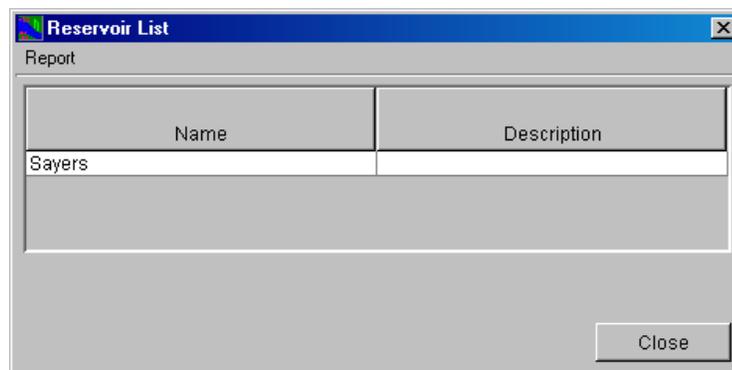


Figure 8.15 Reservoir Network Reports: Reservoir List

8.5.2 Viewing the Reach List

The **Reach List** (Figure 8.16) displays the names and descriptions of all reaches in your network. For information about printing and exporting options available from the report's **Report** menu, see Appendix F.

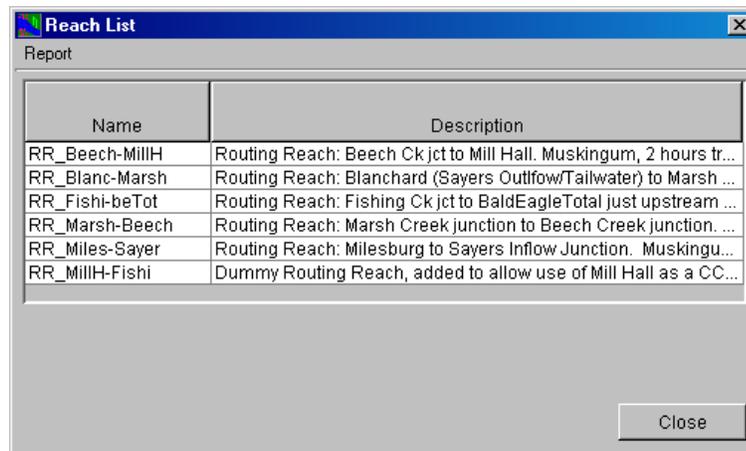
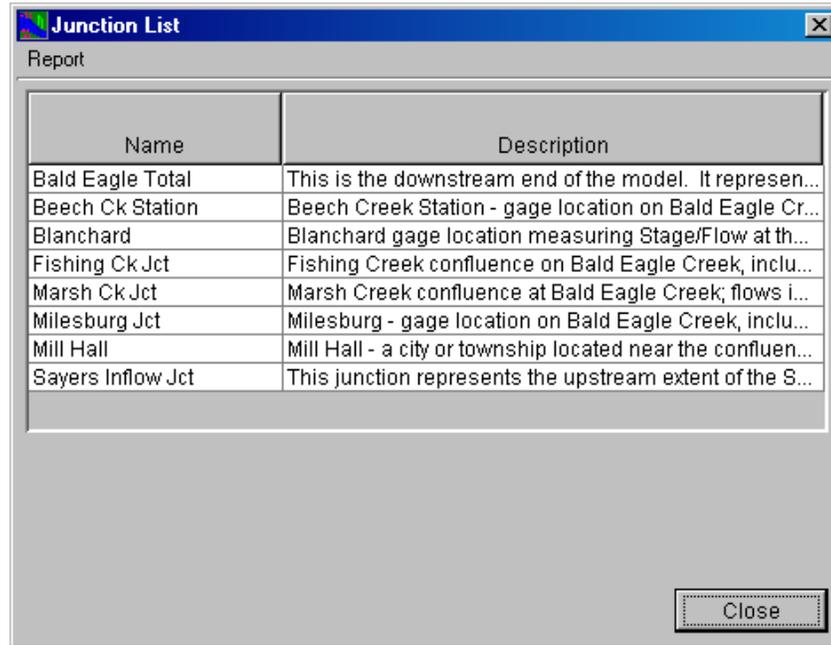


Figure 8.16 Reservoir Network Reports: Reach List

8.5.3 Viewing the Junction List

The **Junction List** (Figure 8.17) displays the names and descriptions of all junctions in your network. For information about printing and exporting options available from the report's **Report** menu, see Appendix F.

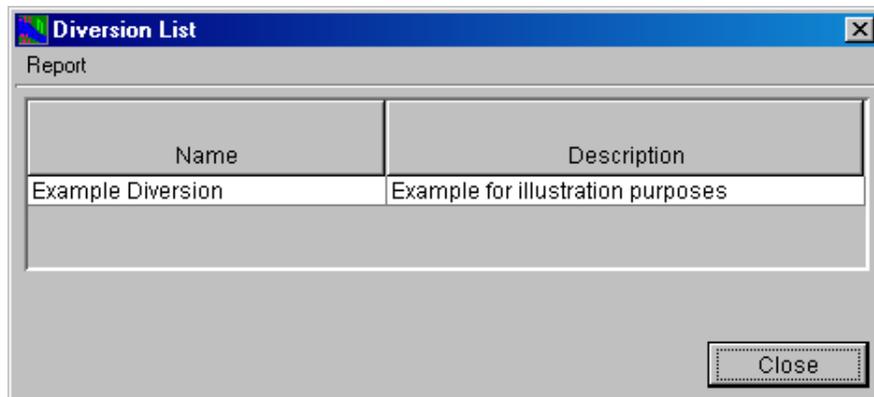


Name	Description
Bald Eagle Total	This is the downstream end of the model. It represen...
Beech Ck Station	Beech Creek Station - gage location on Bald Eagle Cr...
Blanchard	Blanchard gage location measuring Stage/Flow at th...
Fishing Ck Jct	Fishing Creek confluence on Bald Eagle Creek, inclu...
Marsh Ck Jct	Marsh Creek confluence at Bald Eagle Creek; flows i...
Milesburg Jct	Milesburg - gage location on Bald Eagle Creek, inclu...
Mill Hall	Mill Hall - a city or township located near the confluen...
Sayers Inflow Jct	This junction represents the upstream extent of the S...

Figure 8.17 Reservoir Network Reports: Junction List

8.5.4 Viewing the Diversion List

The **Diversion List** (Figure 8.18) displays the names and descriptions of all diversions in your network. For information about printing and exporting options available from the report's **Report** menu, see Appendix F.



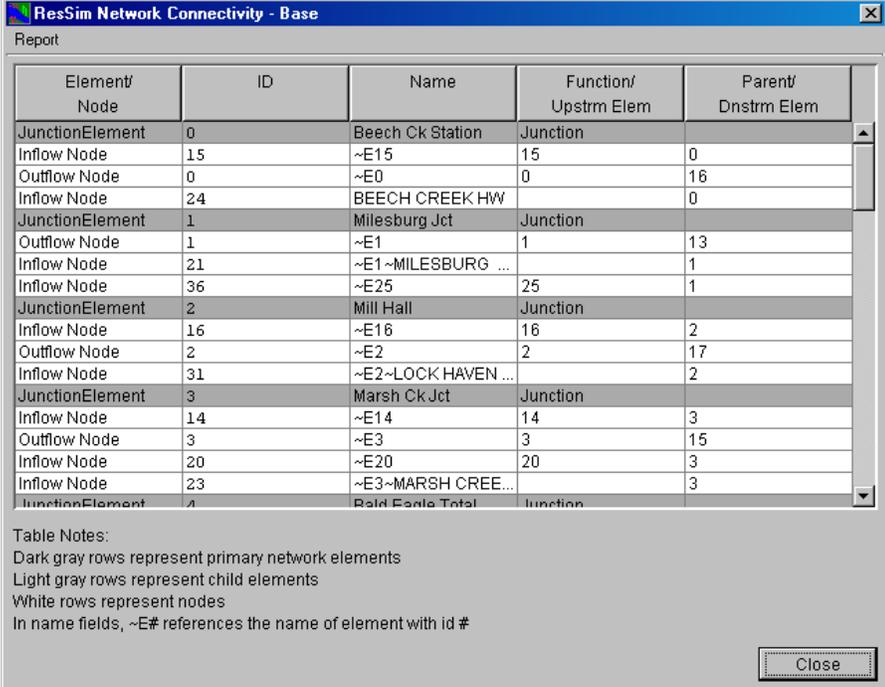
Name	Description
Example Diversion	Example for illustration purposes

Figure 8.18 Reservoir Network Reports: Diversion List

8.5.5 Viewing Advanced Reports

Two advanced reports are available from the **Reports** menu. The first report is the **Network Summary** (Figure 8.19). This report provides a connectivity summary of all of the elements/nodes in your reservoir network. Details include the Element ID, Name, Function/Upstream Element, and Parent/Downstream Element.

For information about printing and exporting options available from the report's **Report** menu, see Appendix F.



The screenshot shows a window titled "ResSim Network Connectivity - Base" with a "Report" tab. Below the title bar is a table with the following columns: Element/Node, ID, Name, Function/Upstrm Elem, and Parent/Dnstrm Elem. The table contains 20 rows of data, alternating between dark gray (primary elements) and light gray (child elements) rows. Below the table is a "Table Notes" section with instructions on how to interpret the data.

Element/Node	ID	Name	Function/Upstrm Elem	Parent/Dnstrm Elem
JunctionElement	0	Beech Ck Station	Junction	
Inflow Node	15	~E15	15	0
Outflow Node	0	~E0	0	16
Inflow Node	24	BEECH CREEK HW		0
JunctionElement	1	Milesburg Jct	Junction	
Outflow Node	1	~E1	1	13
Inflow Node	21	~E1~MILESBURG ...		1
Inflow Node	36	~E25	25	1
JunctionElement	2	Mill Hall	Junction	
Inflow Node	16	~E16	16	2
Outflow Node	2	~E2	2	17
Inflow Node	31	~E2~LOCK HAVEN ...		2
JunctionElement	3	Marsh Ck Jct	Junction	
Inflow Node	14	~E14	14	3
Outflow Node	3	~E3	3	15
Inflow Node	20	~E20	20	3
Inflow Node	23	~E3~MARSH CREE...		3
JunctionElement	4	Bald Eagle Total	Junction	

Table Notes:
 Dark gray rows represent primary network elements
 Light gray rows represent child elements
 White rows represent nodes
 In name fields, ~E# references the name of element with id #

Figure 8.19 Reservoir Network Reports: Advanced -- Network Summary

The second advanced report is the **Node List** (Figure 8.20). This report provides a summary of all nodes in your reservoir network. Details include the Node ID, Name, Key String, Upstream Element and Downstream Element.



ResSim Node Report - Base

Report

Node ID	Name	KeyStr	Upstrm Elem	Dnstrm Elem
0	Beech Ck Station	~E0	Beech Ck Station	RR_Beech-MillH
1	Milesburg Jct	~E1	Milesburg Jct	RR_Miles-Sayer
2	Mill Hall	~E2	Mill Hall	RR_MillH-Fishi
3	Marsh Ck Jct	~E3	Marsh Ck Jct	RR_Marsh-Beech
4	Bald Eagle Total	~E4	Bald Eagle Total	
7	Fishing Ck Jct	~E7	Fishing Ck Jct	RR_Fishi-beTot
8	Sayers Inflow Jct	~E6	Sayers Inflow Jct	Sayers-Pool
9	Sayers-Dam Tailwater	~E11	Sayers-Dam Tailw...	Blanchard
10	Sayers-Dam IN	~E12~IN	Sayers-Pool	Sayers-Dam
11	Sayers-Dam	~E12	Sayers-Dam	Sayers-Dam Tailw...
12	RR_Miles-Sayer	~E13	RR_Miles-Sayer	Sayers Inflow Jct
13	Blanchard	~E5	Blanchard	RR_Blanc-Marsh
14	RR_Blanc-Marsh	~E14	RR_Blanc-Marsh	Marsh Ck Jct
15	RR_Marsh-Beech	~E15	RR_Marsh-Beech	Beech Ck Station
16	RR_Beech-MillH	~E16	RR_Beech-MillH	Mill Hall
17	RR_MillH-Fishi	~E17	RR_MillH-Fishi	Fishing Ck Jct
18	RR_Fishi-beTot	~E18	RR_Fishi-beTot	Bald Eagle Total
19	Sayers-SayersSpillway Tailwater	~E21	Sayers-SayersSpil...	Sayers-SayersSpil...
20	Sayers-SayersSpillway Reach	~E20	Sayers-SayersSpil...	Marsh Ck Jct
21	Milesburg Jct MILESBU... HW	~E1~MILESBU... HW	MILESBU... HW	Milesburg Jct
23	Marsh Ck Jct MARSH CREEK HW	~E3~MARSH CRE... HW	MARSH CREEK HW	Marsh Ck Jct

Table Notes:
In KeyStr fields, ~E# references the name of element with id #

Close

Figure 8.20 Reservoir Network Reports: Advanced -- Node List

For information about printing and exporting options available from the report's **Report** menu, see Appendix F.

8.6 Updating a Reservoir Network

In the Watershed Setup Module, if you make changes (e.g., add, delete, or move elements) to the watershed configuration your network is based on, you need to update your Reservoir Network to include those changes. First, in the **Watershed Setup** module, from the **Watershed** menu, select **Save Configuration** (see Figure 8.21).



Figure 8.21 Watershed Setup Module, Watershed Menu, Save Configuration before Updating Network

Next, in the **Reservoir Network** module, with the network to be updated shown in the display area, select **Update Network from Configuration** from the **Network** menu (see Figure 8.22).

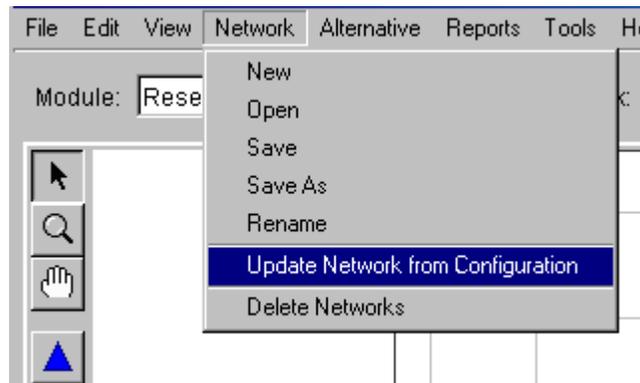


Figure 8.22 Reservoir Network Module, Network Menu, Update Network from Configuration

After the network has been updated, you should see the revisions in the display area.



You will need to update each Reservoir Network that is based on the revised watershed Configuration.

