

MIKE NET SCENARIO MANAGER

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1 MIKE NET SCENARIO MANAGER

1.1 The need for a Scenario Manager

Water and Wastewater models have many uses in practice ranging from operational tools in real-time control applications to design and analysis support tools. Scenario management is most commonly used in practice today when applying MIKE NET as a design and analysis tool.

The development of a Water Supply and Water Distribution Master Plan, supply strategy requires the analysis of a large number of alternative system configurations and operational controls.

Balancing the lifecycle and capital cost of the proposed infrastructure upgrades or augmentations against standards of service that the authorities provide develops the plan or strategy. This process produces a large number of scenarios that must be examined in order to find the optimal solution. To test the standard of service for each of these scenarios a numerical model is developed to analyse each of the alternatives

The difficulty arising from this design process is that a large number of alternative models are developed where the data stored in each of the models is essentially the same except for a small number of changes relating to a particular part of the system. This results in a large amount of duplicate files and combinations of files that must be used for each alternative.

The management of this large number of files is cumbersome and prone to error. The updating of the models with additional information is also extremely cumbersome as it requires editing of multiple files to change the same element, e.g. if a pipe diameter is found to have been incorrectly registered in the GIS data during the course of a project the pipe diameter will have to be updated multiple times in each of the scenario model files.

The design process also requires the analysis of multiple alternatives in combination or in isolation. As such it is necessary to build up to 4 models to analyse 2 alternatives (i.e Base Case, Case1, Case2 and Case1 and 2 in combination).

MIKE NET Scenario Manager provides an easy way of examining these multiple 'What-If' scenarios.

1.2 What is a Scenario Manager

The Scenario Manager provides a user interface to MIKE NET that enables the efficient examination of alternative modelling scenarios such as:

- Augmentation of existing trunk and reticulation water mains
- Alternative demand conditions
- Alternative cost and energy conditions
- Alternative pumping conditions
- Alternative storage tanks conditions
- Alternative operational rule based controls

- Building of new pipes in order to cater for new development

You can create an unlimited number of scenarios that share data in existing alternatives and then submit a multiple number of scenarios for a batch run computation. In the MIKE NET scenario manager there is no limit to what kind of changes that can be made in the alternatives, e.g. topological changes (adding and deleting elements) can be made and reports of these changes are available. All the standard MIKE NET editors are used for editing the alternatives.

1.3 **Scenarios and Alternatives**

The scenario management deals with two levels: The scenario and the alternative level, where the scenarios contain the alternatives. A scenario is a set of alternatives that together make up the model.

1.3.1 **Alternatives**

Alternatives are the basic components of the scenarios. The alternatives contain the actual data. Different sets of alternatives can be combined in scenarios. Alternatives can vary independently within scenarios and can be shared between scenarios, as the different alternatives can be grouped as one pleases within a given scenario. In MIKE NET the input data can be grouped the following way, corresponding to the different types of available alternatives:

- Network data
- Multiple demands
- Extended data
- Water quality data
- Cost and energy data
- Operational data
- Computational parameters

In Table 1 the different alternatives in MIKE NET are displayed next to the data belonging to the alternative (by reference to the name of the respective dialogs).

Alternative	Name of dialogs belonging to the alternative (database table)
Network	Junction Editor (NODES) Reservoir Editor (NODES) Tank Editor (NODES) Pipe Editor (PIPES) Pump Editor (PIPES) Valve Editor (PIPES) Emitter Editor (EMITTERS)

Multiple Demand	Multiple Demand Editor (MDEMANDS)
Extended	Times Editor (TIMES) Patterns Editor (MPATTERNS)
Water Quality	Initial Water Quality Editor (QUALITY) Point Constituent Source Editor (SOURCES) Reaction Rate Editor (REACTIONS)
Cost and Energy	Energy Editor (ENERGY) Water Source Editor (WATER_SRC)
Operational	Control Editor (CONTROLS) Rule-Based Control Editor (RULES) Curves Editor (CURVES)
Computational	Project Options (PROJECT)

Table 1 Alternatives and data belonging to the alternatives

The editing facilities are the same as in standard MIKE NET, e.g. elements can be added or deleted in the different alternatives as one likes to. An easy overview over the changes made to scenarios and alternatives are provided through different reports of the changes. After creating an arbitrary number of scenarios a 'Batch Run' facility can be accessed where user-specified scenarios may be submitted for computation.

1.3.2 Base data contra child data

When the scenario manager is activated for the first time there will be number of built in base alternatives to begin with for each alternative. A base alternative can be empty, e.g. no operational data may be specified to begin with, thus leaving the Operational Data base alternative empty. It is then possible to add child to the Operational Data base alternative, which contains operational data. This way a scenario containing operational data can be tested. The base data is the root of all the alternative trees. The reasons for adding child alternatives can be many. E.g. it can be for testing what the performance of the system would be if the diameters for certain pipes are upsized, or what an increase in population would mean or what the result of applying different real time control strategies could be. When making a scenario active and starting to edit the data, all the alternatives that are a part of the scenario may be altered.

When an alternative has been found that is suited the best for a given system it is possible to merge the changes from the chosen alternative to the base alternative. It is also possible to save a given scenario with the specific combinations of alternatives that is the best for the system on files and perhaps use this as basis for making new scenarios later on.

1.3.3 Inheritance principles

With the inheritance from parent alternatives to child alternatives, some specific must be kept in mind.

Making a change to an alternative will affect all child alternatives of that alternative as well as having impact on all the scenarios where either the alternative or the children of that alternative are applied. This also ensures that if one value needs updating it will be updated in all the scenarios where the alternative is applied (e.g. if a pipe diameter is found to have been incorrectly registered in the GIS data during the course of a project then the pipe diameter can be changed one place only, regardless of the number of scenarios and alternatives that reference this alternative)

- Adding an element (e.g. a node) in the parent with an ID that already exists in one or more of the children will overwrite the content of the child element
- If adding an element (e.g. pump/link) in the parent that cannot be added to all the children (because some parts may have been deleted/changed there), the element is added where possible (will work as after performing a soft delete).

1.3.4 Data not specific to any alternative/scenario

Some data is common for all the scenarios and can be accessed from every scenario regardless of the alternatives that make up that specific scenario. Items not included in any alternative, but common for the entire project are:

- Project prototypes
- Engineering tables
- Pressure zones
- User defined objects
- Pipe roughness calibration data

This data should be understood as belonging to a general project database. As they are not part of the scenario, they cannot as such be varied from one scenario to another.

1.3.5 Reporting of the changes

A number of very informative reports are available for tracking and documenting the changes made in the different scenarios and alternatives. Reports can be produced using colours or in black/white. Reports can only be produced for the active scenarios/alternatives.

By local data below, we mean data that is modified in the current alternative and thus is defined locally for that alternative.

Selected

For an alternative: This will create a report for the local and new data for the selected group of the active alternative.

For a scenario: This will create a report for the local and new data for all alternatives belonging to the active scenario.

Selected Compared

For an alternative: This will create a report for the local and new data including the data from the parent alternative for comparison reasons. The parent data is

indicated by having 'Parent' written in the last field and the local and new data will be indicated by having 'Inherited, Local, or New' written in the last field.

For a scenario: This will create a report for the local and new data including the data from the parent alternative belonging to all the alternatives present in that scenario. This report is created for all alternatives belonging to the active scenario.

All

For an alternative: This will report the content of the alternative, local as well as inherited data.

For a scenario: This will report the entire content of all the alternatives belonging to that scenario, displaying local as well as inherited data.

All Compared

For an alternative: This will create a report for all the local data including the data from the parent alternative. It will also report the deleted records.

For a scenario: This will create a report for all the local data for each alternative belonging to the scenario including the data from the parent alternative.

Hierarchy

For an alternative: This will report the tree of the alternatives.

For a scenario: This will report the list of scenarios including the tree of the alternatives of the active scenario.

1.3.6 Saving scenarios

When having worked with scenarios in a given project you the scenario data is automatically saved by saving the project.

1.4 The scenario manager window

The Scenario Manager has two tabular pages:

- Scenarios - for creating, editing and managing scenarios, see Figure 1
- Alternatives - for creating, editing and managing alternatives, see Figure 2

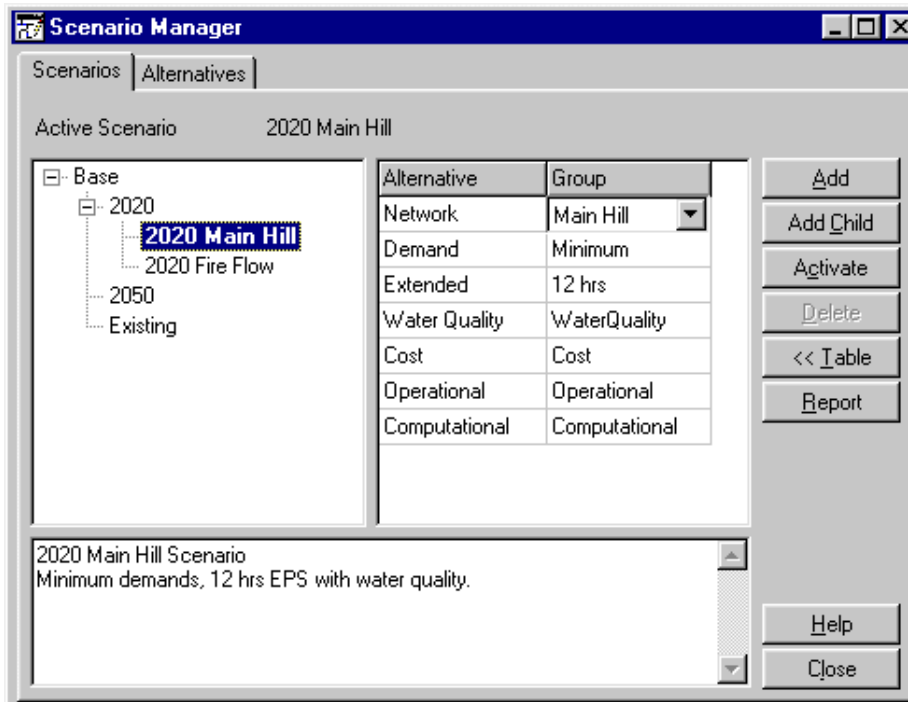


Figure 1: Scenario Manager Dialog, Scenario Tab

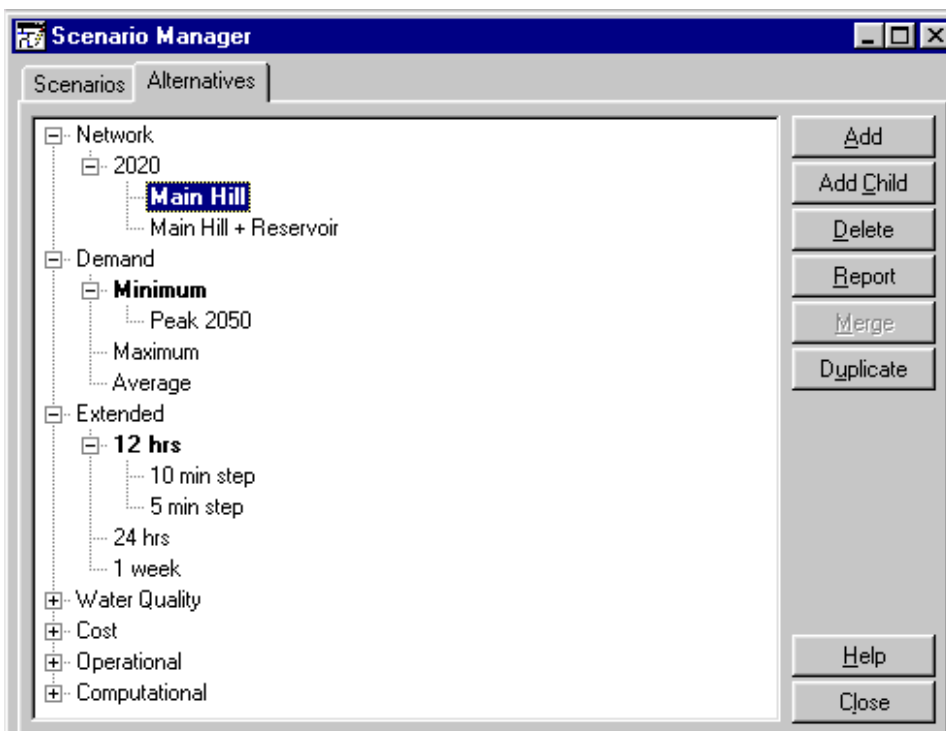


Figure 2: Scenario Manager Dialog, Alternative Tab

1.4.1 Creating, adding and managing scenarios

The scenario page is used for creating, editing, and manage scenarios. Per default there will one built-in scenario, i.e. the Base scenario. The Base scenario cannot be edited or deleted. An unlimited number of additional scenarios can then be added to cover the various 'What if' scenarios.

The scenario page consists of seven speed buttons on the top of the window, along with display of the current (active) scenario. The speed buttons represent some of the functionality found on the ordinary buttons along the right side of the window.

Add

The add button adds a scenario, per default the alternatives of that scenario will be the alternatives of the Base scenario, i.e. the Base alternatives. Using the button down functionality in each field (activated by left-clicking in the field) will allow changing the alternative content. A name the new scenario will be pr. default be suggested. Left clicking on the name once and then editing the name can change the name.

Add Child

The add child button adds a scenario that is a child of the highlighted (not to be confused with the active/current scenario), i.e. the alternatives of new scenario will to begin with be that of the highlighted scenario. Using the button down functionality in each field (activated by left-clicking in the field) will allow changing the alternative content. A name the new scenario will be pr. default be suggested. Left clicking on the name once and then editing the name can change the name.

Activate

The activate button will load the scenario, i.e. the project data is manipulated so that all editors contain the appropriate data. Depending on the size of the project this may take some time.

Delete

The delete button will delete the highlighted scenario. The Base scenario cannot be deleted. Note that deleting a scenario will not delete any data as the alternatives hold the data (the scenarios just refer to alternatives). The comments for the scenario being deleted, however, will also be deleted.

Tree/Table

The Tree/Table button (depending on which view is currently chosen the button will display the either Tree or Table) will switch between the two views of the scenarios.

Report

The Report button will open up a local menu from which the report type can be chosen.

Help

Activates the online help for the scenario page

Close

Closes the scenario manager

The middle of the scenario window can display either a table with all the scenarios (along with the alternatives that are used in the specific scenarios), or a tree view of the scenarios (where only the alternatives of highlighted scenario will be displayed).

The table view also contains a column with the possibility to choose the scenarios to commit for a batch run. Pressing the respective buttons easily makes the switch between the table or tree view.

1.4.2 **Run and batch run of scenarios**

It is very useful to set-up and run multiple scenarios in a batch run that does not require user interaction.

Submitting scenarios for a batch run can easily be done by first selecting the relevant the scenarios on the scenario manager. This is done by checking off the relevant scenarios in the 'Run' column in the table view, see Figure 3. The actual batch run is then activated by choosing File | Run Batch Analysis. The selected scenarios for the batch run will remain unchanged until you un-select them on the scenario page (by simply removing the check).

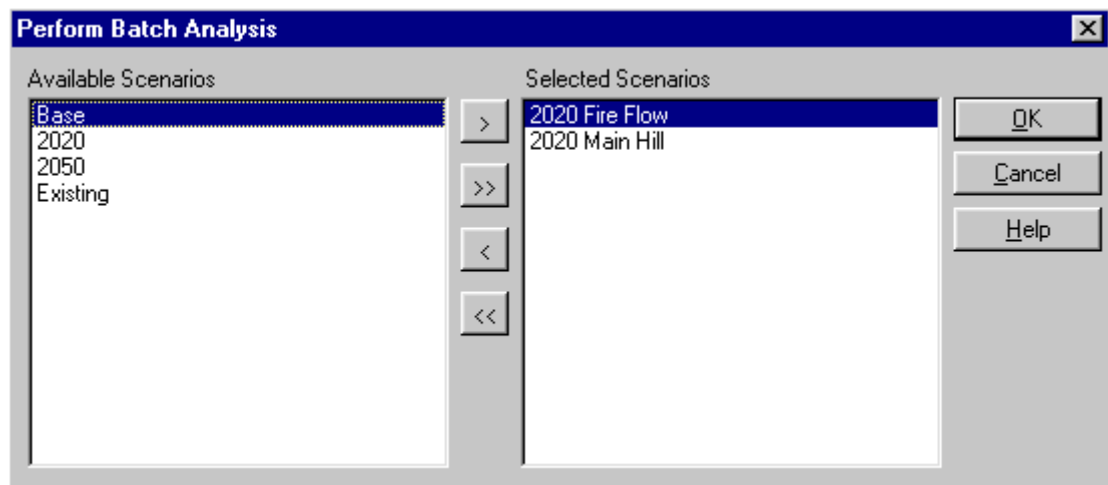


Figure 3: Selecting scenarios for a batch run

The result of the different scenarios will be saved in result files corresponding to the scenario name. E.g. making a batch runoff computation of Scen01 and Scen02 will result in two result files named Scen01.res and Scen02.res.

1.4.3 **Creating, adding and managing alternatives**

Alternatives can be edited only if the appropriate scenario is made active. When the scenario is loaded, the project data is manipulated so that all editors contain the appropriate data. The title bar of each dialog will display the name of the alternative that is currently being displayed and edited.

You can make any changes that you like to an alternative, i.e. you can add, modify or delete data.

The alternative page consists of a number of buttons along the right side of the window. The window in the middle displays all the alternatives. The alternatives that are referenced from the active scenario are displayed in bold. The base alternatives are simply named the same as the alternatives. By right clicking on active alternative a local menu opens that provides a short cut to all the editors related to that alternative.

Add

The add button adds a scenario, per default the alternatives of that scenario will be the alternatives of the Base scenario, i.e. the Base alternatives. Using the button down functionality in each field (activated by left-clicking in the field) will allow changing the alternative content. A name the new alternative will be pr. default be suggested. Left clicking on the name once and then editing the name can change the name.

Add Child

The add child button adds a scenario that is a child of the highlighted (not to be confused with the active/current scenario), i.e. the alternatives of new scenario will to begin with be that of the highlighted scenario. Using the button down functionality in each field (activated by left-clicking in the field) will allow changing the alternative content. A name the new scenario will be pr. default be suggested. Left clicking on the name once and then editing the name can change the name.

Delete

The delete button will delete the highlighted alternative. The Base alternative cannot be deleted. Remember: Deleting an alternative will delete input data.

Report

The report button will open up a local menu from which the report type can be chosen.

Merge

The merge button will merge the child alternative into the parent alternative. The merge button will merge the child alternative into the parent alternative. Merge moves all records from the selected child alternative into its parent alternative, and then removes the selected alternative. The records in the selected alternative will replace the corresponding records in the parent. This is helpful when you have been experimenting with changes in a child alternative, and you want to permanently apply those changes to the parent alternative. All other alternatives that inherit data from that parent alternative will reflect these changes.

Duplicate

The duplicate button will make a duplicate of the highlighted alternative. This means that all the changes made to the highlighted alternative

Help

Activates the online help for the alternative page

Close

Closes the scenario manager

If you e.g. would like to investigate how an upsizing of certain pipes and adding some real time control to the system can affect the performance of the system, then you simply start out by making two child alternatives. One for the physical data (as the pipes are a part of this alternative) and one for the operational data (as the real time control is a part of that alternative). Then you make a scenario that contains e.g. the new physical alternative and the new operational data alternative and activate this scenario. Then you simply start editing the data (e.g. upsizing the pipes and adding real time control). Once the data is edited in the alternatives as you like them to be you can perform a simulation. You can also choose to make a new scenario that contains e.g. the physical alternative (but not the operational data

alternative), to see what change in performance the upgrading of the pipes alone will have. And so on - the combinations are endless.

EDITING DATA

The data, belonging to the active alternative is edited in the standard editors. Most of the editors, such as Pipe Editor, are adjusted to display flags, which help to distinguish between base data, inherited data, changed data, and new data.

This flag SMFLAG is a part of the record definition in the corresponding database tables, and it is easy to use it for data querying. The SMFLAG has the following values:

- 0: Base data
- 1: Inherited data
- 2: Local data
- 3: New data
- 4: Deleted data

Examples:

Select * from pipes where linktype=1 and smflag = 1

To select pipes inherited from the parent alternative

Select * from pipes where linktype=1 and smflag = 2

To select changed pipes

Select * from pipes where linktype=1 and smflag = 3

To select new pipes

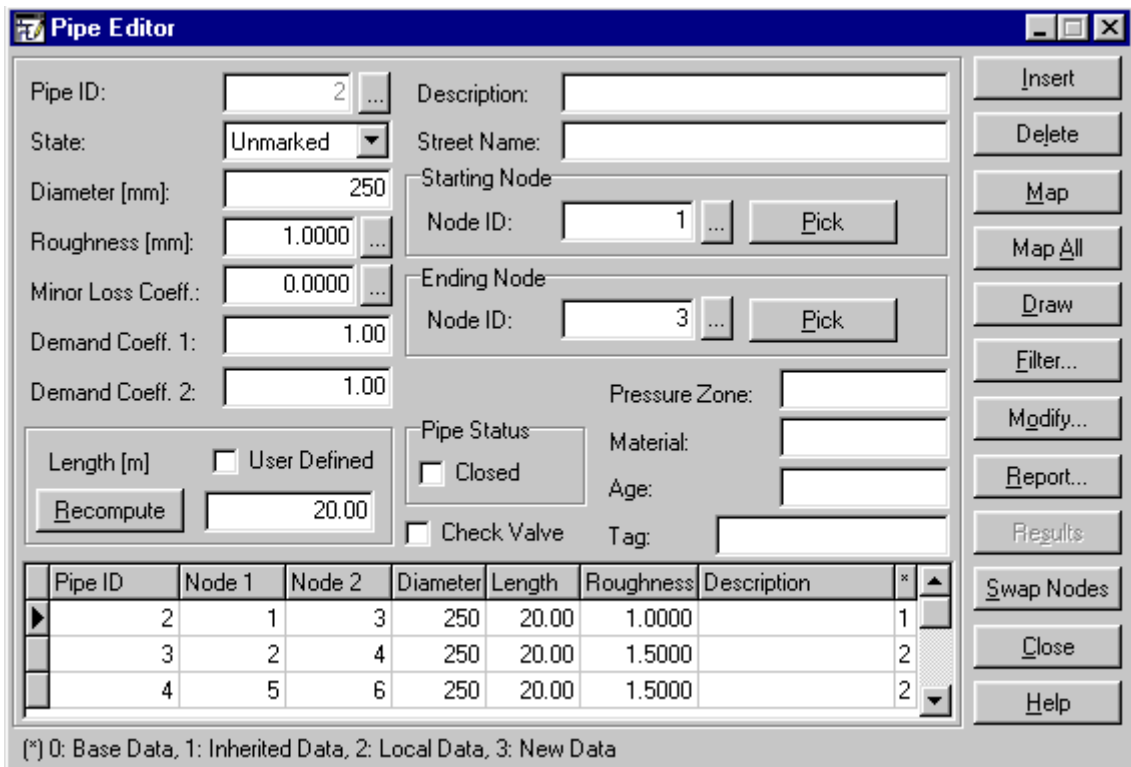


Figure 4: Editing alternatives data

NETWORK ALTERNATIVES

The network alternatives allow you to add new pipes (nodes) into your project, change the current network layout, or delete parts of the network.

To edit network alternatives, use the scenario and alternative manager to define the network alternatives, make its scenario active and then use any of the existing tools to change the network geometry (insert new pipes and nodes, modify selected pipes, delete nodes and pipes, etc).

Each time you make the appropriate network alternative active by selecting its scenario, the horizontal plan window will be regenerated from the database.

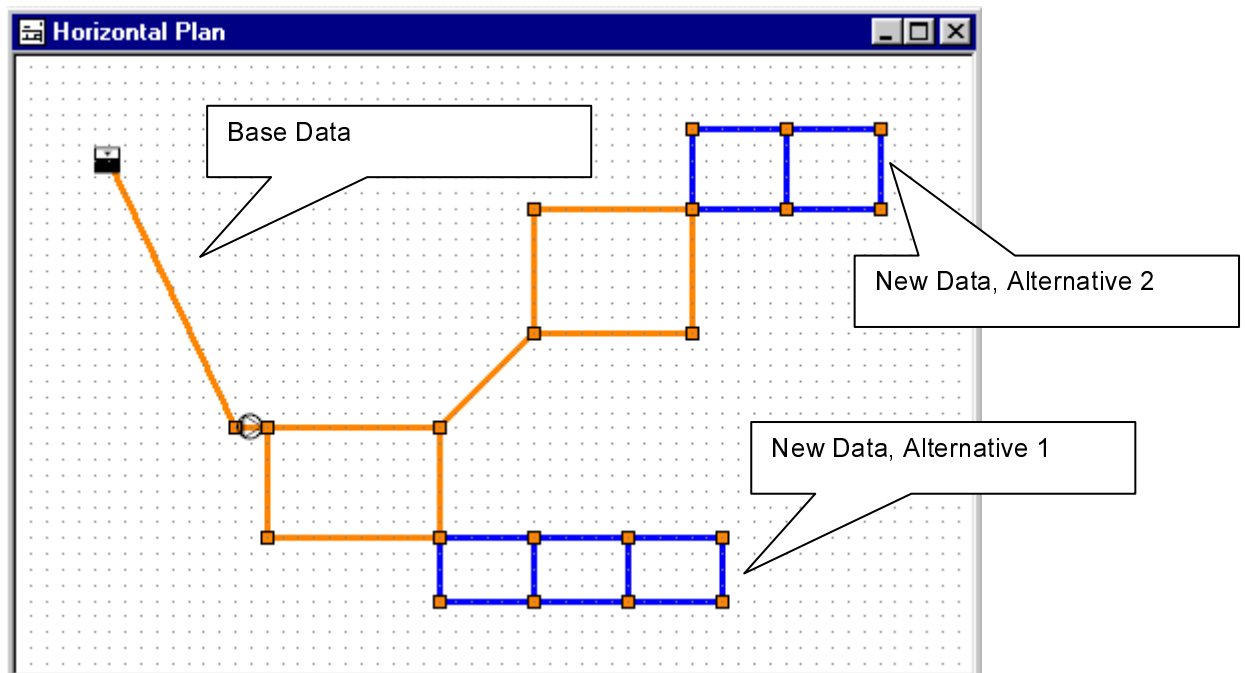


Figure 5: Topological alternatives (Base alternative, Alternative 1, Alternative 2)

DEMAND SCENARIOS

Demand alternatives/scenarios can be handled in two different ways. Junction demand is a part of the junction table and it is therefore edited along with the Network Alternative.

Multiple node demands are stored in the separate database table MDEMANDS and multiple demands are therefore edited separately in the Multiple Demand Alternative.

If you wish to handle node demands separately from the network alternatives, do not use base junction demand and base junction pattern but use only multiple node demands.

1.4.4 Database structure of the scenario and alternative manager

Scenarios and alternatives are stored in the project database; there are several new database tables, which are automatically created:

Database Table	
ZS_SCENARIO	Scenarios
ZS_SCENARIODATA	Scenarios link to alternatives
ZS_ALTERNATIVES	Alternatives
ZS_GROUP	Groups used by alternatives
ZS_GROUPDATA	Groups attributes
ZSA_PIPES	Working copy of a PIPES table
ZSB_PIPES	Working copy of a PIPES table
ZSD_PIPES	Working copy of a PIPES table
ZSP_PIPES	Parent data of a PIPES table
ZSA_NODES	Working copy of a NODES table
ZSB_NODES	Working copy of a NODES table
ZSD_NODES	Working copy of a NODES table
ZSP_NODES	Parent data of a NODES table

And similar for other database tables, such as EMITTERS, MDEMANDS, MPATTERNS, MPATTMULT, ENERGY, TIMES, CONTROLS, RULES, CURVES, CURVESDAT, QUALITY, REACTIONS, SOURCES, WATER_SRC, PROJECT.