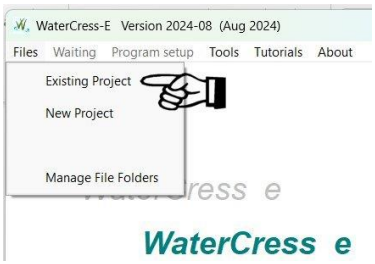
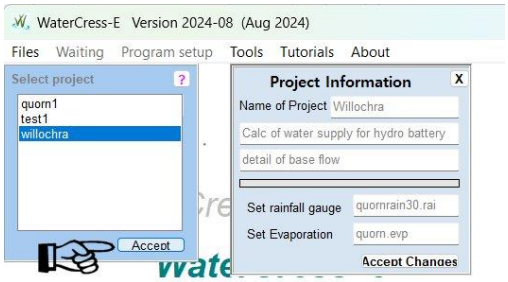
# Setup and the Running WaterCress

A WaterCress project is a grouping of nodes and linkages between these nodes, which combined form a conceptual representation of the water supply and/or energy system you wish to analyse. A project name is stored as a folder name with node and linkage data stored within this folder. These project folders and the executable watercress programs are typically stored under the watercress encompassing folder **c:\watercress**.

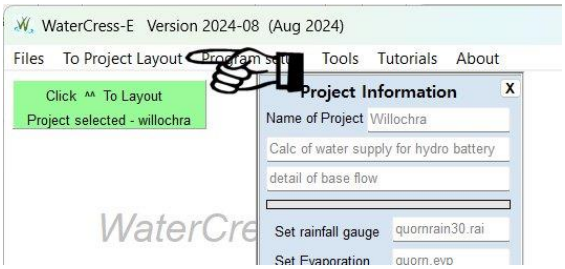
Commence watercress by clicking "files" on the main menu and then from the pop-up box choose either "existing" or "new project"



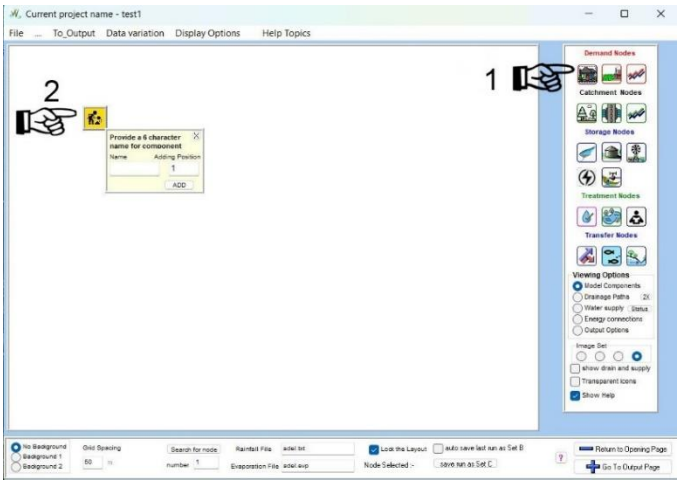

Choosing "existing project" provides a list of projects that you have created, and choosing "new" enables a new project to be created.

On clicking "accept" the project loads, opens the project information screen. Project information is as is implied for information only. You can progress to the layout screen by clicking " To Project Layout". This takes you to the second page where you develop or modify the project layouts.



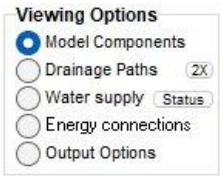

*Note: The first 3 edit input windows in the **project information** window do not have to be changed but update is useful for your own reference. The project information page more importantly allows you to change the default time series file name which will automatically be incorporated into any new nodes you add. Update the **project information** by overwriting the fields and clicking the **accept changes** button.*

Choosing new project will present a blank screen, then to add nodes, firstly 1: left click on the the node type and then 2: click on the position on the screen where the node is to be positioned. This will raise a popup requesting a 6 character name for the node. Providing a name and then selecting "add" positions the node ready for editing data.

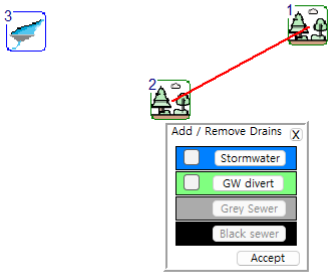


Watercress runs by stepping through time increments input by time-series files which contain sequential data typically daily in nature. Rainfall input is converted by the algorithms in particular nodes to runoff which can then be routed between the nodes and used as it passes through. The water resource generated and then be stored and supplied as demanded by other nodes in the project. Power is generated in a power generation node and then routed to all nodes requesting power.

This movement of resources is handled by 3 linkage processes selected in the right-hand viewing options window. These paths are drainage, water supply and power.



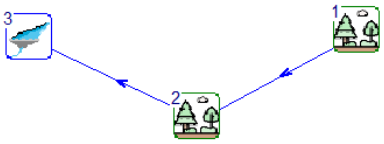

**Drainage paths** are essential to track water draining from each of the nodes. These might be, for example, creeks, rivers, stormwater drains and sewerage systems. Such paths transmit the resource in an uncontrolled manner, meaning that the downstream (receiving) node does not demand nor refuse acceptance of the resource. The downstream node on receiving the water processes it as determined by the node type and may then continue the transfer further downstream.

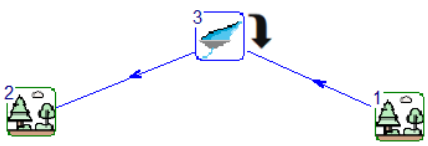



These drainage links are made by selecting "drainage paths" in the viewing options, and then left click and hold on the upstream node and then release the hold over the downstream node. This will raise a further options window requesting additional detail of the link.

*Note: Nodes typically only have one drainage path, but certain node types may be allowed multiple paths. For example, a catchment node may have 2 paths exiting being stormwater and groundwater. Also a town node can have 4, stormwater, drinking water, grey sewage and black sewage.*

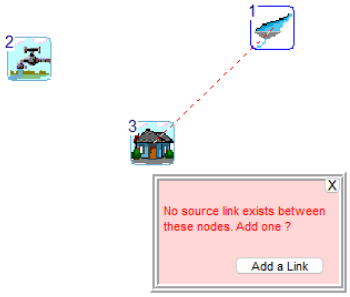
Where there are multiple paths optioned, selecting an option incorporates the drainage path. Here shows a catchment draining through another catchment through to a dam. In this set up water will only spill from the dam when it overflow.



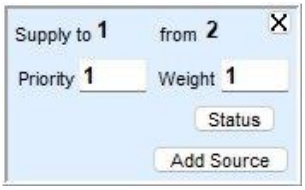




Alternatively you can request the dam to be offstream, which identifies with a black arrow. Here node 1 is still directly draining to node 2 but the dam will take a proportion of this flow as it passes.

**Water Supply** paths are essentially required to direct water from a source node (such as a storage or an aquifer, to a node demanding water. These paths transmit the resource in a controlled manner, meaning that the downstream (receiving) node demands both the quantity and quality. The downstream node can receive water from multiple sources, and it takes the supply in the order determined by the priority and weight of the supply link provided.




These drainage links are made by selecting "water supply" in the viewing options, and then left click and hold on the source node and then release the hold over the demanding node. This will raise a further options window, firstly checking whether a link already exists, and then if you add a link, leads to a request to input the priority and weight of the link.




*Note: The **priority and weight** control the sequence of supply from multiple nodes. For water to be supplied, primarily it must meet the quality demanded. Once this is met the link with the highest priority is attempted first. Priority is a number between 1 and 10 where 1 is the highest priority. The demand node will be attempted to be supplied by the highest priority source and the next priority source is only needed when the demand cannot be met by the first. Where there are two sources of the same priority the supply from each is proportioned as determined by the weights.*

**Energy** paths are generally simpler and are made by selecting "energy connections" in the viewing options, and then left click and hold on the power node and then release the hold over the demanding node.

A node can only be connected to one energy node, and only nodes which utilize energy will be allowed to be connected.

There are essentially 5 types of nodes that can be added, demand, catchment, storage, treatment and transfer.

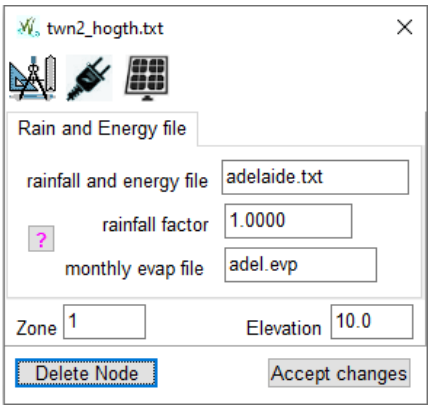
**Demand nodes** include towns and industry which demand both water and energy. Usage is defined in these nodes by setting a wide range of parameters allowing assessment from a town or city scale down to a single house. A simpler input node is also provided where demand is input as a file structure. This is typically used where a known set demand is required. Other nodes such as dams, wetlands and aquifers may also demand energy.

**Catchment nodes** define the generation of water on the catchment with the conversion of rainfall to runoff. These include complex algorithms to provide this conversion process which often require confirmation of on-site stream flow gauging or other assessments. A simpler input node is also provided where a known flow is input often drawn from stream flow gauging.

**Storage nodes** provide the resource supply which is demanded by other nodes. Dams, tanks and aquifers store water generated from catchment nodes making it available for future use. *Note: a catchment node cannot supply a demand by itself. Supply can only be made from a storage node or a treatment node.* Within the storage group there are two nodes, energy and external water source which can both generate and store resources. The external water source simply makes available a user defined limited water supply to demand nodes. The energy node is more complex providing a series of algorithms to both generate and store energy to meet the demands.

**Treatment nodes** enable the user to introduce cost penalties to treat water to the accepted standard required by a particular node. These nodes can also act directly as a water supply source and a wetland also can act as a storage retaining runoff from a catchment.

**Transfer nodes** control the movement of water through the layout. These are diversion, stream path and groundwater attenuation. Diversion nodes allow the splitting of streams defined by set parameters. Stream path nodes are often used to chart the main stream lines through complex layouts and can also be used to attenuate flows through the system. Groundwater attenuation nodes provide algorithms to modify baseflow returning to the river systems.




To modify the parameters in each of these nodes select Model Components from the right-hand menu and then left click on a node currently in the layout. This raises the base window shown adjacent.

This window is common to open with all nodes and identifies the name of the rainfall and energy file to be used for this node. This is a sequential time-series file. The window also displays a series of icons which lead you into the specific requirements of the node.

WaterCress provides a methodology to enable a detailed assessment of resource supply and demand, but it does require significant user input to create the time series files needed and to define the correct node parameters. The program then runs over the available time series period enabling the risk of failure of supply to be determined. Obviously the longer the timeseries you can create the more accurate you may access the risk of failure to meet your needs. This data may include (for your location):

Rainfall.
Evaporation.
Wind data if you have a wind turbine.
Cloud cover data (if you are using PV panels).

*Note: Data for the time series files is readily available in Australia through the Bureau of Meteorology but requires modification in external programs such as excel or notepad++. See a detailed explanation in the separate article provided.*

Each node can have a different time-series data file name, but a common file name can be used if it contains all the data needed for all nodes in question. Information not needed for a particular node's requirement is simply ignored.

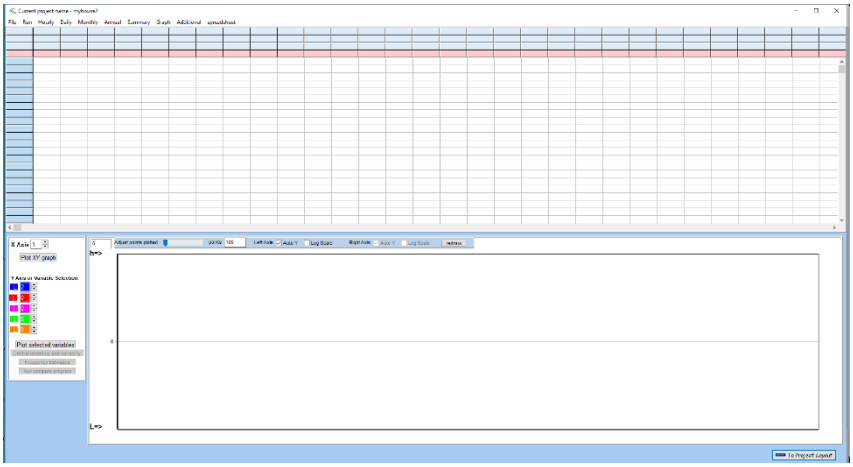
*Note: Any time series files used need to cover the period you wish to examine. If you use multiple timeseries files watercress will automatically restrict the time duration of the run based on the time duration common to all files. Thus, if the file durations are not synchronised well, this can cause the program to not run over the period you expect or not run at all. A common error can occur when you are adding nodes which will automatically incorporate a default time series file. Be aware that this default input may control the duration of a run in an unexpected way. Note the name of the default file is set in the project information input or in the lower menu of the spatial input page.*

Clicking on the icons takes you through the specific set up for each node type. This detail is not presented here but I suggest you read the other articles particularly the self-sustainable house for greater detail

## Running the Model

Once all the parameters are correct the program is run by moving to the output page by selecting **To_Output** from the upper menu.

This shows a spreadsheet and a graphing window.



To run the program simply click Run on the upper menu the RUN on the sub menu. A program completed window will appear. Close this and the spreadsheet will be updated.

*Note: clicking Run on the upper menu opens a sub-window with options, run information, RUN, and set quality codes.* ***Run Information*** *opens a window allowing you to set the output selection you wish to see (discussed earlier) and the start and duration of the run to be made. "Access data from" is the time from when the data is placed on the spreadsheet ie the time between "access data" from and "start run" is essentially a "warm up" period for the model. Unless you are particularly needing a warm-up period keep the start run and access data the same*

The spreadsheet will initially provide monthly data but can be toggled between daily, monthly and annual from the top menu bar.