

Wetlands SRG

Wetland functionality is provided in Source to allow modelling of quasi-two-dimensional situations where flow is governed by hydraulic considerations. Wetlands that may be modelled include both simple wetlands consisting of a single water body, and more complex systems such as Hattah Lakes, which consist of several interconnected wetlands.

Key modelling features provided are:

- Hydrological behaviour of perennial or ephemeral water bodies in a wetland. This includes the interaction between storage volume, groundwater seepage, rainfall, evaporation, inflow and outflow. This is modelled using the Storage node.
- Connections within the wetland, and between the wetland and other parts of a river system. This includes inlets to and outlets from water bodies that can either be controlled (regulated) or uncontrolled (unregulated). In cases where flow is governed by head difference or may be in either direction, connections between water bodies are modelled via the Wetland Link. The Hydraulic Connector is used to model situations where the flow into or out of a wetland link is too small to have a material effect on the water level in the river. The Storage node is used when a water body, such as a lake or weir, is part of a wetland system.
- Conservative constituents. When this modelling option is enabled for a scenario, the movement of conservative constituents such as salt can be tracked through a wetland.
- Demand. Wetlands may have ecological, recreational, cultural or consumptive requirements. All demands, including those for wetlands, are modelled via a combination of a Water User node with the appropriate demand model, and Supply Point node(s) that associate water user demand with a physical source of supply.

Note: Groundwater fluxes are not considered in the wetlands hydraulic solution as these have negligible effects on the outcome.

Scale

On a spatial scale, wetland functionality may apply to a single water body, or a complex system of interconnected wetlands (each made up of one or more water bodies). Every water body and connection may be modelled. Flow of water, its ownership (if relevant) and constituents through a wetland is calculated and reported at every model time-step.

Principal developer

This version of Wetland modelling has been developed by eWater CRC for Source.

Scientific provenance

The approach to wetland modelling used in Source is the Cells Model. The Cells Model was used in the formulation of the first Mekong model (Zanobetti et al 1970). This approach is employed by IQQM, which has been used in Australia for many years.

Version

Source 4.1.1

Dependencies

None. A wetland exists in a Source scenario once a Storage node is created.

Assumptions

The following assumptions and constraints apply:

- A uniform water level (ie. level pool) is assumed across each storage compartment
- The variation of water level and flow is assumed to be slow enough that the hydraulic conveyance can be estimated based on a quasi-steady-state assumption.
- The response of a wetland is slow enough that all groundwater, management and ecological responses can be made based on information of the last time-step.
- Daily or sub-daily time-step is small enough for the quasi-steady-state hydraulic response.

Wetland clusters and the "Cells model"

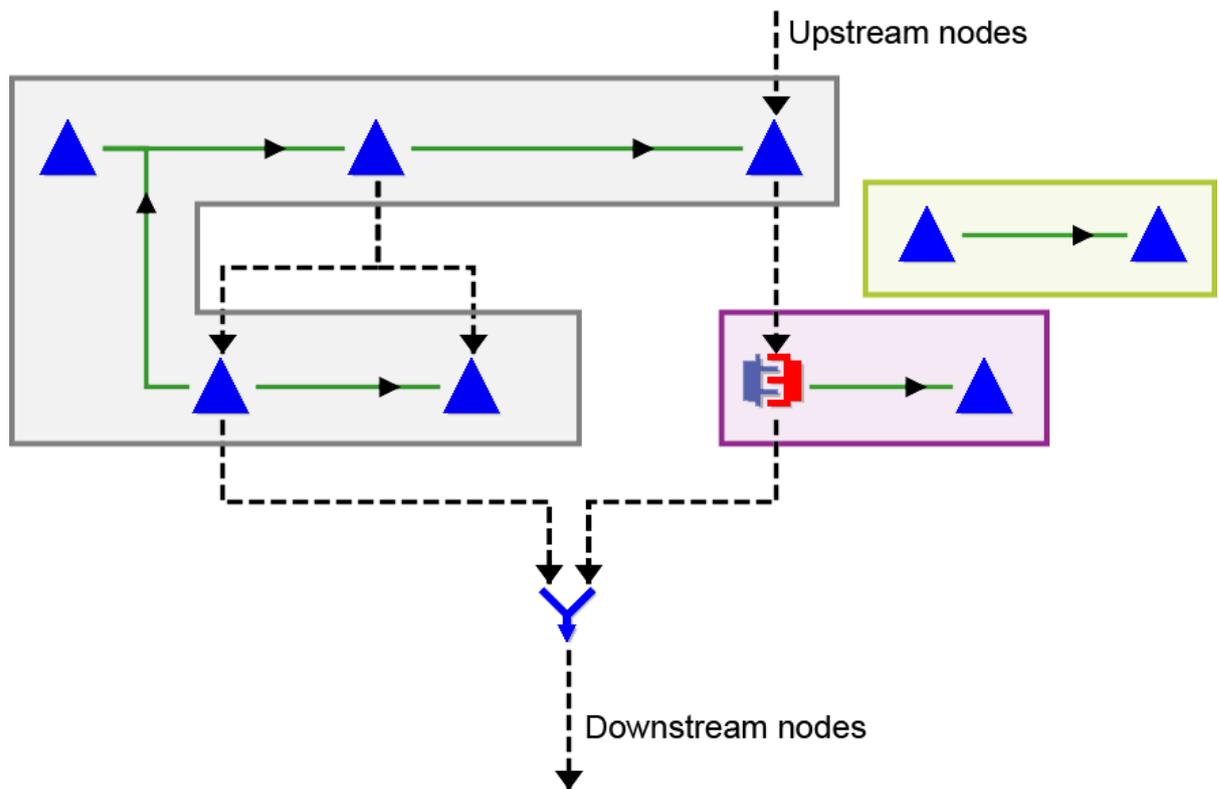
The group of nodes and links that represent a wetland in Source are referred to as a "wetland cluster". These can be Storage nodes, Wetland links and Hydraulic Connector nodes.

Figure 1 illustrates some types of wetland that may be represented in Source by nodes in a wetland cluster:

- A wetland without river flow (green box). Examples include upland swamps, or spring fed wetlands on a floodplain.
- A wetland with a single water body (purple box). Examples include billabongs and oxbow lakes.
- A complex wetland with multiple water bodies (grey box). There are multiple paths of river flow through this type of wetland. Examples include the Macquarie Marshes, Hattah Lakes and Menindee Lakes.

Boundary conditions in the Source model shown in Figure 1 occur whenever the clusters (boxes) intersect with a non-Wetland link (dashed line).

Figure 1. Example wetland clusters



Cells model

In Source each wetland cluster in a scenario is treated as a modelling unit, which is processed using a Cells Model. In this type of model, a wetland consists of a number of storage cells with the movement of water between them described by a set of functions (that are specified by the modeller) and boundary conditions. The main elements of the cells model and the Source components that are used to represent them are shown in Table 1.

Table 1. Cells model vs Source components

Cells Model	Source Component
Boundary condition	Wetlands Hydraulic Connector node, Storage node inlet or outlet
Connector	Wetland link
Cell	Storage node

Water surface elevation (WSE or "Reduced level")

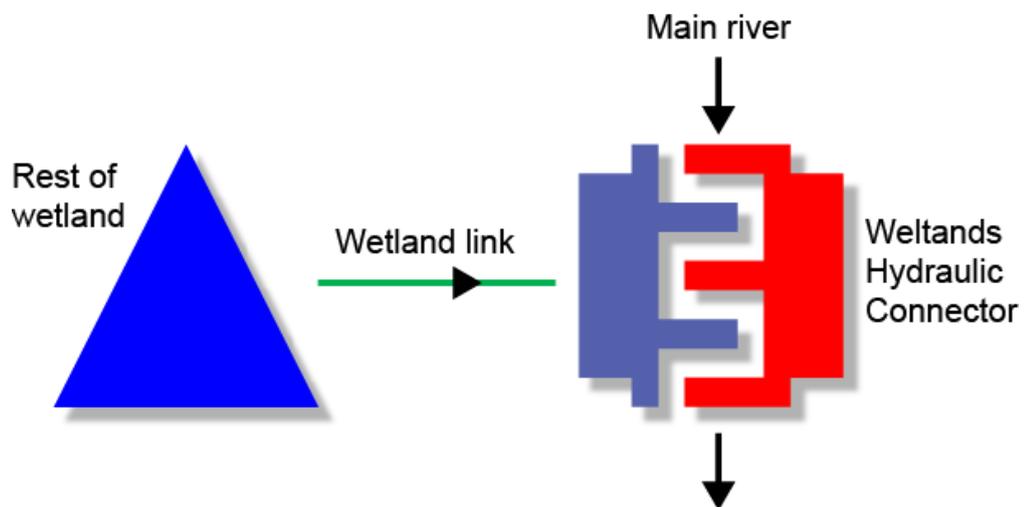
The Cells Model approach assumes that the movement of water within a wetland is related to the head difference between the water bodies that make up the wetland. To enable this in Source, the water surface elevation (WSE) is determined for nodes in a wetland cluster.

Wetlands Hydraulic Connector nodes and boundary conditions

Boundary conditions are points at which water can flow in to or out of a wetland. In Source, these points are at either a Wetlands Hydraulic Connector node or a Storage node's inlet or outlet link (Figure 1). The Wetlands Hydraulic Connector node is used to represent situations where a wetland interacts with a river reach and the inflows and outflows are too small to have an effect on the water surface elevation in the river.

Figure 2 shows a representation of this type of wetland in Source, where the wetland's boundary is modelled at the Wetlands Hydraulic Connector node.

Figure 2. Wetland boundary at an hydraulic connector

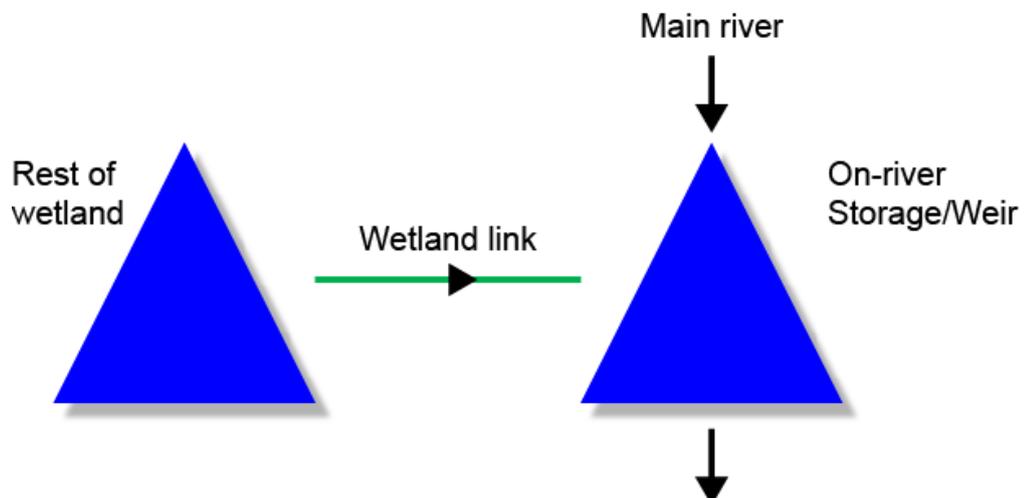


If the outlet of a Storage node in a wetland cluster is connected to a conventional link then that storage is a boundary of the wetland cluster. Examples in the Murray include:

- Lock 3, which could be modelled as a Storage node at a boundary of a wetland system that includes Lake Bonney, and;
- Euston Weir, modelled as a Storage node at a boundary of the Euston Lakes wetland system.

Figure 3 shows a representation of this type of wetland in Source, where the wetland boundary is modelled at the Storage node's outlet.

Figure 3. Wetland boundary at an on-river storage/weir



The rules governing outflow from a boundary depend on the type of node:

Wetlands Hydraulic Connector nodes:

- Mass balance: Downstream flow is the difference between upstream inflow and total flow in connected wetland links.
- Flow in each connected wetland link is a function of water surface elevation (WSE) at the hydraulic connector node and the node at the other end of the link. See the Wetland Links (Connectors) section for more information.
- The modeller specifies a relationship between upstream inflow and WSE at the hydraulic connector node.

Storage nodes:

- If the storage node is a weir, and this is within its target operating range, releases are set so that the storage remains at the same volume where possible.
- When there is a spillway, there is a minimum volume "spilled". This amount varies with water surface elevation.
- The release from a storage is determined by the volume ordered, and is limited by outlet capacity (which varies with water surface elevation). It also takes into account spill.

Wetland links (connectors)

In a Cells Model, connectors allow water to move between cells. In Source, connectors are represented by the wetland link. Flow rate in a connector can be described as a function of water surface elevation (WSE) at each end of the link:

Equation 1	$Q_c = f_{Q_c}(WSE_1, WSE_2)$
------------	-------------------------------

where:

f_{Q_c} is a function that returns flow rate along connector c .

Q_c is the flow rate along connector c . A positive value indicates a flow from WSE_1 to WSE_2 .

WSE_1 and WSE_2 are the water surface elevations at each end of connector c .

Flow in a wetland link can be in either direction (unless the modeller specifies otherwise). The default flow direction is set when the modeller selects one node before the other when creating the wetland link. It is indicated by the direction of the arrow on the link in the Schematic Editor. Flow that moves in the default direction is represented by a positive number, while flow in the other direction is represented by a negative number.

Channel

Currently Source has only one type of wetland link function implemented to represent a channel. The specific form of wetland link flow function for a channel implemented in Source is:

Equation 2	$Q_c = C(WSE_c) \times \sqrt{\Delta WSE}$
------------	---

where:

Q_c is the wetland link's flow rate (m^3/s).

$C()$ is the modified conveyance relationship, this is the hydraulic conveyance divided by the square root of the channel length ($m^{2.5}/s$).

WSE is the drop (m) in surface water elevations along the channel.

In cases where $WSE < 0.01m$, the flow function is adjusted to prevent computational issues due to an infinite slope of the curve at the point where WSE approaches zero. This adjusted function is:

Equation 3	$Q_c = \frac{\Delta WSE}{0.01} \cdot C(WSE_c) \cdot \sqrt{0.01}$
------------	--

The value for hydraulic conveyance will vary according to where it is calculated. To model this, a piecewise relationship between modified conveyance c and water surface elevation (sometimes referred to as reduced level) is configured using the wetland link's feature editor. The WSE_c at the point at which the modified conveyance is calculated is estimated as:

Equation 4	$WSE_c = weighting \bullet WSE_1 + (1 - weighting) \bullet WSE_2$
------------	---

where:

WSE_1 is the water surface elevation at the originating node

WSE_2 is the water surface elevation at the destination node

weighting is a spatial weighting factor configured by the modeller in the wetland link's feature editor. It is specified in relationship to the from end of the link.

Source interpolates between points in the defined modified conveyance versus water surface elevation relationship to find the value of C that corresponds to WSE_c . The originating and destination nodes are defined by the modeller by which direction they drag the wetland link into their system and is shown as an arrow on the link.

Regulated channel

Source models regulated flows in wetland links by allowing the modeller to specify a target flow rate. This limits the rate of flow on the wetland link to the target value. It is assumed that regulated flow has a specific direction, ie. if a positive target flow rate is configured, Source will not permit flow in the opposite direction on the wetland link (ie. the value will be set to zero if the flow calculation returns a negative value, and vice versa). The following calculations adjust the channel flow rate to implement the regulated channel.

Where target flow rate $Q_{target} \geq 0$

Equation 5	$Q_c = \text{Max}(0, \text{Min}(Q_{target}, Q_c))$
------------	--

Where target flow rate $Q_{target} < 0$

Equation 6	$Q_c = \text{Min}(0, \text{Max}(Q_{target}, Q_c))$
------------	--

Storage nodes (Cells)

In Source, storage nodes are used to represent the "cells" or wetland compartments in which water can be stored. A storage node has a relationship between water surface elevation and surface area that can be used to represent the spatial distribution of water in a wetland. Another function relates its water surface elevation WSE_{ws} to the volume of water stored:

Equation 7	$A_{ws} = f_{A_{ws}}(WSE_{ws})$
-------------------	---------------------------------

Equation 8	$S_{ws} = f_{S_{ws}}(WSE_{ws})$
-------------------	---------------------------------

where:

A_{ws} is the surface area of storage node ws .

S_{ws} is the volume stored in storage node ws .

$f_{A_{ws}}$ is a function that relates surface area to water surface elevation of the storage node ws .

$f_{S_{ws}}$ is a function that relates storage volume to water surface elevation of the storage node ws .

WSE_{ws} is the water surface elevation of storage node ws .

The functions above are based on relationships configured by the modeller in the Storage node Dimensions table (in the Storage node's Feature Editor). The Level parameter found in this table is translated into WSE by addition of the node's Elevation parameter (set in the same dialog).

Mass balance equations are used to model the behaviour of a storage node as a cell within a wetland cluster's cells model. As an implicit Eulerian numerical scheme is used, for each storage node the mass balance over an arbitrary time period is:

Equation 9	$S_2^{WS} - S_1^{WS} = In_{ws} - Out_{ws}$
-------------------	--

or

Equation 10	$S_1^{WS} - S_2^{WS} = In_{ws} - Out_{ws} = 0$
--------------------	--

where:

S_1^{WS} is the volume of water stored in storage node ws at the start of the period

S_2^{WS} is the volume of water stored in storage node ws at the end of the period

In_{ws} is the volume that flowed into storage node ws over the period

Out_{ws} is the volume that flowed out of storage node ws over the period.

The storage node's WSE is an input parameter to its cells model calculations (the process by which this is ascertained is described later starting at Model Initialisation). Elements of each storage node's mass balance equation are calculated as follows:

End of time-step storage volume S_2^{WS} is determined using the function described above that relates this attribute to WSE .

Volume of inflow to the storage node:

Equation 11	$In_{ws} = I_{ws} - (NetEvaporation_{ws} + Groundwater_{ws}(Level_{ws}) + WetlandFlow_{ws})$
--------------------	--

where:

I_{ws} is the volume of upstream inflow entering storage node ws from outside the wetland cluster (ie. via its inlet link).

$Groundwater_{ws}(Level_{ws})$ is the groundwater flow volume over the time-step in storage node ws . The relationship between groundwater and level is defined in the Seepage table, configured by the modeller on the storage node. WSE is converted to Level by subtracting the base Elevation.

$NetEvaporation_{ws}$ is the net evaporation flow volume for the time-step in storage node ws . This is a combination of the Rainfall and Evaporation functions configured by the modeller on the storage node. These would usually have surface area A_{ws} as a parameter.

$WetlandFlow_{ws}$ is the total flow volume over the time-step on wetland links connected to storage node ws . See the Wetland Links (Connectors) section.

Volume of downstream outflow from the storage node (leaving the wetland cluster): This calculation depends on whether the storage node represents a weir, and if so, where the weir's WSE is in relation to its operating range:

- Weir: If WSE_{ws} *minimum target WSE*, downstream outflow is zero.
- Weir: If WSE_{ws} *maximum target WSE*, downstream outflow is set to the maximum of the orders and volume as upstream inflow (entering the node via the inlet link).

Where the storage node is not a weir, or the weir's WSE_{ws} is within its target range:

Equation 12	$Out_{ws} = \sum_o^{no_{ws}} f_{Spill}(WSE_{ws}) \bullet dt +$ $\sum_o^{no_{ws}} \left(f_{omax}(WSE_{ws}), \max(Order_o - f_{Spill}(WSE_{ws}), 0) \right) \bullet dt$
--------------------	--

where:

dt is the length of the time-step.

$f_{omax}()$ is the outlet path capacity relationship that relates the storage node's WSE to the maximum flow rate that can be made through the outlet path. Note that this capacity includes a spill rate that is also determined by WSE .

$f_{Spillo}()$ is the spillway relationship for outlet path o that relates the storage node's WSE to the flow rate leaving the storage node over the spillway.

no_{ws} is the number of outlet paths from storage node ws .

o is a storage node outlet path.

$Order_o$ is the flow rate ordered to go down outlet path o .

Wetlands and ordering

Orders can be placed on behalf of a wetland. This may be modelled in Source by connecting a water user node with an in-stream demand model to a supply point node upstream of the wetland cluster for which the water is to be ordered, and using "target flow" functions on the wetland links to move the water into the wetland once it arrives.

The order processing for both the above configurations is described in the Scientific Reference Guide entries for the water user node, supply point node and ordering system.

Storage nodes on the boundary of a wetland cluster may also be used to supply downstream orders. The interaction of the storage node and ordering system are described under Scientific Reference Guide entries for these items.

Conservative constituents in wetlands

Source treats all water bodies modelled using the storage node as fully mixed. This is discussed in more detail in the Scientific Reference Guide entry on the Storage node. Conservative constituent modelling in wetland links is not yet implemented.

Model Initialisation

At the start of the scenario run, the schematic network analyser works from upstream to downstream to identify the nodes and links that make up each wetland cluster (representing a wetland). The following rules are used:

- Node types that may belong to a wetland cluster include the hydraulic connector and the storage node. A node is a part of a wetland cluster only if it has a wetland link connected to it.
- Each node can only belong to one wetland cluster.
- If a node has not been assigned to a cluster yet, and is connected via a wetland link to another node that has been assigned, it is assigned to the same cluster as that node.

Source keeps track of the number of nodes that are in each wetland cluster, referred to as *NodesInCluster*.

Flow phase

When the schematic network analyser encounters a node in a wetland cluster during the flow phase, it processes the cluster together as a unit before running the model for individual nodes and links that make up the cluster. The component that performs the cluster's Cells Model processing will be referred to here as the "cluster processor".

Cluster processing results in an estimate of the water surface elevation in each storage node and the direction and rate of flow in each wetland link. The model that is later run for each individual storage node determines the node's final water surface elevation for the time-step. The storage node model is described in the Scientific Reference Guide entry for the Storage node.

As the order of execution of model components cannot be specified, the cluster processor may need to process storage and hydraulic connector nodes for which the current time-step's inflow rate has not yet been calculated. In these cases, the previous time-step's inflow values are used.

Flow phase processing of each wetland cluster will only occur once in every time-step, no matter how many connections there are between wetlands or rivers modelled.

The cluster processor uses an iterative method to find and return a set of water surface elevations that satisfy the mass balance equation for every one of its storage nodes. The initial iteration uses the following initial values for WSE:

- Hydraulic connector nodes: The *Reduced Level* value for the current rate of inflow in the piecewise relationship between *Average Inflow* and *Reduced Level* specified by the modeller.
- Storage nodes: The *WSE* at the end of the previous time-step.

At each subsequent iteration a new set of trial values is created and fed into storage node mass balance equations. This involves the following steps:

- The trial *WSEs* are used to determine flow rate and direction in the cluster's wetland links as described under Wetland Links (Connectors).
- The mass balance equation is evaluated for every storage node in the cluster. This equation is described under Storage Nodes (Cells).
- The precision of the solution is determined and compared to the cluster's convergence limit.
- Precision is calculated as the root mean square of storage node mass balance volumes:

Equation 13	$Precision = \sqrt{\frac{\sum_{ws} MassBalance_{ws}^2}{n_{ws}}}$
--------------------	--

where:

ws is a storage node in the wetland cluster

$MassBalance_{ws}$ is the result of the mass balance equation for storage node ws .

n_{ws} is the number of storage nodes in the wetland cluster

The wetland cluster's convergence limit is calculated based on the scenario's wetland node convergence limit that was specified by the modeller.

Precision is compared to the cluster's convergence limit to determine whether a solution was found:

- If the $Precision < ClusterConvergenceLimit$, or the maximum number of iterations has been reached, the process of solving the cluster is finished.
- If the $Precision > ClusterConvergenceLimit$ and more iterations are allowed, parameters for each storage node in the cluster are adjusted ready for the next iteration:
- The mass balance error is subtracted from the end of time-step storage volume estimate
- The corresponding *WSE* for the adjusted storage volume is determined using the Storage Dimensions relationship (between storage volume and level).



The solution technique implemented in Source allows other types of node to be used within wetland clusters that like the hydraulic connector node have a WSE that is not impacted by wetland link flow. At present this functionality is not used as the only types of node that may be connected by wetland links are storage nodes and hydraulic connector nodes.

Input data

All input data is configured via user interfaces. The parameters are summarised in the following tables:

Table 2. Wetland Configuration parameters

Parameter	Description	Units	Default	Range
Max iterations	The maximum number of sets of node <i>WSEs</i> (trial solutions) to examine for a wetland cluster in finding an acceptable one, ie. where <i>Precision</i> <i>Convergence Limit</i> . Equation 13 of the Flow phase section describes this further. On rare occasions this number will be exceeded by up to 2.	n/a	5	Integer > 0
Convergence limit	The upper threshold on error per node for an acceptable wetland cluster solution. At each solution iteration of a wetland cluster's Cells Model, its <i>Precision</i> is compared to the <i>Convergence Limit</i> to determine whether it is acceptable (and hence the final one).	volume	1	Real number > 0

These parameters are accessed via the scenario **Edit** menu, and apply to all wetland clusters in the scenario.

If log diagnostics are required, there are also parameters that determine the location of the log file, the time-steps to be logged, and whether to only log those in which no acceptable Cells Model solution could be found. These parameters are described in more detail in the Source User Guide.

Table 3. Location Control parameters

Parameter	Description	Units	Default	Range
Elevation	Base elevation of the currently selected node.	m	0	Real numbers

Note that this information is also available in the Schematic Editor on the node's tool tip.

Table 4. Hydraulic Connector node parameters (average inflow vs WSE)

Parameter	Description	Units	Default	Range
Average inflow rate	Average inflow rate associated with the WSE	ML/day	0	Real numbers 0
Water surface elevation (WSE)	<i>WSE</i> for an average inflow rate	m	0	Real numbers

Table 5. Wetland link parameters

Parameter	Description	Units	Default	Range
From	Name of the node connected to the link from which outflow is given a positive value and inflow a negative value.	n/a	First node connected	Node names
To	Name of the other node connected to the link from which outflow is given a negative value and inflow a positive value.	n/a	Second node connected	Node names
Flow direction	Indicates whether flow can move in both directions	n/a	Bi-directional	Bidirectional or Unidirectional
Weighting	Represents the point at which conveyance is calculated. Determines the influence of each end of the link's <i>WSE</i> on conveyance. A value of 0.5 gives each end equal weighting.	n/a	0.5	Real numbers between 0 and 1

Modified Conveyance vs Water Surface Elevation (or Reduced Level) Table

Modified conveyance	Modified conveyance for a water surface elevation	m ^{2.5} /s	0	Real numbers 0
Water surface elevation (WSE)	<i>WSE</i> for a modified conveyance	Elevation (m)	0	Real numbers

Flow Regulation Parameters

Flow Regulated?	Indicates whether the link is regulated.	n/a	No	Yes or No
-----------------	--	-----	----	-----------

Target flow	Value returned by the selected time series, function or scenario. It represents a maximum flow rate permitted on the link. Also controls flow direction. Refer to the section on Regulated channel	Volume /time Default: m3/s	none	Real numbers
-------------	--	-------------------------------	------	--------------

Table 6. Storage node parameters

Parameter	Description	Units	Default	Range
Storage Dimensions Table: This describes a relationship between the storage's Level, Volume and Surface Area				
Level	Maximum depth of water in the storage	m	Row 1: 0 Row 2: 100	Real numbers 0
Volume	Volume of water stored in the storage	ML	Row 1: 0 Row 2: 100000	Real numbers 0
Surface area	Surface area of water in the storage.	Ha	Row 1: 0 Row 2: 1000	Real numbers 0
Storage Details				
Initial storage level	Initial depth of water in the storage.	Volume: Default m	100	Real numbers 0
Minimum operating level	Minimum depth of water to operate the storage at. Below this level no releases are made.	Volume: Default m	None (not enabled)	Real numbers 0
Maximum operating level	Maximum depth of water to be kept in storage. Releases are made to attempt to ensure this depth is not exceeded.	Volume: Default m	None (not enabled)	Real numbers 0
Rainfall and Evaporation: Used to calculate $NetEvaporation_{ws}$				
Rainfall	Value returned by the selected time series, function or scenario. Used to represent storage inflow/gain due to rain falling on the surface of the water stored.	distance/time: Default mm/day	0	Real numbers
Evaporation	Value returned by the selected time series, function or scenario. Used to represent storage outflow/loss due to evaporation from the surface of the water stored.	distance/time: Default mm/day	0	Real numbers
Seepage Table: Used to calculate $Groundwater_{ws}$				
Level	Depth of water in storage associated with the rate of seepage.	Distance: Default: m	Row 1: 0	Real numbers 0
Seepage	Rate of seepage associated with a depth of water in storage.	Volume/time: Default: m3/s	Row 1: 0	Real numbers
Outlet Level versus Discharge Tables: Used to calculate $f_{Spillo}(WSE_{ws})$ and $f_{Omax}(WSE_{ws})$				
Level	Depth of water in storage associated with a discharge rate.	m	Row 1: 0	Real numbers 0
Discharge	Discharge rate for a depth of water in storage.	ML/day	Row 1: 0	Real numbers

Use of these parameters is described in Storage Nodes (Cells). For a full list of Storage Node parameters, see the Source User Guide.

Output data

Output data is viewed using the Recording Manager. The recorded attribute values (results) are reported for each time-step of the model run. Results relevant to wetland Cells Model processing are summarised in the following tables:

Table 7. Wetland cluster (Cluster solver) attributes

Attribute	Description	Units	Range
Iterations	Number of solutions (sets of storage node <i>WSE</i>) that were tried for the time-step before one was found with acceptable (ie. <i>Precision Convergence Limit</i>) or the maximum iteration limit was reached. See Equation 13.	n/a	Integer, between 0 and the Maximum Iterations setting for Wetlands on the Edit menu.
Precision	Root mean square of mass balance error volume for the wetland cluster's storage nodes in its final solution for the time-step.	Volume	Real number > 0.

Table 8. Storage node attributes

Attribute	Description	Units	Range
Cell mass balance error	Value returned from the storage node's Cells Model mass balance equation, described under Storage Nodes (Cells). This result comes from the final trial solution for the wetland cluster in each time-step.	Volume	Real number.
Reduced Level or Water surface elevation	Elevation at the surface of the water in the storage. This is the <i>Storage Level(depth)</i> plus the base <i>Elevation</i> (see Location Control or the tool tip in the Schematic Editor)	Elevation: Default m	Real number.

Table 9. Hydraulic connector node attributes

Attribute	Description	Units	Range
Average Reduced Water Level	Elevation at the surface of the water at the point in the river represented by the hydraulic connector node. This is based on the upstream inflow rate.	Elevation: Default m	Real number.
Conveyance flux	Rate of flow (or flux) to/from the wetland(s) connected to the river at the hydraulic connector node.	Volume /time: Default ML/day	Real number
Total conveyance flow volume	Total volume and direction of flow to/from the wetland(s) connected to the river at the hydraulic connector node over the time-step. Equals <i>Conveyance flux • time-step length</i> .	Volume Default ML	Real number

Table 10. Wetland link attributes

Attribute	Description	Units	Range
Average flow rate	Rate and direction of flow in the wetland link. See Q_c in the Wetland Links (Connectors).	Volume /time: Default ML/day	Real number.
Total flow volume	Total volume and direction of flow in the link over the time-step. Equals <i>Average flow rate • time-step length</i> .	Volume Default ML	Real number.
Average reduced water level	Elevation of the water surface at the point at which the link's conveyance is calculated; WSE_c described in Wetland Links (Connectors)	Elevation: Default m	Real number. Should be between From node reduced level and To node reduced level.
From node reduced level	Elevation of the water surface, calculated by the cluster solver, at the end of the link configured to be upstream by default.	Elevation: Default m	Real number
To node reduced level	Elevation of the water surface, calculated by the cluster solver, at the end of the link configured to be downstream by default.	Elevation: Default m	Real number

Target flow	Maximum permitted flow rate on the link. Also indicates the permitted flow direction. See the sub-section in Wetland Links (Connectors).	Volume /time: Default ML/day	Real number
Target flow volume	Same as the <i>Target Flow</i> attribute but expressed as a volume over the time-step.	Volume Default ML	Real number

For a full list of output data for wetland nodes and links, refer to the Source User Guide.

Reference list

Zanobetti, D., Lorgeré, H., Preissmann, A., & Cunge, J.A., 1970, Mekong Delta mathematical model program construction, J. Waterways and Harbors Division, American Society of Civil Engineers, vol.96, no.2, pp.181-199.