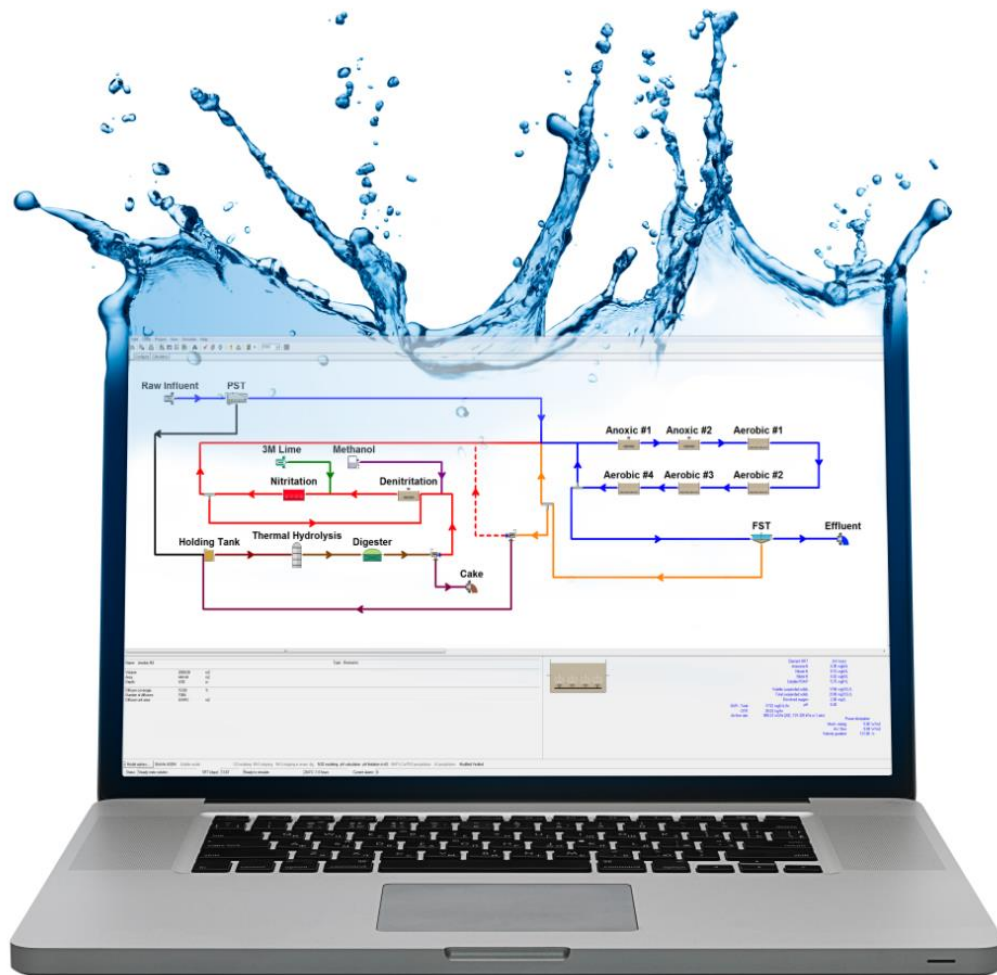


What's New in BioWin 6.1



EnviroSim
ASSOCIATES LTD.

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Separate Hydrolysis Rate for External Organics

- Degradable external organics state variable (*i.e.* COD_p – Degradable external organics) now has its own kinetic hydrolysis rate parameter (*c.f.* BioWin 6.0 where hydrolysis rate for slowly degradable particulate COD was used)
- Hydrolysis rate for external organics can be independently adjusted *via* **Project > Parameters > Kinetic > Common**
- Also can be adjusted locally as per other kinetic parameters

Kinetic parameter editor

Methylotrophic | **Phosphorus accumulating** | Propionic acetogenic | Methanogenic | Sulfur oxidizing | Sulfur reducing | pH | Switches
Common | Ammonia oxidizing | Nitrite oxidizing | Anaerobic ammonia oxidizing | Ordinary heterotrophic | Heterotrophic on industrial COD

Parameters

Name	Default	Value	Arrhenius
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
External organics hydrolysis rate [1/d]	2.1000	2.1000	1.0290
External organics hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.5000	0.5000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.1500	1.0290
Ammonification rate [L/(mgCOD d)]	0.0800	0.0800	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Endogenous products decay rate [1/d]	0	0	1.0000

Print all Set current tab to default values OK Cancel

Additional State Variables in Source Separated Organics Input

- Particulate COD can now consist of both degradable and non-degradable components
- VSS / TSS ratio for SSO stream can now be adjusted through addition of ISS if desired

Input - SSO



×

Edit Influent

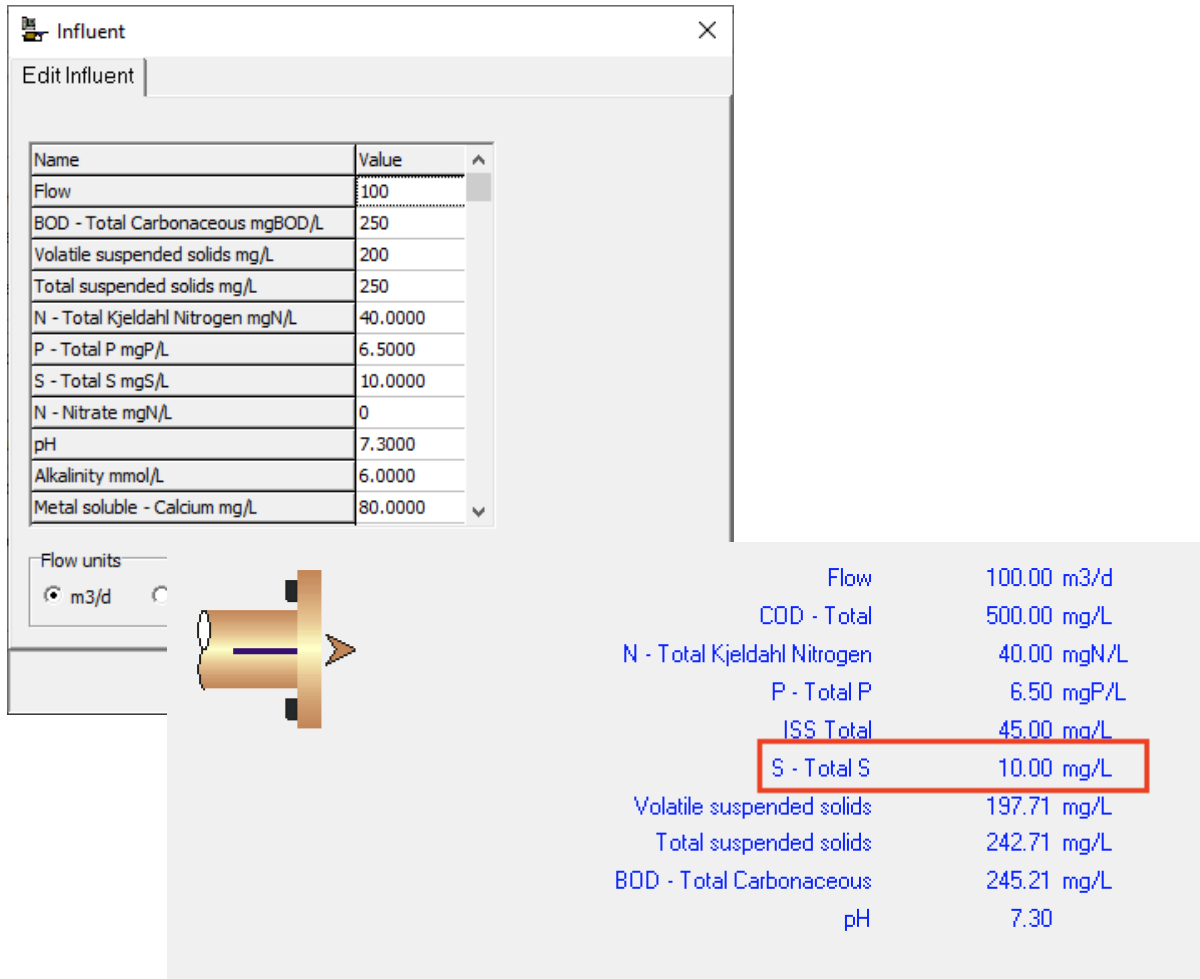
Name	Value
Flow	100
CODp - Degradable external organics	80.00000
N - Particulate degradable external organics	0
P - Particulate degradable external organics	0
CODp - Undegradable non-cellulose	20.00000
Influent inorganic suspended solids	10.00

Flow units
☐ m3/d ☐ m3/hr ☒ L/d ☐ ML/d ☐ mgd ☐ gal/d

Close

Sulfur in BOD Input

- Sulfur component now available for BOD inputs
- Also displayed in main window summary pane



Influent

Edit Influent

Name	Value
Flow	100
BOD - Total Carbonaceous mgBOD/L	250
Volatile suspended solids mg/L	200
Total suspended solids mg/L	250
N - Total Kjeldahl Nitrogen mgN/L	40.0000
P - Total P mgP/L	6.5000
S - Total S mgS/L	10.0000
N - Nitrate mgN/L	0
pH	7.3000
Alkalinity mmol/L	6.0000
Metal soluble - Calcium mg/L	80.0000

Flow units: ☒ m3/d ☐ C

Flow 100.00 m3/d

COD - Total 500.00 mg/L

N - Total Kjeldahl Nitrogen 40.00 mgN/L

P - Total P 6.50 mgP/L

ISS Total 45.00 mg/L

S - Total S 10.00 mg/L

Volatile suspended solids 197.71 mg/L

Total suspended solids 242.71 mg/L

BOD - Total Carbonaceous 245.21 mg/L

pH 7.30

Additional Metal Salt Inputs

- Now seven separate metal salt inputs
- Ferric Chloride; Ferric Sulfate
- Ferrous Chloride; Ferrous Sulfate
- Aluminum Chloride; Aluminum Sulfate; PAC/ACH
- More distinct coloration for flowsheet clarity



Input - Iron (as ferric chloride)



Input - Iron (as ferrous chloride)



Input - Aluminum (as AlCl_3)



Input - Iron (as ferric sulfate)



Input - Iron (as ferrous sulfate)



Input - Aluminum (as $\text{Al}_2(\text{SO}_4)_3$)



Input - Aluminum (as PAC)



Metal Salt Pricing Information

- Pricing now input as price per unit weight of **metal**
- Input *via* **Project > Costs/Energy > Fuel/Chemical**
- \$ per kilogram metal for SI units
- \$ per pound metal for US units
- ***Not \$ per unit weight of metal salt or metal salt solution***

Parameter editor

Heating fuel/Chemical Costs | Calorific values of heating fuels | Density of liquid heating fuels

Parameters

Name	Default	Value	^
Methanol [\$ /L]	0.4400	0.4400	
Ferric chloride [\$ /kg Fe]	1.1700	1.1700	
Ferric sulfate [\$ /kg Fe]	0.7900	0.7900	
Ferrous chloride [\$ /kg Fe]	0.6100	0.6100	
Ferrous sulfate [\$ /kg Fe]	2.3700	2.3700	
Aluminum sulfate [\$ /kg Al]	1.6900	1.6900	
Aluminum chloride [\$ /kg Al]	1.9800	1.9800	
Poly Aluminum Chloride (PAC) [\$ /kg Al]	1.1700	1.1700	

Natural gas [\$ /GJ]
Heating oil [\$ /L]
Diesel [\$ /L]
Custom fuel [\$ /L]

Note: If digester gas (Biogas) is not used for CHP it can be sold (if used for heating any excess can be sold) at the price specified above

Print all

Parameter editor

Heating fuel/Chemical Costs | Calorific values of heating fuels | Density of liquid heating fuels

Parameters

Name	Default	Value	^
Methanol [\$ /gal]	1.6656	1.6656	
Ferric chloride [\$ /lb Fe]	0.5307	0.5307	
Ferric sulfate [\$ /lb Fe]	0.3583	0.3583	
Ferrous chloride [\$ /lb Fe]	0.2767	0.2767	
Ferrous sulfate [\$ /lb Fe]	1.0750	1.0750	
Aluminum sulfate [\$ /lb Al]	0.7666	0.7666	
Aluminum chloride [\$ /lb Al]	0.8981	0.8981	
Poly Aluminum Chloride (PAC) [\$ /lb Al]	0.5307	0.5307	
Natural gas [\$ /MMBTU]	3.1652	3.1652	
Heating oil [\$ /gal]	1.8927	1.8927	
Diesel [\$ /gal]	2.6498	2.6498	
Custom fuel [\$ /gal]	3.7854	3.7854	

Note: If digester gas (Biogas) is not used for CHP it can be sold (if used for heating any excess can be sold) at the price specified above

Print all
Set current tab to default values
OK
Cancel

Metal Salt Dialogue Improvements

- Cost per unit volume of actual input solution is displayed in the input dialogue
- Based on input price of pure solution under **Project > Costs/Energy > Fuel/Chemical**, pure solution density under **Project > Parameters > Physical/Chemical > Metal salt solution densities**, and strength of input solution
- Additional clarification notes provided (e.g. basis for metal salt chemical composition with or without waters of hydration)

Left Screenshot: Ferric Chloride Input

Name	Value
Flow	250
Ferric [mg Fe/L]	1.50000E+5

Cost of solution : 0.66 \$/gal
 Note: Calculations based on anhydrous formula FeCl₃

Fe concentration as

☒ Ferric Chloride as mg Fe / L
☐ Ferric Chloride as mg FeCl₃ / L
☐ Ferric Chloride as % FeCl₃ by wt.

Flow units

☐ m³/d ☐ m³/hr ☐ L/d ☐ gal/d

Right Screenshot: Aluminum Input

Name	Value
Flow	250
Aluminum [mg Al/L]	6.56750E+4

Cost of solution : 0.29 \$/gal
 Note: BioWin does not automatically change the Al concentration when switching between PAC and ACH. The user must change the Al concentration accordingly.

Al concentration as

☒ PAC/ACH as mg Al / L
☐ PAC/ACH as mg Al₂(OH)_nCl(6-n) / L

where n =

**For PAC (Al₂O₃H₃Cl₃), specify n = 3;
 for ACH (Al₂O₃H₅Cl), specify n = 5.**

Flow units

☐ m³/d ☐ m³/hr ☐ L/d ☐ ML/d ☐ mgd ☒ gal/d

Close

Project Location and Currency Exchange Rates

- Location of project can now be specified *via* **Project > Info**
- Ensures proper currency conversion rates *versus* the US dollar for costing calculations
- Currency exchange rates can now be edited / set directly within BioWin using the **Set exchange rate to** button; editing of external *.ini* files no longer required

The top screenshot shows the 'Project' window with the following fields:

- Creation date: Friday, January 24, 2003, 12:00:00 AM
- Last saved: 4/27/2020 1:59:50 PM
- Simulation start date: Friday, February 10, 2017, 12:00:00 AM
- User name: Remote user
- Project name: An Example
- Project ref.: Exampleville WWTP
- Plant name: Example Plant
- Project country setting: Windows Country or Region setting (dropdown menu open showing: AD=Andorra, AE=United Arab Emirates, AF=Afghanistan, AG=Antigua and Barbuda, AI=Anguilla, AL=Albania, AM=Armenia)
- Exchange rate button
- Close button

The bottom screenshot shows the 'Exchange rate' window with the following fields:

- Country setting: US : United States of America
- Exchange rate: \$ 1.0 = US\$1
- CA : 1.3999 Canada
- CA : Set exchange rate to 1.3999 = US\$1
- Close button

Upper / Lower Flow Split Bounds

- Applicable for any flow-splitting element that can be flow-paced based on an influent element
- Splitters, primary and secondary clarifiers, dewatering units, MBRs, grit tanks, cyclones, *etc.*
- Useful for modelling pumping limitations (*e.g.* upper and/or lower limits on RAS flow pacing)

Editing Sec Settler

Dimensions | Operation | Flow split | Power | Model | Tags | Monitor items

Conventional

Split method

☐ Ratio [U/O]

☐ Fraction [U / (U+O)]

☒ Underflow [U]

Flow

1.000E+5 m³/d

☒ Constant

Pattern ...

Notes

If flow paced is selected, a percentage and an influent stream must be specified.

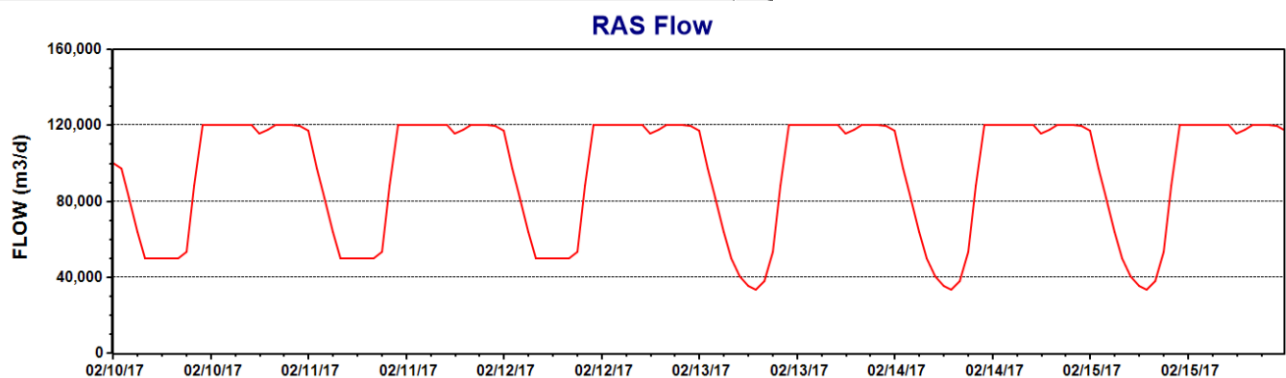
Flow pacing

☒ Paced at 100.00 % of Influent

Constrain underflow rate

☒ Bound flows

Minimum flow rate 5.000E+4 Maximum flow rate 1.200E+5



Swing Zone Setting

- Bioreactor-type elements can be designated as “swing zones” if there is on/off aeration if they are set as *unaerated*
- This setting allows input of diffuser coverage even if zone is set as unaerated (this was not possible in previous BioWin versions)
- The element can display the number of diffusers in tables and this information also is available to BioWin Controller
- Allows for proper implementation of BioWin Controller’s air distribution tool in aeration control strategy simulations involving swing zones

Editing Bioreactor - Model Builder

Dimensions | **Operation** | Outflow | Initial values | Power | Model | Tags | Monitor items

Specify aeration method

- ☐ DO setpoint
- ☐ Air flow rate
- ☒ Un-aerated ☒ **Swing zone**

Un-aerated

- ☒ Constant at
- ☐ Scheduled

Diffusers

- ☒ Density (%)
- ☐ ATAD
- ☐ Number of diffusers

Air flow rate constraints

- ☐ Minimum air flow rate of
- ☐ Maximum air flow rate of

Note: Constraints only applied for dynamic simulations. For steady state alarms are generated

☐ Local temperature

Temperature

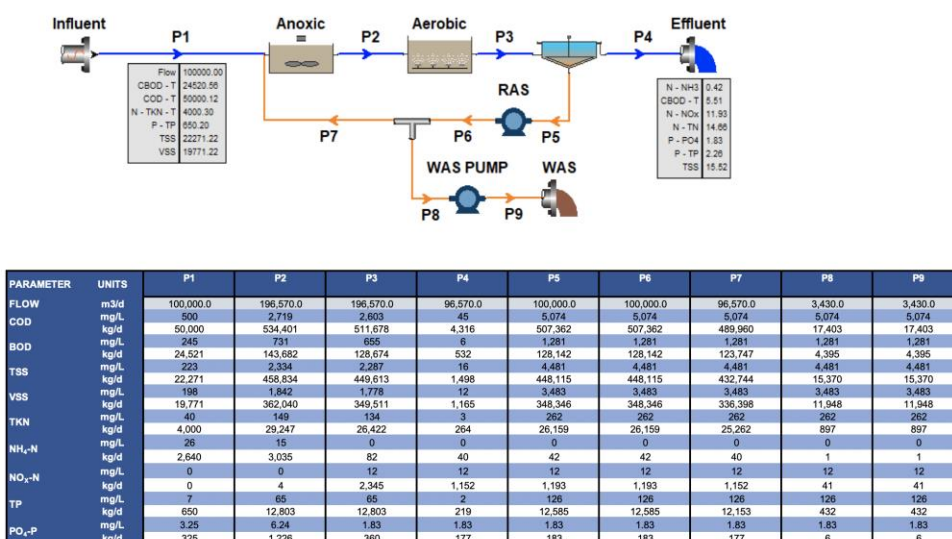
- ☒ Constant value of (deg. C)
- ☐ Scheduled

Press F1 for help

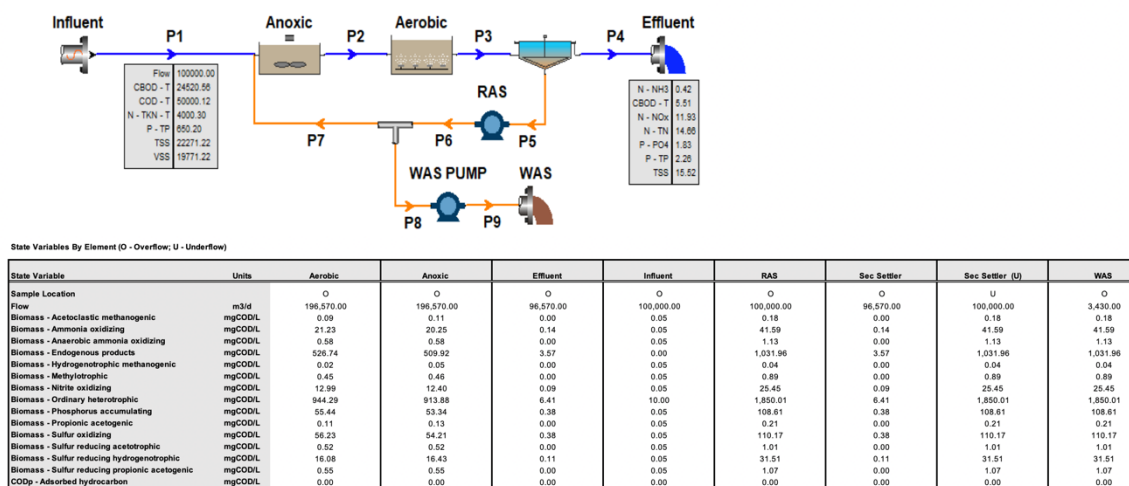
Report to Excel Refinements

- If multiple unmerged templates are used in report creation, each output report can be saved with unique name/location
- Color has been added to default mass balance tables
- State variable table is now available (default table excludes pipe elements but these can be added through use of filtering)
- AlphaF, Beta, and Diffuser Density now available for bioreactor-type elements

BioWin Mass Balance Summary

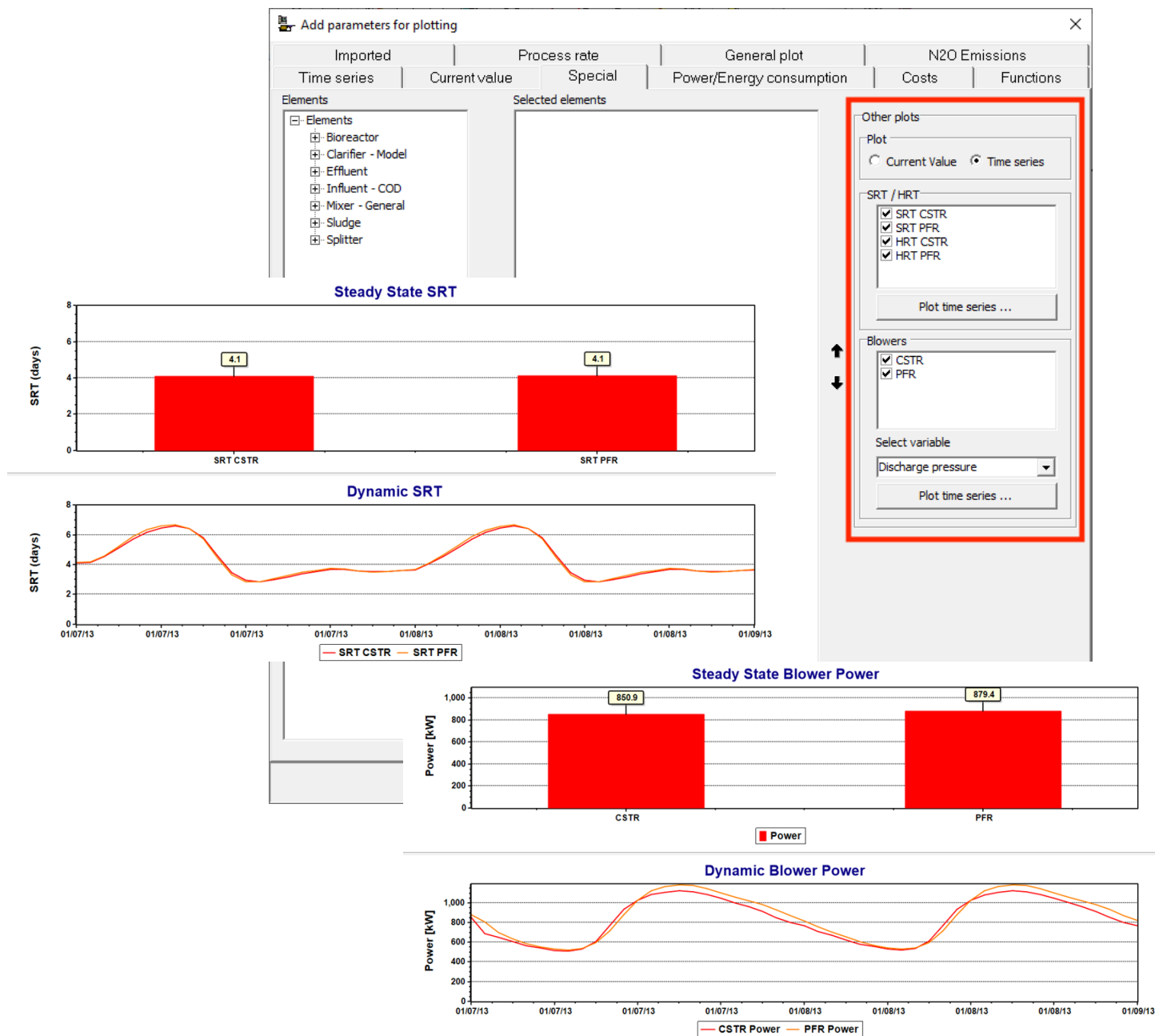


BioWin Overall Element State Variable Summary



Plotting Blower Group Information

- Variables of interest for blower groups (e.g. intake airflow, power requirement) can now be plotted in current value or time series charts *via* **Special** tab of **Add Series** dialogue
- Capability of SRT / HRT plotting has been expanded to allow for current value plots (only time series were available in previous versions of BioWin)



New Variables

- Total Calcium and Total Magnesium available under Combined variables group for tables and charts
- Aids in overall mass balance-checking for nutrient recovery systems

Edit table

Table editor

Combined

- N - Total Kjeldahl Nitrogen
- N - Total N
- P - Phosphorus in HMO
- P - Soluble PO4-P
- P - Total P
- pH
- S - Total S
- Total aluminium (all forms)
- Total Calcium (all forms)
- Total iron (all forms)
- Total Magnesium (all forms)
- Total suspended solids
- Volatile suspended solids

Element specific

--- 1. Diffused aeration ---

- # of diffusers
- Air flow rate
- Air flow rate / diffuser

--- 2. Reactors and digesters ---

- Actual DO sat. conc.
- Alpha

Variables

State variables

- Biomass - Acetodlastic methanogenic
- Biomass - Ammonia oxidizing
- Biomass - Anaerobic ammonia oxidizing
- Biomass - Endogenous products
- Biomass - Hydrogenotrophic methanogeni
- Biomass - Methylotrophic
- Biomass - Nitrite oxidizing
- Biomass - Ordinary heterotrophic
- Biomass - Phosphorus accumulating
- Biomass - Propionic acetogenic
- Biomass - Sulfur oxidizing
- Biomass - Sulfur reducing acetotrophic
- Biomass - Sulfur reducing hydrogenotroph

Water chemistry

- Acetate
- Acetic acid
- Aluminium ion
- Bicarbonate
- Bisulfate
- Bisulfide
- Carbonate

Selected variables

☐ Duplicates

Add blank line

Add total so far

Elements

[-] Elements

- [+] Bioreactor
- [+] Clarifier - Model
- [+] Effluent
- [+] Influent - COD
- [+] Pump
- [+] Sludge
- [+] Splitter

Selected elements

Show

☒ Concentrations

☐ Mass rates

☐ Both

☐ Transpose table

OK Cancel

Screen Redraw Moved to Customize Settings

- Frequency of screen refresh / summary pane update moved to **Tools > Customize** dialogue
- Reduces screen “flicker” if drawing board tags are used

The screenshot shows the 'Customize' dialog box with the 'Display options' tab selected. The 'Summary pane update interval' is highlighted with a red box. The interval is set to 5 days, 0 hours, and 0 minutes. Other settings visible include 'Decimal places' (2), 'Use thousands separator' (checked), 'Column starting width option' (Title width), 'Hints' (Delay: 500 msec, Hide Delay: 2500 msec), 'Element' (Show names for: Bioreactor, Bioreactor - Media, Bioreactor - Membrane, Bioreactor - Model Builder, Bioreactor - Sidestream, Bioreactor - Sidestream (Media), Bioreactor - Submerged aerated filter), 'Explorer summary items' (Flow, VSS, TSS, COD, COD sol., Total N, TKN, TKN sol., NH3, NO3, Total P, PO4, BOD, BOD sol., Volume), 'Variable view options' (Mass rates), 'Variable sorting' (Alphabetical sorting), 'State variable naming' (Full names), and 'General' (Display option to store previous time series plots in the album).

Customize

Default tags | Automatic logging | File locations | System settings

General | Display options | Printing options | Report options

Decimal places

Concentrations [fractions, %, pH] 2

Mass rates 2

Others 2

☒ Use thousands separator

Columns

Column starting width option

☒ Title width

☐ Fixed width of 95

Align Right

Hints

Delay: 500 msec.

Hide Delay: 2500 msec.

Element

Show names for :

☒ Bioreactor

☒ Bioreactor - Media

☒ Bioreactor - Membrane

☒ Bioreactor - Model Builder

☒ Bioreactor - Sidestream

☒ Bioreactor - Sidestream (Media)

☒ Bioreactor - Submerged aerated filter

Summary pane update interval

d h m

5 0 0

Explorer summary items

Select items to display

☒ Flow

☒ VSS

☒ TSS

☒ COD

☒ COD sol.

☒ Total N

☒ TKN

☒ TKN sol.

☒ NH3

☒ NO3

☒ Total P

☒ PO4

☒ BOD

☒ BOD sol.

☒ Volume

Variable view options

☒ Mass rates

Variable sorting

☒ Alphabetical sorting

State variable naming

☒ Full names

☐ Abbreviated (cryptic)

☐ Abbreviated (IWA)

General

☐ Display option to store previous time series plots in the album

Close

Minor Bug Fixes

- User manual additions / corrections
- Spurious generation of pH alarm for variable volume bioreactors
- Error message when switching from DO setpoint to power supply schedule for surface-aerated bioreactors
- Equalization tank outflow is now available to BioWin Controller even if it is set to have constant volume in BioWin
- Fixed typo in process names of some HFO reduction processes in the stoichiometric matrix view
- Addressed an issue where values in cost summary tables were not adding up correctly
- Fixed a rounding issue with time values in flow split patterns