



Welcome to the inaugural edition of The BioWin Advantage. The purpose of this e-letter is to facilitate knowledge transfer to BioWin users. In each edition, a brief case study will be used to highlight BioWin features that will give you a competitive advantage...The BioWin Advantage.

This issue looks at an application where sludge (e.g. waste activated sludge, primary sludge, digested sludge) was required as a model input rather than a model output. The steps required to achieve this, as well as some useful scenarios using this approach are featured. The accompanying BioWin and data files can be found [here](#).

Please also note that we are emailing you as the registered contact for your BioWin serial number(s). For organizations with multiple copies / users, we would be pleased if you could forward this email to all your BioWin users.

We trust that you find this technical topic both interesting and informative.

## Featured Article

### SLUDGE AS A MODEL INPUT

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## Sludge - Not Just An Output Anymore

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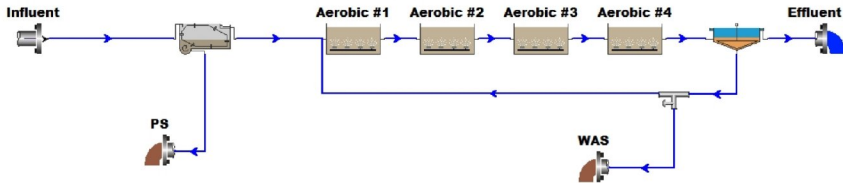
[In Conclusion](#)

## Generating Sludge

The first step in setting up a sludge input is to extract information from a regular sludge output in the proper format. The way we will be setting up sludge inputs is through the use of BioWin's State Variable input. Since this input requires concentrations of the various state variables, we need



to output sludge information in state variable format. To generate sludge output information, we can use a simple model such as this:



In a simple model layout such as the one shown, the influent wastewater characteristics (e.g. soluble versus particulate breakdown), primary settling tank solids capture rate, and activated sludge system solids retention time all interactively impact the composition of the primary and waste activated sludge (PS & WAS). All of these variables can be manipulated to explore various scenarios. To obtain the state variable composition of the PS and WAS outputs, we can add Element info (state variable) displays like the one shown below to the BioWin Album. To do this, we complete the following steps:

1. Right-click on the PS sludge output.
2. In the resulting pop-up menu, point to the Add to album.
3. When you do this, a fly-out menu appears. Click on the option that says Element info (State variables).
4. Repeat these steps for the WAS sludge output.

Now that we've got the state variable composition of the PS and WAS in the album, we can quickly export it to Excel. To do this, we complete the following steps:

1. Open the BioWin Album by simultaneously holding the (Ctrl+A) keys on our keyboard.
2. Locate your PS state variable summary added in the previous steps.
3. Right-click anywhere on the text of the display, and select Copy from the resulting pop-up menu.
4. Open Excel, right-click in any cell, and select Paste from the resulting pop-up menu.
5. Repeat steps 2 through 4 for the WAS.

State variable	Conc. (mg/L)	Mass rate (kg/d)	Notes
Non-polyP heter...	7.50	3.00	
Anoxic methanol...	7.50	3.00	
Ammonia oxidati...	7.50	3.00	
Nitrite oxidizing b...	7.50	3.00	
Anaerobic ammo...	7.50	3.00	
PolyP heterotrophs	7.50	3.00	
Propionic acetog...	7.50	3.00	
Acetoclastic met...	7.50	3.00	
Hydrogenotrophs...	7.50	3.00	
Endogenous pro...	0	0	
Slowly bio. COD ...	37074.38	14829.75	
Slowly bio. COD ...	82.39	32.96	
Part. inert. COD	9750.00	3900.00	
Part. bio. org. N	787.01	314.81	
Part. bio. org. P	378.02	151.21	
Part. inert N	341.25	136.50	
Part. inert P	107.25	42.90	
Stored PHA	0	0	
Releasable store...	0.75	0.30	
Fixed stored polyP	0	0	
PolyP bound cell...	0.96	0.22	
Readily bio. CO...	68.00	27.20	
Acetate	12.00	4.80	
Propionate	0	0	
Methanol	0	0	
Dissolved H2	0	0	
Dissolved metha...	0	0	
Ammonia N	26.40	10.56	
Sol. bio. org. N	5.25	2.10	
Nitrite N	0	0	
Nitrate N	0	0	
Dissolved nitrog...	16.00	6.40	
PD4 P (Sol. & M...	3.25	1.30	
Sol. inert COD	25.00	10.00	
Sol. inert TKN	0.00	0.32	

Options

General

Element: PS

Volume:

Area:

Depth:

Temperature 20.00 deg. C.

Location: Output

An Excel file with this exercise completed for WAS of varying SRTs has been included with this document. We've now generated - and captured - sludge information that we can set up as BioWin inputs.

## Setting Up Sludge Inputs

In this next step, we'll take the sludge information we've captured in Excel and encapsulate it in a BioWin state variable input. To do this, we complete the following steps:

1. In the Excel file with the sludge state variable information, select the range of numerical values in the "Conc. (mg/L)" column for the sludge you want to represent as an input in BioWin, and click the Copy button. [Note that the first value in your range will be the Non-polyP heterotrophs concentration, and the last will be the Dissolved oxygen concentration]
2. Open a BioWin file, and drop a State Variable input onto the drawing board.
3. Double-click the State Variable input, and click the Edit data button.
4. Click in the Non-polyP heterotrophs concentration field to highlight that cell (it is the second cell from the top).
5. Right-click and select Paste from the resulting pop-up menu. You should now see values in all of the concentration fields. Note: If the active cell does not update, try clicking on a different cell.
6. Click on the Flow field, and manually enter the value you wish to use. Click Close to accept the data that you've just entered into the state variable input.

You now have a state variable input that represents a sludge of type and composition that you are interested in using as a model input! The following

steps may be good ideas:

- Right-click on the newly created state variable input, select Name... from the resulting pop-up menu, and give it a descriptive name.
- Double-click the newly created state variable input, click the To file button, and save the information to a BioWin \*.sif file so that you can rapidly open it up in other state variable inputs.
- Save the BioWin file containing your newly created sludge input(s) for future reference.

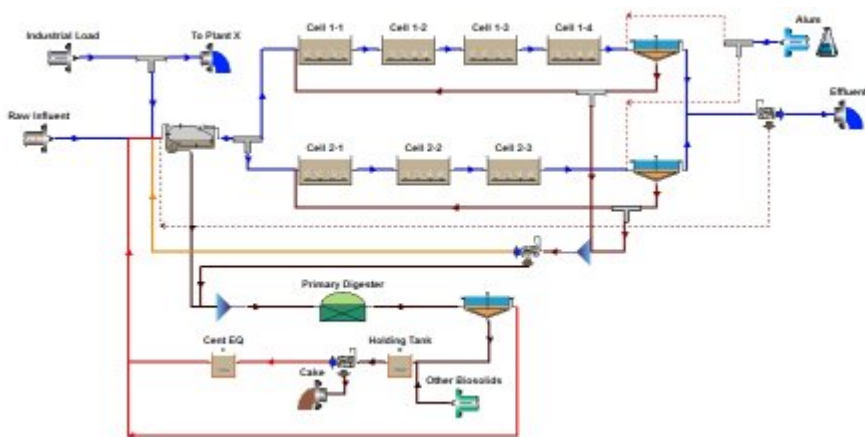
## Putting it all Together

So where to from here? How can we use sludge as an input? Here are a few ideas that we've used in the past...

### Centralized Dewatering of Biosolids

In the model layout below, a state variable input was set up using the techniques we've discussed above to represent a digested sludge input (labelled Other Biosolids). To generate this input, the state variable composition of an anaerobic digester output was captured, exported to Excel, etc. as outlined above.

The goal of this model was to explore the ability of a plant with a newly commissioned sludge dewatering facility to process tankered digested sludge from other plants as well as its own internally generated digested sludge.



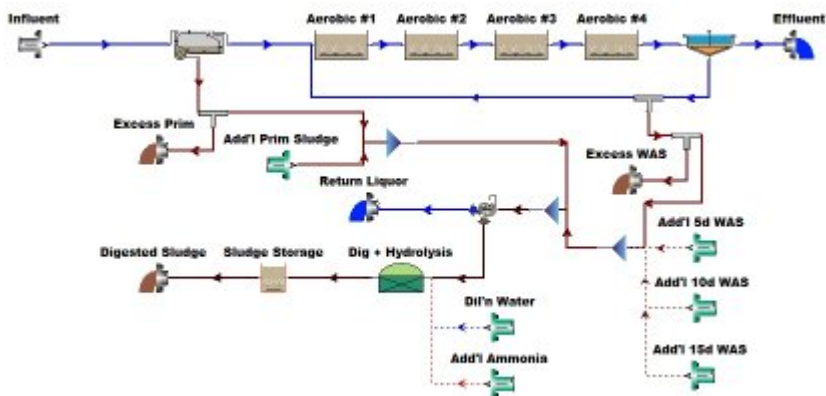
### Exploring Anaerobic Digester Performance

In the model layout below, state variable inputs are used to represent a variety of sludge types, including:

- Primary sludge
- Short SRT waste activated sludge
- Medium SRT waste activated sludge

- Long SRT waste activated sludge

The goal of this model was to explore the anticipated performance of a centralized anaerobic digestion facility that would be receiving sludge from a variety of plants. By setting up sludge inputs representing each of the sludge types, the relative flows (and hence digester VSS loads) could be varied to explore a wide range of sludge mixing scenarios.



## In Conclusion

The EnviroSim Team will be issuing this collection of technical topics on a regular basis to stay in touch with our user base. User feedback drives our product development, and we're continually striving for ways to enhance and build upon that feedback. To download a pdf of this newsletter, [click here](#).

Please feel free to contact us at [info@envirosim.com](mailto:info@envirosim.com) (Subject: The BioWin Advantage) with your comments on this article or suggestions for future article.

Thank you and good modeling

From the EnviroSim Team



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