WALLRUS modelling for use with MOSQITO

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MOSQITO is HR Wallingford's water quality simulation model for sewerage systems. The hydraulic component of MOSQITO is WALLRUS, and the starting point for building a MOSQITO model is a verified WALLRUS model.

WALLRUS models which are to be used with MOSQITO have to be verified to a high standard, because MOSQITO is very sensitive to errors in the hydraulic model. This note describes the particular requirements for WALLRUS models which are going to be used with MOSQITO.

Pipe data

WALLRUS has two alternative input formats for pipe data. Record type 4 is compatible with WASSP, and Record type 18 was introduced with WALLRUS 1.0. For models which are going to be used with MOSQITO, Record type 18 should be used. This gives MOSQITO access to more information about the sewer system, including sediment depths in pipes (see following section) and land use.

Record 18 has been modified to include a land use index. This replaces the parallel/ series flow routing flag in column 71. The land use index can be used by MOSQITO to assign different dry weather flow and sediment characteristics to different areas.

WALLRUS includes a conversion program to produce SSD files containing Record type 18 from existing WASSP files.

Sediment depths

Using Record type 18 makes it possible to define a sediment depth in each pipe. This is used by WALLRUS to reduce the hydraulic capacity of the pipes.

MOSQITO simulates the erosion, deposition, and transport of sediment in the system, and requires an initial depth of consolidated sediment for each pipe. By default, MOSQITO will use the depths given in the SSD file. Changes in sediment depths during the MOSQITO simulation will **not** affect the hydraulic capacity of the pipes.

MOSQITO also has its own sediment data file which can contain sediment depths for each pipe. MOSQITO gives these values priority over depths given in the SSD file, but WALLRUS will not use them to reduce hydraulic capacities. Care should therefore be taken that sediment depths given in the SSD file are for significant consolidated deposits. Any loose sediment which is likely to be eroded during a storm should not be included.

Outfalls

In WALLRUS it is permissible for an overflow to discharge to branch zero, which is taken as representing an outfall from the system. For MOSQITO this should not be done. Overflows should discharge to a pipe which leads to an outfall. This allows MOSQITO to correctly total all the pollutant outflows from the system.

Tank levels

For use with MOSQITO, the levels of the bottoms of tanks should be below those of the inflow and continuation pipes. This prevents the tank from draining completely during the simulation, which can cause errors in MOSQITO.

Tank records giving floor levels the same as the adjacent pipes should be altered so the floor level is dropped by 50mm. This will avoid errors in MOSQITO without noticeably affecting the hydraulic calculations.

Dry weather flows

There are several different ways of defining dry weather flows in WALLRUS: as individual flows to each pipe in the SSD file; as a total dry weather outflow from the system; and as a dry weather flow per unit area of catchment, in a separate DWF file.

The method recommended for use with MOSQITO is the DWF file. Industrial dry weather flows should be represented as inflow hydrographs (QIN files). This allows MOSQITO to assign different qualities to dry weather flows from different sources.

It is particularly important that flows of different quality (such as domestic, infiltration and industrial flows) should not be added together and given in the SSD file.

Many of the pollutants discharged through overflows and outfalls are from the dry weather flow. It is therefore important that these flows and their qualities are represented accurately in WALLRUS and MOSQITO.

Verification data

The data collected for MOSQITO verification include rainfall and flow measurements during dry weather and storm conditions. The first stage of MOSQITO verification is to run these data through the WALLRUS model as an additional check on its accuracy. If the MOSQITO storm data are available when the WALLRUS model is being verified, they should be used as additional WALLRUS verification data.

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Discussion

Paper 1 : MOSQITO UPDATE (J Payne - Hydraulics Research Ltd)

J High (Wolverhampton) : Is there a constant relationship between pollution load and the amount of solids in the flow? I suggest this is an area for further research.

Answer: The relationship between BOD & sediment from a particular source is fixed in the software. Sediment from different sources with different relationships can be incorporated.

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D Wright (Applied Research) : What pollutants are modelled?

Answer: Suspended solids, sediment, ammonia, COD and BOD - if the necessary information is available on a particular pollutant other than these, then this can be modelled also.

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Delegate (Stevenage) : Is the "first flush" effect successfully modelled?

Answer: At Royton this phenomenon was not obvious. The model does reproduce the effect.

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C Jeffries (Dundee I.O.T.) : How many samplers compared to the number of flow monitors have been found to be required to verify MOSQITO?

Answer: Initially, the number of samplers used was half that of flow monitors in some of the pilot studies. However, there has been a wide variation throughout the pilot studies. At the moment we are feeling our way, but hopefully, we can aim for as few as possible because of the cost.

A Eadon (Severn Trent Water) : Do we need to reassess the simplification carried out in WALLRUS models used for MOSQUITO?

Answer: Yes. Because of the reduced number of pipes caused by simplification, MOSQUITO predicts less sediments.

D Balmforth (Sheffield City Polytechnic) : What role does verification have in MOSQITO model preparation. Do you always see verification as part of MOSQITO model building?

Answer: Always need to collect some pollution data. Pilot studies are underway to show what data needs to be collected. The hope is to reduce the data collection burden on a model building by building a database.

D Balfmorth (Sheffield City Polytechnic) : Do you see different pollutants becoming important in the future eg toxics and bacteria?

Answer: Toxic pollution sources are largely industrial and these are not likely to be routinely modelled as would be catchment specific. At the moment bacteria will be impossible to model. Any pollutant may be modelled in MOSQITO either as dissolved or with sediment, provided the data is available.