

# StormTac – Manual

2006-03-10

StormTac is a watershed management model for the quantification of pollutant loads and for the design of stormwater treatment and detention facilities.

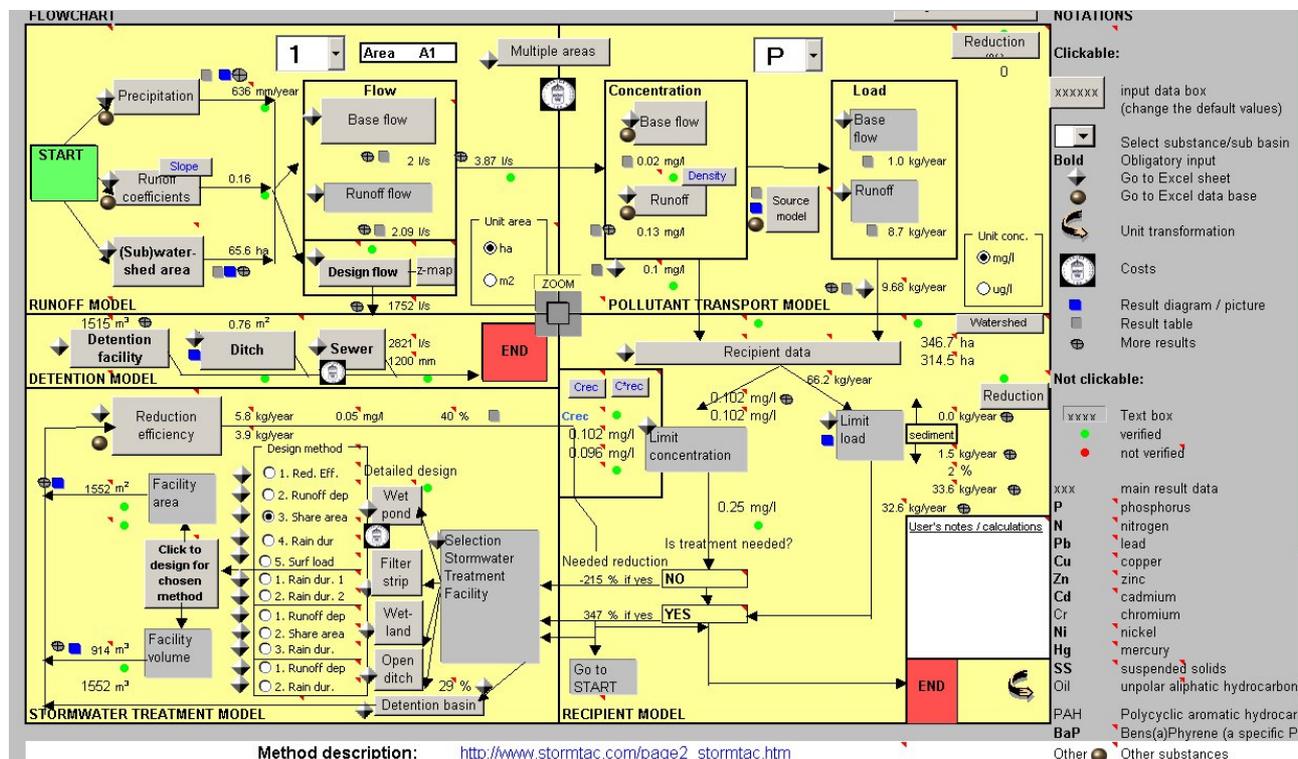


Figure 1 Model main page and flowchart.

## System requirements and user information

- Microsoft Excel 2000 or later is required.
- English is the model language.
- The number format in Windows must be points and decimals in the model must be written in points.

## Installation guide

1. Create a new program folder on a desired location on the hard drive of your computer, e.g. C:/program/StormTac.
2. Copy the CD content to this new folder. Except for the StormTac excel file the CD also contains some folders with pictures and reports to study if desired.
3. Check the national number format from the Control panel, national adjustments. If necessary change the number format to point "." Instead of ",". This is needed for the model to function correctly. In the model you must also write decimals with points.
4. To run the model StormTac you have two alternatives; Alt. 1) Open Excel and open StormTac.xls that is located directly under the program folder of StormTac (e.g. directly from the CD or from C:/Program/StormTac/StormTac.xls); Alt. 2) Open the model (and Excel) from Explorer by clicking on the file StormTac.xls from where it is located.

# Manual

## Generally

1. The flowchart appearing when you open the model file is the main page (flowchart) of the model (the sheet "StormTac"), see Fig. 1. From here you can add or change default input data and from here you can study the main results of your input. Only if you would like to study data bases, the model equations and other information, you need to go to the other Excel sheets in the model.
2. Click on a box and you will come to a form in which you can change the default values. Start by clicking on the box "(Sub)watershed area" in the Runoff model, to the right of the green box marked "Start", and change the default values, see Fig. 2. Then you can automatically clear all default values by clicking on the corresponding box within this form. The values at the arrows will be changed if you change the values in the forms.
3. Follow the arrows in the flowchart for the desired path of your study objective. The grey boxes with bold text are the only obligatory ones for adding input data and of course you only need to choose input values in the boxes that are relevant for the study. Use the rest of the boxes for more detailed/specific calculations; otherwise default values are used.
4. From the header "StormTac" in the tool menu you can save new input data and open saved data. These data files are in Excel format and have the extensions ".tac" and can therefore be searched for from e.g. Explorer. If desired, you can open the file restore.tac from the catalogue "StormTac data files" to restore the original input data files, including formulas/links that may be overwritten with values. When you have saved the input data file from the menu and are ready with the calculations, you can and are recommended to exit from Excel and the file StormTac.xls without saving it. Changes of values in the input boxes may result in overwritten default values and operative formulas. The user is therefore strongly recommended to; a) start new calculations/case studies from the original file for the model to function correctly; b) store at least one original StormTac file on the hard drive as a backup for the CD, i.e., start from an original file. It is possible to save StormTac.xls as a new file name, but that file will occupy much more space than the saved input data file. Another reason for opening and saving input data files instead of whole model files are that you can open these from updated model versions, not having to rewrite input data into a new model file when the model is updated.

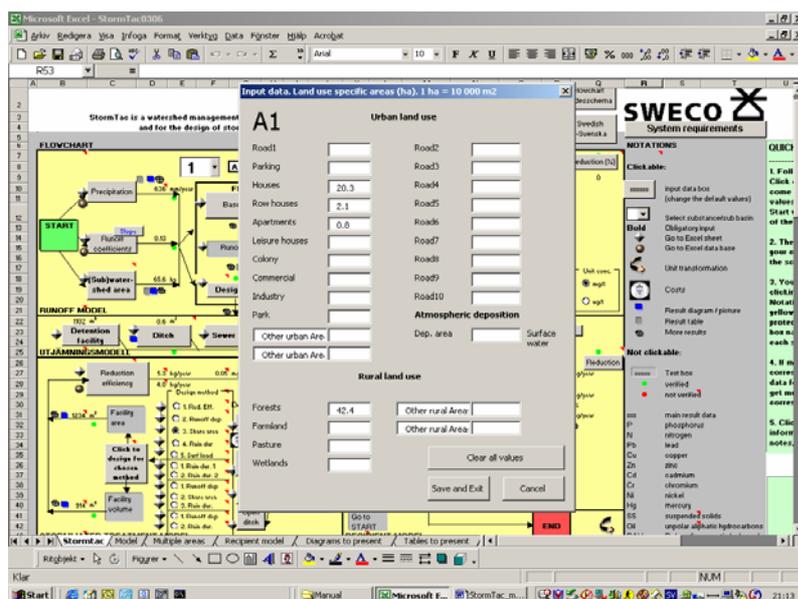
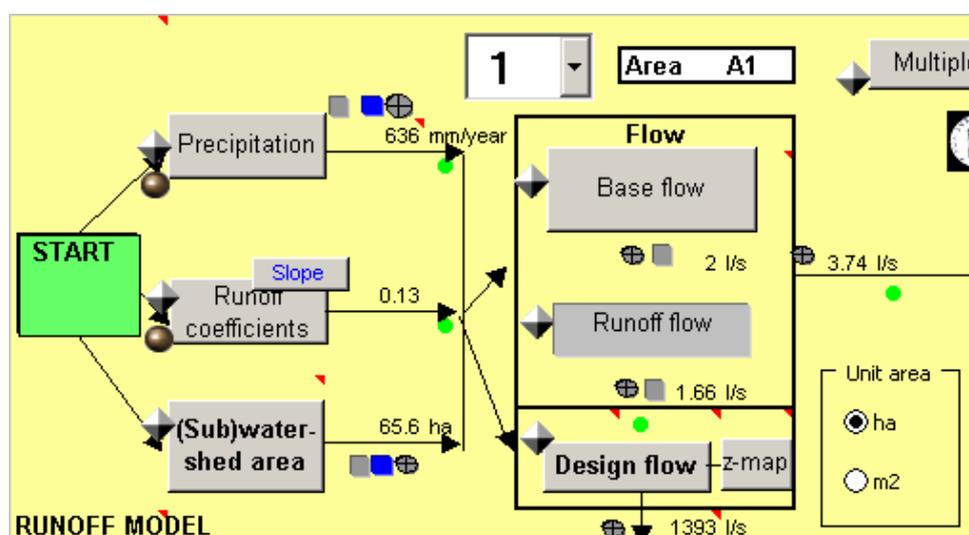


Figure 2 Input data form that appears when clicking on the box "(Sub)watershed area".

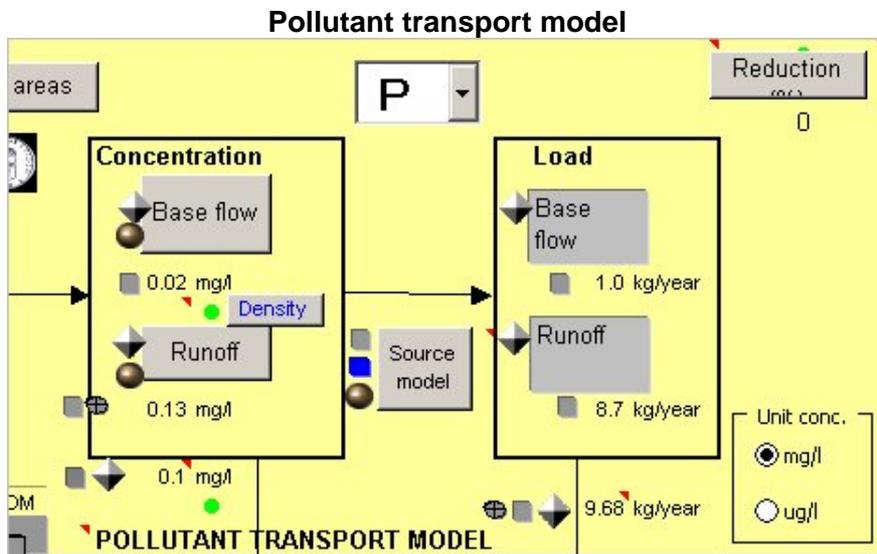
- The model includes 5 sub models; Runoff model, Pollutant transport model, Recipient model, Stormwater treatment model and Detention model. These are appearing on the flowchart, see Fig.1.
- You can study the equations and more data by clicking on the symbol "Go to Excel sheet", see Notations on the right side of the flowchart (Fig. 1). In these other sheets you may write the input data in yellow cells (the rest of the cells are generally protected), which is an alternative of using the input boxes in the flowchart. However, there are more input data cells in the sheets than in the flowchart. Go back to the flowchart by selecting "To flowchart" from the menu "StormTac" or by clicking on the box named "flowchart" which is placed near cell A1 on each sheet, and in other places.
- Click on a symbol to study data bases or other information (see Notations). See also red standard Excel symbols for notes appearing in many places around in the different sheets of the model, providing you with hints, further information and references.
- For descriptions of calculation methods either go to the corresponding Excel sheets, study the reports included in the CD or in the Internet page of the model (address appearing below the flowchart).

### Runoff model

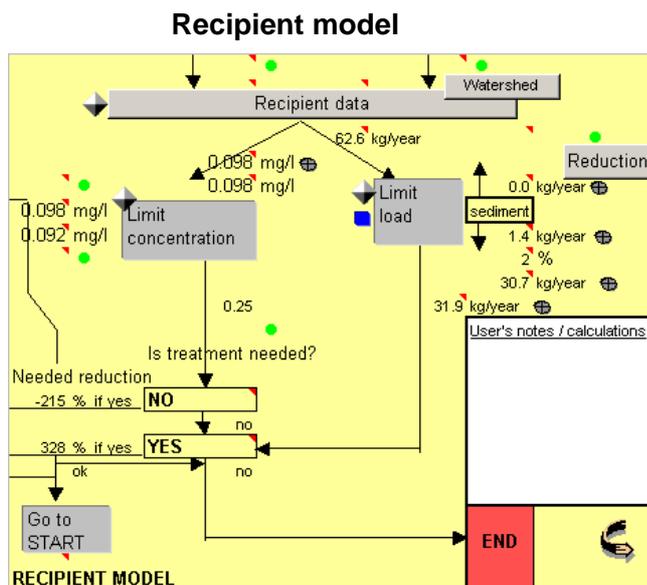


- Click on the boxes "Precipitation" and "Runoff coefficients" if you would like to review or change the default values. By clicking on the box "Slope" you can alternatively change the runoff coefficients by setting a certain factor (5 is the default standard factor, 1 results in the minimum and 10 the maximum runoff coefficient from the data base) for each land use, considering the average slope and impermeability. Click on the obligatory box "(Sub)watershed area" to change the areas of each land use in the studied watershed. The results appear adjacent to the arrows. The default area values correspond to sub watershed Herrängsparken, Lake Flaten case study in Salem Municipality, Sweden. Each (sub)watershed area is to be studied separately. However, it is possible to add input data of areas per land use for up to 150 (sub)watershed areas in the same file. Either all these area values are to be written directly in the Excel sheet "Multiple areas", accessed by clicking on the corresponding box in the flowchart, or an area number can be chosen from the scroll list in the flowchart and the area values for that selection may be written in the input data form. The latter is accessed by clicking on the box "(sub)watershed area". After the input data values of the different (sub)watershed areas have been written, it is easy to select/change areas directly from the scroll list in the flowchart.

- By default, base flow is included and the area of base flow automatically is set to equal the watershed area (generally a reasonable approximation), else change area values in the box "Base flow". To exclude base flow, clear the area values.
- If you would like to calculate design flow for the design of sewers, ditches or detention facilities click on the box "Design flow" and change or review the values. Continue directly down to the Detention model if pollutants are not to be considered.

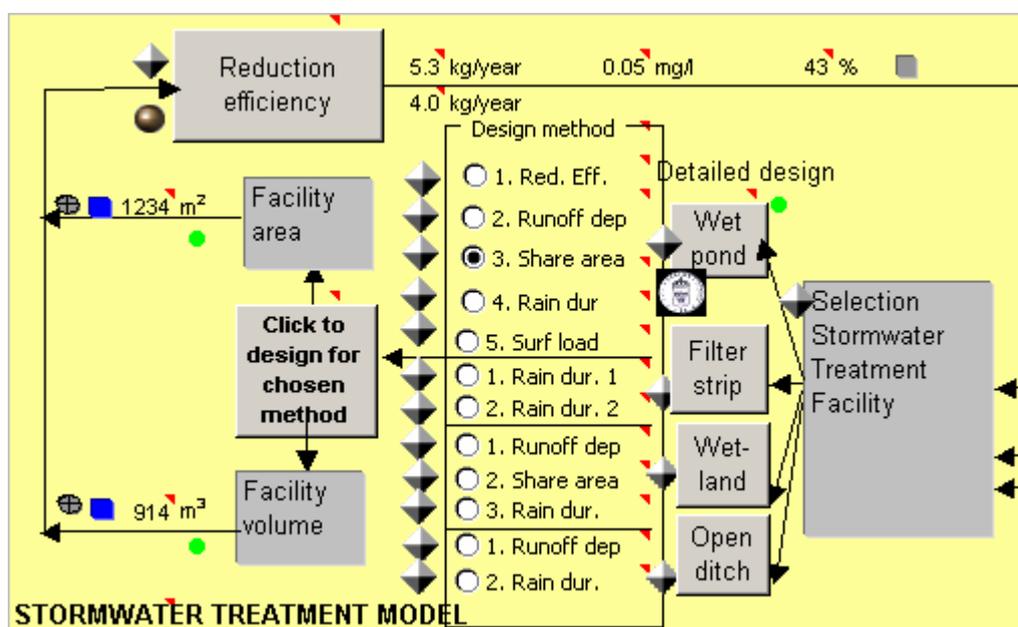


- Click on the boxes "Base flow" and "Runoff" if you would like to change the default standard model values. In these cases, other sheets in the model are opened. You may alternatively change the runoff (stormwater) concentrations by clicking on the box "Density" to set a certain factor (5 results in the default standard concentration value, 1 results in the minimum and 10 the maximum concentrations from the data base) for each land use, or you can change the traffic intensities.
- Select substance to study in the scroll list, see Notations on the main sheet.
- Study the resulting changes of the values adjacent to the arrows.



1. Click on the box “Watershed” to change the areas per land use of the total watershed to the receiving water body to study, e.g. a lake or a watercourse. The default values are from the watershed of Lake Flaten in Salem Municipality, Sweden.
2. Click on the box “Recipient data” to change parameters describing the receiving water, e.g. the lake water volume, the recipient sensitivity class and measured pollutant concentrations in the water body. Furthermore, extra point flows and loads not accounted for by stormwater and base flow can be added in the box, e.g. fluxes from upstream surface water bodies. The latter example can be calculated from separate StormTac files for those recipients, whereas the outflow values will equal the extra point fluxes.
3. The resulted numbers next to the arrows present the limit concentrations and acceptable (limit) loads on the recipient. They also present the resulted recipient concentrations of a designed treatment facility. If you have not access to the recipient data, study only the limit concentrations and the resulted need of reduction (%), i.e. disregard the default values of total and limit loads for the recipient. Test for different substances from the scroll list in the Pollutant transport model. If you perform the recipient study you can check the required reduction efficiency (%) for reaching the limit load. From the flowchart, you can also study the calculated net internal load from the sediment to the water body if that is the case, else the net sediment load and the reduction efficiency of the recipient. Furthermore, you can study the changed recipient concentration as a result of the designed stormwater treatment facility. Observe that this is a planning level tool and that only yearly average values are presented. However, the recipient model has been calibrated and verified to several case studies.
4. If more detailed studies or information of equations are desired, click on the symbol that leads you to the Excel sheet of the recipient model. You can also study water and mass balances of the recipient.

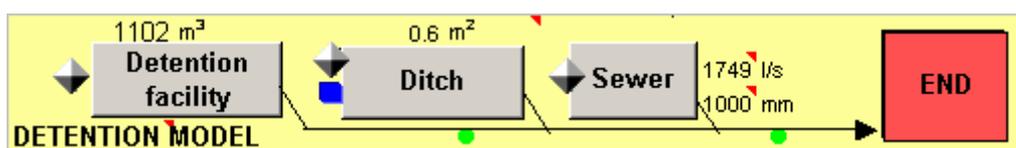
**Stormwater treatment model**



1. Choose a stormwater treatment facility, e.g. “Wet pond”. Click on corresponding box to change/study the default data.
2. If a treatment facility is to be designed, choose a design method to the left of the facility type.

3. You can study the equations and more data by clicking on the symbol "Go to Excel sheet", next to the chosen design method.
4. Click on the obligatory box "Click to design for chosen method" in order to calculate the dimensions as results of the chosen method and the changed values in the input form (this is the only box in the model you need to click on for changes in input data to take effect, all other changes happen automatically and without any noticeable delay).
5. The resulted permanent area and volume are presented next to the arrows to the left.
6. Click on the symbol next to these values for viewing a simplified section view of the facility or the symbol for studying more results, such as the detention volume, see Notations to the right of the flowchart.
7. If you like, choose another design method and study the results of that method, repeating the steps 2-6.
8. Click on the box "Reduction efficiency" from which you choose a method for calculating the reduction efficiency of the chosen design.
9. Study the reduction efficiency for different substances. Change substances from the scroll list in the Pollutant transport model.
10. Compare the resulted reduction efficiency with the required reduction efficiency from the Recipient model. To the right of this arrow you can study the changed recipient concentration as a response of the reduction efficiency.

### Detention model



1. After having changed/studied the input form in the box "Design flow" in the Runoff model, you choose between designing a "Detention facility", open "Ditch" or a stormwater "Sewer" (pipe). Click on the corresponding box. An alternative sub model for ditch or channel design is accessible by clicking on the symbol "Go to Excel sheet", next to the box "Ditch". You only have to use the Detention model if one of these designs is your objective. The detention volume of a wet pond is designed in the Stormwater treatment model.
2. Study the corresponding Excel sheet Detention if you want further information on the design methodology. The method used is simple and the default values are based on precipitation data from Stockholm, Sweden. To get more site-specific results (for other regions), the user may change the z-value from the flowchart (including a z-map for Sweden) or may alternatively and for other countries change equations in the Excel sheet Detention.

## Other information

You can study the Product specification to see areas of model implementations etc. Complementary information, such as pictures and reports (e.g. a reviewed PhD thesis that is focused on the methodology of StormTac), is included in the CD and the following Internet address: <http://www.stormtac.com>. From this address you can also review the updates and changes of the model, and take contact if you have any questions or comments.

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