Wettelijke Onderzoekstaken Natuur & Milieu

Surface WAter Scenario Help (SWASH) version 5.3

Technical description

| WOt-technical report 27

J.A. te Roller, F. van den Berg, P.I. Adriaanse, A. de Jong & W.H.J. Beltman

WAGENINGEN UR
For quality of life

Surface WAter Scenario Help (SWASH) version 5.3

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Abstract
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The user-friendly shell SWASH, acronym for Surface WAter Scenarios Help, assists the user in calculating pesticide exposure concentrations in the EU FOCUS surface water scenarios. SWASH encompasses five separate tools and models: (i) FOCUS Drift Calculator, calculating pesticide entries through spray drift deposition, (ii) PRZM-3, calculating pesticide entries through run-off, (iii) MACRO, calculating pesticide entries through drainage, (iv) TOXSWA, calculating the behaviour of pesticides in small surface waters, and (v) SPIN is a central database for storage and editing of pesticide properties. The SWASH database contains information on projects and runs created by the user. This report gives a detailed description of the necessary flow of data between the various models, to make them communicate smoothly with each other. It also specifies the installation requirements for the MACRO, PRZM and TOXSWA models. The MACRO model uses an MS-Access database to store its substance and run information, while PRZM makes use of separate data files. TOXSWA uses the central SWASH database. After completing a SWASH session the user should manually perform simulations with the three individual models.

Keywords: ditch, drainage, drift, exposure assessment, FOCUS, MACRO, pesticide, pond, PRZM, run-off, scenario, stream, SPIN, surface water, TOXSWA

Referaat
Roller, J.A. te, F. van den Berg, P.I. Adriaanse, A. de Jong, W.H.J. Beltman (2015). *Surface WAter Scenario Help (SWASH) versie 5.3. Technische beschrijving*. Wageningen, WOT Natuur & Milieu. 77 p. 1 Fig.; 2 Tabs; 4 Refs; 12 Annexes.

De gebruikersvriendelijke schil SWASH, acroniem voor Surface WAter Scenario Help, ondersteunt de gebruiker om blootstellingsconcentraties van gewasbeschermingsmiddelen in de EU FOCUS scenario's te berekenen. SWASH omvat vijf verschillende instrumenten en modellen: (i) FOCUS Drift Calculator berekent belasting van gewasbeschermingsmiddelen door drift depositie, (ii) PRZM-3 berekent belasting van gewasbeschermingsmiddelen door afspoeling, (iii) MACRO berekent belasting van gewasbeschermings-middelen als gevolg van uitspoeling, (iv) TOXSWA berekent het gedrag van gewasbeschermingsmiddelen in kleine watersystemen, en (v) SPIN is een centrale database voor opslag en aanpassen van eigenschappen van gewasbeschermingsmiddelen. De SWASH-database bevat informatie over projecten en runs die de gebruiker heeft gemaakt. Dit rapport geeft een gedetailleerde beschrijving van de overdracht van data tussen de verschillende modellen om de communicatie tussen de modellen efficiënt te laten verlopen. Het rapport specificeert ook de installatie-eisen voor de modellen PRZM, MACRO en TOXSWA. Het MACRO-model gebruikt een MS-Access-database om stof- en run-informatie op te slaan, PRZM maakt gebruik van verschillende datafiles. TOXSWA gebruikt de centrale SWASH-database. Na het afronden van een SWASH-sessie kan de gebruiker de simulaties met de afzonderlijke modellen uitvoeren.

Trefwoorden: sloot, drainage, drift, blootstellingsbeoordeling, FOCUS, MACRO, gewasbeschermingsmiddel, poel, PRZM, run-off, scenario, beek, oppervlaktewater, TOXSWA, SPIN

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Preface

End 1997 the FOCUS Surface Water Scenarios Working Group started its activities. The Group developed a tiered approach to estimate pesticide exposure concentrations in surface water, which was submitted to the Working Group on Pesticide Legislation of the European Union. Since 2003, the calculated concentrations in the FOCUS Surface Water Scenarios have become part of the EU review process for plant protection products according to EU Directive 1107/2009. In the proposed Step 3 calculations a tool for drift assessment and three models are combined to calculate exposure concentrations in the various types of surface water bodies. To promote an easy and consistent way of calculation, an overall user-friendly software shell was developed to guide the user through the needed calculations and to maintain a central pesticide database.

Alterra took the initiative to realise the user-friendly shell SWASH, acronym for Surface WAter Scenarios Help, was developed by Erik van den Berg and Paulien Adriaanse from Alterra-ERA, in co-operation with Johnny te Roller and Daniel van Kraalingen from Alterra-EI (1999 - 2003). Nick Jarvis (Swedish Univ. Agric. Sci., S) for MACRO, Mark Russell (Dupont Crop Protection, USA) and Mark Cheplick (Waterborne–env., USA) for PRZM collaborated closely with them to realise the communication between the models and the SWASH database. Denis Yon (Dow Agrosciences, UK) and Mark Russell developed together the FOCUS drift calculator (FOCUS, 2001) and this instrument has also been included in SWASH.

The first version of SWASH, FOCUS_SWASH_1.1, was financed for ¼ by the ECPA (European Crop Protection Agency) ¼ by the Dutch Ministry for Agriculture, Fisheries and Nature Management and ½ by DG SanCO from the EU. All other work have been financed by the the Dutch Ministry of Economic affairs and its precursor the Dutch Ministry of Agriculture, Nature and Food Quality.

The current document is an update of a technical document of Te Roller *et al.* (2002). It explains the technical design of the SWASH database and communication and installation procedures. This document will be helpful for future extensions or updates.

Additionally an user's manual was made (F. van den Berg *et al.*, 2015), to explain to users how to use SWASH and next, perform the Step 3 FOCUS Surface Water Scenarios runs.

The authors

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Summary

To carry out the EU FOCUS pesticide exposure assessment scenarios for surface waters, a number of tools and models have to be run in sequence. Each of these tools and models have been developed separately targeting a specific aspect relevant to the assessment.

These are:
- Drift Calculator, calculating pesticide transport through drift;
- FOCUS_PRZM_SW_4.3.1, calculating pesticide transport through run-off and erosion;
- FOCUS_MACRO_5.5.4, calculating pesticide transport through drainage;
- FOCUS_TOXSWA_4.4.3 , calculating the fate of pesticides in surface waters;
- FOCUS_SPIN 2.2, storage of pesticide properties.

To facilitate the calculation of exposure concentrations at Step 3 level a software tool has been developed: SWASH, acronym for Surface WAter Scenarios Help. It is an overall user-friendly shell, encompassing a number of individual tools and models involved in Step 3 calculations. From SWASH version 4.2 onwards the substance database was separated from SWASH and in its place the tool SPIN (Substances Plug IN) was introduced.

The pesticide transport through drift is automatically calculated by the Drift Calculator. The Drift Calculator can be also used as a tool to calculate spray drift depositions for separate, not standard FOCUS step 3, runs.

FOCUS_PRZM is a model that uses binary files to store information on substances. These files are updated by SWASH.

FOCUS_MACRO is a run-oriented model. It uses a MS Access database (pest_focus.mdb) to store information on substances and runs. This database is updated by SWASH.

FOCUS_SWASH is project-oriented. The user defines a project for a substance. In the project runs are created for the selected crops, scenarios and waterbody types. For each project SWASH can generate a report with an overview of all the runs.

FOCUS_SPIN is used to store pesticide properties in a common database that can be accessed by different pesticide fate models from Alterra Wageningen UR. SPIN can be accessed from SWASH and from TOXSWA.

SWASH sets a directory structure for the various models and their input and output to enable a smooth and correct communication between the various tools.

After completing a SWASH session, the user must manually perform simulations with the individual models: PRZM, MACRO and TOXSWA. From SWASH it is possible to start the shells of these models and perform the simulations. SWASH prepared the models to guide the user easily through the various runs for pesticide applications to various crops, and it defines projects and runs for MACRO, PRZM and TOXSWA that can be selected for execution after starting the corresponding shells.

Samenvatting

Om de beoordeling van blootstellingscenario's voor oppervlaktewater uit te voeren, dienen een aantal modellen en hulpmiddelen na elkaar te worden gebruikt. Elk van deze hulpmiddelen en modellen is ontwikkeld voor een bepaald onderdeel van de beoordeling.

Dat zijn:
- Drift Calculator, om de depositie op het oppervlaktewater als gevolg van drift te berekenen;
- FOCUS_PRZM_SW_4.3.1, om de belasting van het oppervlaktewater via run-off en erosie te berekenen;
- FOCUS_MACRO_5.5.4, om de belasting van het oppervlaktewater via drains te berekenen;
- FOCUS_TOXSWA_4.4.3, om het gedrag van de actieve stoffen en hun metabolieten in oppervlaktewater te berekenen.

Om de berekening van de blootstellingsconcentratie voor Stap 3 te vergemakkelijken, werd een instrument ontwikkeld: SWASH, acronym voor Surface WAter Scenarios Help. Het is een overkoepelende gebruikersvriendelijke schil, die zowel het instrument om de depositie als gevolg van spuitdrift te bepalen omvat als de modellen die gebruikt worden voor berekeningen voor Stap 3. Sinds SWASH versie 4.2 is de module met de stofgegevens geen onderdeel meer van SWASH en in plaats daarvan is SPIN (Substance Plug In) geïntroduceerd.

De depositie op het oppervlaktewater als gevolg van drift wordt automatisch berekend door de Drift Calculator. De Drift Calculator kan ook gebruikt worden om de drift te berekenen voor afzonderlijke, niet-standaard FOCUS stap 3, runs.

FOCUS_PRZM is een model dat binaire bestanden gebruikt voor opslag van gegevens van stoffen. Deze bestanden worden door SWASH bijgewerkt.

FOCUS_MACRO is een run-georiënteerd model. Het model gebruikt een MS Access-database (pest_focus.mdb) voor opslag van gegevens van stoffen en runs. Deze database wordt bijgewerkt door SWASH.

FOCUS_SWASH is een project-georiënteerd model. De gebruiker definieert een project voor een stof. Voor het project worden runs gemaakt voor de geselecteerde gewassen, scenario's en type waterlichamen. Voor elk project kan SWASH een rapport genereren met een overzicht van de runs.

FOCUS_SPIN wordt gebruikt om gegevens over de stoffen op te slaan in een gemeenschappelijke database die kan worden gebruikt door verschillende modellen van Alterra Wageningen UR. SPIN kan worden benaderd vanuit SWASH en vanuit TOXSWA.

FOCUS_SWASH maakt ook een bestandsstructuur voor de verschillende modellen en hun invoer en uitvoer om daarmee een soepele en correcte communicatie tussen de verschillende modellen en hulpmiddelen. mogelijk te maken.

Na voltooiing van een SWASH sessie, moet de gebruiker handmatig runs met de individuele modellen afzonderlijk uitvoeren: FOCUS_PRZM, FOCUS_MACRO en FOCUS_TOXSWA. Vanuit FOCUS_SWASH is het mogelijk de interfaces te starten en de runs uit te laten voeren. FOCUS SWASH is gemaakt om de gebruiker op een makkelijke manier te loodsen in het proces van het maken en het uitvoeren van verschillende runs voor toepassingen van gewasbeschermingsmiddelen voor verschillende gewassen, en het definieert projecten en runs voor FOCUS_PRZM, FOCUS_MACRO en FOCUS_TOXSWA die uitgevoerd kunnen worden na het opstarten van deze applicaties.

1 Introduction

Spray drift, drainage and run-off are three major routes of pesticide entry into surface waters. Using spray-drift deposition tables and the MACRO, PRZM and TOXSWA models the exposure concentrations in surface waters can be assessed. Exposure scenarios have been developed as part of the EU evaluation process under 91/414/EEC (FOCUS, 2001). To carry out the EU FOCUS pesticide exposure assessment scenarios for surface waters, a number of FOCUS tools and models have to be run in sequence. Each of these tools and models have been developed separately targeting a specific aspect relevant to the assessment:

- Drift Calculator, calculating pesticide transport through drift;
- PRZM-3, calculating pesticide transport through runoff and erosion;
- MACRO, calculating pesticide transport through drainage;
- TOXSWA, calculating the fate of pesticides in surface waters;
- SPIN, storage of pesticide properties.

To facilitate the calculation of exposure concentrations at step 3 level a software tool has been developed: SWASH, acronym for Surface WAter Scenarios Help. It is an overall user-friendly shell, encompassing a number of individual tools and models involved in Step 3 calculations. The main functions of SWASH are:

- Connecting with SPIN to maintain the pesticide properties database. Updating MACRO database (pest_focus.mdb) and PRZM data-files (chmdat.dat, chmnum.dat);
- Provision of an overview of all Step 3 FOCUS runs required for use of a specific pesticide on a specific crop. Therefore a project is created containing all needed runs with unique runId's for all models;
- Calculation of spray drift deposition onto various receiving water bodies; and
- Preparation of input for the MACRO, PRZM and TOXSWA models. Exporting run information to the MACRO database. Creating a przm.prj file with run information for PRZM. Updating the SWASH database to prepare for TOXSWA.

In addition, SWASH provides information on the FOCUS Surface Water Scenarios.

Finally, SWASH proposes and creates a directory structure for the various models and their input and output to enable a smooth and correct communication between the various tools.

After defining a project in SWASH the user can start from SWASH the other individual models: SPIN, PRZM, MACRO and TOXSWA. SWASH does not execute model runs, but provides guidance, it helps the user to determine which runs need to be performed for pesticide applications to various crops, and it defines projects and runs for MACRO, PRZM and TOXSWA that can be selected for execution after starting the corresponding shells.

Major differences with the previous version:

- All pesticide properties are now handled through the SPIN interface and maintained in the SPIN database. In the previous version the pesticide properties where synchronized between SWASH, PRZM and MACRO. In this version of SWASH synchronisation is done in one direction, SWASH updates the PRZM and MACRO pesticide databases with the information from the SPIN database.

2 Dataflow between the models

SWASH is responsible for the flow of data between the models. Figure 2.1 shows a scheme of the dataflow.

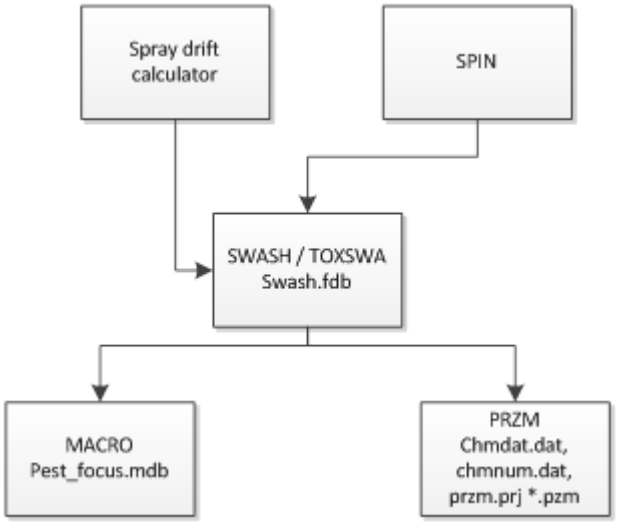


Figure 2.1 Flow of data between the models

SWASH gets input from the Drift Calculator. The drift percentage is calculated and used by SWASH as input for TOXSWA.

TOXSWA uses the same database as SWASH. No transfer of data is necessary. SWASH just updates some tables in the database that are used by TOXSWA.

SWASH uses SPIN to get the necessary pesticide data. SWASH updates the database of MACRO with information of the pesticides. Runs created in a SWASH project are exported to MACRO. It is not possible to create runs in MACRO so no run information has to be exported from MACRO to SWASH.

SWASH updates the data files chmdat.dat and chmnum.dat of PRZM with information of the pesticides.. Projects created by SWASH are stored in the file przm.prj. This file is used by PRMZ to locate the information of the runs in the projects. Information of the runs needed for one crop is stored in pzm-files.

3 Data Structure

The central pesticide database (SPIN database) stores information on physico-chemical properties as well as the use patterns of the compound. Data can be entered directly by the user using the SPIN shell. After exiting SWASH, the information in the central database is written back into the databases of MACRO or in sets of input files for PRZM. TOXSWA makes use of the SPIN database. In this way SWASH ensures that identical or consistent information on pesticide properties and pesticide use is introduced into the consecutive model runs.

The SWASH database holds, among other data, information about crops, locations, occurrence of crops in locations, use patterns of chemicals on crops and water body types of locations (i.e. pond, ditch, stream).

The SWASH application communicates with the database and interacts with the user on the type of assessment to be made. The application allows the user to select a chemical, a crop and a use pattern.

3.1 SWASH database

See Appendix 1 for the database structure of the SWASH database. It is located at the \SWASH\DATA directory.

3.1.1 Projects

In SWASH the user creates projects. Each project has one or more runs (table runs). Each run is characterized by a substance, location, crop and waterbody type and has a specified application scheme (table applications).

3.1.2 Runs

In SWASH each run is characterized by an unique run identity number (runid). This number contains no other information like in previous versions of SWASH, the number is used to create filenames belonging to this specific run.

Also each run has one substance, identified by the unique SubstanceGUID . This unique identifier is maintained by SPIN, the SPIN database contains all the information about the substance.

MACRO has another system to number runs. Its input files and output files have names according to the format names123.ext, in which:

Names	Specifies file name: macro, paren or metab
123	A unique 3-digit number, enabling a maximum of 999 different runs to be istinguished
Ext	Specifies file extension, e.g. .par, .bin, .log, or .sum.

Only the m2t output file, containing the water and pesticide fluxes entering the waterbody, is named differently. This output file has the format Macro12345_x.m2t, in which:

Macro	Specifies file name
12345	The unique 5-digit number, corresponding with the SWASH runid for the indicated run. N.B. Note that this 5-digit runid differs from the 3-digit runid of MACRO !
X	Substance type: p = parent, m = metabolite. MACRO can only handle one metabolite per parent run. However, if two parallel soil metabolites have been defined in SWASH, the output of the two MACRO runs can be combined, resulting in renamed metabolite files 'm_1' and 'm_2', connecting the two soil metabolites to one runID.
m2t	Extension, indicating this the MACRO output file with lateral entry fluxes for TOXSWA.

The PRZM model does not use run identity numbers to identify input files and output files, except the p2t file, containing the water and pesticide fluxes for TOXSWA. The p2t output file has the format 12345_Cx.p2t, in which:

12345 The unique 5-digit number, corresponding with the SWASH runid for the indicated run.

Cx Substance type: C1 = parent, C2 = first metabolite and C2 = second metabolite (parallel or consecutively formed) PRZM can handle both metabolites in a single run.

p2t Extension, indicating this the PRZM output file with lateral entry fluxes for TOXSWA.

More details on the run identity numbering are given in the first section of Chapter 4.

3.1.3 Substances

The maximum length of the substance name is currently 15 characters. All the other info about substances is moved into the SPIN database, see the SPIN manual for more information (Van Kraalingen *et al.*, 2013).

3.1.4 Global information

Data for projects and substances can be changed by the user. Next to these data the database contains static data that is used by SWASH and contains information about crops, locations, occurrence of crops in locations, pesticide properties, use patterns of chemicals on crops and water body types of locations (i.e. pond, ditch, stream). The user can just view this information. e.g. a list with crops for a specified scenario.

The tables FocusSubstancexCropxLocation and FocusScenarios store some default values on the application pattern.

The tables Waterbodies, Ganzelmeier and Regression have data needed for the drift calculator.

3.2 MACRO

MACRO uses three MS Access databases:

1. Crops.mdb : crop information.
2. Focus.mdb : soil information.
3. Pest_focus.mdb : run and substance information.

SWASH only uses the pest_focus.mdb. Appendix 2 shows the structure of this database. It is located at the main MACRO directory \SWASH\MACRO.

The tables compound and metab have the substance information whereas the tables run and applications hold the project information. However MACRO doesn't define projects but just uses runs. Each run is characterized by a substance (compound), location and crop.

3.3 PRZM

PRZM stores its information in data files. The files chmdat.dat and chmnum.dat are used by SWASH. These files contain the substance information, chmdat.dat the real information and chmnum.dat the number of substances. They are located at the subdirectory \SWASH\PRZM\WPIC.

3.4 TOXSWA

TOXSWA uses the same database as SWASH. TOXSWA runs are linked to an Application scheme. This scheme has one or more applications and can be used by one or more runs. In SWASH each runs has its own applications, this makes it necessary that SWASH prepares the database for TOXSWA.

3.5 Matching Data

At the start of SWASH all projects are checked if the used substances were not changed since last time and if the substances are still valid for use in SWASH.

When the user in SWASH has created a project and has selected the option to export FOCUS input, runs are exported to the MACRO database. This option also creates input files for PRZM.

Before the user starts the MACRO shell from SWASH substances are exported to the MACRO database. Analogously, substance information is exported to the PRZM data files chmdat.dat, chmnum.dat, when the user starts the PRZM shell. TOXWA uses the SWASH database and the SPIN database therefore no further matching of data for TOXSWA is necessary.

3.5.1 Export runs to MACRO

With the 'Export FOCUS input to MACRO, PRZM and TOXSWA' button in SWASH all runs are exported to the MACRO database. This means adding or replacing the records in the runs and applications tables.

Just one run is created in MACRO for locations with more than one waterbody type and only for drainage scenarios.

These are the matching fields in the MACRO and SWASH tables.

MACRO	SWASH
Run:	**Runs:**
- runid (i.e. communal SWASH runID)	- RunID
- first_day	- FirstDayYrApp
- last_day	- LastDayYrApp
- num_apps	- NumberOfApps
- min_int	- MinIntervalApps
- app_method	- AppMeth
- compound	- SubstanceCaption from Spin
- cropname	- CropCode
- location	- LocationCode
- text_info	Description
- PathInOut	**Project**.Path + '\MACRO\' + CropCode (without illegal characters like space and &,*,?)
- projectname	Projects.Caption
- projectid	Projects.ProjectID
Applications:	**Applications:**
- RunID	- RunID
- ApplicationNr	- ApplicationNr
- Dose	- Rate

3.5.2 Export substances to MACRO

When the user starts the MACRO shell, all substances are exported to the MACRO database. First all substances in the MACRO compound and metab table are removed. The information MACRO needs of a compound is stored in SPIN. The contents is copied into the MACRO table compound or metab. All substances which are marked as parent go to table compound. Substances not marked as parent or substances used as metabolite are exported to table metab. In the MACRO table metab the field inform refers to the parent substance.

MACRO	SWASH
If Parent then:	
Compound:	**substance_Macro:**
- name	- substanceCode
- Koc	- 1.724 * KOMEQL
- halflife	- DT50Ref
- tref	- TEMPREFTRA
- vap	- PREVAPREF
- VpTemp	- TEMREFVAP
- pf	- PFTRA
- expb	- EXPLIQTRA
- tresp	- EXPEMTRA
- freund	- EXPFRE
- diffusion	- COFDIFWATREF / 86400
- fstar	- FACUPT
- fext	- FACWASCRP/1000
- candeg	- 0.6931/DT50DSPCRP
	substances:
- inform	- NAME
- FOCUStest	- Locked
- MolMas	- MOLMASS
- Slb	- SLBWATREF
- SlbTemp	- TEMREFSLB
If Parent Compound has metabolites then:	
* *first metabolite*	
Metab:	**substances:**
- name	- SubstanceCode
- inform	- ParentCode
* *second metabolite*	
Metab:	**substances:**
- name	- SubstanceCode
- inform	- ParenteCode
If not Parent:	
Metab:	**substance_Macro:**
- name	- SubstanceCode
- Koc	- 1.724 * KOMEQL
- halflife	- DT50REF
- tref	- TEMREFTRA
- vap	- PREVAPREF
- VpTemp	- TEMREFVAP
- pf	- PETRA
- expb	- EXPLIQTRA
- tresp	- EXPTRMTRA
- freund	- EXPPFRE
- diffusion	- COFIDFWATREF / 86400
- fstar	- FACUPT
- fconvert	- fraction = FRAPARTDAU (Molmass Metabolite / Molmass parent)

3.5.3 Export substances to PRZM

SWASH gets all parents from the SPIN database, if necessary adds the information of the metabolites and writes this to the PRZM datafile chmdat.dat. The number of written records to the datafile is written in the other datafile chmnum.dat.

```
sub.subcode := substanceCode;
sub.pstname[1] := substanceCode;//SubstanceInfo.Values['NAME'];

sub.prtrn12 := 0;
sub.prtrn13 := 0;
sub.prtrn23 := 0;

sub.dtr121a := 0;
sub.dtr121b := 0;
sub.dtr121c := 0;
sub.dtr122a := 0;

sub.dtr131a := 0;
sub.dtr131b := 0;
sub.dtr131c := 0;
sub.dtr132a := 0;

sub.dtr231a := 0;
sub.dtr231b := 0;
sub.dtr231c := 0;
sub.dtr232a := 0;

if (iSpin.StrToBoolean(SubstanceInfo.Values['OPTTRABIP'])) then
sub.icheck1 := 1
else
sub.icheck1 := 0;

sub.icheck2 := 1;
sub.icheck3 := 1;

sub.icheck5 := 1;
sub.iqfac   := 1;
sub.iqfac_  := 1;

sub.kdtyp[1] := 1;
sub.apptyp[1] := 0;
sub.apprel[1] := 0;
sub.napp[1] := 0;

sub.drate1a[1] := StrToFloat(SubstanceInfo.Values['DT50REF']);
sub.drate1c[1] := 0;

if iSpin.StrToBoolean(SubstanceInfo.Values['OPTTRABIP']) then
begin
sub.dknum[1] := StrToInt(SubstanceInfo.Values['NUMDAYLAGTRABIP']);
sub.drate2a[1] := StrToFloat(SubstanceInfo.Values['DT50TRABIP'])
end
else
begin
sub.dknum[1] := 0;
sub.drate2a[1] := 0;
end;

sub.fextrc[1] := StrToFloat(SubstanceInfo.Values['FACWASCRP'])/100;
sub.q10fac[1] := StrToFloat(SubstanceInfo.Values['Q10FACTRASOL']);
sub.qbase[1] := StrToFloat(SubstanceInfo.Values['TEMREFTRA']);
```

```
sub.mseff[1] := StrToFloat(SubstanceInfo.Values['EXPLIQTRA']);
sub.mslab[1] := StrToFloat(SubstanceInfo.Values['CNTLIQTRAMEA']);

sub.iset1 := StrToInt(SubstanceInfo.Values['OPTCNTLIQTRAMEA']);
sub.iset2 := StrToInt(SubstanceInfo.Values['OPTCNTLIQTRAMEA']);
sub.iset3 := StrToInt(SubstanceInfo.Values['OPTCNTLIQTRAMEA']);

sub.mwght[1] := StrToFloat(SubstanceInfo.Values['MOLMASS']);

sub.kdsp[1] := Kom2Koc(StrToFloat(SubstanceInfo.Values['KOMEQL']));
sub.solub[1] := StrToFloat(SubstanceInfo.Values['SLBWATREF']);
sub.enpy[1] := StrToFloat(SubstanceInfo.Values['MOLENTVAP'])*4.18;
sub.dair[1] := StrToFloat(SubstanceInfo.Values['COFDIFAIRREF'])*10000;
sub.drate1a[1] := StrToFloat(SubstanceInfo.Values['DT50REF']);
sub.vp[1] := StrToFloat(SubstanceInfo.Values['PREVAPREF']) * 1000;
sub.uptkf[1] := StrToFloat(SubstanceInfo.Values['FACUPT']);
sub.frndcf[1] := StrToFloat(SubstanceInfo.Values['EXPFRE']);
sub.pldkrt[1] := StrToFloat(SubstanceInfo.Values['DT50DSPCRP']);
```

The information about the metabolites involves some code to resolve the correct scheme. Four valid schemes can be determined, for creating metabolites.

- One parent no metabolites
- One parent one metabolite
- One parent splitting into two metabolites
- One parent two metabolites in sequence

3.5.4 Crop names

Every model should use the crop names in the following table. When SWASH creates a project (see Chapter 4) a subdirectory is created for each crop in a project using the name of the crop. As some characters cause problems these are replaced by underscore characters. The names in the second column are used as directory names.

MACRO doesn't know early or late applications. For MACRO this part of the crop name is omitted.

Name	Directory name
Appln, aerial	
Appln, hand (crop < 50 cm)	
Appln, hand (crop > 50 cm)	
Cereals, spring	Cereals_spring
Cereals, winter	Cereals_winter
Citrus	Citrus
Cotton	Cotton
Field beans	Field_beans
Grass/alfalfa	Grass_alfalfa
Hops	Hops
Legumes	Legumes
Maize	Maize
no drift (incorp or seed trtmt)	
Oil seed rape, spring	Oil_seed_rape_spring
Oil seed rape, winter	Oil_seed_rape_winter
Olives	Olives
Pome/stone fruit, early applns	Pome_stone_fruit_early_applns
Pome/stone fruit, late applns	Pome_stone_fruit_late_applns
Potatoes	Potatoes
Soybeans	Soybeans
Sugar beets	Sugar_beets

Name	Directory name
Sunflowers	Sunflowers
Tobacco	Tobacco
Vegetables, bulb	Vegetables_bulb
Vegetables, fruiting	Vegetables_fruiting
Vegetables, leafy	Vegetables_leafy
Vegetables, root	Vegetables_root
Vines, early applns	Vines_early_applns
Vines, late applns	Vines_late_applns

3.5.5 Scenarios

For the scenarios or locations the next coding should be used:

LocationCode	Weather station	LocationTypeCode
D1	Lanna (S)	DRAINAGE
D2	Brimstone (UK)	DRAINAGE
D3	Vredepeel (NL)	DRAINAGE
D4	Skousbo (DK)	DRAINAGE
D5	La Jailliere (F)	DRAINAGE
D6	Thiva (GR)	DRAINAGE
R1	Weiherbach (D)	RUNOFF
R2	Porto (P)	RUNOFF
R3	Bologna (I)	RUNOFF
R4	Roujan (F)	RUNOFF

4 Creating projects

4.1 General

In SWASH the user creates projects. Each project is characterized by one substance. Each project has one or more runs (table runs). This means for one substance several runs can be defined. Each run is characterized by a location, crop and waterbody type and has a specified application scheme (table applications). The last column of the projects grid on the Overview of composed projects screen contains the status of the project (see Appendix 10 for an explanation of the status).

SWASH searches for every possible combination of location, crop and waterbody type. For each combination SWASH creates a run for the parent substance. If the parent substance has metabolites, a run is created for each metabolite.

Each run has a RunID which is unique.
Below two examples are presented, that illustrate how runids are allocated to the various runs of the different models.

Example 1: fictitious crop in D2 and R1 for a parent and two parallel metabolites, runid starting at 30, all Runid's are unique

Scenario	Waterbody	Parent/meta	Runid SWASH	Runid MACRO or PRZM
D2	Ditch	Parent	00030	Macro00030_p.m2t
D2	Ditch	Meta1	00030	Macro00030_m1.m2t
D2	Ditch	Meta2	00030	Macro00030_m2.m2t
D2	Stream	Parent	00031	Macro00031_p.m2t
D2	Stream	Meta1	00031	Macro00031_m1.m2t
D2	Stream	Meta2	00031	Macro00031_m2.m2t
R1	Pond	Parent	00032	00032_C1.p2t
R1	Pond	Meta1	00032	00032_C2.p2t
R1	Pond	Meta2	00032	00032_C3.p2t
R1	Stream	Parent	00033	00033_C1.p2t
R1	Stream	Meta1	00033	00033_C2.p2t
R1	stream	Meta2	00033	00033_C3.p2t

Example 2: fictitious crop at D4 and R1 for a parent and two (consecutive) metabolites, one being formed from the first metabolite, runid starting at 50, al Runid's are unique

Scenario	Waterbody	Parent/ metabolite	Runid SWASH=TOXSWA	Runid MACRO or PRZM
D4	Pond	Parent	00050	Macro00050_p.m2t
D4	Pond	Meta1	00050	Macro00050_m.m2t*
D4	Stream	Parent	00051	Macro00051_p.m2t
D4	Stream	Meta1	00051	Macro00051_m.m2t
				Please note that MACRO cannot handle meta2
R1	Pond	Parent	00052	00052_C1.p2t
R1	Pond	Meta1	00052	00052_C2.p2t
R1	Pond	Meta2	00052	00052_C3.p2t
R1	Stream	Parent	00053	00053_C1.p2t
R1	Stream	Meta1	00053	00053_C2.p2t
R1	Stream	Meta2	00053	00053_C3.p2t

*see Section 3.1.2 for explanation of numbering parallel metabolites in MACRO

One of the main functions of SWASH is the preparation of input for the MACRO, PRZM and TOXSWA models. This consist of three parts: Creating a project report, files required to run PRZM and preparing the MACRO database. SWASH also updates some tables in the SWASH database to prepare for TOXSWA.

When the user creates a project he has to enter a path for the project. Default path is C:\SWASHProjects\. The directory is always the project name. At this directory all input and output will be written. The next structure is created in case of the default path name and a project called 'test' with scenarios for 2 crops:
(Files in italic are created by SWASH, rest are model output files)

```
C:\SWASHProjects\test
                  \MACRO                 test_report.txt
                        \crop1           *.M2T
                        \crop2           *.M2T
                  \PRZM\
                        \crop1           *.P2T, *.zip, *.pzm
                        \crop2           *.P2T, *.zip, *.pzm
                  \TOXSWA                *.txw
```

SWASH maintains for PRZM a file with a listing of all created projects. This file, przm.prj, is located at the main directory of the PRZM application. It has the next record structure:

```
1-20:      Projectname     // EPPOA
21-100:    Projectpath     // C:\SWASHprojects\EPPOA
101-117:   CreationDate    // 26-Nov-2001-09:49
```

4.2 Project Report

SWASH creates a report file (<projectname>_report.txt) with a listing of all created runs and its application pattern. The report also shows the Mean Deposition and Mass Loading from the drift calculation. In case there are two or more primary metabolites formed in water also indicated is for which primary water metabolite a correction factor is calculated (for more information see Section 2.1.6 in Van den Berg et al., 2014) This report is a guideline for the user, it gives an overview of all runs to be performed with the various models.

4.3 Files for PRZM

PRZM has only runs to do for the runoff scenarios. For each crop in the project a przm.pzm file is created. It is located at the PRZM\crop subdirectory. This file is read by PRZM and contains all information it needs to do a run. The file is structured like a windows ini-file and looks like this:

```
[generalsettings]
ProjectName=Eppoa
SubstanceCode=EPPOA
Relationship=1          // one, two or no metabolites
CropCode=Legumes
R1=00005                // run ids
R2=00006
R3=00007
R4=00008

[Applications]          // Application pattern is identical for all runs
AppMethod=ground spray
NumberOfApp=1
// Rate  CAM   Depi
1= 1.00  0     4.0

[R1]
```

```
FirstDayYrApp=91       // first possible day in year of LastDayYrApp=121
           // last possible day in year of MinIntervalApps=1          //
minimum interval in days between

[R2]
FirstDayYrApp=96
LastDayYrApp=126
MinIntervalApps=1

[R3]
FirstDayYrApp=97
LastDayYrApp=127
MinIntervalApps=1

[R4]
FirstDayYrApp=97
LastDayYrApp=127
MinIntervalApps=1
```

Corresponding application methods:

PRZM	SWASH
A	arial appl.
AB	arial blast
G	grannular appl.
GS	ground spray
S	soil incorp.

For some application methods additional information is required in PRZM such as CAM values (Chemical Application Method) and Depth.

Allowed combinations and default values:

App. Method	CAM	Depth
aerial appl.	1 - appln soil linear	4
	2 - appln foliar linear	4
air blast	1 - appln soil linear	4
	2 - appln foliar linear	4
granular appl.	1 - appln soil linear	4
	4 - incorp soil uniform	10
	5 - incorp soil lin.increase	10
	6 - incorp soil lin.decrease	10
	8 - incorp soil at one depth	10
ground spray	1 - appln soil linear	4
	2 - appln foliar linear	4
soil incorp.	1 - appln soil linear	4
	4 - incorp soil uniform	10
	5 - incorp soil lin.increase	10
	6 - incorp soil lin.decrease	10
	8 - incorp soil at one depth	10

4.4 Preparing MACRO database

Preparing the MACRO database means exporting the created runs in the project to the MACRO database. (See 3.5.1 Export runs to MACRO).

MACRO uses the same application methods as SWASH. However in the MACRO database it is stored in the table run as a number in the app_method field:

SWASH	MACRO
aerial appl.	0
air blast	1
granular appl.	2
ground spray	3
soil incorp.	4

4.5 Preparing TOXSWA database

TOXSWA uses the SWASH database. To prepare the database for TOXSWA some tables are updated.

- Table Projects
  - ProjectID: create new id
  - Caption: projects.Name
  - Description: projects.Description
  - ModificationDate: Now
- Table R*uns*
  - RunID: Runs.RunID
  - OptTimStp 1
  - TimestepSediment 600.0
  - TimStpWat 600.0
  - TimestepHydrology 600.0
  - OptSimHydrology 2
  - OptLatEntryModel 1
  - OptDelTimPrn 1
  - OptLoadingHourDay 1
  - InitialConcWL 0.0
  - nrOfHydrologyCurves 1

if Runoff
  - OptLatEntryModel 3

Else
  - OpLatEntryModel: 2 (MACRO)

  - StartDate: Default startdate simulation (see 4.4.1)
  - EndDate: Default enddate simulation (see 4.4.1)
  - ThicknessSedimentOutput 0.05
  - LatEntryFile: MACRO_M2T or PRZM_P2T filename

  - ThicknessSedimentOutput 0.05
  - StartDistanceEntries 0

If Pond
  - EndDistanceEntries 30

Else
  - EndDistanceEntries 100

  - RatioUpstreamBound 0.2
  - OptInputUpstreamBound True

If R2 en R3
  - RationInfiltration 0.03

Else if R1 en R4
  - RationInfiltration 0.1

Else
  - RationInfiltration 0.0

  - ThicknessSedEroAdded 0.01
  - FraMetForDrfUps 1
  - FraMetForDraRnfUps1

- Table *ApplicationSchemes*
  - ApplicationSchemeID ID
  - Name AppScheme_ + aRun.RunID
- Table *AbsoluteApplications*
  - AbsoluteApplicationsID ID
  - ApplicationNr i+1

- Rate 1
- FocusPrzmCamTypeID FocusPrzmCAMType.ID
- FocusPrzmApplicationMethodID FocusPrzmApplicationMethods.ID
- FocusPrzmDepi FocusPrzmApplicationCAMDefaults.Depi
- DrifPerc Calculated SprayDrift by Calculator (0 if metabolite and multiplied by 1.2 if STREAM).

Default Simulation dates

Scenario	StartDate	EndDate
D1	01-Jan-1982	30-Apr-1983
D2	01-Jan-1986	30-Apr-1987
D3	01-Jan-1992	30-Apr-1993
D4	01-Jan-1985	30-Apr-1986
D5	01-Jan-1978	30-Apr-1979
D6	01-Jan-1986	30-Apr-1987

Scenario	First day of application	StartDate	EndDate
R1	March – May	01-Mar-1984	28-Feb-1985
R1	June – Sept	01-Jun-1978	31-May-1979
R1	Oct – Feb	01-Oct-1978	30-Sep-1979
R2	March – May	01-Mar-1977	28-Feb-1978
R2	June – Sept	01-Jun-1989	31-May-1990
R2	Oct – Feb	01-Oct-1977	30-Sep-1978
R3	March – May	01-Mar-1980	28-Feb-1981
R3	June – Sept	01-Jun-1975	31-May-1976
R3	Oct – Feb	01-Oct-1980	30-Sep-1981
R4	March – May	01-Mar-1984	28-Feb-1985
R4	June – Sept	01-Jun-1985	31-May-1986
R4	Oct – Feb	01-Oct-1979	30-Sep-1980

5 Installation & Software Requirements

The installation procedure only includes the installation of SWASH. Versions of MACRO, PRZM or TOXSWA should be installed at subdirectories of SWASH. The FOCUS Version Control Workgroup takes care of version control of the various tools. The SWASH developer has made 'Installation and Communication requirements' protocols for the various tools, to which each model update should comply (Appendix 6, 7 and 8).

SWASH is default installed at the directory C:\SWASH. The user has the possibility to choose another drive. However versions of PRZM, MACRO and SWASH must be installed at a subdirectory of the chosen drive. (See Appendix 9 for details.)

At that drive the next structure is created:

```
C:\SWASH                SWASH-applicationfiles
      \DATA             SWASH.fdb
            \MAPS       map-files
      \MACRO            <MACRO-applicationfiles>
      \PRZM             <PRZM-applicationfiles, przm.prj>
            \MET
            \PROGS
            \T3G
            \WPIC       <chmdat.dat, chmnum.dat>
      \TOXSWA           <TOXSWA-applicationfiles>
```

Files between <> are not installed during the SWASH installation. Installations of MACRO, PRZM or TOXSWA take care of that.

For requirements and platforms see Appendix 9: Read_me file for installation of the SWASH software package

References

Berg, F. van den , G. Fait, P.I. Adriaanse, A. de Jong , J.A. te Roller & W.H.J. Beltman (2015). SWASH Manual 5.3. WOt-technical report 36. WOT Natuur & Milieu Wageningen UR, Wageningen, the Netherlands

FOCUS (2002). FOCUS Surface Water Scenarios in the EU Evaluation Process under 91/414/EEC. Report of the FOCUS Working Group on Surface Water Scenarios, EU Document Reference SANCO/4802/2002, rev.1.221 pp.

Kraalingen, D. van , E.L. Wipfler, F. van den Berg, W.H.J. Beltman, M.S. ter Horst, G. Fait & J.A. te Roller (2013) SPIN Manual 1.1, Users Guide version 1. WOt-werkdocument 354. WOT Natuur & Milieu Wageningen UR, Wageningen, the Netherlands.

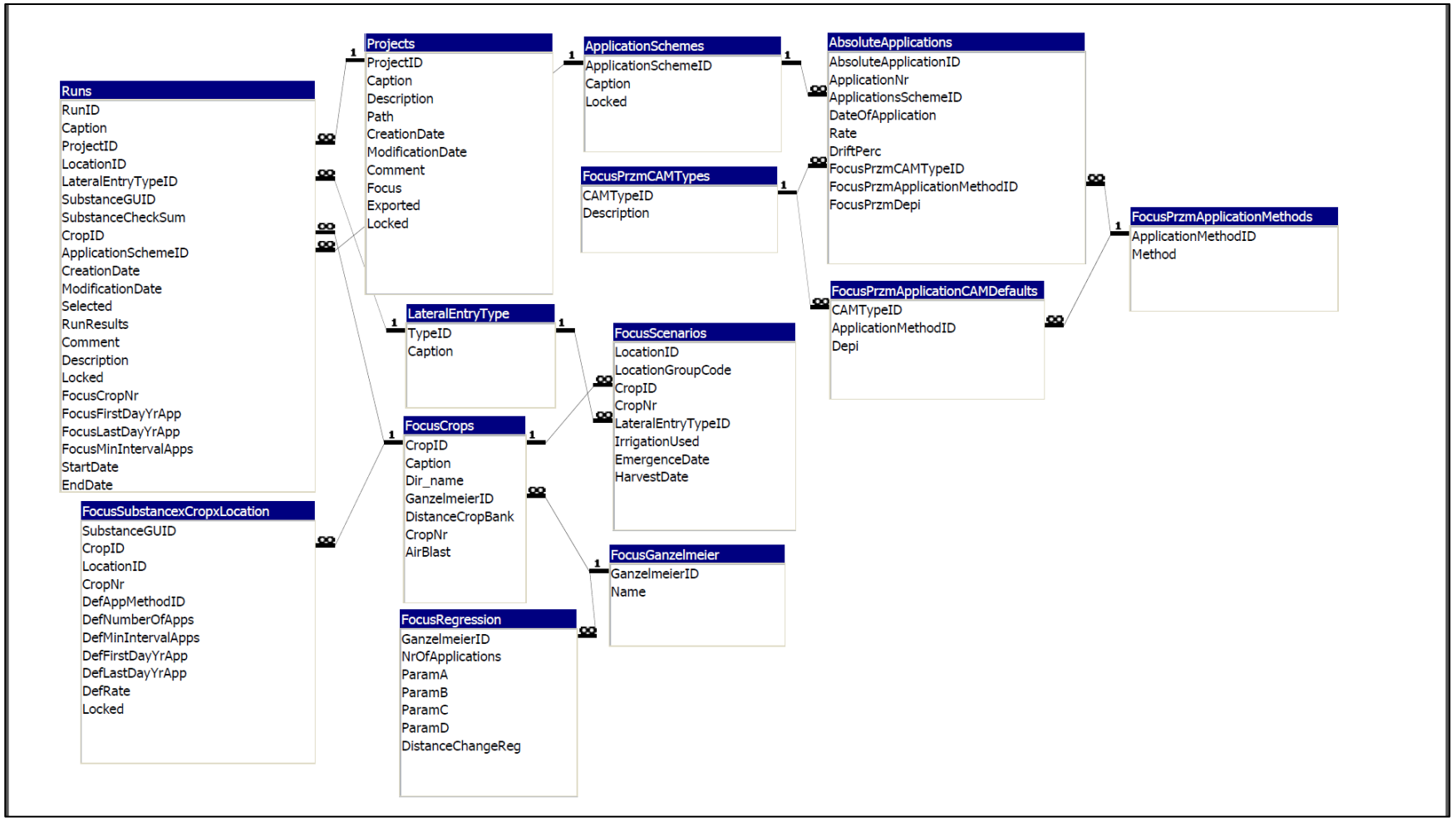
Roller, J.A. te, F. van den Berg, P.I. Adriaanse (2002). Surface Water Scenarios Help (SWASH), version 1.94, Technical report version 1.3. Alterra-rapport 508. Alterra Wageningen UR, the Netherlands.

Justification

This document is an update of the technical description of FOCUS_SWASH 1.1 (Te Roller *et al.*, 2002). The description is updated because the SWASH database and user interface have been adapted, of which the main change is that the pesticide properties part of SWASH has been moved to a new tool, SPIN.

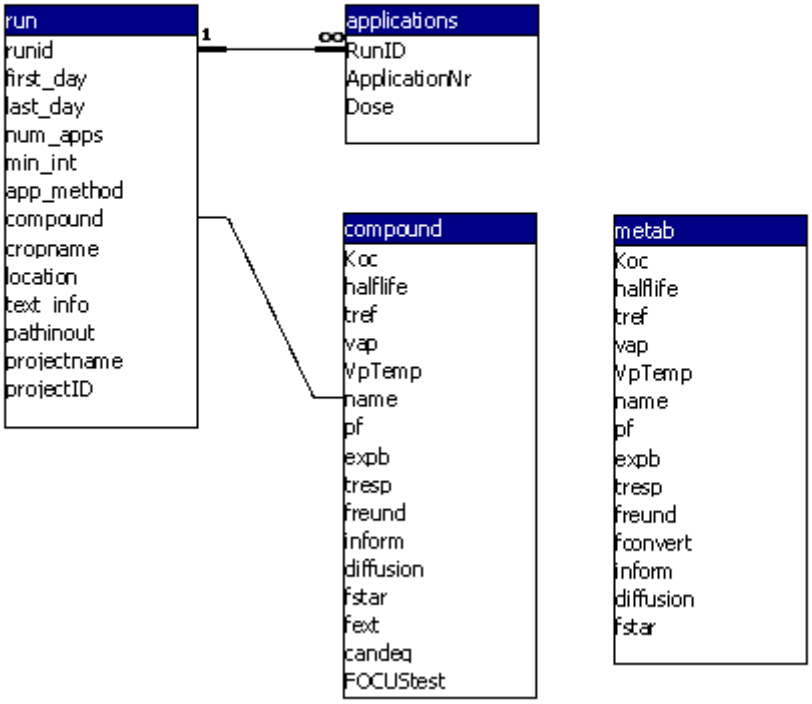
The content of this report was reviewed by Wim Beltman of Alterra Wageningen UR. The project was supervised by Jennie van der Kolk (contact of WOT Natuur & Milieu, theme Agri-Environment) and seen and approved by Anja van Gemerden (Ministry of Economic Affairs).

Annex 1 SWASH/TOXSWA database relationships



Annex 2 MACRO database relationships

Relationships for pest_focus
donderdag 26 september 2002



Annex 3 PRZM datafile structure CHMDAT.DAT

This part of a fortran subroutine shows the record structure of the data file chmdat.dat.

```
  SUBROUTINE GETCHM
!
!  Gets values of chemical from database and puts them into
!  dialog fields.
!
200 FORMAT(A20,A20,9(I1),I3,I2,e10.4,9(F7.2),A20,3(I1),I3,I2,e10.4,13(F7.2),&
           A20,3(I1),I3,I2,e10.4,17(F7.2),I1,6(F7.3),3(E10.4),6(F7.3),3(E10.4),4I1,&
           15I5,15F5.2,6F8.3)
  OPEN(21,FILE=DRVLTR//'\SWASH\PRZM\WPIC\CHMDAT.DAT',&
              STATUS='UNKNOWN',&
              ACCESS='DIRECT',&
              FORM='FORMATTED',RECL=760)
  READ(21,200,REC=NOPT1)SUBCODE,&
          PSTNAM(1),ICHECK1,ICHECK2,ICHECK3,ICOMBO3,&
          ICHECK5,IQFAC,KDTYP(1),APPTYP(1),APPREL(1),DKNUM(1),&
          NAPP(1),KDSP(1),DRATE1A(1),FRNDCF(1),DRATE1C(1),&
          DRATE2A(1),FEXTRC(1),PLDKRT(1),PRTRN12,Q10FAC(1),QBASE(1),&
          PSTNAM(2),KDTYP(2),APPTYP(2),APPREL(2),DKNUM(2),NAPP(2),&
          KDSP(2),DRATE1A(2),FRNDCF(2),DRATE1C(2),DRATE2A(2),&
          DTR121A,DTR121B,DTR121C,DTR122A,FEXTRC(2),PLDKRT(2),&
          PRTRN13,Q10FAC(2),QBASE(2),&
          PSTNAM(3),KDTYP(3),APPTYP(3),APPREL(3),DKNUM(3),NAPP(3),&
          KDSP(3),DRATE1A(3),FRNDCF(3),DRATE1C(3),DRATE2A(3),DTR131A,&
          DTR131B,DTR131C,DTR132A,DTR231A,DTR231B,DTR231C,DTR232A,&
          FEXTRC(3),PLDKRT(3),PRTRN23,Q10FAC(3),QBASE(3),IQFAC,&
          (MSEFF(K),K=1,3),(MSLAB(K),K=1,3),(SOLUB(K),K=1,3),&
          (MWGHT(K),K=1,3),(UPTKF(K),K=1,3),(VP(K),K=1,3),ISET1,ISET2,ISET3,&
          ICHECK6,((KDDAYS(K,I),I=1,5),K=1,3),((KDFAC(K,I),I=1,5),K=1,3),&
          (ENPY(K),K=1,3),(DAIR(K),K=1,3)
  CLOSE(21)
  IF(ICHECK3.EQ.0)IQFAC=0
!
  RETURN
  END SUBROUTINE GETCHM
```

Variable Definitions (Note: (1)=chemical 1 (2)=chemical 2 (3)=chemical 3)

SUBCODE	Substance Code
PSTNAM(1)	Pesticide name of chemical 1
ICHECK1	Flag for bi-phase degradtion
ICHECK2	Flag for Foliar applications
ICHECK3	Flag for Freundlich isotherm (non-linear adsorption)
ICOMBO3	Parent/Metabolite relationship
ICHECK5	Flag for volatilization
IQFAC	Flag for soil temperature/moisture degradation correction
KDTYP(1)	Soil Partition type
APPTYP(1)	Application type
APPREL(1)	Application timing
DKNUM(1)	Second Phase 1/2-life beginning relative to 1st application
NAPP(1)	# of applications
KDSP(1)	Soil Partition value
DRATE1A(1)	1/2-life days phase 1
FRNDCF(1)	Freundlich coefficient
DRATE1C(1)	unused in INFOCUS PRZM
DRATE2A(1)	1/2-life days phase 2
FEXTRC(1)	Foliar Extraction
PLDKRT(1)	Foliar Decay rate
PRTRN12	% transfer of parent degradation on foliage
Q10FAC(1)	q10 factor
QBASE(1)	q10 base temperature

```
PSTNAM(2)   Pesticide name of chemical 2
KDTYP(2)    Soil Partition type
APPTYP(2)   Application type
APPREL(2)   Application timing
DKNUM(2)    Second Phase 1/2-life beginning relative to 1st application
NAPP(2)     # of applications
KDSP(2)     Soil Partition value
DRATE1A(2)  1/2-life days phase 1
FRNDCF(2)   Freundlich coefficient
DRATE1C(2)  unused in INFOCUS PRZM
DRATE2A(2)  1/2-life days phase 2
DTR121A     % transfer of parent degradation in soil phase 1
DTR121B     unused in INFOCUS PRZM
DTR121C     unused in INFOCUS PRZM
DTR122A     % transfer of parent degradation in soil phase 2
FEXTRC(2)   Foliar Extraction
PLDKRT(2)   Foliar Decay rate
PRTRN13     % transfer of parent degradation on foliage
Q10FAC(2)   q10 factor
QBASE(2)    q10 base temperature
PSTNAM(3)   Pesticide name of chemical 3
KDTYP(3)    Soil Partition type
APPTYP(3)   Application type
APPREL(3)   Application timing
DKNUM(3)    Second Phase 1/2-life beginning relative to 1st application
NAPP(3)     # of applications
KDSP(3)     Soil Partition value
DRATE1A(3)  1/2-life days phase 1
FRNDCF(3)   Freundlich coefficient
DRATE1C(3)  unused in INFOCUS PRZM
DRATE2A(3)  1/2-life days phase 2
DTR131A     % transfer of parent degradation in soil phase 1 (1->3)
DTR131B     unused in INFOCUS PRZM
DTR131C     unused in INFOCUS PRZM
DTR132A     % transfer of parent degradation in soil phase 2 (1->3)
DTR231A     % transfer of parent degradation in soil phase 1 (2->3)
DTR231B     unused in INFOCUS PRZM
DTR231C     unused in INFOCUS PRZM
DTR232A     % transfer of parent degradation in soil phase 2 (2->3)
FEXTRC(3)   Foliar Extraction
PLDKRT(3)   Foliar Decay rate
PRTRN23     % transfer of parent degradation on foliage
Q10FAC(3)   q10 factor
QBASE(3)    q10 base temperature
IQFAC       Flag for soil temperature/moisture degradation correction
(MSEFF(K),K=1,3) Soil Moisture correction factor (exponent)
(MSLAB(K),K=1,3) Soil Moisture corrction factor (lab moisture)
(SOLUB(K),K=1,3) Solubility
(MWGHT(K),K=1,3) Molecular weight
(UPTKF(K),K=1,3) Uptake Factor
(VP(K),K=1,3)    Vapor Pressure
ISET1            Moisture factor relative to FC or % chemical 1
ISET2            Moisture factor relative to FC or % chemical 2
ISET3            Moisture factor relative to FC or % chemical 3
ICHECK6          Flag soil moisture correction
((KDDAYS(K,I),I=1,5),K=1,3) unused in INFOCUS PRZM
((KDFAC(K,I),I=1,5),K=1,3)  unused in INFOCUS PRZM
(ENPY(K),K=1,3)  enthalpy of vaporisation of pesticide for chem K
(DIAR(K),K=1,3)  diffusion coeff of pesticide in air for chem K
```

Annex 4 Format for proposal to change SWASH used for FOCUS Surface water scenarios, excluding the drift calculator (19 December 2014)

1. Current instrument version:	FOCUS_SWASH v4.2
tested with:	FOCUS_Drift Calculator v1.1 FOCUS_MACRO v5.5.4 FOCUS_PRZM_SW v3.1.1 FOCUS_TOXSWA v4.4.2
2. New instrument version:	FOCUS_SWASH v5.3
3. Change in shell or scenario input ?	Change in shell
4. Initiator for change: E-mail: Telephone:	Erik van den Berg erik.vandenberg@wur.nl + 31 317 481854
5. Is initiator part of team that developed the instrument ?	yes

6. Does the new version comply with the installation and communication requirements for FOCUS_MACRO, FOCUS_PRZM_SW and FOCUS_TOXSWA ?
yes

7. When did initiator send proposal to chairman ? 19 December 2014

8. When did chairman forward proposal to workgroup ?

9. Deadline for reactions by workgroup members:
(within two weeks after receipt; no reaction will be interpreted as approval)

10. Which independent expert has agreed to perform the quality check ?
P. Rainbird (email:peter.rainbird@syngenta.com)
Syngenta
Basel, Switzerland

11. Proposed change:

The new version:

- Calculates and stored the correction factor $CF_{m,up}$ for formation of primary metabolites in upstream catchment in stream scenarios, and
- Transfers a calibrated value of the exponent for the effect of liquid on the transformation rate from the SPIN database to the MACRO database, instead of the Walker values (default) in previous versions of SWASH.

FOCUS_SWASH version 5.3 can be installed on Windows XP, Windows Vista, Windows 7 and Windows 8. As Windows XP is no longer supported by Microsoft we cannot guarantee the working of the software on that platform.

12. Only if scenario input data change, the following questions have to be answered:
   - Is proposal change to underlying scenario definition ? no
   - Is proposal change to interpretation of existing scenario definition ? no

13. Would changes be needed as a result of this proposed change to:
   - Generic Guidance Document ? yes
   - Model parameterisation document for MACRO_SW ? yes
   - Model parameterisation document for PRZM_SW ? no
   - Model parameterisation document for TOXSWA ? yes
   - Technical guidance report for SWASH ? no

14. Comparison between old and new SWASH output for

A. All substance properties exported to MACRO and PRZM_SW for a compound plus one metabolite defined by the user in SWASH (see appendices for explanation and information of substance and metabolite).
B. All valid combinations of scenarios-crops-waterbody types, composed with the aid of the user-defined wizard.
C. All input data for the Pesticide Application Timer (PAT), exported to MACRO and PRZM_SW; one test for each application technique, plus one test for ground spray with multiple applications (see appendices for explanation and information on application pattern).
D. Runid exported to MACRO and PRZM_SW for runs defined in SWASH.

For step A, C and D the same project is used. Description of the project and its substance is given in the appendices.

A:
SWASH output for MACRO
(Defined in SPIN, then written by SWASH to C:\SWASH\MACRO\pest_focus.mdb and next read into the MACRO **shell**, from where the table below is filled in)

Property	**Parent**		**Metabolite**	
	Old	New	Old	New
Name	Sub7	Sub7	Met7	Met7
Conversion fraction	-	-	0.3	0.3
Diff.coeff. (m2/s)	5.67E-10	5.67E-10	4.51E-10	4.51E-10
Koc (cm3/g)	207	207	842.639	842.6395
Freundlich exp.	0.95	0.95	0.94	0.94
Half-life (d)	177	177	75.75	75.75
At temp (°C) [§]	21	21	15	15
And pF value	1	1	2	2
Exp. for temp. response	0.077	0.077	0.069	0.069
Exp. for moisture response	0.64	-	0.76	-
Exp. for moisture response (Calibrated)*	-	0.62	-	0.74
Crop uptake factor	0.47	0.47	0.56	0.56
Washoff coeff (1/cm)	0.064	0.062	-	-
Canopy dissipation coeff. (1/d)	1.04E-3	1.04E-3	-	-
Vapour pressure (mPa)	2.55E-3	2.55E-3	Not on screen in shell; but present in database	Not on screen in shell; but present in database
At temp (°C)	22	22	Not on screen in shell; but present in database	Not on screen in shell; but present in database

[§] Values for these parameters in MACRO same as in PRZM.

*Calibrated value introduced for use by MACRO in SWASH 5.3, up to SWASH version 4.2 Walker values used by MACRO and PRZM.

SWASH output for PRZM_SW
(Defined in SPIN, then by SWASH written to C:\SWASH\PRZM\wpic\chmdat.dat and next read into the PRZM_SW shell, from where the table below is filled in)

Property	**Parent**		**Metabolite**	
	Old	New	Old	New
Chem. Name	Sub7	Sub7	Met7	Met7
Molecular weight	356.000	356.000	178.000	178.000
Plant uptake factor	0.470	0.470	0.560	0.560
Partition coeff. method	KOC	KOC	KOC	KOC
Partition coeff. (L/kg)	0.2069E+3	0.2069E+3	0.8426E+3	0.8426E+3
Use non-linear adsorption ?	Yes	Yes	Yes	Yes
Freundlich exp. (1/n)	0.95	0.95	0.94	0.94
Simulate aged adsorption ?	No	No	-	-
Simulate volatilization ?	Yes	Yes	Yes	Yes
Vapor pressure (mPa)	0.2550E+01	0.2550E+01	0.7420E-01	0.7420E-01
Solubility (mg/L)	0.7115E+01	0.7115E+01	0.7676E+00	0.7676E+00
Degradation (d), phase 1 Phase 2	 177.00 0.00	 177.00 0.00	 75.75 0.00	 75.75 0.00
Percent of parent, Phase 1 and Phase 2	0.0000	0.0000	0.60	0.60
Use bi-phase degradation ?	No	No	No	No
Days after initial appln bi-phase half-life begins	0	0	1	1
Use temp and moisture corrected half-life ?	Yes	Yes	Yes	Yes
Q10 factor[§]	2.19	2.19	2.22	2.22
Q10 temp (°C) [§]	20.0	21.0	20.0	15.0
Moisture exponent (Walker)	0.640	0.640	0.76	0.76
Moisture content (%)	97.000	97.000	99.000	99.000
Abs or rel (FC)	Rel	Rel	Rel	Rel
Foliar applications ?	No	No	No	No
Foliar half-life (d)	666.00	666.00	- [¶]	- [¶]
Foliar washoff coeff. (1/mm)	0.64	0.64	- [†]	- [†]

[§] Values for these parameters in MACRO same as in PRZM.

[¶] Not relevant because the foliar half life of a metabolite is disabled in SWASH (values listed in SPIN are dummy values).

[†] Not relevant because the foliar wash-off coefficient of a metabolite is disabled in SWASH (value listed in SPIN is dummy value). Note that in SPIN a single value is introduced. For export to PRZM or MACRO the value is expressed in the unit required for each model. It is not mentioned in the PRZM parametrisation document (appendix D of FOCUS, 2001) whether and how PRZM_SW applies the foliar wash-off coefficient of a metabolite.

SWASH output for TOXSWA is not relevant, because SWASH and TOXSWA make use of the same table in the database.

B.

Compare SWASH project with Crops and scenarios association table (section 4.2.1) and Water bodies and scenarios association table (section 4.4.1) from FOCUS Surface Water Scenarios report (version June 2002). The SWASH project should be defined with the aid of the user-defined wizard, by selecting all crops, all waterbodies and all scenarios for an arbitrary compound, resulting in a project with 186 runs.

Project has 186 runs ? ✓ ☐

Comparison made (e.g. for 3 crops, 3 water bodies, 2 D scen and 2 R scenarios) ? ✓ ☐

C.

SWASH output for MACRO, PRZM_SW and TOXSWA

(Defined in SWASH, then written to C:\SWASH\MACRO\pest_focus.mdb, C:\SWASHProjects\testproject\PRZM\testcrop1\przm.pzm and C:\SWASHProjects\testproject\TOXSWA\testcrop1\12345x.txw and next read into the MACRO, PRZM_SW and TOXSWA shell, respectively, from where the table below is filled in)

	MACRO		**PRZM_SW**	
	Old	New	Old	New
5.1 Sugar beets				
6 Aerial appl?	Yes	Yes	Yes	Yes
No of applns	2	2	2	2
Possible d of applns: First Last (MACRO)/ Max appln window (PRZM)	 110 150	 110 150	 65 41	 65 41
Minimum interval	10	10	10	10
Rate of 1st appln (kg/ha PRZM, g/ha MACRO)	444.4	444.4	0.4444	0.4444
Rate of 2nd appln (kg/ha PRZM, g/ha MACRO)	333.3	333.3	0.3333	0.3333
Pome/stone fruit; early appl.				
7 Air blast?	Yes	Yes	Yes	Yes
No of applns	2	2	2	2
Possible d of applns: First Last (MACRO)/ Max appln window (PRZM)	 96 136	 96 136	 77 41	 77 41
Minimum interval	10	10	10	10
Rate of 1st appln (kg/ha PRZM, g/ha MACRO)	444.4	444.4	0.4444	0.4444
Rate of 2nd appln (kg/ha PRZM, g/ha MACRO)	333.3	333.3	0.3333	0.3333
7.1 Legumes				
8 Granular appl?	Yes	Yes	Yes	Yes
No of applns	2	2	2	2
Possible d of applns: First Last (MACRO)/ Max appln window (PRZM)	 99 139	 99 139	 97 41	 97 41
Minimum interval	10	10	10	10
Rate of 1st appln (kg/ha PRZM, g/ha MACRO)	444.4	444.4	0.4444	0.4444
Rate of 2nd appln (kg/ha PRZM, g/ha MACRO)	333.3	333.3	0.3333	0.3333
8.1 Field beans				
9 Ground spray?	Yes	Yes	Yes	Yes
No of applns	2	2	2	2
Possible d of applns: First	 91	 91	 78	 78

Last (MACRO)/ Max appln window (PRZM)	131	131	41	41
Minimum interval	10	10	10	10
Rate of 1st appln (kg/ha PRZM, g/ha MACRO)	444.4	444.4	0.4444	0.4444
Rate of 2nd appln (kg/ha PRZM, g/ha MACRO)	333.3	333.3	0.3333	0.3333
9.1 Maize				
10 Soil incorp?	Yes	Yes	Yes	Yes
No of applns	2	2	2	2
Possible d of applns: First Last (MACRO)/ Max appln window (PRZM)	 116 156	 116 156	 107 41	 107 41
Minimum interval	10	10	10	10
Rate of 1st appln (kg/ha PRZM, g/ha MACRO)	444.4	444.4	0.4444	0.4444
Rate of 2nd appln (kg/ha PRZM, g/ha MACRO)	333.3	333.3	0.3333	0.3333
10.1 Winter cereals				
11 Ground spray?	Yes	Yes	Yes	Yes
No of applns (>1)	6	6	6	6
Possible d of applns: First Last (MACRO)/ Max appln window (PRZM)	 251 311	 251 311	 321 61	 321 61
Minimum interval	6	6	6	6
Rate of 1st appln (kg/ha PRZM, g/ha MACRO)	666.6	666.6	0.6666	0.6666
Rate of 2nd appln (kg/ha PRZM, g/ha MACRO)	555.5	555.5	0.5555	0.5555
Rate of 3rd appln (kg/ha PRZM, g/ha MACRO)	444.4	444.4	0.4444	0.4444
Rate of 4th appln (kg/ha PRZM, g/ha MACRO)	333.3	333.3	0.3333	0.3333
Rate of 5th appln (kg/ha PRZM, g/ha MACRO)	222.2	222.2	0.2222	0.2222
Rate of 6th appln (kg/ha PRZM, g/ha MACRO)	111.1	111.1	0.1111	0.1111

For TOXSWA: create the txw file and use section 7 to fill in the table below:

	TOXSWA	
	Old	New
Sugar beets; Aerial appl		
No of applns	2	2
Deposition mg/m2 1st 2nd	 13.18 9.882	 13.1765 9.8823
Pome/stone fruit; early appl.; Air blast		
No of applns	2	2
Deposition mg/m2 1st 2nd	 9.827 7.370	 9.8257 7.3693

	TOXSWA	
	Old	New
Legumes; Granular appl		
No of applns	2	2
Deposition mg/m^2 1st 2nd	 0.000 0.000	 0 0
Field beans; Ground spray		
No of applns	2	2
Deposition mg/m^2 1st 2nd	 0.5697 0.4273	 0.5697 0.4273
Maize; Soil incorp		
No of applns	2	2
Deposition mg/m^2 1st 2nd	 0.000 0.000	 0 0
Winter cereals; Ground spray		
No of applns (>1)	6	6
Deposition mg/m^2 1st 2nd 3rd 4th 5th 6th	 0.6728 0.5606 0.4485 0.3364 0.2243 0.1121	 0.6726 0.5605 0.4484 0.3363 0.2242 0.1121

D.

SWASH output for MACRO, PRZM_SW and TOXSWA

Select a few runs of the projects defined under C (see behind the 'View Projects and Define Applications' button in SWASH)

(Defined in SWASH, then written to C:\SWASH\MACRO\pest_focus.mdb for MACRO and C:\SWASHProjects\testproject\PRZM\testcrop1\przm.pzm for PRZM.

- For MACRO: compose the selected runs in the MACRO shell and add them to a batch file. Then go to Plot and read the scenario and corresponding run identity number (Run ID =) in the header of the macroxxx.log file The log files can be found in C:\SWASH\MACRO\. It is not necessary to execute the simulation. N.B. Please take notice that the three digit runid in the name of macroxxx.log file is an internal MACRO runid and NOT the communal SWASH runid !
- For PRZM_SW: The runid is nowhere visible in the shell. Therefore refer to C:\SWASHProjects\testproject\PRZM\testcrop1\runid.p2t and check the header of this selected file)
- For TOXSWA: The TOXSWA shell composes its runids from the SWASH database and presents them on the Browse Runs screen.

Run		**Run id**			
	Crop+scen	SWASH	MACRO	PRZM	TOXSWA
Aerial appln (2)	Sugar beets; D4				
Old		213	213		213
New		65	65		65

Granular (2)	Legumes; R3				
Old		218		00218-C1	218
New		70		00070-C1	70
Ground spray (2)	Field beans; D4				
Old		219	219		219
New		71	71		71
Ground spray (>1)	Cereals, winter; R3				
Old		212		00212-C1	212
New		64		00064-C1	64

* i.e. the three runids of each row should all correspond

15. Include here below comparisons between old and new SWASH outputs for those combinations of scenarios, crops, waterbodies and application patterns that are of relevance for the changes proposed, and which are not covered by the checks under point 14.
No additional comparisons are needed.

16. Can the new version use scenario input data (databases) of earlier versions ?
Yes. The database SWASH 4.2 can be taken over when SWASH 5.3 is installed.

17. Can the new version run on a machine on which also one or more earlier versions are still running ? No, the old version of FOCUS-SWASH has to be uninstalled before installing FOCUS_SWASH v5.3.

Note: In principle it would be possible to have a previous set of versions of the FOCUS Surface Water Models running, but that would require modifications in the installation and application of all models, FOCUS-MACRO, FOCUS_PRZM, FOCUS_SWASH and FOCUS_TOXSWA.

Annex 5 Proposed project for Change format SWASH

1. Define a new substance in SWASH: Sub7, with option 'New'. Use the option 'detailed sorption data'

2. Define a new metabolite: Met7, with option 'New'

3. Define the transformation scheme: Sub7 → Met7 (Appendix 2)

4. Use the 'User -defined Wizard' to create a project with:
- Substance: Sub7.
- Crops: Winter Cereals; Sugarbeets; Pome stone fruit, early; Legumes; Field beans and Maize
- Waterbody: Stream
- Scenarios: D4 and R3

5. Name the project: Project7. Project information is given in Table 1

Table 1: Information Project7

Crop	Water body	Method	No Appl.	Inter-val (d)	Dose (kg/ha)	Scenario	First day	Last Day
Sugar beets	Stream	Aerial appl	2	10	0.4444 0.3333	D4	110	150
						R3	65	105
Pome/ stone fruit; early appl	Stream	Air blast	2	10	0.4444 0.3333	D4	96	136
						R3	77	117
Legumes	Stream	Granular appl	2	10	0.4444 0.3333	D4	99	139
						R3	97	137
Field beans	Stream	Ground spray	2	10	0.4444 0.3333	D4	91	131
						R3	78	118
Maize	Stream	Soil incorp	2	10	0.4444 0.3333	D4	116	156
						R3	107	147
Winter Cereals	Stream	Ground spray	6	6	0.6666 0.5555 0.4444 0.3333 0.2222 0.1111	D4	251	311
						R3	321	16

6. Use Table 1 to alter the application scheme. (Button 'View projects and define applications" followed by button "View and edit applications")

7. Export Project_7 to MACRO, PRZM and TOXSWA

Annex 6 Description of test compound Sub_7 and its metabolite Met7 for Change format SWASH

Parent Sub_7			
Parameter	**Value**	**unit**	**measured at**
11.1.1 Tab General			
Molar Mass	356	g/mol	-
Saturated vapour pressure	2.55E-3	Pa	22 °C
Molar enthalpy of vaporization	97777	J/mol	-
Solubility in water	7.115	mg/L	25 °C
Molar enthalpy of dissolution	26888	J/mol	-
Diffusion coefficient in water	4.9E-5	m^2/d	-
Diffusion coefficient in air	0.51	m^2/d	-
11.1.2			
11.1.3 Tab Sorption[§]			
11.1.4 Sub-tab Soil			
Sorption option	Kom, pH-independent	-	-
Kom	120	L/kg	-
Koc	206.880	L/kg	-
Freundlich exponent	0.95	-	-
11.1.5 Sub-tab Surface Water			
11.1.5.1 Suspended solids			
Kom	124	L/kg	-
Koc	213.776	L/kg	-
Freundlich exponent	0.88	-	-
Ref. conc. in liquid phase	1.77	g/m^3	-
11.1.5.2 Macrophytes			
Kom	0	L/kg	-
Koc	0	L/kg	-
11.1.6 Sub-tab Sediment			
Kom	128	L/kg	-
Koc	220.672	L/kg	-
Freundlich exponent	0.93	L/kg	-
Ref. conc. in liquid phase	1.44	g/m^3	-
11.1.7 Tab Transformation[‡]			
11.1.8 Sub-tab Soil-aerobic			
DT50; Half life time soil	177	d	21 °C
Exponent for the effect of water content (Walker)	0.64	-	-
Exponent for the effect of water content (Calibrated)*	0.62	-	-
Option for biphasic transformation	No	-	-
Days after initial application bi-phasic half-life begins:	0	d	-
Moisture content at which half-life has been measured	97	%	-
Option for moisture content in transformation study	Relative to field capacity	%	-

Q10 factor for effect of temperature on transformation (PRZM)	2.19	-	-
pF at which half-life has been measured	1	-	-
Factor for effect of temperature (MACRO)	0.077		
11.1.9 Sub-tab Surface Water			
DT50; Half life time water	17.7	d	19 °C
Molar activation energy for transformation	53999	J/mol	-
11.1.10 Sub-tab Sediment			
DT50; Half life time sediment	188	d	23 °C
Molar activation energy for transformation	56443	J/mol	-
11.1.11 Tab crop processes			
11.1.11.1 Canopy			
Wash off factor from crop	64	1/m	-
Option canopy processes	Lumped	-	-
DT50; Half life time crop	666	d	-
11.1.11.2 Plant root			
Factor for the uptake by plant roots in soil	0.47	-	

	parent	Fraction (molar basis)	Metabolite 7
Transformation scheme in soil	Sub7	0.6	Met7

§ Subtab 'Substrate' not relevant for FOCUS'

‡ Subtabs 'Soil-anaerobic' and 'Other' not relevant for FOCUS

*Calibrated value introduced for use by MACRO in SWASH 5.3

Metabolite Met_7			
Parameter	**Value**	**unit**	**measured at**
11.1.12 Tab General			
Molar Mass	178	g/mol	-
Saturated vapour pressure	7.42E-5	Pa	18 °C
Molar enthalpy of vaporization	88888	J/mol	-
Solubility in water	0.7676	mg/L	17 °C
Molar enthalpy of dissolution	27111	J/mol	-
Diffusion coefficient in water	3.9E-05	m^2/d	-
Diffusion coefficient in air	0.38	m^2/d	-
11.1.13			
11.1.14 Tab Sorption§			
11.1.15 Sub-tab Soil			
Sorption option	Kom, pH-independent	-	-
Kom	488.77	L/kg	-
Koc	842.639	L/kg	-
Freundlich exponent	0.94	-	-
11.1.16 Sub-tab Surface Water			
11.1.16.1 Suspended solids			
Kom	342	L/kg	-

Koc	589.61	L/kg	-
Freundlich exponent	0.93	-	-
Ref. conc. in liquid phase	1.2	g/m^3	-
11.1.16.2 Macrophytes			
Kom	0	L/kg	-
Koc	0	L/kg	-
11.1.17 Sub-tab Sediment			
Kom	150	L/kg	-
Koc	258.6	L/kg	-
Freundlich exponent	0.92	L/kg	-
Ref. conc. in liquid phase	1.33	g/m^3	-
11.1.18 Tab Transformation‡			
11.1.19 Sub-tab Soil-aerobic			
DT50; Half life time soil	75.75	d	15 °C
Exponent for the effect of water content (Walker)	0.76	-	-
*Exponent for the effect of water content (Calibrated)	0.74	-	-
Option for biphasic transformation	No	-	-
Days after initial application bi-phasic half-life begins:	0	d	-
Moisture content at which half-life has been measured	99	%	-
Option for moisture content in transformation study	Relative to field capacity	%	-
Q10 factor for effect of temperature on transformation (PRZM)	2.22	-	-
pF at which half-life has been measured	2	-	-
Factor for effect of temperature (MACRO)	0.069		
11.1.20 Sub-tab Surface Water			
DT50; Half life time water	85.85	d	14 °C
Molar activation energy for transformation	54444	J/mol	-
11.1.21 Sub-tab Sediment			
DT50; Half life time sediment	65.65	d	15 °C
Molar activation energy for transformation	55222	J/mol	-
11.1.22 Tab crop processes			
11.1.22.1 Canopy†			
Wash off factor from crop	1E-6	1/m	-
Option canopy processes	Lumped	-	-
DT50; Half life time crop	1000000	d	-
11.1.22.2 Plant root			
Factor for the uptake by plant roots in soil	0.56	-	

§ Subtab 'Substrate' not relevant for FOCUS'

‡ Subtabs 'Soil-anaerobic' and 'Other' not relevant for FOCUS

† Not relevant for metabolite

*Calibrated value introduced for use by MACRO in SWASH 5.3

Annex 7 Protocol for installation and communication requirements of SWASH

Whenever the SWASH Developer intends to release a new version of the FOCUS SWASH tool he should take care that this new version fulfils the agreed installation procedure as well as the requirements for communication between SWASH and FOCUS MACRO-SW, FOCUS PRZM-SW and FOCUS TOXSWA. The installation and communication requirements are specified below.

1. Installation

The SWASH installation procedure should take care that the following directory structure is created:

```
C:\SWASH                SWASH-application files
        \MACRO          MACRO-application files
        \PRZM           PRZM-application files, przm.prj
             \MET
             \PROGS
             \T3G
             \WPIC
        \TOXSWA         TOXSWA-application files
        \DATA           SWASH.fdb
             \MAPS      map files
```

Instead of C: another drive can be selected, e.g. D: or E:.

The SWASH Developer ensures that the following conditions are fulfilled during installation of SWASH:

- The SWASH application files should be placed in the directory \SWASH
- The SWASH database SWASH.fdb and SWASH map files are placed in the subdirectories \DATA and \DATA\MAPS, respectively.

2. Output

SWASH creates project paths to be able to save the various output files for a specific modelling project. The default path is C:\SWASHProjects\, but the user is able to select any other path. The project name is always the name of the directory. SWASH creates the following structure for project output files:

```
C:\SWASHProjects\testproject\MACRO\
                                      crop1      *.M2T
                                      crop2      *.M2T
                                \PRZM\
                                      crop1      *.P2T, *.pzm
                                      crop2      *.P2T, *.pzm
                                \TOXSWA          *.txw
```

SWASH creates all needed runs for a selected combination of compound and crop and allocates unique runIds to each run. It transfers the relevant runIds to the MACRO, PRZM and TOXSWA models.

3. Communication

Communication with MACRO
SWASH communicates with the MACRO database pest_focus.mdb. When the user enters MACRO from SWASH, SWASH exports all substances and runs from SWASH to the MACRO database pest_focus.mdb. Substance information is located in the tables compound and metab and run information in the tables applications and run of the MACRO database

The SWASH Developer ensures that the following conditions are fulfilled:

- The fields and allowed ranges for them, originally present in the tables compound, metab, applications and run are not changed.
- The agreed names for crops and locations are exported to the tables, i.e.

Crops:
Cereals, spring
Cereals, winter
Citrus
Cotton
Field beans
Grass/alfalfa
Hops
Legumes
Maize
Oil seed rape, spring
Oil seed rape, winter
Olives
Pome/stone fruit
Potatoes
Soybeans
Sugar beets
Sunflowers
Tobacco
Vegetables, bulb
Vegetables, fruiting
Vegetables, leafy
Vegetables, root
Vines

Locations: D1, D2, D3, D4, D5 and D6

Communication with PRZM
SWASH communicates with the PRZM data files chmdat.dat and chmnum.dat. All substance information is located in the chmdat.dat file and the total number of substances in the chmnum.dat file.. When the user enters PRZM from SWASH, SWASH exports all substances from SWASH to the PRZM data files chmdat.dat and chmnum.dat.

SWASH creates a przm.prj file that lists all projects for PRZM and locates this in the \SWASH\PRZM directory. SWASH also creates a przm.pzm file for each crop in the project and locates this at the PRZM\crop subdirectory. From this file PRZM reads all needed information on the run, like project name and crop name, runId numbers and application data.

The SWASH Developer ensures that the following conditions are fulfilled:

- The structure and allowed range for the data of the PRZM data files chmdat.dat and chmnum.dat is not changed and the data, originally present in the chmdat.dat file, is put back unchanged. The chmnum.dat file is updated with the correct total number of substances defined in chmdat.dat. The files are placed in the \SWASH\PRZM\WPIC directory.
- The structure of the przm.pzm file is not changed and placed in the correct PRZM\crop subdirectory
- The structure of the przm.prj file is not changed and placed in the \SWASH\PRZM directory
- The agreed names for crops and locations are used in the files, i.e.

Crops:
Cereals, spring
Cereals, winter
Citrus
Cotton

Field beans
Grass/alfalfa
Hops
Legumes
Maize
Oil seed rape, spring
Oil seed rape, winter
Olives
Pome/stone fruit, early applns
Pome/stone fruit, late applns
Potatoes
Soybeans
Sugar beets
Sunflowers
Tobacco
Vegetables, bulb
Vegetables, fruiting
Vegetables, leafy
Vegetables, root
Vines, early applns
Vines, late applns

Locations: R1, R2, R3 and R4

Communication with TOXSWA
SWASH and TOXSWA make use of the same database.

The SWASH Developer ensures that the following conditions are fulfilled:
- The structure, field names and field ranges of all tables of the SWASH-db.fdb are not changed.
- The agreed names for crops and locations are used in the tables, i.e.

Crops:
See the crop list under PRZM communication

Locations: D1, D2, D3, D4, D5, D6, R1, R2, R3 and R4

More details on communication of SWASH with the three other models have been described in:
Roller, J.A. te, F. van den Berg, P.I. Adriaanse, 2002. Surface WAter Scenarios Help (SWASH), version 2.0. Technical report version 1.3, Alterra-rapport 508, Wageningen, the Netherlands.

4. Test project

A. Check on SWASH:
Execute section 14 A, B, C and D of the SWASH Change Format and append the relevant tables, duly filled in.

B. Run and output tests:
- Replace the old SWASH version with the new one.
- Start SWASH. Check the new SWASH version numbers from the SWASH tab sheet information option versions.
- Create a new substance in SWASH.
- Create a project containing D scenarios using the new substance.
- Create a project containing R scenarios using a FOCUS substance.
- Start the MACRO shell from SWASH
- Run MACRO for the new substance and 2 runs created in SWASH
- Check if the output files are created at the correct directory
- Exit the MACRO shell and enter SWASH

- Start the PRZM shell from SWASH
- Run PRZM for the FOCUS substance and 2 runs created in SWASH
- Check if the output files are created at the correct directory
- Exit the PRZM shell and enter SWASH
- Start the TOXSWA shell from SWASH.
- Run TOXSWA for a D scenario for the new substance and 2 runs created in SWASH and check that the correct M2T file is read into TOXSWA.
- Run TOXSWA for a R scenario for the FOCUS substance and 2 runs created in SWASH and check that the correct P2T file is read into TOXSWA.
- Check if the output files are generated at the correct directory.
- Exit TOXSWA and SWASH.

Annex 8 Protocol for installation and communication requirements of MACRO for SWASH

Whenever the MACRO Model Developer intends to release a new version of the FOCUS MACRO-SW he should take care that this new version fulfills the agreed installation procedure under the SWASH tool as well as the requirements for communication between FOCUS MACRO-SW and SWASH. The installation and communication requirements are specified below.

1. Installation

When SWASH is installed, the following directory structure is created by the installation software:

```
C:\SWASH                SWASH-application files
        \MACRO          MACRO-application files
        \PRZM           PRZM-application files, przm.prj
             \MET
             \PROGS
             \T3G
             \WPIC
        \TOXSWA         TOXSWA-application files
        \DATA           SWASH.fdb
             \MAPS      map files
```

Instead of C: another drive can be selected, e.g. D: or E:.

The MACRO Model Developer ensures that the following conditions are fulfilled during installation of MACRO:

- The complete MACRO tool should be placed in the subdirectory \MACRO. The MACRO Model Developer is free to create new subdirectories in this directory.
- The database pest_focus.mdb and the executable MACRO_Focus.exe are placed at the directory \MACRO, and not in a subdirectory.

2. Output

SWASH needs a project path to be able to save the various output files for a specific modelling project. The default path is C:\SWASHProjects\, but the user is able to select any other path. The project name is always the name of the directory. The following structure is created for project output files:

```
C:\SWASHProjects\testproject\MACRO\
                                    crop1       *.M2T
                                    crop2       *.M2T
                               \PRZM\
                                    crop1       *.P2T, *.pzm
                                    crop2       *.P2T, *.pzm
                              \TOXSWA           *.txw
```

The MACRO Model Developer ensures that the following conditions are fulfilled following completion of MACRO modelling:

- The M2T outputfiles should be placed at the correct output directory. The name of this directory should match the field pathinout from the table run in the database pest_focus.mdb. For each crop an output directory is created. Also the .bin, .log and .sum output files should be located in this same output directory.

- When a run is set up in MACRO-FOCUS you select an application pattern defined in SWASH that has been exported to MACRO-FOCUS. When you do this, the SWASH run ID is fetched from the database. For a parent with two metabolites, there is one application scheme with a SWASH run ID (exported from SWASH). This application scheme is used for the run with parent and first metabolite, and also used for the run of parent with second metabolite.

3. Communication

SWASH updates the MACRO database pest_focus.mdb. Created substances in SWASH via SPIN are exported to the tables compound and metab. Created runs in SWASH are exported to the tables applications and run.

The MACRO Model developer ensures that the following conditions are fulfilled:
- The structure and field names of the tables compound, metab, applications and run is not changed.
- The agreed names for crops and locations are used in the tables, i.e.

Crops:
Cereals, spring
Cereals, winter
Citrus
Cotton
Field beans
Grass/alfalfa
Hops
Legumes
Maize
Oil seed rape, spring
Oil seed rape, winter
Olives
Pome/stone fruit, early applns
Pome/stone fruit, late applns
Potatoes
Soybeans
Sugar beets
Sunflowers
Tobacco
Vegetables, bulb
Vegetables, fruiting
Vegetables, leafy
Vegetables, root
Vines, early applns
Vines, late applns

Locations: D1, D2, D3, D4, D5 and D6

More details have been described in:
Roller, J.A. te, F. van den Berg, P.I. Adriaanse, 2002. Surface WAter Scenarios Help (SWASH), version 1.9. Technical report version 1.2, Alterra-rapport 508, Wageningen, the Netherlands.

4. Test project

A. Check on MACRO input, defined in SWASH:
   Execute section 14 A, C and D of the SWASH Change Format and append the relevant tables, duly filled in.

B. Run and output tests:
   – Replace the old MACRO version with the new one.

- Start SWASH.
- Check the new MACRO version numbers from the SWASH tab sheet **information** option **versions**.
- Create a new substance in SWASH.
- Create a project in SWASH using the new substance.
- Create a project in SWASH using a FOCUS substance.
- Start the MACRO shell from SWASH.
- Run MACRO using the new substance and runs created in SWASH.
- Run MACRO using the FOCUS substance and runs created in SWASH.
- Check if the output files are generated at the correct directory.
- Exit MACRO and SWASH.

Annex 9 Protocol for installation and communication requirements of PRZM for SWASH

Whenever the PRZM Model Developers intends to release a new version of the FOCUS_PRZM_SW they should take care that this new version fulfils the agreed installation procedure under the SWASH tool as well as the requirements for communication between FOCUS_PRZM-SW and SWASH. The installation and communication requirements are specified below.

1. Installation

When SWASH is installed the following directory structure is created by the installation software:

```
C:\SWASH                SWASH-application files
        \MACRO          MACRO-application files
        \PRZM           PRZM-application files, przm.prj
             \MET
             \PROGS
             \T3G
             \WPIC
        \TOXSWA         TOXSWA-application files
        \DATA           SWASH.fdb
             \MAPS      map files
```

Instead of C: another drive can be selected, e.g. D: or E:.

The PRZM Model Developer ensures that the following conditions are fulfilled during installation of PRZM:

- The complete PRZM tool should be placed in the subdirectory \PRZM. The PRZM Model Developer is free to create new subdirectories in this directory.
- The file versionnum.dat and the executable PFSW.exe are placed at the directory \PRZM, and not in a subdirectory.
- The files chmnum.dat and chmdat.dat are placed at the subdirectory \PRZM\WPIC.

2. Output

SWASH needs a project path to be able to save the various output files for a specific modelling project. The default path is C:\SWASHProjects\, but the user is able to select any other path. The project name is always the name of the directory. The following structure is created for project output files:

```
C:\SWASHProjects\testproject\MACRO\
                                    crop1       *.M2T
                                    crop2       *.M2T
                               \PRZM\
                                    crop1       *.P2T, *.pzm
                                    crop2       *.P2T, *.pzm
                              \TOXSWA\          *.txw
```

The PRZM Model Developer ensures that the following conditions are fulfilled following completion of PRZM modelling:

- The P2T output files should be placed at the correct output directory. The name of this directory should match the records 21-100 (projectpath) of the przm.prj file located at the main directory of the PRZM application. For each crop an output directory is created. All other output files should be

also located in this same output directory. The przm.pzm file for the selected crop of this project is also located at this directory.
- The P2T output files are named 12345_C1.P2T, 12345_C2.P2T or 12345_C3.P2T. C1 refers to the parent compound and C2 and C3 to metabolites. The number 12345 corresponds to the communal, SWASH runid.

3. Communication

SWASH updates the PRZM data files chmdat.dat and chmnum.dat.

The PRZM Model developer ensures that the following conditions are fulfilled:
- The structure and allowed range for the datea of the PRZM data files chmdat.dat and chmnum.dat is not changed.
- The agreed names for crops and locations are used in the tables, i.e.

Crops:
Cereals, spring
Cereals, winter
Citrus
Cotton
Field beans
Grass/alfalfa
Hops
Legumes
Maize
Oil seed rape, spring
Oil seed rape, winter
Olives
Pome/stone fruit, early applns
Pome/stone fruit, late applns
Potatoes
Soybeans
Sugar beets
Sunflowers
Tobacco
Vegetables, bulb
Vegetables, fruiting
Vegetables, leafy
Vegetables, root
Vines, early applns
Vines, late applns

Locations: R1, R2, R3 and R4

More details have been described in:
Roller, J.A. te, F. van den Berg, P.I. Adriaanse, 2002. Surface WAter Scenarios Help (SWASH), version 1.9. Technical report version 1.2, Alterra-rapport 508, Wageningen, the Netherlands.

4. Test project

A. ACheck on PRZM_SW input, defined in SWASH:
   Execute section 14 A, C and D of the SWASH Change Format and append the relevant tables, duly filled in.

B. Run and output tests:
- Replace the old PRZM_SW version with the new one.
- Start SWASH.
- Check the new PRZM_SW version numbers from the SWASH tab sheet information option versions.

- Create a new substance in SWASH.
- Create a project in SWASH using the new substance.
- Create a project in SWASH using a FOCUS substance.
- Start the PRZM_SW shell from SWASH.
- Run PRZM using the new substance and runs created in SWASH.
- Run PRZM using the FOCUS substance and runs created in SWASH.
- Check if the output files are generated at the correct directory.
- Exit PRZM_SW and SWASH.

Annex 10 Protocol for installation and communication requirements of TOXSWA for SWASH

Whenever the TOXSWA Model Developers intends to release a new version of the FOCUS MACRO-SW they should take care that this new version fulfills the agreed installation procedure under the SWASH tool as well as the requirements for communication between FOCUS TOXSWA and SWASH. The installation and communication requirements are specified below.

1. Installation

When SWASH is installed, the following directory structure is created by the installation software:

```
C:\SWASH                SWASH-application files
        \MACRO          MACRO-application files
        \PRZM           PRZM-application files, przm.prj
             \MET
             \PROGS
             \T3G
             \WPIC
        \TOXSWA         TOXSWA-application files
        \DATA           SWASH.fdb
             \MAPS      map files
```

Instead of C: another drive can be selected, e.g. D: or E:.

The TOXSWA Model Developers ensure that the following conditions are fulfilled during installation of TOXSWA:

- The complete TOXSWA tool should be placed in the subdirectory \TOXSWA. The TOXSWA Model Developers are free to create new subdirectories in this directory.
- The executable TOXSWA_GUI.exe is placed at the directory \TOXSWA, and not in a subdirectory.
- The file versionnum.dat with the version numbers is updated and also placed at the directory \TOXSWA.

N.B. TOXSWA does not install a swash.fdb. This is done by SWASH !

2. Output

SWASH needs a project path to be able to save the various output files for a specific modelling project. The default path is C:\SWASH\Projects\, but the user is able to select any other path. The project name is always the name of the directory. The following structure is created for project output files:

```
C:\SWASHProjects\testproject\MACRO\
                                    crop1       *.M2T
                                    crop2       *.M2T
                               \PRZM\
                                    crop1       *.P2T, *.pzm
                                    crop2       *.P2T, *.pzm
                              \TOXSWA           *.txw
```

The TOXSWA Model Developers ensure that the following conditions are fulfilled following completion of TOXSWA modelling:

- The M2T output files should be read from the correct MACRO crop directory.
- The P2T output files should be read from the correct PRZM crop directory.
- The txw-files and TOXSWA output files should be placed at the TOXSWA directory.

3. Communication

SWASH and TOXSWA make use of the same database. This implies that

The TOXSWA Model Developers ensure that the following conditions are fulfilled:
- The structure and field names of all tables of the SWASH.fdb are not changed.
- The agreed names for crops and locations are used in the tables, i.e.

Crops:
Cereals, spring
Cereals, winter
Citrus
Cotton
Field beans
Grass/alfalfa
Hops
Legumes
Maize
Oil seed rape, spring
Oil seed rape, winter
Olives
Pome/stone fruit, early applns
Pome/stone fruit, late applns
Potatoes
Soybeans
Sugar beets
Sunflowers
Tobacco
Vegetables, bulb
Vegetables, fruiting
Vegetables, leafy
Vegetables, root
Vines, early applns
Vines, late applns

Locations: D1, D2, D3, D4, D5, D6, R1, R2, R3 and R4

More details have been described in:
Roller, J.A. te, F. van den Berg, P.I. Adriaanse, 2002. Surface WAter Scenarios Help (SWASH), version 1.9. Technical report version 1.2, Alterra-rapport 508, Wageningen, the Netherlands.

4. Test project

A. Check on TOXSWA input, defined in SWASH:
   Execute section 14 A, C and D of the SWASH Change Format and append the relevant tables, duly filled in.

B. Run and output tests:
- Replace the old TOXSWA version with the new one.
- Start SWASH.
- Check the new TOXSWA version numbers from the SWASH tab sheet information option versions.
- Create a new substance in SWASH.
- Create a project containing D scenarios in SWASH using the new substance.
- Create a project containing R scenarios in SWASH using a FOCUS substance.
- Start the MACRO shell from SWASH
- Run MACRO using the new substance and 2 runs created in SWASH
- Check if the output files are created at the correct directory
- Exit the MACRO shell and enter SWASH

- Start the PRZM shell from SWASH
- Run PRZM using the FOCUS substance and 2 runs created in SWASH
- Check if the output files are created at the correct directory
- Exit the PRZM shell and enter SWASH
- Start the TOXSWA shell from SWASH.
- Run TOXSWA for a D scenario using the new substance and 2 runs created in SWASH and check that the correct M2T file is read into TOXSWA.
- Run TOXSWA for a R scenario using the FOCUS substance and runs created in SWASH and check that the correct P2T file is read into TOXSWA.
- Check if the output files are generated at the correct directory.
- Exit TOXSWA and SWASH.

Annex 11 Read_me file for installation of the SWASH software package

Date: April 2015

This read_me_first file contains information for
- SWASH model=shell FOCUS version 5 (shell version 5.1.0, April 2015)
- SWASH/TOXSWA database FOCUS version 3 (April 2015)

Help
If you encounter installation problems or problems using FOCUS_SWASH, please send an e-mail to: swash@pesticidemodels.eu.

More information about FOCUS_SWASH is available at the SWASH website:
http://www.swash.pesticidemodels.eu

Installation
When an old version of FOCUS_SWASH is installed, it should be uninstalled before installing the new version. We advise to remove the SWASHProjects folder manually.

In this version of FOCUS_SWASH the database is not automatically removed, this makes updates of existing databases possible. If you want a new 'empty' (Firebird) database the Swash.fdb file (SWASH\data folder) can safely be removed.

If existing results need to be kept for archiving purposes, the Firebird Swash.fdb database (at SWASH\data folder) and SWASHProjects folder can be saved on an archive directory.
The FOCUS_MACRO and FOCUS_PRZM models can remain on the computer. They are not affected by the change of FOCUS_SWASH version.

The default directory for SWASH is C:\SWASH. You can also choose another drive, for example D or F. In case you select another drive than C, the other applications should also be installed on that drive on subdirectories of the SWASH directory. For example if you have installed SWASH on D:\SWASH the other applications should be installed at:
- TOXSWA: D:\SWASH\TOXSWA
- MACRO: D:\SWASH\MACRO
- PRZM: D:\SWASH\PRZM

Note: FOCUS_PRZM 3.3.1 can be installed only on drive C. Hence, the option to install SWASH on other drives is not possible with this PRZM version.

The complete installation of the FOCUS_SWASH software package consists of six steps. When FOCUS_MACRO and FOCUS_PRZM are still present, steps 1, 5 and 6 can be skipped.

Step 1. Regional settings (for MACRO)
- Check the regional settings on your pc: they should be set to a default national setting, without making any changes.

Step 2. Installation of SPIN
- Run the Setup.exe and follow the on screen instructions. After installation, SPIN can be started from the Start menu

Step 3. Installation of SWASH
- Run the Setup.exe and follow the on screen instructions. After installation, FOCUS_SWASH_5.3 can be started from the Start menu

Step 4. Installation of TOXSWA

- If necessary, uninstall previous versions of FOCUS_TOXSWA
- Run the Setup.exe program and follow the on screen instructions
- FOCUS_TOXSWA can be started from the Start menu

Step 5. Installation of MACRO

- See read_me_MACRO.txt

Step 6. Installation of PRZM

See read_me_PRZM.txt

12. Hard and software requirements

Operating systems:

SWASH has been tested on Vista, Windows 7 and Windows 8.

Configurations tested:

Access rights:

On Windows Vista, Windows 7 and Windows 8 platforms it is necessary to have administrator rights.

Preinstalled software: None

Hard disk memory:

FOCUS_SWASH requires 23.5 Mb for installation.

Display:

Monitor with at least 1024x768, at 256 colours.
Use as display setting, Font size: Small Fonts.

Processor:

The faster the better.

13. Known bugs

- None

Annex 12 Explanation of the project status

The last column of the projects grid on the Overview of composed projects screen contains the status of the project. It is either OK or not OK, when a project is not OK it cannot be exported correctly to Macro, Przm or Toxswa and therefore cannot be run.

The following reasons will set the project to be not OK:

- One of the used substances is incomplete (parent or metabolite).
- The parent – metabolite scheme is not correct, so called ambiguous. See section 2.1.6 of the SWASH manual 5.3 where ambiguous is explained in detail

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WOt-technical reports are available from the secretary's office, T 0317 – 48 54 71; E info.wnm@wur.nl
Reports can also be downloaded from www.wageningenUR.nl/wotnatuurenmilieu

1	Arets, E.J.M.M., K.W. van der Hoek, H. Kramer, P.J. Kuikman & J.-P. Lesschen (2013). *Greenhouse gas reporting of the LULUCF sector for the UNFCCC and Kyoto Protocol. Background to the Dutch NIR 2013.*
2	Kleunen, A. van, M. van Roomen, L. van den Bremer, A.J.J. Lemaire, J-W. Vergeer & E. van Winden (2014). *Ecologische gegevens van vogels voor Standaard Gegevensformulieren Vogelrichtlijngebieden.*
3	Bruggen, C. van, A. Bannink, C.M. Groenestein, B.J. de Haan, J.F.M. Huijsmans, H.H. Luesink, S.M. van der Sluis, G.L. Velthof & J. Vonk (2014). *Emissies naar lucht uit de landbouw in 2012. Berekeningen van ammoniak, stikstofoxide, lachgas, methaan en fijn stof met het model NEMA*
4	Verburg, R.W., T. Selnes & M.J. Bogaardt (2014). *Van denken naar doen; ecosysteemdiensten in de praktijk. Case studies uit Nederland, Vlaanderen en het Verenigd Koninkrijk.*
5	Velthof, G.L. & O. Oenema (2014). *Commissie van Deskundigen Meststoffenwet. Taken en werkwijze; versie 2014*
6	Berg, J. van den, V.J. Ingram, L.O. Judge & E.J.M.M. Arets (2014). *Integrating ecosystem services into tropical commodity chains- cocoa, soy and palm oil; Dutch policy options from an innovation system approach*
7	Knegt de, B., T. van der Meij, S. Hennekens, J.A.M. Janssen & W. Wamelink (2014). *Status en trend van structuur- en functiekenmerken van Natura 2000- habitattypen op basis van het Landelijke Meetnet Flora (LMF) en de Landelijke Vegetatie Databank (LVD). Achtergronddocument voor de Artikel 17-rapportage.*
8	Janssen, J.A.M., E.J. Weeda, P. Schippers, R.J. Bijlsma, J.H.J. Schaminée, G.H.P. Arts, C.M. Deerenberg, O.G. Bos & R.G. Jak (2014). *Habitattypen in Natura 2000-gebieden. Beoordeling van oppervlakte representativiteit en behoudsstatus in de Standard Data Forms (SDFs).*
9	Ottburg, F.G.W.A., J.A.M. Janssen (2014).*Habitatrichtlijnsoorten in Natura 2000-gebieden. Beoordeling van populatie, leefgebied en isolatie in de Standard Data Forms (SDFs)*
10	Arets, E.J.M.M. & F.R. Veeneklaas (2014). *Costs and benefits of a more sustainable production of tropical timber.*
11	Vader, J. & M.J. Bogaardt (2014). *Natuurverkenning 2 jaar later; Over gebruik en doorwerking van Natuurverkenning 2010-2040.*
12	Smits, M.J.W. & C.M. van der Heide (2014). *Hoe en waarom bedrijven bijdragen aan behoud van ecosysteemdiensten; en hoe de overheid dergelijke bijdragen kan stimuleren.*
13	Knegt, B. de (ed.) (2014). *Graadmeter Diensten van Natuur; Vraag, aanbod, gebruik en trend van goederen en diensten uit ecosystemen in Nederland.*
14	Beltman, W.H.J., M.M.S. Ter Horst, P.I. Adriaanse, A. de Jong & J. Deneer (2014). *FOCUS_TOXSWA manual 4.4.2; User's Guide version 4.*
15	Adriaanse, P.I., W.H.J. Beltman & F. Van den Berg (2014). *Metabolite formation in water and in sediment in the TOXSWA model. Theory and procedure for the upstream catchment of FOCUS streams*.
16	Groenestein, K., C. van Bruggen en H. Luesink (2014). *Harmonisatie diercategorieën*
17	Kistenkas, F.H. (2014). *Juridische aspecten van gebiedsgericht natuurbeleid (Natura 2000)*
18	Koeijer, T.J. de, H.H. Luesink & C.H.G. Daatselaar (2014). *Synthese monitoring mestmarkt 2006 – 2012*.
19	Schmidt, A.M., A. van Kleunen, L. Soldaat & R. Bink (2014). *Rapportages op grond van de Europese Vogelrichtlijn en Habitatrichtlijn. Evaluatie rapportageperiode 2007-2012 en aanbevelingen voor de periode 2013-2018*
20	Fey F.E., N.M.A.J. Dankers, A. Meijboom, P.W. van Leeuwen, M. de Jong, E.M. Dijkman & J.S.M. Cremer (2014). *Ontwikkeling van enkele mosselbanken in de Nederlandse Waddenzee, situatie 2013.*

21	Hendriks, C.M.A., D.A. Kamphorst en R.A.M. Schrijver (2014). *Motieven van actoren voor verdere verduurzaming in de houtketen.*
22	Selnes, T.A. and D.A. Kamphorst (2014). *International governance of biodiversity; searching for renewal*
23	Dirkx, G.H.P, E. den Belder, I.M. Bouwma, A.L. Gerritsen, C.M.A. Hendriks, D.J. van der Hoek, M. van Oorschot & B.I. de Vos (2014). *Achtergrondrapport bij beleidsstudie Natuurlijk kapitaal: toestand, trends en perspectief; Verantwoording casestudies*
24	Wamelink, G.W.W., M. Van Adrichem, R. Jochem & R.M.A. Wegman (2014). *Aanpassing van het Model for Nature Policy (MNP) aan de typologie van het Subsidiestelsel Natuur en Landschap (SNL); Fase 1*
25	Vos, C.C., C.J. Grashof-Bokdam & P.F.M. Opdam (2014). *Biodiversity and ecosystem services: does species diversity enhance effectiveness and reliability? A systematic literature review.*
26	Arets, E.J.M.M., G.M. Hengeveld, J.P. Lesschen, H. Kramer, P.J. Kuikman & J.W.H. van der Kolk (2014). *Greenhouse gas reporting of the LULUCF sector for the UNFCCC and Kyoto Protocol. Background to the Dutch NIR 2014.*
27	Roller, te J.A., F. van den Berg, P.I. Adriaanse, A. de Jong & W.H.J. Beltman (2014). *Surface WAter Scenario Help (SWASH) version 5.3. technical description*
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33	Bijlsma, R.J. & J.A.M. Janssen (2014). *Structuur en functie van habitattypen; Onderdeel van de documentatie van de Habitatrichtlijn artikel 17-rapportage 2013*
34	Fey F.E., N.M.J.A. Dankers, A. Meijboom, P.W. van Leeuwen, J. Cuperus, B.E. van der Weide, M. de Jong, E.M. Dijkman & J.S.M. Cremer (2014). *Ecologische ontwikkeling binnen een voor menselijke activiteiten gesloten gebied in de Nederlandse Waddenzee; Tussenrapportage achtste jaar na sluiting (najaar 2013).*
35	Kuindersma, W., F.G. Boonstra, R.A. Arnouts, R. Folkert, R.J. Fontein, A. van Hinsberg & D.A. Kamphorst (2015). *Vernieuwingen in het provinciaal natuurbeleid. Vooronderzoek voor de evaluatie van het Natuurpact.*
36	Berg van den, F., W.H.J. Beltman, P.I. Adriaanse, A. de Jong & J.A. te Roller (2015). *SWASH Manual 5.3. User's Guide version 5*

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