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# Contaminant Balance Component of the Urban Water Volume and Quality (UVQ) Model - Technical Description

Report for the  
CSIRO Urban Water Program

T.F.N. Farley

CSIRO Urban Water Program Report T4-47

Consultancy Report  
CSIRO Land and Water, Canberra Laboratory  
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# **Contaminant Balance Component of Urban Water Volume and Quality (UVQ) Model - Technical Description**

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## **Urban Water Program**

This report is one of the outcomes of the feasibility stage of the CSIRO's Urban Water Program.

The Urban Water Program is a multi-divisional project, sponsored by CSIRO's Executive, involving the Divisions of Building, Construction and Engineering, Land and Water and Molecular Science.

The vision for the Urban Water Program is "in the face of economic, social and climatic change, enable Australia's urban water systems to improve services to the community and improve economic performance while achieving ecological sustainability".

This report stands alone, but information included within it has been used within the wider Urban Water Program. Readers wishing to obtain more information about the Urban Water Program could contact Andrew Speers on 612 9490-5437 or at [andrew.speers@dbce.csiro.au](mailto:andrew.speers@dbce.csiro.au).

The Urban Water Program website can be visited at [www.dbce.csiro.au/urbanwater](http://www.dbce.csiro.au/urbanwater).

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## INTRODUCTION

The Urban Volume and Quality (UVQ) model was developed to support assessment of alternative urban water system scenarios within the feasibility stage of the CSIRO Urban Water Program. An existing model, AQUACYCLE (AC), was enhanced by extending the water balance model and by incorporating contaminant balance modelling. Thus the UVQ model comprises two distinct components - the water flow balance model<sup>1</sup> which calculates water flows through an urban water system; and the contaminant balance model (CB) which calculates contaminant loads and concentrations through an urban water system.

The contaminant balance model is documented in Farley *et al.* (2000). Most importantly, for the purposes of this document, the approach uses contaminant profiles to describe contaminant loads from sources. These loads are then transported along flow paths described in the water balance model.

This report documents the technical specification for the contaminant balance component of the UVQ model and describes:

- ◆ the program structure in terms of its logical structure and internal operation
- ◆ the input and output files (structure and content)
- ◆ the files required to build UVQ
- ◆ the files required to install UVQ
- ◆ how to execute UVQ.

---

<sup>1</sup> Technical specifications for the water flow balance component are given in Mitchell (1998) and Mitchell and Maheepala (1999).

## STRUCTURE

### DESIGN APPROACH

The design approach was based upon the need for the system to be generic and capable of modelling a wide range of urban water configurations. Accordingly, configurations were stored in easily editable text files, rather than embedded in the code. These input files control the contaminants being modelled, the flow paths contained in the system and the way in which these flow paths interact with each other. These input files are described in this report. It should be noted that the contaminant balance component was developed as a prototype only and is not fully functional.

### LOGICAL STRUCTURE

The logical structure of UVQ can be divided into two components, the enhanced AQUACYCLE (AC) component and the contaminant balance (CB) component. The structure of the AC component is not covered in this report. However its function is to define the physical characteristics of the urban water system and to calculate the daily flows through that system. These flows are stored as array variables and used by the routines of the CB component. A number of modifications were made to the original AC component to accommodate the CB component. These changes were predominantly associated with the storing of the different daily flows at different locations within the system as array variables, rather than using the same variable for each location.

### INTERNAL OPERATION

Figure 1 outlines the logical operation of the CB component. The CB component is initialised via the main form of UVQ, see `mnuContaminantGroup_Click()` routine in `frmmai55.frm`. A daily loop which calculates flow values through the system occurs in the `Catchment()` routine in `catch60.bas`. The CB component is called at the very end of that loop and calculates contaminant concentrations and loads. Therefore daily flows, contaminant concentrations and loads are calculated by UVQ.

<b>When</b>	<b>What</b>
Load contaminant balance (CB) group file	Initialise CB component
At end of Aquacycle (AC) daily loop	Write time series flow file Write monthly CB reports if appropriate Write yearly CB reports if appropriate Copy AC flow values to CB flow values Calculate known CB loads Run CB model for each cluster Run CB model for estate
After daily loop has finished	Write CB summary reports

*Figure 1, Outline of logical operation*

## INPUT FILES

### FORMATTING CONVENTIONS

All input files are ASCII text files and are created by using any ASCII editor, such as Microsoft Notepad. Any line beginning with a # or wholly blank are comment lines and are ignored by the CB component. Comment lines may contain any explanatory material you wish to include and are used to document the input files and in particular to describe the structure of each line in the input file. Where a non-comment line contains more than one field, the fields are separated by commas. Where a field is not required or is null, its absence is shown by ,,. Text fields do not require quotes. Figure 2 demonstrates some of these conventions.

---

```
# Cluster Number, Unit Blocks per Cluster, Avge. Number of People per Unit Block
1,4000,2.5
# Code, name, model (M or nothing), Report
8, Phosphorus,,R
```

---

*Figure 2, Example showing formatting conventions*

### CONTAMINANT BALANCE GROUP FILE (CBG)

The input files to UVQ consist of two 'group' files, one for the AC component and the other for the CB component. A discussion of the AC group file is in Mitchell (1998). The CB group file contains the names of five text files as shown in Table 1.

*Table 1, Example of Contaminant Balance group file*

File Type	File Name (example)
System Parameters File (SPF)	Hypothetical_1_SysParams.txt
Contaminants File (CF)	Hypothetical_1_Contaminants.txt
Contaminant Profiles File (CPF)	Hypothetical1-Profiles.txt
Contaminant Treatments File (CTF)	Hypothetical_1_Treatments(NO Efficiencies).txt
Contaminant Operations File (COF)	Hypothetical_1_Operations.txt

Each of the five text files is described below together with an example of their contents.

### SYSTEM PARAMETERS FILE (SPF)

This file contains general parameters that apply to the whole of the system being studied. It lists:

- ◆ the name of the study (the estate)
- ◆ maximum number of flow paths per cluster & maximum operations (contaminant profile manipulations) over all clusters and estates
- ◆ number of clusters
- ◆ for each cluster
  - cluster number (a unique numeric identifier)
  - number of unit blocks

- average number of people per unit block, ie occupancy rate
- ◆ the run status for each report (monthly, yearly, run and summary) where T = Run, F = Don't run.

Note that the maximum number of flow paths per cluster is set (because all possible flow paths are pre-defined). The maximum number of operations is the maximum number of flow paths per cluster multiplied by the number of clusters. There are no real constraints over the parameters. However, array sizes are determined by the magnitude of some of the parameters and execution speeds will deteriorate with increasing values for Maximum Paths per Cluster, Maximum Operations over all Clusters and Number of Clusters.

Figure 3 shows the layout of the System Parameters file.

---

```
# CONTAMINANT BALANCE - SYSTEM PARAMETERS FILE
# Estate Name
Ellenbrook - Hypothetical 1
# Maximum Paths per Cluster, Maximum Operations over all Clusters + Estate
210, 500
# Number of Clusters
10
# Cluster Number, Unit Blocks per Cluster, Average Number of People per Unit Block
1,4000,2.5
2,4000,2.5
3,4000,2.5
4,4000,2.5
5,4000,2.5
6,4000,2.5
7,4000,2.5
8,4000,2.5
9,4000,2.5
10,4000,2.5
# Monthly Reports, Yearly Reports, Run Report, Summary Report (T means Yes, F means No)
T,T,T,T
```

---

*Figure 3, Example of System Parameters File (SPF)*

## CONTAMINANTS FILE (CF)

This file contains a description of each contaminant. For each contaminant, it lists

- ◆ contaminant number (a unique numeric identifier)
- ◆ name of the contaminant
- ◆ units of concentration (eg mg)
- ◆ units of mass (eg mg/l)
- ◆ units of human input (eg mg/p/d)
- ◆ modelling status where M = model (else leave blank)
- ◆ report status where R = Report (else leave blank)
- ◆ threshold concentration NOT to be exceeded (N/A if not applicable).

Modelling status was provided to allow the facility whereby contaminants can be included and described, but not modelled in that run. The Report parameter (R) is not used as all modelled parameters are reported on. Figure 4 shows the layout of the Contaminants file.

---

#	Code	Name	Mass Units	Conc. Units	Per Capita Units	Model (M or nothing)	Report (R or nothing)	Threshold concentration NOT to be exceeded
1		Cu (total)	mg	mg/l	mg/p/d	M,,	N/A	
2		Zn (total)	mg	mg/l	mg/p/d	M,,	N/A	
3		Cd (total)	mg	mg/l	mg/p/d	M,,	N/A	
4		Pb (total)	mg	mg/l	mg/p/d	M,,	N/A	
5		N (total)	mg	mg/l	mg/p/d	M,,	N/A	
6		NH3-N	mg	mg/l	mg/p/d	M,,	N/A	
7		P (total)	mg	mg/l	mg/p/d	M,,	N/A	
8		Suspended Solids	mg	mg/l	mg/p/d	M,,	N/A	
9		Diss. Solids	mg	mg/l	mg/p/d	M,,	500	
11		COD	mg	mg/l	mg/p/d	M,,	N/A	
12		Coliforms	cfu	cfu/100ml	cfu/p/d	M,,	N/A	
13		Pesticides	mg	mg/l	mg/p/d	M,,	N/A	
14		PAH's	mg	mg/l	mg/p/d	M,,	N/A	
15		Oil and Grease	mg	mg/l	mg/p/d	M,,	N/A	
16		Gross Litter	mg	mg/l	mg/p/d	M,,	N/A	

---

*Figure 4, Example of Contaminants File (CF)*

You can report on individual contaminants using the R option shown in Figure 4 and flow paths using the R option within the Contaminant Profiles file shown in Figure 6.

## **CONTAMINANT PROFILES FILE (CPF)**

This file contains details of each contaminant for each flow path represented in the system. Before describing the contents of the file, some background on the urban water system and its flow paths is necessary.

Within AQUACYCLE, the urban water system is made up of four objects or scales, the Estate object, Cluster object, Unit Block object and Indoor object. The Estate object is the highest level and 'owns' the other objects. Each Estate object contains one or more homogeneous Cluster objects with each Cluster object containing one or more homogeneous Unit Blocks objects. Each Unit Block object contains one Indoor object.

Flow paths are simply all the paths where water flows are possible. Figure 5 represents the flow paths possible in the Indoor object of the Urban water system. Similar diagrams exist for Unit Block, Cluster and Estate objects. The flow paths are represented as dotted or full lines and each has a unique number (eg 6, 19). The cluster number\$flow path code is unique for each flow path in the system and allows for multiple clusters. For example, flow path 33 in cluster 2 would be referenced as 2\$33. A cluster number of max. clusters + 1 is used to denote cluster number of the Estate object. For example, in an estate with 3 clusters, cluster number\$flow path codes of the form 4\$ would reference flow paths at the estate level.

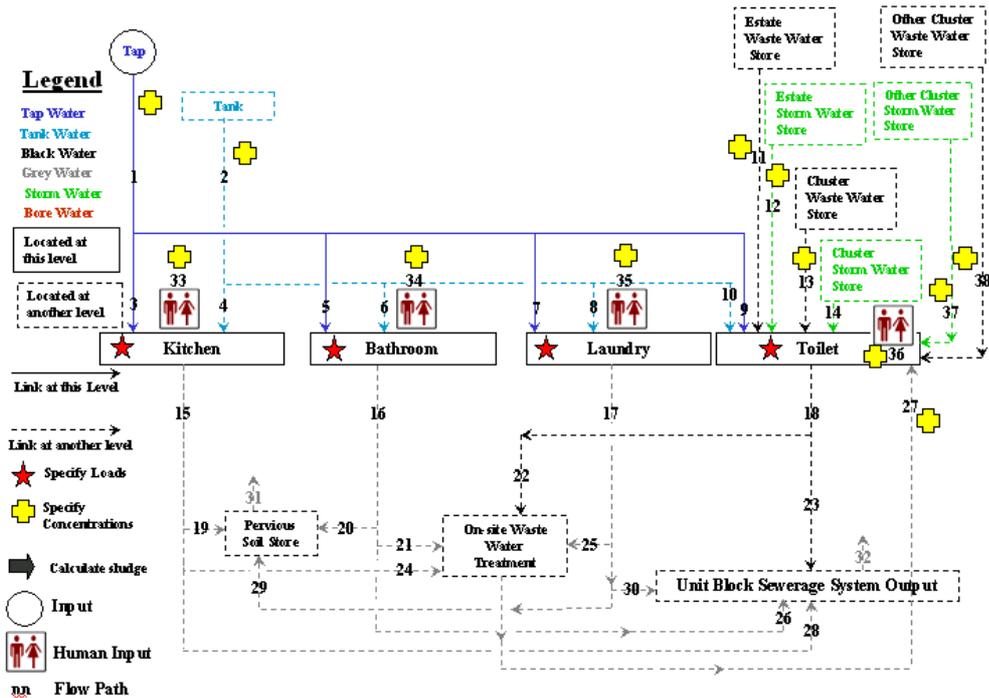


Figure 5, Indoor Object

This file contains general information about each flow path within each object (indoor, unit block, cluster, estate) and specific information for each contaminant being modelled for that flow path. For each flow path, this file lists

- ◆ flow path name (eg tap input) (note this name is optional)
- ◆ flow path code expressed as cluster number\$flow path (eg 1\$1)
- ◆ whether the contaminant profile is specified [S] or calculated [C]
- ◆ report status of contaminants for this flow path where R = Report (else leave blank).

For each contaminant modelled on that flow path, the Contaminant Profile file contains a set of paired values listing:

- ◆ the numeric code of the contaminant (eg 1),
- ◆ the value and measurement units associated with that contaminant.

The contaminant numeric codes are listed in Figure 4 (page 5). Units are used to determine whether the value is a concentration, a mass or a mass per capita which dictates the type of calculations performed when the contaminant balance is run.

Figure 6 shows the layout of the Contaminant Profiles file.

---

# CONTAMINANT BALANCE - CONTAMINANT PROFILES FILE

# Profile Code, S or C (Specified or Calculated),R (report on)  
# Code1, Mass or Conc. Units, Code2, Mass or Conc. Units, Code3, Mass or Conc. Units, etc  
#Note that all profiles specify contaminants, even the calculated ones. This gives us the opportunity to only calculate  
#certain contaminants for particular output profiles.

#URBAN RESIDENTIAL

#Indoor Scale Water Flows, Cluster 1

Tap,1\$1,S,R

1, 0.0 mg/l, 2,0.0 mg/l, 3, 0.0 mg/l, 4, 0.001 mg/l, 5, 0.508 mg/l, 6, 0.140 mg/l, etc

Tank,1\$2,S,R

1, 0.031 mg/l, 2, 0.001 mg/l, 3, 0.0005 mg/l, 4, 0.018 mg/l, 5, 1.080 mg/l, 6, 0.350 mg/l, etc

Catchment Waste Water Store,1\$11,S,R

1, 0.040 mg/l, 2, 0.040 mg/l, 3, 0.002 mg/l, 4, 0.002 mg/l, 5, 45.000 mg/l, 6, 37.00 mg/l, etc

Catchment Storm Water Store,1\$12,S,R

1, 0.040 mg/l, 2, 0.040 mg/l, 3, 0.002 mg/l, 4, 0.002 mg/l, 5, 45.000 mg/l, 6, 37.00 mg/l, etc

Cluster Waste Water Store,1\$13,S,R

1, 0.040 mg/l, 2, 0.040 mg/l, 3, 0.002 mg/l, 4, 0.002 mg/l, 5, 45.000 mg/l, 6, 37.00 mg/l, etc

Cluster Storm Water Store,1\$14,C,R

1, 0.040 mg/l, 2, 0.040 mg/l, 3, 0.002 mg/l, 4, 0.002 mg/l, 5, 45.000 mg/l, 6, 37.00 mg/l, etc

---

*Figure 6, Example of Contaminant Profiles File (CPF)*

## CONTAMINANT OPERATIONS FILE (COF)

This file describes the actual operations that are to be performed on the contaminant profiles as specified in the contaminant profiles file. The contaminant profiles are manipulated as either a:

- ◆ use operation which copies one profile to another,
- ◆ mix operation which mixes multiple input contaminant profiles to produce an output contaminant profile; or as a
- ◆ sludge operation.

These operations apply to all contaminant profiles on a flow path. Thus they can be identified by the flow path code.

For each flow path, this file lists

- ◆ flow path code
- ◆ operation identifier where M = Mix, U = Used by, and S = Sludge calculation
- ◆ Where the operation identifier is M (ie Mix), the identifier is followed by the flow paths of the profiles to be mixed.
- ◆ Where the operation identifier is U (ie Used by), the identifier is followed by the flow paths which use the the operation code
- ◆ whether the contaminant profile is specified [S] or calculated [C]
- ◆ the report status of contaminants for this flow path where R = Report (else leave blank).

There is a record for each flow path. Note that the maximum number of records in this file is set by the field, Maximum Operations over all clusters and estates, in the System Parameters File.

Figure 7 demonstrates the layout of the Contaminant Operations file.

```

## CONTAMINANT BALANCE - CONTAMINANT OPERATIONS FILE

#Profile 1.,Operation (M=Mix, U=Used By, S=Sludge calculation),
#Profile 2. Or Treatment code, Profile 3.,... Profile n.
#Note that
#Profile n. means contaminant profile code n ie cluster no$path no within cluster
#M, first parameter is output profile, profiles to be mixed are in list after M.
#U, first parameter is profile that is being used by other profiles in list after U.
#S first parameter is sludge path, second parameter is treatment code, last parameter is retained volume path
# input profiles are +ve, output profiles are negative, calculated profiles suffixed by *
# which is optional.

# ***** START CLUSTER 1 *****
# ***** Indoor Scale Water Flows, Cluster 1
1$1,U,1$3,1$5,1$7,1$9
1$2,U,1$4,1$6,1$8,1$10

1$15,M,1$3,1$4,1$33
1$15,U,1$19,1$24,1$28
1$16,M,1$5,1$6,1$34
1$16,U,1$20,1$21,1$26
1$17,M,1$7,1$8,1$35
1$17,U,1$25,1$29,1$30
1$18,M,1$9,1$10,1$11,1$12,1$13,1$14,1$65,1$36
1$18,U,1$22,1$23
1$31,M,1$19,1$29,1$20
1$32,M,1$23,1$26,1$28,1$30
    
```

*Figure 7, Example of Contaminant Operations File (COF)*

## Use Operation

Use operation identifies streams that are to have identical contaminant concentrations. For example, flow paths 3, 5, 7 and 9 (see first non-comment line in Figure 7) in the Indoor object (see Figure 5) have as their common source tap water, flow path 1. Therefore, they will have identical contaminant profiles and are simply copies of contaminant profiles for flow path 1.

Table 2 shows the location of each use operation in the system. The number in the parentheses represents the flow path shown in Figure 5.

*Table 2, Use operation locations*

Source	Used By	Level
Tap (1)	Kitchen (3), Bathroom (5), Laundry (7), Toilet (9)	Indoor
Tank (2)	Kitchen (4), Bathroom (6), Laundry (8), Toilet (10)	Indoor
Kitchen (15)	Pervious soil store (19), On-site waste water treatment (24), Unit block sewerage system output (28)	Indoor
Bathroom (16)	Pervious soil store (20), On-site waste water treatment (24), Unit block sewerage system output (26)	Indoor
Laundry (17)	Pervious soil store (29), On-site waste water treatment (25), Unit block sewerage system output (30)	Indoor
Toilet (18)	On-site waste water treatment (22), Unit block sewerage system output (23)	Indoor
Precipitation (50)	Pavement (51), Pervious soil store (52), Roof (53)	Unit Block
Tank (62)	Unit block storm water output (63), Indoor (64)	Unit Block
Roof (58)	Pervious soil store (61), Unit block storm water output (77)	Unit Block
Pervious soil store (31)	Pervious soil store (67)	Unit Block
Precipitation (100)	Road (101), POS pervious soil store (103), Cluster storm water store (132), Cluster waste water store (139)	Cluster

<b>Source</b>	<b>Used By</b>	<b>Level</b>
Road (104)	Cluster storm water store (131)	Cluster
POS pervious soil store (114)	Cluster storm water store (116), Cluster sewerage system output (126), Cluster sewerage system output(44)	Cluster
Unit block storm water output (90)	Cluster storm water store (123)	Cluster
Cluster storm water store (151)	Cluster storm water store (14), Cluster storm water store (79)	Cluster
Infiltration (72)	Infiltration (130)	Cluster
Unit block storm water output (90)	Cluster sewerage system output (40, 41,42)	Cluster
Unit block sewerage system output (89)	Cluster sewerage system output (43), Cluster waste water store (133)	Cluster
Cluster sewerage system output (155)	Cluster storm water output (46)	Cluster
Estate storm water store (173)	Storm water output (175)	Estate
Estate waste water store (176)	Sewerage system output (178)	Estate

## Mix Operation

Mix operations mix multiple input contaminant profiles to produce an output contaminant profile. It is assumed for a mix operation that there is no accumulation or destruction of mass during the mix, ie. mass is conserved. This implies that all water and contaminants flowing into the mix will flow out of the mix. The loads from various sources, which are the product of flow and concentration, are a convenient way of combining, splitting or treating contaminated flows from various sources. For further details on the equations behind the mix operation, refer to Farley *et al.* (2000), p19.

Table 3 shows the location of each mix operation in the system.

*Table 3, Mix operation locations*

<b>Location Name</b>	<b>System Level</b>
Kitchen	Indoor
Bathroom	Indoor
Laundry	Indoor
Toilet	Indoor
On-site Waste Water Treatment Tank	Unit Block
Storm Water Output	Unit Block
Sewerage System Output	Unit Block
Evaporation	Unit Block
Sewer Infiltration	Cluster
Storm Water Output	Cluster
Sewerage System Output	Cluster
Evaporation	Estate
Storm Water Output	Estate
Sewerage System Output	Estate

## Sludge Operation

Sludge operations allow for both the mixing of multiple input contaminant profiles to produce multiple output contaminant profiles and the removal of contaminant in a sludge stream. The sludge operation is used to model treatment processes where there is addition or loss of contaminants from the water system. The loss of contaminants from the water system is indicated by a positive sludge value while an addition of contaminants is indicated by a negative sludge value.

The sludge can be calculated using two approaches. In the simplest approach, the input and output concentration profiles are specified and the sludge is the difference between the input load and the output load. For further details on the equations behind the (simple) sludge operation, refer to Farley *et al.* (2000), p20.

Table 4 shows the location of storages in which the sludge is calculated in this manner.

*Table 4, Simple sludge operation locations*

<b>Location Name</b>	<b>System Level</b>
Pervious Soil Store	Unit Block
Tank	Unit Block
On-site Waste Water Treatment	Unit Block
POS Pervious Soil Store	Cluster
Cluster Waste Water Store	Cluster

The alternative approach for calculating the sludge operation is to assume the treatment process has some volume, and to treat the output streams by a fixed treatment efficiency. The treatment process is regarded as having some volume which is retained by the treatment process along with its contaminants. The incoming flows are mixed with the treatment volume before the compositions of the output streams are calculated. The contaminant profile of the retained volume is equivalent to the calculated profiles of the mixture. The volume of the treatment (mix) process has a user specified maximum value and the retained volume must be below this limit. Upon exceeding the maximum value, the water in the treatment process overflows or spills to a discharge stream.

The contaminant concentrations in the outlet streams are either calculated or specified. The specified concentrations enable flows such as evaporation to be accounted for, and are removed from the treatment before the mixture concentration is calculated. The calculated contaminant profiles are identical for all other output streams and are obtained by multiplying the mix concentration by the treatment efficiency factor for the particular contaminant. The sludge is calculated as the difference between the calculated output volumes with the mix concentration minus the output load following treatment. For further details on the equations behind this sludge operation, refer to Farley *et al.* (2000), p21.

Table 5 shows the location of each complex sludge operation in the system.

*Table 5, Complex sludge with treatment operation locations*

<b>Location Name</b>	<b>System Level</b>
Cluster StormWater Store	Cluster

Flows and contaminant balance are calculated for each flow path in the Indoor, Unit block, Cluster and Estate Objects. (The Indoor Object paths are shown in Figure 5). The calculations are repeated for every estate in the study region.

## **CONTAMINANT TREATMENTS FILE (CTF)**

The CTF contains details of all treatments that are alternatives to the sludge operation. For each treatment, it lists:

- ◆ code identifying the treatment (a unique numeric identifier)
- ◆ name of the treatment
- ◆ treatment efficiency for each contaminant. This is expressed as a set of paired values:
  - contaminant code (for list refer Figure 4)
  - treatment efficiency (eg 90%).

Figure 8 demonstrates the layout of the Contaminant Treatments File for one treatment.

---

1, Treatment 1, 1, 90 %, 2, 100 %, 3, 90 %, etc

---

*Figure 8, Subset of Contaminant Treatments File showing one treatment*

In this example (Figure 8), contaminant code 1 has a treatment efficiency of 90% which means that this treatment only removes 10% of contaminant code 1 as sludge. In the case of treatment code 2, there is no removal of sludge because the treatment efficiency is 100%. In addition to % efficiency, a - (a minus sign) may be used to specify a mass reduction in mg/d or mg/d/p, and a + (a plus sign) may be used to specify a mass increase in mg/d or mg/d/p.

## OUTPUT FILES

The contaminant balance component of UVQ produces two files as its output. Each file contains exactly the same data, only the format of the files is different. One file contains rich text format (rtf) and is suitable for inclusion in reports produced with Word or some other word processing package. The other file contains text format and is suitable for importing to Excel or some other spreadsheet package. **The formatting of the text is incomplete** (as at time of this report). Both files are produced in the **Results** directory see Figure 9.

The naming of these files is derived from the name of the contaminant balance group file (see Figure 3). The same name is used with a file extension of rtf or txt. An example showing the visual format of the rtf version of the output file is given in Figure 13 which is a summary report only.

As indicated in the sections on the input files Contaminants File and Contaminants Profiles File, it is possible to produce a more detailed report on each contaminant for each flow path at monthly and yearly temporal scales by setting the R option. This was not done during the prototype development phase as it increased the run times and also produced very large output files which were several megabytes in size. Further, the extra information produced was not considered to be worth the overheads at this stage.

## BUILDING UVQ

### SOFTWARE

Visual Basic Version 6.0 is required to compile the programs.

### PROGRAM AND FORM FILES

Table 6 lists the Visual Basic program and form files that are required to build the UVQ program.

*Table 6, List of Program and Form Files required to build the UVQ program*

File Type	File Name	Description	Functional Model (AC or CB)
Project	UVQ.vbp	VB project file	N/A
Form	Aveblo54x.frm	Unit Block Information GRid	CB
Form	Frmmai55.frm	AC Main Form	AC, CB
Form	Frmopen.frm	AC Welcome Screen	AC
Module	Gridstuf.bas	AC Grid setting up	AC
Form	Simper45x.frm	AC Simulation Performance Report	AC
Module	CBUtils.bas	CB Utilities	CB
Module	ModErrorHandling.bas	CB Error Handling	CB
Module	Catch60.bas	AC Main Calculations	CB, AC
Module	Contbal.bas	CB Main Calculations	CB
Form	FrmUVQProgress.frm	CB Progress Bar	CB
Form	FrmUVQTextReport.frm	CB Text Report	CB
Form	FrmResultNew.frm	AC, CB Results Form/Menus	AC, CB
Active X	Comdlg32.ocx	Visual Control	AC, CB
Active X	Msflxgrd.ocx	Visual Control	AC
Active X	Mschrt20.ocx	Visual Control	AC
Active X	Graph32.ocx	Visual Control	AC
Active X	Comctl32.ocx	Visual Control	AC, CB
Active X	Richtx32.ocx	Visual Control	CB

## INSTALLING UVQ

### DIRECTORY STRUCTURE

UVQ is manually installed by setting up a directory containing UVQ.EXE and two sub-directories below it named **Input** and **Results**. Note that these names are mandatory. Figure 9 illustrates the two possible directory structures.

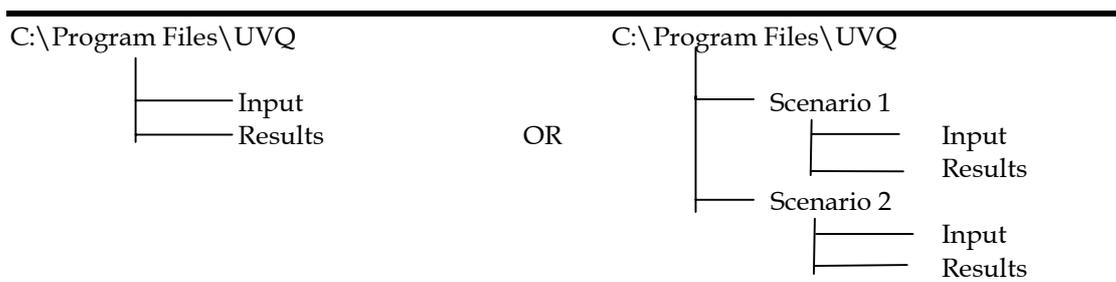


Figure 9, Possible Directory Structures for installing UVQ

The directory structure on the right illustrates how different **Input** and **Results** directories can be set up so that different scenarios may be modelled with the one copy of UVQ.

All input files (group files and files referred to in the group files) must be placed in the **Input** directory. All output files are written to the **Results** directory of their respective scenario directories.

### SYSTEM FILES

A number of system files must also be present. Table 7 lists these files and their suggested locations.

Table 7, List of system files and their suggested locations

File Name	Location
Comdlg32.ocx	Windows System directory
Graph32.ocx	Windows System directory
Gsw32.exe	Windows System directory
Gswag32.dll	Windows System directory
Gswdll32.dll	Windows System directory
Mschrt20.ocx;	Windows System directory
Msfixgrd.ocx;	Windows System directory
Msvbvm60.dll	Windows System directory
Oleaut32.dll	Windows System directory
Riched32.dll	Windows System directory
Richtx32.ocx	Windows System directory

## RUNNING UVQ

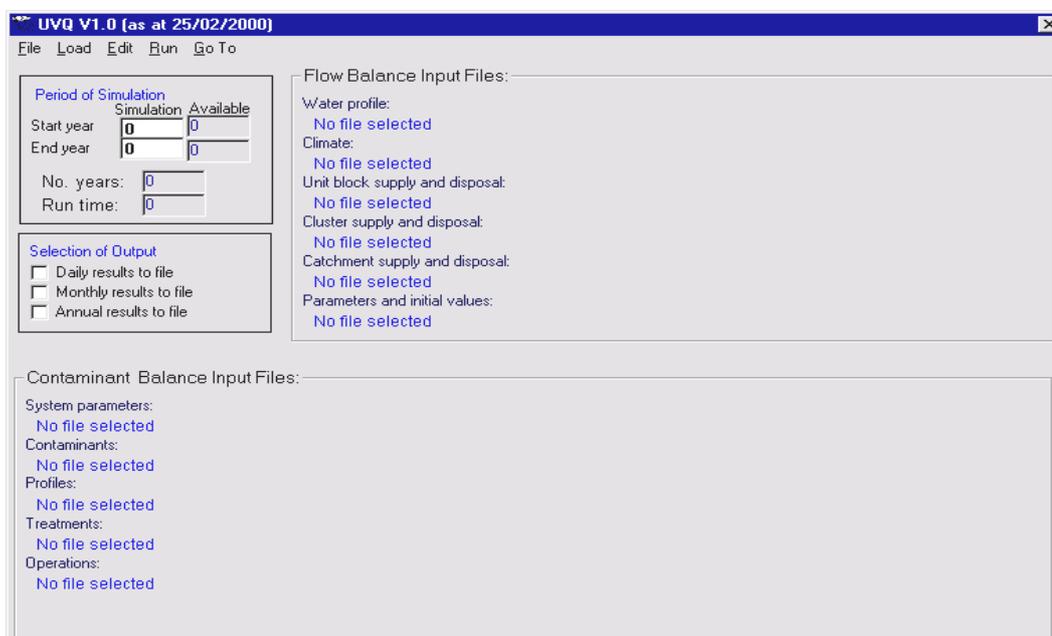
UVQ may be run in two modes:

- normal
- command line.

### NORMAL MODE

Normal mode allows you to fully interact with the UVQ program particularly in terms of its input and output interfaces. A brief description of its use, with respect to the CB component, follows.

When UVQ runs, the first screen that appears is shown in Figure 10.



*Figure 10, UVQ Opening Screen*

The user must then select the Load menu and load both the AC group (Load Group) and the CB group (Load Contaminant Group) files as shown in Figure 11. Clicking each of these menu options displays an open dialog box which allows the user to perform file selection.

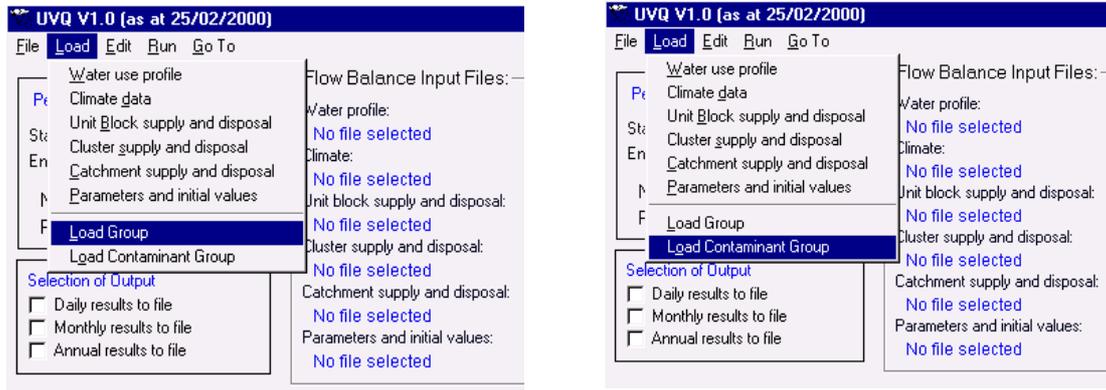


Figure 11, Dialog Boxes to load (a) Aquacycle Group File (b) Contaminant Balance Group File

After the user has selected and loaded both group files, the Contaminant Balance may be run by selecting the Run, Simulation menu (see Figure 12).

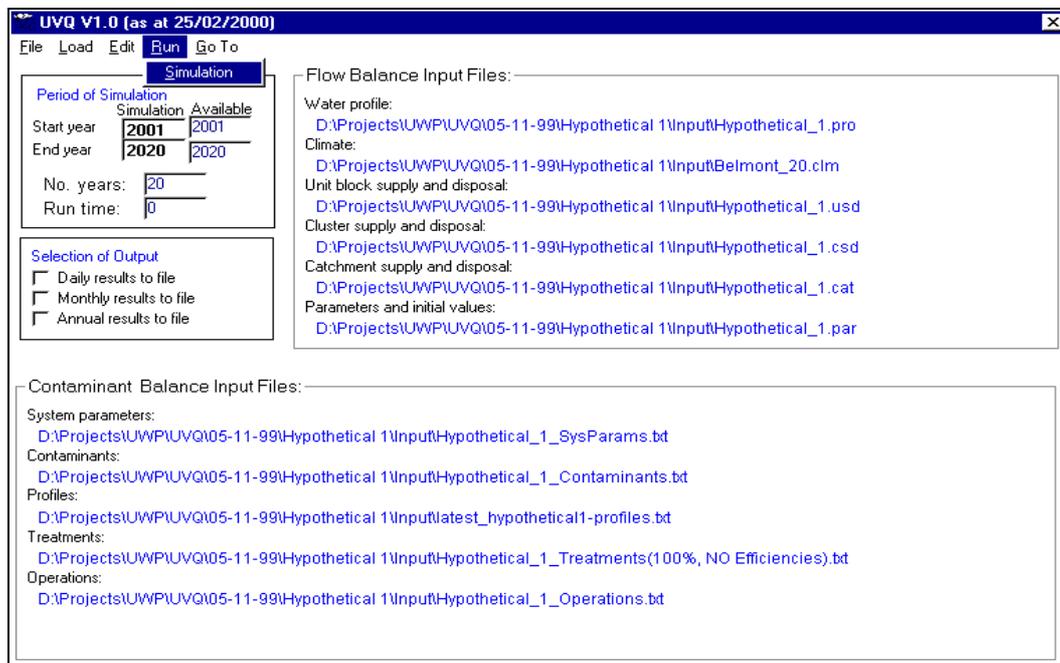


Figure 12, Run Simulation menu

A progress box will appear just after the run has started. When the run is complete, the CB Run Report is automatically shown, see Figure 13.

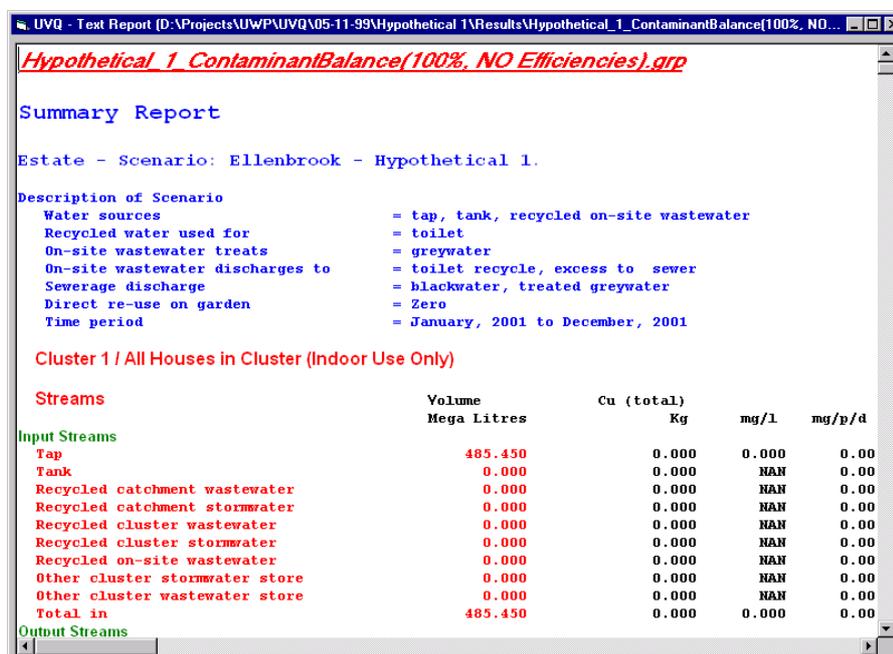


Figure 13, Contaminant Balance Run Report

## COMMAND LINE MODE

The command line mode allows you to run UVQ without showing the UVQ input interface and is useful when UVQ is to be run from another program such as the Scenario Manager (SM). In the case of the SM, all UVQ's input files are created within the SM and the subsequent operation of the SM requires that the UVQ input interface be bypassed. The command line typically looks like :-

**UVQ.exe "\autorun" "\loadgroup=AC.grp" "\loadcgroup=CB.grp"**

Where UVQ.exe is the full path name of the UVQ executable, AC.grp is the full path name of the AC component group file and CB.grp is the full path name of the CB group file.

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