



WATER RESEARCH COMMISSION

USER MANUAL FOR THE
WHICHSAN

Sanitation Decision Support System

September 2009

by Hilary Branfield and David Still

Partners in Development
PO Box 11431
Dorpspruit 3206
Pietermaritzburg

Tel. 033 342 3012
Fax. 033 342 0636

dave@pid.co.za

September 2009

Obtainable from:

Water Research Commission

Private Bag X03

Gezina

0031

The publication of this report emanates from a project entitled: *The Financial Sustainability of Basic Sanitation Services* (WRC Project No. K5/1632)

DISCLAIMER

This report has been reviewed by the Water Research Commission (WRC) and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the WRC, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Table of Contents

1. Introduction.....	1
2. Start Up	1
3. Question Screens	1
4. Results Page	2
5. Scoring Page.....	2
6. Calculations Page.....	3
7. Treatment Works Page.....	3
8. Budget Spreadsheets.....	3
9. Pipe Size Calculator	3
10. List of Questions	4
10.1 Technical Feasibility Questions.....	4
10.2 Financial Feasibility Questions.....	5
10.2.1 Construction.....	5
10.2.2 Sewer Construction	5
10.2.3 Operation and Maintenance	6
10.2.4 Water Cost Questions.....	7

System Requirements

Microsoft Excel with security level set to medium or low. To change security level open Microsoft Excel and go to *Tools>Options>Security>Macro Security* and change level to medium or low. If you choose a medium security level a pop-up screen will appear when you start the SDSS, please click Enable Macros for the programme to run.

Adobe Acrobat

Adobe Reader version 6 or higher will be required to read the supplementary information files which are included with the model.

1. Introduction

The *WhichSan* Sanitation Decision Support System has been developed to assist planners and engineers to consider the relative merits and costs of different sanitation options for a given situation. Users are prompted to consider the many questions which relate to sanitation choice, for example

- Is there a water supply with sufficient spare capacity to provide for flush toilets?
- Is someone (either the users of the municipality) willing and able to pay for the additional water that will be used if waterborne sanitation is chosen?
- Is the bulk sewage system able to deal with additional volumes of sewage?
- Are the ground conditions on site suitable for soakpits or VIP latrines?
- What are the capital cost constraints and what are the maintenance cost constraints?

There is however, no substitute for knowledge and experience of this subject, and the results will only be as good as the assumptions made in supplying the data. The results should be evaluated by someone with the necessary experience.

Finally note that this software, developed on behalf of the Water Research Commission, is distributed at no cost in the public interest. Users are welcome to send suggestions for improvement of the software to the mail address contact@pid.co.za, and as time permits these suggestions will be attended to. A user database will be kept and updates will be sent to all those who supply their contact details. However, users are welcome to customise their own versions of *WhichSan*. In order to unprotect the worksheets, the password is "PID". In order to view the Visual Basic code the password is "Hilary".

2. Start Up

The files *WhichSan.xls*, *User Manual.pdf* and the *Factsheets* and *Drawings* folders must all be saved in the same folder.

To start the *WhichSan* programme open *WhichSan.xls*.

For the programme to work, Microsoft Excel is used with the security level set to medium or low. To change the security level open Microsoft Excel and go to *Tools>Options>Security>Macro Security* and change level to *medium* or *low*. If you choose a medium security level a pop-up screen will appear when you start the *WhichSan*, please click *Enable Macros* for the programme to run.

Note that Adobe Reader version 6 or higher will be required to read the supplementary information files which are included with the model.

3. Question Screens

When you first start *WhichSan* a splash screen will appear. To start the programme press the *Start* button.

The first screen shown asks if you wish to enter an escalation factor. This will scale up all the prices in the programme from 2006 values to current values. To increase all prices by 5% an escalation factor of 1.05 should be entered, by 10% 1.10, etc.

You will then be lead to a series of question screens. All the questions on a screen must be answered before you can proceed to the next screen. If you are unsure of an answer to a question make an estimate and carry on. Any answer can be revised at a later stage without the whole model having to be run from the beginning.

4. Results Page

When you have finished the questions the results will be shown on the *Results* page of the workbook.

The buttons provided along the top (Rows 8 – 10) open factsheets on the different sanitation options. These factsheets are provided in the *Factsheets* folder which come with this programme and which can also be opened directly without having to run the programme.

The first section of the *Results* page shows the technical feasibility of the sanitation options. The *Totals* row (Row 25) gives scores for the technical feasibility of the different options. The more feasible an option, the higher the score. If an option scores 0 it is technically unfeasible. The notes on the bottom of the page will give an indication of why the option has been rated as technically unfeasible (e.g. if there is no available water supply, then a waterborne sanitation option is not feasible).

Above this is the *User Preference* row (Row 24). This displays the order of preference of the different options indicated by the potential users. This has no reflection on the feasibility score and is provided for information only.

The second section of the Results page shows the financial feasibility of the options. If a value appears in red then that value exceeds the budget entered for that activity, and therefore that option is financially unfeasible. For example if a value is shown in red in the *Construction Costs* row (Row 33) then that value exceeds the budget given in the *Construction Budget* row (Row 32). If any sanitation option is marked as N/A then this option was not considered feasible in the technical feasibility section, and therefore has not been considered in the financial feasibility section.

The *Results* row (Row 37) summarises the feasibility of each option. A tick indicates that the option is feasible and a cross that the option is not feasible.

The *Notes* section provides additional information on the results provided.

To edit any of your answers click on the *Edit* button for that section. If you decided to start over again use the *Start Again* button, however all your data will be lost and the default values will be reset.

5. Scoring Page

The next sheet in the workbook displays the scores assigned to each option for all the possible answers to the technical feasibility questions. An Edit button is provided to alter any

of these scores. They are typically scored 0 (a fatal flaw), 3 (not ideal, but possible) or 5 (no problem on this question).

6. Calculations Page

The calculations page displays the values entered for the financial feasibility questions and how they are used to calculate the results. Values entered by you are shown in black; calculated values are shown in red; and values used for calculations are shown in blue. If you wish to edit the blue values use the *Edit Rates* buttons; to edit the black values use the *Edit* button. Red values cannot be edited.

7. Treatment Works Page

The treatment works page displays the values used for the construction and operation and maintenance costs for treatment works. If you wish to use your own values please use the *Edit Rates* buttons on the Calculations page. The *More Information* button will open a factsheet on wastewater treatment works [use Adobe 6 or higher]. The factsheets are provided in the Factsheets folder which came with this programme and which can be opened directly from there.

8. Budget Spreadsheets

The budget spreadsheets provided give an indication of the costs of constructing the different options. The cost of materials and labour and quantities required can be altered for local conditions in Columns E and F. If you wish to alter the budget spreadsheets further (e.g. deleting or adding rows) please copy and paste them into a new workbook, then copy just the total back to the provided worksheets in the block provided for this purpose at the top (row 3 or 4).

If you have previously calculated the budget for an option please enter it in the box provided (row 3 or 4) and it will be used in the programme rather than the budget calculated.

The *View Drawing* button opens technical drawings for the different sanitation options [use Adobe 6 or higher]. The drawings are provided in the *Drawings* folder which came with this programme and which can be opened directly from there.

9. Pipe Size Calculator

The *pipe size calculator* follows the guidelines laid out in Chapter 9 of *Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development* (the CSIR “Red Book”) to aid you in selecting the pipe size required for the bulk main sewer.

To use the *pipe size calculator* follow the instructions below:

1. Read value for Peak Factor from Graph 1 and enter into cell E15 shown in red;
2. Enter a value for the slope of the project site in cell E24 shown in red;
3. Click *Find Pipe Size* button;
4. When finished click *Finished* button to return to questions.

The *pipe size calculator* works by substituting the relevant values into Manning's equation and then increasing the size of the pipe until a velocity of 0.7m/s is reached at the design flow. If the pipe size calculated is not a standard pipe size, the standard pipe size larger than the one calculated should be selected.

10. List of Questions

Listed below are the questions that are asked in the programme along with a brief explanation of why the question is asked. The questions asked will vary depending on answers to previous questions and therefore you may not be asked all of these questions. This list is to aid you to gather the required data before running the programme.

10.1 Technical Feasibility Questions

1. *Is there an on site water supply? Or will there be when sanitation is required?*
Water borne sanitation options: fully water borne sewerage, septic tanks and pour flush, are technically unfeasible without an on-site water supply.
2. *What is the mean plot size?*
Septic tanks with soakaways require plot sizes greater than 500m², and VIPs are generally not advised where plot sizes are less than 200m².
3. *Is the soil depth less than 1m?*
Sanitation technologies that rely on percolation ideally require a soil depth of greater than 1m.
4. *Is the mean slope of the site greater than 25°?*
Sites with a very steep slope are not suitable for sanitation options that require a pit or soakaway.
5. *Where are the sanitation facilities planned to be?*
It is not desirable to have VIP latrines inside a house. All other sanitation options can be either inside or outside.
6. *What type of anal cleansing method is used?*
If hard or bulky material is used, and the users are unwilling to change to soft paper or water, then water borne sanitation is not feasible.
7. *What is the soil type?*
Different soil types have different percolation rates. Soils with either very low or very high percolation rates can be problematic for soakpits (if very low the soakpit will not work, while if very high groundwater contamination may result). Factsheets are provided in the Factsheet folder on soil types and percolation testing
8. *Is the area prone to flooding?*
If the area is prone to flooding then sanitation options that require pits or soakpits would not be suitable.

Questions 9, 10 and 11 would only be asked if water borne sanitation is still considered feasible following the previous questions.

9. *What is the volume of water available for sanitation?*
Although on-site water may be available, there needs to be enough available to cover basic needs for drinking, cooking and hygiene as well as for the sanitation system envisaged.

10. *Is there capacity in the local treatment works for additional demand?*

If fully water borne sewerage is to be used there needs to be capacity in the local treatment works, or at least the ability to increase the capacity of the local treatment works, to cope with the additional demand.

11. *Are users willing to pay for additional water for sanitation?*

The additional water required for water borne sanitation will have to be paid for. If the users are not willing or not able to meet this cost, non-water borne sanitation options need to be considered.

10.2 Financial Feasibility Questions

10.2.1 Construction

1. *How much money is each household contributing to the construction, either in cash or the relative value of sweat equity?*

Each household may either be contributing cash to the construction of their sanitation facilities, or may be contributing sweat equity, for example by digging their own pit.

2. *How much money is coming from other sources?*

Additional money for construction could be coming from a variety of other sources e.g. international aid, national government, local government, or a non-governmental organisation.

3. *Approximately how many people live at each site?*

This enables costs per person to be calculated.

10.2.2 Sewer Construction

The following questions would only be asked if fully water borne sewerage is feasible following the technical feasibility questions.

1. *How far is the main sewerage network?*

The cost to connect the project site to the sewerage network must be included in the project construction cost calculations

2. *What is the current maximum capacity of the sewage treatment works?*

3. *What is the current use of the sewage treatment works?*

If the capacity of the sewage treatment works needs to be increased to cope with the additional demand created by the project, then the cost of increasing the capacity needs to be taken into account when calculating project construction costs

4. *What type of sewerage treatment plant would be used?*

Different sewerage treatment plants have different construction costs.

5. *What pipe size would be required for the bulk main in the project area?*

Different pipe sizes are required depending on the population. To aid you in calculating the size required a pipe size calculating spreadsheet has been provided.

6. *What is the trench size that will be required for the bulk main sewer pipe?*

7. *How will the trenches be dug?*
Costs are calculated differently according to whether the excavation will be done principally by hand or by machine.
8. *What will be the typical percentages of each soil type in the excavations?*
To enable the total cost of laying sewerage pipes to be calculated, the cost of the excavations also needs to be included. This varies depending on the method used, hand or machine, and the difficulty in removing the soil depending on whether it is soft, intermediate or hard.
9. *What sewerage pipe size would be required for the internal sewerage reticulation in the project area?*
10. *What is the average trench size that will be required for internal sewerage reticulation pipes?*
11. *What length of internal sewerage reticulation pipes would be used?*
12. *What would be the average distance between manholes?*

Questions 9 - 12 enable the approximate cost of the internal sewerage reticulation to be calculated.

10.2.3 Operation and Maintenance

1. *What is the mean monthly household income?*
This is to enable you to assess whether the projected operation and maintenance costs are reasonable in comparison with the typical income in the area.
2. *Who would be responsible for maintenance?*
Either the householder, the municipality, another organisation or a combination could be responsible for maintenance of the sanitation facilities.
3. *How much money is available for maintenance?*
How much is the organisation or household able to provide for the maintenance of the sanitation facilities?
4. *Where would waste be disposed of?*
Whether the waste from pits is disposed of in the project area or is to be transported to a treatment works affects the costs.
5. *Is the project area mainly rural or urban?*
If waste from pits is to be disposed of in treatment works, the cost to transport it is higher in rural areas.
6. *Is there road access to the site that allows a vacuum tanker within 30m of the potential sites of sanitation facilities?*
For a vacuum tanker to be used to empty pits it must be able to get within 30m of the sanitation facilities, otherwise emptying must be carried out by alternative means.

7. *Is there room on plots to bury waste?*

To cut the cost of transporting the waste off site, the waste can be buried on the householders plots.

8. *Is it acceptable to reuse waste as compost, and would householders or others be willing to do this?*

Waste from pits that has been left for a suitable length of time to decompose, and for disease causing pathogens to die, can be used as compost. If communities are willing to do this, the cost of transporting waste from site can be reduced.

10.2.4 Water Cost Questions

The following questions would only be asked if fully water borne sewerage is feasible following the technical feasibility questions:

1. *What is the current water use per person, including losses, but excluding current water borne sanitation?*

This will enable the additional water requirements to be calculated.

2. *How will water be billed when sanitation is in place?*

Water can either not be billed at all, have no charge for a basic allowance only, be charged using a flat rate, or be billed for based on a water meter reading.

Which of the following questions are asked depends on the answer to question 2; these questions allow the cost of additional water requirements to be calculated:

3. *What is the free basic allowance?*

4. *How is additional water charged?*

5. *What is the mean cost of 1 m³ (kilolitre) of water to the municipality?*

6. *What is the mean cost of 1 m³ of water to the household?*

7. *What is the flat rate charged to the household?*

8. *What percentage of the monthly household income would be available to pay for water?*

This question provides the budget for water requirements.