TankSmart$_{XL}$™

A Tool for Planning Industrial & Domestic Water Supply, Recycling, Storage, & Disposal

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User Manual

Version 1.01

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Preface

DOCUMENT CONFIDENTIALITY & LIMITATIONS

This manual is regarded as 'Commercial-in-Confidence' and is for use by persons who have purchased the TankSmart$_{XL}$™ product. It shall not be disclosed to any external parties whatsoever without the permission of the Principal Engineer – Nufer & Associates (Aust) Pty Ltd. The contents of this manual have been authored carefully however whilst every attempt has been made to substantiate its contents there may be discrepancies in some information contained within, as a consequence of changes which the author has little control.. Where such occurrences are substantiated it is requested that the necessary corrections be made known to the author so that the document can be amended accordingly. Contact details are provided below.

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Glossary of Terms & Definitions

CT	Configuration Tab - TankSmart$_{XL}$™ MS Excel™ spreadsheet containing the water usage configuration details for the project.
MT	Model Tab - TankSmart$_{XL}$™ excel spreadsheet model for simulating water usage.
PT	Profile Tab - TankSmart$_{XL}$™ MS Excel™ spreadsheet containing the profile information for the project.
ST	Summary Tab – TankSmart$_{XL}$™ MS Excel™ spreadsheet containing the summary details for the project.
TSXL	Acronym for TankSmart$_{XL}$™

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CHAPTER 1

INTRODUCTION

Thank you for purchasing TankSmart$_{XL}$™. This spreadsheet application was developed as an extension of the work done by Nufer & Associates in process control for the water industry, and as a consequence of this region experiencing the worst drought in over 100 years. The product has been given its name as a consequence of the dilemma often faced by water users in dimensioning tanks and storage requirements for water, however TankSmart$_{XL}$™ is a comprehensive water modelling application which can be applied to all water usage applications whether these involve the use of tanks of not.

Product Limitations

Please note that TankSmart$_{XL}$™ is a software modelling tool. Since it deals with estimation of water usage based on multiple and or complex events, the results of the calculations it performs are estimates only, and cannot be used in any way to predict actual outcomes, and for this reason, no responsibility will be accepted by the author for usage of this information whatsoever, whether these be direct or consequential application of the information by the user or others.

What is TankSmart$_{XL}$™?

TSXL™ is a spreadsheet simulation designed to run on MS Excel™ (not supplied). The application is comprised of custom spreadsheets and underlying visual basic code built into a comprehensive model. The system is fully user configurable for investigating water usage and impacts on supply sources, storage and disposal.

What TankSmart$_{XL}$™ Does?

TSXL™ models or simulates water flows in industrial and domestic situations.

It allows the user to calculate out water usage during different periods of the year and accordance with various usage patterns.

This information may then used to determine the demands on water supply, rain water, tanks including grey water recycling, which best suit the application requirements.

Note that it is not necessary to have tanks in the system at all. In these situations TSXL™ works just as well for the purpose of determining impacts on supply sources as well as disposal options.

How Does TankSmart$_{XL}$™ Function?

Put simply TSXL™ is like a set-of-accounts for water supply, usage, and disposal. It comprises various sources of supply, such as the town supply, mains, or rainwater. You can have tanks to store this water in the case of rainwater, and tanks to store recycling supplies such as grey water. Ultimately water is either consumed by users or processes,

and the left-over supply eventually disposed of to sewerage. TSXL™ comprises four components for modelling water usage which include:

- Summary;
- Water Model;
- Usage Profiles; and
- Usage Configuration.

The proper use of these is essential to achieving the desired outcomes from the TSXL™ application and are the subject of this manual.

SUMMARY

The summary page provides the overall project details for TSXL™. It includes details of the water, grey water and other water supplies as well as disposal methods and other options. It also includes details such as the roof-area for rainwater collection. The summary page provides the introduction to the project being considered.

WATER MODEL

The Water Model is the core deliverable of TankSmart$_{XL}$™. Based on historic rainfall information and the details contained in the profiles, it can model water usage in an industrial or domestic application for any period of time – from days through to years.

PROFILES

The way water is used is dependent on the particular industry and household. This is also subject to the constraints imposed by the particular jurisdiction in which the modelling is being undertaken.

TSXL™ comprises a series of tables, which allow the user to build up water usage patterns called profiles for various scenarios and times of the year and in accordance with the prevailing water usage constraints. Note prevailing restrictions must be entered by the user and cannot be pre-installed in TankSmart$_{XL}$™.

USAGE CONFIGURATION

In TSXL™ water usage configuration describes water usage for a wide range of situations found in the home. An additional aspect is the restriction level imposed by various water usage practices. For example washing the car, may be restricted under levels three and above. The jurisdiction where you may be applying TSXL™ will have special definitions which you enter here. This part of the spreadsheet also includes water supply sources and disposal for the various applications you are entering. For example the water supply source for toilet flushing may be grey water.

Benefits of TankSmart$_{XL}$™

The primary benefits of TSXL™ lie in its ability to;

- Audit & Review,
- Plan, and
- Explore various what-if scenarios for;

Multiple TankSmart$_{XL}$™ applications can also be coordinated to provide summary water usage information and compare before and after implementations.

Water supply and disposal in situations such as;

- New Industrial Complexes,
- Shops and Warehouses,
- Residential Construction,
- Domestic Water Management, and
- Similar Water Usage Applications.

Are readily undertaken with TankSmart$_{XL}$™, and the basis for appropriate decisions subsequently made.

Audit & Review

TSXL™ can be used as an auditing tool to review proposed water strategies against current water usage practices.

For example if water consumption is compiled for the typical week for all the activities around a factory or in a residential situation, and the water meter read at the beginning and end of this period then a comparison made for estimates versus actual, and questions asked as to:

(a) How much water do I consume in particular industrial processes, in areas of administration, the kitchen, bathroom or laundry?

(b) Is there close agreement with the indicated water usage from the meter and that calculated from my usage profile?

(c) Is the water supply meter correct?

(d) Are my usage assumptions correct?

(e) Should I test these assumptions using independent measurement?

(f) What is the effect on usage of modifying these practices(see what-if scenarios)?

(g) Should I consider water harvesting strategies such as a rainwater tank?

(h) Should I consider water recycling strategies such as greywater collection and reuse?

(i) Should I contact the council to have my water meter checked?

(j) What will be the effect on my usage of new water restriction levels?

PLANNING

For people building new warehouses, factories, and residences, there is increasing need to plan resource usage in order to optimise funds and ensure make good use of available materials.

For example, the reducing size of residential blocks means there is less space to locate rainwater and greywater tanks. Similarly why buy large water supply tanks if the application does not demand it or more importantly there is little likely-hood of the water tank filling due to a small roof or lack of rain.

TSXL™ provides a means for planning water supply options including the dimensioning of rainwater and greywater tanks. Questions which it might help to answer include:

(k) What size rainwater tank should I consider for my new home given its roof-area, location, and planned usage of the water it holds?

(l) How often will it fill[2] or empty?

(m) What size greywater[3] tank should I consider for my home given the planned sources and usage I am considering?

WHAT-IF SCENARIOS[4]

In a whole raft of situations where water supplies are being reviewed TSXL™ provides the means of considering the what-if scenarios, as a means to looking at alternative strategies in either modifying the use of existing water supplies or examining options for the development of new water supply installations.

The fact TankSmart$_{XL}$™ is implemented using MS Excel™ also means that summations from various scenarios can be summed and compared into a combined analysis, thereby allowing a comprehensive comparison of multiple strategies.

Examples of some scenarios:

(a) What will be the impact of new restriction levels on water usage configurations?

(b) What are the optimum tank sizes for various water recycling methods?

(c) How will my reliance on town water be affected by these water strategies?

(d) What are the cost savings versus to be obtained using various water saving and recycling strategies.

TankSmart$_{XL}$™ Water Supply & Disposal Scope

TSXL™ modelling includes the consideration of four main aspects of water supply and disposal. With respect to water supply the modelling includes:

- Mains or Town Supply;
- Rainfall & Storage in Tanks of a Nominal Capacity;
- Recycled Grey Water of a Nominal Capacity; and
- Alternative or User Defined Water Sources.

Similarly TSXL™ also models the disposal of water through a number of mechanisms including:

- Consumption of the water outright;
- Recycling or grey water through nominal tank capacities;
- Disposal to sewerage; and
- Disposal to some other user-based system.

In so doing TSXL™ is therefore able to provide an excellent means of indicating tank capacity based on planned usage and recycling.

[2] Based on previous rainfall records for the locale.
[3] Greywater usage maybe controlled by the council or government jurisdiction in which the residence is located notwithstanding that various greywater sources may not be appropriate and/or may require primary treatment for the applications intended which will involve additional equipment considerations outside the scope of this document.
[4] Scenarios are dependent on the accuracy of the information being put into the model. Since this is a simulation process only, no responsibility can be or will be accepted for usage of the resulting information or subsequent actions based on this information.

TankSmart$_{XL}$™ Features

Whilst primarily directed to modelling of water supply flows around the residential application it also has a number of other features which provide the user with excellent planning information in terms of water supply configuration. Features include:

- User definition of water usage applications;
- Application of water restriction rules or permissions[5];
- User definition of water sources and sinks per application;
- Nomination of rain-water[6] and grey water tank sizes;
- Override of default water rate applications with manual entry option;
- Infinite number of model graphing options including those built in;
- Weekly summaries of input/output water flows on a day-by-day basis;
- Sensitivity analysis of rainfall, storage and consumption data;
- Calculation of mains or town water supply costs;
- Because it is a spreadsheet the user is free to add their own graphs etc.

The other benefit of TSXL™ is that it allows you to take into account past rainfall events, and see the results with respect to the tank sizes.

TSXL™ also allows the modelling of greywater storage which is set to become a major consideration for future optimisation of water usage in all applications.

What Does this Manual Contain & How is it Structured?

This manual comprises all you need to use TSXL™. However should you wish to leverage the computations carried out by TSXL™ then you will need a good understanding of MS Excel™. This manual is structured based on the following sections.

Section	Description
Introduction	This section of the manual providing a lead-in overview to the implementation and use of TSXL™.
Installation & Set-Up	Licensing and installation of TSXL™, as a standalone and core helper application for use with other spreadsheets.
TankSmart$_{XL}$™ Overview	A general overview of TSXL™ and how it is structured and used, including the inter-relationships between the various table (spreadsheets).
Summary Tab	Stepping through the operation of the TSXL™ summary screen.
Configuration Tab	How to set up the usage information in the spreadsheet under the 'Config' tab.
Profile Tab	Setup and operation of the spreadsheet under the 'Profile' Tab and is relation to spreadsheet data on the 'Config' Tab.
Model Tab	Setup and running of the 'Model' spreadsheet, along with leveraging of its additional information outputs and graphing capabilities.
TankSmart$_{XL}$™ Tutorial	A tutorial in the actual usage of TSXL™ for some hypothetical water supply applications.

Table 1 TankSmart$_{XL}$™ Manual Contents

For more information please send your requests to tanksmart@nufer.com.au.

[5] This is a user responsibility owing to the fact there are so many different water jurisdictions around the world, and that each one has its own rules w.r.t. the restriction of water usage e.g. washing the car may be restricted above Level 4 as it is in Brisbane, Queensland, Australia.
[6] Note that nomination of tank sizes is based on one rain-water tank, and one grey water tank, on the basis that each tank system is aggregated for modelling purposes, as is the roof area – see discussion for other options later in manual.

Limitations in Use of TankSmart$_{XL}$™

As with other modelling software, TSXL™ has limitations based on the data that is put into the spreadsheets, and sophistication of the model used for calculating the water flows such as –

(a) The modelling depends on the integration of water flows within the tanks i.e. as long as the water tanks do not run dry or flow over, the inflows over the 24 hour period during which rainfall will be calculated will aggregated with the outflows:

(b) Under particular conditions or rainfall, such as deluge conditions, the efficiency of water collection systems will change leading to limitations in the ability to harvest rainfall run-off. Notwithstanding this fact rainfall records are at best an indication due to the wide scale variance of precipitation over short distances:

(c) Water flow applications are calculated using the parameters for the model. Whilst the ability to redefine these at the time of entry is provided, it must be remembered that the quantity involved is likely to be quite variable, and so a best-estimate is required.

CHAPTER 2

INSTALLATION & SET-UP

There is no real installation requirement for TSXL™ with the exception that you need a properly functioning computer system on which to run the application. A licence is required for both TSXL™ and for MS Excel™ (not provided by Nufer & Associates as part of this solution).

In terms of the TSXL™ application you receive from Nufer & Associates, it is suggested that you retain the original file and make a copy for your usage. The copy of TSXL™ should then be used for your calculations so that the original is not corrupted.

Licensing

TANKSMART$_{XL}$™ LICENCE

A paid licence is required to use TSXL™ in order to help underwrite support and ongoing development. Help us to help you get the most out of this program.

MS EXCEL™ LICENCE

TSXL™ is based on MS Excel™. Its capabilities are exploited in TSXL™ to provide the user with a very powerful working environment for modelling of water flows and usage scenarios.

In order to start using TSXL™ you must have a legal licence for MS Excel™. Note this is not part of the TSXL™ offer from Nufer & Associates.

Suggested Hardware Requirements

In order to run TSXL™ it is suggested you have the following –

(a) Properly licensed environment for running Microsoft™ applications including up-to-date licensed copies of Microsoft XP Service Pack 2 along with MS Excel™ or MSOffice 2002/2003:

(b) Appropriate computer hardware such as a widescreen monitor (17" or greater suggested) due to the width of the spreadsheets:

(c) A reasonable amount of computer capacity ~ Pentium 4 1.8 GHz plus at least 500 MByte (1GByte Suggested) or RAM, and to minimise the other apps in the background (note this probably depends on how big your model becomes):

(d) An appropriate printer on which to print the results of your calculations.

Minimum System requirements for TankSmart$_{XL}$™

TSXL™ is based around the use of MS Excel and should work from versions 2002 upwards. There are a couple caveats to the use of TSXL™ associated with the versions of MS Office™ being used.

At this time TSXL™ has only been tested on MS Office™ 2002 and MS Office™ 2003. This is not to say it will not work on Vista Office and testing has suggested it will operate satisfactorily in compatibility mode, however extensive testing for operation under Microsoft™ Office 2007 have yet to be carried out.

Starting TankSmart$_{XL}$™

To use TSXL™ simply start MS Excel™ and load TSXL™.

Open the first tab marked ‘Summary’ to bring up the summary sheet containing the TSXL™ configuration data. Complete the fields marked with light yellow.

If Problems Occur

Since TSXL™ is essentially just a spreadsheet application, test the underlying MS Excel™ program using some other work you may have done.

If the problem persists, send an email describing the problem to tanksmart@nufer.com.au. Ensure that you put the word ‘TANKSMART’ as the first work in the title in order to ensure the email is accepted through the spam filtering. We will endeavour to reply to you within 24 hours.

Note if you cannot validate your TSXL™ licence, support will be refused.

CHAPTER 3

TANKSMART$_{XL}$™ OVERVIEW

The TSXL™ application has been developed to replicate a common look and feel throughout so that whatever practices you use on one sheet are also used on others.

TankSmart$_{XL}$™ Environment

There are very few differences between the TSXL™ and a normal spreadsheet. This has been done on purpose in order not change the user installed MS Excel™ environment. Consequently if there is a computer malfunction due to some reason there will be no change to the MS Excel™ environment.

Characteristics of the TankSmart$_{XL}$™ Environment

In working with applications such as TSXL™ from Nufer & Associates the spreadsheet is supplemented with a number of additional features comprising;

(a) Preformatted spreadsheets for holding usage data;

(b) Formulae specific to the TSXL™ application;

(c) Macro functions to supplement the base MS Excel™ application; and

(d) Helper procedures for the automation of data entry and manipulation.

Without the TSXL™ application loaded MS Excel™ will continue to function normally.

DATA ENTRY

Data Entry within the context of the TSXL™ application refers to the entry of some information into a specific field. This may in some case be part of a record which is discussed separately below.

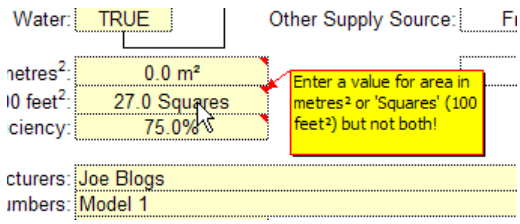

Figure 1 TankSmart$_{XL}$™ Data Entry Fields & Help Information

Data entry fields throughout the TSXL™ applications are shown as light yellow. In some cases, these are supplemented with a red chevron to signal in-cell help information. Positioning the cursor over such entries will display a message regarding that particular cell. Other fields marked white or other colours comprise general information or formula and must not be changed pursuant to the licence agreement, and proper functioning of the TSXL™ application.

Drop-Down Boxes

An additional aspect of some yellow data entry fields in the appearance of a drop-down list. This is initiated to display a list of options for selection and entry of prescribed data into the field.

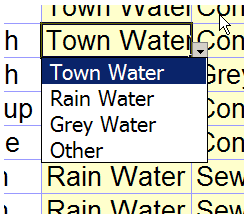

Figure 2 TankSmart$_{XL}$™ Drop-down Entry Fields

Such data is either generated by other user functions or procedures within the application and in the latter case cannot be changed. In such cases the provided options are all that is available, unless modified in some other part of the application.

Verification

In addition to the use of drop-down boxes, most user data entry fields have data verification. Should you enter information not appropriate for the field you will get a similar warning to that shown in Figure 3.

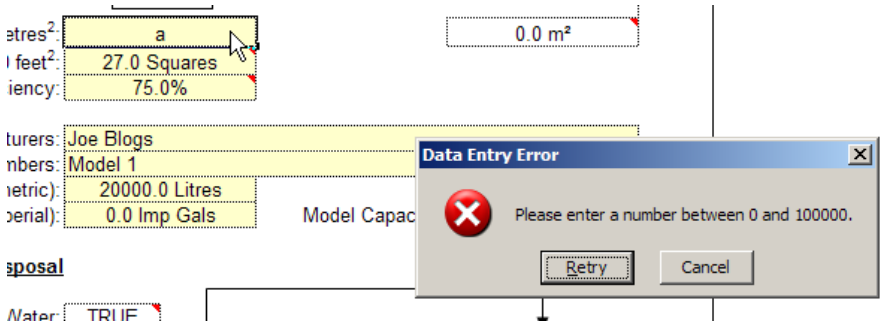

Figure 3 Data Entry Error

Simply click the 'Cancel' button to exit the data entry process and revert to the previous contents, or attempt a new numerical entry in keeping with the stated requirements.

Data Synchronisation

A loss of data synchronisation occurs if data already posted to a down-stream part of the application is invalidated by subsequent editing.

For example if the reference to water was changed, the cross referencing of tables within TSXL™ would change and a Loss of Data Synchronisation error flagged as shown in Figure 4.

19	er Usage Detail			
20	Profile Usage Patte	plication		
21	Water Usage Activity	Data Syn-chronised	From Town Supply Subtotal	Fr Ta Su
47	Test Flow Mains 27	TRUE	27.0 l/day	
48	Test Flow Mains 33	TRUE	33.0 l/day	
49	Clean Teeth	TRUE	4.0 l/day	
50	Test Flow Mains 27	TRUE	27.0 l/day	
51	Test Flow Mains 31	TRUE	31.0 l/day	
52	Test Flow Mains 32	TRUE	32.0 l/day	
53	Test Flow Mains 29	TRUE	29.0 l/day	
54	Test Grey 70	TRUE		

Figure 4 Data Synchronisation Established

10	Washing Machine (Top Load)	Laundry	20.0
11	Wash the Car (Hose)	Yard	10.0
12	Wash the Car (Bucket)	Yard	20.0
13	Wash Tub (Wash)	Laundry	25
14	Rinse Mouth	Bathroom	1
15	Swimming Pool Top Up	Yard	250
16	Watering Garden	Yard	500
17	Flush Toilet (Full)	Bathroom	6

Figure 5 Entry Changed to Rinse Mouth

If the data should change due to a variation in the entry of the 'Config' sheet, the data will be in entry and therefore provide a user alert in the form shown in Figure 6.

19	er Usage Detail			
20	Profile Usage Patte	plication		
21	Water Usage Activity	Data Syn-chronised	From Town Supply Subtotal	F T S
47	Test Flow Mains 27	TRUE	27.0 l/day	
48	Test Flow Mains 33	TRUE	33.0 l/day	
49	Clean Teeth	FALSE	FALSE	
50	Test Flow Mains 27	TRUE	27.0 l/day	
51	Test Flow Mains 31	TRUE	31.0 l/day	
52	Test Flow Mains 32	TRUE	32.0 l/day	
53	Test Flow Mains 29	TRUE	29.0 l/day	
54	Test Grey 70	TRUE		

Figure 6 Emergence of False Annunciation Due Loss of Data Sync

Throughout TSXL™ data errors are trapped where possible to provide an alert to the user and prevent to whatever extent possible the propagation of erroneous information. In Figure 6 wherever the error arises, the data is subsequently enunciated as being false wherever a computation involving that information occurs.

Record/Row Entry

Record entry within the context of the TSXL™ application refers to the entry of a collection of data into one of the tables that makes up the application. This is important due to the way in which the application works.

Tables are actually live, with many of the fields incorporating macros and formulae with links to the underlying visual basic environment. For this reason it is not possible to merely enter a new row in a TSXL™ table, as it will fail, and is not designed for this type of spreadsheet operation. Each row of a TSXL™ must be entered using the provided buttons at the top and bottom of the spreadsheet table.

Two buttons are provided;

- One for entry of a new row to the bottom of the table; and
- One for entry of a new row at the cursor position within the table.

Note that the insertion of a new row cannot be achieved without have the highlighted cell within the active table area. It will not work and will flag a fault message as shown in Figure 7. In this example, and although not shown, the selected cell was in the white area to the top of the table. Subsequent clicking of the 'Insert New Row@Line' button resulted in the generation of an error.

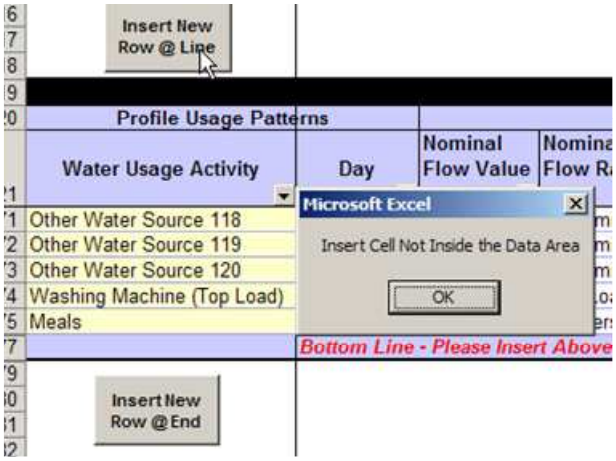

Figure 7 Error Message Arising from Cursor Being Outside Table Boundary

The reason for this requirement in the design of TSXL™ and similar applications by Nufer & Associates was the requirement to indicate the actual cell where it was required to enter the new row of information. Doing so ensures the maintenance of integrity in the row equations. Note that on completing the action, the cursor is restored to the start of the new line ready for insertion of new information.

A similar manner of operation exists for the 'Insert New Row@End' button however in this case, the row is added to the end of the table. Once again, the cursor is positioned on the start of the new row, ready to add the record.

Note that because TankSmart$_{XL}$™ is a MS Excel™ spreadsheet, new rows can be copied from the lines above or below and inserted either once or multiple times, to speed up entry if required.

RECORD ROW/DELETION

If it is desired to delete a record or row, it is simply a matter of highlighting the row/s involved and right-clicking to select the delete function as shown in Figure 8.

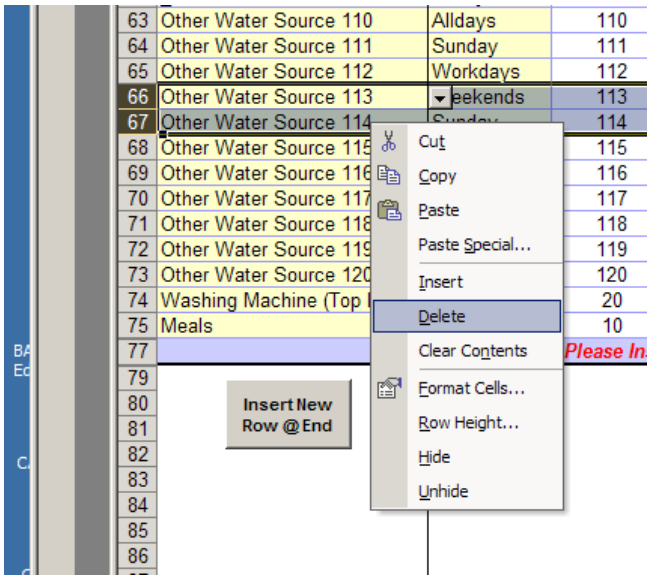

Figure 8 Row/Record Deletion in TankSmart$_{XL}$™

In this regard TSXL™ leverages existing functionality where possible to reduce the 'learning curve' for users and increase their level of comfort with the application. Note that for this reason TSXL™ has been largely left unprotected to allow users to build their own custom variations on the theme the application presents.

Note however that TSXL™ 'Undo' functionality is limited to built-in functions and procedures of MS Excel™ since underlying functions, procedures and macros cannot be reversed. Any operation which comprises a native spreadsheet function such as deleting a row on the other hand, may be undone if needed.

TANKSMART$_{XL}$™ STRUCTURE

TSXL™ is structured around a pseudo database comprising flat tables with limited relational data connections. Nevertheless it is able to operate very effectively from the rich functionality of the underlying data processing available to each cell of the spreadsheet table.

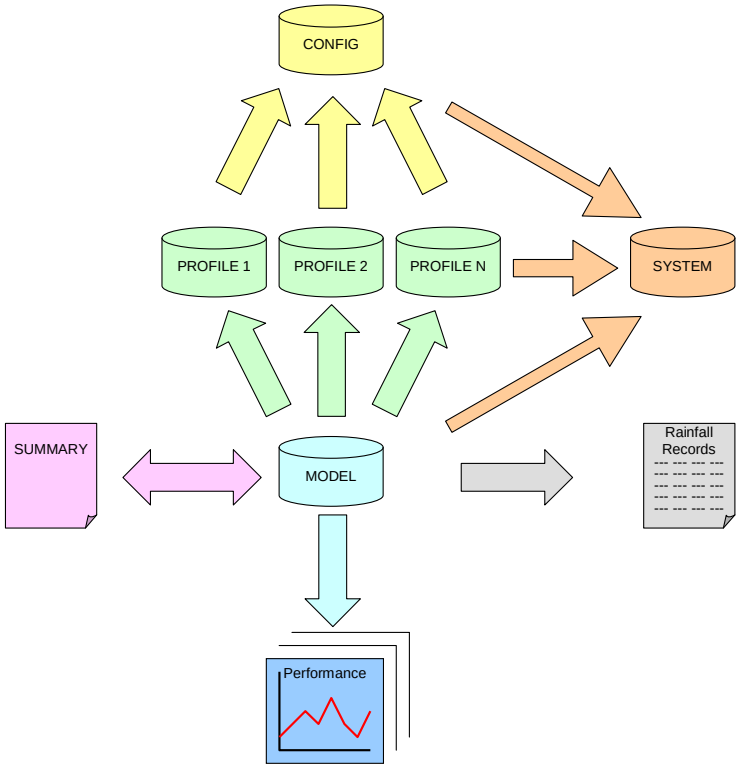

Figure 9 TankSmart$_{XL}$™ Structure & Interdependencies

Given the enormous processing capability of the MS Excel™ application, is able to easily process and present the resulting information. This is of course conditional on the operating platform having the necessary hardware and operating support.

Data Tables

With reference to Figure 9, the system comprises four categories of tabular data. These include:

(a) The System Tables – Comprising a large number of small tables which provide user options and standardised data filtering criteria. This table in not user configurable:

(b) The Config Table – Of which there is only one, which is set up by the user to establish the categories of water usage they want to include in their profile/s:

(c) The Profiles – Of which there is initially one, but which the user may wish to create any number of depending on the application or variations in water usage that they want to consider for their particular application:

(d) The Model Table – Of which there is only one, although there may be others created, in which the user builds the final usage model they require for their residential application, including any number of profiles, along with historic rainfall records, and the set-up information from the summary page which includes the project constants.

Other Information

As shown in the diagram, other information also goes into the analysis process. This includes:

(a) Summary Information – Information regarding the details of the water usage application including tanks sizes, roof area, etc; and

(b) Rainfall Records – In the case of including rainfall particulars as part of the analysis process.

Graphical & Tabular Outputs

The results of these calculations and analysis are presented in a variety of means including the:

(a) Native Tabular Results – Printing of the analysis tables as is;

(b) Inbuilt Graphs – Which may be repositioned as part of the overall spreadsheet by themselves for easier viewing and printing; or

(c) User Data/Graphical Extracts – Through the use of the rich analysis environment provided by MS Excel™.

To assist with Item (c) all of the tables used in the TSXL™ are individually named, so that the database functions of MS Excel™ can be used for the outcome required.

A detailed discussion of each of the tables and their usage is presented in the following chapters of the manual.

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CHAPTER 4

THE SUMMARY TAB (ST)

This Summary Tab (ST) provides the user with the first stage of running the TSXL™ Spreadsheet Application (TSA). It is designed as a cover page for those who want to develop a project summary using the printouts from the underlying analysis and assumptions made in putting together their water usage solution.

Note it is important to complete the data entries required for the TSA on this page as much of the calculation cannot be effectively completed without valid data entries. Be aware however that the ST is live linked to other spreadsheets in the TSA, and can be altered at any time during the analysis process to explore what-if scenarios.

The ST is discussed as follows:

- Areas of Functionality
- ST Data Entry Requirements
- The completed ST.

These are discussed in detail throughout the remaining part of this chapter.

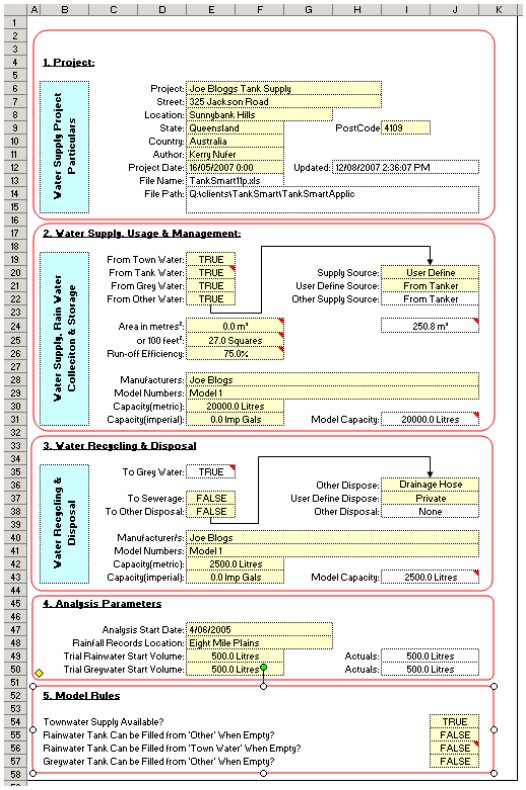

Figure 10 Summary Tab (ST) Areas of Functionality

Summary Tab (ST) Areas of Functionality

The Summary Tab can be effectively divided into five areas. These include the:

- Water Supply Particulars;
- Water Supply Usage & Management;
- Water Recycling & Disposal;
- Analysis Parameters; and
- Model Rules.

These are shown encircled by red rectangles in Figure 10.

Data Entry Requirements

WATER SUPPLY PARTICULARS

A close-up of a typically completed section of the Water Supply Particulars section is shown below in Figure 11.

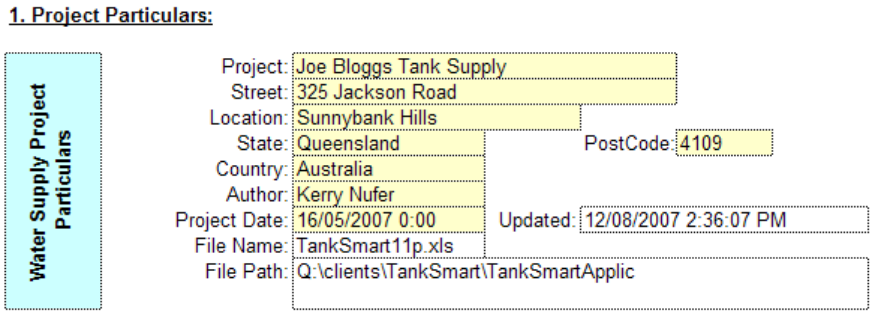

Figure 11 Summary Tab – Project Particulars Detail

The records completed here comprise typical information regarding the project being undertaken. It should be noted that in the TSA, most data entry fields and some computed data fields are actually named. This means these can be readily cross-referenced from anywhere in the TSA as well as your own applications.

The most important outcomes of this aspect of the ST are the;

- Updated Field;
- File Name Field; and
- File Path Field.

These and the information are self explanatory and will not be described any further.

Water Supply Usage & Management

The Water Supply Usage & Management section of the ST is shown in Figure 12. It comprises a series of fields which define water sources and the associated details of the sources relevant to the TSA.

Water Sources

The completion of these fields allows the user to define the four sources of water supply to be used in the model. Clicking the applicable field results in this being set as true or false.

In the case of the 'From Other Water' field, the user is then directed to complete information regarding that water supply source. The supply source provides the user with the ability to select a number of predefined alternative sources. However if these are unacceptable then a new option can be chosen under 'User Define Source'.

This value then takes precedence in the 'Other Supply Source' field which is not user configurable.

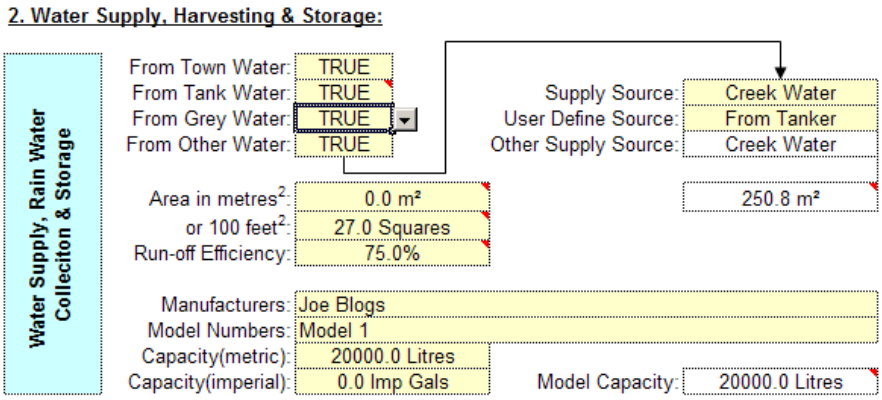

Figure 12 Summary Tab – Water Supply, Usage & Management Detail

The next three entry fields and results field allow the user to input water-harvesting details.

Roof Collection Detail

Water harvesting or collection of rain from roof run-off in the TSA works on the principle of having a single rainwater collection system. It allows for one roof only, and assumes that there is one rain-water tank.

Where there are multiple roof areas and multiple storages, the model assumes the resulting tanks are interconnected so that the cumulative run-off is stored equitably in the site tanks as a whole until tank capacity is exceeded.

To assist with the calculation of water collection, the model allows either entry of collection are in square metres or squares (100 square foot). A further entry here is a figure for run-off efficiency. This is meant to take into account a number of factors concerning the water collection system including:

(a) Roof Condition;

(b) Roof Slope;

(c) Run-off Handling Capacity etc.

If a roof is old and subject to the absorption of moisture into the tiles, it may not be as effective in hot dry conditions where there is light rain. Similarly if the roof is steep, and experiences deluge conditions, the run-off may reach a high velocity which results in it splashing over the edge of the gutters. Small gutters may not be able to handle the resulting flow.

Tank Manufacturers & Capacity

The final part of this section deals with the tank manufacturer, model numbers and other information. Most importantly however is the capacity of the combined water tanks in use for the project which may be input in either litres or Imperial Gallons but not both.

Water Recycling & Disposal

The flip side to 'Water Supply, Harvesting, & Storage' is its recycling, and disposal. Information regarding this aspect of water supply usage is discussed in this next part of the model.

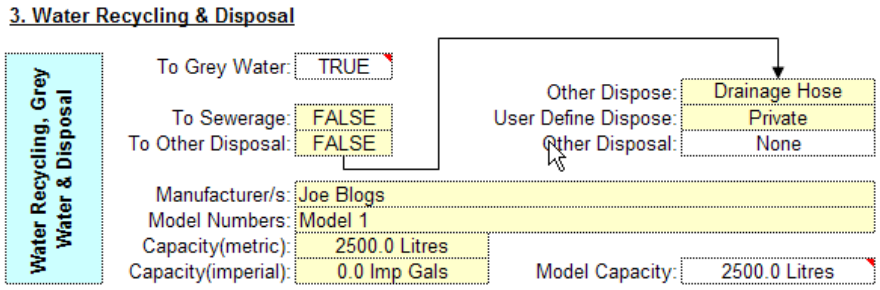

Figure 13 Summary Tab – Water Recycling & Disposal

In this section of the ST, the selection options for water recycling and/or disposal are made. Grey Water and sewerage are fairly obvious selections, however other user options are also provided, including consumption (not shown on the options, but an implicit option presented to the user when configuring water usage scenarios under usage configuration.

The second part of Section 3, provides for the entry of details of the grey water tanks used in the project. Manufacturing details and model numbers may be entered and the total capacity tallied for the overall capacity of grey water in terms of either litres or Imperial Gallons.

Analysis Parameters

Under Section 4 of the ST, a number of other parameters need to be completed as shown in Figure 14.

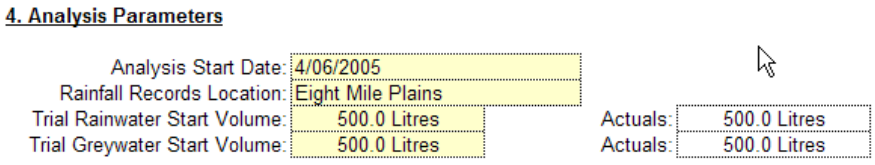

Figure 14 Summary Tab – Analysis Parameters

The analysis start date provides the reference start date for the water usage model, whilst the Rainfall Records Location is merely a reference name for the location[11] where the rainfall records were derived from.

Start volumes may be entered for the rainwater and grey water tanks at the start of the modelling period as referred to in the 'Analysis Start Date' field.

[11] A future release of the TankSmart$_{XL}$™ will feature a rainfall records database and in that scenario this field will be used to reference the records for the water usage model.

Model Rules

The last section of the ST allows the user to define some of the rules by which the model may operate under unusual circumstances.

Users should be aware that under community and local government jurisdictions these options may not be permitted and where this is the case must not violate local regulations. These options have been provided in accordance with the wide scale application of TSXL, but there is no implied requirement for 'TRUE' to be entered into any of the fields in Section 5, for proper operation of the spreadsheet software.

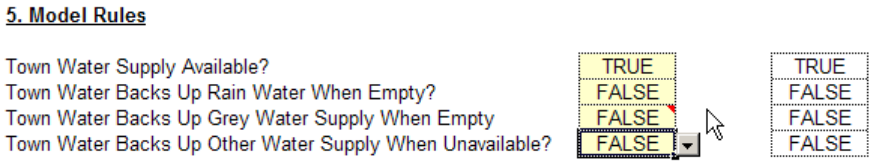

Figure 15 Summary Tab – The TankSmart$_{XL}$™ Model Rules

The option as to whether town water is available is used in the model for calculating the daily draw-down on the mains supply. Where permitted, this also includes the backing up of short-falls in the other water supply options as shown.

The other selections are designed to model the interconnection of water supply and disposal options under various scenarios and will normally set to be false.

Note that certain jurisdictions, local authorities and governments, may have prescribed rules on which determine whether these are legitimate options. Users of TankSmart$_{XL}$™ will need to determine these selection options on their own and Nufer & Associates shall not take any responsibility – in any director indirect way – for the selection so determined by the user.

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CHAPTER 5

THE CONFIGURATION TAB (CT)

The configuration Tab exposes the configuration spreadsheet for TankSmart$_{XL}$™. This spreadsheet has the function of listing the various types of water usage in the domestic or residential application. With reference to Figure 9, Page 3-6, there is one CT in the TankSmart$_{XL}$™ model.

Introduction

As provided the CT comes with a number of pre-existing water usage categories predefined for you, however you may vary these to suit your own requirements, and add others if required.

The CT spreadsheet exists in the form of a large table and records the water usage application, along with a number of other details including the validity of the particular water application based on a specific restriction level.

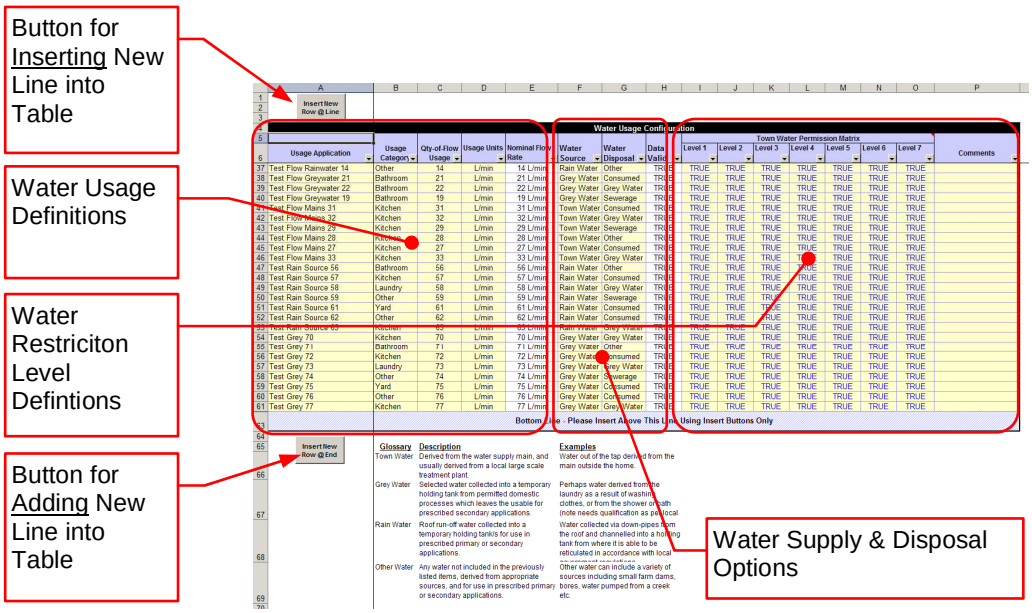


Figure 16 Configuration Tab – High Level View

The restriction characteristics can then be used to legitimise the water application in the model, against the particular time of tear and water supply source.

There is only one CT in use, and it is the reference for any number of profiles that may be used

The CT is discussed below in terms of its:

- High-Level View;
- Areas of Functionality;

- Data Entry & Application Requirements.

A general high-level view of the Configuration Tab (CT) spreadsheet is shown above in Figure 16.

High-Level View

The CT spreadsheet is a table of all water usage applications for developing TankSmart$_{XL}$™ profiles. It comprises three main sections:

(a) Water Usage Definitions;

(b) Water Supply/Disposal Options;

(c) Water Restriction Level Definitions.

In addition the CT spreadsheet comprises the usage tools that were described in the TankSmart$_{XL}$™ Overview.

Water Usage Definitions

The water usage definitions are the actual activities that water may be used for. There are more than you may think, and in addition to the basic applications included in TankSmart$_{XL}$™, you may add as many as you would like.

	Usage Application	Usage Category	Qty-of-Flow Usage	Usage Units	Nominal Flow Rate
8	Dishwasher	Kitchen	4.0	L/Load	4 L/Load
9	Meals	Kitchen	10.0	L/Person	10 L/Person
10	Washing Machine (Top Load)	Laundry	20.0	L/Load	20 L/Load
11	Wash the Car (Hose)	Yard	10.0	L/Min	10 L/Min
12	Wash the Car (Bucket)		20.0	L/Wash	20 L/Wash
13	Wash Tub (Wash)		25	L/Wash	25 L/Wash
14	Rinse Mouth		1	L/Clean	1 L/Clean
15	Swimming Pool Top Up		250	L/Top-up	250 L/Top-up
16	Watering Garden	Yard	500	L/Time	500 L/Time
17	Flush Toilet (Full)	Bathroom	6	L/Flush	6 L/Flush
18	Flush Toilet (Half)	Bathroom	3	L/Flush	3 L/Flush
19	Shower (No Water Saver)	Bathroom	20	L/4 min	20 L/4 min
20	Shower (Water Saver)	Bathroom	15	L/4 min	15 L/4 min

Bathroom
Kitchen
Laundry
Other
Yard

Figure 17 Configuration Tab – Water Usage Definitions

Under water usage definitions, the usage application is entered, along with the usage category. Note that usage categories are limited to five options (being for a domestic or residential application) including;

- Bathroom,
- Kitchen,
- Laundry,
- Other,
- Yard.

Following entry of this information, a ‘Quantity of Usage’ is entered along with the usage units. Note these can be anything that might be expected such as litres-per-flush, or litres-per-load, in the case of a washing machine.

The outcome of this section of the spreadsheet is then the final Unit Water Usage Rate for usage in your Water Usage Profile.

Note: It is important to note here that the name of the application can reflect many different variations. For example you may have a 'Washing Machine (Light Load)'; and/or a, 'Washing Machine (Heavy Load)'; or various other names to provide options for use in your various water usage profile/s.

Note: Do not worry that you may need a different 'Usage Rate' in your final profile. Usage rates can be over-ridden for specific applications in the profile – refer to the next section for more information.

Water Supply/Disposal Options

An important aspect of TankSmart$_{XL}$™ is the definition of water supply and disposal options. These are defined against the various water supply options.

Note that it is not possible to vary the water supply disposal options anywhere else in TankSmart$_{XL}$™. It is suggested that if other options are required then these should be defined with slightly different Usage Application Names e.g. 'Washing Machine (Tank Water)' versus 'Washing Machine (Town Water)'.

WATER SOURCE

All usage applications will require a water supply, which is defined in the next columns under the CT.

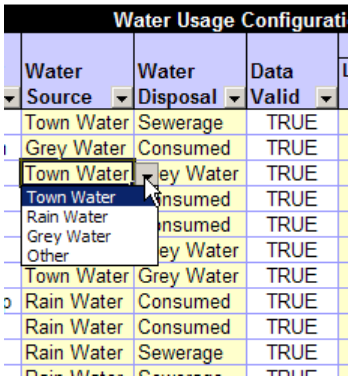


Figure 18 Configuration Tab - Water Source Options

Four sources of water supply provided-for under TankSmart$_{XL}$™. These are shown in Figure 18, and follow-through to the other parts of the model.

Obviously some selections would not be sensible in certain applications e.g. drinking grey-water, however strange scenarios develop and it is left up to the user to manage their water supply situations.

Note that certain local government authorities, government health departments and other jurisdictions may declare some water supplies unavailable for the usage applications listed. In such cases it is the TankSmart$_{XL}$™ user's responsibility to determine what these may be and no liability can be accepted for subsequent or consequential outcomes.

WATER DISPOSAL

The outcome of most water usage is the need for disposal as a result of it no longer being

fit for the purpose originally used. In some cases the water is consumed by the process in question, and no disposal is necessary.

The method of disposal is fundamental to the accounting of water flows into and out of the residence and is part of the accounting system that TankSmart$_{XL}$™ does.

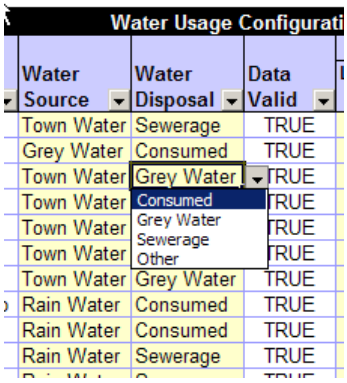


Figure 19 Configuration Tab - Water Disposal Options

As shown in Figure 19, four disposal methods are possible. Consumed water is commonly associated with irrigation or inside the residence – the use in preparation of food, or straight consumption by individuals.

Note that since water is lost from the body via perspiration as well as loss of bodily waste it is not possible to account for this addition to the sewerage system.

Water from laundry and bathroom applications may be disposed to grey-water depending on prevailing laws and regulations. The 'Other' option is provided for special water usage schemes which are nominated by the user.

The 'Data Valid' column carries our a check of the selections made to see these are consistent with the rules made elsewhere in TankSmart$_{XL}$™. If data is not valid then an error condition will be flagged for the user's attention.

Water Restriction Definitions

The remaining part of the Configuration Tab Spreadsheet is the definition of restriction levels. As water supply management becomes more critical for the guarantee of water supplies to communities and cities under conditions of drought, restriction levels are applied to various water usage applications.

Restriction Definitions are defined under a Town Water Permission Matrix. This approach has been used in TankSmart$_{XL}$™ in order to make data entry easier to understand.

Data is entered into the Town Water Permission Matrix as a 'True' or 'False'. 'True' indicated that the associated Water Usage Application e.g. 'Washing the Car (Bucket)' is permitted under the level shown.

PERMISSION LEVEL MATRIX

In this version of TankSmart$_{XL}$™, the permissions have been defined around a seven level model, in which less-necessary water usage applications are constrained or made illegal as the situation becomes worse (Restriction Level Increases from 1 through to 7).

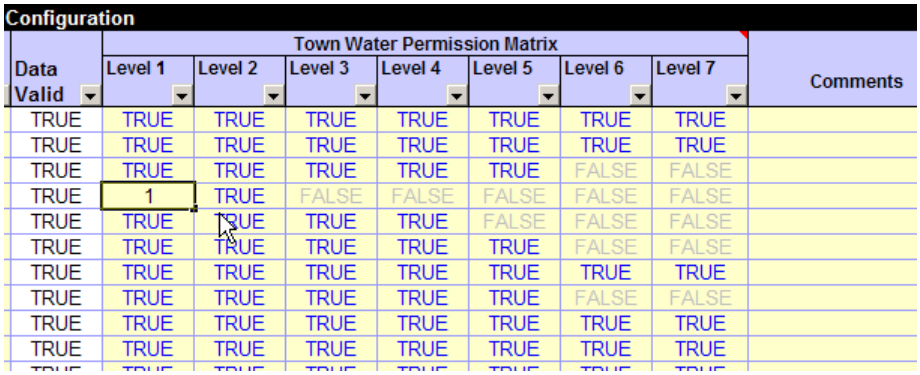
HOW THE PERMISSION (RESTRICTION) LEVELS WORK

The addition of a permission qualification in TankSmart$_{XL}$™ was introduced to assist in the modelling process.

Restriction levels are entered into the usage model, against the date range for the modelling period. These are then used to reference the relevant records out of the water usage profile in use at that time. Please refer to the following chapters for more details.

ENTERING DATA INTO WATER PERMISSION MATRIX

The restriction matrix works as a permissions based table in which the ability to use water for specific applications is either true or false. By doing so, the ability to use water for the various usage applications is clearly defined as shown in Figure 20.



Configuration

Data Valid	Town Water Permission Matrix							Comments
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	
TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	
TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	
TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	
TRUE	1	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	
TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	
TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	
TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	
TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	
TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	
TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	

Figure 20 Configuration Tab - Water Restriction Matrix

The data entered is then cross-referenced against the usage profile to factor in the water demand created by that application into the overall water supply model.

In practical applications the permissions matrix exhibits a steadily increasing number of ‘false’ permissions, as the situation deteriorates. Eventually all but the most critical of water needs are addressed by the application and the water usage cut to a minimum.

ENTERING DATA INTO THE RESTRICTION MATRIX

Entering data into the permission matrix is easily carried out and more straightforward than immediately apparent.

ABBREVIATED DATA ENTRY

It is not necessary to type ‘True’ or ‘false’ into the table, although this is also possible. The table as been designed for rapid data entry and can equally take any of the following to represent the required ‘True’ or ‘False’

Abbreviated Entry	Translation Result
Y, y	TRUE
Yes, yes	
1	
N, n	FALSE
No, no	
0 (zero)	

Table 2 Configuration Tab – Permission Matrix Abbreviated Data Entry

As a consequence of the development of data entries into the permissions matrix, a pattern should emerge in which the 'True' areas of the table eventually taper-off to the 'False' areas of the table on the right.

Note that government authorities will issue particular restriction notices in relation to water usage applications. Because TankSmart$_{XL}$™ is designed for general usage throughout the world, it is the responsibility of the user to complete the Water Permission Matrix.

COMMENTS

The final column of the table provides an entry for comments regarding the particular water usage application shown on the left. This is useful for clarifying the entry in some circumstances.

Data Entry & Application Requirements

The Configuration Tab (CT) Spreadsheet provides a live reference to the Water Usage Profiles (discussed in the next chapter).

If you delete or change the **name of a water usage application**, then it will be found to propagate an error in all the profiles where this application is referenced, resulting in erroneous information being passed up to the Water Usage Model.

The reason for this is that the Usage Application term provides the reference index for the profiles below.

Note however that changing the values **associated with the Usage Application Term** including water supply source, disposal, or restrictions levels, will result in these quantities and references being automatically propagated throughout the rest of TankSmart$_{XL}$™ resulting in the necessary updates to aspects such as the Water Usage Restriction that is applicable at the time.

CHAPTER 6

THE PROFILE TAB (PT)

The Profile Tab references one of the most important spreadsheets in TankSmart$_{XL}$™. It contains the day-by-day usage pattern for the water usage model, based on the water usage applications developed for the particular residence or domestic application. With reference to Figure 9, Page 3-6, there is at least one usage Profile in TankSmart$_{XL}$™, and may be any number of profiles depending on available resources, although it is suggested that a maximum of five may be appropriate for most situations – one for each season, and another for special applications.

Introduction

As provided, TankSmart$_{XL}$™ is supplied with one profile. It is suggested that this be used as the basis for other profiles, and the original retained as a master.

As with the Configuration Tab, the PT comprises a large table of records regarding how water is used by the residence or domestic application over the period of one week. As shown in Figure 21 below, the table also comprises a large amount of summary information above the table. This is referenced by the Usage Model (please refer to the following chapter).

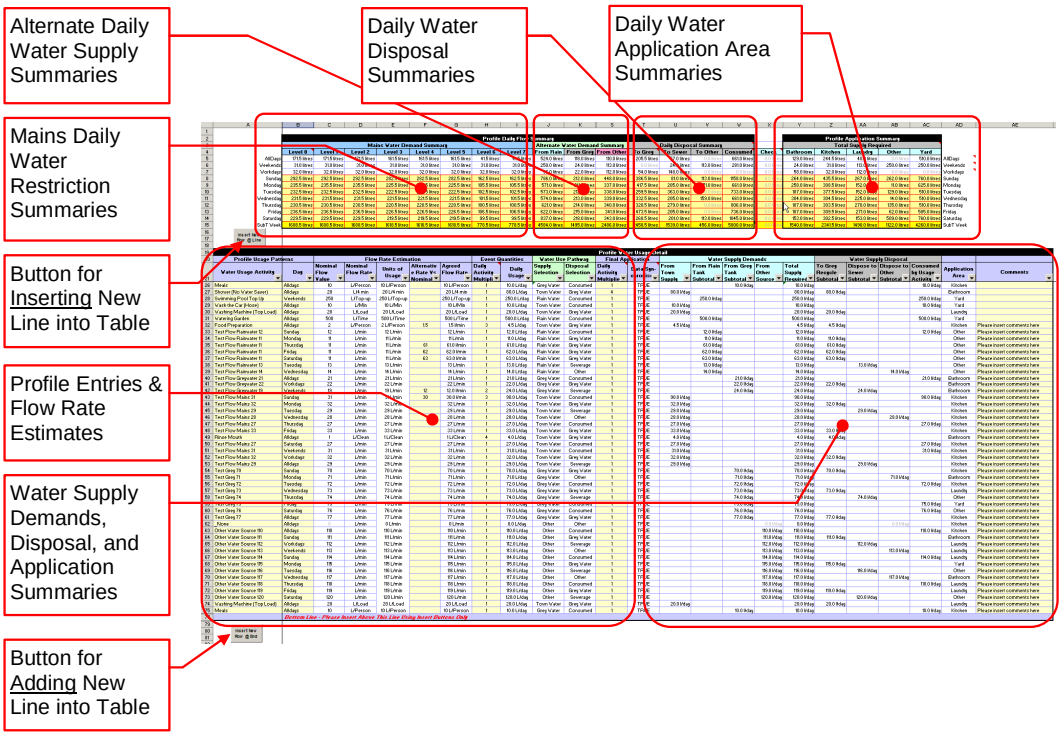


Figure 21 Profile Tab – High-Level View

As shown in the High-Level View, the profile is comprised of two main areas – the table summary data at the top and the table component at the bottom.

PROFILE TAB TABLE DATA

With regard to the table entry portion of the PT Spreadsheet it can be seen there are a limited number of data entry fields in each record – as evidenced from the yellow field entries – refer Chapter 2 - TankSmart$_{XL}$™ Overview for more information.

Data in the white fields of the PT spreadsheet, contain information derived from underlying tables as a consequence of referencing the usage application from the Configuration Tab spreadsheet (refer previous Chapter).

PROFILE TAB SUMMARY DATA

Data in the summary area of the spreadsheet is derived from the underlying table and is tabulated as shown for the purposes of being cross-referenced from the water usage model (Refer following Chapter).

This is very important since it summarises water flows for the profile in terms of the;

- Day;
- Flow Type;
- Area of Application.

These are described in detail under the following subsections:

(a) Profile Entries & Flow Rate Estimates;

(b) Profile Entry Summary Demands, Disposal & Applications;

(c) Mains Water Daily Restriction Summaries;

(d) Alternate Daily Water Supply Summaries;

(e) Daily Water Disposal Summaries;

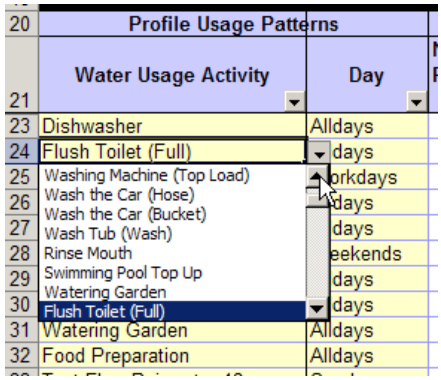
(f) Daily Water Application Area Summaries.

Although seemingly complex, the water supply profile is merely a way of cross-linking the application configurations to the water supply model, based on the daily usage patterns, and accounting for the number of people and repetition of the water application each day through the week.

Profile Entries/Flow Rate Estimates

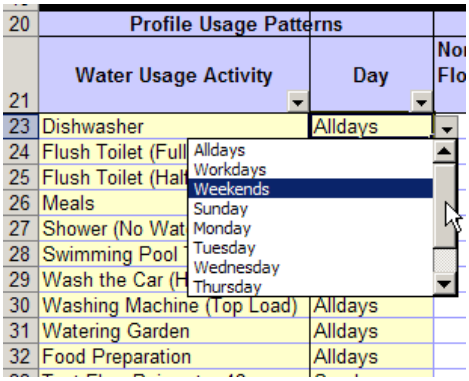
The water usage profile for a week is made up from consecutive entries for each activity as shown in Figure 22.

WATER USAGE ACTIVITY



Clicking on the Water User Activity field of the record produces a drop-down box listing the various activities defined under the Configuration Tab as shown. The option required is selected and on closure of the drop-down box, the non-entry fields of the new record are automatically inserted as required across all columns.

DAY ENTRY



The 'Day' entry for the record allows for the cross-referencing of the particular activity to the necessary days of the week.

As shown, clicking on the yellow entry field, results in a number of options being presented for selection. To speed up entry various day combinations are allowed such as all days, work days (Monday to Friday inclusive) or specific days of the week where the activity is special.

This entry then allows a summary to be created for the record, and used for water flow estimates over the period of a week. As a result of these entries, default data is extracted from the Configuration Tab spreadsheet and presented.

FLOW RATE ESTIMATION

With reference to Figure 22, nominal flow rates for water usage are derived from the Configuration Tab spreadsheets. Two details are extracted – the Nominal Flow Quantity and the Nominal Flow Units..

Profile Usage Patterns		Flow Rate Estimation			
Water Usage Activity	Day	Nominal Flow Value	Nominal Flow Units	New Flow Value	Agreed Flow Rate
Dishwasher	Alldays	4	L/Load		4.0 L/Load
Flush Toilet (Full)	Alldays	6	L/Flush		6.0 L/Flush
Flush Toilet (Half)	Workdays	3	L/Flush	4	4.0 L/Flush
Meals	Alldays	10	L/Person		10.0 L/Person
Shower (No Water Saver)	Alldays	20	L/4 min		20.0 L/4 min
Swimming Pool Top Up	Weekends	250	L/Top-up		250.0 L/Top-up
Wash the Car (Hose)	Alldays	10	L/Min		10.0 L/Min
Washing Machine (Top Load)	Alldays	20	L/Load		20.0 L/Load
Watering Garden	Alldays	500	L/Time		500.0 L/Time
Food Preparation	Alldays	2	L/Person	1.5	1.5 L/Person

Figure 22 Profile Tab – Flow Rate Estimates

Note that whilst the nominal flow units can be almost anything you want as long as it is expressed in litres per 'something' the objective is litres per day.

Therefore firstly the option is provided to vary the flow value as shown. The 'Half Toilet Flush' entry value is changed from the default which is 3, to a new value of 4. The Agreed Flow Rate is now updated to reflect this change in terms of the default units. Next it is required to determine the actual flow rate subtotals for the day.

FLOW RATE SUBTOTALS

In order to arrive at the daily flow-rate subtotals, two other factors are taken into account for profile entries – these are the:

(a) Daily Activity Multiplier – Or the number of times the activity is repeated every day by an individual, and

(b) Daily Person Multiplier – The number of persons undertaking the activity each day.

Together with the Agreed Flow Rate the quantity of water used on a daily basis is then obtained and the result presented in units of litres/day as the Activity Subtotal as shown in Figure 23.

Profile Water Usage						
	Flow Rate Subtotals			Water Use Pathway		
Agreed Flow Rate	Daily Activity Multiplier	Daily Person Multiplier	Activity Subtotal	Supply Selection	Disposal Selection	Data Synch
4.0 L/Load	1	1	4.0 L/day	Town Water	Sewerage	TRUE
6.0 L/Flush	1	4	24.0 L/day	Rain Water	Sewerage	TRUE
3.0 L/Flush	3	4	36.0 L/day	Rain Water	Sewerage	TRUE
10.0 L/Person	1	2	20.0 L/day	Grey Water	Consumed	TRUE
20.0 L/4 min	1	4	80.0 L/day	Town Water	Grey Water	TRUE
250.0 L/Top-up	1	1	250.0 L/day	Rain Water	Consumed	TRUE
10.0 L/Min	1	1	10.0 L/day	Town Water	Consumed	TRUE
20.0 L/Load	1	1	20.0 L/day	Town Water	Grey Water	TRUE
500.0 L/Time	1	1	500.0 L/day	Rain Water	Consumed	TRUE
1.5 L/Person	3	1	4.5 L/day	Town Water	Grey Water	TRUE

Figure 23 Profile Tab – Water Supply/Disposal Pathways

Together with the 'Water Use Pathway' (derived from the 'Configuration Tab spreadsheet' the entry for the 'Water Usage Activity' is completed.

The remainder of the Water Usage Profile is concerned with the analysis of these requirements, and their presentation in the summary area at the top of the profile. This allows this information to be made available to the model.

Summary Demands, Disposal, & Applications

The remaining columns of the table are concerned with summarising the water requirements for each Water Usage Application.

WATER SUPPLY DEMANDS

Water supply demands are separated out into a number of columns in accordance with the three categories and options source as described in the Summary Tab. Some examples are shown in Figure 24.

20	Profile Usage Patte	Water Supply Demands				
21	Water Usage Activity	From Town Supply Subtotal	From Rain Tank Subtotal	From Grey Tank Subtotal	From Other Source Subtotal	Total Supply Required
23	Dishwasher	4.0 l/day				4.0 l/day
24	Flush Toilet (Full)		24.0 l/day			24.0 l/day
25	Flush Toilet (Half)		48.0 l/day			48.0 l/day
26	Meals			20.0 l/day		20.0 l/day
27	Shower (No Water Saver)	80.0 l/day				80.0 l/day
28	Swimming Pool Top Up		250.0 l/day			250.0 l/day
29	Wash the Car (Hose)	10.0 l/day				10.0 l/day
30	Washing Machine (Top Load)	20.0 l/day				20.0 l/day
31	Watering Garden		500.0 l/day			500.0 l/day
32	Food Preparation	4.5 l/day				4.5 l/day

Figure 24 Profile Tab – Water Supply Demain Summaries

Columns in turn are summed for the whole of the profile to give the total water supply requirements over a period of a week. In the case of Town or Mains water supplies, this information is further dissected in terms of the various restriction levels.

20	Profile Usage Patte	Water Supply Disposal				
21	Water Usage Activity	To Grey Recycle Subtotal	Dispose to Sewer Subtotal	Dispose to Other Subtotal	Consumed by Usage Activity	Application Area
23	Dishwasher		4.0 l/day			Kitchen
24	Flush Toilet (Full)		24.0 l/day			Bathroom
25	Flush Toilet (Half)		48.0 l/day			Bathroom
26	Meals				20.0 l/day	Kitchen
27	Shower (No Water Saver)	80.0 l/day				Bathroom
28	Swimming Pool Top Up				250.0 l/day	Yard
29	Wash the Car (Hose)				10.0 l/day	Yard
30	Washing Machine (Top Load)	20.0 l/day				Laundry
31	Watering Garden				500.0 l/day	Yard
32	Food Preparation	4.5 l/day				Kitchen

Figure 25 Profile Tab – Water Disposal Summaries

In a similar way to supply, the disposal summaries for each Water Usage Activity are derived as shown in Figure 25. In addition the Application Area for the particular activity is shown as derived from the Configuration Tab.

Mains Water Restriction Summaries

Mains Water Restriction Summary data is developed out of the profile for the purposes of linking into the water usage model (refer following chapter).

	Mains Water Restriction Summary							
	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
AllDays	171.5 litres	171.5 litres	171.5 litres	161.5 litres	161.5 litres	161.5 litres	41.5 litres	41.5 litres
Weekends	31.0 litres	31.0 litres	31.0 litres	31.0 litres	31.0 litres	31.0 litres	31.0 litres	31.0 litres
Workdays	32.0 litres	32.0 litres	32.0 litres	32.0 litres	32.0 litres	32.0 litres	32.0 litres	32.0 litres
Sunday	292.5 litres	292.5 litres	292.5 litres	282.5 litres	282.5 litres	282.5 litres	162.5 litres	162.5 litres
Monday	235.5 litres	235.5 litres	235.5 litres	225.5 litres	225.5 litres	225.5 litres	105.5 litres	105.5 litres
Tuesday	232.5 litres	232.5 litres	232.5 litres	222.5 litres	222.5 litres	222.5 litres	102.5 litres	102.5 litres
Wednesday	231.5 litres	231.5 litres	231.5 litres	221.5 litres	221.5 litres	221.5 litres	101.5 litres	101.5 litres
Thursday	230.5 litres	230.5 litres	230.5 litres	220.5 litres	220.5 litres	220.5 litres	100.5 litres	100.5 litres
Friday	236.5 litres	236.5 litres	236.5 litres	226.5 litres	226.5 litres	226.5 litres	106.5 litres	106.5 litres
Saturday	229.5 litres	229.5 litres	229.5 litres	219.5 litres	219.5 litres	219.5 litres	99.5 litres	99.5 litres
SubT Week Days	1688.5 litres	1688.5 litres	1688.5 litres	1618.5 litres	1618.5 litres	1618.5 litres	778.5 litres	778.5 litres

Figure 26 Profile Tab – Daily Water Restriction Summary

This table is of particular importance because it summarises the flows arising from draw down on the town water supply. Where the user has tanks installed (as shown in the

following chapter) this reliance on the water supply under various restriction levels is reduced. The table also provides some indication on either a daily or level basis for the sensitivity of the residence to water to restriction levels.

Note that the "SubT Week Days" Row at the bottom of this table is the total of the individual days including the AllDays, Weekends, and Workdays definitions. If the individual requirements for Wednesday are needed, then the AllDays and Workdays values must be subtracted from the Wednesday total.

Alternate Water Supply Requirements Summaries

With the option of other water supplies, a further summary of interest is the impact of the profile on alternate water sources. These are developed in the table shown in Figure 27.

	Alternate Water Demand Summary		
	From Rain	From Grey	From Other
AllDays	524.0 litres	128.0 litres	110.0 litres
Weekends	250.0 litres	24.0 litres	113.0 litres
Workdays	48.0 litres	22.0 litres	112.0 litres
Sunday	786.0 litres	222.0 litres	448.0 litres
Monday	583.0 litres	221.0 litres	337.0 litres
Tuesday	585.0 litres	222.0 litres	338.0 litres
Wednesday	586.0 litres	223.0 litres	339.0 litres
Thursday	633.0 litres	224.0 litres	340.0 litres
Friday	634.0 litres	225.0 litres	341.0 litres
Saturday	837.0 litres	228.0 litres	343.0 litres
SubT Week	4644.0 litres	1565.0 litres	2486.0 litres

Figure 27 Profile Tab – Daily Alternate Water Supply Summaries

Note that mains water is not included in this table due to the need to have its own dedicated set of records for cross reference with the seven restriction levels (refer previous subsection).

Daily Water Disposal Summaries

Water Disposal Summaries are provided on a daily basis for each of the water disposal categories.

	Daily Disposal Summary			
	To Grey	To Sewer	To Other	Consumed
AllDays	205.5 litres	57.0 litres	0.0 litres	671.0 litres
Weekends	0.0 litres	24.0 litres	113.0 litres	281.0 litres
Workdays	54.0 litres	160.0 litres	0.0 litres	0.0 litres
Sunday	386.5 litres	81.0 litres	113.0 litres	1168.0 litres
Monday	417.5 litres	217.0 litres	71.0 litres	671.0 litres
Tuesday	259.5 litres	375.0 litres	0.0 litres	743.0 litres
Wednesday	332.5 litres	217.0 litres	159.0 litres	671.0 litres
Thursday	320.5 litres	291.0 litres	0.0 litres	816.0 litres
Friday	473.5 litres	217.0 litres	0.0 litres	746.0 litres
Saturday	268.5 litres	201.0 litres	113.0 litres	1055.0 litres
SubT Week	2458.5 litres	1599.0 litres	456.0 litres	5870.0 litres

Figure 28 Profile Tab – Daily Water Disposal Summaries

In a similar manner to the previous two tables these are referenced from the water supply model to calculate flows with respect to grey water tanks.

Daily Water Application Area Summaries

The 'Profile Application Summary' table shows water usage for the particular profile for each of the five application areas, on a daily basis. An example of this table is shown in Figure 29. Associated with the table in the Figure is a small column called 'Check'. This column should only contain 'zeros' and is used as a balance check on the water inflows and outflows. The 'Application Summary Table' also includes other capabilities to show profile water flows in each of the application areas on a daily basis.

Profile Application Summary						
	Dispose to Sewer Subtotal					
Check	Bathroom	Kitchen	Laundry	Other	Yard	
0.0 litres	24.0 litres	33.0 litres	0.0 litres	0.0 litres	0.0 litres	AllDays
0.0 litres	24.0 litres	0.0 litres	0.0 litres	0.0 litres	0.0 litres	Weekends
0.0 litres	48.0 litres	0.0 litres	112.0 litres	0.0 litres	0.0 litres	Workdays
0.0 litres	48.0 litres	33.0 litres	0.0 litres	0.0 litres	0.0 litres	Sunday
0.0 litres	72.0 litres	33.0 litres	112.0 litres	0.0 litres	0.0 litres	Monday
0.0 litres	72.0 litres	62.0 litres	112.0 litres	129.0 litres	0.0 litres	Tuesday
0.0 litres	72.0 litres	33.0 litres	112.0 litres	0.0 litres	0.0 litres	Wednesday
0.0 litres	72.0 litres	33.0 litres	112.0 litres	74.0 litres	0.0 litres	Thursday
0.0 litres	72.0 litres	33.0 litres	112.0 litres	0.0 litres	0.0 litres	Friday
0.0 litres	48.0 litres	33.0 litres	0.0 litres	120.0 litres	0.0 litres	Saturday
0.0 litres	456.0 litres	260.0 litres	560.0 litres	323.0 litres	0.0 litres	SubT Week

Figure 29 Profile Tab – Daily Application Area Summaries

These quantities can be selected by clicking on the drop-down box under the table label as shown in Figure 30.

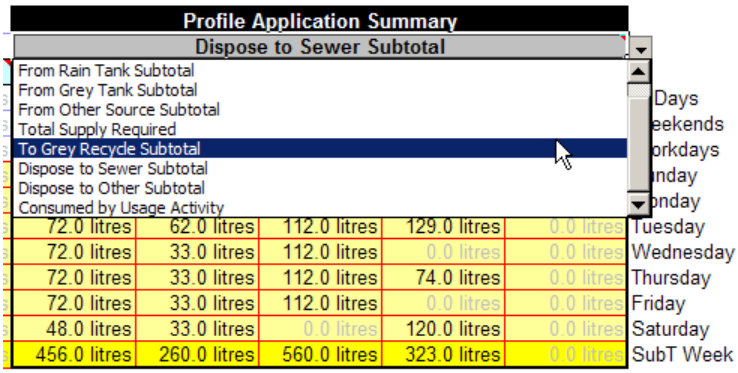


Figure 30 Profile Tab - Daily Application Area Supply/Disposal Options

A range of options commensurate with the sources and disposal sinks described can be selected. On choosing the appropriate option, the specific flow for that option is shown across al days for each area of the residence.

Applying Water Usage Profiles

A number of profiles may be built up to describe water usage patterns for a given week. If water usage changes then a new weekly profile is required to be developed.

The normal way of handling this would be to develop a prototype profile, then copy this for application in other profiles.

For example if you washed the car once every month, then you would copy the basic profile, and add a new entry for car washing to a new profile based on the prototype. This would be picked up by the model as described in the following paragraph and the change taken into account in the resulting water flows.

Naming of Profiles

Any number of profiles can be developed for modelling water flows. It is suggested that short simple names or mnemonics be used to represent the particular usage pattern, since this name must be entered into the Water Supply Model – Please refer to the next chapter for more information.

CHAPTER 7

MODEL TAB (MT)

The MODEL Tab is the focus of the TankSmart$_{XL}$™ application and the outcome of the modelling inputs. The MT can be as small or large as needed in order to reflect the water usage scenario being considered, and models water supplies, storage, and disposal strategy based on the usage configurations and profiles that have been developed. The Model Tab spreadsheet is comprised of a large amount of linked information from the underlying profile/s, configuration and summary screens. It is suggested that if these have not been completed then the relevant chapters be reviewed before proceeding with this chapter.

Introduction

The Model Tab spreadsheet is not unlike any of the other modules described in the preceding chapters in that it comprises a single table with graphical summaries at the top. These are provided by default, however others are possible based on the user's skills and familiarity with MS Excel™.

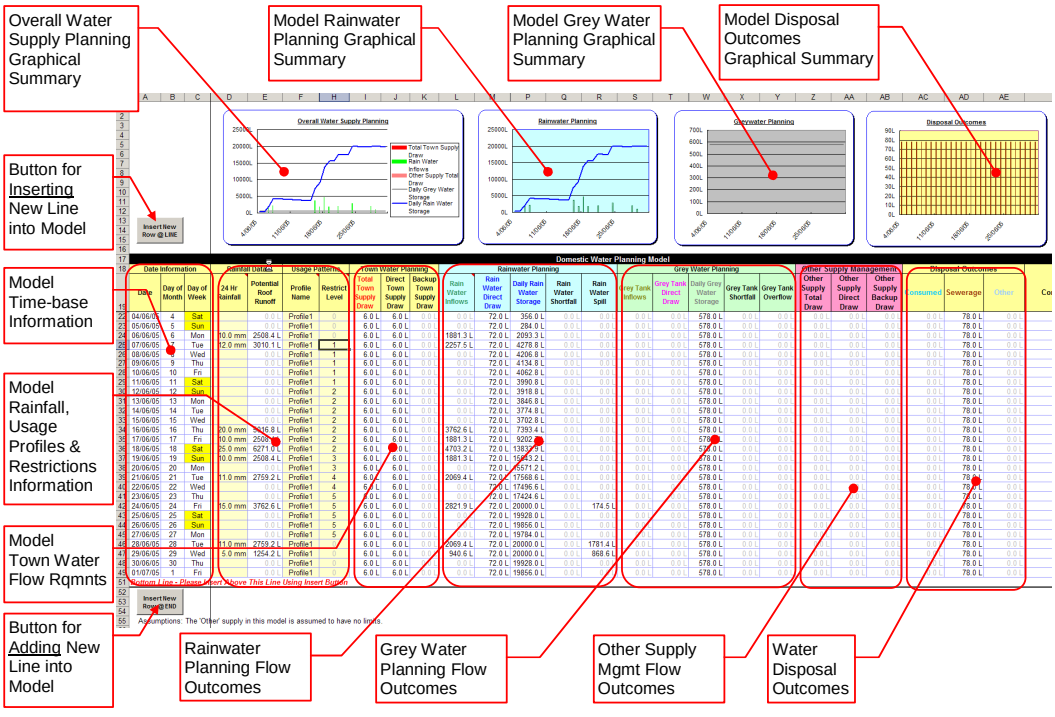


Figure 31 Model Tab - High-Leve View

Apart from the graphical summary information at the top of the screen, the model comprises one main table which can be divided up into seven sections. These are the:

(a) Model Time Base;

(b) Model Usage Profiles and Restriction Information;

(c) Town Water Flow Requirements;

(d) Rainwater Planning Flow Requirements;

(e) Grey Water Planning Flow Requirements;

(f) Other Flow Management Outcomes; and

(g) Water Disposal Outcomes.

Collectively these operate together to provide an overall visual estimation of water flows over the period being modelled as described below.

Model Time Base

The Model Time Base is at the heart of the modelling process, as it provides the reference for:

- Rainfall Records;
- Application of Profile Information;
- Application of Restriction Information; and
- Subsequent Water Flows.

These other aspects are described below.

Note that the time base is slightly skewed by the rainfall measurement process which in Australia starts and finishes at 9AM every day. However under most circumstances this misalignment with the 24 hour clock could be expected to be integrated-out by the tanks storage process.

The Time Base comprises a list of consecutive references which obtain its start date from 'Item 4 Analysis Parameters', where the entry is made for the Analysis Start Date. Leaving this field empty defaults the Analysis Start Date to the current date, which may not be appropriate since each time TankSmart$_{XL}$™ is opened the date will adjust accordingly.

18	Date Information			Rainfall Data		Usage Patterns	
19	Date	Day of Month	Day of Week	24 Hr Rainfall	Potential Roof Runoff	Profile Name	Restrict Level
22	02/10/07	2	Tue		0.0 L	Profile1	0
23	03/10/07	3	Wed		0.0 L	Profile1	0
24	04/10/07	4	Thu	10.0 mm	2508.4 L	Profile1	0
25	05/10/07	5	Fri	12.0 mm	3010.1 L	Profile1	1
26	06/10/07	6	Sat		0.0 L	Profile1	1
27	07/10/07	7	Sun		0.0 L	Profile1	1
28	08/10/07	8	Mon		0.0 L	Profile1	1

Figure 32 Model Tab – Time Base, Rainfall Data, & Usage Patterns

In the case of the excerpt shown in the screen capture above, the date has defaulted to the current date due to the entry field in the Summary Tab being left unfilled. However on entry of a valid date, this starting entry will reference that entry as the basis for the resulting calculations.

DERIVED DATE INFORMATION

As a consequence of the 'Date' field entry, it is possible to determine the "Day of the Month' and 'Day-of-the Week' for subsequent cross-referencing with the Usage Profiles.

LEGACY RAINFALL DATA

Similarly the date can be used to cross-reference the applicable rainfall records for calculation of 'what-if' scenarios based on legacy rainfall records from previous years.

POTENTIAL RUN-OFF

Based on the collection area of the roof or other harvesting surfaces the quantity of run-off[12] can be estimated. This area information which is also completed as part of the Summary Tab spreadsheet therefore allows for the modelling of rain water tank inflows.

Model usage Profiles & Restrictions

The TankSmart$_{XL}$™ system has been designed to take into account restriction levels and various water usage profiles. These must be entered against a particular date.

PROFILE INFORMATION

As the profile information represents water usage characteristics over the period of a week, each day as an argument is passed to the profile in use to determine what the scheduled water flows were on those days – whether these were for town water, rainwater sewerage etc.

RESTRICTION LEVEL

In a similar way to the profile information the restriction level for that day is also entered and town water demands determined.

Note that where continuous entries need to be made it is possible to simultaneously depress the <CTRL> and <;> keys to duplicate the cell from above.

Profiles and Restriction entries will usually be entered continuously over long periods of time. Profiles may be influenced by changing operational conditions or seasonal factors, whilst Restrictions will be determined by government.

[12] Note that Run-Off can be difficult to estimate and maybe totally wrong under conditions of light rain interspersed with very hot sunny conditions. In such cases the initial precipitation is largely evaporated before run-off can occur. Similarly the quality and condition of certain roofing materials can be expected to have an impact on the amount of run-off achieved. An example might be old porous roof-tiles versus new galvanised roofing iron. If in doubt it maybe possible to test the roof collection efficiency to more accurately determine efficiency.

Town Water Flow Requirements

The town water planning and subsequent draw-down of mains supply is one of the most important outputs of TankSmart$_{XL}$™ and is described in the first part of the model. By using the savings arising from the use of rain-water, grey-water, and other supply sources, the reduced impact on town water can be calculated on a day-by-day basis.

Two components are considered in the use of town-water – the 'Normal Mains Requirement' for the purposes of critical applications such as human consumption and food processing, and the 'Backup Mains Requirement' resulting as a consequence of supporting other sources such as grey water or 'Other' e.g. bore water.

Note the use of town water to back-up alternate water sources being used at a site may be prohibited or require special technical considerations.

The ability to use town water can be disabled in the options under the Summary Tab.

18	Date Information			Town Water Planning		
19	Date	Day of Month	Day of Week	Actual Town Supply Draw	Normal Mains Rqmnt	Backup Mains Rqmnt
22	04/06/05	4	Sat	1082.5 L	245.5 L	837.0 L
23	05/06/05	5	Sun	1094.5 L	308.5 L	786.0 L
24	06/06/05	6	Mon	251.5 L	251.5 L	0.0 L
25	07/06/05	7	Tue	248.5 L	248.5 L	0.0 L
26	08/06/05	8	Wed	247.5 L	247.5 L	0.0 L
27	09/06/05	9	Thu	246.5 L	246.5 L	0.0 L
28	10/06/05	10	Fri	252.5 L	252.5 L	0.0 L
29	11/06/05	11	Sat	245.5 L	245.5 L	0.0 L
30	12/06/05	12	Sun	753.7 L	308.5 L	445.2 L
31	13/06/05	13	Mon	822.5 L	251.5 L	571.0 L
32	14/06/05	14	Tue	821.5 L	248.5 L	573.0 L
33	15/06/05	15	Wed	821.5 L	247.5 L	574.0 L

Figure 33 Model Tab – Town Water Planning

In addition to backing-up rain water supplies, it may be allowed to backup other water sources, although the experience is that the system generally produces much more grey-water than can actually be put to good use, and should normally need to be supported.

Storage Modelling

Both rain water and grey water are different to the other water supplies in that these are held in temporary holding tanks for supply on demand. In operation the levels rise and fall continually in accordance with the usage, and under extreme conditions either run dry or over flow.

Although it happens over an indeterminate time span and in accordance with prevailing daily supply and usage patterns, for the purpose of the model, the situation represented in the model is that which exists at the end of the day. Therefore the balances of water in tanks are passed forward as part of the first field in the following record from each row in the table.

Both rain and grey water storage information comprises the same set of entries i.e.

- Inflows,
- Direct Draw,
- Storage Balance (at end of day),
- Short Fall, and
- Overflow or Spill.

In situations where a tank overflows, that quantity is lost from the system, and may actually be run into the sewerage system.

In the case of rain water, in conditions where the tank runs dry, this water may be backed-up from the mains supply if permitted.

Rainwater Planning Flow Requirements

In the excerpt from the model shown in Figure 34, a number of rainfall events gives rise to inflows of water into the rainwater tank based on the roof-area. These accumulate in the tank, but are simultaneously taken out by the allocated uses. When the tank runs empty the installation in this case allows for that water to be second-sourced from the mains supply.

Rainfall Data		Usage Patterns		Town Water Planning			Rainwater Planning				
24 Hr Rainfall	Potential Roof Runoff	Profile Name	Restrict Level	Actual Town Supply Draw	Normal Mains Rqmnt	Backup Mains Rqmnt	Rain Water Inflows	Rain Water Direct Draw	Daily Rain Water Storage	Rain Water Shortfall	Rain Water Spill
	0.0 L	Profile1	0	1082.5 L	245.5 L	837.0 L	0.0 L	837.0 L	0.0 L	837.0 L	0.0 L
	0.0 L	Profile1	0	1094.5 L	308.5 L	786.0 L	0.0 L	786.0 L	0.0 L	786.0 L	0.0 L
10.0 mm	2508.4 L	Profile1	0	251.5 L	251.5 L	0.0 L	1881.3 L	571.0 L	1310.3 L	0.0 L	0.0 L
12.0 mm	3010.1 L	Profile1	1	248.5 L	248.5 L	0.0 L	2257.5 L	573.0 L	2994.8 L	0.0 L	0.0 L
	0.0 L	Profile1	1	247.5 L	247.5 L	0.0 L	0.0 L	574.0 L	2420.8 L	0.0 L	0.0 L
	0.0 L	Profile1	1	246.5 L	246.5 L	0.0 L	0.0 L	621.0 L	1799.8 L	0.0 L	0.0 L
	0.0 L	Profile1	1	252.5 L	252.5 L	0.0 L	0.0 L	622.0 L	1177.8 L	0.0 L	0.0 L
	0.0 L	Profile1	1	245.5 L	245.5 L	0.0 L	0.0 L	837.0 L	340.8 L	0.0 L	0.0 L
	0.0 L	Profile1	2	753.7 L	308.5 L	445.2 L	0.0 L	786.0 L	0.0 L	445.2 L	0.0 L
	0.0 L	Profile1	2	822.5 L	251.5 L	571.0 L	0.0 L	571.0 L	0.0 L	571.0 L	0.0 L
	0.0 L	Profile1	2	821.5 L	248.5 L	573.0 L	0.0 L	573.0 L	0.0 L	573.0 L	0.0 L
	0.0 L	Profile1	2	821.5 L	247.5 L	574.0 L	0.0 L	574.0 L	0.0 L	574.0 L	0.0 L
20.0 mm	5016.8 L	Profile1	2	246.5 L	246.5 L	0.0 L	3762.6 L	621.0 L	3141.6 L	0.0 L	0.0 L

Figure 34 Model Tab - Rain Water Planning

In this case (allowed for by the set-up in the Summary Tab), the additional water requirements are added to the primary supply being drawn from the mains for normal purposes. As noted elsewhere this may not be permitted under local jurisdictions.

Grey Water Planning Flow Requirements

Grey water flows are balanced in the same manner as rain water, with the exception that the inflows for grey water come via other clean water usage process in the water cycle.

18	Date Information			Grey Water Planning					Other Supply Direct Draw
19	Date	Day of Month	Day of Week	Grey Tank Inflows	Grey Tank Direct Draw	Daily Grey Water Storage	Grey Tank Shortfall	Grey Tank Overflow	
22	04/06/05	4	Sat	264.5 L	198.0 L	1120.0 L	0.0 L	0.0 L	343.0 L
23	05/06/05	5	Sun	382.5 L	192.0 L	1310.5 L	0.0 L	0.0 L	448.0 L
24	06/06/05	6	Mon	413.5 L	191.0 L	1533.0 L	0.0 L	0.0 L	337.0 L
25	07/06/05	7	Tue	255.5 L	192.0 L	1596.5 L	0.0 L	0.0 L	338.0 L
26	08/06/05	8	Wed	328.5 L	193.0 L	1732.0 L	0.0 L	0.0 L	339.0 L
27	09/06/05	9	Thu	316.5 L	194.0 L	1854.5 L	0.0 L	0.0 L	340.0 L
28	10/06/05	10	Fri	469.5 L	195.0 L	2129.0 L	0.0 L	0.0 L	341.0 L
29	11/06/05	11	Sat	264.5 L	198.0 L	2195.5 L	0.0 L	0.0 L	343.0 L
30	12/06/05	12	Sun	382.5 L	192.0 L	2386.0 L	0.0 L	0.0 L	448.0 L
31	13/06/05	13	Mon	413.5 L	191.0 L	2608.5 L	0.0 L	0.0 L	337.0 L
32	14/06/05	14	Tue	255.5 L	192.0 L	2672.0 L	0.0 L	0.0 L	338.0 L
33	15/06/05	15	Wed	328.5 L	193.0 L	2807.5 L	0.0 L	0.0 L	339.0 L
34	16/06/05	16	Thu	316.5 L	194.0 L	2930.0 L	0.0 L	0.0 L	340.0 L
35	17/06/05	17	Fri	469.5 L	195.0 L	3204.5 L	0.0 L	0.0 L	341.0 L
36	18/06/05	18	Sat	264.5 L	198.0 L	3271.0 L	0.0 L	0.0 L	343.0 L
37	19/06/05	19	Sun	382.5 L	192.0 L	3461.5 L	0.0 L	0.0 L	448.0 L
38	20/06/05	20	Mon	413.5 L	191.0 L	3500.0 L	0.0 L	184.0 L	337.0 L
39	21/06/05	21	Tue	255.5 L	192.0 L	3500.0 L	0.0 L	63.5 L	338.0 L
40	22/06/05	22	Wed	328.5 L	193.0 L	3500.0 L	0.0 L	135.5 L	339.0 L

Figure 35 Model Tab – Grey Water Planning

For this reason, there it is usually easy to maintain grey-water supplies as opposed to town water and rain water sources.

Other Flow Management Outcomes

The fourth water supply option is shown under ‘Other Supply Direct Draw’ in Figure 35. For the purposes of the modelling process this is assumed to be an unrestricted alternative supply of water. It could however also be another storage, in which case a different modelling process would be required.

TANKSMART$_{XL}$™ OPTIONS

A number of options exist for modelling water supplies, however the ones provided are believed to be the most common. If alternative custom arrangements are required please contact Nufer & Associates at the address on the front of this document.

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CHAPTER 8

TANKSMART$_{XL}$™ TUTORIAL

In this Chapter two example tutorials are provided for using the TankSmart$_{XL}$™ spreadsheet application. The result may be used as a guide for your own situations where there is a desire to plan water usage and the potential benefits of installing rain water and grey water storage tanks.

Domestic Scenario

The Smith household comprises four persons, Jack and Alice, and their two teenage children John & Anne, residing in Eight Mile Cliffs, Brighton.

After building their home some 15 years earlier, Jack and Alice are considering improvements to save on water usage, through the installation of rain water and grey water tanks, along with new water saving shower rose.

CURRENT SITUATION

Before commencing, they are keen to examine just what saving and removal of dependency on the town water supply based on the rainfall experienced over the previous 12 months.

During this time they have noted how the water restriction levels have steadily increased from Level 1 through to Level 5, and since Alice has been concerned at the loss of her garden she is keen to see what potential exists for reusing grey-water for application to her garden and as a replacement for flushing the toilet.

Jack has compiled a list of water usage applications around the home including the Kitchen, Laundry, Bathroom, Yard, & Other.

There are little differences between the Summer/Autumn and Winter/Spring Months in Brisbane due to the local climate. Consequently Jack prepares a weekly water usage budget for a typical week during each period of time. He also produces an additional profile to account for washing the car every month.

Current Present Water Usage – Summer/Autumn

The summer autumn period is characterised by being fairly and consistently warm to hot. This results in people tending to use water more including drinks, bathing, and similar. As it represents the present situation all water is derived from the mains.

On weekends the teenage children tend to be out with their friends, reducing the impact on the domestic water supply a little.

During workdays, the absence of all but Alice from the house means the water requirements of the others are born by their respective work places.

Current Summer/Autumn Kitchen & Laundry

Area	Water Usage Activity	Usage	Water Source
Kitchen	Preparation of Breakfast (Everyone) Workdays	20 litres/meal	Town Water
	Preparation of Breakfast (Everyone) Weekends	30 litres/meal	
	Preparation of Lunch (Alice Only) Workdays	5 litres/meal	
	Preparation of Dinner – Each workday for (Jack, Alice, John & Anne)	40 litres/meal	
	Preparation of Lunch Saturday (Jack & Alice Only)	15 litres/meal	
	Preparation of Lunch Sunday (Jack & Alice Only)	15 litres/meal	
	Preparation of Dinner Party Saturday (Jack & Alice + 2 Adult Friends)	50 litres/meal	
	Preparation of Barbeque Sunday Evening (Jack, Alice & Family)	30 litres/meal	
	Dishwasher Workdays	20 litres/day	Town Water
	Dishwasher Saturdays	45 litres/day	
	Dishwasher Sundays	35 litres/day	
	Drinking (Workdays)	12 litres/person	Town Water
	Water Consumption – Jack, John & Anne (Workdays)	5 litres/person	
	Water Consumption – Alice (Workdays)	8 litres/person	
	Water Consumption – Jack & Alice (Weekends)	10 litres/person	
	Water Consumption – John & Anne (Weekends)	5 litres/person	
	Washing of Floors	50 litres/wash	Town Water
	Garbage Disposal	30 litres/day	Town Water
Laundry	Washing Machine (Top Loader) Three Loads on Saturday	200 litres/wash	Town Water
	Washing Machine (Top Loader) Four Loads on Wednesday	200 litres/wash	

Table 3 Domestic Scenario - Current Summer/Autumn Kitchen & Laundry

Current Summer/Autumn Bathroom, Yard & Other

Area	Water Usage Activity	Usage	Water Source
Bathroom	Toilet Full – 2 visits per day each (Jack, Alice, John & Anne)	11 litres/flush	Town Water
	Toilet Half – 5 visits per day Alice	6 litres/flush	
	Toilet Half – 2 visits per workday (John & Anne)	6 litres/flush	
	Toilet Half – 3 visits per weekend day (John & Anne)	6 litres/flush	
	Toilet Half – 4 visits per workday (Jack)	6 litres/flush	
	Toilet Half – 6 visits per weekend day (Jack)	6 litres/flush	
	Showers – 2 showers per work day each (Jack, Alice, John & Anne)	20 litres/minute	Town Water
	Bath – 1 bath per Sunday (Jack & Alice)	50 litres/bath	
	Showers – 1 shower per weekend day each (John & Anne)	20 litres/minute	
	Showers – 1 shower per Saturday each (Jack & Alice)	20 litres/minute	
	Brushing Teeth – 1 each per (Jack, Alice, John & Anne)	1 litre/clean	Town Water
	Basin – 1 each per (Jack & John)	5 litres/wash	
	Basing – 2 each per (Alice & Anne)	5 litres/wash	
	Hand Washing – 10 each workday per (Anne)	1 litre/wash	
	Hand Washing – 5 times each workday per (Jack, John, & Anne)	1 litre/wash	
	Hand Washing – 7 times each weekend day per (Jack & Alice)	1 litre/wash	
	Hand Washing – 3 times each weekend day per (John & Anne)	1 litre/wash	
Yard	Sprinkling the Grass – two hours each three times per week each odd day not including Monday	1000 litres/hour	Town Water
	Topping-Up Swimming Pool – once per weekend day	250 litres	
	Hosing Dust off Driveways - Refer Monthly Profile – once each month in summer	75 litres/5 mins	
Other	Washing the Car – Refer Monthly Profile – once each month in summer	200 litres/12 minutes	Town Water

Table 4 Domestic Scenario - Current Summer/Autumn Bathroom, Yard & Other

Current Present Water Usage – Winter/Spring

During the winter and spring months, the demand for water tends to drop slightly due to the cooler temperatures. Evaporation reduces the requirement to fill up the pool, whilst people may tend to revert to one shower per day due to the discomfort of the cold.

Similarly consumption for drinking and associated purposes also drops, along with the need to wash the car. Other activities usually curtailed by the cooler weather include the sprinkling of the lawn and hosing of driveways etc. aspects are reflected in the modified usage tables below.

Current Winter/Spring Kitchen & Laundry

Area	Water Usage Activity	Usage	Water Source
Kitchen	Preparation of Breakfast (Everyone) Workdays	20 litres/meal	Town Water
	Preparation of Breakfast (Everyone) Weekends	30 litres/meal	
	Preparation of Lunch (Alice Only) Workdays	5 litres/meal	
	Preparation of Dinner – Each workday for (Jack, Alice, John & Anne)	40 litres/meal	
	Preparation of Lunch Saturday (Jack & Alice Only)	15 litres/meal	
	Preparation of Lunch Sunday (Jack & Alice Only)	15 litres/meal	
	Preparation of Dinner Saturday (Jack & Alice)	40 litres/meal	
	Preparation of Dinner Sunday Evening (Jack, Alice & Family)	40 litres/meal	
	Dishwasher Workdays	20 litres/day	Town Water
	Dishwasher Saturdays	25 litres/day	
	Dishwasher Sundays	25 litres/day	
	Drinking (Workdays)	10 litres/person	Town Water
	Water Consumption – Jack, John & Anne (Workdays)	5 litres/person	
	Water Consumption – Alice (Workdays)	6 litres/person	
	Water Consumption – Jack & Alice (Weekends)	6 litres/person	
	Water Consumption – John & Anne (Weekends)	6 litres/person	
	Washing of Floors	50 litres/wash	Town Water
	Garbage Disposal	30 litres/day	Town Water
Laundry	Washing Machine (Top Loader) Three Loads on Saturday	200 litres/wash	Town Water
	Washing Machine (Top Loader) Four Loads on Wednesday	200 litres/wash	

Table 5 Domestic Scenario - Current Winter/Spring Kitchen & Laundry

Current Winter/Spring Bathroom, Yard & Other

Area	Water Usage Activity	Usage	Water Source
Bathroom	Toilet Full – 2 visits per day each (Jack, Alice, John & Anne)	11 litres/flush	Town Water
	Toilet Half – 7 visits per day Alice	6 litres/flush	
	Toilet Half – 3 visits per workday (John & Anne)	6 litres/flush	
	Toilet Half – 3 visits per weekend day (John & Anne)	6 litres/flush	
	Toilet Half – 4 visits per workday (Jack)	6 litres/flush	
	Toilet Half – 7 visits per weekend day (Jack)	6 litres/flush	
	Showers – 1 showers per work day each (Jack, Alice, John & Anne)	20 litres/minute	Town Water
	Showers – 1 shower per weekend day each (John & Anne)	20 litres/minute	
	Showers – 2 shower per weekend day each (Jack & Alice)	20 litres/minute	
	Brushing Teeth – 1 each per (Jack, Alice, John & Anne)	1 litre/clean	Town Water
	Basin – 1 each per (Jack & John)	5 litres/wash	
	Basing – 2 each per (Alice & Anne)	5 litres/wash	
	Hand Washing – 8 each workday per (Anne)	1 litre/wash	
	Hand Washing – 4 times each workday per (Jack, John, & Anne)	1 litre/wash	
	Hand Washing – 5 times each weekend day per (Jack & Alice)	1 litre/wash	
	Hand Washing – 3 times each weekend day per (John & Anne)	1 litre/wash	
Yard	Sprinkling the Grass – 1 hour each week each odd day not including Monday	1000 litres/hour	Town Water
	Topping-Up Swimming Pool – once per weekend day	0 litres	
	Hosing Dust off Driveways - Refer Monthly Profile – once each month in summer	0 litres/5 mins	
Other	Washing the Car – Refer Monthly Profile – once each month in summer	200 litres/12 minutes	Town Water

Table 6 Domestic Scenario - Current Winter/Spring Bathroom, Yard & Other

PROPOSED SITUATION

After reviewing the current situation Jack decides that he would like to implement some changes to the home to improve the efficiency with which they utilise water.

Jack also notes that with increasing restrictions certain activities in the future such as sprinkling the garden, hosing dirt off driveways, washing the car and other expected activities will no longer be possible with the town water supply.

He wishes to examine the best strategies and investment for maintaining a environmentally consistent water usage practices.

Having set-up all of the profiles required in TankSmart$_{XL}$™, he is now ready to investigate the benefits of water saving measures. He decides to consider initiatives such as the fitting of water efficient shower heads and collection of rain water off his 20 square metal roof, along with the installation of a basic recycling system and grey water storage tank.

He also decides to re-plumb his toilet for use of grey water, and utilise his new water tank for utility applications around the home such as watering the garden, washing the car, and topping up the swimming pool. In doing so he makes the following changes to the water usage schedules previously listed, and using the previous 18 months of rainfall records, evaluates the size of rain water tank that provides the optimum storage volume.

He adjusts the previous schedules as indicated to reflect the new design.

Proposed Summer/Autumn Kitchen & Laundry

Area	Water Usage Activity	Usage	Water Source
Kitchen	Preparation of Breakfast (Everyone) Workdays	20 litres/meal	Town Water
	Preparation of Breakfast (Everyone) Weekends	30 litres/meal	
	Preparation of Lunch (Alice Only) Workdays	5 litres/meal	
	Preparation of Dinner – Each workday for (Jack, Alice, John & Anne)	40 litres/meal	
	Preparation of Lunch Saturday (Jack & Alice Only)	15 litres/meal	
	Preparation of Lunch Sunday (Jack & Alice Only)	15 litres/meal	
	Preparation of Dinner Party Saturday (Jack & Alice + 2 Adult Friends)	50 litres/meal	
	Preparation of Barbeque Sunday Evening (Jack, Alice & Family)	30 litres/meal	
	Dishwasher Workdays	20 litres/day	Town Water
	Dishwasher Saturdays	45 litres/day	
	Dishwasher Sundays	35 litres/day	
	Drinking (Workdays)	12 litres/person	Town Water
	Water Consumption – Jack, John & Anne (Workdays)	5 litres/person	Town Water
	Water Consumption – Alice (Workdays)	8 litres/person	
	Water Consumption – Jack & Alice (Weekends)	10 litres/person	
	Water Consumption – John & Anne (Weekends)	5 litres/person	
	Washing of Floors	50 litres/wash	Town Water
	Garbage Disposal	30 litres/day	Town Water
Laundry	Washing Machine (~~Top Loader~~) (Front Loader) Three Loads on Saturday	~~200 litres/wash~~ **100 litres/wash**	Town Water **Dispose to Grey Water**
	Washing Machine (~~Top Loader~~)**(Front Loader)** Four Loads on Wednesday		

Table 7 Domestic Scenario - Proposed Summer/Autumn Kitchen & Laundry

Proposed Summer/Autumn Bathroom, Yard & Other

Area	Water Usage Activity	Usage	Water Source
Bathroom	Toilet Full – 2 visits per day each (Jack, Alice, John & Anne)	11 litres/flush	~~Town Water~~ **Grey Water Dispose to Sewerage**
	Toilet Half – 5 visits per day Alice	6 litres/flush	
	Toilet Half – 2 visits per workday (John & Anne)	6 litres/flush	
	Toilet Half – 3 visits per weekend day (John & Anne)	6 litres/flush	
	Toilet Half – 4 visits per workday (Jack)	6 litres/flush	
	Toilet Half – 6 visits per weekend day (Jack)	6 litres/flush	
	Showers – 2 showers **(efficient shower rose)** per work day each (Jack, Alice, John & Anne)	~~20 litres/minute~~ **9 litres/minute**	Town Water **Dispose to Grey Water**
	~~Bath – 1 bath per Sunday (Jack & Alice)~~	~~50 litres/bath~~	
	Showers – 2 shower **(efficient shower rose)** per weekend day each (John & Anne)	~~20 litres/minute~~ **9 litres/minute**	
	Showers – 1 shower **(efficient shower rose)** per weekend day each (Jack & Alice)	~~20 litres/minute~~ **9 litres/minute**	
	Brushing Teeth – 1 each per (Jack, Alice, John & Anne)	1 litre/clean	Town Water **Dispose to Grey Water**
	Basin – 1 each per (Jack & John)	5 litres/wash	
	Basin – 2 each per (Alice & Anne)	5 litres/wash	
	Hand Washing – 10 each workday per (Anne)	1 litre/wash	
	Hand Washing – 5 times each workday per (Jack, John, & Anne)	1 litre/wash	
	Hand Washing – 7 times each weekend day per (Jack & Alice)	1 litre/wash	
	Hand Washing – 3 times each weekend day per (John & Anne)	1 litre/wash	
Yard	Sprinkling the Grass – two hours each three times per week each odd day not including Monday	1000 litres/hour	~~Town Water~~ **Tank Water**
	Topping-Up Swimming Pool – once per weekend day	250 litres	~~Town Water~~ **Rain Water**
	Hosing Dust off Driveways - Refer Monthly Profile – once each month in summer	75 litres/5 mins	~~Town Water~~ **Rain Water**
Other	Washing the Car – Refer Monthly Profile – once each month in summer	200 litres/12 minutes	~~Town Water~~ **Rain Water**

Table 8 Domestic Scenario - Proposed Summer/Autumn Bathroom, Yard & Other

Proposed Winter/Spring Kitchen & Laundry

Area	Water Usage Activity	Usage	Water Source
Kitchen	Preparation of Breakfast (Everyone) Workdays	20 litres/meal	Town Water
	Preparation of Breakfast (Everyone) Weekends	30 litres/meal	
	Preparation of Lunch (Alice Only) Workdays	5 litres/meal	
	Preparation of Dinner – Each workday for (Jack, Alice, John & Anne)	40 litres/meal	
	Preparation of Lunch Saturday (Jack & Alice Only)	15 litres/meal	
	Preparation of Lunch Sunday (Jack & Alice Only)	15 litres/meal	
	Preparation of Dinner Saturday (Jack & Alice)	40 litres/meal	
	Preparation of Dinner Sunday Evening (Jack, Alice & Family)	40 litres/meal	
	Dishwasher Workdays	20 litres/day	Town Water
	Dishwasher Saturdays	25 litres/day	
	Dishwasher Sundays	25 litres/day	
	Drinking (Workdays)	10 litres/person	
	Water Consumption – Jack, John & Anne (Workdays)	5 litres/person	Town Water
	Water Consumption – Alice (Workdays)	6 litres/person	
	Water Consumption – Jack & Alice (Weekends)	6 litres/person	
	Water Consumption – John & Anne (Weekends)	6 litres/person	
	Washing of Floors	50 litres/wash	Town Water
	Garbage Disposal	30 litres/day	Town Water
Laundry	Washing Machine (~~Top Loader~~) (Front Loader) Three Loads on Saturday	~~200 litres/wash~~ **100 litres/wash**	Town Water **Dispose to Grey Water**
	Washing Machine (~~Top Loader~~)**(Front Loader)** Four Loads on Wednesday		

Table 9 Domestic Scenario - Proposed Winter/Spring Kitchen & Laundry

Proposed Winter/Spring Bathroom, Yard & Other

Area	Water Usage Activity	Usage	Water Source
Bathroom	Toilet Full – 2 visits per day each (Jack, Alice, John & Anne)	11 litres/flush	~~Town Water~~ **Grey Water Dispose to Sewerage**
	Toilet Half – 7 visits per day Alice	6 litres/flush	
	Toilet Half – 3 visits per workday (John & Anne)	6 litres/flush	
	Toilet Half – 3 visits per weekend day (John & Anne)	6 litres/flush	
	Toilet Half – 4 visits per workday (Jack)	6 litres/flush	
	Toilet Half – 7 visits per weekend day (Jack)	6 litres/flush	
	Showers – 1 showers **(efficient shower rose)** per work day each (Jack, Alice, John & Anne)	~~20 litres/minute~~ **9 litres/minute**	Town Water **Dispose to Grey Water**
	Showers – 2 shower **(efficient shower rose)** per weekend day each (John & Anne)	~~20 litres/minute~~ **9 litres/minute**	
	Showers – 1 shower **(efficient shower rose)** per weekend day each (Jack & Alice)	~~20 litres/minute~~ **9 litres/minute**	
	Brushing Teeth – 1 each per (Jack, Alice, John & Anne)	1 litre/clean	Town Water **Dispose to Grey Water**
	Basin – 1 each per (Jack & John)	5 litres/wash	
	Basing – 2 each per (Alice & Anne)	5 litres/wash	
	Hand Washing – 8 each workday per (Anne)	1 litre/wash	
	Hand Washing – 4 times each workday per (Jack, John, & Anne)	1 litre/wash	
	Hand Washing – 5 times each weekend day per (Jack & Alice)	1 litre/wash	
	Hand Washing – 3 times each weekend day per (John & Anne)	1 litre/wash	
Yard	Sprinkling the Grass – 1 hour each week each odd day not including Monday	1000 litres/hour	~~Town Water~~ **Tank Water**
	Topping-Up Swimming Pool – once per weekend day	0 litres	~~Town Water~~ **Rain Water**
	Hosing Dust off Driveways - Refer Monthly Profile – once each month in summer	0 litres/5 mins	~~Town Water~~ **Rain Water**
Other	Washing the Car – Refer Monthly Profile – once each month in summer	200 litres/12 minutes	~~Town Water~~ **Rain Water**

Table 10 Domestic Scenario - Proposed Winter/Spring Bathroom, Yard & Other

APPENDIX

INTRODUCTION

The TankSmart$_{XL}$™ Appendix contains information which may be of interest in the undertaking of tutorials and use of TankSmart$_{XL}$™.

Typical Water Usage Allowances

There have been a number of typical water usage allowances published by a variety of agencies and commercial organisations. The following are provided as a guide for input into the Configuration Tab Spreadsheet.

DOMESTIC APPLICATIONS

Table 11 comprises a list of water usage rates – obtained from numerous sources mainly in Australia. These are meant as a guide for the completion of the Configuration Tab Spreadsheet of TankSmart$_{XL}$™.

Water Appliance	Water Usage
Dishwasher (Full Load)	16 - 32 litres/load
Garbage Disposal	30 litres/day
Washing-Up by Hand (Washing)	5 litres/wash ???
Washing-Up by Hand (Rinsing)	5 litres/wash ???
Domestic Cleaning (Washing Floors)	20 litres/week ???
Cooking & Meal Preparation	10 litres/meal ???
Drinking Purposes	20 litres/person ???
Hand Washing	5 litres/person/day ???
Washing Machine (Twin Tub)	40 litres/load
Washing Machine(Front Loader)	100 litres/load
Washing Machine (Top Loader)	170 - 265 litres/load
Bath (Typical Max)	150 litres/bath
Bath (Typical Min)	50 litres/bath
Shower (Typical)	20 litres/minute
Shower (Best Practice)	9 litres/minute
Basin (Typical)	5 litres/use
Brushing Teeth (Typical)	5 litres/clean
Brushing Teeth (Best Practice)	1 litre/clean
Sprinkling	1000 litres/hour
Car Washing	200 litres/12 minutes
Hosing Driveway	75 litres/5 minutes

Table 11 Typical Domestic Applications – Water Usage Rates

COMMERCIAL APPLICATIONS

Table 12 comprises a list of commercial water usage rates have been obtained from numerous sources mainly in Australia. These are meant as a guide for the completion of the Configuration Tab Spreadsheet of TankSmart$_{XL}$™.

Water Appliance	Water Usage
Dishwasher (Hood Type)	156 litres/hour
Dishwasher (Rack Conveyer)	320 litres/hour
Sinks (Best Practice)	12 litres/min
Sinks (Typical)	25 litres/min
Basins (Best Practice)	6 litres/min
Basins (Typical)	12 litres/min
Washer Extractor – Good (Without Reuse)	17 – 22 litres/kg linen
Washer Extractor – Fair (Without Reuse)	22 – 26 litres/kg linen
Washer Extractor – Poor (Without Reuse)	>26 litres/kg linen
Washer Extractor – Good (With Reuse)	12 – 15 litres/kg linen
Washer Extractor – Fair (With Reuse)	15 – 18 litres/kg linen
Washer Extractor – Poor (With Reuse)	>18 litres/kg linen
Hotel Showers – (Typical)	15 litres/min
Hotel Showers – (Best Practice)	9 litres/min
Hotel Toilets – (Typical Single Flush)	11 litres/flush
Hotel Toilets Dual Part Flush – (Best Practice)	3 litres/flush
Hotel Toilets Dual Full Flush – (Best Practice)	6 litres/flush
Hotel Basins – (Typical)	12 litres/min
Hotel Basins – (Best Practice)	6 litres/min
Urinals – Typical	2-3 gallons/flush
Urinals – Best practice	1 gallon/flush

Table 12 Typical Commercial Applications - Water Usage Rates

Reference Documents

The following documents are provided for reference purposes on the matter of reducing the demand for fresh water and investigation of recycling.

http://www.homewaterwise.com/

Queensland Dept Natural Resources
http://www.nrw.qld.gov.au/publications/water_management.html

Queensland Water Commission Home Page
http://www.qwc.qld.gov.au/HomePage

North Carolina Dept Environment “Water Efficiency Manual”
http://www.p2pays.org/ref/01/00692.pdf