

Addition of a Water Module to AccuRate

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EXECUTIVE SUMMARY

For house sustainability assessment and for helping home owners to determine the most appropriate actions to improve the environmental performance of a property, the Residential Buildings Group (RBG) of Department of Environment, Water, Heritage and the Arts (DEWHA) requires the addition of a water module to the AccuRate software. The module calculates water consumption of a residential property (including indoor and outdoor water usages) based on user input.

CSIRO was engaged by RBG to implement the water module in AccuRate. This project accomplished the following deliverables:

- A water page has been implemented in the AccuRate user interface, containing the input data fields required which include: house location, house style and land block information, occupant patterns and behaviours, indoor/outdoor water related facilities, etc.
- The calculations of water consumption in this water page are based on the House Water Expert software, which was developed by CSIRO for people to estimate and reduce household water consumption [1].
- A new water report page has also been added to AccuRate's summary report, showing yearly-averaged daily water consumption estimation of town water, onsite treated water, grey water, rain water, stormwater runoff and the averaged daily total water consumption estimation.

1. BACKGROUND

For house sustainability assessment and for helping home owners to determine the most appropriate actions to improve the environmental performance of a property, the Residential Buildings Group (RBG) of Department of Environment, Water, Heritage and the Arts (DEWHA) requires the addition of a water module to the AccuRate software. The module will calculate water consumption according to the water systems used within the property. CSIRO was engaged by RBG to implement the water module in AccuRate.

The project includes the following deliverables:

- A water page will be implemented in the AccuRate user interface, containing the input data fields required which include: house location, house style and land block information, occupant patterns and behaviours, indoor/outdoor water related facilities, etc.
- The calculations of water consumption in this water page will be based on the House Water Expert software, developed by CSIRO for people to estimate and reduce household water consumption [1].
- A new water report page will be added to AccuRate's summary report, showing annual town water consumed, wastewater generated, stormwater generated.

This report details the implementation of the water module in AccuRate.

2. WATER CONSUMPTION CALCULATION METHODOLOGY

The implementation of the water module was based on the House Water Expert (HWE) software, developed by CSIRO which was designed for household to estimate and reduce water consumption [1]. House Water Expert was primarily a communication and education tool. The development of House Water Expert's algorithms involved trade offs between modelling accuracy and program usability. A one day time-step was adopted. The most sensitive item to time step length in the model is the Rainwater Tank. Whilst time-steps shorter than one day would improve accuracy, the improved accuracy was considered to be relatively insignificant [1]. A longer time-step such as a week or a month was deemed to reduce accuracy and potentially provide misleading results about the effectiveness of a Rainwater Tank.

The modelling platform of House Water Expert was originally based on the National Water Conservation Rating and Labelling Scheme ('A ratings'), which specifies the range of flow rates in litres per minute for each 'A rating'. Since the WELS scheme (Australia's Water Efficiency Labelling Scheme) replaced the 'A rating' from 1st July 2006 (<u>www.waterrating.gov.au</u>), the implementation in AccuRate has been updated the modelling platform to the WELS water labelling scheme. The label scheme has a zero to six star rating. The range of water flow rate in litres per minute is specified in each star level.

To characterise behaviours within the household, AccuRate adopts the methodology of House Water Expert which asks the user to create and input the individual occupant behaviours such as Showers and Toilets require inputs on an individual basis. End Uses with a household focus such as the Garden, Lawn, Car wash and the Dishwasher only require inputs for the household. The calculation methodologies of water consumption have been detailed in House Water Expert software and its accompany document [1]. In this report, the formula and the parameters used in the water module implementation in AccuRate are listed for references. Table 1 shows the formula used for the calculation of the water consumption for indoor, outdoor, water sources and stormwater runoff. The default input values for various parameters are listed in Appendix A Table A1.

Item Name and abbreviation	Formula		Comments
Dishwasher Water used by dishwasher Q _D (L/day); Hot water used by dishwasher Q _{DH} (L/day); Cold water used by dishwasher Q _{DC} (L/day)	$Q_{D} (L/day) = F_{D} * (S_{DB} + S_{D} * P_{D}) / 7$ $Q_{DH} = H_{DF} * Q_{D}$ $Q_{DC} = (1-H_{DF}) * Q_{D}$	(1) (2) (3)	Where 7 is a conversion from week to days; S_D corresponding value (L / Place setting) for star rating of dishwasher (see Table 2); F_D frequency of dishwasher used (loads/week); P_D place settings of dishwasher (=13 Place Setting); S_{DB} corresponding baseline (L) for star rating of dishwasher (see Table 2). H_{DF} portion of dishwasher hot water usage (=100%).
Kitchen tap and Sink Water used by kitchen tap and sink Q_K (L/day); Hot water used by kitchen tap and sink Q_{KH} (L/day); Cold water used by kitchen tap and sink Q_{KC} (L/day)	$\begin{aligned} Q_{K} &= S_{K} * F_{K} * D_{K} / 60 + F_{ks} * V_{ks} / 7 + L_{K} * L_{Kr} \\ Q_{KH} &= H_{FF} * S_{K} * F_{K} * D_{K} / 60 + H_{SF} * F_{ks} * V_{ks} / 7 + \\ H_{FF} * L_{K} * L_{Kr} \\ Q_{KC} &= (1 - H_{FF}) * S_{K} * F_{K} * D_{K} / 60 + (1 - H_{SF}) * F_{ks} * V_{ks} / 7 \\ &+ (1 - H_{FF}) * L_{K} * L_{Kr} \end{aligned}$	(4) (5) (6)	Where 60 is a conversion from seconds to minutes, 7 is a conversion from weeks to days; S_K corresponding value (L / min) for 'star rating' of kitchen tap (see Table 3); F_K frequency of rinsing (per day); D_K duration of rinsing (seconds); L_K leaking tap (y=1, n=0); L_{Kr} leaking tap rate (10 L/day); F_{ks} frequency of kitchen sink use (times filled per week); V_{ks} volume of kitchen sink (=30 L) (this is not a user input); H_{FF} portion of faucet hot water usage (=0.25); H_{SF} portion of sink hot water usage (=0.57).
Clothes Washer Water used by clothes washer Q_{cw} (L/day); Hot water used by clothes washer Q_{cwH} (L/day); Cold water used by clothes washer Q_{cwC} (L/day)	$Q_{cw} = S_{cw} * C_{cw} * F_{cw} * R_{cw} / 7$ $Q_{cwH} = H_{cwF} * Q_{cw}$ $Q_{cwC} = (1 - H_{cwF}) * Q_{cw}$	(7) (8) (9)	Where 7 is a unit conversion from week to day; S_{cw} corresponding value (L/kg) for star rating of washing machine (see Table 4); C_{cw} rated capacity of washing machine (kg) (5, 6.5 and 8 kg for small, medium and large); F_{cw} frequency of washing machine use (cycles per week); R_{cw} rinse cycle factor of washing machine = 1.2 (not a user input); H_{cwF} portion of hot water usage (=0.29).
Laundry tap and Sink	$Q_L = S_L * D_L / 7 + L_L * L_{Lr} + F_{lt} * V_{lt} / 30.44$	(10)	Where 30.44 is a conversion from months to days, 60

Table 1 Formula used for the calculation of the water consumption (Reference: Grant *et al*, 2004)

Water used by laundry tap and sink Q_L (L/day); Hot water used by laundry tap and sink Q_{LH} ; Cold water used by laundry tap and sink Q_{LC} (L/day)	$Q_{LH} (L/day) = H_{FF} * S_L * D_L / 7 + H_{FF} * L_L * L_{Lr} + H_{SF} * F_{lt} * V_{lt} / 30.44$ $Q_{LC} (L/day) = (1 - H_{FF}) * S_L * D_L / 7 + (1 - H_{FF}) * L_L * L_{Lr} + (1 - H_{SF}) * F_{lt} * V_{lt} / 30.44$	(11) (12)	is a conversion from seconds to minutes and 7 is a conversion from weeks to days; S_L corresponding value (L/min) for 'star rating' of laundry tap (see Table 3); D_L typical duration of rinsing (minutes/week); L_L leaking tap (y=1, n=0); L_{Lr} leaking tap rate (= 10 L/day); F_{lt} frequency of laundry tub use (per month); V_{lt} volume laundry tub filled to (= 40 L); H_{FF} portion of faucet hot water usage (= 0.25); H_{SF} portion of sink hot water usage (= 0.57).
Shower Water used by shower Q _s (L/day); Hot water used by shower Q _{SH} (L/day); Cold water used by shower Q _{SC} (L/day)	$Q_{s} = \sum_{n \text{ individuals}} (S_{s}*F_{s}*D_{s} / 7) + L_{s}*L_{sr}$ $Q_{SH} = H_{shF}*Q_{S}$ $Q_{SC} = (1 - H_{shF})*Q_{S}$	(13) (14) (15)	Where 7 is a conversion from week to day; S_s corresponding value (L/min) for star rating of shower (see Table 5) for each shower rose; F_s frequency of shower usage (showers per week) for each individual for each shower rose; D_s typical duration of shower (min) for each individual for each shower rose; L_s leaking shower rose (y=1, n=0) for each shower rose; L_{sr} leaking shower rose rate (= 10 L/day); n number of individuals; H_{shF} portion of shower hot water usage (= 0.57).
BathWater used by bath Q_B (L/day);Hot water used by bath Q_{BH} (L/day); Cold water used by bath Q_{BC} (L/day)	$Q_{B} = \sum_{n \text{ individuals}} V_{B} * F_{B} / 30.44 + L_{B} * L_{Br}$ $Q_{BH} (L/day) = H_{BF} * Q_{B}$ $Q_{BC} (L/day) = (1 - H_{BF}) * Q_{B}$	(16) (17) (18)	Where 30.44 is a conversion from month to day; F_B frequency of bath usage (times filled per month); L_B leaking tap (y=1, n=0); L_{Br} leaking bath tap rate (= 10 L/day); V_B volume of water used by bath per use (L) (set to 120 L); n number of individuals. H_{BF} portion of bath / spa bath hot water usage (=0.51).

Spa Bath Water used by spa bath Q_{SB} (L/day); Hot water used by spa bath Q_{SBH} (L/day); Cold water used by spa bath Q_{SBC} (L/day)	$Q_{SB} = F_{SB}*V_{SB} / 30.44 + L_{SB}*L_{SBr}$ $Q_{SBH} = H_{BF}*Q_{SB}$ $Q_{SBC} = (1 - H_{BF})*Q_{SB}$	(19) (20) (21)	Where 30.44 is a conversion from months to days; F_{SB} frequency of bath usage (per month); V_{SB} volume of spa bath (user will choose between small, medium & large and see Table 6 for the corresponding size); L_{SB} leaking spa bath tap (y=1, n=0); L_{SBr} leaking spa bath tap rate (= 10 L/day); H_{BF} portion of bath / spa bath hot water usage (= 0.51).
Bathroom Tap and Basin Water used by bathroom tap and basin Q _{bt&b} (L/day)	$\begin{split} Q_{bt\&b} &= \sum_{n \text{ individuals}} (S_{bt} * F_{bt} * D_{bt} / 60 + F_{bb} * V_{bb} / 7) + \\ & L_{bt} * L_{btr} \\ Q_{bt\&bH} &= \sum_{n \text{ individuals}} (H_{FF} * S_{bt} * F_{bt} * D_{bt} / 60 + H_{SF} * F_{bb} \\ & * V_{bb} / 7) + H_{FF} * L_{bt} * L_{btr} \\ Q_{bt\&bC} &= \sum_{n \text{ individuals}} ([1 - H_{FF}] * S_{bt} * F_{bt} * D_{bt} / 60 + \\ & [1 - H_{SF}] * F_{bb} * V_{bb} / 7) + (1 - H_{FF}) * L_{bt} * L_{btr} \end{split}$	(22) (23) (24)	Where 60 is a conversion from seconds to minutes and 7 is a conversion from weeks to days; S_{bt} corresponding value for star rating of bathroom tap (L/min, see Table 3); F_{bt} frequency of rinsing (eg. hand washing, brushing teeth) (per day) for each individual; D_{bt} typical duration of rinsing (sec) for each individual; L_{bt} leaking bathroom basin tap (y=1, n=0); L_{btr} leaking bathroom basin tap rate (= 10 L/day); F_{bb} frequency of basin use (per week) for each individual; V_{bb} volume basin typically filled to (3 L); H_{FF} portion of faucet hot water usage (= 0.25); H_{SF} potion of sink water usage (= 0.57).
Single Flush Toilet Water used by a single flush toilet Q _{Ts} (L/day)	$Q_{Ts} = \sum_{n \text{ individuals}} S_{Tsf} * F_{tsf} + L_{toilet} * L_{toilet Rate}$	(25)	Where S_{Tsf} is corresponding value for star rating of single flush toilet (L/flush) (see Table 7); F_{tsf} frequency of use of single flush toilet (per day) for each individual; L_{toilet} toilet cistern leaking (no leak; leak with noise; and leak without noise); $L_{toilet Rate}$ toilet cistern leaking rate (24 L/day for slow leak without noise; and 204 L/day for fast audible leak).

Dual Flush Toilet Water used by a dual flush toilet Q _{Td} (L/day)	$Q_{Td} = \sum_{n \text{ individuals}} S_{Tdf} * F_{Tdf} + L_{toilet} * L_{toilet Rate}$	(26)	Where S_{Tdf} is corresponding value of average flush volume for star rating (L/flush) (see Table 7) respectively; F_{Tdf} frequency of half flushes (flushes per day) respectively; L_{toilet} toilet cistern leaking (no leak; leak with noise; and leak without noise); $L_{toilet Rate}$ toilet cistern leaking rate (24 L/day for slow leak without noise; and 204 L/day for fast audible leak with noise).
Evaporative Air Conditioner Water used by evaporative air conditioner Q _{ac} (L/day); The rate of air conditioner bleed Q _{ac bleed} (L/day)	$Q_{ac} = N_{ac} * L_{ac} * F_{ac} * Q_{ac rate}/365.25$ $Q_{ac bleed} = N_{ac} * L_{ac} * F_{ac} * Q_{ac bleed rate}/365.25$	(27) (28)	Where F_{ac} is Number of cooling days per season (days) (user input); L_{ac} Length of cooling per cooling day (= 9.7 hours) (this is not a user input); $Q_{ac rate}$ rate of consumption by evaporative cooler (L/hr) (User has choice of three types of coolers as per Table 8); N_{ac} number of air conditioner units (user input) (for whole of house system = 1); $Q_{ac bleed rate}$ rate of water bled from the air conditioner (= 12 L/hr) (this is not a user input).
Swimming Pool Water used by swimming pool Q _p (L/day)	$Q_p = 1000*P_{av depth}*(S*F_{pf} + S*F_{pt}*P_{top up}) / 365.25$	(29)	Where 1000 is a conversion from kilolitres to litres; 365.25 a conversion from years to days; S surface area of pool (m ²); F_{pf} frequency of pool filling (times filled per year); F_{pt} frequency of topping up pool (top ups per year); $P_{top up}$ (= 20 %) nominal portion of pool that is topped up; $P_{av depth}$ average depth of the pool (m).
Spa Water used by spa Q _{spa} (L/day)	$Q_{spa} = 1000* S_{av depth} *(A_{S}*F_{spaf} + A_{S}*F_{spat}* S_{top up}) / 365.25$	(30)	Where 365.25 is a conversion from years to days; A_s are (m^2) ; F_{spaf} frequency of spa filling (times filled per year); frequency of topping up spa (times topped up per year); 20%) nominal portion of spa that is topped up (this value HWE); $S_{av depth}$ (=1.0 m) (average depth of the spa).

Water Features Water used by water features Q _{wf} (L/day)	$Q_{wf} = 1000 * W_{av depth} * A_{wf} (F_{wf} + F_{wft} * W_{top up}) / 365$	5.25 (31)	Where A_{wf} is area of water feature (m ²) (graphical interaction); F_{wf} frequency of water feature filling (times filled per year); F_{wft} frequency of water feature topping up (times topped up per year); $W_{av depth}$ average depth of water feature ; $W_{top up}$ average top up percentage of the water feature (= 20%).
Garden and Lawn Water used for watering garden	$Q_{Lsummer} = [Q_{IrriMethod} * F_{Irri} * D_{Summer}]$	(32)	Where Q _{IrriMethod} is application rate of the irrigation method (L/min) (see Table 9); D _{Summer} average
and lawn in the summer season Q _{Lsummer} (L/day); Water used for	$Q_{Lwinter} = [Q_{IrriMethod} * F_{Irri} * D_{winter}]$	(33)	duration of each watering in summer (min); D _{winter} average duration of each watering in winter (min);
watering garden and lawn in the winter season Q _{Lwinter} (L/day); Water used for watering garden and lawn in the spring/autumn	$Q_{Lspring/autumn} = [Q_{IrriMethod} * F_{Irri} * D_{spring/autumn}]$	(34)	D _{spring/autumn} average duration of each watering in spring and autumn (min); F _{Irri} frequency of irrigation per day.
season Q _{Lspring/autumn} (L/day)			
Car Washing Water used for washing a car	$Q_{cw bucket} = V_{bucket} N_{bucket} F_{cw bucket} / 30.44$	(35)	Where 30.44 is a conversion from months to days; V_{bucket} volume of water in a bucket (= 10 litres); N_{bucket}
with a bucket $Q_{cw bucket}$ (L/day); water used for washing a car with a hose, $Q_{cw hose}$ (L/day)	$Q_{cw hose} (L/day) = Q_{hose} * D_{hose} * F_{cw hose} / 30.44$	(36)	number of buckets used per car wash; $F_{cw bucket}$ frequency of car washing per month; Q_{hose} volume of water discharged from hose per minute (= 10 litres / min); D_{hose} duration of hose use per car wash (minutes); $F_{cw hose}$ frequency of car washing per month.
Stormwater runoff Q _R (L/year)	$\begin{split} Q_{R} &= R*[r_{cb}*A_{B}+r_{cp}*A_{P}+r_{cg}*A_{Gr}+r_{cc}*A_{C}+\\ & E_{hsw}/100*A_{h}*r_{chouse}+E_{ssw}/100*A_{s}*r_{cshed}\\ &+r_{cg}*E_{hg}/100*r_{chouse}*A_{h}+r_{cg}*E_{sg}/100\\ &r_{cshed}*A_{s}] + (R+365.25*Q_{L}/A_{L})*A_{L}*r_{cl}\\ &+ (R+365.25*Q_{G}/A_{G})*A_{G}*r_{cg}+365.25\\ &*Q_{cw}*r_{ccw}+\sum U_{ff}*r_{cff}+\sum Q_{over} \end{split}$	(37)	Where R is annual rainfall (mm); r is co-efficient of runoff from impervious and pervious surfaces (see Table 10); A_B brick area (m ²); A_P pervious area (m ²); A_{Gr} gravel area (m ²); A_C concrete area (m ²); Q_L volume of water used on lawn (L/day); Q_G volume of water used on garden (L/day); Q_{cw} volume of water used to wash car (L/day); U_{ff} first flush volume (L/day) of rainwater tank; A_L lawn area (m ²); A_G garden area

			(m ²); r_{ccw} runoff co-efficient from car washing (0.7); Q _{over} overflow from rainwater tank (L/day); A _s area of shed roof (m ²); A _h area of house roof (m ²); E _{hsw} percentage of house roof directed to municipal stormwater drainage (%) (user specified); E _{ssw} percentage of shed roof directed to municipal stormwater drainage (%) (user specified); E _{hg} percentage of house roof directed to garden / lawn (%) (user specified); E _{sg} percentage of shed roof directed to garden / lawn (%) (user specified).
Rainwater Tank Stormwater inflow to the rainwater store tank over	$Q_{in} (L/day) = max(a*R_d*[A_h * E_h / 100 + A_s * E_s / 100] - F_f, 0)$	(38)	Where a (= r_{chouse} , r_{cshed}) is co-efficient of runoff from shed and house roof (= 0.9); R_d rainfall in the day (mm/day); A_h area of house roof (m ²); E_h percentage of
timesteps Q_{in} (L/day); First flush F_f (L/day); Overflow from	$F_{f} (L/day) = \min(a*R_{d}*[A_{h}*E_{h}/100 + A_{s}*E_{s}/100], U_{ff})$	(39)	house roof directed to rainwater tank (%); A_s area of shed roof (m ²); E_s percentage of shed roof directed to
rainwater tank over timesteps	$Q_{over} = max(Q_{in} - Q_{out} + V_{t-1} - V_t, 0)$	(40)	rainwater tank (%);V _{t-1} volume stored in rainwater
Q _{over} (L/day); Consumption of rainwater tank water over	$V_{t} (L) = min(V_{t-1} + Q_{in} - Q_{out}, V_{cap})$	(41)	tank at the end of previous timestep (L); $U_{\rm ff}$ is first flush volume (L).
timestep Q _{out} (L/day); V _t volume stored in rainwater tank at the	$Q_{out}(L/day) = min(D_t, V_{t-1} + Q_{in})$	(42)	
end of timestep (L); Demand on rainwater tank water over timestep D_t (L/day)	$\begin{split} D_t &= \sum_{User \ Defined \ Rainwater \ Tank \ Demand} (Dishwasher + Kitchen \ sink \ \& \ tap + Clothes \ Washer + Laundry \ Tub \ \& \ Tap + Shower + Bath + Spa \ Bath + Basin \ \& \ Tap + Toilet + Air \ conditioner + Swimming \ Pool + Spa + Garden \ + Lawn + Water \ Feature + Car \ Washing) \end{split}$	(43)	
On Site Treatment System Inflow to the on site treatment	$Q^{T}_{in} = \sum_{user defined supply} (Dishwasher + Kitchen Sink &$		Where V_{t-1}^{T} is volume of water in treatment unit at end of previous timestep (L); A diurnal use pattern co-

system over a timestep Q_{in}^{T} (L/day); Overflow from the on site treatment system over	Tap + Clothes Washer + Laundry Tub & Tap + Shower + Bath + Spa Bath + Basin & Tap + Toilet + Air Conditioners)	(44)	efficient (ratio of total water can be used / total water supplied to treatment unit) (= 0.9).
timestep Q ^T _{over} (L/day); Volume of water in treatment unit at end	$Q^{T}_{over} = max(Q^{T}_{in} - Q^{T}_{out} + V^{T}_{t-1} - V^{T}_{t}, 0)$	(45)	
of timestep $V_t^T(L)$; Demand of	$\mathbf{V}_{t}^{\mathrm{T}} = \min(\mathbf{V}_{t-1}^{\mathrm{T}} + \mathbf{Q}_{in}^{\mathrm{T}} - \mathbf{Q}_{out}^{\mathrm{T}}, \mathbf{V}_{cap}^{\mathrm{T}})$	(46)	
treated water over timestep D_t^T (L/day); Volume of water from the on site treatment system consumed over timestep Q_{out}^T (L/day)	$D^{T}_{t} = \sum_{User Defined On Site Treatment System demand} (ClothesWasher + Toilet + Garden Bed + Lawn +Water Feature)Q^{T}_{out} ("24 hour flush": FALSE) = min(V^{T}_{t-1} + Q^{T}_{in},$	(47)	
	D_{t}^{T}	(48)	
	Q_{out}^{T} ("24 hour flush": TRUE) = min(A* $Q_{in}^{T}, D_{t}^{T})$	(49)	
Greywater Diversion Volume of greywater consumed over timestep Q^{G}_{use} (L/day);	$Q^{G}_{use} = \min(D^{G}_{t}, B^{*}Q^{G}_{in})$ $Q^{G}_{in} = \sum_{user \ defined \ supply} (Dishwasher + Kitchen \ Sink \&$	(50)	Where B is diurnal use pattern co-efficient (1- greywater overflow/total greywater) (= 0.7).
Total amount of water diverted to greywater Q_{in}^{G} (L/day); Demand of water over timestep D_{t}^{G} (L/day)	Tap + Clothes Washer + Laundry Tub & Tap + Shower + Bath + Spa Bath + Bathroom Basin & Tap + Air Conditioners) $D^{G}_{t} = \sum On Site Treatment System demand from(Toilet + Garden + Lawn)$	(51) (52)	
		(0-)	

Table 2 Dishwasher water consumption by star rating (Reference: AS/NZS 6400:2005)

Star	0	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Baseline (L)	3.0	2.5	2.27	2.06	1.87	1.7	1.55	1.4	1.28	1.16	1.05	0.96
Values (L/Place	1.95	1.60	1.45	1.32	1.20	1.09	0.99	0.90	0.82	0.74	0.67	0.61
setting)												

 Table 3 Star rating specifications for taps (Reference: AS/NZS 6400:2005)

	0 Star	1 Star	2 Star	3 Star	4 Star	5 Star	6 Star
Ranges as per standard	>16.0	12.0-16.0	9.0-12.0	7.5-9.0	6.0-7.5	4.5-6.0	0-4.5
(L/min)							
Values used in AccuRate	\geq 16, user input	14.0	10.5	8.25	6.75	5.25	4.5

Table 4 Cloth washing machines water consumption by star rating (Reference: AS/NZS 6400:2005)

Star	0	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Values (L/Place	35.0	30	25.1	21	17.6	14.7	12.3	10.3	8.6	7.2	6	5
setting)												

Table 5 Star rating specifications for showers (Reference: AS/NZS 6400:2005)

	0 Star	1 Star	2 Star	3 Star
Ranges as per standard	>16.0	12.0-16.0	9.0-12.0	7.5-9.0
(L/min)				
Values used in AccuRate	≥16, user input	14.0	10.5	8.25

Table 6 Spa bath size classifications (Reference: Grant et al 2004)

	Small	Medium	Large
Size of Spa (L)	200	275	350
Volume to fill (L)	120	180	250

Ranges per standard	0 Star	1 Star	2 Star	3 Star	4 Star	5 Star	6 Star
Full flush (L)	N/A	6.5-9.5	6.5-9.5	4.7-6.5	0-4.7	0-4.7	0-4.7
Half flush (L)	N/A	3.5-4.5	3.5-4.5	3.2-3.5	0-3.2		
Average flush volume(L)	N/A	4.5-5.5	4.0-5.5	3.5-4.0	3.0-3.5	2.5-3.0	0-2.5
Values used in AccuRate							
Average Full flush (L)	11.0	8.0	8.0	5.6	4.7	3.0	2.5
Average Half flush (L)	6.0	4.0	4.0	3.35	3.2	3.0	2.5
Average flush volume(L)	7.0	5.5	4.5	4.0	3.5	3.0	2.5
Single flush (L)	11.0						

 Table 7 Star rating specifications for toilets (Reference: AS/NZS 6400:2005)

Table 8 Rate of consumption by evaporative coolers (Reference: Grant et al 2004))

Cooler type	Rate (L/hr)	Source
Whole of House Evaporative Cooler with	33	Extrapolated from Karpiscak et al. (1998)
bleeding		
Whole of House Evaporative Cooler without	14	Extrapolated from Karpiscak et al. (1998)
bleeding		
Portable or zoned cooler	4	Sustainable Energy Authority of Victoria
		(2004) & Country Energy (2002)

Table 9 Application rate for different imgation	
Irrigation Method	Application rate – AppRate _{IrriMethod}
By Hand – Bucket / Watering Can	10 litres per bucket ^a
By Hand – Hose	20 L/min ^b
By Sprinkler – Hose Connections	15 L/min ^b
By Sprinkler – Fixed Connections	30 L/min ^b
By Drip Irrigation	5 L/min ^b
By Micro-spray Irrigation	10 L/min ^c

Table 9 Application rate for different irrigation method (Reference: Grant et al 2004)

a: This is an estimate – assumes a full bucket / watering can of a fixed size

b: Green Plumbers (2003)

c: assumed to be twice the flow rate of drip irrigation

Bricks / Tiles (r _{cb})	0.6
Pervious Paving (r _{cp})	0.2
Gravel (r_{cgr})	0.2
Concrete (r_{cc})	0.7
Lawn (r _{cl})	0.05
Garden (r _{cg})	0.05
First Flush (r _{cff})	0.05
Shed Roof, House Roof (r _{cshed} , r _{chouse})	0.9
runoff co-efficient from car washing (r _{ccw})	value is dependant on surface car is being washed on

Table 10 Runoff coefficients (Reference: Grant et al 2004)

3. IMPLEMENTATION OF WATER MODULE IN ACCURATE

Using the same style as the other AccuRate input pages, a water page has been added to the AccuRate user interface as shown in Figure 1, which contains the input data fields required. As shown in Figures 1-8, the user input data fields for house water usage include:

- occupant numbers (Fig. 1);
- indoor water related facilities (Fig. 2): dishwasher, kitchen tap and sink, clothes washer, laundry tap and sink, shower, bath, spa bath, bathroom tap and basin, toilet (single flush or dual flush) and air conditioner;
- outdoor water related facilities (Fig. 4): swimming pool, spa, water features, garden and lawn, car washing;
- water source information (Fig. 6): rainwater tank, on-site water treatment system, grey water diversion and bore water;
- Storm water information (Fig. 8): impervious areas such as brick, paving, concrete, gravel areas, ratio of stormwater from roofs to municipal drainage and to garden/lawn;

Based on the user inputs, AccuRate calculates for indoor water usage, outdoor water usage, seasonal average daily water usage for different water sources and stormwater runoff as shown in Figures 3, 5, 7 and 8. The yearly-averaged daily water usages from different water sources are displayed on the top of the water page as shown in Fig. 1. Figure 9 shows the AccuRate summary report for the house water usage.

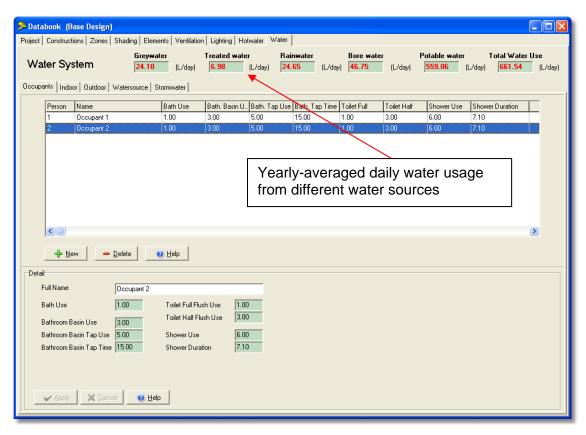
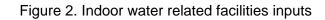


Figure 1. Occupants information

🔗 Databook (Ba		F 5	<u> </u>				
Project Constructio	ons Zones Shading Eleme						
Water Sys	tem Greywal		ated water	Rainwater	Bore water (L/day) 46.75	Potable v (L/day) 559.06	Total Water Use 661.54 (L/day)
				,	,	,	 , , , , , , , , , , , , , , , , ,
	「Outdoor Watersource S						
	Туре	Water Use (L/day)					<u>^</u>
	Dishwasher	5.08 46.75					
	Kitchen Sink & Tap Clothes Washer	46.75					
	Laundry Tub & Tap	10.34					
5	Shower	127.80					
2	B-0	7.00					>
	wDelete	0) <u>H</u> elp					
Detail Calculatio	ons						
Detail	· .						1
Type Dishw	vasher 💌						
Place Settings	13 🗢						<u>~</u>
Frequency Of U		-1.	Cold Water Usage		Litres / Day		
			Hot Water Usage	5.08	Litres / Day		
Efficiency Ratin		<u> </u>					
BaseLine	0.96 🛨 Litres						
Corresponding ¹	Value 0.61 🚔 Litres / place	e setting					≡∥
Used Treatmen	t Sewerage	•					
Available Wate	r Sources Assigned \	Vater Sources					
Rainwater Tan	nk Potable W	/ater					
Bore Water Potable Water							~
V Apply	🗙 Cancel 🛛 🕜 Help						

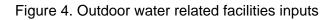


Databook (Base Design) Project Constructions Zones Shading I	Elements Ventilation	Lighting	Water			
	ywater	Treated water	Rainwater	Bore water (L/day) 46.75	Potable water (L/day) 559.06 (L/d	Total Water Use lay) 661.54 (L/day)
Occupants Indoor Outdoor Watersourc	e Stormwater					
Entity Type	Water Use (L/o	lay)				<u>^</u>
1 Dishwasher	5.08					
2 Kitchen Sink & Tap 3 Clothes Washer	46.75 45.91					
4 Laundry Tub & Tap	10.34					
5 Shower	127.80					
	7.00					>
Lew Delete Detail Calculations Results Kitchen Sinks Kitchen Sinks 46.75 Clothes Washers 45.91 Laundry Tubs 10.34 Baths 7.88	Help Spas Bathroom Basins Toilets Air Conditioner	0.00 13.82 31.30 11.15	Dishwashers Showers	5.08		

Figure 3. Indoor water usage calculation

IMPLEMENTATION OF WATER MODULE IN ACCURATE

-		l <mark>ase Design)</mark> tions Zones Shading Eleme	nto Montilation	Lighting	laturator V	Vater							
	ter Sy:	Grevwat	er 1	reated wa		Rainwater 24.65	(L/day)	Bore water 46.75	(L/day)	Potable wate	er (L/day)	Total Water 661.54	Use (L/day)
Оссира	ants Indo	or Outdoor Watersource SI	ormwater										
	Entity	Туре	Water Use (L/d	ay)									
	1	Swimming Pool	219.03										
	2	Outdoor Spa Water Feature	27.38 10.95										_
	4	Garden	61.90										_
	5	Lawn	39.29										
	6	Car Wash	2.96										
	<												>
			<u>H</u> elp										
	be Swin face Area	nming Pool											
	quency of l	Filling v v Times Topping Up 5 ✿ Times											
	erage Dept		/ Teal										
	minal Top l												
Ra Bo	Available Water Sources Assigned Water Sources Rainwater Tank Bore Water Potable Water												
	🗸 Apply	Cancel 🕑 Help											



-		D <mark>ase Design)</mark> tions Zones Shading Elen	. To are	Lieue II		(stor							
	iter Sy	Greywa	ater	reated wa		Rainwater 24.65	(L/day)	Bore water 46.75	(L/day)	Potable wate	r (L/day)	Total Water U 661.54	se (L/day)
Оссира	ants Indo	or Outdoor Watersource	Stormwater										1
	Entity	Туре	Water Use (L/d	ay)									-
	1	Swimming Pool	219.03										
	2	Outdoor Spa	27.38										_
	3	Water Feature Garden	10.95 61.90										_
	5	Lawn	39.29										-
	6	Car Wash	2.96										-
	<												>
	₽ №	ew Delete	😢 <u>H</u> elp										
Detail		tions											
Resu	lts												
Sp	a 27.	38 Water Fea	ture 10.95		Gardens	61.90							
Po	ol 21:	9.03 Car Wash	es 2.96		Lawn	39.29							

Figure 5. Outdoor water usage calculation

🔑 Data	ibook (B	ase Design)								
Project	Construct	ions Zones Shading Elem	nents Ventilation Lig	hting Hotwater V	Vater					
	ter Sy	,	(L/day) 6.5	ited water 98 (L/day)	Rainwater 24.65 (Bore water L/day) 46.75	r Potable (L/day) <mark>559.0</mark>			
Uccupi	ants Indo	or Outdoor Watersource :	stormwater							_1
	Entity	Туре	Water Use (L/day)							
	1	Potable Water	559.06							
	2	Rainwater Tank	24.66							
	3	Greywater Diversion	24.10							
	4	Bore Water	46.75							
	5	On-site Treatment System	6.98							
	<								>	
	+ N	w <u>D</u> elete	❷ <u>H</u> elp							
Detail Detai		•	7							
Тур		water Tank	Runoff coefficients S	Shed Beer (Herrer B	oof 0.90					
	apacity (L)				,			Demand		
	rst Flush (L	/day) 50 🚖	Rainfall First Flus	h Inflow Deman	d Consumption	Volume Stored 0ve	erflow	C Consumption		
	of Area									
		e Roof (m²) 161.1 🚖	(iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii					Demand of rainwater	27.38 L/day	
	Area Shed	Roof (m²) 0.0 🚖	5 40							
E P	ercentarie	directed to rainwater tank	30 +				Bar Barro	Summer	27.38 L/day	
			≥ 10 + · · · · •		talrath-dia			Autumn	27.38 L/day	
	House Roo		بل ير بار و م	0 200 300	400 500 60	וויא ן אין אין אין און און אין און און אין אין און א ון און און אין אין אין אין אין אין אין אין אין אי	900 1,000	Winter	27.38 L/day	
1	Shed Roof	(%) •	10	0 200 300	400 500 60 Days	10 700 800	300 1,000	Spring	27.38 L/day	
	✔ Apply	X Cancel 🛛 🖉 He	p]	L		

Figure 6. Water source inputs

🔗 Databook (B	ase Design)										
Project Construc	ions Zones S	hading Elem	ents Ventilation	Lighting Hot	water Water	•					
Water Sy	stem	Greywa 24.10	ter (L/day)	Treated water 6.98		ainwater 4.65 (L/day)	Bore water 46.75	(L/day)	Potable water 559.06 (L/d	Total Water ay) 661.54	Use (L/day)
Occupants Indo	or Outdoor W	atersource S	tormwater								
Entity	Туре		Water Use (L/	day)							
1	Potable Water		559.06								
2	Rainwater Tan	k	24.66								
3	Greywater Dive	rsion	24.10								
4	Bore Water		46.75								
5	On-site Treatm	ent System	6.98								
											>
4 N	w <u>– D</u>	elete) <u>H</u> elp								
Detail Calculat	ons										
Results											
Daily wate	r demand fron	n water sourc	es 661.54	(L/day)							
	Summer	Autumn	Winter	Spring					Bore water	7.07.0	
Greywater	32.14	32.14	0.00	32.14	(L/day)				Rainwate		
Treated wa	er 9.31	9.31	0.00	9.31	(L/day)					water 1.06 %	
Rainwater	21.50	22.33	27.38	27.38	(L/day)					ater 3.64 %	
Bore water	46.75	46.75	46.75	46.75	(L/day)			14			
Potable wa	er 598.27	521.25	486.23	630.49	(L/day)						
	,	· /	· ·	·		Potable wate	84.51 %				
Water dema	nd 707.97	631.78	560.35	746.07	(L/day)						

Figure 7. Seasonal average daily water usage for different water sources

🔎 Databook (Base Design)	5 - 5 - 1	
Project Constructions Zones Shading Elements Water System 224.10 Occupants Indoor Outdoor Watersource Stormw	Treated water Rainwater (L/day) 6.98 (L/day) 24.65 (L/day)	Bore water Potable water Total Water Use 1 46.75 (L/day) 559.06 (L/day) 661.54 (L/day)
Stormwater runoff 237.14 [L/day] Pervious Area Area Brick 200 ♀ m² Area Paving 200 ♀ m² Area Gravel 200 ♀ m² Area Gravel 200 ♀ m² Area Gravel 200 ♀ m² Area Gravel 200 ♀ m² Area Gravel 200 ♀ m² Roof Area Area House Roof 161.1 ♀ m² m² Area Shed Roof 00 ♀ m² m² Impervious Area Area Garden 14.0 ♀ m²	Percentage directed to municipal stormwater drainage House Roof 50 ♣ 2 Shed Roof 0 ♣ 2 Percentage directed to garden / lawn House Roof 10 ♣ 2 Shed Roof 0 ♣ 2 Shed Roof 0 ♣ 2 Percentage directed to rainwater tank. House Roof 25 ♣ 2 Shed Roof 0 ♣ 2 Percentage directed to rainwater tank. House Roof 25 ♣ 2 Shed Roof 0 ♣ 2 Runoff coefficient from Car Wash 0.7 ♣ mm Annual Rainfall 677 ♣ mm	Volume of water used on Lawn 9929 L / day Volume of water used on Garden 9190 L / day Volume of water used on Car Wash 296 L / day Overflow from Rainwater Tank 27.80 L / day First Flush volume 12.82 L / day Runoff coefficients 12.82 L / day Pervious Paving 0.05 Garden 0.05 Gravel 0.20 First Flush 0.05 Concrete 0.70 Shed Roof, House Roof 0.90
Apply X Cancel @ Help		

Figure 8. Stormwater inputs and calculation

* * *	AccuRate V	/1.2.0.0	***		
HOUSE Rating SchemeNationwide House Energy Rating Scheme HO HO HO					
	Project De	taila			
Project Name : Example					
	eAUS\Nathers4\Projects\Example 1-	etorez			
house Water.PRO	erios utalieista fojects example 1-	storey			
Postcode: 6000	Cli	mate Zone: 13			
Design Option: Base De					
Description: Medium-s:					
a courp none for outselles.	1204 DILETO-20010 A 110000				
	Client Det	aile			
Client Name : A ccuRate	example: single-storeyhouse	alls			
Phone:	Fax:	Email:			
Postal Address:	Гал.	Eman.			
Site Address:					
Exposure: Suburban					
Council submitted to (i	flemance by accorrently				
	I Known by assessor).				
	Assessor De	taile			
Assessor Name : Assesso		Assessor	No		
	Fax:	Email:	110.		
Phone					
Phone: Assessment Date: 5/06/2			12		
Assessment Date: 5/06/2		Time :12:	12		
Assessment Date: 5/06/2 Project Code:			12		
Assessment Date: 5/06/2			12		
Assessment Date: 5/06/2 Project Code:	2009	Time :12:	12		
Assessment Date:5/06/2 Project Code: Assessor Signature:	CALCULATED WATER	Time :12: USAGE DEMAND*			
Assessment Date:5/06/2 Project Code: Assessor Signature: Home Daily	CALCULATED WATER Total Water Use (L/day)	Time :12: USAGE DEMAND*	1.5		
Assessment Date:5/06/2 Project Code: Assessor Signature: Home Daily Home Daily J	CALCULATED WATER I CALCULATED WATER I Total Water Use (L/day) Potable Water Use (L/day)	Time :12: USAGE DEMAND* 66	i1.5 9.1		
Assessment Date:5/06/2 Project Code: Assessor Signature: Home Daily Home Daily Home Daily	CALCULATED WATER CALCULATED WATER Total Water Use (L/day) Potable Water Use (L/day) Bore Water Use (L/day)	Time :12: USA GE DEMAND* 66 52 4	11.5 99.1 5.8		
Assessment Date:5/06/2 Project Code: Assessor Signature: Home Daily Home Daily Home Daily Home Daily	CAL CULATED WATER CAL CULATED WATER Total Water Use (L/day) Potable Water Use (L/day) Pore Water Use (L/day) Rain Water Use (L/day)	Time :12: USAGE DEMAND* 66 53 4 2	11.5 99.1 5.8 4.6		
Assessment Date : 5/06/2 Project Code: Assessor Signature: Home Daily Home Daily Home Daily Home Daily Home Daily	CAL CULATED WATER Total Water Use (L/day) Potable Water Use (L/day) Bore Water Use (L/day) Rain Water Use (L/day) Freated Water Use (L/day)	Time :12: USAGE DEMAND* 66 53 4 2	11.5 99.1 5.8 4.6 7.0		
Assessment Date : 5/06/2 Project Code: Assessor Signature: Home Daily Home Daily Home Daily Home Daily Home Daily These daily waterusageshave be pattern or lifestyle of the interdedo	CAL CULATED WATER CAL CULATED WATER Total Water Use (L/day) Potable Water Use (L/day) Pore Water Use (L/day) Rain Water Use (L/day)	Time :12 : USA GE DEMAND* 66 52 4 2 2 et of occupant behaviours and so do no see of rating the building water system.	1.5 9.1 5.8 4.6 7.0 4.1 necessarily represent the usage		
Assessment Date : 5/06/2 Project Code: Assessor Signature: Home Daily Home Daily Home Daily Home Daily Home Daily These daily waterusgeshave be pattern or lifestyle of the interdedo	CAL CULATED WATER Total Water Use (L/day) Potable Water Use (L/day) Potable Water Use (L/day) Rain Water Use (L/day) Greated Water Use (L/day) Grey Water Use (L/day) encalculatedas a yearly werage using astandards compants. They should be used so lely for the purpon maing costs. The setting used for the simulation ar	Time :12: USAGE DEMAND* 66 52 4 2 etofoccupantbehaviours and so do no se of rating the building water system. e shown in the building data report.	11.5 9.1 5.8 4.6 7.0 4.1 necessarily represent the usage		
Assessment Date : 5/06/2 Project Code: Assessor Signature: Home Daily Home Daily Home Daily Home Daily Home Daily These daily waterusgeshave be pattern or lifestyle of the interdedo	CAL CULATED WATER Total Water Use (L/day) Potable Water Use (L/day) Pore Water Use (L/day) Pore ated Water Use (L/day) Freated Water Use (L/day) Fore Water Use (L/day) encalculatedas a yearly warage using astandards comparis. They should be used so ledyfor the purpo	Time :12: USAGE DEMAND* 66 52 4 2 etofoccupantbehaviours and so do no se of rating the building water system. e shown in the building data report.	11.5 9.1 5.8 4.6 7.0 4.1 necessarily represent the usage		
Assessment Date : 5/06/2 Project Code: Assessor Signature: Home Daily Home Daily Home Daily Home Daily Home Daily These daily waterusgeshave be pattern or lifestyle of the interdedo	CAL CULATED WATER Total Water Use (L/day) Potable Water Use (L/day) Potable Water Use (L/day) Rain Water Use (L/day) Greated Water Use (L/day) Grey Water Use (L/day) encalculatedas a yearly werage using astandards compants. They should be used so lely for the purpon maing costs. The setting used for the simulation ar	Time :12: USAGE DEMAND* 66 52 4 2 etofoccupantbehaviours and so do no se of rating the building water system. e shown in the building data report.	11.5 9.1 5.8 4.6 7.0 4.1 necessarily represent the usage		
Assessment Date : 5/06/2 Project Code: Assessor Signature: Home Daily Home Daily Home Daily Home Daily Home Daily These daily waterusgeshave be pattern or lifestyle of the interdedo	CAL CULATED WATER Total Water Use (L/day) Potable Water Use (L/day) Potable Water Use (L/day) Rain Water Use (L/day) Greated Water Use (L/day) Grey Water Use (L/day) encalculatedas a yearly werage using astandards compants. They should be used so lely for the purpon maing costs. The setting used for the simulation ar	Time :12: USAGE DEMAND* 66 52 4 2 etofoccupantbehaviours and so do no se of rating the building water system. e shown in the building data report.	11.5 9.1 5.8 4.6 7.0 4.1 necessarily represent the usage		

Figure 9. Water usage summary report

4. CONCLUSIONS

A water usage module has been implemented in AccuRate based on the House Water Expert (HWE) software, developed by CSIRO for estimating household water consumption [1].

The project achieved the following deliverables:

- A water page has been implemented in the AccuRate user interface, containing the input data fields required which include: house location, house style and land block information, occupant patterns and behaviours, indoor/outdoor water related facilities, etc.
- The calculations of water consumption in this water page are based on the House Water Expert software, which was developed by CSIRO for people to estimate and reduce household water consumption [1].
- A new water report page has also been added to AccuRate's summary report, showing yearly-averaged daily water consumption estimation of town water, onsite treated water, grey water, rain water, stormwater runoff and the averaged daily total water consumption estimation.

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- Country Energy (2002) Choosing a Cooling System, Retrieved: July 4, 2004, from <u>http://www.countryenergy.com.au/internet/cewebpub.nsf/AttachmentsByTitle/flib</u> <u>-energyeff/\$file/es cooling.pdf</u>.
- 5. Green Plumbers 2003, *50 point environmental household inspection report,* Green Plumbers – Master Plumbers & Mechanical Services Association of Australia, West Melbourne.

APPENDIX A – DEFAULT USER INTERFACE INPUT VALUES

End Use	User Interface Input	Unit	Default Value
Dish Washer	Frequency of dishwasher used, F _D	loads/week	4
	Star rating, S _D		0
Kitchen sink & tap	Frequency of rinsing, F_K	per day	1
	Duration of rinsing, D_K	seconds	30
	Leaking tap, L _K	y/n	Ν
	Frequency of kitchen sink use, F _{ks}	per week	7
	Star rating, S _K		0
Clothes Washer	Star rating, S _{cw}		0
	Rated capacity of washing machine, C_{cw}	kg	Medium (6.5)
	Frequency of washing machine use, F _{cw}	per week	4
Laundry Tub & Tap	Star rating, S _L		0
•	Frequency of rinsing from laundry tap, F _L	per week	1
	Typical duration of rinsing, D _L	minutes	5
	Leaking tap, L _L	y/n	Ν
	Frequency of laundry tub use, F _{lt}	per week	1
Shower (per individual)	Star rating, S _s		0
	Frequency of shower usage, F _s	per week	6
	Typical duration of shower, D _s	min	7.1
	Leaking shower head, L _s	y/n	Ν
Bath (per individual)	Frequency of bath usage, F _B	per month	1
	Leaking bath tap, L_B	y/n	Ν
Spa Bath	Frequency of spa bath usage, F _{SB}	per month	4
	Volume of spa bath, V_{SB}	small, medium & large	medium
	Leaking spa bath tap, L _{SB}	y/n	Ν
Bathroom Tap (per individual)	Star rating, S _{bt}		0
	Frequency of rinsing, F _{bt}	per dayseconds y/n per weekper weekcwper weekcwper weekper monthy/nper daysecy/nper daysecy/nper daysecy/nper daysecy/nper daysecy/nper daysecy/nper daysecy/nper daysecy/nper daysecy/n	5
	Typical duration of rinsing, D _{bt}	sec	15
	Leaking bathroom basin tap, L _{bt}	y/n	Ν
	Frequency of basin use, F _{bb}	per week	3
Toilet (per individual)	Toilet type (Full, half, composting)		Half
	Single flush Star rating, S _{Tsf}		0
	Dual flush Star rating, S _{Thf}		3
	Frequency of half flushes, F _{Thf}	per day	3
	Frequency of full flushes, F _{Tff}	per day	1
	Frequency of use of single flush toilet, F _{tsf}	per day	4
Air conditioner (refrigerative)	Number of cooling days per season, F_{ac}		30
× č /	Cooler type (Whole of House Evaporative		Whole of
	Cooler with bleeding, Whole of House		House
	Evaporative Cooler without bleeding,		Evaporative

Table A 1: Default User Interface Input Values (Source: Grant *el at*, 2004)

End Use	User Interface Input	Unit	Default Value
	Portable or zoned cooler)		Cooler
			without
			bleeding
	Number of air conditioner units, N _{ac}		
			whole of
			house
			system $= 1$
Swimming pool	Frequency of pool filling, F _{pf}	per year	1
* *	Frequency of topping up pool, F _{pt}	per year	5
	Average depth of the pool, P _{av depth}	metres	1.0 m
Spa	Frequency of spa filling, F _{spaf}	per year	1
1	Frequency of topping up spa, F _{spat}	per year	5
	Average depth of the pool, S _{av depth}	metres	1.0 m
Water feature	Frequency of water feature filling, F _{wf}	per year	1
	Frequency of water feature topping up, F _{wt}	per year	5
	Average depth of the water feature, W _{av depth}	metres	1.0 m
Car washing by	Number of buckets used, N _{bucket}	per car wash	3
bucket (per car)		P	
	Frequency of car washing, F _{cw bucket}	per month	3
Car washing by hose (per car)	Duration of hose use per car wash, D _{hose}	minutes	10
x /	Frequency of car washing, F _{cw hose}	per month	3
House Roof	Percentage of House Roof directed to	%	100
	municipal stormwater drainage, E _{hsw}		
	Percentage of House Roof directed to garden / lawn, E _{hg}	%	0
	Percentage of House Roof directed to Rainwater tank, E _h	%	0
Shed roof	Percentage of Shed Roof directed to municipal stormwater drainage, E_{ssw}	%	100
	Percentage of Shed Roof directed to garden / lawn, E_{sg}	%	0
	Percentage of Shed Roof directed to Rainwater tank, E_s	%	0
Rainwater tank	First Flush device capacity, $U_{\rm ff}$	L/day	50
	Capacity of Rainwater Tank, V_{cap}	L	3500
On Site treatment	Capacity of Treatment Unit, V_{cap}^{T}	L	1000
	24 hour flush	True/False	True
Bore Water	Pump rate	L/d	200

Garden Watering (per garden bed)

Watering Method Sum		ner Autumn/Sprin		n/Spring	Wi	Winter	
	Frequency	Number of buckets	Frequency	Number of buckets	Frequency	Number of buckets	
By Hand – Bucket or watering	Every 3 days	10	Once a week	10	never	0	
can							

Watering Method	Sur	nmer	Autum	n/Spring	Winter	
	Frequency	Duration, min	Frequency	Duration, min	Frequency	Duration, min
By Hand – Hose	Every 3 days	20	Once a week	20	never	0
By Sprinkler – Hose Connections	Every 3 days	20	Once a week	20	never	0
By Sprinkler – Fixed Connections	Every 3 days	20	Once a week	20	never	0
By Drip Irrigation	Every 3 days	90	Once a week	90	never	0
By Micro-spray Irrigation	Every 3 days	40	Once a week	40	never	0

Lawn Watering

Watering Method	Summer		Autumn/Spring		Winter	
	Frequency	Number of buckets	Frequency	Number of buckets	Frequency	Number of buckets
By Hand – Bucket	Every 3 days	10	Once a week	10	never	0

Watering Method	Summer		Autumn/Spring		Winter	
	Frequency	Duration, min	Frequency	Duration, min	Frequency	Duration, min
By Hand – Hose	Every 3 days	45	Once a week	45	never	0
By Sprinkler – Hose Connections	Every 3 days	45	Once a week	45	never	0
By Sprinkler – Fixed Connections	Every 3 days	45	Once a week	45	never	0
By Drip Irrigation	Every 3 days	180	Once a week	180	never	0
By Micro-spray Irrigation	Every 3 days	90	Once a week	90	never	0

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