

CHAPTER 4

WATER COMSUMPTION PATTERN

4.1 INTRODUCTION

Water is used at homes for cooking, drinking, laundry, washing dishes and hands, flushing toilet, bathing and showering, gardening and satisfying a variety of other usage. The Star (8 April 2001) reported that an average Malaysian uses 200 to 250 litres water a day while Australian is said to use 400 litres, an American 600 litres and the British 147 litres a day.

This chapter will analyse the amount of water usage of respondents in doing some selected activities such as, washing clothes, dishes, hand and face, bathing and some outdoor activities such as gardening and washing vehicles. The habit of the respondents on the daily water usage and some of the water conservation practices such as rain harvesting also will be studied.

4.2 WATER USAGE ASSUMPTION

To estimate the water usage for various daily activities, the guideline of Selangor Water Supply Department (*Jabatan Bekalan Air Selangor*) is used. The assumption of water usage is listed as below:

Activities	Water Usage
Type of Bathing	
Bathtub/'Gayung'(dipper) ¹ .	110 litres per bath
Shower - Close the showerhead when applying the soap.	20 litres per bath
Shower - Leaving the showerhead running when applying the soap.	30 litres per bath
Laundry	
Hand wash -the faucet closed.	6.5 litres per minute
Hand wash - the faucet is running.	9 litres per minute
Washing machine.	6.5 litres per minute
Other Indoor Activities	
Washing dishes when the faucet is running.	9 litres per minute
Brushing teeth when the faucet is running.	9 litres per minute
Washing hand when the faucet is running.	9 litres per minute
Washing face when the faucet is running.	9 litres per minute
Gardening	
Watering with pail.	18 litres per pail
Watering with hose/ water pipe.	12 litres per minute
Watering with watering-can.	5 litres per time
Vehicle	
Cleaning with hose.	40 litres per minute
Cleaning with pail and wet clothes.	18 litres per pail

4.3 INDOOR RESIDENTIAL WATER USAGE

The residential sector is the largest urban water consumption sector and it offers the largest volume of potential saving compared with other urban sectors. This section

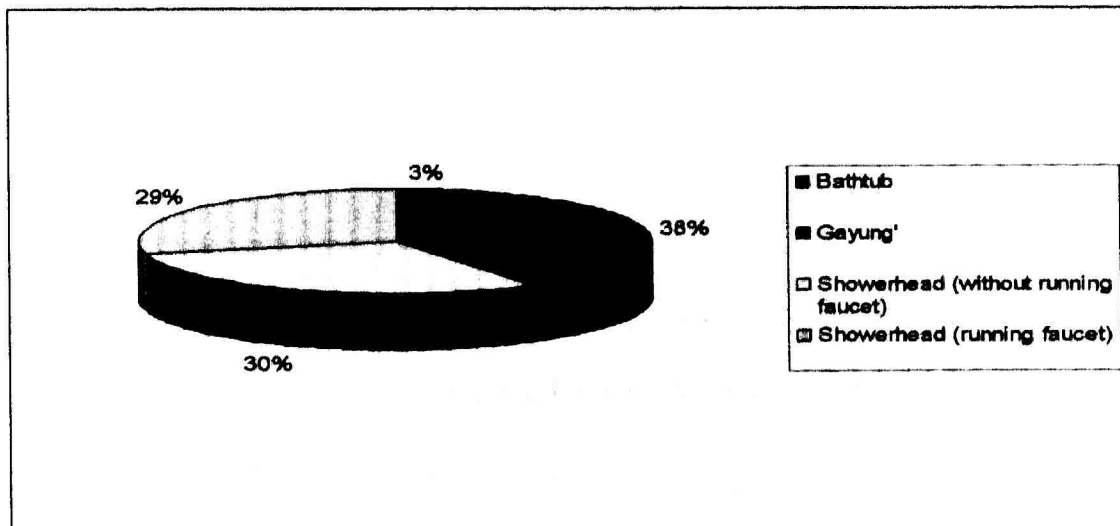
¹ A vessel with a handle for dipping out liquids (Sin Chew Jit Poh (Malaysia) & The Shanghai Book Co. Sdn Bhd., 1983)

describes some selected indoor residential activities and estimates the potential saving if we practise the water conservative action.

4.3.1 Bathing

In this study, the most commonly used method of bathing is the shower. Some 59 per cent of the respondents owned showerhead facilities for bathing (Figure 4.1). However, 30 per cent of the respondents have the habit of leaving the showerhead running when they are applying the soap. About 38 per cent of respondents are using the 'gayung' to take their baths, and the rest, 3 per cent are using the bathtub.

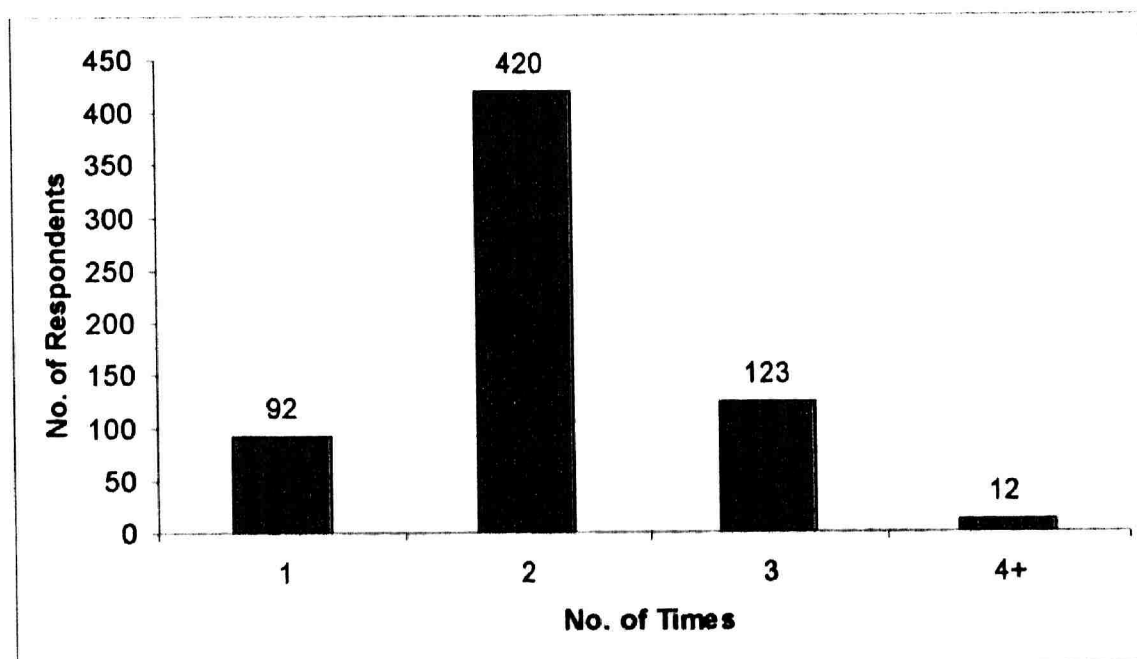
Figure 4.1: Type of Bathing



The bathing frequency ranges from 1 to 5 times per day and it comes to an average of 2.1 times per person. Figure 4.2 shows that most of the respondents are

taken 2 baths per day, there are about 65 per cent of them. Another 21 per cent of respondents are taking bath at least 3 times a day.

Figure 4.2: Histogram on the Bathing Frequency



Number of cases = 647 respondents

For those respondents who use the shower as bathing method, about half of them have the habit of leaving the showerhead running while applying soap. Females have a slightly higher percentage of letting the showerhead running while applying the soap compared with males (Table 4.1).

Amongst the ethnic groups, Indians and Others tend to let the showerhead running while applying soap, followed by Chinese and Malays. The difference is significant at 5 per cent level.

Table 4.1: Percentage of Respondents Who Let the Water Running When Applying Soap During Their Shower Baths by Selected Characteristics

Characteristics	Per cent	n
Total	51.2	(385)
Gender		
Male	50.9	(173)
Female	51.4	(212)
Ethnic Group*		
Malays	42.2	(45)
Chinese	51.5	(297)
Indians and Others	58.1	(43)
Age group		
< 30	50.4	(127)
30-49	59.6	(141)
50+	42.1	(114)
Education		
No Schooling and Primary	@	@
Secondary	48.5	(167)
Tertiary	54.7	(172)
Income group		
<3000	48.7	(76)
3000 - 4999	58.6	(37)
5000+	47.8	(67)

* Significant at 5 per cent level.

@ Less than 30 cases

() number of cases

Older respondents are least likely to let the showerhead running while applying soap compared with younger respondents. Education level does not show any positive effect on the behaviour of respondents towards water usage in shower bath. In fact, the higher the educational level, the more likely to let the showerhead running while

applying soap compared with other counterparts. Those with the middle income (RM3000 – RM4999) are more likely to let the showerhead running while applying soap.

Using the guideline of Selangor Water Supply Department, respondents who are taking the baths using bathtub and 'gayung' used about 60,830 litres of water per day, at an average of 232.2 litres per person per day (Table 4.2). Those respondents who are using the showerhead and let the running water when applying soap consumed about 60 litres per person per day and this reduced to 42.3 litres of water per person per day if he or she close the showerhead when applying soap. Thus, if all the respondents use the showerhead to take bath and close the showerhead when applying soap and without changing their bathing frequency, some 53,770 litres of water per day would be saved. This mean about an average-sized (52,000 litres) swimming pool of water could be saved.

Table 4.2: Summary of Water Usage on Bathing in a Day

Type of Bathing	Water Usage (litres) *	Per person per day (litres)	Number of Respondents
Bathtub & 'Gayung'	60,830	232.2	262
Shower (let the water running when applying soap)	12,000	60.1	197
Shower (without water running when applying soap)	7,960	42.3	188
Shower (without water running when applying soap)	27,020	41.8	647

* The water usage estimated based on the guideline of the Selangor Water Supply Department.

For an illustration, a household consists of 5 members and everyone is bathing one time in a day. If all of them are taking their showers without water running when applying soap instead of using 'gayung' or bathtub, the household can save about 13,500 litres of water per month or equivalent to between RM5.67 per month if the lowest water rate is used (RM0.42 per m³) and RM14.18 if the highest rate is used (RM1.05 per m³) (Table 4.3).

Table 4.3: Summary of Water and Cost Saved per Household in A Month When Bathing with Showerhead without Water Running When Applying Soap

Type of Bathing	The size of household (persons)	Frequency In a Day (times)	Water Saved in Month (litres)*	Cost Saved in a month (lowest rate) (RM0.42/m ³)	Cost Saved in a month (highest rate) (RM1.05/m ³)
Bathtub & 'Gayung'	5	1	13,500	5.67	14.18
	5	2	27,000	11.34	28.35
	5	3	40,500	17.01	42.53
Shower (let the running water when apply soap)	5	1	1,500	0.63	1.58
	5	2	3,000	1.26	3.15
	5	3	4,500	1.89	4.73

* The water usage estimated based on the guideline of the Selangor Water Supply Department.

4.3.2 Laundry

The study found that about 62 per cent of the respondents are using washing machines for their laundry and the rest are doing their laundry by hand (Table 4.4). Some 12 per cent of respondents have a habit of leaving the faucet unclosed while they are washing the clothes.

Table 4.4: Percentage Distribution by Methods of Washing Clothes

Method of Washing Clothes	Per cent	Number of cases
Washing Machine	61.7	399
By hand – with running faucet	11.7	76
By hand – without running faucet	26.6	172
Total	100.0	647

On average, the laundry frequency is about 4.8 times per week and 42.0 minutes per laundry (Table 4.5). There is no difference in the washing frequency for different laundry methods. Overall, some 39 per cent of the respondents are washing the clothes everyday and this is also true for those who are using washing machine or by hand (Figure 4.3). For respondents who do the washing by hand and let the faucet running tend to do their laundry more frequent and take longer time than those who have the habit to close faucet. The majority of respondents spend about half an hour to wash their clothes. Figure 4.4 shows that 37 per cent of respondents need 21 to 30 minutes to wash their clothes but some 5 per cent of respondents need longer time, that is 60 minutes.

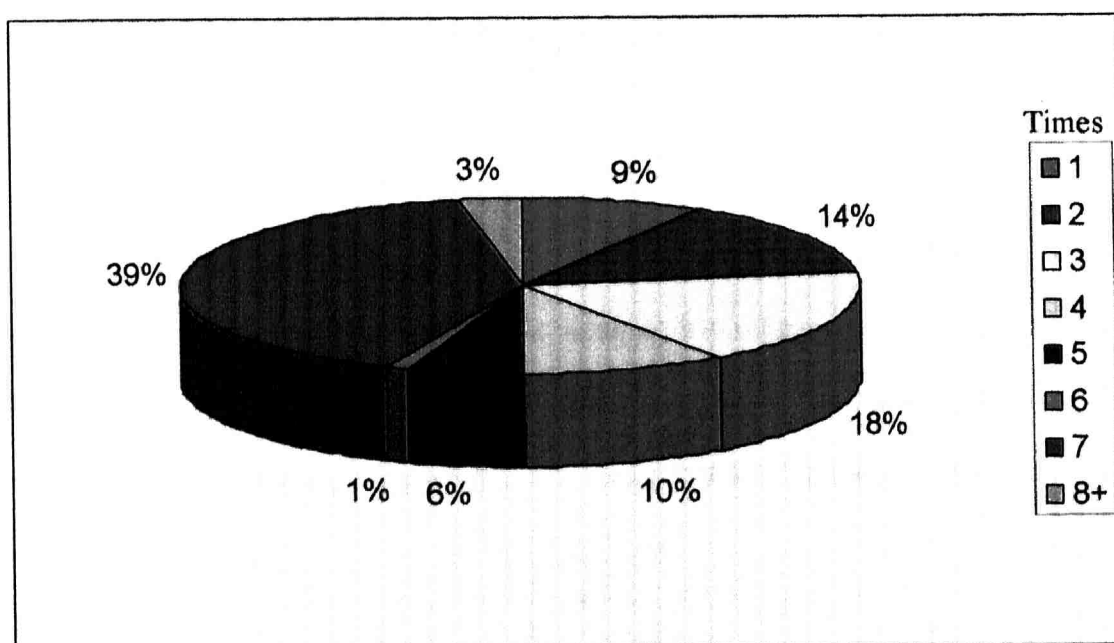
For those respondents who do their laundry by hand, about 31 per cent of them have the habit of leaving the faucet running while washing the clothes. Males generally are more likely than female to do so (Table 4.6). Amongst the ethnic groups, Malays tend to let the faucet running while washing the clothes by hand compared to the Chinese.

Table 4.5 Summary of Laundry Frequency

Laundry Frequency		Average	The most frequency	n
Overall	Times per week	4.8	7.0	646
	Minutes per laundry	36.2	30.0	
By Washing Machine	Times per week	4.9	7.0	398
	Minutes per laundry	42.0	30.0	
By Hand (with running faucet)	Times per week	4.8	7.0	76
	Minutes per laundry	27.2	30.0	
By Hand (without running faucet)	Times per week	4.7	7.0	172
	Minutes per laundry	26.9	30.0	

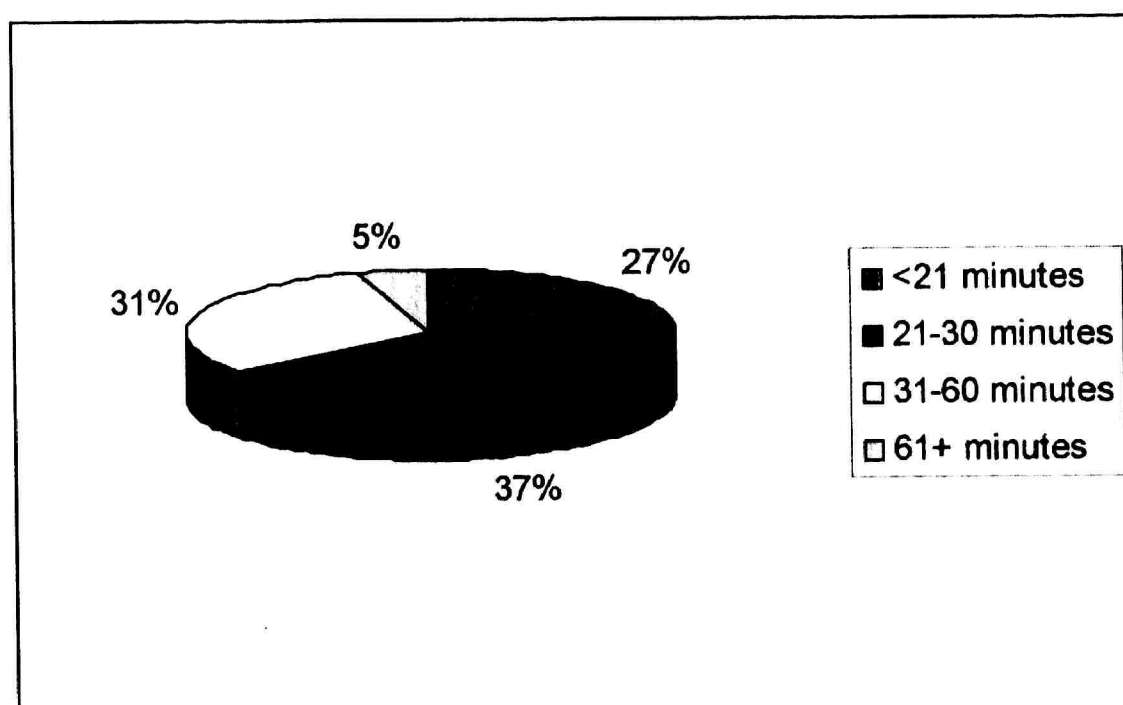
n = number of cases

Figure 4.3: Percentage Distribution of Laundry Frequency in a Week



Number of cases = 646 cases

Figure 4.4: Washing Duration Frequencies (per laundry)



Number of cases = 646 cases

Older respondents are least likely to let the faucet running while washing the clothes by hand compared with other younger generation. The difference is significant at 5 per cent level.

For those respondents who are washing the clothes by hand with faucet closed, are used about 139,431.5 litres water per week or 810.6 litres per person (Table 4.7). This increased to about 1,162.3 litres of water per person if the faucet unclosed. The water consumption for washing machines is about 537,403.7 litres or 1,350.3 litres in a week.

For further illustration, a family is washing the clothes by hand with closed faucet instead of running faucet, for duration of 30 per laundry and 5 times in a week. The family can save about 1,500 litres of water per month (Table 4.8), which is cost about RM0.63 if the lowest rate is used or RM1.58 if the highest water rate is used.

Table 4.6: Percentage of Respondents Who Leave the Faucet Running While Washing Clothes by Hand by Selected Characteristics

Characteristics	Per cent	n
Total	30.6	(252)
Gender		
Male	32.5	(120)
Female	28.8	(132)
Ethnic Groups		
Malays	44.1	(34)
Chinese	27.1	(199)
Indians and Others	@	@
Age group*		
< 30	31.9	(119)
30-49	38.8	(67)
50+	20.0	(65)
Education		
No School and Primary	31.6	(38)
Secondary	28.7	(94)
Tertiary	31.7	(120)
Income group		
<2000	36.7	(49)
2000 - 4999	26.9	(52)
5000+	@	@

* Significant at 5 per cent level.

@ Less than 30 cases.

() number of cases.

The water usage for laundry by washing machine is higher compared with other methods. However, if a household could use the washing machine with full load, about 3 times a week (about 40 minutes per wash) instead of daily, they can save about 4,160 litres per month or RM1.75 per month (30 days) per household if the lowest water rate or RM4.37 if the higher rate.

Table 4.7: Summary of Water Usage of Laundry Per Week

Type of Laundry	Average (litres/person)	Total water usage (litres)	Number of cases
By hand (without running faucet)	810.6	139,431.5	(172)
By hand (with running faucet)	1,162.3	88,335.0	(76)
By washing machine	1,350.3	537,403.7	(398)
Total	1,184.5	765,170.2	(646)

Table 4.8: Summary of Water and Cost Saved per Household in A Month When Laundry Wisely

Current Practice	Suggested Practice	Water Saved in Month (litres)*	Cost Saved in a month (lowest rate) (RM0.42/ m ³)	Cost Saved in a month (highest rate) (RM1.05/ m ³)
Washing the clothes by hand and let water run continuously for 30 minutes per wash and 4 times in a week	Washing the clothes by hand without running faucet for 30 minutes per wash and 4 times in a week	1,500	0.63	1.58
Washing the clothes by washing machine for 40 minutes per wash and 7 times in a week	Washing the clothes by washing machine for 40 minutes per wash and 3 times in a week	4,160	1.75	4.37

* The water usage estimated based on the guideline of the Selangor Water Supply Department.

4.2.3 Other Selected Activities

The majority of respondents have the habit of leaving the tap running while washing hand and face. Table 4.9 shows that 70 per cent and 56 per cent of respondents let the water flow when washing their hands and faces, respectively. Some 45 per cent of respondents let the faucet running while they are washing dishes. Another 30 per cent of respondents have the habit of letting the water running when they are brushing teeth. Leaving the tap running while doing certain activities is very wasteful. For example, if they let the tap runs for 5 minutes, they would use up to 45 litres of water instead of a glass of water, which may only use 0.5 litres of water.

Table 4.9: Percentage of Respondents Doing the Selected Activities with the Running Faucet

Activities	Per cent	n
Washing Hand	69.8	646
Washing Face	55.7	635
Washing Dishes	44.8	627
Brushing Teeth	30.0	647

n = number of cases

Males generally are more likely than female to let the faucet running while doing the selected activities (Table 4.10). The difference is significant at 5 per cent level for activities like brushing teeth and washing face. About 38 per cent of the males are leaving the faucet running while brushing teeth compared to 23 per cent of females.

Amongst the ethnic group, non-Malay respondents tend to let the faucet running while washing dishes and brushing teeth, the Malays are more likely to have the faucet running when washing their hands, Indians and Others are the most likely to leave the faucet running when washing their faces. Older respondents tend to leave the faucet running while washing dishes and brushing teeth, they are less likely to do so when washing their hands and faces compared to younger respondents (Table 4.10).

Education level does not show any positive effect on the behaviour of respondents towards water usage in the selected activities. In fact, the higher the educational level, the more likely to let the faucet running while carry out the selected activities. This is especially true for washing face, where 41 per cent of those with primary education or less leave the faucet running when washing face compared to 62 per cent of those with tertiary education. The higher the income level of respondents, the more likely the respondents leave the faucet running when carry out the selected activities.

The suggested practice by Selangor Water Supply Department for washing dishes is to use 3 sink with full water (1 for washing and 2 for rinsing) and it uses about 25 litres of water per wash. If a household follows the suggested practice instead of washing the dishes with running faucet (for 10 minutes per washing and 2 times per day), they can save about 3,900 litres of water per month or between RM1.64 per month (30 days) per household if the lowest rate is used and RM4.10 if the highest water rate is used (Table 4.11).

Table 4.10: Percentage of Respondents Who Let the Water Running When Doing Selected Activities by Selected Characteristics

Characteristics	Activities			
	Washing Dishes	Brushing Teeth	Washing Hand	Washing Face
Total	44.8 (627)	30.0 (647)	69.8 (646)	55.7 (635)
Gender				
Male	45.7 (282)	37.9* (298)	71.4 (297)	60.3* (290)
Female	44.1 (345)	23.2* (349)	68.5 (349)	51.9* (345)
Ethnic Group				
Malays	34.9 (86)	26.7 (90)	72.2 (90)	53.5 (86)
Chinese	46.6 (481)	30.4 (494)	69.6 (493)	54.9 (488)
Indians and Others	45.0 (60)	31.7 (63)	68.3 (63)	65.6 (61)
Age group				
< 30	43.8 (224)	26.4 (231)	70.9 (230)	54.8 (228)
30-49	44.2 (217)	31.3 (227)	71.8 (227)	58.3 (223)
50+	45.9 (181)	32.6 (184)	65.8 (184)	52.5 (179)
Education				
No Schooling and Primary	41.6 (89)	24.2 (91)	62.6 (91)	41.1* (90)
Secondary	45.6 (274)	30.4 (283)	70.3 (283)	54.8* (279)
Tertiary	45.1 (264)	31.5 (273)	71.7 (272)	61.7* (266)
Income group (RM)				
<2000	41.9 (93)	26.5 (98)	70.4 (98)	49.0 (96)
2000 - 4999	46.7 (137)	35.5 (141)	70.9 (141)	57.2 (138)
5000+	45.8 (72)	21.3 (75)	78.7 (75)	59.5 (74)

* Significant at 5 per cent level.

() number of cases

Table 4.11 shows the water and cost saved if respondents change their habit from the current practice to suggested practice by Selangor Water Supply Department. Changing daily practice habit such as brushing teeth can save up to 13,350 litres per month or between RM5.61 per month if lowest rate is used and RM14.02 if the highest water rate is used as respondents aware and practise the suggested practice.

Table 4.11: Water and Cost Saved in A Month if Respondents Swift to the Suggested Practice

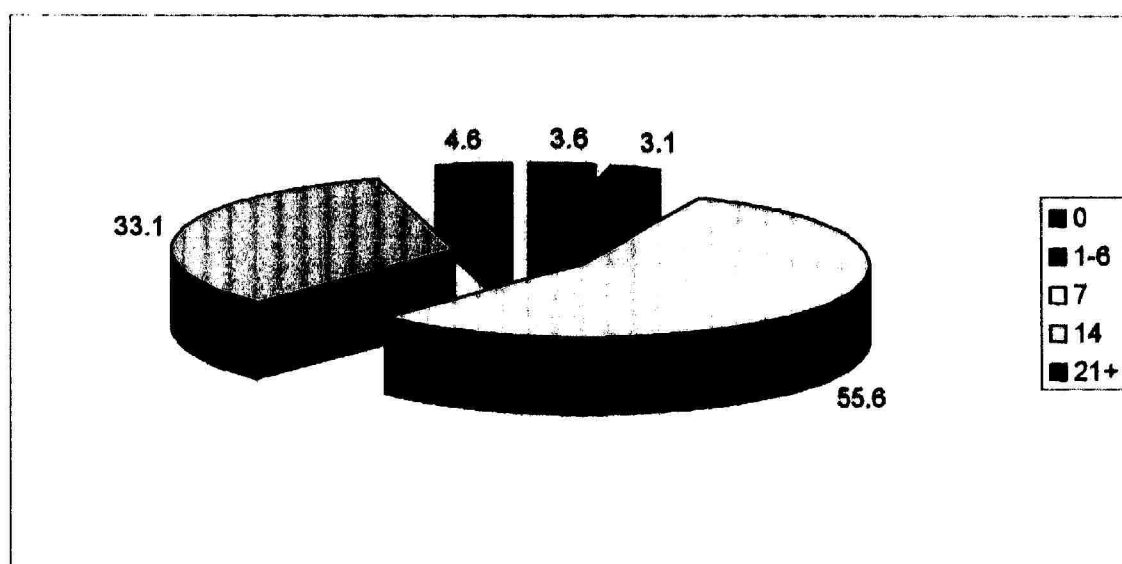
Activities	Current Practice	Suggested Practice*	Water saved in a month (litres)	Cost Saved in a month (lowest rate) (RM0.42/m ³)	Cost Saved in a month (highest rate) (RM1.05/m ³)
Washing Dishes	Let the faucet run (2 times per day and 10 minutes per wash).	Use 3 sink with full water (1 for washing and 2 for rinsing) (use about 25 litres per wash).	3,900	1.64	4.10
Brushing Teeth	Let the faucet run (2 times per day and 5 minutes per time).	Use glass (Use about 0.5 litres per time).	13,350	5.61	14.02
Washing Hand	Let the faucet run (5 times per day and 2 minutes per wash).	Use the basin with half-full of water (use about 2 litres per basin).	2,400	1.01	2.52
Washing Face	Let the faucet run (2 times per day and 4 minutes per wash).	Use the basin with half-full of water (use about 2 litres per basin)	2,040	0.86	2.14

*The suggested practices are following the suggestion of Selangor Water Supply Department (Selangor Water Supply Department, n.d.).

4.4 GARDENING

In Section 17, Petaling Jaya, some 65 per cent of respondents have to do the gardening. On average they water their plants 10 times a week. More than half of the respondents water the plants 7 times a week or one time per day (Figure 4.5). One third of respondents water their plants twice a day or 14 times a week. Some 4 per cent of respondents do not do any watering at all and leave their plants to be watered by the moisture or rainwater.

Figure 4.5: Frequency Distribution of Garden Watering in a Week



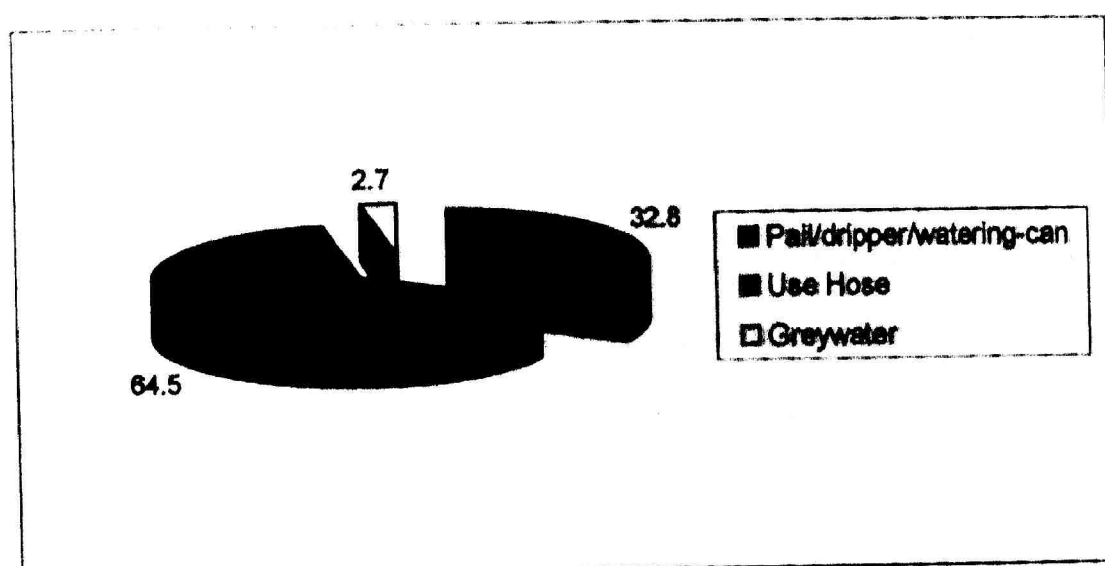
Total number of cases = 417 cases

Figure 4.6 shows that some 65 per cent of the respondents use hose to water their plants. This will use a lot of water since watering by hose will consume up to 400 litres water per ten minutes. About one-third of respondents prefer to use watering-can,

pail and dipper to water the plants. Only about 3 per cent of respondents use the greywater to water the plant.

Let say, a family waters the plants with watering can or graywater¹ instead of hose, 7 times in a week and 10 minutes each time. The household can save about 805 litres of water per week or between RM1.45 per month according to the lowest water rate and RM3.38 according to the highest water rate.

Figure 4.6 Gardening Watering Methods



Total number of cases = 406 cases

¹ Graywater is domestic wastewater composed of wash water from kitchen sinks, bathroom sinks and tubs, clothes washers, and laundry tubs that can be used for non-potable purposes such as irrigation (California Urban Water Conservation Council, 2002).

4.5 WASHING VEHICLES

Some 92 per cent of respondents own vehicles either car or van, motorbike, bicycle or lorry (Table 4.12). Among them, 84 per cent possess cars or vans, 26.7 per cent own motorbikes, 3.7 per cent have bicycles and only 0.3 per cent of respondents owned lorry. On average, each household possesses 1.8 cars and 2.1 motorbikes. However, some of the households possess up to 7 cars or vans or 13 motorbikes. This study will focus on the water usage on car or van and motorbike.

Figure 4.7 shows various ways of washing vehicles. Some 55 per cent of respondents are using hose to wash their vehicles, and 18 per cent of them send their vehicles to car wash center, which are using hose and the rest, one-fourth of respondents are using a pail with wet cloth to wash their vehicles. Using a pail and wet cloth to wash the vehicle is a more water conservative way. For example, using 2 pails of water which is about 36 litres of water compared with 40 litres per minute if using the hose (Jabatan Bekalan Air Selangor, n.d.).

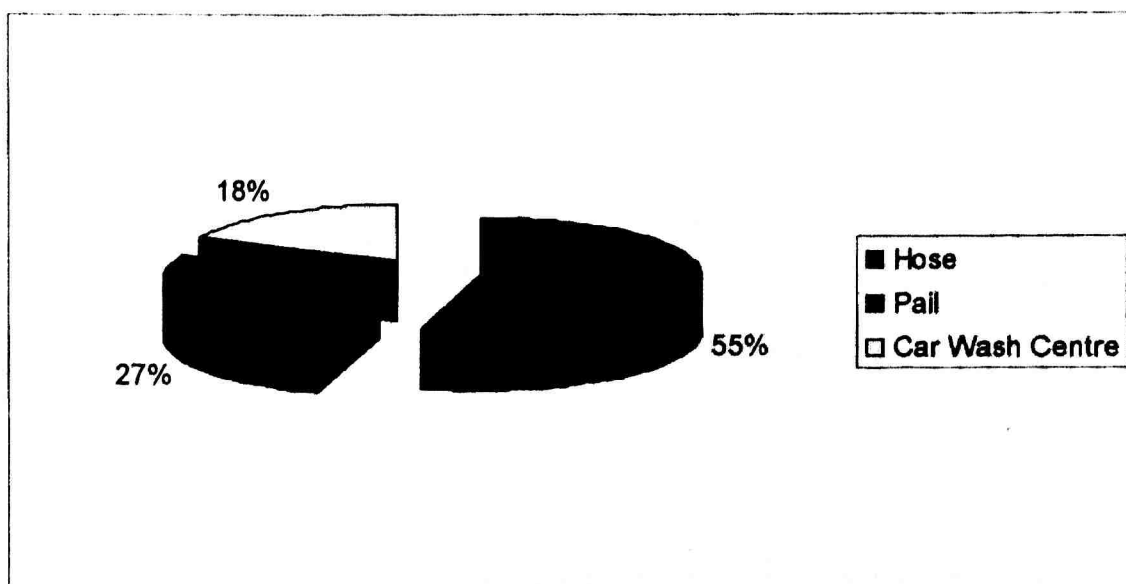
Table 4.12: Summary of Vehicle Ownership

	Overall	Car	Motorbike	Bicycle	Lorry	n
Average per household	0.9	1.8	2.1	1.5	1.0	
Per cent	92.0	83.5	26.7	3.7	0.3	(647)

n = Number of cases

On average, respondents wash the cars and motorbikes about 3.7 times and 2.0 times per vehicle in a month, respectively. They also spend about 29.1 minutes to wash one car and 20.7 minutes for a motorbike.

Figure 4.7 Percentage Distribution by Methods of Washing Vehicles



Total number of cases = 647 cases

Table 4.13: The Monthly Summary of Washing Vehicles in a Household

Water Usage	Car/Van		Motorbike	
	Washing Frequency (times)	Time per wash (minutes)	Washing Frequency (times)	Time per wash (minutes)
Average	3.7	29.1	2.0	20.7
Maximum	60.0	120.0	8.0	60.0
Mode	4.0	30.00	1.0	20.0
Number of cases	493	490	121	120

Let say, a household owns a car and spends 30 minutes each time to wash the car for 4 times in a month. If the car is being washed with pail and wet clothes instead of hose or send to a car wash center, the household can save about 4,656 litres of water per month or between RM1.96 according to the lowest water rate and RM4.89 according to the highest water rate.

4.6 SOME PRACTICES OF WATER CONSERVATION

Whenever it rains, naturally distilled water falls on building. It flows off through the roof surfaces and guided into gutters. Then it is quickly sent into sewers to be combined with other wastes, and is then 'taken away' at great expense.

A well-designed rainwater harvesting system can be effectively save water usage outdoors. While few rainwater systems can completely eliminate the need to use regular treated water outdoors, they can be substantial supplementary supply. Rainwater harvesting also is the most effective water supplier and cost effective in term of finance private cisterns in some places of Australia. However, this study found that not many respondents practise the rain harvesting in their households. For example, some 87 per cent of respondents do not collect rainwater in their residents (Table 4.14). The main purpose of the harvesting rainwater is for cleaning usage such as cleaning the floor, car, toilet, and watering the plants and others.

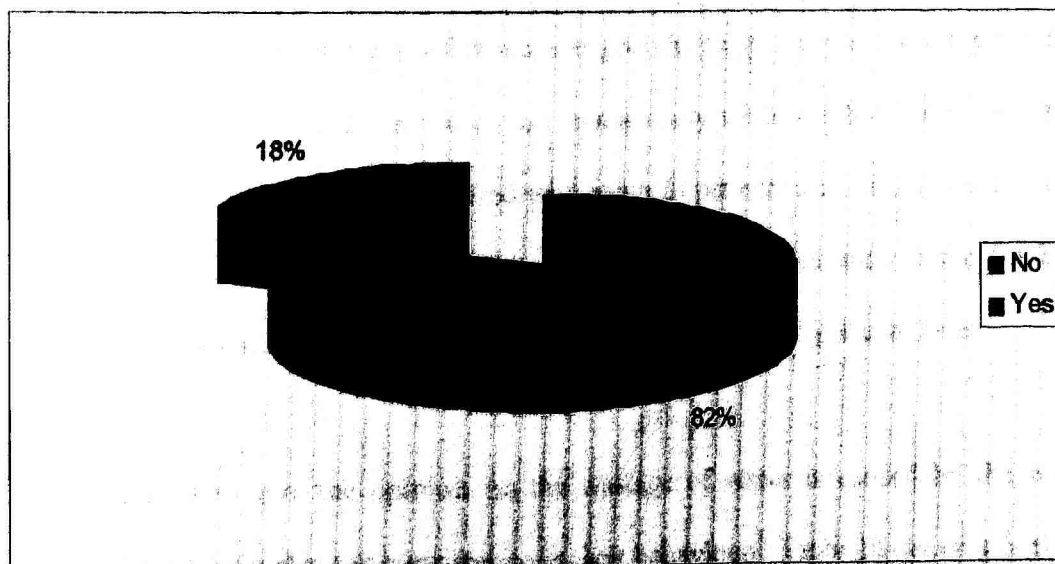
When respondents were asked whether they change the drinking water daily, some 18 per cent of respondents said that they are practising this habit (Figure 4.8).

This means they would throw unfinished drinking water and supply the new drinking water everyday. Then, it would consume quite a lot of water and energy. However, further question do not asked on this habit.

Table 4.14: Percentage Distribution by Whether Respondents Collected the Rainwater and the Usage of Rainwater

Harvesting Rainwater	Per cent	Number of Cases
No	87.0	(563)
Yes	13.0	(84)
Cleaning	53.6	(45)
Watering Plants	32.1	(27)
Cleaning and Watering Plants	9.5	(8)
Others	4.8	(4)

Figure 4.8: Percentage Distribution by Whether Respondents Change their Drinking Water Daily



Number of cases = 646 cases

4.7 KNOWLEDGE AND ACTION

This section would like to address the gap between the perception and the knowledge of respondents in water conservation with their behaviour in their daily activities such as brushing teeth, washing hand and face.

Table 4.15 shows that the behaviour of respondents when doing the selected activities do not affected by their perception on the possibility of water shortage in future. We can say that many of them who have the perception of water shortage in future are still take it for granted in their daily life.

Those who suggested saving the water through avoiding water running continuously less likely do put the suggestion into practice in daily life. For example, only 28 per cent and 38 per cent of those who give the suggestion to avoid the running water are practising to avoid let water run continuously while washing hand and face, respectively. It is much lower compared with some 24 per cent and 51 per cent of those who do not give the suggestion but yet avoid water run continuously while washing hand and face, respectively. The differences are significant at 5 per cent level.

Those who give the opinion on the wastage of water is caused by the water running continuously also not consistence in their behaviour. Only 28 per cent of them are avoid letting the water run continuously in washing hand compared with 32 per cent of those who give general suggestion.

Generally, even though, respondents provide positive suggestion and knowledge in conserving the water, their behaviour is otherwise. There is a gap between knowing and practising. The gap remains in getting water conservation messages across to the general public. The knowledge acquired by respondents are not persuasive to convict them to change their habits in daily life.

Table 4.15: Percentage of Respondents Avoiding Water from Running Continuously While Doing Some Selected Activities by Perception, Suggestion and Knowledge

Avoid water run continuously while	The possibility of water shortage in future		Suggestion to save water		Causes of water wastage	
	No	Yes	Other ways	Avoid water running continuously	General answer	Letting the water run continuously
brushing teeth	69.4 (108)	70.0 (534)	69.7 (317)	70.3 (330)	68.7 (310)	71.2 (337)
washing hand	31.5 (108)	29.6 (534)	34.4* (317)	26.1* (329)	32.4 (309)	28.2 (337)
washing face	43.0 (107)	44.0 (523)	51.1* (309)	37.7* (326)	44.2 (308)	44.3 (327)

() number of cases

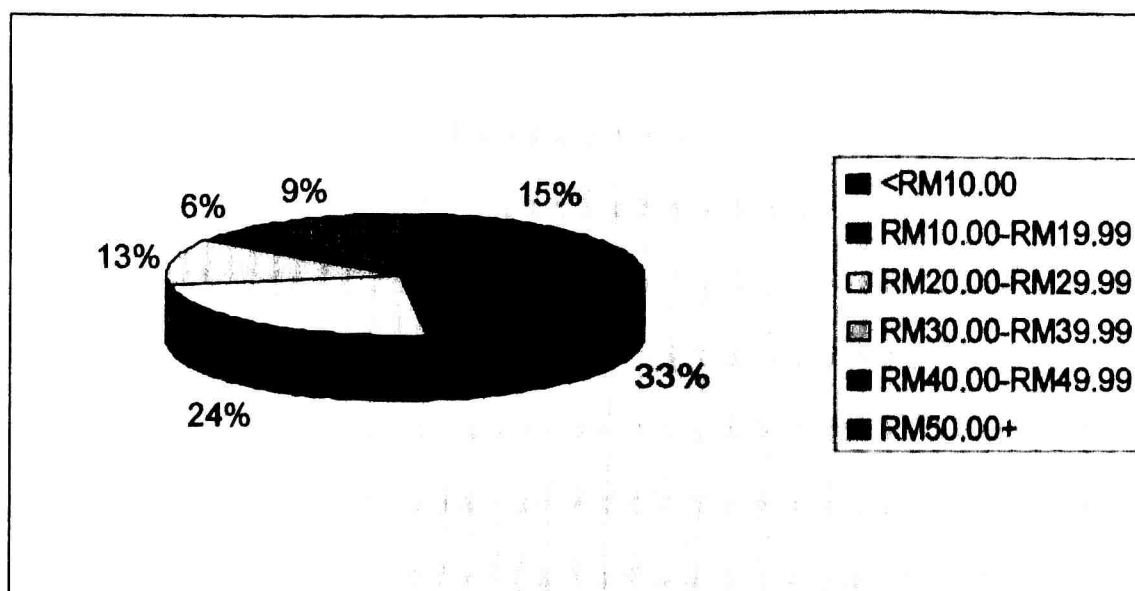
* Significant at 5 per cent level.

4.8 HOUSEHOLD WATER BILL AND USAGE

The monthly household water bills vary from the minimum charge of RM3.00 to RM350.00. On average, the monthly water bill is about RM24.79. The distribution

shows that about 57 per cent of the households pay about RM10.00 to RM39.99 monthly for water bills (Figure 4.9). However, nearly 10 per cent of households are paying more than RM50 per month.

Figure 4.9: Percentage Distribution of Monthly Household Water Bill



The computation of the monthly household water usage is based on the water bill. On average, the water usage is about 39.42m³ per household. The distribution shows that 8 per cent of the households use less than 15 m³ of water in a month, half the households use about 15m³ to 40m³ of water and the rest, 42 per cent use more than 40 m³ (Figure 4.10).

The average water usage per person is estimated about 6.9 m³ (6,900 litres) or RM2.90 per person per month. It comes to about 230 litres per person per day for

drinking, bathing, cooking, washing, watering garden and, so on. It is quite similar with the average person in the United States who uses between 250 to 300 liters of water per day. However, the water usage is much more higher if compare with the average person in the Netherlands (uses only 104 liters of water per day) and African nation of Gambia (uses only 4.5 liters of water per day) (Pacific Institute for studies in development, Environment and Security, 2002).

Among the ethnic groups, Malays are more likely to use more water compared with non-Malays, where some 47 per cent of the Malays use more than 40.1 m³ of water per month (Table 4.15). Indians and Others are more likely to use less water than other counterparts with 16 per cent use less than 15m³ of water per month. This may partly due to the Malays have larger household size as more household member tend to use more water. For example, more than half of the large households are using more than 40 m³ of water per month. The different is significant at five per cent level.

Figure 4.10: Percentage Distribution of Household Water Usage (m³)

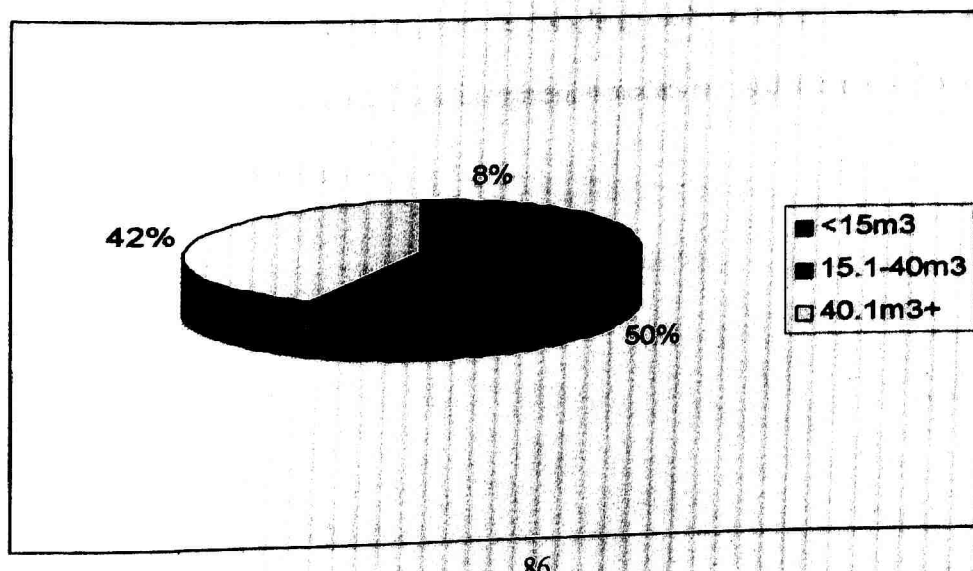


Table 4.16: Percentage Distribution of Respondents by Water Usage by Ethnic Group and Household Size

	Water Usage			n
	Les than 15m ³	15 - 40m ³	More than 40m ³	
Ethnic Group				
Malays	10.3	42.5	47.1	87
Chinese	5.8	51.2	43.0	463
Indians and Others	16.4	57.4	26.2	61
Household Size*				
1 - 4 members	13.3	61.0	25.7	249
5 - 8 members	3.7	46.3	50.0	300
9 members and above	3.3	29.0	67.7	62

n = number of cases

* Significant at 5 per cent level.

4.9 MULTIVARIATE ANALYSIS

This section uses a multivariate framework to study the behaviour of respondents in selected activities, such as, brushing teeth, washing face and washing hand. Thus, three multivariate logistic regression models are used to estimate the effect of the explanatory variables.

The three dependent variables are as follows:

Model 1

AWBTEETH is dummy variable that takes '1' if the respondents does not let the water run continuously while brushing teeth, '0' or otherwise.

Model 2

AWFACE is dummy variable that takes '1' if the respondents does not let the water run continuously while washing face, '0' or otherwise.

Model 3

AWHAND is dummy variable that takes '1' if the respondents does not let the water run continuously while washing hand, '0' or otherwise.

The explanatory variables in the estimated models are defined as follows:

- GENDER** is a dummy variable that takes the value of 1 if the respondent is a male, 0 for female;
- AGE** representing the age of respondent;
- CHINESE** is a dummy variable that takes the value of 1 for Chinese, 0 for non-Chinese;
- EDU** representing the educational level of the respondent; EDUSEC = 1 if the respondent has attained secondary education, 0 or otherwise; EDUTER = 1 if the respondent has attained tertiary education, 0 or otherwise;
- KWASTE** is a dummy variable that takes the value of 1 if the respondent acknowledges the wastage of water is due to letting the water run

continuously in doing activities, 0 if the respondent acknowledges of wastage of water is due to other reasons;

MODEL 1

The model 1 uses the individual awareness of water usage in brushing teeth together with other explanatory variables listed above.

The result of the logistic regression equation is as follows:

$$P(\text{AWBTEETH}=1) = 1 / (1 + e^{-z})$$

Where

$$\begin{aligned} \text{AWBTEETH} = & 1.782 - 0.689\text{GENDER}^* - 0.008\text{AGE} - 0.123\text{CHINESE} - 0.200\text{EDUSEC} \\ & (0.439) \quad (0.181) \quad (0.006) \quad (0.211) \quad (0.292) \\ & - 0.071\text{EDUTER} + 0.040\text{KWASTE} \\ & (0.197) \quad (0.053) \end{aligned}$$

* Significant at 5 per cent level.

Table 4.17: SPSS Output of the Variables in the Equation

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Constant	1.782	0.439	16.462	1	0.000	5.941
GENDER	-0.689	0.181	14.585	1	0.000	0.502
AGE	-0.008	0.006	1.639	1	0.200	0.992
CHINESE	-0.123	0.211	0.338	1	0.561	0.884
EDUSEC	-0.200	0.292	0.470	1	0.493	0.818
EDUTER	-0.071	0.197	0.129	1	0.719	0.931
KWASTE	0.040	0.176	0.053	1	0.818	1.041

The model chi-square is 19.4 and is significant at one per level, implying the coefficients for all the terms in the model are significantly different from zero. The χ^2

Goodness of Fit is 763.9, which is significant at one per level, which indicates that the model fits the data well. The positive coefficient of the variables indicates higher probability of individual awareness of water usage in brushing teeth.

The negative relationship of GENDER shows that the females are more conscious than males in using water when brushing teeth. It also indicates that males are 0.5 times likely to use water wisely as females, controlling for other variables in the model. The relationship is significant at 5 per cent level.

The negative relationship of age, indicating that the younger a person is, the greater the likelihood of he or she would avoid run the water continuously in brushing teeth. Likewise, the negative coefficient of tertiary education shows the most educated people are more likely to run water continuously in brushing teeth. In this model, non-Chinese are more conscious than Chinese in using water when brushing teeth. The acknowledging the running faucet is not significant helping the respondent to use water more aware in brushing teeth. However, the model shows that age, education background, ethnic group and the knowledge are not significant at 5 per level.

For illustration of the model, a non-Chinese female aged 30 years old with tertiary education who think that the wastage of water is due to the running faucet continuously has 82 per cent probability of avoiding the water running continuously while brushing teeth. The probability is reduced to 70 per cent if a male who has same background and knowledge with the above female.

Model 2

The model 2 uses the individual awareness of water usage in washing face together with other explanatory variables listed earlier.

The result of the logistic regression equation is as follows:

$$P(AWFACE=1) = 1 / (1 + e^{-z})$$

Where

$$\begin{aligned} AWFACE = & 0.824 - 0.261GENDER - 0.004AGE + 0.102CHINESE - 0.519EDUSEC* \\ & (0.405) \quad (0.168) \quad (0.006) \quad (0.199) \quad (0.262) \\ & - 0.305EDUTER - 0.545KWASTE* \\ & (0.187) \quad (0.164) \end{aligned}$$

* Significant at 5 per cent level.

Table 4.18: SPSS Output of the Variables in the Equation

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Constant	0.824	0.405	4.144	1	0.042	2.279
GENDER	-0.261	0.168	2.400	1	0.121	0.770
AGE	-0.004	0.006	0.436	1	0.509	0.996
CHINESE	0.102	0.199	0.261	1	0.609	1.107
EDUSEC	-0.519	0.262	3.935	1	0.047	0.595
EDUTER	-0.305	0.187	2.644	1	0.104	0.737
KWASTE	-0.545	0.164	11.022	1	0.001	0.580

The model chi-square is 26.5 and is significant at one per level, implying the coefficients for all the terms in the model are significantly different from zero. The χ^2

Goodness of Fit is 839.5, which is significant at one per level, which indicates that the model fits the data well. The positive coefficient of the variables indicates higher probability of individual awareness of water usage in washing hand.

Like the previous model, the negative relationship of GENDER shows that the females are more aware than males in using water when washing face. It indicates that males are 0.8 times likely to use water wisely as females, controlling for other variables in the model. In this model, Chinese are more conscious than non-Chinese in using water when washing face. Secondary and tertiary education have negative relationship. It indicates that those who have secondary education background and above are 0.6 times likely to avoid water running continuously in washing face, controlling for other variables in the model. However, secondary education background is significant at 5 per level.

The opinion of wastage of water due to the running water has negative relationship with dependent variable. It is implying that if those who give the opinion have a lower the probability of being more aware when use the water to wash face than those do not give the opinion, controlling for other variables in the model. They are 0.6 times likely to use the water more aware in washing face than those do not give the opinion, *ceteris paribus*. It shows a contradicting relationship occurred where the knowledge of respondent does not make him or her to be more aware in using water when washing face.

For illustration of the model, a person with secondary education who do not give the opinion that the wastage of water is due to the running faucet continuously has 58 per cent probability of avoid letting the water running continuously while washing face. The probability is reduced to 44 per cent if a person with the same background who give the opinion that the wastage of water is due to the running faucet continuously. Table 4.19 shows the estimated probability of individual awareness of water usage in washing face by some combination of the significant explanatory variables, controlling for other variables in the model.

Table 4.19: Estimated Probability of Individual Awareness of Water Usage in Washing Face by Various Characteristics

No	Explanatory Variables		Estimated Probability
	EDUSEC	KWASTE	
1.	No Schooling and Primary	No	0.695
2.	Secondary education	No	0.576
3.	No Schooling and Primary	Yes	0.569
4.	Secondary education	Yes	0.440

Model 3

The model 3 uses the individual awareness of water usage in washing hand together with age and knowledge of respondents that the wastage of water is due to let the water run continuously in doing activities. Gender, ethnic group and educational background do not include as the explanatory variables because the chi-square of the model is not significant at five per level if included this three variables. Thus, this

model only included two variables, age and the opinion of wastage of water due to the running water

The result of the logistic regression equation is as follows:

$$P(AWHAND=1) = 1 / (1 + e^{-z})$$

Where

$$AWHAND = -0.919 + 0.007AGE - 0.380KWASTE^*$$

(0.48) (0.005) (0.173)

* Significant at 5 per cent level.

Table 4.20: SPSS Output of the Variables in the Equation

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Constant	-0.919	0.248	13.744	1	0.000	0.399
AGE	0.007	0.005	1.600	1	0.206	1.007
KWASTE	-0.387	0.173	4.988	1	0.026	0.679

The model chi-square is 16.47 and is significant at one per level, implying the coefficients for all the terms in the model are significantly different from zero. The χ^2 Goodness of Fit is 779.4, which is significant at one per level, which indicates that the model fits the data well.

Age shows the positive relationship and indicates that the older a person is, the greater the likelihood of he or she is more aware in using water to wash hand. However, the difference is not significant at 5 per level. Again, Those who give the suggestion of avoid running water is significantly with negative relationship with dependent variable. It indicates that those who give the suggestion of avoid running water are 2.56 times likely to use water wisely as those who do not give the suggestion, controlling for other variables in the model.

For illustration of the model, a person who does not give the opinion that the wastage of water is due to the running faucet continuously has 36 per cent probability of avoid letting the water running continuously while washing hand. The probability is reduced to 28 per cent if a person who give the opinion that the wastage of water is due to the running faucet continuously.

4.10 CONCLUSION

From the study, respondents can save plenty of water if they are more aware in using the water. For bathing, some 70 per cent of respondents have the habit of bathing with 'gayung' and bathtub and let the water run continuously while applying the soap during their showers. Half of the respondents have habit of washing the clothes more than 5 times in a week. About 30 per cent of those who wash the clothes by hand are letting the water run continuously. At least one third of respondents are letting the water run continuously while washing dishes, brushing teeth, washing hands and faces.

Some 65 per cent of respondents have the habit of using hose to water their plants. About 55 per cent of respondents also use hose to wash their cars or vans and motorbikes. The habit of harvesting rainwater is not common among the respondents. It is only about 13 per cent of respondents collect the rainwater for other usage. About 18 per cent of respondents have the habit of changing their drinking water daily.

The gap is appearing between perceived knowledge and actual action. The knowledge acquired by respondents are not necessary persuaded them to take a action to be more water conservative.

Age and ethnic group do not have the effect on the individual awareness in using the water. Gender and education background only affect certain activity of the individual awareness in using the water. For example, gender only explains some of the behaviour of water usage in brushing teeth. It could mean that the behaviour of respondents who take the water for granted may cultivate as habit from their upbringing. They may not receive a lot of teaching from parents who also take the water for granted.

However, by practicing some water conservative method, a lot of water and money can be saved. For example, an individual could save 12,510 litres water per month or RM 5.25 per month (Table 4.2b) if they are changing the habit from current practice to suggested practice. Another finding is that most people do not even know how much water they use, let alone how much they waste. For example, many of them

could provide the data on the monthly water bills but not monthly water usage even though the water usage is listed at the water bills.

Table 4.21: Water and Cost Saved for a Household in a Month by Changing the Habit from Current Practice to Suggested Practice

Current Practice	Suggested Practice	Frequency (times)	Water Saved in Month (litres)	Cost Saved in month (RM)
Bathtub & 'Gayung'.	Shower without let the water run continuously when applying the soap.	2 times per day	5,400	2.27
Brushing Teeth (let the water run continuously).	Use glass (use about 0.5 litres per time).	2 times per day and 5 minutes per time	2670	1.12
Washing Hand (let the water run continuously).	Use the basin with half-full of water (use about 2 litres).	5 times per day and 2 minutes per wash	2,400	1.01
Washing Face (let the water run continuously).	Use the basin with half-full of water (use about 2 litres of water).	2 times per day and 4 minutes per wash	2,040	0.86
Total			12,510	5.25¹

Thus, widespread water conservation at a community level through the participation of the community center such as water conservation campaign of Sri Damansara Resident Association in Bandar Sri Damansara (Sri Damansara Resident Association, 2002) can be a effective way of managing the demand for water resources,

¹ The water usage rate is based on the guideline of Department of Water Supply of Selangor in Year 1998. The water rate is as follow:
 For the first range, 0 – 15 m³ is RM0.42 per unit.
 For the second range, 15.1 – 40 m³ is RM0.65 per unit.
 For the following range, 40.1 and above is RM1.05 m³.

as opposed to simply increasing the quantity of supply due to unnecessary water consumption. Adopting water conserving practices can be the most effective strategy for minimizing the water consumption.