CHAPTER 1
GENERAL BACKGROUND

1.1 INTRODUCTION

After thousands of years of human development in which water has been a plentiful resource in most areas, amounting virtually to a free good, the situation is now abruptly changing. Particularly in the more arid regions of the world, water scarcity has become the single greatest threat to food security, human health and natural ecosystem. Based on a recent International Water Management Institute (IWMI) (Seckler et al., 1998) projection of water supply and demand for 118 countries for the period 1990 to 2025, it is estimated that nearly 1.4 billion people, amounting to a quarter of the world's population, or a third of the population in developing countries, live in regions that will experience severe water scarcity within the first quarter of this century.

In 2000, 550 million people in 30 countries face water shortage. In possibly the next 10 years, that figure could swell to one billion people in 41 countries. By the year 2025, two out of three people on earth will live in water-stressed conditions (Tabung Alam Malaysia, 2000). So you and I are very likely to be the two. Thus, during the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, the United Nations General Assembly designated March 22 each year as World Day for Water. Through March 22, everybody will be reminded that solutions are possible and that key tools to our water problems are strengthened participation and global cooperation.

With an average annual rainfall of between 2,500 mm and 3,500 mm, the nation often faces torrential downpour; and according to the Department of Statistics Malaysia, the projected water demand constitutes less than 3 per cent of the available water resources in the country (Sahabat Alam Malaysia, 2001). Nonetheless, where does it go? Of course rainfall varies greatly from location to location. According to Department of Statistics Malaysia (1999), shortages occur in some states, including Selangor, are due to the uneven and disparity in distribution. A few states have begun to find out that their water resources are not able to meet their mounting water demand, such as the Pahang-Selangor Raw Water Transfer Project (Public Works Department, 1999). Furthermore, discharge of pollutants from agriculture, industry, household wastes and others has contributed to the deterioration of water quality. Hence, it may be an ironic reality that we have water everywhere but not a drop to drink.

Malaysians are also very careless with this liquid resource and believe that the taps will never run dry. Much used and abused, clean water is something we all take for granted in these days of plenty (The Star, 20 March 2001). Consumers in Selangor waste 200 million litres of water a year or half a million litres a day. This amount can fill up 44 Olympic-size swimming pools (The Star, 8 April 2001). On 23 March 1998, however, the reservoirs emptied and there was inconvenience of water rationing, and people were left to queue up every day for a few bucketfuls of water to satisfy their cooking, bathing and washing needs. A high awareness and participating to save water may avert water scarcity in Malaysia. It is especially necessary to understand basic

attitude towards water usage in view of a growing population, urbanization and industrialization where demand for water is expected to be even higher.

1.2 WATER RESOURCES

In Malaysia, the average annual rainfall is 2,400 mm for Peninsular Malaysia, 2,360 mm for Sabah and 3830 mm for Sarawak. This totals about 990 billion cubic meters, out of which about 566 billion cubic meters appears as surface run-off, about 64 billion cubic meters go to groundwater recharge and the rest (about 360 billion cubic meters or 36 per cent) returns to the atmosphere as evapo-transpiration (JICA, 1982; Sahabat Alam Malaysia, 2001). Of the total of about 566 billion cubic meters of surface run-off, about 147 billion cubic meters is found in Peninsular Malaysia (Table 1.1). Selangor, the most developed state, is the state with the lowest run-off (Public Works Department, 1999). Since water in the atmosphere is unavailable for use, the water supply must come from a combination of surface run-off and groundwater recharge. Thus, we have a total of about 630 billion cubic meters of water to squander or save. Residents in Selangor have access to about 9 billion cubic meters of water.

Only about 10 per cent of the surface run-off is readily available for consumption (Department of Environment, 1999). Thus, renewable water resources amount to only 120 billion cubic meters per year (10 per cent of surface run-off and 64 billion cubic meters from ground water recharge) or approximate 12 per cent of the total

annual rainfall. Every Malaysian has about 5,400 cubic meters at his and her disposal yearly.[1]

Table 1.1: Hydrological Balance by State (billion m^3 per year)

State/Region	Rainfall (billion m^3/ year)	Surface Runoff (billion m^3/ year)	Groundwater Recharge (billion m^3/ year)	Evapo transpiration (billion m^3/ year)
Perlis	2	1	0	1
Kedah	23	12	1	10
Pulau Pinang	3	2	0	1
Perak	50	22	4	24
Selangor	18	7	2	9
Negeri Sembilan	14	5	1	8
Melaka	3	1	0	2
Johor	45	19	3	23
Pahang	80	33	4	43
Terengganu	43	22	2	19
Kelantan	39	23	3	13
Peninsular Malaysia	**320**	**147**	**20**	**153**
Sabah	194	113	14	67
Sarawak	476	306	30	140
Malaysia	**990**	**566**	**64**	**360**

Source: JICA, 1982, as quoted in Public Works Department, 1999.

1.3 WATER DEMAND

The demand for water is constantly on the rise. In 1980, Malaysians used up about 8.9 billion cubic meters for irrigation, domestic, industry and others compared to

[1] 1,000 m^3 per person per year represents water scarcity (Population Information Program, 1998).

11.8 billion cubic meters in 1990 and this is expected to rise to 20.0 billion cubic meters in 2020 (Table 1.2). Table 1.2 shows that annual domestic and industrial water demand of 1.3 billion cubic meters in 1980 is doubled to 2.6 billion cubic meters in 1990 and almost doubled again to 4.8 billion cubic meters in 2000. Water demand in this sector is projected to be 5.8 billion cubic meters by 2020. Sahabat Alam Malaysia (2001) commented that this projection is extremely conservative based on historical record, which showed an increase of 270 per cent from 1980 to 2000, as compared to the 21 per cent hike expected in the next twenty years.

Table 1.2: Water Demand in Malaysia (billion m^3)

User	1980 (billion m^3)	1990 (billion m^3)	2000 (billion m^3)	2020 (billion m^3)
Domestic/Industry	1.3	2.6	4.8	5.8
Irrigation	7.4	9.0	10.4	13.2
Others	0.2	0.2	0.3	1.0
Total	8.9	11.8	15.5	20.0

Source: Hj. Keizrul A. and Juhaimi, 1996; Fauzi A.S., 1999.

Among the water usage, domestic water forms the bulk, about 70 per cent of total water consumption while the rest goes to industrial and commercial usage. In Selangor, the demand for water has grown faster than the growth of population. Based on statistics of the Selangor State Water Works Department, water usage shows an increase every year, from 342 million cubic meters in 1995 to 398 million cubic meters in 1996 to 559 million cubic meters in 1997 (Public Works Department, 1998). This works out to be an increase of 16.3 per cent between 1995 and 1996 and 40.5 per cent between 1996 and 1997. The population of Selangor increased about 3.1 per cent in

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1996 and 1997 (Department of Statistics Malaysia, 2000). The per capita consumption increase is 121.3 cubic meters in 1995 to 186.5 cubic meters in 1997 (Department of Statistics Malaysia, 2000).

1.4 WATER QUALITY

Deteriorating water quality has become an issue of national environment focus. From siltation and stinking sewage to despicable discharges and illegal dumping, the pollutant load has left a devastating trail from the headwaters to the river mouths (Sahabat Alam Malaysia, 2001). This leads to unsafe drinking water, loss of aquatic life and biodiversity and adverse impacts on human health and economic activities. Over the years, more and more rivers are being contaminated by pollutants, as evidenced by the increasing percentage of rivers that are deemed "slightly polluted" – 40 per cent or 34 rivers in 1989 versus 59 per cent or 71 rivers in 1998 (Table 1.3).

Table 1.3: Water Quality of Rivers in Malaysia, 1989 – 1998

Water Quality	Year						
	1989	1993	1994	1995	1996	1997	1998
	%	%	%	%	%	%	%
Highly Polluted	3.5	9.5	12.1	12.2	11.2	21.6	13.3
Slightly Polluted	39.5	63.8	55.2	46.1	52.6	57.8	59.2
Clean	57.0	26.7	32.8	41.7	36.2	20.7	27.5
Total (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Rivers	86	116	116	115	116	116	120

Source: *Department of Environment, 1999; Department of Statistics Malaysia, 1998.*

1.5 OBJECTIVES OF STUDY

The objectives of this study are:

a) To determine the level of knowledge and awareness of the residents at Section 17, Petaling Jaya on water usage;
b) To understand and examine the attitude and participation of the people in conserving water;
c) To suggest some policies and programmes based on the findings of this study.

1.6 REVIEW OF LITERATURE

Fresh water is a critical resource in the transition to a sustainable future. According to the hydrological cycle, water is the life-blood of food production, commerce, human needs, and innumerable aquatic ecosystems (Department of Environment, 1999). Fresh water is a scarce resource (United Nation Population Fund, 2001). The earth has 1,386,000,000 km^3 of water total but only 2.5 per cent of that is fresh water (35,029,000 km^3 or 9,254,661,800 billion gallons of fresh water) (Pacific Institute, 2001). According to a 1997 Stockholm Environment Institute (SEI) Report, only 0.007 percent of all freshwater is available for human use[2] (Stokholm Environment Institute, 1997; International Institute for Sustainable Development, 1999; United Nations Development Programme (UNDP), United Nations Environment Programme

[2] 99% of the world fresh water stocks are locked up in the underground, or as glaciers and ice cap in the Polar Regions (Lasisi Adedoyin, 2003).

(UNEP), World Bank and World Resources Institute, 2000). If all the water in the world is a liter, then the amount of fresh water accessible to us is less than 0.25 cm3 – barely a teaspoon (The Star, 20 March 2001).

The supply of fresh water on earth is finite (United Nation Population Fund, 2001). Only half of Southeast Asia's 550 million people have access to safe drinking water[3] (Population Report, 2000). Demand for freshwater is rising rapidly as the population grows and the country becomes more urbanized, and as water use per capita increases. In 1989, about 9,000 cubic meters of freshwater was available for human use per person. By 2000, due to population growth, that amount dropped to about 7,000 cubic meters per person. If the world population grows to over 8 billion in 2025 as expected, the amount of water per capita will be just 5,100 cubic meters (Population Reports, 2000). In Malaysia, with water availability at 120 billion cubic meters, each Malaysian has about 5,400 cubic meters of water at his or her disposal each year (Sahabat Alam Malaysia, 2001). In Selangor the water needs rose from 2,259 million litres a day (mld) in 1998 to 2,890 mld in 2000. By 2005, the demand will shoot up to 3,858 mld and by 2010, 5,047 mld (The Star, 8 April 2001). Malaysia does experience water shortage problems in areas of rapid growth such as the Klang Valley and Penang (Department of Environment, 1999; Public Works Department, 1998).

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[3] The average person needs minimum of 1.3 gallons (5 liters) of water to survive in a moderate climate at an average activity. The minimum amount of water needed for drinking, cooking, bathing and sanitation is 13 gallons (50 liters).

The advent of the industrial revolution and the consequent dawn of western materialism have led to non-traditional commodity based perception of nature's resources. This had resulted in a price tag being placed on water and ironically, devaluation in the intrinsic worth of water. Western materialistic society scorned ancient values, which regarded nature as scared (The Star, 20 March 2001). Thus, we need to change our values to ensure that the planet's inhabitants remain worth living (Button, 1990). The most important step in the direction of finding solutions to issues of water and environmental conservation is to change people's attitudes and habits (The Star, 22 March 2001, Lasisi Adedoyin, 2003). The best policies and technologies cannot help to solve the problem if humanity continues to treat water as a waste-able cheap resource. Likewise, no major breakthrough in water conservation would take place if the world continues to feel that they are legislated to access to clean water with money (The Star, 21 March 2001).

Ongoing population growth will heighten water shortages and create "hydrological poverty" for millions of people, according to the Worldwatch Institute (International Water Management Institute, 2001). Drawing attention to the projected addition of three billion people to the global population by 2050, the Institute, warned that water deficit is likely to become even more severe and will have flow-on effects in other areas, such as in terms of food production, which relies on adequate irrigation. Industrialization and urbanization will also increase demands on limited water supplies (International Water Management Institute, 2001).

In addition to population growth, urbanization and industrialization would also increase the demand for water. Freshwater demand for municipal use is expected to out-space the capacity of many cities to provide it (Population Report, 2000). As countries develop, villagers who traditionally rely on the village well move to urban high-rise apartment buildings with indoor plumbing and their residential water use can easily triple. Industrialization takes even more water than urbanization. Practically, all industrial process consumes large quantities of water. For example, the production of one tonne of steel can consume 280 tonnes of water; manufacturing one kilogram of paper can require as much as 700 kilograms of water (if the factory does not recycle the water); and processing just one frozen chicken takes at least 26 litres (Lasisi Adedoyin, 2003). With the trend in industrialization, there is strong indication that industries will be clamoring for more water and many of the demands will have to be met, by drawing on the planet's reserves – ground water. Aquifers are one of the earth's main deposits of fresh water. But they are not inexhaustible if industrialization growth continues at the rate it is presently in many developing countries, the problem of water abstraction will be doubled. Thus, less water will be available for the growing communities. Added to the need for large quantity of water by the industries, industrialization also causes water pollution making the little available water unfit for consumption or health treat to the community.

The most essential use of water is for drinking and to sustain the body fluids necessary for life. Water for drinking should be of high quality, free of contaminants that cause ill effects. Water pollution is any chemical, biological or physical change in water quality that has a harmful effect on living organisms or makes water unsuitable for

desired uses (G. Tyler Miller, 2002). Drinking water pollution is a global problem from a remote village in Africa to an industrialized city in United State (Lasisi Adedoyin, 2003). Even in developed countries, there is no guarantee of safe drinking water. What is clear from our record is that there is improvement of water quality in Malaysia (New Straits Times, 7 April 2002). Since 1983, Malaysia has established the national guidelines for Drinking Water Quality under National Drinking Water Quality Surveillance Programme (NDWQSP)[4] based on the World Health Organisation's own extensively research recommendation (Utusan Konsumer, October 2002). Record shows that, in spite of greater vigilance, the violation of water quality standards still persists on a localized basis. However, on countywide scale, there is a discernible general downward tend of treated water quality (New Sunday Times, 7 April 2001).

There has been increasing concern over the quality of potable water coming out of the taps (New Straits Times, 7 April 2002). There also have been many complaints of turbid, rusting coloured or cloudy water flowing out of household taps. To large extent, consumers have no means of judging the safety of potable water themselves. Their attitude towards the water supply is determined largely by what they see.

Providing clean water would save a lot of life by reducing the prevalence of water-related diseases. In the world, 2.3 billion people suffer from diseases that are linked to water and some 60 per cent of all infant mortality is linked to infectious and

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[4] The division has also formulated a water quality assurance programme that focuses on the conformance of four selected parameters as indicators of quality. The four selected parameters are RCL (Residual Chlorine (not less than 0.2 milligrammes per liter), FC (Faecal Coliform (total absence), RC & FC (Residual Chlorine & Faecal Coliform (total absence of FC in Residual Chlorine) and TUR (Turbidity (not more than 5 Nephelometric Turbidity Units)) (New Straits Time, 7 April 2002).

parasitic disease, most of them water-related (Population Information Program, 1998). One of the sources of water related diseases (water-borne disease[5]) is caused by water that has been contaminated by human, animal or chemical waste.

We are profligate wasters of water. We flush one third of our drinking quality water down the toilet, further 17 per cent for bathing and another 12 per cent and another 12 per cent is utilized through our washing machine and dishwashers. Only 0.008 per cent of drinkable tap water is actually drank (Button, 1990).

The study of California's Urban Water Use 2000 (Gleick et al, 2003) reported that residential (domestic) water consumption is the largest urban water use sector (other sectors are industrial and commercial consumption), and it offers the largest volume of potential savings compared with other urban sector. In Perth, the domestic sector accounts for about 70 per cent of the city's total demand (Loh and Peter, 2003). Likewise, in Malaysia, where domestic (residential) water consumption is also the largest urban water use compared with non-domestic sector such as industrial and commercial institution. For example, in 1998, the domestic water consumption in Selangor is 432,799,546 m^3 or 70 per cent of the urban water use (Public Works Department, 1999). Pacific Institute (Gleick et al, 2003) estimated that indoor residential in use in California could be reduced by approximately another 40 per cent by changing our behaviour and attitude such as, replacing fault equipment and reducing

[5] Water-related diseases vary substantially in their nature, transmission, effects, management, adverse health effects related to water can be organized into three categories: water-borne disease, water-based diseases and water-related vector (Population Report, September 1998).

the level of leaks, even without improvements in technology. Institute for Sustainable Futures prepared for the Water Services Association (1998) viewed the attitude towards water conservation is a critical factor in reducing our overall water consumption. Thus, changing behvaiour and attitude would offer a lot room for improvement for water conservation.

At the domestic level, there are various reasons to save water. It can result in reducing the running costs and spending less on water and electricity bills, especially when it comes to washing clothes, showering and others. At national level, water conservation reduces water demand, which allows rivers and streams to maintain adequate water levels and flow. This helps to sustain healthy aquatic ecosystems. Water conservation also reduces the need to develop new water treatment facilities and new reservoirs, a process that often causes unfavorable environmental repercussions. In other words, saving water across communities and regions can help reduce the significant financial investment required to build new water storages. In addition, indirectly, saving water also helps to reduce energy consumption for water and waste water development, treatment, and distribution (California Urban Water Conservation Council, 2002).

Water usage for showers and baths is typically the second or third largest category of indoor residential water use (Gleick et al, 2003, Mayer, et al, 1999). In United State, shower duration is averagely of 8.2 minutes (Mayer, et al, 1999). Domestic Water Use Study (Loh and Peter 2003) shows that shower water usage for residents at Perth, Western Australia is 7 minutes per shower and 9 litres per minutes.

The study estimated that the bath and shower water usage for an individual is 51 litres per person per day. In fact, showerhead flow rates vary widely depending on the specific model, water pressure, and condition of fitting and often throttled below their maximum rate flows (Mayer et al, 1999). The study in Perth (Loh and Peter, 2003) shows that the total usage of household is 1,259 litres per house per day for single residential and 768 litres per house per day for multi-residential (for example, townhouse, apartment and flat).

Substantial amounts of water are used in the outdoor residential sectors, primarily for landscape irrigation. Matyac (Gleick et al, 2003) estimates that watering gardens and lawns accounts for half of all residential water use. In Australia, about 35 to 50 per cent of all domestic water use occurs in the garden (Yarra Valley Water, 2003). The amount of water used by the average Melbourne household each year is the equivalent of six average-size (40,000 litres) swimming pools. Each year the average household uses around two swimming pools worth of water in the garden alone. In Perth, domestic water use study (2003) estimates on average a single residential household used 687 litres water per day on the lawn and garden.

The study by Malaysian Science and Technology Centre (MASTIC) (1997) found out that the Malaysian public was aware of air pollution, flash floods and haze. However, most Malaysians were generally not aware of the direct effect of environment degradation.

According to a 1998 survey, MASTIC found that Malaysians' perceived knowledge of science and technology was poor. However, a third of the respondents have excellent knowledge on environmental pollution and 40 per cent was average. Malaysian are more aware of environmental issues since we have already suffered a number of environmental-related disasters, including water shortage in Selangor in 1998 and a horrific haze episode in 1997 (MASTIC, 1999; Sahabat Alam Malaysia, 2001).

Different perception levels of environmental terms and concepts and other issues are closely related to different levels of education and specializations, different levels of income different age grouping and gender. Only a small percentage of the respondents were able to answer questions pertaining to environmental issues correctly. Comparing the results of 1998 against 1996 answers showed that the youths continue to be more knowledgeable than adults in understanding of environmental term. The level of awareness and understanding of the environment-related issues among youths (24.5 per cent) is also considerably higher that that of the adults (19.8 per cent). This discovery affirms the 1996's findings. The lower income group exhibits the least perceived knowledge (MASTIC, 1999).

Based on MASTIC (1999), as expected, public has understanding of environmental problems close to home better than more global-related issues. While over 80 per cent have heard of water shortages, only 50 per cent understood them to some degree. The difference between perceived and actual knowledge shows the gap in getting environment messages across to the general public (Malaysia Environment

Alert, 2001). In fact, environmental awareness is found to be generally high but this is not matched with the high participation on environmental issues (Tan, 2000). The phenomena of "overinformed, but undercomprehending" occurred where it comes to environmental issues (Forrest and Mays, 1997). This means that the public receives many messages about environmental issues but it receives little education regarding what the messages actually mean, especially within the context of specific issues. There are also possibly intervening factors, which have affected participation.

Table 1.4: Percentages who had Knowledge of Environmental Issues

Question	Adults		Youth		Children	
	1998	1996	1998	1996	1998	1996
Acid rain damages forests. (True)	14.8	8.9	21.1	12.5	8.8	4.8
Flash floods are caused by rapid development. (False)	8.2	4.2	11.6	5.6	10.2	4.7
Indiscriminate dumping of toxic waste is hazardous to life. (True)	33.9	NA	40.6	NA	24.4	NA
The water shortage problem is due to development and not the effect of El-Nino. (False)	22.6	NA	26.2	NA	23.4	NA

NA = Not Asked

Source: MASTIC, 1999; Sahabat Alam Malaysia, 2001.

Gender issue seems play a significant role in raising awareness of environment. Female population rated themselves higher than males on the issues of environmental pollution. Generally, the male population, especially the youths, demonstrates a higher level of perceived interest compared to the female population who tend to primarily focus on a wider and more diversified range of issues (MASTIC, 1999; Sahabat Alam Malaysia, 2001).

Knowledge and information raise awareness. A lot of people still feel they lack the basic information they need to change the lifestyle (Porritt, 1989). As we gain enough understanding of the consequences of the environment, we will be prepared to do something (Button, 1990). We are concerned about our own health and that of the people we care about. Environmental education is a vital link to strengthen the overall awareness of the Malaysian public (Sahabat Alam Malaysia, 2001). Tan (2000) concluded that unless the public link environmental issues as directly affecting themselves, otherwise, they are unlikely to respond to any programme. Even though educating the public is difficult, it is an unavoidable challenge (The Star, 21 March 2001).

Most countries, including Malaysia, are caught in meeting the growing demand for freshwater but faced with limited and increasingly polluted supplies. Finding solutions requires responses at local, national and international levels. Most of the water used is lost due to poor conservation culture. Measure to conserve water required both the will and the way (Lasisi Adedoyin, 2003). Changing a culture of water use will help to reduce the water usage; for example; leaving the water running while you brush your teeth can waste 3 gallons of water; cutting one minute off your shower time can save about 700 gallons of water per month. A faucet that drips 60 times in one minute would waste over 3 gallon a day, 1255 gallons per year.

Community–led initiatives to manage water resources better can help urban dwellers gain access to safe piped water supplies, thus improving sanitation and public

health (Population Report 2000). Community would be sensitised to environmental programme if sufficient and suitable support systems such as awareness materials and relevant infrastructure are provided in order to make participation more convenient (Yeo, 2003). The advent of the Internet and its use in the media give rise to another dimension of environmental awareness and action (Sahabat Alam Malaysia, 2001).

1.7 FRAMEWORK OF STUDY

This study comprises five chapters. The first chapter presented the background of study, research objectives and literature review. The research framework and methodology are presented in Chapter Two. The bivariate analysis and multivariate model applied in the study are also presented. This chapter also discusses the key variables used for analysis. A description of the characteristics of survey respondents will also be presented.

Chapter Three discusses the awareness of respondents on water conservation. Attitude towards water conservation both self-perception and public attitude are covered in this chapter. Analyzing household behavior towards water usage is presented in Chapter Four. Water consumption in daily activities will be analysed. This chapter will conclude by highlighting how much water is wasted and suggest ways for saving.

Chapter Five summaries the findings of the study. Some policy and programme implications and recommendations emanating from the findings are also highlighted.