

WATER CONSUMPTION PATTERN OF URBAN HOUSEHOLDS IN
JOHOR BAHRU

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A thesis submitted in fulfilment of the
requirements for the award of the degree of
Master of Science (Urban and Regional Planning)

Faculty of Built Environment
Universiti Teknologi Malaysia

APRIL 2016

Specially dedicated to *Mak* and *Abah*

ACKNOWLEDGEMENT

BismillahiRahmanirRahim...

Alhamdulillah, with the permission and blessing from Allah S.W.T., I finally managed to complete this master project within the specified period. I am grateful for the strength given to complete this thesis as fulfilment for the award of Master of Science in Urban and Regional Planning, Faculty of Built Environment, Universiti Teknologi Malaysia.

I would like to take this opportunity to express the deepest appreciation to my supervisor, Prof. Madya Dr. Nooraini Yusoff for her reading, guiding and most of all patience throughout the entire process. Without her guidance and persistent help this thesis would not have been possible. A special thanks is also addressed to my former supervisor, Prof. Dr. Noor Sharipah binti Sultan Sidi for her countless hours and always providing guidance and moral support throughout the study.

I also wish to thank both my parents for their sacrifices in term of money in order to complete this thesis. In addition, they also provide a lot of moral support during the completion of this thesis. I will always remember their kindness forever. Finally, I extend my sincere thanks to all respondents who were willing to answer the questionnaire provided. Their excitement and willingness to provide feedback made the completion of this research an enjoyable experience. Without their help, this study certainly will not achieve the objectives that have been set.

ABSTRACT

Knowledge about water consumption is necessary for water resource planning and development. In the past, many countries in the world including Malaysia adopted the supply management approach for the management of water resources. The conventional supply approach has been proven to be insufficient to cope with increasing water demand to meet changing standards in water utilization. As a new approach in water planning and management, not many studies have been undertaken on analyzing water consumption of Malaysian water consumers. Hence, this research is aimed towards understanding the water usage, awareness, attitudes and perception of water consumers in a major urban area of Johor Bahru District, Malaysia. The study was conducted with four hundred (N=400) sampled respondents comprising of residents of planned housing areas, traditional village, new village and squatter settlements. A questionnaire administered randomly to the selected respondents based on housing type, settlement type and some socio-economic criteria. The data analysis techniques applied are descriptive analysis and inferential analysis using Chi-Square Test. The result had identified that the average water consumption of Johor Bahru is 566 litre per capita per day. Housing type, type of settlement, ethnicity, age, numbers of household, level of education and income have significant effect on water consumption among households. The attitude towards water conservation is not encouraging as only about half of the opinion that conserving water is necessary. The finding indicates that in order to change human behavioral towards water conservation, economic alternative can foster attitude or behavioral shifts. For instance, setting and enforcing higher prices can encourage lower consumption.

ABSTRAK

Pengetahuan tentang penggunaan air adalah sangat diperlukan bagi perancangan dan pembangunan sumber air. Pada masa lalu, banyak negara di dunia termasuk Malaysia mengguna pakai pendekatan pengurusan bekalan air bagi pengurusan sumber air. Pendekatan bekalan air secara konvensional telah terbukti tidak mencukupi untuk menampung peningkatan permintaan air bagi memenuhi perubahan standard dalam penggunaan air. Sebagai pendekatan baru dalam perancangan dan pengurusan air, tidak banyak kajian dan analisis yang dijalankan terhadap penggunaan air dalam kalangan rakyat Malaysia. Oleh itu, kajian ini adalah bertujuan ke arah memahami cara penggunaan air isi rumah, tahap kesedaran, sikap dan persepsi pengguna di kawasan bandar utama di daerah Johor Bahru, Malaysia. Kajian ini dijalankan ke atas empat ratus ($N = 400$) sampel responden yang terdiri daripada penduduk di kawasan perumahan terancang, kampung tradisional, kampung baru dan kawasan setinggan. Soal selidik yang dijalankan secara rawak kepada responden yang dipilih adalah berdasarkan kepada jenis perumahan, jenis penempatan dan beberapa kriteria sosio-ekonomi. Teknik analisis data yang digunakan adalah analisis deskriptif dan analisis inferensi yang menggunakan *Chi-Square Test*. Hasil penemuan menemui purata penggunaan air di Johor Bahru adalah 566 liter per kapita sehari. Jenis perumahan, jenis penempatan, bangsa, umur, bilangan isi rumah, tahap pendidikan dan pendapatan memberikan kesan yang besar ke atas penggunaan air dalam kalangan isi rumah. Sikap terhadap pemuliharaan air adalah tidak menggalakkan kerana hanya kira-kira separuh daripada jumlah responden berpendapat bahawa penjimatan air adalah perlu. Hasil kajian mendapati bahawa untuk mengubah tingkah laku manusia terhadap pemuliharaan air, alternatif ekonomi boleh memupuk perubahan sikap pengguna. Sebagai contoh, menetapkan dan menguatkuasakan harga air yang lebih tinggi boleh menggalakkan penggunaan air yang lebih rendah.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xii
	LIST OF FIGURES	xiii
	LIST OF ABBREVIATIONS	xix
	LIST OF APPENDICES	xx
1	INTRODUCTION	1
	1.1 Introduction	1
	1.2 Water Resource Management in Malaysia	3
	1.3 Statement of Problem	5
	1.4 Research Questions	8
	1.5 Research Goal	8
	1.6 Research Objectives	8
	1.7 Scope of Research	9
	1.8 Case Study	9
	1.9 Research Methodology	10
	1.10 Expected Contributions	12

2	WATER RESOURCE PLANNING AND MANAGEMENT	14
2.1	Introduction	14
2.2	Sustainable Water Resource Planning and Management	14
2.3	Integrated Water Resource Management (IWRM)	16
2.3.1	Water Supply Management Approach (WSM)	18
2.3.2	Water Demand Management Approach (WDM)	18
2.4	Water Consumption Pattern for Household	19
2.4.1	Understanding of Water Consumption Pattern	20
2.5	Water Consumption for Domestic Usage	24
2.5.1	Domestic Water Usage	24
2.5.2	Main Household Water Usage	26
2.5.3	Quantity and Quality Needed	27
2.6	Factors Affecting Domestic Water Consumption	28
2.6.1	Water Price	29
2.6.2	Demographic Factors	29
2.7	Conclusion	33
3	WATER RESOURCE MANAGEMENT IN MALAYSIA CONTEXT	34
3.1	Introduction	34
3.2	National Water Resource Policy (NWRP)	35
3.3	Legislative Framework	38
3.3.1	Water Services Industry Act 2006 (Act 655)	38
3.3.2	National Water Services Commission Act (SPAN) 2006 (Act 654)	39
3.4	Water Related Agencies	39

3.4.1	Ministry of Energy, Green Technology and Water (KeTTHA)	40
3.4.2	Ministry of Natural Resource and Environment (NRE)	41
3.4.3	National Water Service Commission (SPAN)	41
3.4.4	Syarikat Air Johor Holding (SAJH)	44
3.4.5	Badan Kawalselia Air Johor (BAKAJ)	45
3.5	Issues and Problems of Water Provision in Johor	45
3.6	Conclusion	48
4	RESEARCH METHODOLOGY	49
4.1	Introduction	49
4.2	Study Area	49
4.3	Data Collection Technique	52
4.3.1	Questionnaire	52
4.3.2	Developing of Questionnaire	53
4.3.3	Sampling Technique	54
4.4	Distribution of Sample	55
4.5	Method of Analysis	56
4.6	Conclusion	57
5	BACKGROUND OF RESPONDENTS AND HOUSEHOLD WATER CONSUMPTION	56
5.1	Introduction	56
5.2	Profile of Respondents	56
5.2.1	Ethnicity	56
5.2.2	Age	57
5.2.3	Level of Education	57
5.2.4	Occupation	58
5.2.5	Income	58
5.2.6	Number of Household	59
5.3	Settlement and Housing Types	59
5.4	Sources of Water Supply	60

5.5	Household Water Consumption	61
	5.5.1 Monthly Water Bill	65
	5.5.2 Average Water Consumption	67
5.6	Indoor Water Use	68
	5.6.1 Cooking	69
	5.6.2 Washing Dishes	70
	5.6.3 Bathing	71
	5.6.4 Ablution	72
	5.6.5 Washing Clothes	73
	5.6.6 House Cleaning	74
	5.6.7 Flushing Toilets	75
5.7	Outdoor Water Use	75
	5.7.1 Watering Plants	76
	5.7.2 Watering of Lawns	78
	5.7.3 Watering Fruit Trees	79
	5.7.4 Washing Cars and Motor Cycles	80
	5.7.5 Washing Porch	83
5.8	Conclusion	85

6	ATTITUDE AND LEVEL OF AWARENESS ON WATER CONSERVATION	86
6.1	Introduction	86
6.2	Opinion on the Need for Water Conservation	87
6.3	Attitude towards Water Conservation	88
	6.3.1 Letting Tap Water Flow while Brushing Teeth	88
	6.3.2 Monitoring / Control of Water Usage	89
	6.3.3 Concern over Water Wastage	90
	6.3.4 Rain Water Harvesting	92
	6.3.5 Water Recycling Activity	93
6.4	Awareness on Water Conservation Campaigns	95
6.5	Conclusion	98

7	SUMMARY OF FINDINGS, RECOMMENDATION AND CONCLUSION	100
7.1	Introduction	100
7.2	Achievement of Objective	100
	Objective 1: Determine Current Water	
7.2.1	Consumption for Urban Residents	100
	Objective 2: Identify Factors Effecting	
7.2.2	Water Consumption in Residential Sector	101
	Objective 3: Study Attitude and Level of	
7.2.3	Awareness on Water Conservation	101
7.3	Recommendation	102
7.4	Conclusion	103
	REFERENCES	105
	Appendices A - Questionnaire	112
	Appendices B – Chi-Square Test for Water Bill	116

LIST OF TABLES

TABLE NO.	TITLE	PAGE
1.1	Fraction of water resource	1
2.1	Estimated average domestic use	25
3.1	Water related agencies	43
4.1	Parameter for questionnaire	53
4.2	Sample size by population size	54
4.3	Distribution of sample	55
4.4	Example of Chi Square Test	57
5.1	Cross tabulation of Type of Settlement and Water Bill	61
5.2	Cross tabulation of Housing Type and Water Bill	62
5.3	Cross tabulation of Ethnicity and Water Bill	62
5.4	Cross tabulation of Age and Water Bill	63
5.5	Cross tabulation of Level of Education and Water Bill	63
5.6	Cross tabulation of Number of Household and Water Bill	64
5.7	Cross tabulation of Income and Water Bill	64
6.1	Used of water recycle	90

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
1.1	Population of Malaysia by age group	6
1.2	Flow chart of the research methodology	12
2.1	The interaction of IWRM principles	17
2.2	Water supply and demand trend with and without demand management (DM)	21
2.3	Hierarchy of water requirements (Abraham Maslow's:1908-1970)	28
4.1	Distribution of study area	51
5.1	Ethnicity of respondents	57
5.2	Age of respondents	57
5.3	Education level of respondents	58
5.4	Occupation of respondents	58
5.5	Income of respondents	59
5.6	Number of household	59
5.7	Type of settlement	60
5.8	Housing type	60
5.9	Water supply source	61
5.10	Water bill	65
5.11	Water bill according to type of settlement	66
5.12	Water bill according to housing type	66
5.13	Water bill according to ethnicity	66

5.14	Water bill according to age	66
5.15	Water bill according to level of education	67
5.16	Water bill according to income	67
5.17	Water bill according to no. of household	67
5.18	Cooking activity	69
5.19	Cooking activity according to age	69
5.20	Cooking activity according to no. of household	69
5.21	Cooking activity according to income	69
5.22	Washing dishes activity	70
5.23	Washing dishes activity according to ethnicity	71
5.24	Bathing	71
5.25	Bathing according to ethnicity	72
5.26	Ablution	72
5.27	Washing clothes	73
5.28	Washing clothes according to age	73
5.29	House cleaning	74
5.30	House cleaning according to ethnicity	74
5.31	Flushing toilet	75
5.32	Watering plant	76
5.33	Source for watering plant	76
5.34	Watering plant according to type of settlement	77
5.35	Watering plant according to housing type	77
5.36	Watering plant according to ethnicity	77
5.37	Watering lawn	78
5.38	Source for watering lawn	78
5.39	Watering lawn according to type of settlement	78
5.40	Watering lawn according to housing type	78

5.41	Watering lawn according to ethnicity	79
5.42	Watering lawn according to occupation	79
5.43	Watering fruit plant	79
5.44	Source of watering fruit plant	79
5.45	Watering fruit plant according to type of settlement	80
5.46	Watering fruit plant according to ethnicity	80
5.47	Watering fruit plant according to income	80
5.48	Washing cars and motor cycles	81
5.49	Washing car and motor cycle according to area	81
5.50	Washing car and motor cycle according to type of settlement	81
5.51	Washing car and motor cycle according to housing type	82
5.52	Washing car and motor cycle according to age	82
5.53	Washing car and motor cycle according to occupation	82
5.54	Washing porch	83
5.55	Source of washing porch	83
5.56	Washing porch according to type of settlement	84
5.57	Washing porch according to housing type	84
5.58	Washing porch according to ethnicity	84
5.59	Washing porch according to income	81
6.1	Opinion on water saving	87
6.2	Opinion on water saving according to ethnicity	87

6.3	Opinion on water saving according to age	87
6.4	Running tap while brushing teeth	88
6.5	Running tap while brushing teeth according to ethnicity	88
6.6	Running tap while brushing teeth according to age	88
6.7	Running tap while brushing teeth according to level of education	88
6.8	Control water usage	89
6.9	Control water usage according to ethnicity	89
6.10	Control water usage according to age	90
6.11	Control water usage according to income	90
6.12	Concern on water wasting	90
6.13	Concern on water wasting according to ethnicity	91
6.14	Concern on water wasting according to age	91
6.15	Concern on water wasting according to income	91
6.16	Rainwater harvesting	92
6.17	Rainwater harvesting according to ethnicity	92
6.18	Rainwater harvesting according to income	92
6.19	Water recycle	93
6.20	Water recycle according to type of settlement	93
6.21	Water recycle according to housing type	93
6.22	Water recycle according to ethnicity	94
6.23	Water recycle according to age	94
6.24	Water recycle according to occupation	94
6.25	Water recycle according to income	94
6.26	Aware about water campaign	95
6.27	Source of information	95

6.28	Aware about water campaign according to ethnicity	96
6.29	Aware about water campaign according to age	96
6.30	Aware about water campaign according to level of education	96
6.31	Aware about water campaign according to income	96
6.32	Participation in water campaign	97
6.33	Participation in water campaign according to ethnicity	97
6.34	Participation in water campaign according to age	97
6.35	Participation in water campaign according to level of education	98

LIST OF ABBREVIATIONS

ASCE	-	American Society of Civil Engineers
BAKAJ	-	Badan Kawalselia Air Johor
DSAN		Dasar Sumber Air Negara
EPA	-	Environmental Protection Agency
IWRM	-	Integrated Water Resource Management
KSAN	-	Kajian Sumber Air Negara
LCD	-	Litre per capita per day
MDG	-	Millennium Development Goal
MBJB	-	Majlis Bandaraya Johor Bahru
MPJBT	-	Majlis Perbandaran Johor Bahru Tengah
MPPG	-	Majlis Perbandaran Pasir Gudang
NWRC	-	National Water Resource Council
PUB	-	Public Utility Board
SAJ	-	Syarikat Air Johor
UNESCO	-	United Nations Educational, Scientific and Cultural Organizations
WD	-	Water Demand
WHO	-	World Health Organization
WS	-	Water Supply
WDM	-	Water Demand Management
WSIA	-	Water Service Industry Act

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	QUESTIONNAIRE	114
B	CHI-SQUARE TEST	118

CHAPTER 1

INTRODUCTION

1.1 Introduction

Water plays a significant role in human being development. It become a basic necessity for economic growth and better living standards. The volume of freshwater resources on Earth is approximately about 35 km³, or about 2.5% of the total volume of water. There is only a small fraction of the freshwater resource that is available. Estimates suggest that “the freshwater in rivers and lakes constitute only about 0.3% of the overall freshwater resources, while the groundwater resource is much larger, about 30% of all freshwater resources. Most of the freshwater (70%) is locked up in glaciers and snow cover in mountainous regions” (United Nation Water, 2012).

Table 1.1: Fraction of water resource

Type of water resource	Volume (x 106 km ³)	Percentage of total water (%)	Percentage of freshwater (%)
Total water	1386	100	
Oceans	1338	96.7	
Polar ice	24	1.7	68.6
Other ice and snow	0.3	0.025	1.0
Groundwater			
Fresh	10	0.8	30.1
Saline	13	0.9	
Surface water	0.2	0.01	0.3

Source: United Nation Water, 2012

Nowadays world had face the global issues which is water crisis. There are a lot of issues related to water such as water scarcity, sanitation, clean drinking water

and others. “Water is an increasingly critical issue of global policy change, management and planning. There are growing concerns about water as a renewable resource, its availability for a wide range of users, aquatic ecosystem health and global issues relating to climate change, water security, water trading and water ethics” (Grafton and Hussey, 2011). According to the Millennium Development Goals Report (MDG) in year 2012, eleven percent of the global populations do not have access to clean drinking water.

The growth in population and expansion in urbanization, industrialization and irrigated agriculture are imposing growing demands and pressure on water resources, besides contributing to rising water pollution. One of the most important use of water is for domestic purpose. It was the third largest water consumer from the total water consumption after agriculture and industry. Domestic water supplies are one of the essential requirements for human life. Based on Guidelines for Drinking Water Quality, domestic water define as being water used for all usual domestic purposes including consumption, bathing and food preparation (WHO, 1993). There are several problems arising in relation to the management of water consumption for domestic use. “This implies that the requirements with regard to the adequacy of water use across all these uses and not solely in relation to consumption of water” (Howard and Bartram, 2003).

The presence of water as a natural element needs a competent management to reduce water treatment cost, cater water shortage caused from pipe leakage and to recover weakness of water distribution. As water is the resource that will diminish over the time, so management of water is very important to ensure the sufficiency of water supply in future. Water management is actually a process of distributing clean water from resources to the consumers efficiently in order to meet human needs. It covers all sectors like residential, industry, agriculture, commercial as well as institutional. Water management should concentrate on improving water availability and quality and also in reducing non-renewable water.

1.2 Water Resource Management in Malaysia

“Malaysia is blessed with abundant of rainfall that contributed to abundance of water resources, but inefficient management and abuse of water usage have resulted in water crisis that caused hardship” (Filzah, 2013). Malaysia received rainfall estimated about 2500 mm annum especially during the rainy season. The average rate of groundwater resources is between 330.00 km² to 990 billion m³ per year of which 36 percent were absorb into the atmosphere, 566 billion m³ or 57 percent of which still exist on the surface of the earth and sustain 64 billion m³ or 7 percent for the exchange to form energy (Department of Water Supply, 2015).

According to the constitution, matters related to natural resources such as water supply are under the jurisdiction of the states. State governments are responsible for the development, operation and maintenance of water supplies (Abidin, 2004). If a dispute arises in case like river basin that crosses states, it will subject to the federal jurisdiction. National Water Resources Council (NWRC) was set up at the federal level aimed to pursue a more effective water management. To ensure sustainable water resources and efficient water supply services, the federal government is moving towards greater involvement in the management of water resources and water supply services and the implementation of integrated water resources management.

“In Malaysia, the demand for water has increased with the level of development. This has been an advantage as the water that is necessary for drinking, cooking, personal hygiene and house cleaning has been made readily available to almost all the people through piped supply” (Nur’ain, 2012). However, in recent years the population has become careless in the use of water. Average consumption per person at home has increased tremendously. “Average consumption at home now stands at about 203 liters per capita per day (LCD). This level of usage is far greater than many developed countries such as Singapore which only consume about 154 liters per capita per day” (Chan, 2004).

Previously, the development of water supply projects had been invested with huge capital expenditure by the government of Malaysia. However, the cost of developing new sources or expanding existing sources is getting costly as the cheaper and easily accessible water resources already developed. Since continuous development of water resources or water supply projects becomes more costly, the state water authorities have to take water management seriously. This trend had continued but while focusing in development projects to increase water demand; emphasis has to be on slowing down the rate of the increase in water consumption. Due to the high cost involved in water supply management, so study on water consumption is the effective way to cope with water management issue (Department of Water Supply, 2014).

Towards improving water resource management efficiently, Integrated Water Resource Management (IWRM) had been introduced as a sustainable approach that can be implemented. It integrates all sectors under one comprehensive water management plan purposely to optimize the water use. IWRM involves many stakeholders and water users in order to achieve one ultimate goal which is reducing water consumption and improving water reliability. Water Demand Management (WDM) is one of the tools under IWRM. For sustainable management of water resources, many countries had gradually shifting from supply based water management to demand based water management. Demand management approach is different from supply management because it focuses on reducing water consumption among users.

In order to manage water resource efficiently, it is essential to understand the pattern of water consumption. Usually, water consumption pattern depends on certain socio-economic and other factors. Many studies had been carried out to understand factors that influence water consumption in other country however, only a few researches has been done on estimation of water demand in Malaysia.

This research will focus on residential sector where it is the third largest sector of water used. If water consumption in this sector can be used effectively, there will be more water saved for other sector and it also can be saving for future generation.

1.3 Statement of Problem

In general, Malaysia has many water resources. However, supply of clean water resources nowadays is dwindling while water consumption is growing in line with the increase in number of population. Extensive and rapid development in all sectors such as industrial, commercial, residential as well as agricultural had also caused the increasing of water consumption.

Water consumption for residential sector is happen to be the third largest water consumer. However, it is worst in urban area as most of the housing scheme is developed in this area. Thus, it makes us face the water crisis to obtain an adequate supply of clean water to meet demand of all daily activities needed. Several problems related to water consumption for residential sector have been identified.

i) Increasing number of population

Based on the Department of Environment and Resource Management Planning Guidelines for Water Supply & Sewerage in year 2010, the number of consumer will increase as the world population is increasing. According to the report presented in *Kajian Sumber Air Negara (KSAN)*, domestic and industrial water demand in Peninsular Malaysia will rise 3 times ($3,483,000,000 \text{ m}^3 / \text{year}$) in year 2000 to ($11,543,000,000 \text{ m}^3 / \text{year}$) in year 2050.

Based on the census in year 2000, the population in Malaysia had achieved 23.27 million compared to 18.38 million in year 1991 (Figure 1.1). This gives an annual average population increase by 2.6% in the last 9 years (Population and Housing Cencus, 2000). With this, the total demand for water is expected to grow to 20 billion m^3 by 2020 (Nadiah, 2005).

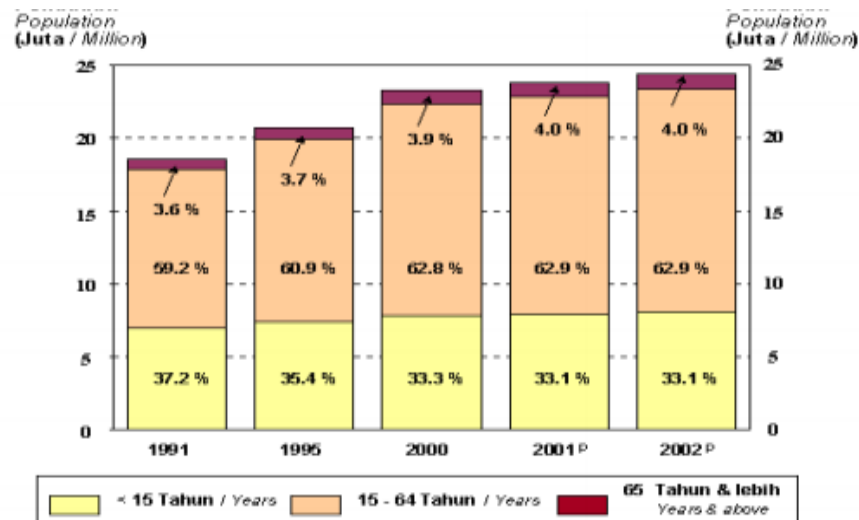


Figure 1.1: Population of Malaysia by age group

Source: Department of Statistics, 2000

Thus, the needs of water resource in future will also arising and it can cause insufficient water supply if the water is not properly managed. Here, the needs of water consumption management is very high in order to make sure water supply can meet water demand in the future. Even though water is an exhaustible resource but we need to remember that not all water in universe is available for people used.

ii) Excessive usage of water in urban area

In Malaysia, water consumption for domestic used is the third largest consumer of water after agriculture and industrial sector which is thirteen percent from total water used (Chan, 2009). The domestic use that consume large amount of water are referring to the both indoor and outdoor activities such as cooking, flushing toilets, bathing, washing cars and clothes, watering plant and others. Normally, people just need 80 liters of water per day to meet basic needs. From the overall total, 5 liters use for drinking, 30 liters for hygiene, 25 liters for bathing and 20 liters for food preparation. However, the use of water for one individual can reach 500 liters a day especially those who live in the city (Rokiah *et al.*, 2004).

The study done by Renganathan (2000) and Chan (2004) had shows that water usage for domestic purpose in Malaysia had increase from 200 litres of water per capita per day in 1970's to 250 LPD in year 1980's. It is worst in urban area

where the average person use of water is about 500 LPD. If compare to the water used for International Standard recommended by United Nations, the average person used should be only 230 LPD.

iii) Less application of efficient water appliances among households

There are a lot of household activities that do not use water optimally due to inefficient water appliances. It is happened due to the lack of awareness among households about the significant used of efficient water appliances while doing the activities at home. For example, the country of United States would save more than 3 trillion gallons of water and more than \$18 billion dollars per year if the household installed water-efficient appliances at home. For instance, the average washing machine uses is about 41 gallons of water per load which is the second largest water user at home. High-efficiency washing machines will only use 35 to 50 percent less water (EPA, 2012). By reducing household water used, it can save energy consumption and at the same time may save costs in terms of reducing water bills.

iv) Lack of awareness about recycling water

In many countries, water is possibly the most wasted natural resource. Usually water for drinking, landscaping and washing often being disposing after one used. In fact, they do not need a big treatment facility and chemicals to recycle water at home. Many people are intuitively to recycle water at home. Saving bathwater for pet's bath is a multiple-use strategy that conserves water. People actually can recycle rainwater for bathing and hand-washing laundry. There are some residents of Asian and African countries harvest rainwater as their primary water supply (Demand Media, 2011).

1.4 Research Questions

- i. What is the average water consumption for urban household in Johor Bahru?

- ii. What are the factors that effecting consumption for water among urban household?
- iii. How is the attitude of household towards water usage they used in doing their daily routine?
- iv. What is the level of awareness of household about the importance of water?

1.5 Research Goal

This research is done on purpose to study the water consumption pattern among urban household according to the major issue of high water consumption for residential sector.

1.6 Research Objectives

The aim of this research is to conduct a comprehensive study on water consumption, awareness, attitude and perception of respondents of the residential sector in Johor Bahru District. The objectives of the research are:

- i. To determine the average water consumption of residents in Johor Bahru District
- ii. To identify factors affecting water consumption in residential sectors
- iii. To study attitude and level of awareness of household pertaining water consumption

1.7 Scope of Research

Several scopes of studies have been identified in this study. The main scope is to determine average water consumption of household in Johor Bahru District. The information obtained is from the monthly water bill of the respondents.

This research will only concentrate on residential sector mainly among urban household. It will focus on household water usage, attitude and level of awareness of household towards water usage they used in doing their daily routine.

The study will be conducted within Johor Bahru region consisting of the area covered by the local authorities of Johor Bahru City Council, Central Johor Bahru and Pasir Gudang Municipality. This area is chosen because it is an urban area with plenty of residential areas and settlements.

The main targeted respondents to be interviewed are the head of the households or household within the age of 23 and above. These respondents are considered mature and have the ability to make decisions on behalf of their family.

1.8 Case Study

In conducting this research, Johor Bahru district was chosen as the study area for several reasons. Johor Bahru district is actually the state capital for Johor. There are a lot of planned and unplanned housing schemes that are seen as a focus area for the residents of the surrounding area and throughout the state of Johor. Since this study is concentrated on urban household, it is easier for researcher to obtain respondents who meet the criteria in conducting this study. Johor Bahru district comprises of three major local authorities namely Majlis Bandaraya Johor Bahru / MBBJ (Johor Bahru City Council), Majlis Perbandaran Johor Bahru Tengah / MPJBT (Central Johor Bahru Municipality) and Majlis Perbandaran Pasir Gudang / MPPG (Pasir Gudang Municipality) (Department of Statistics, 2010).

1.9 Research Methodology

The overall structure of the study involves five major phases as follows:

Phase 1: Introduction

Research on water demand for urban household will be conducted based on the problem statements concerning the issue on high usage of water among urban communities. It has been based on finding from literature review and some researches that had verified urban household had utilize huge amount of water to run their daily routine compared to people lived in rural area. Hence, the research start by conceptualizing and identified which type of housing is the largest water consumer. The respondent will be selected randomly for household survey based on proportion from the total population of an area. Based on the problem statement that had been identified, the objectives, goal and scope of study will be determined.

Phase 2: Literature Review

Literature review is the foundation of this study. The literature review study has determined the direction of water demand study. At this stage, the inputs from the readings process will be taken as a guide to the study. A comprehensive study of literature review about the concept of water demand management will be discussed in this chapter. It also discussed on current water policy in Malaysia, water availability (quantity) needed for residential sector, factors effecting water demand as well as strategies and programs in reducing water demand that is successfully implemented in other countries.

Phase 3: Research Methodology

It describes the methodologies used to collect the required information. Formulation of instrument for data collection, which is specifically designed questionnaire is to be conducted base on face-to-face interviews. The main focus of the questionnaire is to identify the socio-economic profile of respondents, water usage of households, issues and problems encountered by households pertaining to

water supply and services and the attitudes and awareness of respondents on water conservation.

For method of assessment, the appropriated method will be recognized in order to analyze the data. After that, the number of population, sampling size and research instrument will be identified. Then, pilot survey is to be done in order to test and improve research instrument that had been prepared. Data collection will be obtained either from primary data which are observation and questionnaire, or from secondary data.

Phase 4: Data Analysis

As all the findings from literature review and data collection from survey had been acquired, it will be processed shortly after and the conclusion will be drawn and the result will be discussed and concluded for further review. Most of the raw data and summary results from field are described in figures and tables. The calculation of average water consumption is also shown in this chapter.

Phase 5: Conclusions and Recommendations

The study findings and used methodologies have been summarized. The results of the analysis will be summarized to see if the objectives set at the earlier stage were achieved. A summary of the possible future study are also describe. Figure 1.0 below summarizes the overall research methodology of this study.

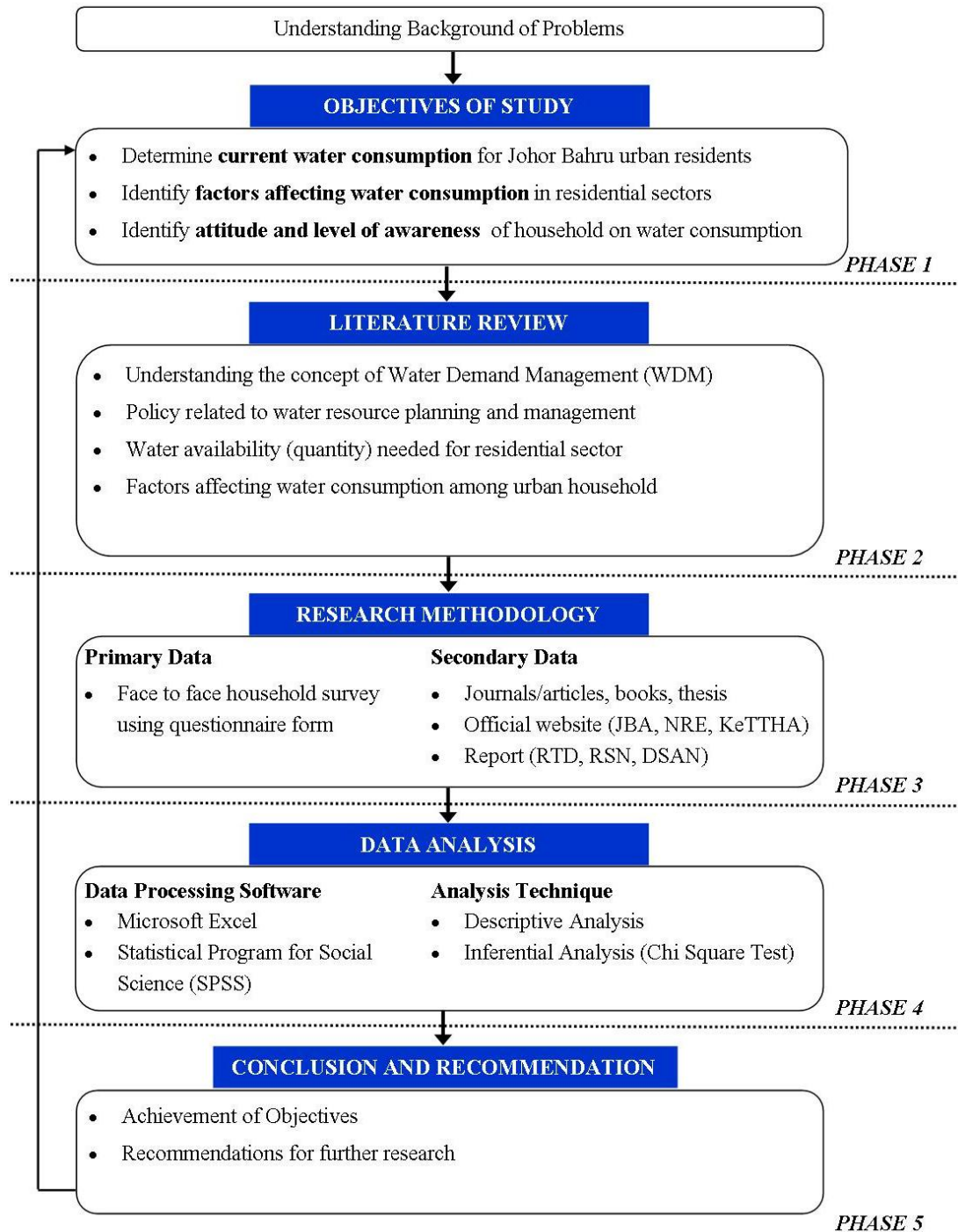


Figure 1.2: Flow chart of the research methodology

1.10 Expected Contributions

The aim of this study is to improve current water management of residential sector concentrated in urban area. This research will be significant to water agencies

that responsible for water management especially in urban area in order to control the water usage among household. The researcher believes that to manage water in urban area it requires a deep and comprehensive study on water consumption pattern. The water consumption in urban area that is supposed to be used optimally as our resource is infinite and diminishing. Most of the urban household did not give much concern on this issue; hence there must be an adoption of new strategies that can strengthen the management of water in urban area.

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