No.

MALAYSIA
Ministry of Energy, Green Technology and Water
(Kementerian Tenaga, Teknologi Hijau dan Air)

MALAYSIA
PREPARATORY SURVEY
ON
CREATION OF THE BEST OPTIMIZED WATER INFRASTRUCTURE PPP
IN
MAJOR URBAN AREAS

FINAL REPORT

JUNE 2012

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

SUMITOMO CORPORATION
TOKYO SUIDO SERVICES CO., LTD.
TOKYO METROPOLITAN SEWERAGE SERVICE CORPORATION
NJS CONSULTANTS CO., LTD.

OPS
JR
12-024

Prepared by the Study Team using Map of Malaysia published by the Ministry of Tourism

Location Map of Study Areas

TABLE OF CONTENTS

PART III: SEWERAGE

PART IV: ENVIRONMRENTAL AND SOCIAL CONSIDERATIONS

LIST OF TABLES

PART I: GENERAL

PART II: WATER SUPPLY

PART III: SEWERAGE

PART IV: ENVIRONMRENTAL AND SOCIAL CONSIDERATIONS

LISTS OF FIGURES

PART I: GENERAL

PART II: WATER SUPPLY

PART III: SEWERAGE

PART IV: ENVIRONMRENTAL AND SOCIAL CONSIDERATIONS

ABBREVIATIONS

ABS	Styrene-acrylonitrile-butadiene Copolymers
AC	Asbestos Cement Pipe
AIDS	Acquired Immune Deficiency Syndrome
Antara Report	"Sewerage Catchment Planning and Sludge Management Strategy Study for Upper Langat Basin", (November 2009)
ATM	Automatic Teller Machine
BOD_5	Biological Oxygen Demand
CI	Cast Iron Pipe
COD	Chemical Oxygen Demand
CST	Communal Septic Tank
dB	Decibel
DCIP	Ductile Cast Iron Pipe
DID	Department of Irrigation and Drainage
DO	Dissolved Oxygen
DOSH	Department of Occupational Safety and Health
EC	Electric Conductivity
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
HDPE	High Density Polyethylene Pipe
HHs	Households
HIV	Human Immunodeficiency Virus
IEE	Initial Environmental Evaluation
IST	Individual Septic Tank
IWA	International Waterworks Association
IWK	Indah Water Konsortium Sdn. Bhd.
JBA	Water Supply Department (Jabatan Bekalan Air)
JBA Pahang	State Department of Water Supply
JICA	Japan International Cooperation Agency
JKR	Public Works Department/Ministry
JPP	Sewerage Services Department (Jabatan Perkhidmatan Pembetungan)
JPY	Japanese Yen
KeTTHA	Ministry of Energy, Green Technology and Water （Kementerian Tenaga, Teknologi Hijau dan Air）
KVA	Kilowatt Voltage Ampere
kW	Kilowatt
Lpcd	Litter per capita day
masl	Mean above Sea Level
mH_2O	Meter equivalent to water head
MS	Mild Steel Pipe
MWA	Malaysian Water Association
MWIG	Malaysia Water Industry Guide
NGO	Non-governmental Organization
NJS	NJS Consultants Co., Ltd.
OPEX	Operation Expenditure
PAAB	National Water Asset Management Company (Pengurusan Aset Air Berhad）
PEMANDU	Performance Management & Delivery Unit

PIs	Performance Indicators
RM	Malaysian Ringgit
SC	Sumitomo Corporation
SPAN	National Water Service Commission (Suruhanjaya Perkhidmatan Air Negara)
STP	Sewage Treatment Plant
SUS	Stainless Steel Pipe
TOR	Terms of Reference
TPS	Total Suspended Particulates
TSS	Tokyo Suido Services Co., Ltd.
TSS	Total Suspension Solid
uPVC	Un-plasticize Polyvinyl Chloride Pipe
USD	United American Dollar
WHO	World Health Organization
WSIA	Water Services Industry Act

Note: The wording in parentheses shows the name in Malay

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

1 History, Agencies concerned and Situation and Problem of Water services

1.1 The Water Services Industry after WSIA 2006

The Federal Government began the water services industry (consisting of water and sewerage sector) restructuring in 2004. A new operating model was introduced to reform the water services industry. There are five (5) key stakeholders which comprises of the whole value chain

- Federal Government Policy-making
- State Government Water resource management
- SPAN Regulatory authority
- PAAB Water asset management, raise funding
- Water operators Operation and maintenance, and provision of water sevices

The instrument to restructure or to enable the new operating model in the water and sewerage sector was based on the promulgation of the National Water Services Commission 2006 and the Water Services Industry Act 2006.

Table E-1, which shows the Water Services Industry Reform Roadmap, provides an overview of the above, as well as the situation during the Eight and Ninth Malaysia Plan periods.

Table E-1 Restructuring of the Water Services Industry towards Improving Efficiency in Operations and Management – Water Industry Reform Roadmap

8th Plan period *2001-05*	**9th Plan period *2006-10***	**10th Plan period *2011-15***
Stabilisation	**Consolidation**	**Moving towards efficiency in operations and management**
• Privatisation and corporatisation of state water authorities • Planning for restructuring of water services industry	• Operationalisation of National Water Services Commission (SPAN) • Enforcement of Water Services Industry Act (WSIA), 2006 • Pengurusan Aset Air Berhad (PAAB) takes over existing water assets from state at negotiated values and is responsible for implementing water infrastructure development • State water operators are asset-light and focus on service provision	• Tariff-setting mechanism to allow full cost recovery to be completely phased in by 2013 • Integration of water supply and sewerage services • Initial efforts towards the introduction of integrated water and sewerage tariffs

Source: Tenth Malaysia Plan (2011-15)

1.2 Situation and Problems in Water Services Industry

(1) Water supply sector

In Malaysia, the majority of the population has access to water supply. In 2010, the total population served was 94.2%, compared to 93.0% in the previous year. People in urban areas have better access to water supply than those in rural areas, with 96.8% of the urban population served compared to 88.4% served in rural areas, both in 2010.

The water services industry has historically faced persistent challenges which have prevented it from achieving financial sustainability without assistance from the government. Over the years, the industry has been suffering from problems of three (3) types:

- Efficiency in operations;
- Effectiveness in the institutional framework/ governance; and
- Funding constraints.

The GOM realized that in order for the industry to be self-sustainable, a swift and decisive reform was required to address the above problems. Essentially, the reform is a transformation exercise aimed at changing the industry into one that is more organized, consumer-focused, efficient and competitive.

In Japan, NRW reduction has been addressed to control leakage from the viewpoints of utilizing valuable water resources, namely not wasting even a drop of water and NRW rate, which is almost equivalent to water leakage ratio in Japan, has been declined below 10% at present in many water supply utilities in Japan. While, in Europe and USA, NRW is mainly composed of leakage but also includes other factors which cannot be negligible in percentage such as registered error, etc., from the viewpoint of no necessecity to invest more than a certain level of amount to NRW reduction, taking into account benefit-to-cost and has been in the level of 10 to 20% in many countries

In recent years, NRW in developing countries is in the range of 30 to 60%, since in addition to leakage from old pipelines installed in colonial times, the existence of pilferage and registered error such as meter error, reading error, etc. is too big to be neglected and NRW reduction has been tackled from the viewpoints of managerial improvement of water supply business and utilization of water resources. Malaysia is no longer to say a developing country, but the percentage of NRW is 37% on average in 2009 which is in the level of developing countries. The Government of Malaysia has put an effort on NRW reduction under a target of 34% by 2015.

(2) Sewerage Sector

1) Population Coverage by Sewerage

There is no concept on population coverage by sewerage in Malaysia. Therefore, any political goals doesn't indicate its numerical target.

Population coverage by sewerage in Malaysia can be estimated by the following method but has a few problems.

The estimated population coverage by sewerage is 49.8% in the Peninsula and 77.8% in Selangor. The highest coverage is found in Kuala Lumpur as 84.8% followed by Pulau Pinang as 84.3%, while the lowest is in Terengganu as 6.7% followed by Kelantan as 9.6%.

2) Key Challenges in Sewerage Sector

The sewerage sector continues to face a myriad of issues with the consumers, environment and the authorities. Among the challenges faced, which result in operational problems, are the following (Figures in the following text are for 2010 and from the Malaysia Water Industry Guide 2011, unless otherwise stated.):

- Proliferation of small STPs – The proliferation of small STPs increases operation and maintenance (O&M) costs, decreasing the efficiency of the sewerage service providers to run their operations. 71% of the STPs in West Malaysia have been built to serve a population equivalent (PE) of less than 2,000, a figure which is typically equivalent to 400 households.
- Resistance to payment of and increases in tariff – Sewerage service was dichotomised as a separate service for consumers that had never paid for such a service in the past.
- Large numbers of private STPs (2,240 nos.) and communal septic tanks (CSTs) (4,382 nos.) which are poorly regulated, operated and maintained. CSTs were operated and maintained by IWK up to 2007, but with the enforcement of WSIA, operation and maintenance of CSTs is

the responsibility of the owner or tenants. It should be noted that the Environmental Quality (Sewage) Regulations 2009 is not applied to CSTs

1.3 Concrete Plan and Policy of KeTTHA

(1) Water service

In the Tenth Malaysian Plan starting from 2011, the NRW programme, involving replacement of pipes and old meters, will be expanded with an allocation RM1.1 billion to improve the quality of water and reduce losses in water supply. Out of this amount, approximately RM369 million will be allocated in the first two years of the Plan.

(2) Sewerage service

KeTTHA has the following long-term national sewerage plan.

- The percentage of population equivalent in urban areas receiving 'connected sewerage services' to increase from 60% in 2008 to 87% in 2040.
- The percentage of population that will be connected to a regional sewerage system is to increase from 19% in 2008 to 79% in 2040
- All existing small sewage plants located in the urban areas to be rationalized and connected to the regional sewerage system by 2020.
- Effluent standard compliance for plants with capacity of 20,000 PE and above to increase from 80% to 100% by 2020.
- All communal septic tanks and Imhoff tanks to be rationalized by year 2024.
- Sub-standard septic tanks to be changed to septic tanks that will meet the standard.
- Encourage the application of green technology in the sewerage industry. Key focuses are on effluent and sludge reuse, using energy efficient M&E equipment and Biogas production.

2 Water Supply Sector

2.1 Situation of the Study Area

The study area is Temerloh District of Pahang State where is located 133 km away from Kuala Lumpur and 126 km away from Kuantan along the National Road (A2) and expressway connecting between Kuala Lumpur and Kuantan, and is the second biggest city in Pahang.

Water service has been provided by previously JBA Pahang and currently PAIP which was corporatised from JBA Pahang on February 1, 2012.

Water service in Pahang has a high rate of NRW (Non-Revenue Water) or 55.29% following 57.35% of Sabah State and rather higher than the national average of 36.73%.

NRW of JBA Temerloh (66.73%) is secondary highest out of 11 district jurisdictions of PAIP and rather higher than the state average of 55.29%.

The water tariff of PAIP has been left as it is since 1983 and the tariff revenue cannot cover the operation and maintenance expenditures but has been compensated with a subsidy from the state government.

2.2 Outline of the Proposed Project

Following action plans in each working stage are proposed on condition that project period of 5 years.

< Stage-I: the 1st year >

- Preparation of the entire action plans,
- Preparation of the works (office, warehouse, staffs, etc.),
- Establishment of the special purpose company (hereinafter called as “SPC”) and the project management unit (hereinafter called as “PMU”) at PAIP,
- Preparation of distribution pipeline drawings,
- Designing of enlarged DMA at 5 sites,
- Establishment of pilot DMAs at 4 sites,
- Commencement of activities for NRW reduction, and
- Practice of staff training

< Stage-II: the 2nd to 5th years >

- Preparation of distribution pipeline drawings in the expanding areas for NRW reduction measures,
- Installation of a simplified telemeter system,
- Continuation of activities for NRW reduction, and
- Continuation of training

Contents of activities for NRW reduction would be composed of;

- Leak detection and repair,
- Finding and remedying illegal connections,
- Replacement of distribution and service pipes in much leakage areas,
- Replacement of water meters,
- Control of water supply pressure,
- Correction of meter error by replacement,
- Reduction of meter error and educational training for reduction of data handling errors, and institutional renovation

(2) Form of Contract and Project Organization

Although it is assumed that the NRW reduction work shall be undertaken under the performance–based contract by the Special Purpose Company (SPC) to be established by Sumitomo and MMC as the core, the concrete implementation form shall be fixed taking into account the business scale expected. However, the object of performance shall be limited to of NRW reduction rate only but not include other indicators such as the number of leak detection and repair, etc. On the other hand, the Project Management Unit (PMU) shall be established within the PAIP to accept such contract.

The SPC will address to the NRW reduction works in Temerloh District for the time being. When the business will be placed in orbit, the SPC will extend the business horizontally bringing other areas than Temerloh in view and then vertically to not only the NRW reduction work but also the overall operation and maintenance work of water services, furthermore, to the entire management of water services. Anyhow, the SPC will start the business as a trigger for NRW reduction work in Temerloh and aim to expand the business area to the entire Pahang State and then to other states than Pahang in turn in the future.

(3) Project Design Matrix

The target for NRW reduction shall be 40% for the first five yeras (the substantial working period is over four years). Assuming that the NRW reduction rate is 62% at the commencement of work, the targets by component of the NRW reduction rate are shown below.

- Reduction of Leakage including Replacement of Pipes: 20 % (40%)
- Minimization of Metering In-accuracy: 8 % (16%)
- Correction of Illegal Connections: 2% (3%)
- Unbilled measured water 0% (3%)

Total NRW reduction rate 30%

Note:
Figures in parentheses shows the estimated component percentages to the present water distribution amount.

The long-term NRW reduction is set at 20% ten years after the commencement of measures. After that, since the environment surrounding the business will be expectedly changed largely, the working contents for NRW reduction shall be reviewed and the targets for the NRW rate shall be reset corresponding to the social environment and improvement status of financial conditions at that time.

(4) Project Monitoring by PIs

Relating to the project activities proposed above, following PIs in **Table II-3.4** would be estimated periodically as an activity for project monitoring. Baseline values shall be the previous year statistics in principle but will be settled through the detailed survey in the first year.

When assuming the commencement of the business from 2013, project indicators are as shown in **Table E-2**.

Table E-2 Progress Management of NRW Reduction Project using PIs

Monitoring PIs	2012	2017
Proportion of Meter with less than 7 years	60 %	100 %
Proportion of Pipe with younger than 2002	(7) %	20 %
NRW Rate	(60) %	30 %

Source Prepared by the Study Team

Note: The PIs values other than the NRW rate are affected by the policy of PAIP (investment amount in material and equipment and managerial endevour) and are not directly concerned with the Project but are shown for reference.

(5) Cost Estimate

The Project cost is estimated at RM 33,800,000 for the case excluding the costs for pipeline replacement, etc. and RM 112,100,000 for the case including the above to implement the Project as shown in **Table E-3**.

Table E-3 Project Cost for Five Years

Item			Currency		
Category	Item	Sub-item	RM	JPY	USD
(1) SPC operation	Labour	Personnel	10,146,000		
		Personnel administration	1,015,000		
		Head office overhead	3,043,000		
		Travelling	1,027,000		
		Per diem & accomadation	3,819,000		
	Procurement of materials & eqipment	Local procurement of materials & equipment	538,000		
		Carrying equipment	767,000		
	Office expenditures	Rental	420,000		
		Office supply	93,000		
		Office maintenance	89,000		
	Conveyance & Transportation of equipment		42,000		
	Engineering cost		3,040,000		
	Overhead		6,219,000		
	Total (I)		**30,258,000**	**786,700,000**	**9,834,000**
(II) Outsourcing	DMA installation **(A)**		1,080,000		
	Simlified telemetering system installation **(B)**		2,438,000		
	Leak repair (15,200 locations)		5,970,000		
	Pipeline replacement (200 km,including water service pipes)		52,715,000		
	Meter replacement (39,000 units)		7,119,000		
	Total (II)		**69,322,000**	**1,802,400,000**	**22,529,000**
(III) Contingency	Physical contingency		2,080,000		
	Price and exchange rate valuation		10,398,000		
	Total (III)		**12,478,000**	**324,400,000**	**4,055000**
Total (I)+(A)+(B)			**33,776,000**	**878,200,000**	**10,977,000**
Total (I)+(II)+(III)			**112,058,000**	**2,913,500,000**	**36,419,000**

(6) Effectiveness

The benefit that PAIP Temerloh will receive from the Project implementation is shown in **Table E-4** From the table, the profit by the Project implementation is estimated at RM 89,600,000 in total for five years. As a result, the net balance by deducting the project cost from the benefit by the Project implementation is RM 55,089,000 for five years in case that the pipeline replacement cost, etc. are excluded, while RM (-)22,1938,000 in deficit in case that the pipeline replacement cost, etc. are included.

Table E-4 Income and Expenditure by Project Implementation (Five Years)

Difference between Project Cost & Expenditure	Cost			Remarks
	RM	JY('1,000)	USD	
(A) Benefit by Project Effect				
(1) Pipe Replacement	19,800,000			Service pipes and distribution pipes 200 km
(2) Correction of Theft & Meter Error	34,000,000			Meter 39,000 units
(3) Leak Repair	19,300,000			15,200 points
(4) Construction Containment of New Water Treatment Plant	16,500,000			Cap.: 6,600 m^3/day
Subtotal (1)+(2)+(3)+(4)	89,600,000	2,330,000	29120,500	

(B) Project Cost 1: Excluding all the costs	33,511,000	871,300	10,891,000	Refer to **Table II-3.1**
(C) Project Cost 2 : Including all the costs	111,793,000	2,906,600	36,333,000	
Balance: (A) - (B)	55,089,000	1,458,700	18,229,500	
Balance: (A) - (C)	-22,193,000	-576,600	-7,212,500	

2.3 Status and Movement of Third Country's Companies for the Project in Question

There is no movement of third country's company for the Project in Temerloh, Pahang, although local tenders for NRW reduction in Kuantan and Pekan, using the Federal Government's budget was declared on January 12, 2012.

The contents of these bids shall be the case study to propose the NRW reduction project. Outline of the bid are as follows:

1) Conditions for the Bidding Qualifications
- Experience in NRW reduction project/s in Malaysia. The total contract amount shall be RM 10 million or more.
- Experience in GIS or hydraulic pressure model, as well as knowledge in NRW
- Qualified in all related fields such as NRW, GIS, hydraulic pressure model, software, SCADA, etc.

2) Overview of the City Water of Kuantan
- Total length of water pipes (approx.): 2,200 km
- Number of households connected to city water: 117,000 households (110 DMAs & 45 Pressure Management Area (PMA))
- Water supply volume: 140.86 million cu. m/ year
- Consumption volume of billed water: 71.60 million cu. m/ year
- Rate of NRW at present: 54.12% (baseline to be discussed separately)

3) Scope of Work of Contractor
- The NRW rate shall be reduced by 15% from the agreed baseline, or 25% from the current rate; either of the higher rate shall be achieved. However, replacing the main pipes is not included in the scope of work. The period for achieving the target is 3 years and the target shall be 35% by reducing 15% from the agreed baseline at 50%, or, if the baseline is at 35%, then the target shall be 25%.
- GIS, hydraulic pressure model, setup of DMA/PMA, replacing water meters, inspection on water leakage, water leakage repair, and remote measurement / SCADA /
- NRW IT management system.

4) Guarantee and Bonus
- Deduction of 5% from the Performance Bond when the target is not achieved.
- Bonus is awarded when 20% or more reduction is achieved.

2.4 Need for the Project

(1) Basic policy for Evaluation

Policies for evaluation are set as follows:
- The project meets the national policy.
- There is a nationwide need for the Project.
- The Project contributes to an improvement of water operators' financial conditions.
- The Project is technically feasible.

(2) Needs Assessment

Some water operators, such as in Pulau Pinang have been successful in reducing NRW, but in others

such as in Pahang NRW has increased in recent years. As far as the national average is concerned, NRW has reduced marginally in the last 10 years from 40.03% in 2000 to 36.37% in 2010, or 0.37% per annum.

While SYABAS, a water service operator covering Kuala Lumpur and the State of Selangor, reported that they could achieve a reduction in NRW in from 42.78% in 2005 to 32.39% in 2009 and evidenced that they could do it, if tried.

For Malaysia, which aims at becoming an advanced country by (?) 2020, it is urgent to reduce NRW to the level in countries that are advanced in the water services industry.

(3) Economic Evaluation

In general, NRW reduction leads to the following economic benefits:

- Since the existing water supply facilities can augment their capacities substantially through NRW reduction, investment in new facilities can be reduced.
- The wasteful operation and maintenance cost spent for NRW production, transportation and distribution can be reduced.
- NRW reduction can stop the wasteful use of water resources and achieve efficient water use.
- If old pipes and meters are left as they are, NRW changes for the worse; however, if they are replaced by those of new material or higher specification, accuracy of meters improves and asset life increases.
- A meter has a tendency of under-registration as the years pass by. This is the reason why the customer does not want to replace it even after seven years have passed by.

Replacement of meters as part of NRW reduction measures is expected to increase the revenue from tariffs.

(4) Priority Evaluation

As stated earlier, since NRW reduction results in a decrease in investment required for construction of new facilities, cuts the wasteful operation and maintenance cost for NRW and expectedly brings an increase in revenue from tariffs, it contributes significantly to achieving a substantial improvement in the financial condition of water service operators. Therefore, NRW reduction measures should be implemented as soon as possible in order to progress towards sustainable operation and management of water services.

(5) Maturity Evaluation

The treatment plant reserve margin calculated by dividing a water treatment capacity by an actual production amount varies stably in the range of 15% to 25% for these ten years during 2000 to 2010 and there is less problems. It is high time to address NRW reduction.

(6) Technical Evaluation

If replacement of old pipes and meters, leakage detection and repair of damaged pipes is carried out steadily and continuously, NRW can definitely be reduced. For this purpose, it is imperative to invest in replacement and to enhance the skills of employees regarding leakage detection and repair through training and continuous practice. Although financing for such investment should be considered separately, technology itself can be mastered by employees, if they are highly motivated, receive proper training and guidance and have appropriate and adequate instruments. Some water service operators in Malaysia have already demonstrated that NRW can be reduced by implementing leak detection, investing in training, etc.

2.5 Objectives of the Project

The objectives of the Project are to stabilize the sustainable management of water service operators through NRW reduction and to attain full cost recovery with more appropriate tariff level in the

earliest possible time.

2.6 Demand Projection for the Projects

In Malaysia in 2010, NRW was less than 30% in five states, namely Johor, Labuan, Melaka, Pulau Pinang and Perak, while it was more than 40% in six states, namely Kelantan, Pahang, Perlis, Sabah, Kedah and Negeri Sembilan.

In recent years some states have been successful to varying degrees in reducing NRW, however others have not managed to reduce NRW significantly and in some states NRW has increased. The demand for NRW reduction is very high.

2.7 Project Risk

In the State of Pahang, the customer is required to pay the cost of water meter procurement and its installation work at the time of connection to water pipes and thereafter the replacement cost is borne by a water service operator. As long as there is no requirement or claim for meter replacement by the customer, it is normal for a water service operator to not replace meters proactively. As a water meter has a tendency to show under-registration figures as time has elapsed, as stated previously, there are few requests from customers to replace meters. Thus meters are typically used for longer periods than the recommended asset life. Replacement of old meters is undoubtedly one of major measures for NRW reduction and whether a customer agrees to replace his/her meter, resulting in an increase of the bill to be paid, is a key issue.

2.8 Environmental and Social Consideration

The main scopes of project are;

- To establish DMAs,
- To replace service installations and distribution pipes, and
- To work leakage control.

To examine the advantages and dis-advantages for each work, necessity of (i) land alternation and (ii) existence of protected areas were compared. Beside, (iii) other conceivable major environmental and social impacts were identified quantitatively. **Table E-5** shows the comparison of major conceivable environmental and social impacts for each work.

Table E-5 Comparison of Major Conceivable Environmental and Social Impacts

Alternatives	Establishment of DMAs	Pipe Replacement	Leakage Control
Land Alternation	No settlement is required.	No settlement is required.	No settlement is required.
	Negative	Negative	Negative
Protected Area	None.	None.	None.
	Negative	Negative	Negative
Major Impacts	Construction environment will be affected within limited site and period.	Construction environment will be affected along the pipeline and limited period.	None.
	Positive	Positive	Negative

Source: Prepared by the Study Team

In this regard, the project is to be judged as “Category B” in accordance with “JICA Guidelines for Environmental and Social Considerations” since the impact of the project is considered to be less compared to the case of “Category A.”

EIA process was formally established by virtue of the Federal Government (DOE, Ministry of Natural Resources and Environment). In the sector of water supply, the EIA report shall be

required for the new development of water source and the new construction of water treatment plant since there will be impacts to the surrounding environments. Although this project may not be required to prepare an EIA report since the project involves a replacement works of existing pipes.

The factors of environmental and social impacts accompanied by replacement of service and distribution pipes are considered as below.

- Air pollution: dust, emission gas, etc.
- Wastes: excess soil, debris, etc.
- Noise and vibration
- Traffic near construction sites

In construction stage of the project, the typical impacts mentioned above may occur, although they are temporal. The PMU and the SPC are required to take countermeasures in order to minimize the impacts through proper management of the project.

3 Sewerage Sector

3.1 Situation of the Study Area

The study area is located in the upper reach of the Langat River and adjoins to Kuala Lumpur. Through the development of road network including the expressways, the area has rapidly developed as a satellite city of the national capital. The population of Cheras and Kajang involving the study area has rapidly increased from 68,779 in 1980, to 164,141 in 1991, 393,205 in 2000 and 559,700 in 2010.

In such a situation, the housing estates has been developed throughout the study area, which has resulted in a number of small scale sewage treatment plants, namely 94 plants in Cheras, 83 plants in Kajang and 177 plants in total. They are now under the operation and maintenance of IWK.

The catchment strategy for Cheras and Kajang Catchments has a plan to subdivide the area into six subcatchments, namely Cheras Batu 11, Cheras Jaya, Kajang 1, Kajang 2 and Kajang 3 and construct the centralized sewage treatment plant at each subcatchment. Out of them, the construction of Kajang 2 centralized sewage treatnrent plant has already commenced. Since Kajang 1 was combined with Kajang 3 due to no possibility of land acquisition for the sewage treatment plant, the construction of three centralized sewage treatnrent plants will be constructed in Cheras Batu 11, Cheras Jaya and Kajang 1&3, respectively, in the future.

3.2 Outline of Proposed Project

(1) Outline of Proposed Project

The PPP scheme proposes to integrate the above three subcatchments, namely Cheras Batu 11, Cheras Jaya and Kajang 1&3 into one and construct only one centralized sewage treatment plant at the site for Kajang 1&3 sewage treatmentt plant. The construction of a trunk sewer network is also involved in the plan to collect and convey all sewage from the above three subcatchment to the new centralized sewage treatment plant.

Design Parameters are as follows:

Service area	Cheras Batu 11, Cheras Jaya and Kajang 1&3	
Design population	539,900 persons (2035)	
Design PE	920,000 PE (2035)	
Trunk sewer network	300~2,000 mm 16.5 km (Including two pumping stations)	
Branch sewer network	100~1,050 mm 89.7 km (Including 24 pumping stations)	
Centralized Sewage Treatment Plant		
Design flow	104,000 m^3/day (Phase I), 207,000 m^3/day (2035)	
Target effluent quality		
	BOD_5	10 mg/L
	SS	20 mg/L
	COD	60 mg/L
	AMN	5 mg/L
	NO_3-N	10 mg/L
	O&G	2 mg/L
Sewage treatment process		
	Step feed two stage biological denitrification process.	
Sludge treatment process		
	Thickening - Digestion - Mechanical dewatering	
Construction cost	RM 1,135.919 million (JY 29,893 million)	
Annual O&M cost	Sewage treatment plant	RM 20,969,742
	Pumping station	RM 6,400,000
	Sewers	RM 192,000

Note:

1) The connection work of approximately 15,000 individual septic Tanks to a sewer system is provided as an option.
2) The photovoltaic power generation using solar panels installed on the roof of the sewage treatment plant, power generation using the digestion gas generated from sludge digestion tanks, reuse of sewage sludge as fertilizer and reuse of sewage effluent are provided as options.

(2) Framework of Proposed PPP Scheme

The framework of the proposed PPP scheme is shown in **Figure E-1**.

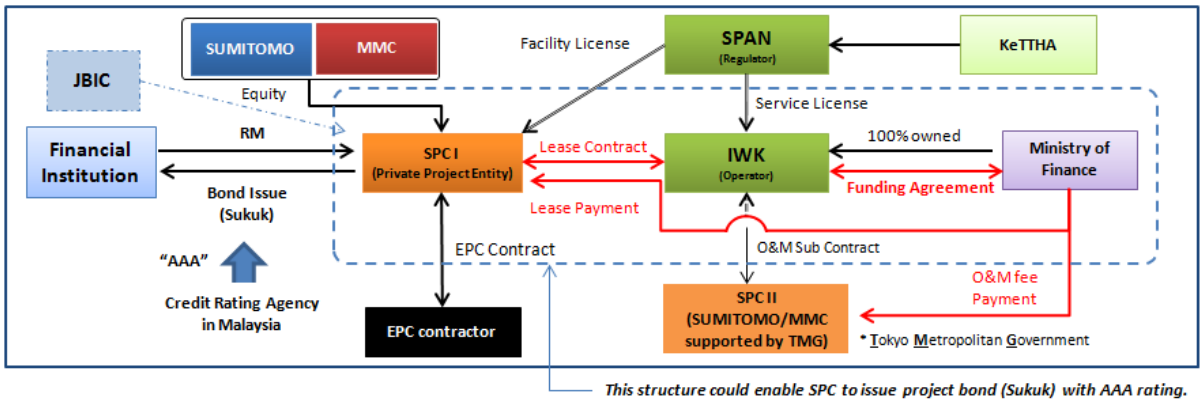


Figure E-1 Framework for Proposed PPP Scheme

1) Investment Structure

Shareholder's funds provided by private companies will finance the equity portion of the LMP. **Two Special Purpose Companies ("SPC")** will be established by MMC and Sumitomo:

- **SPC I** will be responsible for **development, design, engineering, procurement, construction and financing.** A lease contract will be arranged among SPC I, IWK and MOF. Upon obtaining a facility license from SPAN, SPC I is to be a facility owner of the project. Lease payments will be paid by MOF.
- **SPC II** will be responsible for **O&M** of the plant. The O&M sub-contract will be arranged among SPC II, IWK and MOF where O&M fee is to be paid by MOF. The service license will be owned by IWK and is sub-contracted to SPC II.

2) Overview

In line with our key underlying beliefs, this proposed financing plan utilises private finance in the form of Islamic bonds (sukuk) issued by the SPC (held by private sector shareholders), and is secured with a lease payment agreement with MOF to support the funding of the LMP.

3) Annual Lease Payments for CAPEX

The total estimated project cost up to RM1,339 million is planned to be financed with a 80:20 debt to equity ratio; i.e. RM1,073 million in debt and RM266 million in equity. Annual lease payments from MOF will only commence after the commercial operation date in 2016 for 20 years. This translates into and annual lease payment of RM167 million.

4) Annual OPEX Payments

To facilitate the provision of O&M services to the LMP, an O&M subcontracting company will be established by MMC/Sumitomo. The company will provide O&M service to the LMP for 20 years after the commercial operation date in 2016.

The average annual estimated OPEX is approximately RM31 million, including the sludge disposal cost.

3.3 Status and Movement of Third Country's Companies for the Project in Question

There is no movement of third country's company for the Project in Cheras and Kajang Catchment, Kajang, Selangor. However the consulting services for construction of Kajang 1&3, Cheras Batu 11 and Cheras Jaya Regional Sewage Treatment Plants have been tendered respectively since October 5, 2011 and JPP, KeTTHA has already completed the consultants' selection as of the beginning of March 2012. These are to construct a centralized sewage treatment plant respectively in three sub-catchments based on the idea in Antara Report. On the contrary this Study proposes to construct only one centralized sewage treatment plant to cater all sewage generated from three sub-catchments under the PPP scheme, which is, therefore, competitive with the above JPP's plan. The adoption of the proposed PPP scheme depends on whether the tables can be turned.

3.4 Need for the Project

(1) Basic policy for Evaluation

Policies for evaluation are set as follows:

- The project meets the national policy.
- There is a nationwide need for the Project.
- The Project contributes to an improvement of water operators' financial conditions.
- The Project is technically feasible.

(2) Needs Evaluation

Sewerage services in Malaysia has been under the operation and maintenance of IWK under the concession contract after the sewerage facilities has been transferred to the Federal Government under the enactment of the Sewerage Services Act in 1993. The sewage treatment plants transferred to the Federal Government has counted more than 9,000 plants in vast numbers, out of which a majority of plants has a treatment capacity of less than 2,000 PE. There are a variety of treatment processes adopted and some of them cannot meet the sewage effluent standards. For this reason, In Selangor, the small scale sewage treatment plants with a treatment capacity of less than 2,000 PE shares 70.5% of the total but the per PE operation and maintenance cost is 52.79 RM/PE which is more than four times of that with a treatment capacity of more than 50,000 PE, or 11.26 RM/PE which is obviously inefficient in operation and maintenance. For this reason, the abandonment and integration of small scale sewage treatment plants is the urgent issue in the sewerage sector.

(3) Economic Evaluation

- The total treatment capacity of 5,398 small scale sewage treatment plants with a treatment capacity of less than 50,000 PE is 12,924,580 PE. Assuming that these plants can be operated and maintained with the same per PE O&M cost as sewage treatment plants with a treatment capacity of more than 50,000 PE, the total O&M cost is reduced to RM145.531 million from the present RM389.997 million by RM389.997 million or 62.7% with a great economic advantage.
- Some of the existing small scale sewage treatment plants may be used as a lift station to pumped sanitary sewage to the trunk sewer lines leading to a centralized sewage treatment plant, but the remaining plants can be used for other purposes and contribute to improve the living environment through no more occurrence of smell and flies and mosquitos
- By abandoning existing small scale sewage treatment plants and constructing the new plant that can meet the sewage effluent standards, the pollution load generated from the sewage treatment plants that they say the biggest pollution source for public water bodies, can be reduced greatly.
- The operation and maintenance of existing small scale sewage treatment plants is carried out through patrol and inspection, however the housing estate developments have been still going on in the metropolitan area due to economic development and population concentration, the number of plants that IWK has to operate and maintain has increased by 200 plants per annum. The IWK's O&M system cannot catch up with this speed and it is difficult to say that the existing plants are not well operated and maintained. By constructing the new centralized sewage treatment plant and a new trunk sewer system and connecting such new housing

scheme developments to the sewer system, such problems will be expectedly solved and the proliferation of small scale sewage treatment plants will be controlled.

(4) Priority evaluation

KeTTHA has a policy that all existing small sewage plants located in the urban areas to be rationalized and connected to the regional sewerage system by 2020 and is now processing the tender for construction of four centralized sewage treatment plants in Cheras Batu 11, Cheras Jaya, Kajang 1&3 and Kajang 2 in Cheras and Kajang area where a part of the metropolitan area, Out of which, Kajang 2 Centralized Sewage Treatment Plant has just started its construction work and other three plants are now in the stage of consultants' selection. Therefore, the priority of the Project is very high.

(5) Maturalition evaluation

In addition to the description in above (4), the site for the centralized sewage treatment plant has been already procured by JPP, the construction work can be commenced at any time.

(6) Technical evaluation

The advanced technologies in the sewerage sector are introduced in the proposed Project. Green technologies such as digestion gas power generation, photovoltaic power generation above the sewage treatment facilities, utilization of sewage sludge are provided as options. For these application technologies, it is arranged that the Tokyo Metropolitan Government with sufficient experience and knowhow in operation and maintenance of sewerage facilities will be responsible for the long-term technical guidance and technology transfer to the local staff, so that the happening that although the advanced technologies are introduced, they cannot be handled by the local staff, will not occur.

3.5 Objectives of the Project

Through abandoning the existing small scale sewage treatment plants that have been not well operated and maintained and constructing the new centralized sewage treatment plant that can meet the sewage effluent standards, the project will contribute the improvement of water pollution in the public water bodies and improve the living environment of the surrounding people by sweeping away a variety of problems attributed to the defects of the existing plants.

3.6 Demand Projection for the Projects

In Malaysia, the sewerage catchment strategies and sludge management plans has been prepared for many areas and cities and the sites for future sewage treatment plants has been procured, however the actual sewerage development has been delayed due to limited investment in the sewerage sector and cannot catch up with the economic development and urbanization progress, resulting in no significant improvement of water pollution in the public water bodies. The Project proposes to introduce the private fund into sewerage development as the model project for the PPP scheme. If it will be successful, such approach can be applicable to other sewerage projects with a possibility to expand sewerage development in Malaysia remarkably. There is a high potential demand not only in the metropolitan area but also in the core cities in other areas where the public sewerage system has not been implemented with the public fund.

3.7 Project Risk

To realize the Project proposed in this Study, there are some conditions to be cleared as follows:

- The Malaysian Government and IWK, of which both are concerned with the concession contract of sewerage services in the Peninsula, will allow that the Special Purpose Company (SPC) will construct and own the centralized sewage treatment plants and a sewer system in the study area.
- The Ministry of Finance will make a contract with the SPC to pay the lease fee for the sewerage facilities to be leased to IWK during the leasing period.

- The SPC will get the triple A rating under the payment assurance by the Ministry of Finance based on the lease contract and issue the Islamic bond to raise the low-interest Malaysian Ringgit.
- The SPC shall be given the assurance from SPAN to renew the license as the facility operator every three years during the leasing period or if failed, the conditions on the contract termination shall be clearly defined including the purchase clause by the Malaysian Government.

One by one mentioned above is the condition to be cleared for realization of the Project but also the risk that the Project involves.

3.8 Environmental and Social Consideration

(1) Scoping

The Project is classified into Category B based on the scoping as shown in **Table E-6**.

Table E-6 Scoping List

Category	No	Impact Items	Evaluation		Evaluation Reasons
			P-Const* U-Const*	Operating*	
Mitigation Measure	1	Air Pollution	B-	D	U-Const: Degradation of air quality is supposed on the temporary basis by operation of construction machines and vehicles. Operating: Degradation of air quality will not be caused because pumps, blowers, and motors are always operated by commercialized electric power. Digester gas power generation is planned. In the collecting stage of a little sewage, the gas amount may be very little. Methane gas which largely affects to greenhouse warming is burned and it is exhausted as CO_2. Thus, air pollution may happen in some degree.
	2	Water Pollution	B-	B+	U-Const: water pollution may be caused by discharged water derived from construction site, construction machines and vehicles and workers' camp. High turbidity water may be discharged to the Langat River through existing artificial canal from construction site and by the construction works for the outlet with discharge pipes. Operating: Water quality of effluent from the STP is planned to apply "Standard A" of "Sewage Industrial guidelines in Malaysia" (to be applied for discharge of effluent in the river where an intake point for water supply is located in the upstream). Heretofore, effluent from simple sewage treatment system and septic tanks were directly discharged to the river. The proposed STP will discharge comparatively clean effluent less than standard A by sewage treatment. Thus, water pollution will be improved.
	3	Waste	B-	B-	U-Const: Construction waste soils and scrap woods will be produced. Operating: general waste will be produced by workers at a completed STP. All the sludge is planned to sell to fertilizer company as fertilizer. If it is not bought into reality, the sludge shall be dumped in dumping site.
	4	Soil Contamination	B-	D	U-Const: soil pollution which may be caused by oil spill of construction machines is supposed. Operating: adverse impact to environment is not

					supposed.
	5	Noise and Vibration	B-	B	U-Const: noise and vibration caused by construction works, operation of construction machines and vehicles are supposed. Operating: adverse impact to environment is not supposed.
Social Environment	19	Existing Social Infra and Social Service	B-	B+	U-Const: traffic congestion at the local roads in the periphery of proposed STP site is supposed. Operation: As vehicles for transportation of sludge and aggregating agent only a few times pass through roads, adverse impact for traffic will not almost happen. Since treated effluent with better quality is discharged into the Langat River through existing artificial canal by the proposed STP, fluvial environment will be improved and residents' life will be good sanitary condition. Thus, it will become the upgrading of social service.
	28	Work Environment (Including Safety Control)	B-	D	U-Const: It is necessary to make an arrangement for work environment (including safety control) of construction workers.
Others	29	Accidents	B-	B-	U-Const: It is necessary to make an arrangement on construction accidents and handling accidents of construction machines and vehicles. Falling-down of workers from height must be protected Operation: It is necessary to make an arrangement on handling accidents of operating equipment. In the maintenance works of sewers, oxygen deficiency and generation of hydrogen sulfate must pay attention for workers life's protection. Falling-down of workers from height must be protected
	30	Trans-boundary Impact and Climate Change	D	B+	The project is to construct centralized STP. It will not almost affect trans-boundary impact. To somewhat cope with global heating, solar panels on the top of the proposed STP are set up and it is planned to generate about 1 Giga Watt. Furthermore, digester gas–power generation (about 400 KW) is planned. The generated power will cover a part of electric requirements of proposed STP.

Source: Prepared by the Study Team

Note: P-Const*: Pre-construction stage, U-Const*: Under construction stage, Operating*: Operating stage; STP: Sewage Treatment Plant.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive /negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses.)
D: No impact is expected.

(2) Stakeholder Meeting

The project is in the preliminary stage and the implementation agency for the project is not still fixed. Project design is also under processing.

Under this situation, to hold stakeholder meeting with residents around the proposed STP site is in premature stage because it may cause surprised happening. Thus, the stakeholder meeting shall be conducted through the implementation agency after the implementation agency and the project design are fixed in the design stage.

(3) Necessity of Land Acquisition and Resettlement

There are no squatters excluding 5 houses at lot number 347 in land acquisition. According to IWK, these 5 houses originally are rented to other people as commercial business with house building by land owner. It is his free if how kinds of business are carried out by land owner. If buying and selling are agreed between government and land owners, tenants shall transfer to another lands based on the discussion with land owners. But it will generally need notification from land owners to tenants one – two months ago.

Acquisition of the necessary land for the proposed STP is conducted based on Land Acquisition Act and in addition, there are no squatters in the area. Thus, it is judged that there are no issues on necessary of the resettlement by squatters. .

(4) Adverse Impact and Mitigation Measures at Construction and Operation Stages

1) Adverse Impact and Mitigation Measures at Construction Stage
   - Soil erosion from cut and fill, and temporary sedimentation of natural waterways
   - Adverse impacts on surface hydrology
   - Ground and surface water contamination by oil, grease and fuel
   - Creation of stagnant water bodies in dumping site of surplus excavation soils, borrow pits, and quarries, etc. suited for mosquito and other vectors to breed, impairing aesthetics or posing danger to humans/animals
   - Dumping of surplus excavation soils caused by pipe laying
   - Noise and vibration pollution at the time of pipe laying and construction of treatment plant
   - Fog and dust during construction works
   - Traffic accidents and disturbance during pipe laying works in roads
   - Accidents by entrance and exit of construction vehicles at construction site
   - Dirtied road by adhering tires of wetted soils and fallen objects by vehicles for transportation of equipment and materials and surplus excavation soils
   - Discharge of muddy water by construction works
   - Wastewater and solid waste caused by construction sites and camps
   - Safety control of construction workers
   - Safety control and management on installation of machineries and equipment at STP

2) Adverse Impact and Mitigation Measure at Operation Stage
   - Disposal of sludge generated by sewage treatment from STP.
   - In the target year of 2035, sludge of 130 kg/day (25,971 kg/day) with water content of 80 % is generated.
   - Noise pollution caused by blowers and main pumps booster pumps of intake facility and treatment plant, and generator
   - Bad odor generated by STP

In addition, the buffer zone is maintained in accordancewith the requirements by DOE

(5) Monitoring Plan

Adverse impacts and mitigation measures at construction and operation stages and monitoring plan for environmental protection are prepared.

.

PART I

GENERAL

1 Socio-economic Conditions in Malaysia

1.1 General Information and Population

Malaysia is a federal nation, which is composed of eleven states in Peninsula Malaysia, two states, namely Sabah and Sarawak in Borneo Island and the three federal territories of Kuala Lumpur, Putrajaya and Labuan (in Borneo Island) with a total land area of 330,803 km^2 [1].

Malaysia had a total population of approximately 28.3 million in 2010[2]; however the annual population growth rate has declined from 2.64% and 2.60% in the periods from 1980 – 1991 and 1991 – 2000 respectively to 2.00% in the period from 2000 – 2010. Regarding the state-wise distribution of population, the population in the State of Selangor has almost doubled from 10.86% of the total population in 1980 to 19.28% in 2010, with the population in the State of Sabah increasing from 7.07% to 11.32% in the same period (all figures being of the total population). The percentage of the population living in each of the remaining states is lower in 2010 than in 1980, with the exception of in W.P. Labuan.

In the period from 2000 to 2010, W.P. Putrajaya (which became a federal territory in 2001) had a significantly higher annual average growth rate in the population than other states, with a growth rate of 17.8 %, followed by Selangor (2.7%), Melaka (2.6%) and Sabah (2.1%). The growth rates in some states, including Perak, Perlis and Terengannu, in the same period was less than 1.5%.

About a quarter of the population (25.44%) reside in the Metropolitan area consisting of Kuala Lumpur, Putrajaya and the State of Selangor. Population density in Malaysia as a whole is highest in Kuala Lumpur at 6,891 persons/square kilometer as of 2010, with the densities in Putrajaya and Selangor being 1,478 and 674 persons/square kilometer respectively in the same year. In the remaining states population density exceeds 500 persons/square kilometer only in Pulau Pinang and W.P. Labuan with the density in Pahang, Sabah and Sarawak being less than 50 persons/square kilometer (all in 2010).

The proportion of urban population increased to 71.0% in 2010 from 62.0% in 2000. Both W.P. Kuala Lumpur and W. P. Putrajaya are 100% urbanized as of 2010, with urbanization exceeding 90% in Selangor (91.4%) and Pulau Pinang (90.8%). Urbanization is lowest in Kelantan (42.4%), Pahang (50.5%) and Perlis (51.4%).

1.2 Economic Condition

The Tenth Malaysia Plan[3] describes the economic growth of Malaysia during the period of the Eighth (2001-2005) and Ninth Malaysia Plan (2006-2010) as follows:

Malaysia has experienced a period of high economic growth over the last few decades, propelling the nation from an agricultural and commodity-based economy to become a prosperous thriving middle-income nation. Malaysia's real Gross Domestic Product (GDP) has grown by an average of 5.8% per annum from 1991 to 2010. This growth rate has helped improve the quality of life for Malaysians and supported widespread advances in education, health, infrastructure, housing and public amenities.

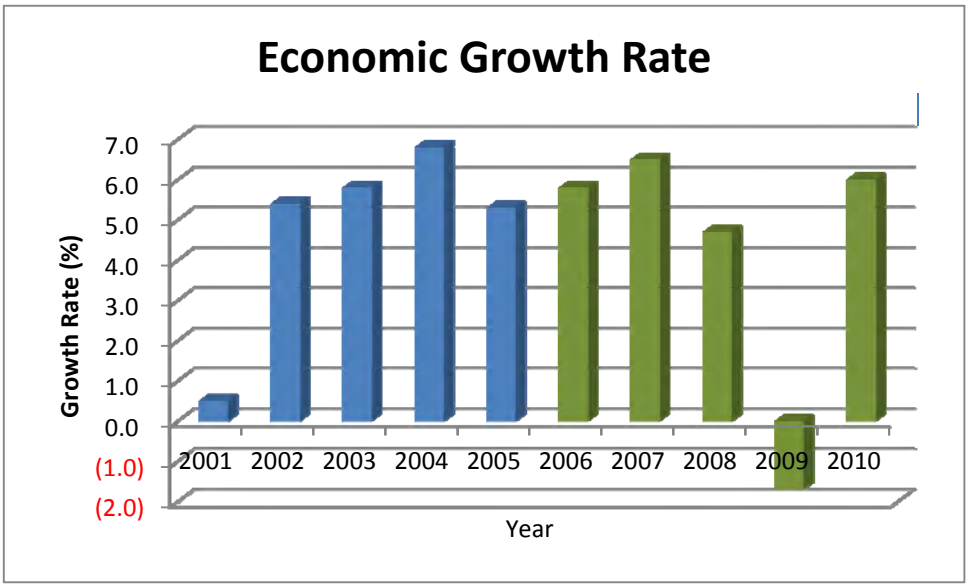
During the Ninth Malaysia Plan period, 2006-2010, the country progressed in the achievement of the National Mission to transform Malaysia into a developed nation by 2020. Though the growth momentum has recently slowed down due to the global economic and financial crisis, public spending through the two economic stimulus packages and accommodative monetary policy have

[1] Compendium of Environment Statistics, Malaysia 2010, Department of Statistics, Malaysia
[2] Population Distribution and Basic Demographic Characteristics 2010, Department of Statistics, Malaysia (information in this and following two paragraphs is also from this source)
[3] Tenth Malaysia Plan 2011-2015, published by the Economic Planning Unit, Prime Minister's Department 2010

helped the nation recover. Looking ahead, Malaysia is now at an important juncture in its economic development to chart its path towards becoming a high-income economy by the year 2020. For this, the nation will need to build upon the strong platform created by the country's past achievements.

The global economic environment is, however, changing in ways that will make it more challenging to generate high rates of economic growth. There is now slower global economic growth, while competition for investment, trade and talent is more intense. In this context, Malaysia will need to intensify efforts to generate the growth required to achieve its targets under the Tenth Malaysia Plan, 2011-2015.

According to the Tenth Malaysia Plan, real GDP growth slowed in the Ninth Plan period to 4.2% per annum from 4.7% per annum during the Eighth Plan period. **Figure 1.1** shows the real GDP growth rate during the period from 2001 to 2010, as included in the Tenth Malaysia Plan, with the figure for 2010 being an estimate by the Economic Planning Unit as of May 2010.



Source: Tenth Malaysia Plan

Figure I-1.1 Real GDP Growth Rate of Malaysia 2001 to 2010

Actual GDP in 2010 was 7.2%[4], which was higher than forecast in the Tenth Malaysia Plan, although in 2011 growth slowed to 5.2%, 4.3% and 5.8% in each of the first three quarters.

The Kuala Lumpur cluster including Kuala Lumpur, Klang, Petaling Jaya, Subang Jaya, Ampang Jaya, Shah Alam, Cheras and Kajang contributes about eight times the GDP of the second cluster in term of contribution to GDP[5]. In this cluster GDP increased by 10.8% and 9.2% in 2010 in Selangor and W.P. Kuala Lumpur respectively, with growth in the other states varying from 2.4% to 6.0%, apart from in Johor (9.3%) and Pulau Pinang (10.0%).[6]

1.3 Social Condition

The 2011 Human Development Report[7] prepared by the United Nations Development Programme (UNDP) includes information on the Human Development Index (HDI). This index is a composite statistic, which is used to rank countries by level of "human development" and distinguish "very high human development", "high human development", "medium human development", and "low human development" countries. The HDI is a comparative measure of life expectancy, literacy, education

[4] Department of Statistics, Malaysia (all figures in this paragraph)
[5] World Gazeteer, Department of Statistics, Malaysia
[6] Department of Statistics, Malaysia
[7] Human Development Report 2011, United Nations Development Programme

and standards of living for countries worldwide.

Malaysia's HDI value for 2011 is 0.761, which is in the high human development category, as it has been since about 1995. Overall Malaysia was ranked 61st out of 187 countries and territories in 2011 and compares favorably to the East Asia and Pacific Region, for which the average HDI for 2011 was 0.671, and also to the world average of 0.682. However, significant progress is still required for Malaysia to have a comparable HDI to the very high human development index.

Table I-1.1 shows HDI indicators as well as HDI for selected countries and groups in 2011.

Table I-1.1 Malaysia's HDI Indictors 2011 relative to selected countries and groups

Country/Group	HDI Rank	HDI Rank	Life expectancy at birth	Expected years of schooling[1]	Mean years of schooling[2]	GNI per capita (2005 PPP$)
Malysia	0.761	61	74.2	12.6	9.5	13,685
Thailand	0.682	103	74.1	12.3	6.6	7,694
Vietnam	0.593	128	75.2	10.4	5.5	2,805
East Asia and Pacific	0.671	-	72.4	11.7	7.2	6,466
High HDI	0.741	-	73.1	13.6	8.5	11,579

Notes
1. Total number of years of schooling a child of school-entrance age can expect to receive if prevailing patterns of age-specific enrolment rates stay the same throughout the child's life.
2. Average number of years of education received in a life-time by people aged 25 years and over.
Source: UNDP Development Report 2011

Between 1980 and 2011 Malaysia's HDI value increased from 0.559 to 0.761, an increase of approximately 36%, with the annual average increase of 1.0%. **Table I-1.2** shows Malaysia's progress in each of the HDI indicators as well as HDI between 1980 and 2011.

Table I-1.2 Trends in Malaysia's HDI (1980-2011)

Year	Life expectancy at birth	Expected years of schooling	Mean years of schooling	GNI per capita (2005 PPP$)	HDI Value
1980	67.4	9.1	4.4	4.722	0.559
1985	68.8	10.0	5.6	5,125	0.600
1990	70.1	9.8	6.5	6,375	0.631
1995	71.1	10.5	7.6	8,765	0.674
2000	72.1	11.8	8.2	9,461	0.705
2005	72.9	12.7	8.9	11,220	0.738
2010	74.0	12.6	9.5	13,192	0.758
2011	74.2	12.6	9.5	13,685	0.761

Source: UNDP Development Report 2011

In the period from 1980 to 2011 per capital GNI increased by about 190%, with life expectancy at birth increasing by 6.8 years, expected years of schooling by 3.5 years and mean years of schooling by 5.1 years.

Hardcore poverty was 0.7% in 2009, reducing from 1.2% in 2004[8]. The incidence of overall poverty

[8] Tenth Malaysia Plan 2011-2015, published by the Economic Planning Unit, Prime Minister's Department 2010

also fell from 5.7% in 2004 to 3.8% in 2009. However there were variations in poverty throughout the country in 2009 with overall poverty in Peninsular Malaysia being 2.0% and nationally the figures varying from 0.5% in Melaka to 19.7% in Sabah.

Overall poverty was lower in 2009 than in 2004 in all states, with the exception of in Pulau Pinang and W.P. Labuan. The largest percentage decrease in overall poverty in the period from 2004 to 2009 occurred in Terengganu (15.4% to 4.0%).

2 Situation and Issues in Water Services Industry Sector

2.1 The Water Services Industry Prior to WSIA 2006

(1) Water Supply Sector

Prior to the promulgation of WSIA, matters relating to water supplies and services industry were governed by the respective State Water Supply Enactments and the Federal Government had no jurisdiction over water supplies and services industry. Water infrastructures and services matters were under the jurisdiction and control of the State Governments. In some states, such as Selangor and Johor, the water services operations were privatized and private concessionaires were responsible for treating and supplying of water to consumers.

As the outlook for the water industry was plagued further by operational efficiency issues and financial constraints, the Government decided to intervene. The Government took its first initiative to reform the water services industry by amending the Federal Constitution in 2005. Provision of water supplies and services are now a shared responsibility between the State and Federal Government. Water resources such as rivers, water catchment areas and groundwater are still under the exclusive jurisdiction of the State Governments.

(2) Sewerage Sector

Before the promulgation of the SSA, there were 144 local authorities in Malaysia which were responsible for sewerage activities under their respective areas. However, they had limited funds and technical skills, hence providing limited services. The sewerage systems were in dire straits whereby:

- Only 1% of the approximately 1.2 million septic tanks were desludged and even so, these were done mainly upon request. Additionally, there was no proper sludge treatment facility available.
- 80% of the more than 3,600 public treatment plants operated by the local authorities were not functioning to the required performance levels or completely out of order.
- Sub-standard sewerage systems were built by private developers due to lack of uniform standards for sewerage designs and technical supervision of sewerage construction.
- Private plants were almost completely neglected.
- Local authorities were not making long-term investments in sewerage infrastructure.
- Sewerage masterplans were prepared by the local authorities (with technical assistance and funding from the Federal Government) for most state capitals and major towns. However, only a few of these masterplans were implemented due to lack of funding.

The administrative and legal structure at that time in Malaysia made it difficult for the sewerage services industry to progress as it faced financial constraints. The Federal Government restructures the sector by introducing the SSA. The provision of the Act allowed the Federal Government to privatise sewerage services.

By the enactment of Water Services Act in 1993, the Federal Government became the executing agency for sewerage services and the transfer of existing sewerage facilities owned by the local governments and housing estate developers has commenced to the Federal Government.

On 9 December 1993, a concession agreement was signed between the Federal Government and Indah Water Konsortium (IWK), which was established as the takeover company under the concession contract, to plan, design, construct, and maintain sewerage systems within the local authority areas in return for the right to collect tariffs from the customers. All regulatory and administrative functions of local authorities with regard to sewerage were transferred to Sewerage Services Department (SSD) with the enactment of the SSA. The concession agreement was for a period of 28 years and the period was further extended to a total period of 40 years to accommodate the additional needs of the government.

In the concession agreement, IWK was expected to undertake the following scope of work:

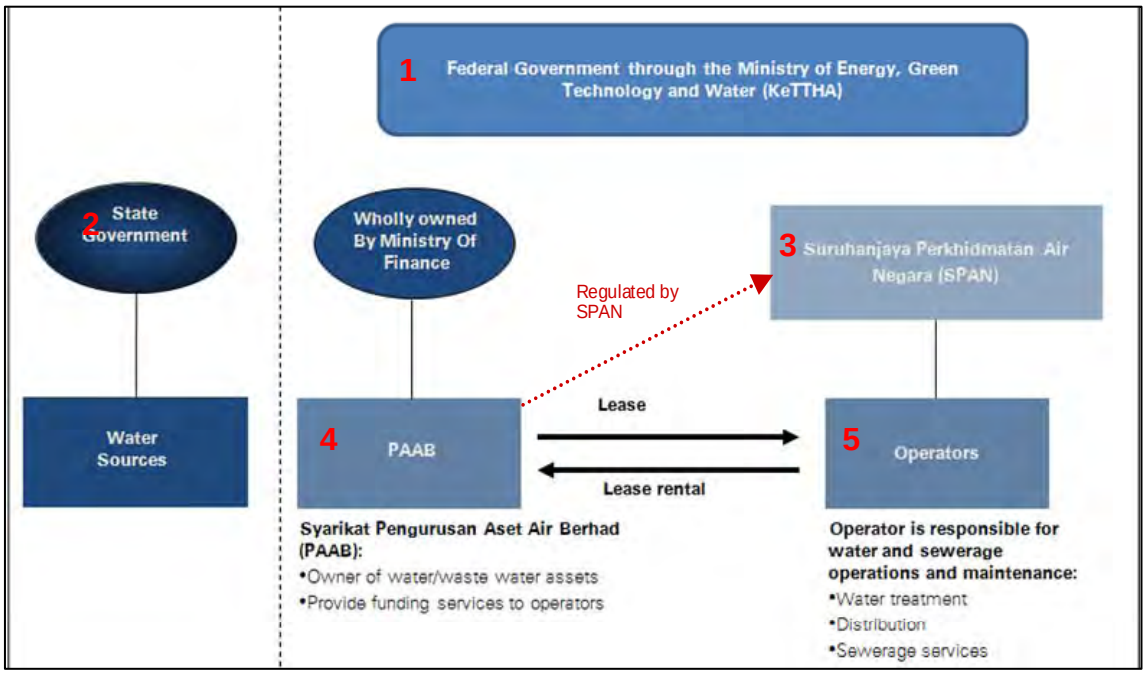
- to take over from the Government the management, operation, maintenance of the existing public sewerage systems;
- to upgrade and refurbish the existing public sewerage systems;
- to plan, design, construct and commission new public sewerage systems;
- to inspect, repair, replace, install the public sewerage systems including all structures, equipment and appurtenances forming part or parts of such public sewerage systems;
- to receive, collect, convey, gather, store, transport, treat and dispose of sewage and sewage sludge entering any public sewerage systems from private connection pipes;
- to clear, cleanse, empty, remove, transport, treat and dispose of sewage sludge from septic tanks or any other form of sewerage systems, including, but not limited to, latrines and bucket systems;
- to demand, collect, and retain sewerage charges from customers to whom the sewerage services are provided by the Concessionaire;

Over time, IWK fell into major financial constraints as the public did not consider that sewerage services were tangible. This resulted in a heavy resistance to the sudden imposition of a sewerage tariff that was not previously required. Due to the resistance in paying tariffs, IWK suffered major debts.

Eventually, IWK was bought back by the Malaysian Government in June 2000. Therefore, IWK is now a wholly owned company of the Ministry of Finance Incorporated ("MOF"); which is under the direction of the Federal Government. IWK is currently responsible for providing water sewerage services to all the States except for Kelantan, Johor, Sabah, and Sarawak.

2.2 The Water Services Industry after WSIA 2006

The Federal Government began the water services industry (consisting of water and sewerage sector) restructuring in 2004. A new operating model was introduced to reform the water services industry. There are five (5) key stakeholders which comprises of the Federal Government, State Government, the water regulator, the water asset management company and the water operators who operate the whole value chain. The new operating model is depicted in **Figure I-2.1**.



Source: The Water Tablet: Malaysian Water Reforms, 2008

Figure I-2.1 New operating model of the Malaysian Water Services Industry

The instrument to restructure or to enable the new operating model in the water and sewerage sector was based on the promulgation of the National Water Services Commission 2006 and the Water Services Industry Act 2006.

1) National Water Services Commission Act 2006 (NWSC)

The NWRC was enforced in March 2007. This established Malaysia's water commission or the Water services industry regulator, the Suruhanjaya Perkhidmatan Air Negara ("SPAN").

2) Water Services Industry Act 2006

The WSIA came into force on 1 January 2008 but applies only in Peninsular Malaysia and the Federal Territories of KL, Putrajaya and Labuan. WSIA replaces two major existing legislations which are SSA and the State Water Supply Enactments. The SSA is repealed in respect of its application to Peninsular Malaysia and the Federal Territories of KL, Putrajaya and Labuan whilst the State Water Supply Enactments are repealed in respect of its application in the states of Peninsular Malaysia.

WSIA was created to allow the Federal Government to ensure uniformity of the laws, policies and regulate the treated water supply services and sewerage services which was formerly under the responsibility of the state authorities to be under a licensing regime. More importantly, WSIA paved the way for the institutional reforms and financial reforms.

Table I-2.1 Water Value Chain Flow

	Water catchment	Storage facilities	Treatment process	Distribution system	Sewerage services	Billing system	Internal reticulation	Customer relations
State government	-Gazette catchment areas -Maintain, conserve and rehabilitate catchment areas -License of abstraction of raw water	Not applicable	-Not applicable	-Not applicable	-Not applicable	-Not applicable	-Not applicable	-Not applicable
SPAN	-Feedback on the raw water quality from operators -Liaise with States, NWRC, DOE, etc.	-Liaise with operators on planning and monitoring of storage capacity -Define stds. for reservoirs	-Define stds. for water treatment plants -Liaise with operators on water production	-Liaise with operators to monitor NRW -Liaise with operators to monitor treated water quality	-Set stds. for sewerage services -Monitor performance of operators	-Set stds. of revenue assurance -Set standards of collection efficiency	-Licensing of pipe contractors and plumbers -Set stds. of internal piping and water filters	-Water forum -Monitor customer demand and reach
PAAB [1)]	-Not applicable	-Fund construction of reservoirs -Fund upgrading of reservoirs	-Fund construction of WTPs -Fund upgrading of WTPs	-Fund construction of distribution pipelines -Fund upgrading and replacement of pipelines	-Fund construction of STPs -Fund upgrading of STPs	-Not applicable	-Not applicable	-Not applicable
Water Operators[2)] [3)]	-Monitor raw water quality	-Monitor water loss -Maintain reservoir	-Treat water -Maintain WTPs -Monitor water loss -Ensure adequate	-Maintain distribution of piping sys. -Repair piping -Maintain	-Treat waste water -Maintain and operate STPs -Deploy quality	-Install and maintain billing sys. -Read meters -Quality revenue assurance	-Not applicable	-24x7 service -Prompt response -Courteous and helpful service -Facilitate payment

			production -Deploy quality material and equipment -24x7 services -Process of continuous improvement	adequate water pressure -Rectify stagnant water -Minimize water pressure -Deliver water quality -Deploy quality material -24x7 services	material and equipment -24x7 services -Process of continuous improvement	program -Achieve collection efficiency -Programme of meter replacement -Process of continuous improvement		through counters, online means, post office, banks and collection agencies -Communication channel -Info. Availability

Source: The Water Tablet: Malaysian Water Reforms, 2008

1) PAAB has not been involved in sewerage services up to now.

2) There is no water operators covering both water and sewerage services.

3) There are genuine private water operators besides those derived from state public work or water supply departments

2.3 Organizations Involved in Water Services Industry

(1) Ministry of Energy, Green Technology and Water ("KeTTHA")

In managing the diverse issues and aspects in the water and sewerage services industry and based on the new operating model, the Federal Government has come to rely on the functions of the Ministry of Energy, Green Technology and Water ("KeTTHA"). The key function of KeTTHA (under the water and sewerage sector) is the policy setting of key planning and development, economic and social aspects to advance the water and sewerage industry sector in accordance with Malaysia aspirations of a developed nation.

1) Water Supply Department (JBA or WSD)

- To provide technical advisory services to the ministry and other agencies in planning, designing, implementing and managing water supply programmes
- To plan, implement, coordinate and monitor national water supply development programmes/projects to meet the targets that fulfil the needs of the people and nation
- To plan, monitor and implement the development of water resources
- To monitor the quality of raw water at intakes in Malaysia and of treated water in Sabah and Sarawak
- To carry out safety monitoring on high-risk water supply dams and tanks on slopes
- To serve as committee member (SIRIM and SPAN) in preparing the list of approved materials for water supply projects
- To act as certifying agent for the Sungai Langat Water Treatment Plant implemented by PAAB
- To plan, implement and monitor NRW programmes
- To plan, prepare and maintain water supply infrastructure for domestic and industrial requirements in Labuan Island

2) Sewerage Services Department (JPP or SSD)

- To promote smooth implementation of suitable and modern sewerage system throughout the country and accordingly to the stipulated standards.
- To promote and develop the sewerage industry so that it will be managed with efficiency in term of cost, technology and work force.
- To protect consumers' right by ensuring the best services at reasonable cost.
- To ensure successful and satisfactory implementation of privatisation projects.
- To assist the economic growth of our country through the development of modern sewerage sector by protecting our water resources and environment.

(2) Suruhanjaya Perkhidmatan Air Negara (SPAN)

In the new operating model, the water services industry regulator is SPAN. The role of SPAN is to implement the policies set out by KeTTHA, oversee, regulate, setting of standards, monitor and maintain uniformity in the country's water services industry.

The Commision shall have all the function imposed on it under the water supply and sewerage services laws and shall also have the following functions:

- To advise the Minister on all matters in relation to the national policy objectives of the water supply and sewerage services laws and to implement and promote the national policy objectives;
- To implement and enforce the water supply and sewerage services laws and to consider and recommend reforms to the water supply and sewerage services laws;
- To ensure the productivity of the water supply and sewerage services industry and the monitoring of operator compliance with stipulated services standards, contractual obligations and relevant laws and guidelines;
- To increase concerted efforts towards improving the operational efficiency of the industry and in particular the reduction of non-revenue water through short-term, medium-term and long-term programmes;
- To advise the Minister on a fair and efficient mechanism for the determination of tariffs that is fair to both consumers and licensees and to implement tariffs that have been establish through appropirate mechanism and tools;
- To ensure the national development goals pertaining to coverage, supply and access to water supply and sewerage services are achieved;
- To ensure long-term sustainability of quality of water and sewerage services through continued capital works development;
- To formulate and implement a plan so that all reasonable demands for sewerage services are satisfied and in consultation with the relevant authorities, prepare a sewerage catchment plan formulating the policy and general proposals in respect of the development of any new sewerage system and measures for improvement of any existing sewerage system;
- To carry out any function conferred upon it under any other law; and
- To advise Minister generally on matters relating to water supply services and sewerage services.

(3) Pengurusan Aset Air Berhad (PAAB or WAMCO)

In the new operating model, a water asset management company was set-up under the Ministry of Finance (MOF). The water asset management company is now known as PAAB. Under the new operating model, the financing of infrastructure assets in the water services industry for water operators are alleviated through PAAB. The water operators operate as "Asset-Light" entities which focus on O&M only. The principal role of PAAB is to raise funding to acquire existing and fund new infrastructure assets in the water services industry. PAAB is also tasked to the following objectives[9]:

- to construct, refurbish, improve, upgrade, maintain and repair water infrastructure and all other assets in relation to the water systems;
- to source and obtain competitive financing for the development of the nation's water assets and lease such assets to the water operators licensed by SPAN for operations and maintenance; and
- to assist SPAN to restructure the nation's water services industry towards achieving the Government's vision for efficient and quality water services.

More importantly, PAAB is established as a means of funding CAPEX for as long as the industry has not reached a full-cost recovery.

In October 2009, PAAB launched a RM20 billion bond issuance programme which involve Islamic

[9] "*Inside PAAB*" - http://www.paab.my/inside-paab

term notes and commercial papers, known as 'Sukuk Programmes' to help fund the water asset acquisitions and development of water infrastructure on various assets[10]. The proceeds of the facility would also be used for debt financing and working capital[11].

In light of PAAB's embarkation on taking over the States' water assets to attain the goal of the "Asset-Light" model, PAAB has acquired water assets from Melaka, Negeri Sembilan, Johor, Perlis and Pulau Pinang billion to date as shown in **Table I-2.2**

.

Table I-2.2 Status of PAAB Asset Acquisition Deals

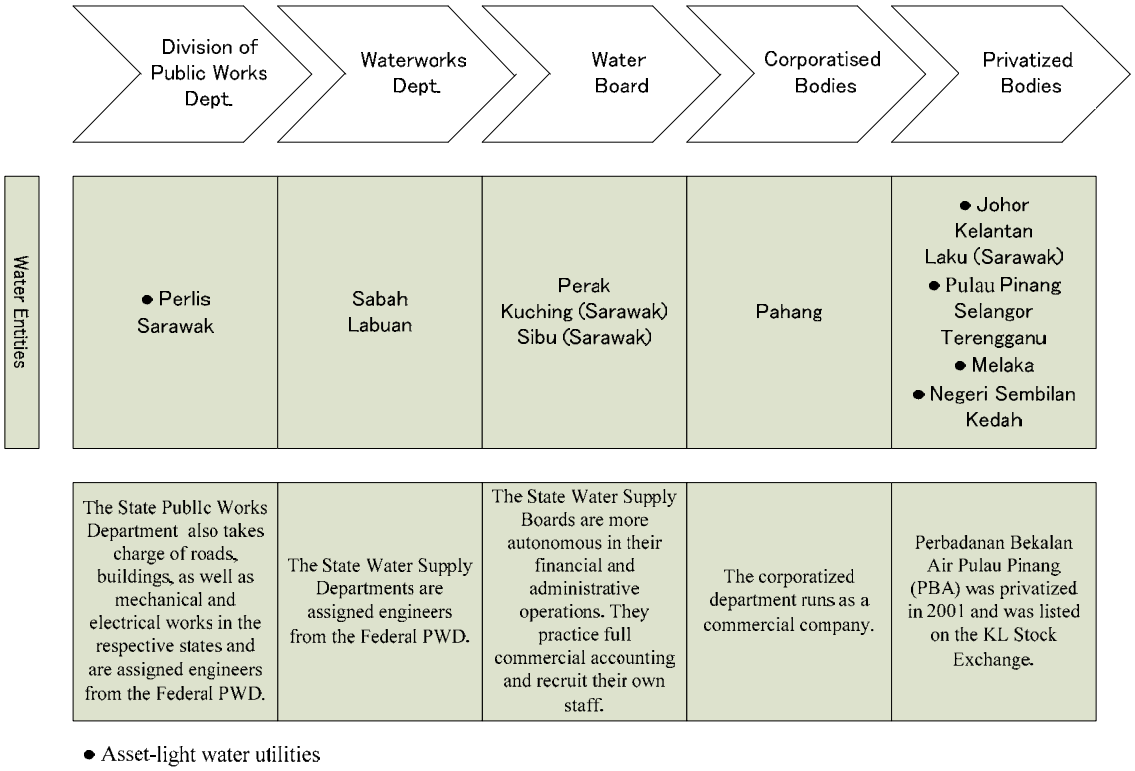
State	Operator	Acquisition Date	Value
Melaka	Syarikat Air Melaka Berhad	Dec. 2008	RM0.89 billion
Negeri Sembilan	Syarikat Air Negeri Sembilan (SAINS)	Jan. 2009	RM1.21 billion
Johor	SAJ Holdings Sdn Bhd	Mar. 2009	RM4.03 billion
Perlis	Public Work Department of Perlis	Aug. 2010	RM0.20 billion
Pulau Pinang	Perbadanan Bekalan Air Pulau Pinang	Jun. 2011	RM0.66 billion

Source: PAAB

(4) Water Services Operators

1) Water Services Operators

Water services operators are in a various development status starting from the Public Works Department or the Water Supply Department of the State Government as shown in **Figure I-2.2**.



Source: Prepared by the Study Team based on MWSIGs 2004 and 2011

Figure I-2.2 Development Status of State Water Supply Department

Some of them have entrusted the operation and maintenance of some water treatment plants or distribution systems to private companies under the concessionaire contract.

[10] *"PAAB launches RM20billion Sukuk Programme"*, The Edge Financial Daily, 8 October 2009
[11] Ibid.

2) Sewerage Services Operator

To date as of 2011, in Peninsular Malaysia and Labuan, 87 Local Authorities except for the State of Kelantan, Johor Bahru and Pasir Gudang Municipal Area, Ketengah Area and Kejora Local Authority Area, have handed over their sewerage operations to Indah Water Konsortium Sdn. Bhd. (IWK). Presently, IWK has a total of 2.56 million accounts including households, commercial, government and industrial sector. In terms of infrastructure, IWK operates and maintains a sewerage system which comprises of 5,605 sewage treatment plants (STPs), 778 network pumping stations and 14,342 km of sewer networks[12].

Overall in Malaysia as of 2010, there were 5,781 public STPs, 2,240 private STPs, 828 network pumping stations and 15,744 km of sewers.[13]

IWK currently provides the following services:

- Operation and maintenance of public sewerage systems
- Provide regular and scheduled operation and maintenance of 14,342 km of public sewers, 778 pumping stations and 5,605 public sewage treatment plants within service areas.
- Provide corrective and preventive maintenance of public sewers, network pump stations, sewage and sludge treatment facilities to meet the regulatory requirements.
- Septic tank desludging services
- Scheduled desludging services for government offices' communal septic tanks and responsive desludging of communal and individual septic tanks.
- Monitoring of effluent quality and sludge disposal activities
- Sampling, analysis, and monitoring of effluent quality and sludge disposal activities. Effluent compliance data submitted to DOE and SPAN.
- Sewerage capital works and refurbishment management
- Sewerage project management, monitoring on compliance of capital works and refurbishment of national and regional sewerage projects.
- Research and development (R&D) works in sewerage sector
- In-house R&D works and continuous improvement projects, external vendor led R&D, structured institutional /universities R&D, and academia's student research initiatives
- Sewerage technical and operational skills training
- Professional technical and non-technical training on sewerage planning strategy, engineering, environmental monitoring and analysis, operational, preventive maintenance, health and safety in sewerage systems, etc. Local and international training on sewerage management and operation /maintenance.
- Sewerage technical and environmental services/consultancy services
- International consultancy on sewerage management, policy, public awareness, etc.
- Conduct audit of sewerage systems/company's (international projects, Indonesia, Middle East, etc.)
- HAZOP studies for water and wastewater industries
- Sewerage planning, sewerage asset data monitoring and certifying services
- Planning services: development and up keep of nationwide sewerage catchment strategy, sludge management strategy, sewerage project planning, sewerage asset database, GIS system and mapping, etc.
- Certification services: evaluating, certifying and approving of sewerage facilities application on behalf of the Commission (SPAN).

More importantly, IWK and the Federal Government are still subject to the 1993 Concession Agreement to provide sewerage services nationwide. With reference to WSIA, s.191 provides for the operation of agreements stipulated under the Schedule of the Act:

- Under s.191, authorized persons may carry out services and activities stipulated in the agreement and supplementary agreement set out in the Schedule of WSIA.

[12] Indah Water Konsortium Sdn Bhd Sustainability Report 2010
[13] Malaysia Water Industry Guide 2011

- The Concession Agreement signed between IWK and the Government on 9th December 1993 is one such agreement listed out in effect under the Schedule of WSIA and hence in operation till the present day.

The duration of the Concession Agreement is still taken to be at the original 28 years awarded, as any extension granted would necessitate the Schedule to be amended. This means that the Concession Agreement is due to expire in 2021. Since the 1993 Concession Agreement is in effect, IWK's function to provide sewerage services is still subject to the rights and liabilities imposed under the Agreement.

2.4 Situation and Problems in Water Services Industry

(1) Water supply sector

In Malaysia, the majority of the population has access to water supply. In 2010, the total population served was 94.2%, compared to 93.0% in the previous year.[14] People in urban areas have better access to water supply than those in rural areas, with 96.8% of the urban population served compared to 88.4% served in rural areas, both in 2010.

In each of the last 10 years the percentage of the urban population served has been similar, ranging from 96.5 % in 2007 to 97.8% in the previous year, with 97.0% served in 2001 (a higher figure than in 2010).[15] It should however be noted that 56.3% of the urban population were served in Kelantan in 2007, significantly lower than 79.0% in the previous year. In 2007 Kelantan commenced determining the population served based on the percentage of the population with a metered water supply and this was probably a factor in the reduction in the percentage of the urban population served year on year in this state.

The percentage of the rural population served has increased from 86.0% in 2001 to 89.7% in 2010, with about 91.0% served in both 2005 and 2006. The 'high' coverage in these years may be due to availability, methods of compilation and accuracy of data, as coverage in 2007 in Kelantan, Sabah and Sarawak was reported to be significantly lower than in recent previous years. The above comment regarding Kelantan is also applicable to the percentage of the rural population served.

The water services industry has historically faced persistent challenges which have prevented it from achieving financial sustainability without assistance from the government. Over the years, the industry has been suffering from problems of three (3) types:

- Efficiency in operations;
- Effectiveness in the institutional framework/ governance; and
- Funding constraints.

The GOM realized that in order for the industry to be self-sustainable, a swift and decisive reform was required to address the above problems. Essentially, the reform is a transformation exercise aimed at changing the industry into one that is more organized, consumer-focused, efficient and competitive.

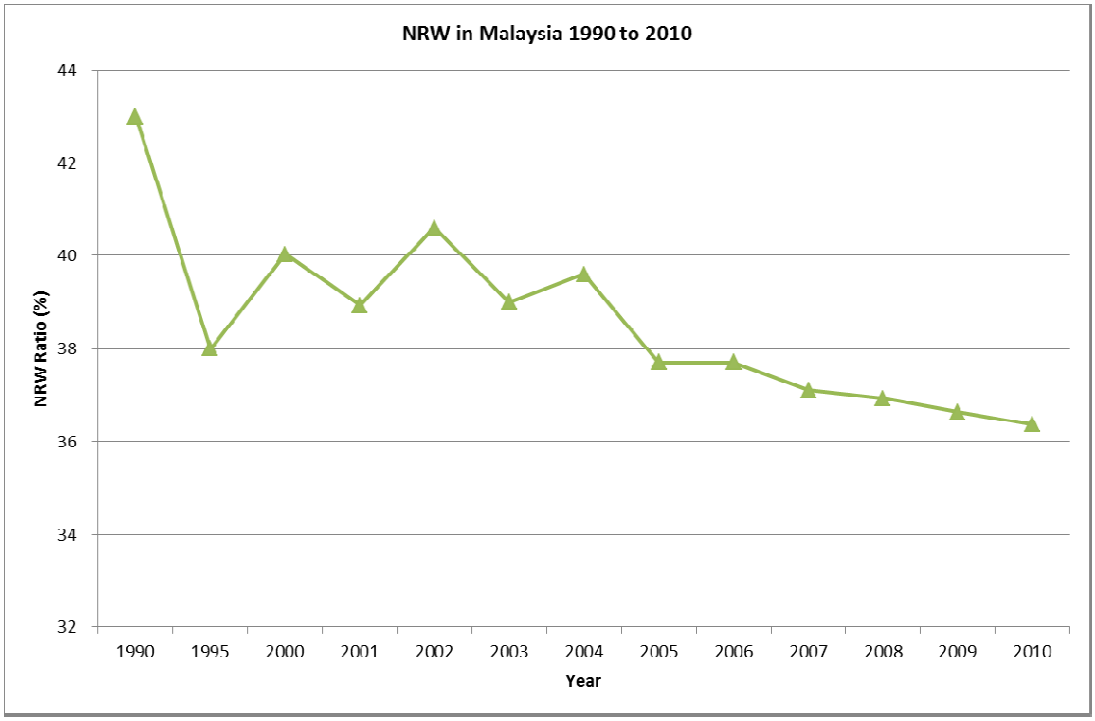
1) Efficiency in operations

In Japan, NRW reduction has been addressed to control leakage from the viewpoints of utilizing valuable water resources, namely not wasting even a drop of water and NRW rate, which is almost equivalent to water leakage ratio in Japan, has been declined below 10% at present in many water supply utilities in Japan. While, in Europe and USA, NRW is mainly composed of leakage but also includes other factors which cannot be negligible in percentage such as registered error, etc., from the viewpoint of no necessecity to invest more than a certain level of amount to NRW reduction, taking into account benefit-to-cost and has been in the level of 10 to 20% in many countries

[14] Malaysia Water Industry Guide 2011
[15] Malaysia Water Industry Guide 2005 to 2011

In recent years, NRW in developing countries is in the range of 30 to 60%, since in addition to leakage from old pipelines installed in colonial times, the existence of pilferage and registered error such as meter error, reading error, etc. is too big to be neglected and NRW reduction has been tackled from the viewpoints of managerial improvement of water supply business and utilization of water resources. Malaysia is no longer to say a developing country, but the percentage of NRW is 37% on average in 2009 which is in the level of developing countries. The Government of Malaysia has put an effort on NRW reduction under a target of 34% by 2015.

The key challenge in the operations of the water services industry is the high level of NRW. As shown in **Figure I-2.3**, NRW in Malaysia has improved little since the mid 90's, with little reduction since 2005 (37.70% in 2005 to 36.63% in 2010). As discussed later in **3.1** the target in the Ninth Malaysia Plan for NRW in Malaysia in 2010 was not met.



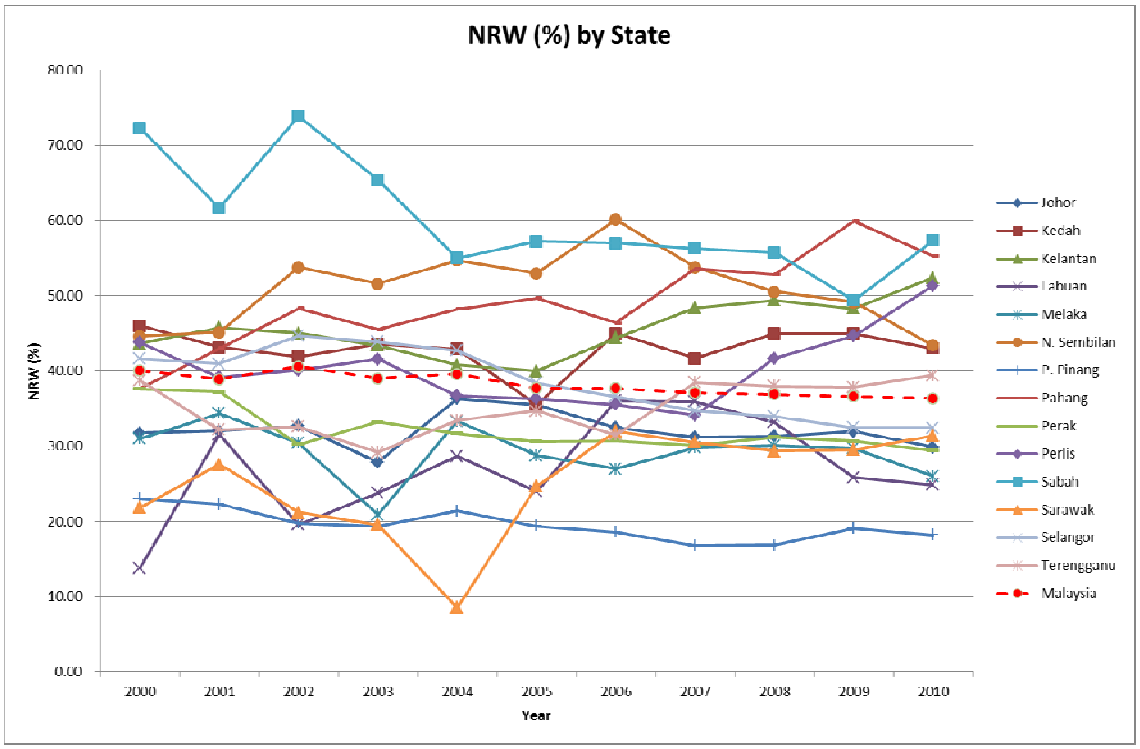
Source: Malaysia Water Industry Guide 2003 - 2011

Figure I-2.3 NRW in Malaysia from 1990 to 2010

The NRW in each state and in Malaysia in the period from 2000 to 2010 is shown in **Figure I-2.4**. The highest percentage reductions in NRW, when comparing 2010 with 2000, have been obtained in Selangor, Perak, Pulau Pinang and Sabah, where in all cases NRW has been reduced by more than 20%. NRW in Pulau Pinang in 2000 was already relatively low at about 23% and was bettered only by Labuan and Sarawak. As such to reduce NRW to current levels and the level in recent years (less than 20% in all years from 2005 to 2010, including less than 17% in both 2007 and 2008) is a significant achievement.

Again comparing 2010 and 2000, the highest percentage increases in NRW have occurred in Labuan (80%), Pahang (47%) and Sarawak (44%). It should however be noted that in the case of Labuan the data may not be reliable in some years, as NRW was 13.85%, 31.56% and 19.60% in 2000 to 2002 respectively, which would mean that NRW has been reduced in percentage terms, if 2010 is compared with 2001.

The trend in NRW in some other states appears to show inconsistencies, which may be due partly to unreliable data.



Source: MWIG 2003 - 2011

Figure I-2.4 NRW in Malaysia by State and National Average from 2000 to 2010

2) Effectiveness of the Institutional Framework

Historically prior to WSIA, water supply fell under the respective state jurisdiction under the Federal Constitution of Malaysia. Under this setting, treatment and distribution of water was undertaken either by state agencies or corporatized or private companies. These were either as shown in **Figure I-2.2**.

In the various forms of operating entities, a significant contrast in the service performance levels among the water operators in the states was evident[16]. The water services industry was a fragmented industry with no uniformity in governance.

As a result, consumers faced varying degrees of quality of water supply and services, and differing water charges from state to state. There was a lack of an effective industry structure with some state governments controlling raw water resources, more than one private concessionaire being in charge of water treatment operations and another company managing water distribution.

The lack of an effective industry structure gradually increased inefficiency from the abstraction of water to the water distribution, leading to flawed cost structures for water operators and poorly determined tariff rates for consumers. This resulted in a major challenge for water operators to be viable and have a sustainable operation in a key sector for the economy and the population.

3) Funding constraints

The water services industry has been plagued by escalating deficits of developing new water infrastructure, resulting in most states having to borrow from the Federal Government to fund operation and maintenance of existing and development of new water supply services.

Given that tariffs have not been at full-cost recovery, water operators have not been generating sufficient cash flow to fund the replacement and development of their water infrastructure assets.

[16] *The Water Tablet: Malaysian Water Reforms*, Ministry Energy, Water and Communications Malaysia, 2008

Other than the above, the key challenges in the water supply sector, which result in operational problems, are described in the following points (Figures in the following text are for 2010 and from the Malaysia Water Industry Guide 2011.):

1) Long Term Sustainability of Water Resources:
Contamination of rivers which are the main water source in terms of quantity, is a serious issue. In recent years (2005 to 2009) there has been a general trend of deteriorating raw water quality (as reported in the Compendium of Environment Statistics) mainly due to an increasing number of polluting sources such as inadequate sewage treatment plants, agro based industries and animal farms and a decrease in rainfall. The potential implications of deteriorating raw water quality are numerous, including (1) increased operation costs, (2) difficulties in treating raw water which exceeds the limits in the design criteria, with the potential consequence that treated water quality does not meet the required standard, as well as increased operation costs.

2) Aging Water Assets:
There is a substantial length of aging water pipes, for which pipe replacement or rehabilitation is required to reduce leakage. Many water treatment plants (WTPs) are more than 50 years old and although upgrading has been carried out, it is probable that further upgrading or replacement is required or would be beneficial. More than 23% of water meters are more than 7 years old, a small improvement since 2007, when 25.6% of meters were more than 7 years old.

3) Inefficient small size and scattered Water Treatment Plants:
There is a significant number of WTPs with a small capacity and operation of some of these (as well as larger WTPs) is inefficient in terms of for example operation cost/m^3 raw water treated, water loss in the WTP process. There may also be inefficiencies related to the number of WTPs and associated transmission and distribution systems in some areas and rationalization could reduce operation and maintenance costs and improve levels of service.

4) Inadequate Sludge Treatment Facilities:
A significant amount of sludge from WTPs is discharged to rivers without adequate treatment.

5) Low Tariff Regime:
Water tariffs are very low, compared with the tariff in other countries with similar economic levels in terms of Gross National Income (GNI) per capita to Malaysia. In several states, the tariff has not been changed for many years, even though the economic level in these states has increased significantly since the last change in the tariff.

(2) Sewerage Sector

1) Population Coverage by Sewerage

There is no concept on population coverage by sewerage in Malaysia. Therefore, any political goals doesn't indicate its numerical target.

Population coverage by sewerage in Malaysia can be estimated by the following method but has a few problems.

Two kinds of statistical data are available for the estimation of population coverage by sewerage. One is the number of connections by category as shown in **Table I-2.3**, in which the numbers of connections for domestic and governmental quarters are concerned with it. The other is the population using communal septic tanks (CST) and pour flush (PF) latrines as shown in **Table I-2.4**.

The number of domestic connections in **Table I-2.3** is converted to Population equivalent (PE) assuming that one connection equals to five PE which is derived from five persons / household. The CST, IST and PF in **Table I-2.4** is already expressed with PE using the same assumption as the above. CSTs have been under IWK's operation and maintenance but now such responsibility is transferred to the previous owners after the enforcement of WSIA 2006. CST is also connected to the houses with a sewer network and the population using CSTs shall be counted as the sewered

population. The population coverage by sewerage is given by the following equation:

Population served by sewerage
= (Domestic connections + Governmental quarters connections) x 5 + CST PE

Table I-2.3 Number of Connections by Category

State	Domestic	Commercial	Gov. Quarters	Gov. Premises	Industry	Total
Johor	231,367	18,405	1,509	203	533	252,071
Kedah	95,021	7,414	2,726	167	36	105,364
Kelantan	4,932	742	499	-	-	6,173
Melaka	94,150	8,780	1,041	98	38	104,107
N. Sembilan	147,360	11,566	3,533	183	51	162,693
Pulau Pinang	314,025	30,068	8,044	693	837	353,667
Pahang	53,699	4,600	1,386	145	5	59,835
Perak	214,109	16,353	3,011	131	22	233,626
Perils	4,209	260	724	14	*	5,207
Selangor	1,045,819	89,299	8,996	590	1,128	1,145,832
Terengganu	10,220	579	910	131	*	11,840
FT K. Lumpur	306,522	34,642	61,939	1,533	31	404,667
FT Labuan	3,336	801	948	12	3	5,100
FT Putrajaya	3,465	286	10,054	89	**	13,894
Total	2,528,234	223,795	105,320	3,989	2,684	2,864,022

Source: MWIG 2011

Table I-2.4 Population Using Communal Septic Tanks (CST) and Pour Flush (PF) Latrines

State	Public STP	Private STP	CST	IST	PF	Total
Johor	2,283,257	539,769	46,290	1,296,975	667,390	4,833,681
Kedah	706,684	122,682	43,590	772,730	882,855	2,528,541
Kelantan	47,500	70,600	117,728	283,225	342,353	861,406
Melaka	690,457	193,241	32,626	275,420	80,640	1,272,384
N. Sembilan	1,209,167	124,623	38,350	371,445	141,080	1,884,665
Pulau Pinang	2,120,407	40,813	15,680	61,645	286,460	2,525,005
Pahang	368,519	447,183	13,800	667,325	681,940	2,178,767
Perak	1,435,585	104,987	120,603	1,031,850	416,265	3,109,290
Perils	30,629	19,925	2,665	95,300	111,695	260,214
Selangor	7,047,144	348,182	84,965	829,685	106,220	8,416,196
Terengganu	119,109	154,932	15,963	413,470	718,805	1,422,279
FT K. Lumpur	3,402,296	71,430	13,110	266,455	25,000	3,778,291
FT Labuan	43,066	42,408	790	22,715	13,590	122,569
FT Putrajaya	28,706	342,464	N/A	N/A	N/A	371,170
Total	19,532,526	2,623,239	546,160	6,388,240	4,474,293	33,564,458

Source: MWIG 2011

When the population using IST or PF to the above, it should be nearly equivalent to actual population, but the total population using various sanitation facilities exceeds an actual population (Census 2010 population) in many states as shown in **Table I-2.5**.

Table I-2.5 Population Using Various Sanitation Facilities (In case of 5 PE / connection)

State	Domestic (PE)	Gov. Quarters (PE)	CST (PE)	IST (PE)	PF (PE)	Total (PE.)	Census 2010 (pers.)	Difference (pers.)
Johor	1,156,835	7,545	46,290	1,296,975	667,390	3,175,035	3,233,434	-58,399
Kedah	475,105	13,630	43,590	772,730	882,855	2,187,910	1,890,098	297,812
Kelantan	24,660	2,495	117,728	283,225	342,353	770,461	1,459,994	-689,533
Melaka	470,750	5,205	32,626	275,420	80,640	864,641	785,806	78,835
N. Sembilan	736,800	17,665	38,350	371,445	141,080	1,305,340	997,071	308,269
P. Pinang	1,570,125	40,220	15,680	61,645	286,460	1,974,130	1,520,143	453,987
Pahang	268,495	6,930	13,800	667,325	681,940	1,638,490	1,443,365	195,125
Perak	1,070,545	15,055	120,603	1,031,850	416,265	2,654,318	2,258,428	395,890
Perlis	21,045	3,620	2,665	95,300	111,695	234,325	227,025	7,300
Selangor	5,229,095	44,980	84,965	829,685	106,220	6,294,945	5,411,324	883,621
Terengganu	51,100	4,550	15,963	413,470	718,805	1,203,888	1,015,776	188,112
W.P. K. Lumpur	1,532,610	309,695	13,110	266,455	25,000	2,146,870	1,627,172	519,698
W.P. Labuan	16,680	4,740	790	22,715	13,590	58,515	85,272	-26,757
W.P. Putrajaya	17,325	50,270	0	0	0	67,595	67,964	-369
Total	12,641,170	526,600	546,160	6,388,240	4,474,293	24,576,463	22,024,882	2,551,581

Source: Prepared by the Study Team

This is caused by the following reasons:

1) It is no longer the time that one household equals to five persons. That is to say, according the result of Population and Housing Census 2010 (see **Appendix 2.1**), the per household population is declined from 5.22 persons in 1980 to 4.31 in 2010 on national average and sharply from 5.33 persons to 3.93 persons in Selangor.
2) In Malaysia, it seems that housing bubble has been still going on. The rich persons are purchasing the condominiums without an intention to live therein expecting for future price increase. When the condominium has completed and connected to a public sewerage system, IWK will count all the condominiums as connected PE including non-residential condominiums

As it is considered that the census by the Department of Statistics, Malaysia is carried out for the actually residential condominium, the gap between 5 PE per connection and actual figure in addition to counting of connections including non-residential condominiums, there is a high possibility that the PE has been overestimated.

Incidentally, Based on the result of Population and Housing Census 2010, the population served by sewerage is calculated as shown in **Table I-2.6** using per household population by state except for Sabah and Sarawak due to no data on sewerage statistics The gap between served population by sewerage and total population is decreased from 2.55 million in case of 5 PE per connection to -1.75 million by 4.30 million. According to “Estimate for the use of Improved Sanitation Facilities” by WHO/UNICEF in March 2010, 4% of population uses shared toilet in both urban and rural areas in addition to 1% defecation in the rural area. And unimproved sanitation facilities other than PF latrines is reportedly used. Therefore, the served population should be lower than total population and this approach is more practical. Even say so, the problem that the population using sanitation facilities is higher than actual population in four states, or N. Sembilan, Pulau Pinang, Pahang and Terengganu is left. In this approach, the possibility of Item 1) is considered but Item 2) is not considered due to unknown practice.

Table I-2.6 Population Using Various Sanitation Facilities (In case of actual PE / connection)

State	PE./HH	STP		CST	IST	PF	Total	Census 2010	Difference
		Domestic	Gov. Quarters						
		(PE)	(PE)	(PE)	(PE)	(PE)	(PE.)	(pers.)	(pers.)
Johor	4.17	964,800	6,293	38,606	1,081,677	556,603	2,647,979	3,233,434	-585,455
Kedah	4.29	407,640	11,695	37,400	663,002	757,490	1,877,227	1,890,098	-12,871
Kelantan	4.86	23,970	2,425	114,432	275,295	332,767	748,889	1,459,994	-711,105
Melaka	4.05	381,308	4,216	26,427	223,090	65,318	700,359	785,806	-85,447
N. Sembilan	4.20	618,912	14,839	32,214	312,014	118,507	1,096,486	997,071	99,415
P. Pinang	3.94	1,237,259	31,693	12,356	48,576	225,730	1,555,614	1,520,143	35,471
Pahang	4.59	246,478	6,362	12,668	612,604	626,021	1,504,133	1,443,365	60,768
Perak	4.04	865,000	12,164	97,447	833,735	336,342	2,144,688	2,258,428	-113,740
Perlis	4.26	17,930	3,084	2,271	81,196	95,164	199,645	227,025	-27,380
Selangor	3.93	4,110,069	35,354	66,782	652,132	83,489	4,947,826	5,411,324	-463,498
Terengganu	4.78	48,852	4,350	15,261	395,277	687,178	1,150,918	1,015,776	135,142
W.P. K. Lumpur	3.72	1,140,262	230,413	9,754	198,243	18,600	1,597,272	1,627,172	-29,900
W.P. Labuan	4.72	15,746	4,475	746	21,443	12,829	55,239	85,272	-30,033
W.P. Putrajaya	3.45	11,954	34,686	0	0	0	46,640	67,964	-21,324
Total		10,090,180	402,049	466,364	5,398,284	3,916,038	20,272,915	22,022,872	-1,749,957

Source: Prepared by the Study Tea

The estimated population coverage by sewerage is 49.8% in the Peninsula and 77.8% in Selangor. The highest coverage is found in Kuala Lumpur as 84.8% followed by Pulau Pinang as 84.3%, while the lowest is in Terengganu as 6.7% followed by Kelantan as 9.6% as shown in **Table I-2.7**.

Table I-2.7 Estimated Population Coverage by Sewerage in Malaysia

State	STP		CST	Total	Census 2010	Pop.Coverage by Sewerage
	Domestic	Gov. Quarters				
	(PE)	(PE)	(PE)	(PE)	(pers.)	(%)
Johor	964,800	6,293	38,606	1,009,699	3,233,434	31.2
Kedah	407,640	11,695	37,400	456,735	1,890,098	24.2
Kelantan	23,970	2,425	114,432	140,827	1,459,994	9.6
Melaka	381,308	4,216	26,427	411,951	785,806	52.4
N. Sembilan	618,912	14,839	32,214	665,965	997,071	66.8
P. Pinang	1,237,259	31,693	12,356	1,281,308	1,520,143	84.3
Pahang	246,478	6,362	12,668	265,508	1,443,365	18.4
Perak	865,000	12,164	97,447	974,611	2,258,428	43.2
Perlis	17,930	3,084	2,271	23,285	227,025	10.3
Selangor	4,110,069	35,354	66,782	4,212,205	5,411,324	77.8
Terengganu	48,852	4,350	15,261	68,463	1,015,776	6.7
W.P. K. Lumpur	1,140,262	230,413	9,754	1,380,429	1,627,172	84.8

W.P. Labuan	15,746	4,475	746	20,967	85,272	24.6
W.P. Putrajaya	11,954	34,686	0	46,640	67,964	68.6
Total	10,090,180	402,049	466,364	10,958,593	22,022,872	49.8

Source: Prepared by the Study Tea

2) Key Challenges in Sewerage Sector

The sewerage sector continues to face a myriad of issues with the consumers, environment and the authorities. Among the challenges faced, which result in operational problems, are the following (Figures in the following text are for 2010 and from the Malaysia Water Industry Guide 2011, unless otherwise stated.):

- Proliferation of small STPs – The proliferation of small STPs increases operation and maintenance (O&M) costs, decreasing the efficiency of the sewerage service providers to run their operations. 71% of the STPs in West Malaysia have been built to serve a population equivalent (PE) of less than 2,000, a figure which is typically equivalent to 400 households.
- Resistance to payment of and increases in tariff – Sewerage service was dichotomised as a separate service for consumers that had never paid for such a service in the past.
- Large numbers of private STPs (2,240 nos.) and communal septic tanks (CSTs) (4,382 nos.) which are poorly regulated, operated and maintained. CSTs were operated and maintained by IWK up to 2007, but with the enforcement of WSIA, operation and maintenance of CSTs is the responsibility of the owner or tenants. IWK do however still carry out scheduled desludging of CSTs at government buildings and offices and provide desludging services to private owners/tenants on demand or 'call for service' (responsive desludging service). Furthermore as part of its initiative to keep the environment clean and risk contamination from overloading of septic tanks, IWK conducts desludging for free from religious centres such as mosques, churches, temples, etc and in 2010 carried out 795 charity desludging services nationwide.[17] It should be noted that the Environmental Quality (Sewage) Regulations 2009 is not applied to CSTs
- Large numbers of Individual septic tanks (ISTs) more than 1.25 million) which are not desludged on a scheduled basis. Responsibility for desludging ISTs lies with the owner/tenant.
- Most properties do not have proper sullage connections to public sewers and onsite treatment facilities. As for the private sewers and onsite treatment facilities, most of the properties also do not have proper sullage connections and discharge it into nearby drains.
- Defective sewer network in many locations throughout Malaysia.

[17] Indah Water Konsortium Sdn Bhd Sustainability Report 2010

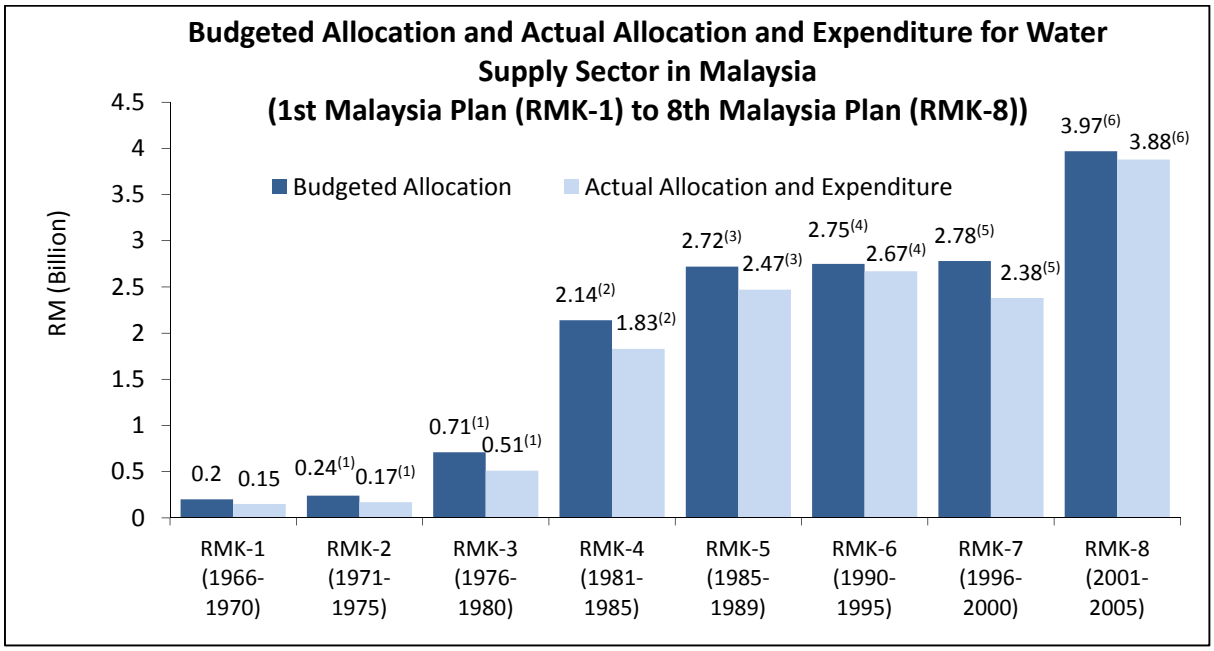
3 Basic Policy and Political Issues of the Malaysian Government for Water Services Industry

3.1 Positioning in Water Supply and Sewerage Development Plans in 9-MP and Prospects in 10-MP

(1) Water Services

1) Up to and Including Ninth Malaysia Plan

The GOM has recognised the need to improve the water services industry as part of achieving the status of a developed nation. A significant amount of budget allocation to the water supply sector services can be observed beginning in the early 80's under the Malaysia Plans as shown in **Figure I-3.1**.



Sources: RMK-1, RMK-4, RMK-5, RMK-6, RMK-7 and RMK-8
Note: (1)This amount was adjusted as per RMK-4, (2)This amount was adjusted as per RMK-5, (3)This amount was adjusted as per RMK-6, (4)This amount was adjusted as per RMK-7, (5)This amount was adjusted as per RMK-8, (6)This amount was adjusted as per RMK-9

Figure I-3.1 Budgeted and Actual Allocation for Water Supply Sector RMK-1 to RMK-8

Actual allocation of funds to the water supply services industry has been less than the budgeted allocation from the Federal Government in each of RMK-1 to RMK-8, with the allocation in RMK-7 being less than in both RMK-5 and RMK-6. This has resulted in delayed investment in new infrastructure (including dams, WTP, distribution systems) and replacement/rehabilitation of existing infrastructure, further compounding operational inefficiency, as is evident from the small reduction in NRW that has been achieved in recent years.

In the Ninth Plan, there were three challenges that were proposed to be addressed, as follows[18]:

Challenge 1: To deliver or make available facilities or services of a high quality;
Challenge 2: To ensure an efficient and effective delivery system to meet the rising aspirations of the people; and
Challenge 3: To optimize the use of natural resources as well as protect the environment in order to improve the quality of life.

In the Ninth Plan, there were 219 projects amounting to RM 8.101 billion approved for implementation. The allocations for state-wise water supply projects which are shown in **Table I-3.1**

[18] *Source: MWIG 2007, Page.52*

include rehabilitation and modernization of water supply, water resources development, water treatment and distribution and inter-state raw water transfer.

Table I-3.1 Water Supply Projects - Budget Allocation under the Ninth Malaysia Plan (2006-2010)

No	State	Budget Allocation (RM million)
1	Kedah	492.949
2	Perlis	155.000
3	Pulau Pinang	200.000
4	Perak	503.600
5	Selangor	383.000
6	Negeri Sembilan	864.500
7	Melaka	144.000
8	Kelantan	351.000
9	Terengganu	210.500
10	Pahang	687.303
11	Johor	65.000
12	Labuan	224.902
13	Sabah	1,313.347
14	Sarawak	590.460
15	Water Supply Modernisation Program	13.500
16	Interstate Wafer Transfer	1,900.000
17	Water Tariff Study	2.500
	Total	8,101.562

Source: MWIG 2007

Works proposed in the Ninth Plan included an NRW reduction programme, with various measures including strict enforcement against water theft, pipe and meter replacement, Geographical Information Systems (GIS) mapping of distribution networks and rehabilitation of distribution systems. The Ninth Malaysia Plan states 'The National NRW rate is expected to decrease to 30 per cent in 2010.'[19] Clearly the 'expectations' in the Plan have not been met, as discussed previously and as shown in **Table I-3.2**, which summarizes the performance in the Ninth Malaysia Plan.

Table I-3.2 Performance in Water Supply in Ninth Malaysia Plan

<table>
<tr><th>Commitment</th><th>Output</th></tr>
<tr><td>• Increase efficiency of water services management</td><td>• Increased production capacity, quantity and quality of water supply
<table>
<tr><th>Malaysia</th><th>2006</th><th>2009</th></tr>
<tr><td>Production capacity (mld)</td><td>15,449</td><td>16,077</td></tr>
<tr><td>Quantity of water supply (mld)</td><td>12,296</td><td>14,743</td></tr>
</table>
Note: Million liters per day (mld)
• Completion of Kinta Dam in Perak and two barrages in Terengganu
• Completion of 12 new water treatment plants
• Installing and laying 14,988 km of new pipes
• 95% compliance to National Standard for Drinking Water Quality set by Ministry of Health</td></tr>
<tr><td>• Reduce Non-Revenue Water (NRW) Percentages</td><td>• Replacement of old meters and 2,577 km of pipes
• Reduction rate of NRW from 37.7% to 37.2%</td></tr>
</table>

[19] Ninth Malaysia Plan 2006-2010, published by the Economic Planning Unit, Prime Minister's Department 2006

Source: Tenth Malaysia Plan
Notes: Output as at December 31st, 2009

2) Tenth Malaysia Plan

Under the Tenth Malaysia Plan (RMK-10) there are currently (as of end of 2011) 63 water supply projects approved by the Economic Planning Unit, Prime Minister's Department (EPU, JPM). The projects approved are divided according to the program categories as shown in **Table I-3.3**.

A total of 60 projects are currently in the implementation stage such as the appointment of consultants, design, bid / procurement and construction work, with the remaining three projects cancelled. Based on the original approval, the ceiling and provision for water supply projects under the Tenth Malaysia Plan are RM1.594 billion and RM702.029 million respectively, as shown in **Table I-3.3**.

Table I-3.3 Water Supply Projects – Budget Allocation under the Tenth Malaysia Plan (2011-2015)

No.	Program	No. of Projects	Budget Ceiling (RM million)	Budget Provision (RM million)
1.	Construction / upgrading / repair of water treatment plant and distribution system, existing and new	34	905.970	383.398
2.	Water rate control program (NRW)	17	333.319	106.466
3.	Development and preservation of water resources	10	339.950	204.940
4.	Increased efficiency and water services industry awareness	2	15.500	7.225
	Total	**63**	**1594.739**	**702.029**

Source: Source: http://www.jba.gov.my
Note： The totals for ceiling and provision includes three projects which have been cancelled.

The 2012 budget includes RM 2.1 billion to expand clean water supply to 200,000 houses, RM 400 million to upgrade the water supply infrastructure in selected Federal Land Development Authority (FELDA) areas and RM 50 million to connect estates which do not have clean water to the water distribution system[20].

(2) Sewerage Service

The budget allocation and expenditure in each of the seventh to ninth Five-Year Malaysia Plans for sewerage services are shown in **Table I-3.4**. In this period budget allocation is 39% of the allocation for water services; however the budget allocation as a percentage of the allocation for water services increased in each Plan.

Table I-3.4 Sewerage Projects - Allocation and Expenditure under the Seventh to Ninth Malaysia Plans (1996-2010)

No.	Plan No and Period	Budget Allocation (RM million)	Expenditure (RM million)	Expenditure/ Budget Allocation (%)
1.	Seventh (1996 – 2000)	668.5 (1)	665.3 (1)	99.52
2.	Eighth (2001 – 2005)	1,583.6 (1)	1,347.9 (2)	85.12
3.	Ninth (2006 – 2010)	3,473.7 (3)	3,206.9 (3)	92.32

Source: (1) Eighth Malaysia Plan

[20] The 2012 Budget Speech, 7 October 2011

(2) Ninth Malaysia Plan
(3) JPP Annual Report 2010

Table I-3.5 shows the budget allocation and expenditure in each year during the 9th Malaysia Plan. Expenditure compared to the budget allocation exceeded the target of 95%, as stated in the JPP Annual Report 2010, in 2010.

Table I-3.5 Performance in 9th Malaysia Plan - Expenditure Compared with Budget Allocation by Year

Year	Budget Allocation (RM)	Expenditure (RM)	Expenditure/Budget Allocation (%)
2006	990,877,010	1,002,062,238.45	101.13
2007	796,030,000	702,965,647.26	88.31
2008	816,755,000	789,288,915.07	96.64
2009	550,357,710	408,679,848.51	74.26
2010	319,682,805	310,899,831.00	97.25
Total for 9th MP	3,473,702,525	3,206,911,596	92.32

Source: JPP Annual Report 2010

Tables I-3.6 summarizes the performance in the Ninth Malaysia Plan, based on information in the Tenth Malaysia Plan and the JPP Annual Report respectively, with the information in the latter being more up to date that in the former.

Table I-3.6 Output Performance List for Ninth Malaysia Plan Projects until 2010

No.	9th MP	Output
1*	Regional sewage treatment plant	2.531 million PE (12 plants)
2*	Sludge treatment plant	1.0 million PE (3 plants)
3**	Length of sewer pipe installed	34 km
4*	Refurbished critical plant	436 plants
5*	Length of sewer pipe refurbished	16 km
6*	Number of connected premises	49 premises

*Source: * JPP Annual Report 2010 (as of December 31, 2010)*
*** Tenth Malaysia Plan (as of December 31, 2009)*

The JPP Annual Report 2010 lists 63 projects in the Ninth Malaysia Plan, of which 44 are reported as complete, 11 on schedule and seven ahead of schedule, with only one project delayed.

3.2 Mid-term Development Goals (Targets for Water Supply and Sewerage and Regional Targets)

The targets in terms of service coverage for water supply and sewerage and the proposed investment in an NRW programme to improve water services infrastructure in the Tenth Malaysia Plan are described below[21]. It should be noted that with regard to sewerage services the percentage of the population served by the grid and septic tanks in in 2009 and a target for 2015 are not stated. Furthermore no target for NRW in 2015 is given, whereas in the Ninth Malaysia Plan a target was stated (refer to **3.1** (1)).

- The national water supply coverage will increase from 93% of population in 2009 to 97% in 2015.

[21] Tenth Malaysia Plan 2011-2015, published by the Economic Planning Unit, Prime Minister's Department 2010

- Sewerage services for households served by the grid and households served by septic tanks, will be extended from 28.8 million to 37.7 million population equivalent during the same period.
  Note: The capacity of sewerage systems is expressed with Population Equivalent (PE) including the PE of not only domestic sewage but also non-domestic sewage. Therefore, the total PE may exceed the PE of actual population.
- The NRW programme, involving replacement of pipes and old meters, will be expanded with an allocation RM1.1 billion to improve the quality of water and reduce losses in water supply. Out of this amount, approximately RM369 million will be allocated in the first two years of the Plan.

Other targets in the Tenth Malaysia Plan[22], which are part of the continuing efforts to restructure the Water Services Industry, are as follows:

- ***"Completing the migration of state water operators".*** *….Full migration of the remaining states will be completed during the Plan period. Upon migration water operators will have to comply with "*
- ***"Moving towards full costs recovery"*** *….(refer to 3.6 for details and discussion).*
- ***"Driving efficiency in operations and capital expansion"****. ….Water operators will be required to provide detailed 30-year business plans and 3-year operational plans. These plans will be the basis for a roadmap towards full cost recovery and will allow Pengurusan Aset Air Berhad (PAAB) to plan long term capital expenditure funding. SPAN will regulate and monitor the performance of water operators based on the plans, linking tariff increases to efficiency gains in operations and capital expenditure.*
- ***"Integrating water and sewerage services****" ….Restructuring of sewerage services will be implemented by parcelling out the operations of centralised sewerage services to the respective state water operating companies. When completed, the industry will move towards implementing an integrated tariff for both water and sewerage services. This will link sewerage charges to water consumption, moving away from flat rate tariffs that do not adequately capture the cost of service provision given the inherent link between water consumption and sewerage production profiles.*

Table I-3.7, which shows the Water Services Industry Reform Roadmap, provides an overview of the above, as well as the situation during the Eight and Ninth Malaysia Plan periods.

Table I-3.7 Restructuring of the Water Services Industry towards Improving Efficiency in Operations and Management – Water Industry Reform Roadmap

8th Plan period *2001-05*	**9th Plan period *2006-10***	**10th Plan period *2011-15***
Stabilisation	**Consolidation**	**Moving towards efficiency in operations and management**
• Privatisation and corporatisation of state water authorities • Planning for restructuring of water services industry	• Operationalisation of National Water Services Commission (SPAN) • Enforcement of Water Services Industry Act (WSIA), 2006 • Pengurusan Aset Air Berhad (PAAB) takes over existing water assets from state at negotiated values and is responsible for	• Tariff-setting mechanism to allow full cost recovery to be completely phased in by 2013 • Integration of water supply and sewerage services • Initial efforts towards the introduction of integrated water and sewerage tariffs

[22] Tenth Malaysia Plan 2011-2015, published by the Economic Planning Unit, Prime Minister's Department 2010

	implementing water infrastructure development • State water operators are asset-light and focus on service provision	

Source: Tenth Malaysia Plan (2011-15)

3.3 Basic Policy for Water Supply and Sewerage Development

(1) Water

The enactment of WSIA and the resultant institutional changes that have been put in place have been made to move the country forward in upgrading the national water supply sector.

The key institutional changes are the restructuring of the role and responsibilities of the federal government, the state governments and the water supply operators. The most important aspect of the restructuring is the transfer of water supply assets of the states to PAAB and lease rental of the water assets.

Key upgrading strategies are as follows:

- Integrate water supply with sewerage in order to develop holistic resource planning and realize economies in management and technical inputs.
- Transfer the responsibility for water supply to the federal Government except for the ownership of the raw water resources and associated catchment areas that will remain under State ownership.
- Compensate the States for the use of raw water through a royalty based on a standardized raw water tariff that will be affordable to the operators.
- Compensate the States for their water assets and infrastructure when they are transferred to PAAB.
- Initiate a collaborative arrangement between the public and private sectors (PPP – PPP) so as to strengthen the water supply infrastructure by leveraging on the core competencies of both sectors. Although private operators should have access to funding raised by PAAB the rate of return should be reasonable and dependent on the effectiveness of the operators. The PPP model will take over from the existing privatized models in certain States that are fragmented and deal only with one component of the supply chain.
- Phase in tariff setting mechanism that allows full recovery of costs for water.

(2) Sewerage

With the enactment of WSIA and SPAN and the creation of the asset holding company PAAB the institutional changes have been put in place to move forwards with a series of reforms designed to upgrade the national sewerage sector. Key upgrading strategies are as follows:

- Integrate sewerage with water supply in order to develop holistic resource planning and realize economies in management and technical inputs.
- Initiate a collaborative arrangement between the public and private sectors (PPP – PPP) so as to strengthen the sewerage infrastructure by leveraging on the core competencies of both sectors.
- Develop a strategic planning process to better integrate urban development planning with infrastructure provision and update the district-level sewerage catchment plans every five years.
- Phase out the current process whereby developers implement sewage treatment plants and replace by a system where water operating companies take on this role with the developers contributing to the Sewerage Capital Contribution Fund.

- Maximise the use of regional sewage treatment plants by rationalizing existing small communal plants and ISTs and enabling new development parcels to connect directly to the regional sewerage system.
- Eradicate discharge of sullage to the drainage system.
- Implement biannual desludging of septic tanks.
- Carry out concerted R&D to develop locally appropriate design criteria for sewage treatment taking into consideration the local sewage characteristics, including reuse of sewage sludge and reclaimed wastewater.
- Narrow the list of approved processes and equipment to increase standardization and encourager Malaysian manufacturing companies to take on a greater role.
- Improve Quality Assurance and Quality Control Procedures for all relevant services over the planning, design, construction and operation cycle.
- Intensify public relations (PR) campaigns to inform the public of the benefits of the upgraded sewerage sector.
- Increase the sewerage tariff and change to a volume basis on the grounds that "polluters must pay", and move towards a combined water and sewerage tariff with regular increases to eventually achieve full cost recovery, in accordance with the 10th Malaysian Plan.

Currently the SSD and IWK are undertaking the following sewerage sector improvement strategies:

- Refurbishment, upgrading and repair of existing sewage treatment plants to address defects, malfunctions and to meet effluent standards. A total of 4,323 public plants have been refurbished up to the end of 2009 out of 6,074 plants identified for refurbishment and upgrading.
- Procurement of land for regional STPs and central sludge treatment plants for all catchments in Peninsula Malaysia based on recommendations from sewerage catchment studies prepared by SSD and IWK.
- Sludge Treatment and Disposal Sites. Currently IWK operates 25 sludge disposal sites nationwide using the trenching method and also disposes sludge at landfills and other approved disposal sites. There are also 18 mechanised dewatering units (MDUs) and 6 dedicated CSTF treatment facilities. The trenching method, sand drying beds and MDUs have proven to be cost efficient and effective methods for sludge dewatering and disposal and it is envisaged that these methods will continue to be used and expanded to most operation areas in small towns and semi-urban areas.
- Regional sewerage schemes for urbanized areas and sensitive catchments (For example water catchment areas, beach resorts areas, etc.) to rationalize small STPs and connect IST and PF latrine areas.
- CCTV surveys of problematic sewers and rehabilitation of these sewers.
- Sewerage catchment strategy studies and sewerage local plans for operational areas and updating previous studies.

3.4 Policy for Promotion of Water Supply and Sewerage Development Using the Loan Assistance from Other Countries and PPP Approach

At present, there is no movement of loan or PPP scheme application by third countries in sewerage sector, but as described below, the Chinese company has undertaken the construction of a sewage treatment plant in Kuala Lumpur on the EPC basis.

On November 3, 2011, Beijing Enterprises Water Group Limited signed the contract for the construction of Pantai Phase-2 Sewage Treatment Plant with KeTTHA. This is the first project to construct an underground sewage treatment plant in Malaysia on the EPC (engineering, procurement and construction) basis namely design-and-build contract. The Phase-1 Pantai Sewage Treatment Plant was constructed under the JBIC loan and this project is its Phase-2 construction works located on the opposite site of the Phase-1 plant beyond an expressway. The plant has a treatment capacity

of 320,175 m^3/day, adopting the A2O denitrification process (anoxic-anaerobic-aerobic) for sewage treatment with a total amount of RM 983,246,360. The construction work will be completed by July 27, 2017 including the 4-year construction work and 2-year operation and maintenance period. This EPC contract has been made through direct negotiation without an open tender procedure.

This kind of EPC contract is the second case in sewerage sector following Jelutong Sewage Treatment Plant in Georgetown, Pulau Pinang as stated below.

The local company of WWE Holdings Bhd. undertook the construction work of Jelutong Sewage Treatment Plant with a treatment capacity of 900,000 PE or 180,000 m^3/day (Ultimate capacity: 1,200,000 PE or 270,000 m^3/day) using the sequential batch reactor (SBR) activated sludge process through direct negotiation with KeTTHA. The construction period was three years from December 1, 2004 to November 30, 2007.

3.5 Basic Policy for OPEX of Water and Sewerage Operators

The Tenth Malaysia Plan[23] specifies below under the title of "Moving towards full cost recovery".

"Tariffs in 2009 covered only 78% of operating expenditure. To address this problem, the Government will phase in a tariff-setting mechanism that allows full recovery of costs to encourage sustained investments in upgrading and rehabilitating water treatment plants and distribution systems. The phasing of the tariff increases will be segregated into tariff bands based on consumption levels to ensure that the vulnerable segments of society are protected."

Table I-3.8 shows the financial status of water and sewerage operators in Malaysia. In Johor, Kedah, Kelantan, Melaka, Pulau Pinang, Perak, Perlis and Sarawak, the total revenue exceeds the total operating expenditure (OPEX) and the total expenditure including (a) operating expenditure, (b) depreciation, (c) amortization, (d) fixed monthly payment (e) lease rental, (f) finance costs and (g) capital expenditure, however, in Salangor, the total revenue exceeds the total operating expenditure but does not cover the total expenditure and, in Labuan, Negeri Sembilan, Pahang, Sabah and Terengganu, the total revenue does not cover even the total operating expenditure.

Table I-3.8 Percentage of Total expenditure and Total OPEX to Total Revenue (2010)

(Revenue as 100)

	Total Expenditure	Total OPEX	Total Revenue	Total Expenditure	Total OPEX
Water Supply					
Johor			100	79.3	76.3
Kedah			100	89.2	87.3
Kelantan			100	97.3	79.2
Labuan	153.4	153.4	100		
Melaka			100	93.4	86.4
N. Sembilan	106.2	105.4	100		
Pulau Pinang			100	84.6	66.9
Pahang	163.7	116.4	100		
Perak			100	69.3	49.5
Perlis			100	89.0	89.0
Sabah	177.3	177.3	100		
Sarawak			100	94.3	73.2
Selangor	106.6		100		51.6
Terengganu	110.6	100.2	100		
Sewerage					
IWK		168.1	100		

[23] Tenth Malaysia Plan 2011-2015, published by the Economic Planning Unit, Prime Minister's Department 2010

Note:
(1) "Operating Revenue" includes tariff and non-tariff revenue.
(2) "Operating Expenditure" comprises (where applicable) (a) water treatment and distribution cost, (b) purchase of treated water, (c) purchase of raw water, and (d) lease rental to PAAB (excluding N. Sembilan), and excludes finance cost, depreciation and amortization.
(3) "Total Expenditure" comprises (where applicable) (a) operating expenditure (b) depreciation, (c) amortization, (d) fixed monthly payment (e) lease rental, (f) finance costs and (g) capital expenditure
(4) IWK revenue excluded a subsidy (RM 150 million in 2010) and expenditure includes depreciation and interest payable.

Source: MWIG 2011
IWK Sustainability Report 2010

Johor, Kedah and Pulau Pinan have implemented the tariff increase effective since November 1, 2010 as well as Melaka since April 1, 2011, but it is noted that the total revenue in these states exceeds the total operating expenditure (OPEX) and the total expenditure, respectively, in terms of 2010.

In the sewerage sector, the sewerage revenue was RM 467.8 million, compared to the Total Operating Expenditure of RM 786.4 million in 2010, which is far from full cost recovery[24]. Compared to 1999, the first year the entire operation of Indah Water Operations was transferred to IWK, Total Operating Expenditure has increased by 306.2%, while sewerage revenue has increased by 187.6% in the same period.

3.6 Concrete Plan, Policy, etc. Formulated by KeTTHA Based on the Above

(1) Water service

In the Tenth Malaysian Plan starting from 2011, the NRW programme, involving replacement of pipes and old meters, will be expanded with an allocation RM1.1 billion to improve the quality of water and reduce losses in water supply. Out of this amount, approximately RM369 million will be allocated in the first two years of the Plan.

(2) Sewerage service

KeTTHA has the following long-term national sewerage plan[25]

- The percentage of population equivalent in urban areas receiving 'connected sewerage services' to increase from 60% in 2008 to 87% in 2040.
- The percentage of population that will be connected to a regional sewerage system is to increase from 19% in 2008 to 79% in 2040
- All existing small sewage plants located in the urban areas to be rationalized and connected to the regional sewerage system by 2020.
- Effluent standard compliance for plants with capacity of 20,000 PE and above to increase from 80% to 100% by 2020.
- All communal septic tanks and Imhoff tanks to be rationalized by year 2024.
- Sub-standard septic tanks to be changed to septic tanks that will meet the standard.
- Encourage the application of green technology in the sewerage industry. Key focuses are on effluent and sludge reuse, using energy efficient M&E equipment and Biogas production.

Table 3.12 shows the targets for the PE connected to Individual Septic Tank (IST), sewage treatment and regional sewage treatment plants in 2020 and 2040, as well as the PE connected to each in 2007. The targets are not entirely consistent with the target in the Tenth Malaysia Plan (refer to 3.2).

[24] Indah Water Konsortium Sdn Bhd Sustainability Reports 2009 and 2010
[25] JPP Annual Report 2010

Table I-3.9 Targeted Coverage of Population Equivalent (PE) Served by Regional Sewage Treatment Plants, Sewage Treatment Plants and Individual Septic Tanks

	2007	2020	2040
Individual septic tank (PE)	5 million	7 million	5 million
Sewage treatment plant (PE)	15 million	16 million	3 million
Regional sewage treatment plant (PE)	5 million (72 STP)	10 million	28.97 million (223 STP)

Source: JPP Annual Report 2010

4 Situation of PPP-related Legislation in Malaysia (Not Yet Prepared)

The Private Finance Initiatives ("PFI") Programme was announced in the 9th Malaysia Plan in March 2006, aimed at facilitating greater participation of the private sector to improve the delivery of infrastructure facilities and public service. It sets out many of the key principles on how some of the public sector infrastructure projects will be procured and implemented. PFI will be undertaken as part of the new modes of procurement under the Public Private Partnership ("PPP") to further enhance private sector participation in economic development.

In April, 2009, Privatization and Private Finance Initiative Unit was established under the Prime Minister's Department which is currently known as Public Private Partnership Unit ("3PU" or "UKAS"). It established "Public Private Partnership (PPP) Guideline" in November, 2009, which is now the observable legal system related to PPP in Malaysia.

According to the guideline, PPP involves the transfer to the private sector the responsibility to finance and manage a package of capital investment and services including the construction, management, maintenance, refurbishment and replacement of public sector assets such as buildings, infrastructure, equipment and other facilities, which creates a standalone business. In these PPP projects, there is a contract for the private party to deliver public infrastructure-based services over a long period of time. The private party will raise its own funds to finance the whole or part of the assets that will deliver the services based on agreed performances. The public sector, in turn, will compensate the private party for these services. In some PPP projects, part of the payments may flow from the public users directly.

Though ownership of assets plays a less important role in PPPs, nevertheless many of the modalities see a transfer of the assets to the public sector (revertible) as a matter of course. There are some PPP projects where the assets are not transferred to the public sector at the end of the concession period. These usually relate to facilities or projects that have little value at the end of the period due to their technological obsolescence.

The guideline states that a PPP proposal will only be considered if there is a need on the part of the Government for the project after taking into account the benefits/probity as a whole in terms of :

- socio-economic impacts
- value for money and cost savings to the Government
- quick delivery of the project and service enhancement
- increased level of accountability, efficiency and effectiveness

PPP is referred to as a public procurement model in which the value for money as shown in **Box 1** is optimised through efficient allocation of risks, whole life service approach, private sector innovation and management skills as well as synergies from inter-linking the design, finance, construction and operations.

Box 1: Value for Money

The main driver of the PPP Programme is Value for Money (VfM), defined as 'the optimal combination of whole life cost and quality to meet the users' requirements'. Generally, VfM is achieved through:

- risk transfer which allocates risks optimally between the public and private sectors
- long term nature of contracts (which embodies whole life costing)
- the use of output specification which allows bidders to innovate
- competition that provides fair value of the project
- performance-based payment mechanism
- private sector management expertise and skills

Generally through the PPP approach, emphasis is given on delivery of services (output driven) and private sector innovation and skills in maintaining the assets/facilities throughout the concession

period. Other main characteristics that differentiate PPP with other procurement methods are shown in **Table I-4.1**.

Table I-4.1 Differences Between Conventional, PPP and Privatisation Approach

Conventional	PPP	Privatisation
Procurements are funded directly via public budget.	Funding via private financial resources without public sector's explicit guarantee.	Funding via private financial resources without implicit or explicit public sector guarantee.
Immediate impact on public sector financial position.	Impact on public budget spreads over the duration of the concession.	No impact on the level of public sector expenditure.
Risks are entirely borne by public sector.	Risks are allocated to parties which can manage them most efficiently.	Risks are entirely borne by the private sector.
Extensive public sector involvement at all stages of project life.	Public sector's involvement is through enforcement of pre-agreed KPIs.	Government acts as regulator.
Relationship with private contractor is short term.	Long duration of relationship with private contractors.	Long duration of relationship with private contractors.
Applicable for projects with high socio-economic returns and those justified on strategic considerations.	Applicable for projects with commercial viability.	Applicable for projects with high commercial viability.

As stated above, "PPP", which is defined in the guideline in Malaysia, is not so different from that of other countries. According to the guideline, to develop a PPP project, all PPP proposals are supposed to be submitted directly to the relevant Ministries/agencies. Therefore, from viewpoint of a private company which wants to materialize a PPP project, it is more important whether a proposed PPP project will comply with related regulations established by related Ministries/agencies or will be at least in line with such regulations.

Due to the water and sewerage industry being a capital intensive business with the need of a huge capital to build plants, dams, and pipes in addition to a constraint of funds on the part of the States, in the 1980s-1990s it was believed that privatization by way of concession agreements was the way to lessen the states burden and improving efficiency.

The enactment of the Sewerage Services Act 1993 ("SSA") led the way for the Government to privatize the sewerage services industry under a concessions scheme. This scheme provided that long term contracts were given to concessionaires in order to fund expensive Government projects. In return, an undertaking was secured by the Government to purchase water and sewerage services from the concessionaire over a long-term pre-agreed period. In addition, the expertise and the efficiency of the concessionaire were deemed invaluable from a financial perspective in developing Governmental projects.

Over time, escalating costs, interests and inflation resulted in a massive financial deficit to the States. This problem was further exacerbated by the overall reluctance to increase tariff costs to the public for water services. Eventually, this manifested in many State's inability to repay debts by defaulting and re-structuring payment of Federal Government loans. Consequently, the financial position of the concessionaires naturally suffered without any tariff increases as the services rendered for water and sewerage supply could not be repaid to the concessionaires. This resulted in the declining quality of water services to the consumers with problems of low pressures, leaks and unscheduled water cuts.

With the Constitution Amendment Act 2005 [Act 1239], the Ninth Schedule has been amended, resulting in the item "water supplies and services' being inserted into the Concurrent List. The scope of 'water supplies and services' encompasses the treatment and supply of treated water to the public;

but does not include the management of raw water. Raw water till today is still retained under the jurisdiction of the States.

The Constitutional Amendment of 2005 paved the way to the legislating of Water Services Industry Act 2006 ("WSIA"). Water Services Industry Act 2006 [Act 655] ("WSIA") came into force on 1 January 2008. WSIA does not encroach nor affect the general application of existing laws on environmental quality and land matters and existing State powers over the water source. Its aim is to implement the restructuring of the national water supply and services industry through a uniform approach in centralizing the regulatory framework with the long term goal of improving efficiency in Peninsular Malaysia and Federal Territory of Labuan.

The Federal Constitution [Malaysia] was amended by WSIA with the Constitution (Amendment) Act 2005 to reflect a new model whereby the State's retained independent control of the water source, but treatment and distribution of the water and sewerage works was transferred to the Federal Government. Previously the State's independently controlled the water source, treatment and distribution of water and sewerage.

Traditionally, the Federal Government under the Ninth Schedule did not have jurisdiction under the scope of 'water services' as provided by the State List. The amendment moved 'water services' from the State List to the Concurrent List; allowing both Federal and State governments to have powers to legislate. Note be that the amendments were specific in terms of 'water services' instead of 'water' in order to avoid encroaching on the State's jurisdiction to regulate 'raw water sources'.

Prior existing legislations were also to be repealed upon the enactment of WSIA, including the SSA, in respect of its application to Peninsular Malaysia and the Federal territories of Putrajaya and Labuan. Additionally, the State Water Supply Enactments in respect of its application in the states of Peninsular Malaysia were advised to be amended or replaced with new legislations. State Governments will need to legislate provisions regarding the management of raw water resources as it will remain to be under State jurisdiction.

In the event of any inconsistency between State law and Federal law, Federal law, being WSIA, will prevail and State law, to the extent of the inconsistency, be deemed void by virtue of Art 75 Federal Constitution (Malaysia).

Importantly, WSIA effectively abolished the availability of any water concessions agreements by shifting towards a licensing regime as per the reasons stated above.

As a result, transition regulations were implemented for existing water concession agreement holders to move towards the newly introduced regulatory scheme under WSIA. These provisions are evident under Part XIII Chapter 2 of WSIA in relation to 'transitional provision for existing operators' as it deals specifically with existing water and sewerage services concession agreements.

In brief, previous concession agreements would still remain valid; although it was advisable for the parties to reach an agreement to settle amicably. In conclusion, this means that there can be no more concession agreements in the future as WSIA has resulted in a movement from the previous concession regime towards a new licensing regime for water and sewerage services in Malaysia.

As stated above, in order to develop a PPP project related to water or sewerage, it is the most important whether a proposed PPP project will comply with WSIA, by which water/sewerage industry have been improved, as well as whether it will be in line with PPP guideline.

PART II

WATER SUPPLY

1 Water Supply Services in the State of Pahang

The State of Pahang is one of the 13 States and 3 Federal Territories of Malaysia that is formed by 11 Districts currently as follows; Districts of (1) Bentong, (2) Bera, (3) Cameron Highlands, (4) Jerantut, (5) Kuantan; State Capital, (6) Lipis, (7) Maran, (8) Pekan, (9) Raub, (10) Rompin and (11) Temerloh. This State with land area of 36,140 km^2 is located at the north-eastern side of Peninsular Malaysia facing to the South Chine Sea as shown in **Figure II-1.1**.

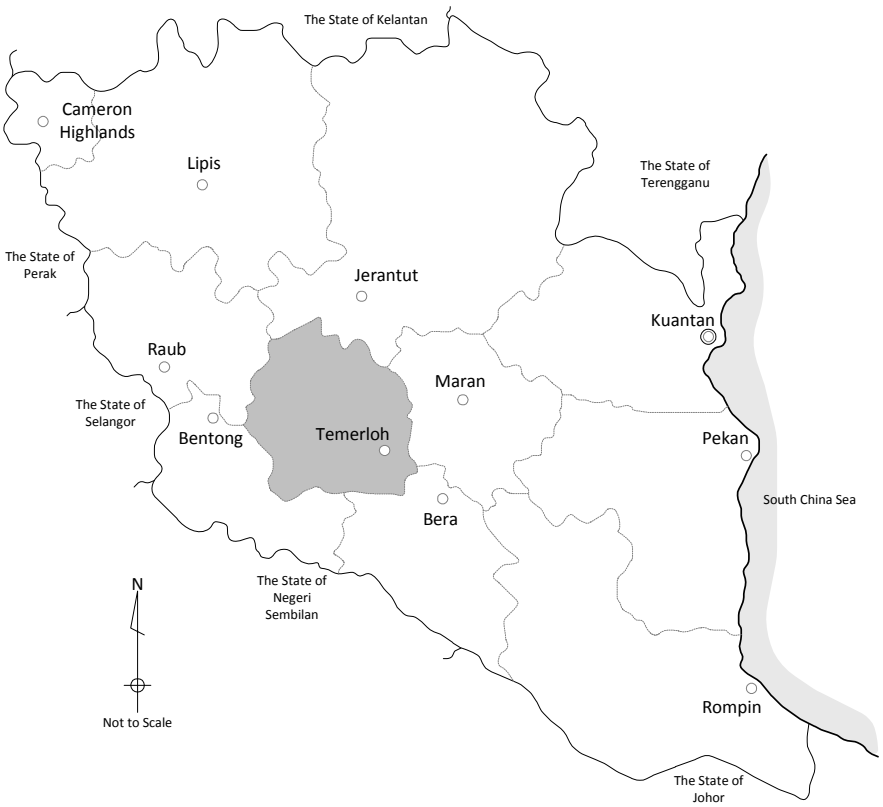


Figure II-1.1 Location of 11 Districts in the State of Pahang

1.1 Historical Background

The first responsible agency of water supply services was Pahang Waterworks Department in the State Government of Pahang called as PWD since early 1970's. Water Supply Department (hereinafter called as "ex-JBA Pahang") in the State Government of Pahang, which was officially established on the 1st day of January 1983 following the re-organization of local government, was responsible for the operations and maintenance of water supply facilities and provision of its water supply services in the entire state jurisdiction of Pahang.

Ex-JBA Pahang was corporatized as it was on the 1st day of February 2012 namely Pahang Water Management Corporation (hereinafter called as "PAIP"). Present situations of water supply services in the State of Pahang and the District of Temerloh were described using information of ex-JBA Pahang in this report accordingly.

- The stocks of the new company are 100% owned by the State Government.
- All the facilities and land is owned by the State Government and the company functions as a genuine operator responsible for operation and maintenance of facilities and billing and collection with free lease fee for the facilities and land.

1.2 Organization

The Head Office of PAIP is located in Kuantan Indera City of Kuantan District. There are 11 District Branches connecting to the Head Office, one in each of the districts in the State of Pahang.

(1) Overall Organization

Figure II-1.2 shows the organization charts of entire ex-JBA Pahang (upper) and PAIP (lower).

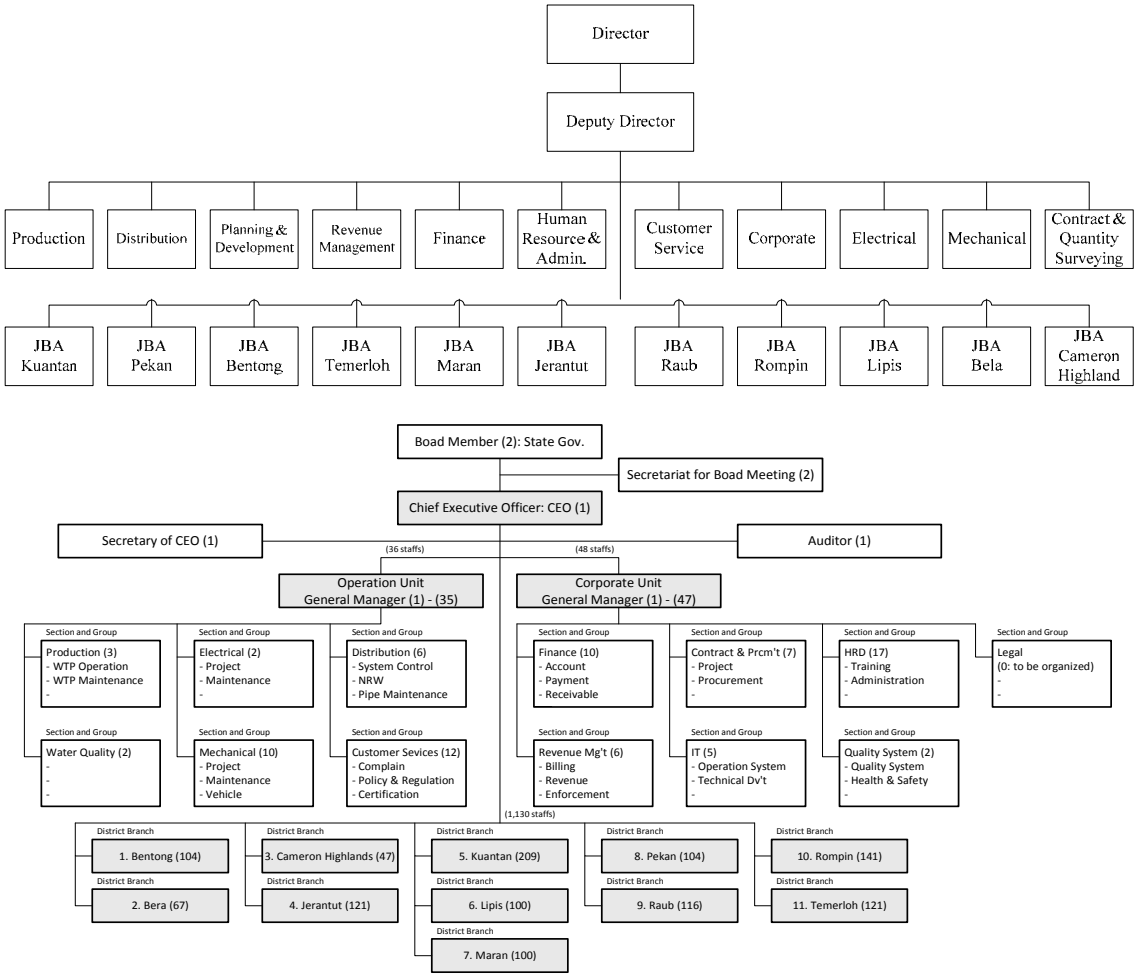


Figure II-1.2 Organization Charts of ex-JBA Pahang (upper) **and PAIP** (lower)

Organization structures of ex-JBA and PAIP are apparently similar with particularities of (1) additional 2 Board Members and 1 auditor, (2) divisional 2 Units for Departments and (3) 11 District Branches directly under the CEO. The whole organization of PAIP is managed by CEO with 2 Board Members (one of the members is Pahang Chief Minister of the State Government) and supported by 2 General Managers in each Unit. Totally, there are 13 Departments under the Units of Operation and Corporate.

Entire PAIP employed 1,221 staffs as of the 1st day of February 2012; organization was re-structured by 78 % of 1,560 staffs in ex-JBA Pahang 2010. Staffing allocation is; head office 91 staffs (7 %) and district branches 1,130 staffs (93 %), respectively. Many loan personnel were returned to the Federal and State Governments, but detailed information is unknown.

(2) Head Office

Functions of the PAIP's Head Office include policy, overall management and budgeting, procurement of all materials, contract management, monitoring of water supply services and reporting for both the State Government of Pahang and the National Water Service Commission (hereinafter

called as "SPAN"). **Table II-1.1** shows the main functions and responsibilities of each Section/ Unit in the PAIP.

Table II-1.1 Main Functions and Responsibilities of PAIP Head Office

Organization and No. of Staffs			Main Function/ Responsibility
CEO and Board Members		7	Overall Management (including secretariat, secretary and auditor)
Operation Unit	General Manager:	1	Identify, plan, formulate and monitor the distribution of water supply services in order to meet the needs of demands, quality and legislation and ensuring excellent service. Develop effective quality management system in compliance with the Quality Assurance Program of the National Clean Water Act.
	Production: WTP Operation and Maintenance	3	Inspect and monitor the treatment process at WTPs and develop methods to improve performance of the WTPs. Control treated water quality. Plan, implement and monitor upgrading of WTPs. Provide center supply contract, chemicals, water meter and water pipes.
	Water Quality:	2	
	Electrical: Project and Maintenance	2	Organize provision of electricity supply to WTPs (water treatment plants), pumps, etc. Analyze information from SCADA and Telemetry System for use in operation of WTPs, pumping stations, reservoirs.
	Mechanical: Project, Maintenance and Vehicle	10	Plan and carry out asset management of mechanical components in accordance with Treasury Instructions. Provide engineering services for design of mechanical equipment for new projects and upgrading of existing facilities. Assist in the preparation of training and carry out technical training programs to staff in operation and maintenance of mechanical equipment. Check and monitor designs carried out by Consultant Engineer.
	Distribution: System Control, NRW and Maintenance	6	Planning, implementing and monitoring the distribution system from the storage tank to the meter. Guarantee a continuous supply of water to users with adherence to the minimum pressure of 10 mH_2O at least daily 8 hours. Carried out pipe breakage and leak repairs. Implement preventive maintenance of distribution system. Carried out NRW activity and reduction of NRW.
	Customer Services: Complain, Policy and Regulation, and Certification	12	Receive complaints from users/ customers from in various forms. Record complaints (key-in) into the E-Complaints by region. Provide feedback to the complainant receipt of the complaint within 1 day by telephone or verbally by giving the reference number of complaints.
Corporate Unit	General Manager:	1	Identify, plan, formulate and monitor the implementation of policies in order to meet the needs of section, services and legislation and ensuring excellent service. Develop strategies for processing and recording of data and information, and use the data and information to make strategic planning decisions. Manage improvement for revenue and operating expense including water tariff system in compliance with the SPAN Act and Water Industry Act.
	Finance: Account, Payment and Receivable	10	Preparing realistic budgets. Preparing financial reports to assist management in planning and decision making. Preparing Financial Statements in accordance with generally accepted accounting standards.
	Revenue Management: Billing, Revenue and Enforcement	6	Ensure that revenue collection and deposits are properly recorded and accounted. Ensure accurate billing. Control water revenue arrears.
	Contract and Procurement: Project and Procurement	7	Provide technical support to other divisions in the implementation of projects. Provide special emphasis on meeting PAIP's objectives with regard to time period for implementing projects and works, as well as minimizing costs.
	Information Technology: Operation System and Technical Development	5	Preparing the plan of system improvement and introduction using IT in the fields of operation and corporate. Provide technical support to relating sections for current IT systems; GIS, E-Water, Complain and Monitoring.
	Human Resources Development: Training and Administration	17	Manpower planning. Managing personnel services and staff employment. Planning training and training courses. Plan and perform public administration development instructions.
	Quality System Quality System, and	2	The duties were not authorized yet and will be created newly as soon as possible.

Organization and No. of Staffs			Main Function/ Responsibility
CEO and Board Members		7	Overall Management (including secretariat, secretary and auditor)
	Health and Safety		
	Legal	0	

Source: PAIP Head Office (Corporate Unit)

(3) District Branch

Figure II-1.3 shows the organization charts of the ex-JBA District Office (upper) and PAIP District Branch (lower) in Temerloh.

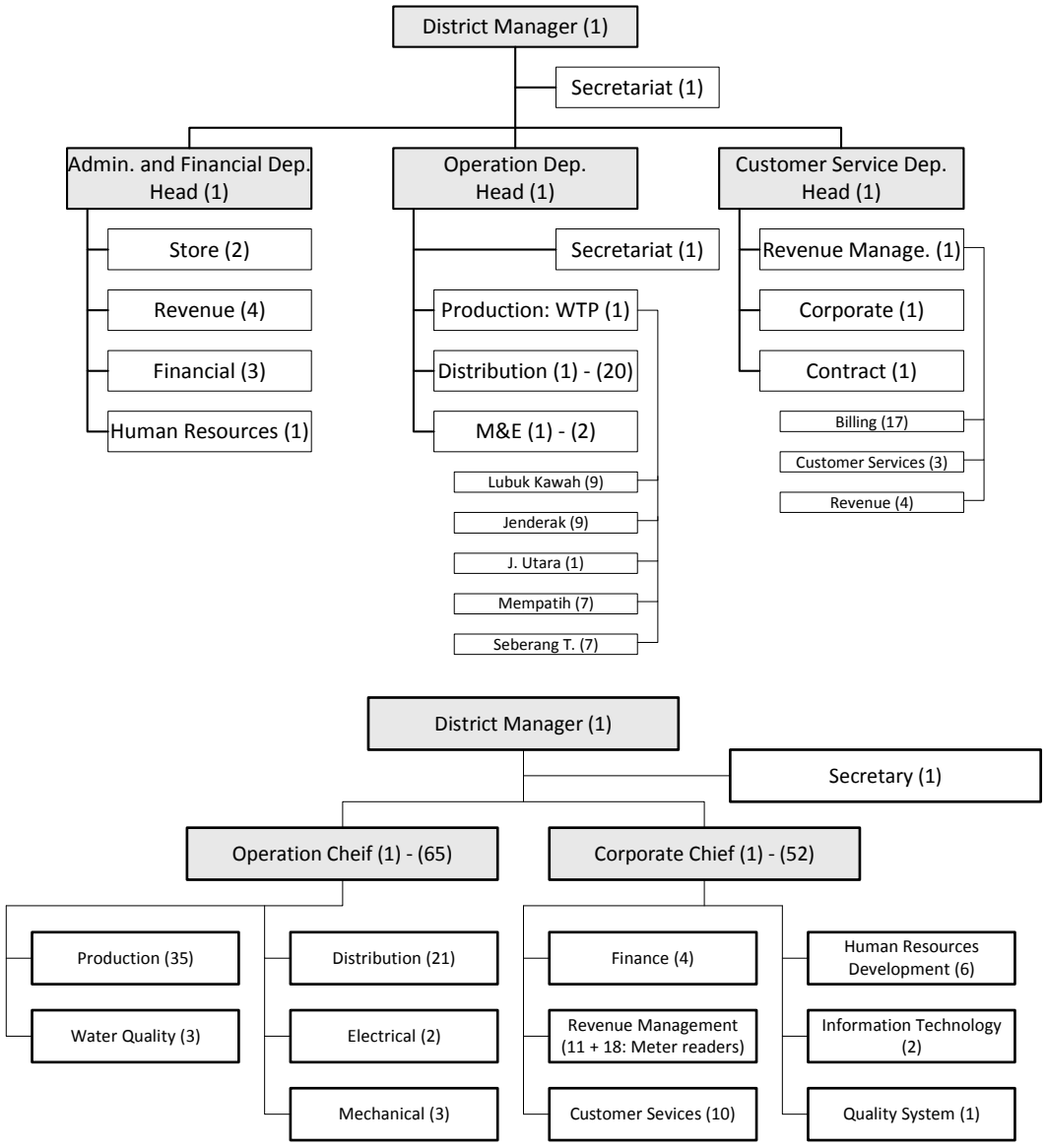


Figure II-1.3 Organization Chart of ex-JBA Temerloh (upper) **and PAIP Temerloh** (lower)

There are 2 units under the District Manager namely, Units of (1) Operation and (2) Corporate, which are similar to the Head Office. It is noted that number of meter readers at Revenue Management Section are counted at 18 (1 chief and 17 leaders), staff number of which is the same to that in December 2010.

Each of the District Branch has responsibility for day to day management of the water supply system, counter actions to customer complaints, meter reading/ billing, etc. **Table II-1.2** summarizes responsibilities and number of staffs at District Branch in Temerloh as of the 1st day of February 2012.

A total of 121 staffs are employed by the District Branch currently, 9.9 % of the total employed by entire PAIP. According to the District Manager of PAIP Temerloh, this District Branch has a plan to employ about 10 additional technicians from the out sourcing company for pipe repair works within year of 2012.

Table II-1.2 Main Functions and Responsibilities of PAIP Temerloh

Organization and No. of Staffs			Main Function/ Responsibility
District Manager		2	Overall Management (including secretary)
Operation Unit	Unit Chief	1	Operation and maintenance of water treatment plant with water quality control and water supply system including reservoirs and distribution pipelines (repairs of leaks, pipe breakages, etc.). Minor maintenance of electric and mechanical devices. Supervise the major maintenance to be used for out sourcing.
	Production	36	
	Water Quality	3	
	Mechanical and Electrical	5	
	Distribution	21	
Corporate Unit	Unit Chief	1	Financial management, human resources management and management of store. Revenue management, customer services including water meter reading and billing. Input the billing records to the E-Water system. Preparation on the plan for requirements of district branches.
	Customer Services	10	
	Finance	4	
	Revenue Management	29	
	Information Technology	2	
	Human Resources Development	6	
	Quality System	1	

Source: PAIP Temerloh

1.3 Financial Conditions

Accounting system of ex-JBA Pahang adopted the modified cash basis as a department of the State Government. On the other hand, the statement of account in the style of enterprise system was also prepared by ex-JBA Pahang for reporting to SPAN. In this statement, on-going project cost of facility was appropriated into the temporary construction counting. But the statement was not audited.

The outline of account settlement for the year of 2010 is described below as shown in **Table II-1.3** and **Table II-1.4**.

Table II-1.3 Profit and Loss Statement

Item	Amount (RM '000))	Remarks
Operating revenue	135,665	Operating revenue includes water tariff income and other income amounting to about RM 2 million
Sales cost	110,096	Sales cost composed of power cost (approx. 60%), chemical cost (approx. 14%), cost for NRW measures, meter cost, etc. is fully paid by the State Government directly.
Operating profit	25,569	
General administration cost	51,330	General administration cost is mostly salary but also includes tariff collecting commission (to be paid to the post office, etc.)
Depreciation cost	65,224	
Other income	2,095	
Current loss	88,890	
Brought-forward Loss	779,702	
Other profit	4	
Loss carry forward period of the current term	868,558	For reference, the operational condition is in a sever condition so that accumulative lose exceeds six times annual tariff income

Table II-1.4 Balance Sheet

Item	Amount (RM '000))	Remarks
Fixed asset	798,581	
Temporary construction account	645,884	
Current assets	110,668	
Current liabilities	69,257	Most of current liabilities is the money on deposit which is drawn and returned throughout the year
Net assets	1,485,876	Net assets is substantially the cumulative debt loan from the Federal Government, etc. and includes the contribution to water supply facilities for large-scale plantations with a little amount.

(3) Cash Flow Statement

Since the capital balance of payments is on an assumption that the income relies on the borrowing from the State Government, the cash flow statement is not prepared in Pahang.

(4) Depreciation

In the Malaysia Water Industry Guide, "OPEX" excludes the depreciation cost. This is reasonable, assuming the Federal Government-promoting basic scheme that the PAAB will hold all the assets. In the present start of PIPE, it is favorable to the new company that all assets are held by the State Government and rend to PIPE free of lease payments. However, when the asset will be transferred to PAAB, PIPE will have to pay the lease fee, which will be the future issue too be studied.

(5) Others

At present, in case of the deficit of the new company, the burden on the added value tax (consumption tax), business tax, etc. does not occur.

As the JBA Pahang has been officially incorporated on February 1, 2012 the following analysis and review of the study results shall be based on the business accounting system.

(1) Water Tariff System

Ex-JBA Pahang and PAIP have applied a uniform water tariff system throughout the state. The current water tariffs are categorized into 11 summarized in **Table II-1.5** with minimum charges and volumetric charges, which also are commonly applied in Temerloh. This tariff system has been pegged for approximately 29 years.

Commercial Loss

Code D (religious facilities) and Code E (Islamic mosques) are further sub-divided into government-administered (Code D1 and E1) and others (Code D0 and E0). For Code D1 and E1, the billing is done deducting a certain volume of water from a measured volume, although the detail of the rules and annual deducted volume and annual deducted amount couldn't be confirmed in the Study. This volume is identified as one of NRW.

While, the long-term arrears and high amount arrears are not necessary to be considered as NRW since the buildings without payment are listed for control and the system that the user of building is responsible to pay the unpaid bill is established as the conditions for water supply. It is, therefore, not necessary to consider them as NRW.

Table II-1.5 Water Tariff of PAIP

Category of ex-JBA Pahang and PAIP	Mini. Charge (RM/month)	volumetric charges (RM/ m^3/month)		
A. Domestic	3.00	0 – 18 m^3	>18 – 45 m^3	>45 m^3
		0.37	0.79	0.99
C. Commercial	20.00	1.45		
D. Religious Institution	3.00	0.44		
E. Mosque	3.00	0.44		
F. Swimming Pool	15.00	1.32		
G1. Passenger Boat and Ship (commercial)	30.00	4.00		
G2 Fishing Boat	30.00	3.00		
H. Bulk Water (untreated)	30.00	0.52		
I. Port	0.00	1.45		
J. Industrial	30.00	0 – 227 m^3	>227 m^3	
		0.92	0.84	
K. Military complex, voluntary services, hostels, flats, condominiums and office buildings	0.00	0.55		

Source: ex-JBA Temerloh, as of December 2011

Only for domestic and industrial uses, the incremental block tariff is adopted by PAIP; otherwise the uniform volumetric charges are adopted. With regard to the domestic and industrial tariffs, the averages nationally and the State of Pahang are compared in **Table II-1.6** for two levels of water consumption, as at May 2011.

Table II-1.6 Comparison of Water Tariffs for Domestic and Industrial Use (May 2011)

Use	Consumption	National Average	State Average	Ratio (State/ National)
Domestic	20 m^3/month	0.54 RM/m^3	0.41 RM/m^3	76 %
	35 m^3/month	0.66 RM/m^3	0.57 RM/m^3	86 %
Industrial	80 m^3/month	1.33 RM/m^3	1.45 RM/m^3	109 %
	500 m^3/month	1.36 RM/m^3	1.45 RM/m^3	107 %

Source: Figures were estimated by the Team using information from MIWG and ex-JBA Temerloh.

As a percentage of the national average, the domestic tariff of the Pahang is higher for the second tier than for the first tier. Average industrial water tariff is adversely higher for the first tier than for the second tier. Comparatively, average industrial tariff in the State of Pahang is higher than that in the National.

② Money for deposit

- The district office is responsible for collection of money for deposit, which is then remitted to the head office.
- Based on the type of buildings such as housing, factory, condominium, etc., the customers are classified into 7 categories with 27 sub-categories and applied the respective unit prices. The minimum amount is RM60 for housing and the maximum amount is RM2,000 for construction work. In case of a large-scale development, the total amount will be big, but the developer can receive water supply for the buildings completed, if he pays a predetermined amount corresponding to the buildings completed.

③ Procedures for Water Supply Application (New Installation of Water Service Installation)

Applicant, who is registered resident, shall request to the District Branch for the subscriber contract and/ or cancellation. District Branch will make the schedule and arrangement of action to be taken by both PAIP and user. When the District Brach accepts the application, following works will proceed normally. In fact, this institution of installation of new meter brings trouble on meter replacement.

- PAIP distributes the bill for deposit and the applicant pays the deposit to PAIP,

- PAIP introduces the registered supplier and contractor to the applicant,
- Applicant purchases the materials and makes the contract for service pipe installation,
- PAIP dispatch the inspector when the materials are installed to the applicant house,
- PAIP' inspector confirms the water meter and records the initial meter reading, and
- PAIP confirms the applicant pay to both the supplier and the contractor.

Licensed Plumber's Shop System for Water Service Installation Work
The new applicant for water supply requests the water service installation work or the material procurement to the plumber's shop licensed by SPAN. The Peninsula is divided into four blocks and the plumber's shops are designated by block in which the State of Pahang belongs to the east coast block. The JBA district office assesses whether the plumber's shop has a license from SPAN, the contents of water service installation work are proper and so on and gives an approval of work at the time of application from the Plumber's shop.

(2) Number of Accounts by Category

Normally, ex-JBA Pahang manages the number of accounts by users of domestic and non domestic for forecasting purposes in terms of water demand and income accounting. The number of domestic and non domestic connections in Pahang in each of the Years 2008 to 2010, together with the percentage of each is shown in **Table II-1.7**. The percentage of non domestic connections increased in each year.

Table II-1.7 Variations of Domestic and Non-domestic Accounts in Pahang

Year	Domestic			Non Domestic			Total	
	Account	proportion	Growth	Account	Proportion	Growth	Account	Growth
2008	292,384	89.8 %	-	33,153	10.2 %	-	325,537	-
2009	298,885	88.4 %	2.2 %/Y	39,261	11.6 %	18.4 %/Y	338,146	3.9 %/Y
2010	308,570	88.0 %	3.3 %/Y	42,187	12.0 %	7.5 %/Y	350,757	3.7 %/Y

Source: MWIG

On the other hand, the numbers of account in domestic and non-domestic users by district are indicated in **Table II-1.8**. Proportion rates of total accounts in each district per entire Pahang (: {A + B}/ Pahang) are estimated at 32.3 % for Kuantan, at 12.8 % for Temerloh and at less than 10 % for others. Proportion rates of domestic account in each district (: A/ {A + B}) have minimum 82.1 % at Cameron Highlands and maximum 91.8 % at Maran.

Table II-1.8 Proportions of Domestic and Non-domestic Accounts by Districts (2010)

Ex-JBA District	No. of Account at Dec-2010		Statistics Information	
	Domestic: A	Non-domestic: B	(A+B)/ (∑A+∑B)	A/ (A+B)
Bentong	24,106	2,623	7.6%	90.2%
Bera	18,825	2,500	6.1%	88.3%
Cameron Highland	7,215	1,573	2.5%	82.1%
Jerantut	20,651	2,716	6.7%	88.4%
Kuantan	97,907	15,437	32.3%	86.4%
Lipis	14,246	1,844	4.6%	88.5%
Maran	23,154	2,069	7.2%	91.8%
Pekan	20,583	2,132	6.5%	90.6%
Raub	22,570	2,691	7.2%	89.3%
Rompin	20,429	2,738	6.6%	88.2%
Temerloh	38,884	5,864	12.8%	86.9%
Ex-JBA Pahang: ∑	308,570	42,187	100.0%	88.0%

Source: PAIP Head Office (Corporate Unit)

(3) Billing and Collection

Revenue management has been carried out by PAIP Head Office using the Electronic Revenue Management Information System (called as "E-Water"), which has used to manage customer information, including new application, installation, checking of arrears, disconnection, reconnection, etc.

This system has been used since the middle of 2006, with customer information management carried out by the District Branches connecting to the Head Office. The objectives of E-Water are:

- To create an effective information system at both Head Office and District Branches for customer' account management from the aspect of application and installation process, termination, arrears, reconnection and disconnection, etc.,
- To enable management to obtain customer' information quickly and accurately and
- To provide a fast and efficient service to all customers.

Meter reading and billing activity is carried out by the District Branches using the Spot Meter Reading System (called as "SMRS"), as shown in **Figure II-1.4**, which has been in use since 2009 with due acceleration of E-Water performances.

Bills are required to be paid within 7 days of issue and can be paid at PAIP Temerloh branches, various banks (including by ATM at Bank Rakyat), Telekom Malaysia, Post Office and by check, money transfer or money order. Online payment of bills is planned to be introduced by PAIP Head Office (IT Section).

Table II-1.9 shows the annual records on amounts billed and collected in each ex-JBA District. The collection rates were 99 % for maximum and 75 % for minimum in 2010. The most of collection rates were fallen on 80's %.

Figure II-1.4 Functions of SMRS

Table II-1.9 Annual Amounts in Billed and Collected by Districts (2010)

District	Billed amount in RM: A	Collected amount in RM: B	Collection Rate: B/ A
Bentong	9,925,142	8,470,701	85 %
Bera	5,425,796	4,845,772	89 %
Cameron Highland	2,938,589	2,570,247	87 %
Jerantut	7,693,172	6,729,756	87 %
Kuantan	59,575,884	49,531,973	83 %
Lipis	4,597,547	4,555,276	99 %
Maran	8,406,398	6,358,211	76 %
Pekan	7,797,356	6,340,484	81 %
Raub	7,399,714	6,535,516	88 %
Rompin	10,151,627	7,636,395	75 %
Temerloh	11,754,247	10,431,831	89 %
State of Pahang	135,665,473	114,006,161	84 %

Source: PAIP Head Office (Corporate Unit)

The disconnection of water supply for nonpayment customers occurs a few cases (at most ten) per month according to the performance of Temerloh District Office.

(4) Revenue and Expenditures

Table II-1.10 summarizes the revenue and the operating expenses (hereinafter called as "OPEX") of ex-JBA Pahang in period from 2007 to 2010 and includes a comparison of the [OPEX/ Revenue] in the state with the average in Malaysia in each of the years.

Table II-1.10 Revenue vs. OPEX in Pahang and National

Year	Revenue: A	OPEX: B	Balance: A – B	OPEX/ Revenue: B/ A	
	Unit: RM '000 (thousand)			Pahang	National
2007	114,558	146,262	-31,704	128 %	66 %
2008	131,053	157,224	-26,171	120 %	63 %
2009	124,452	166,077	-41,625	133 %	74 %
2010	137,761	160,287	-22,526	116 %	75 %

Source: MWIG

OPEX in Pahang increased in each year from 2007 to 2009, but decreased in 2010, compared to the previous year. This decrease combined with an increase in total revenue of about 11 % in 2010 compared to the previous year resulted in a decrease in the [OPEX/ Revenue] to 116 %, which was the lowest in the past 4 year period considered. Nevertheless, [OPEX/ Revenue] in all years was significantly higher than the average in Malaysia. Generally the trend in [OPEX/ Revenue] is positive, with the exception of 2009, although the period considered is short.

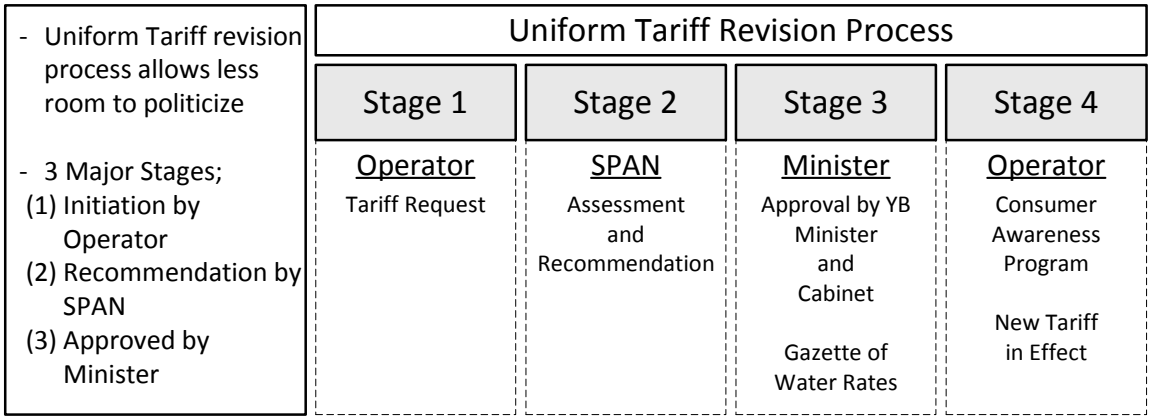
According to ex-JBA Pahang, the monthly OPEX excluding personnel expenses has managed by each WTP. Any information of costs for energy, chemical and maintenance by each WTP was not provided by ex-JBA. In this regard, overall OPEX was merely allocated by districts according to production amount, pipe length and staff number, respectively.

The details of 2010 are described in **Table II- 1.3**.

(5) Process for Application and Approval of Tariff Increase in Malaysia

The State Government had authority to approve changes in the tariff until the end of 1995; subsequent to this date approval has been required from the Federal Government.

A tariff revision process has been applied in all the States, with tariffs reviewed every three years. The process, including the stages, is shown in **Figure II-1.5**. Stages 1 to 3 take between about 7 and 9 months.



Source: SPAN

Figure II-1.5 Tariff Revision Process

Stage 1: An Operator makes a request to SPAN for a change in the tariff, although SPAN can initiate the revision process by suggesting to an Operator that it is an appropriate time to review/ revise the tariff.

States that have migrated to the licensing regime and are regulated by SPAN are required to submit a Business Plan every three years or such other period as may be determined by the Commission. This Business Plan should include targets for Key PIs and NRW and any request for a change in the tariff is intended to be submitted with the Business Plan. It should be noted that for States which have not migrated to or are in the process of migrating to the new regime, targets for Key PIs, to be considered in Stage 2, will be based on National Water Resources Study (NWRS).

Stage 2: SPAN's assessment of the request for a change in the tariff takes into account various factors including the following:

1. Level of efficiency achieved by the Operator as defined by SPAN;
2. Operating effectiveness of the Operator including meeting defined service quality. Proposals to increase service levels are considered;
3. Progress of continuous improvement programme of the Operator including addressing NRW and bill collection;
4. Level of capital expenditure requested by the Operator, for example for upgrading the water supply system and providing sludge treatment in order to comply with environmental legislation;
5. Lease rental charges by PAAB, where applicable;
6. Operating expenditures, including for energy and chemicals; and
7. Consumer Price Index.

In addition as part of their overall role SPAN verify the data provided by the Operator, in terms of reliability, accuracy, etc.

Following the assessment a recommendation for a revision in the tariff is made by SPAN.

The stakeholder consultation process includes consultation with varies parties includes the Operator, PAIP, Malaysian Water Association, Industries, NGOs and Forum Air Malaysia. The latter, which was formally registered on the 25th day of July 2008, has been appointed

as the Water Forum in accordance with Section 69 of WSIA-2006 and has the following functions as prescribed in Section 70:

1. To give feedback and make recommendations to the Commission on any matters concerning the interest of consumers of the water supply services and sewerage services;
2. To represent the interests of consumers of the water supply services and sewerage services;
3. To promote consumer's interests in relation to the tariffs and standards of water supply services and sewerage services;
4. To identify and keep under review matters affecting the interests of consumers and ensure that the water supply services and sewerage services companies are aware of, and responsive to, concerns about their services;
5. To publicize the existence, functions and work of the Water Forum in protecting the interests of consumers; and
6. To carry out the functions as determined by the Commission.

Stage 3: The main activity in this stage is approval to the change in the tariff, in accordance with the prevailing legislation.

Stage 4: In this stage the new tariff takes effect and one of the important roles of the Operator is to promote public awareness of the new tariff, reasons for the change in the tariff, etc.

Unfortunately, no water supply Operator received the SPAN approval for new tariff system yet.

1.4 Water Supply Services

For the acquisition of new subscribers, detailed actions of ex-JBA Pahang for "Customer Charter" are as follows:

- Installation of new water meters will be made within 7 working days after all payment including deposit has been made.
- All verbal bill enquiries will be resolved within a day. Written bill enquiries will be resolved within 2 weeks.
- Disconnected water supply will be reconnected within 3 working days after receiving payment of arrears.
- Deposit will be refunded to customers within 3 months via check after receiving notice to terminate service.
- Scheduled water supply interruptions will be notified at least 3 days in advance through main mass media.
- Application for 100 mm and smaller pipe size burst or leakage will be responded within 1 day after receiving application. Responds on bigger pipe size will be made as soon as possible.
- Application for water reticulations plans and internal plumbing system will be responded within 3 weeks after receiving application.
- Provide a fair and satisfactory service in providing water supply services to all customers.

PAIP follows the National standard, Ministry of Health (hereinafter called as "MoH") and the owned standard for adequate water supply service in terms of quality and quantity below.

- Quality: Drinking Water Quality Standard (wider permissible range than WHO standard)
- Quantity: minimum 1 bar (10 mH_2O) and minimum daily 8 hours

Major performance indicators (hereinafter called as "PIs") in 2010 are shown in **Table II-1.11**.

Table II- 1.11 Major PIs of Water Supply in 2010

Major PIs and its unit		Average in 2010		
		National	Pahang	Temerloh
Staffs per 1,000 accounts	capita/1,000 accounts	2.80	4.40	3.00
Length of pipeline per service area	km/km^2	1.65	0.30	0.40
Domestic population served per pipeline	capita/km	214.00	141.00	144.00
Domestic Connection Density	account/km	43.00	29.00	40.00
Proportion of Meter with 7 years or older	%	23.20	53.40	NA
Account No. per meter reader	account/capita	3,252.00	2,295.00	2,647.00
OPEX per production*[1]	RM/m^3	0.63	0.45	NA
NRW Rate	%	36.37	55.29	64.88

Sources: MWIG 2010 and estimated by the Team using information collected from ex-JBA Pahang and Temerloh.
Note*[1]: OPEX in Temerloh was estimated by the team using entire OPEX in Pahang with proportional allocation.

Comments and/ or trends of the said PIs are described below.

< No. of staffs per 1,000 accounts >

This PI of entire ex-JBA Pahang is estimated at 4.4 based on number of staffs and accounts in 2010, while the same PI in Temerloh is estimated at 3.0, assuming that proportional allotment of staffs in Head Office using the rate of account number in each ex-JBA district. Both figures are higher than the national average.

< Length of pipeline in km per service area in km^2: Network Density >

Records indicate this PI of 0.25 km/km^2 in 2009 to 0.30 km/km^2 in 2010. This increase corresponds with the increase in the length of pipeline (8,853 km in 2009 and 10,638 km in 2010).

< Domestic population served in capita per pipeline length in km >

MWIG Report describes this Pahang' PI of 167 capita/km in 2009 to 141 capita/km in 2010. This decrease which is consistent with the increase in network density and percentage of the urban and rural population served is probably due to extension of the distribution network into area with low population densities in 2010.

< No. of domestic account per pipeline length in km: Domestic Connection Density >

MWIG indicates this Pahang' PI was decreased from 34 domestic connections/km in 2009 to 29 domestic connections/km in 2010. The decrease is consistent with the decrease in the domestic population served per km of pipeline.

< Proportional percentage of Meter with 7 years or older >

This PI of 53.4 % in Pahang is much higher that that of National average of 23.2 %. Ex-JBA Pahang has promoted to replace the old meters since 2008. As a result of this activity, this PI of 67.9 % in 2007 decreased significantly to 53.4 % in 2010. However, this PI in Temerloh stays in higher rate of 71.9 % in 2010.

< No. of account per meter reader in capita >

These Pahang' PI of 2,259 account/capita and Temerloh' PI of 2,647 account/capita in 2010 are much lower than the National average of 3,252 account/capita. Since ex-JBA Pahang introduced the SMRS in 2009, this Pahang' PI of 111 account/capita in 2007 increased significantly.

< OPEX per production amount >

In 2010 in Pahang' PI of 0.45 RM/m^3 was lower than that of National average. Pahang' PI of the same value was recorded in 2007 and increased once at 0.49 RM/m^3 in 2009. Temerloh' PI in 2010 was apparently 0.41 RM/m^3, which was lower than that in Pahang.

< Percentage of non-revenue amount in m^3 per production amount in m^3: NRW Rate >

This Pahang' PI of 55.29 % is much higher that that of National average. Comparing to the state average, Temerloh' PI of 64.88 % in 2010 is also higher that that of state average.

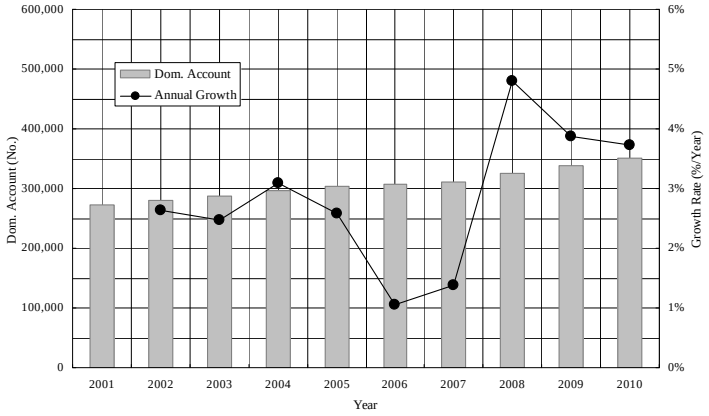
For improvement of water supply services and operation efficiency, ex-JBA Pahang introduced the IT systems of (1) GIS, (2) E-Water, (3) E-Complain and (4) Telemetric Monitoring. Among these systems, GIS using software of "Arc-GIS ver. 9.5" was introduced at Head Office in 2008. Most of inputs data were positioning information of water supply facilities without data of facility operation and customer services.

Ex-JBA Pahang has an enlargement plan of GIS in future for the management integration between engineering and customer information. Terminal units at district branches are not installed yet. Present data in GIS are shown below.

- General Data: coordinate position, construction year, design capacity
- Intake: river name
- WTP: treatment method
- Reservoir: structure, use
- Pipes: material, diameter, use (trunk main or branch)
- Others: booster pump, receiving well

(1) Population Served

Transition related to the number of domestic accounts with its annual growth rate in Pahang is shown in **Figure II-1.6**.



Source: MWIG

Figure II-1.6 Number of Domestic Account in Pahang

Population served was estimated by the study team using the numbers of population, household in the census and domestic accounts counting being registered by ex-JBA Pahang. Average populations per household are estimated at 4.28 capita/HH in Pahang and at 3.57 capita/HH in Temerloh.

The other administrative jurisdiction area has been classified into two namely "Urban: town" and "Rural: village." There are 4 towns in the Temerloh District, areas of which are extending over 7 zones (called as "Mukim" in Malay). Location map is referred to **Figure II-2.1**.

- Temerloh: 4 zones of Bangu, Mentakab, Perak and Songsang
- Sementan: 1 zone of Sementan

- Kerdau: 1 zone of Kerdau
- Jenderak: 1 zone of Jenderak

Percentage of population served in Pahang is shown in **Table II-1.12**. There was a significant improvement in service coverage in 2009 compared to the previous year.

Table II-1.12 Water Supply Coverage in ex-JBA Pahang

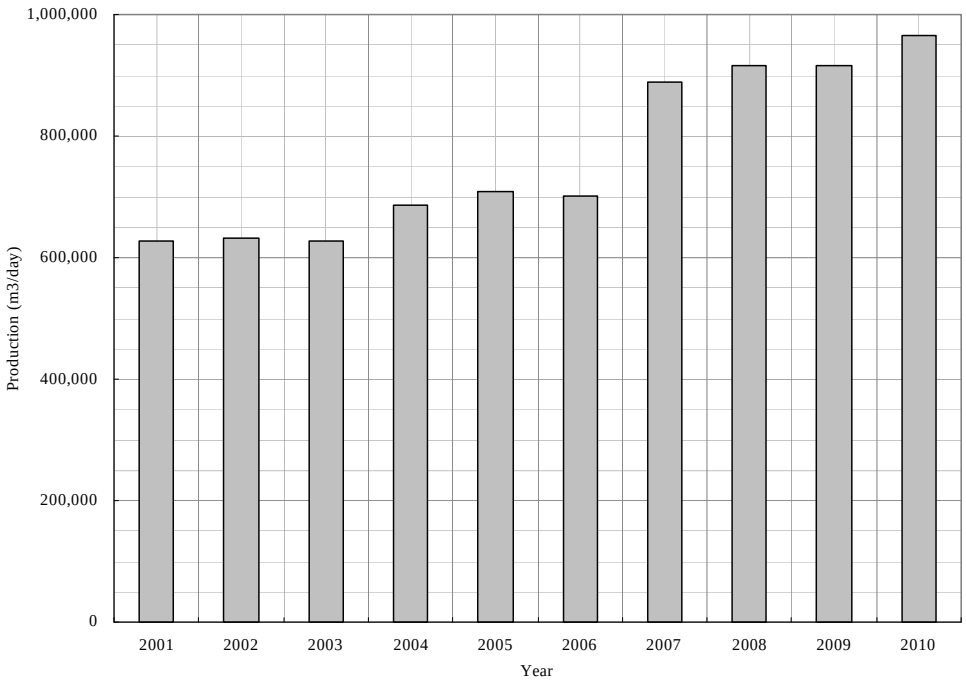
Year	Percentage of Population Served in %		
	Urban	Rural	State Average
2007	98.0	89.0	93.0
2008	98.0	89.0	93.0
2009	100.0	96.0	97.8
2010	100.0	96.0	98.0

Source: MWIG

(2) Water Production

Figure II-1.7 indicates the transition of average daily production amount in Pahang, the value of which in 2007 was increased with 27 % of annual growth.

Daily water production at respective water treatment plants under Temerloh District Office is shown in **Table II-2.3**.



Source: MWIG

Figure II-1.7 Annual Average Daily Water Production in ex-JBA Pahang

Ex-JBA Pahang has gathered monthly report from each ex-JBA District Office, which includes the daily production amount at each WTP. **Table II-1.13** shows the number of WTPs and production records in each district.

Table II-1.13 Production in each ex-JBA District

Ex-JBA Pahang		Production Record in 2010	
Ex-JBA District	Active WTPs	Total in m^3/year	Equivalent in m^3/day
Bentong	10	21,124,493	57,875
Bera	3	15,170,600	41,563
Cameron Highland	2	5,463,016	14,967
Jerantut	10	21,853,439	59,872
Kuantan	9	142,661,726	390,854
Lipis	9	16,637,325	45,582
Maran	9	29,530,598	80,906
Pekan	6	18,537,876	50,789
Raub	8	19,948,972	54,655
Rompin	4	22,388,956	61,340
Temerloh	4	43,177,999	118,296
Total	74	356,495,000	976,699

Source: PAIP Head Office (Corporate Unit)

Ex-JBA Pahang has produced treated water of about daily 0.98 MCM in 2010. The largest production amount in 2010 was recorded at 293,413 m^3/day from Semambu WTP in Kuantan and the second one was recorded at 100,314 m^3/day from Lubuk Kawah in Temerloh.

(3) Water Consumption

In the State of Pahang, statistical information of water consumption may include meter inaccuracy and error, because defective meter by aging is one of NRW issues such as under-measuring and metering with average and estimate.

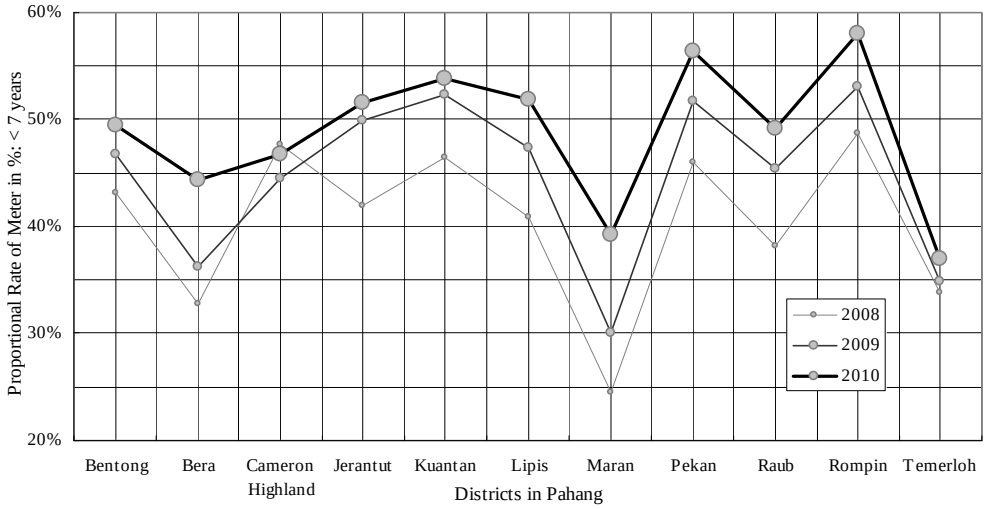
Table II-1.14 shows the numbers of meter aging within 7 years (< 7) and over 7 years (≥ 7) including proportional rate of meter number in acceptable age by standard of ex-JBA Pahang.

Table II-1.14 Meter Age by ex-JBA District

Ex-JBA District	2008			2009			2010		
	Age < 7	Age ≥ 7	Ratio: < 7	Age < 7	Age ≥ 7	Ratio: < 7	Age < 7	Age ≥ 7	Ratio: < 7
Bentong	8,539	11,231	43%	10,408	11,842	47%	12,173	12,468	49%
Bera	4,989	10,235	33%	6,109	10,749	36%	8,931	11,180	44%
Cameron Highland	3,544	3,900	48%	3,485	4,334	45%	3,956	4,507	47%
Jerantut	6,685	9,259	42%	9,687	9,696	50%	11,180	10,508	52%
Kuantan	37,236	42,885	46%	50,189	45,664	52%	57,595	49,268	54%
Lipis	4,393	6,361	41%	6,055	6,712	47%	7,684	7,112	52%
Maran	4,383	13,464	25%	5,978	13,912	30%	9,250	14,277	39%
Pekan	6,742	7,914	46%	9,155	8,548	52%	11,717	9,060	56%
Raub	6,895	11,139	38%	9,594	11,537	45%	11,524	11,902	49%
Rompin	7,611	7,992	49%	9,499	8,390	53%	12,152	8,807	58%
Temerloh	12,614	24,667	34%	13,943	26,072	35%	15,855	27,010	37%
State of Pahang	103,631	149,047	41%	134,102	157,456	46%	162,017	166,099	49%
	252,678			291,558			328,116		

Source: PAIP Head Office

Proportional rate of acceptable meter age in Pahang has been improved year by year (41 % to 49 %), because ex-JBA Districts have replaced the defective meters by new one that was provided from ex-JBA Pahang in last 5 years (2006 to 2010). **Figure II-1.8** shows the said proportional rates by ex-JBA District.

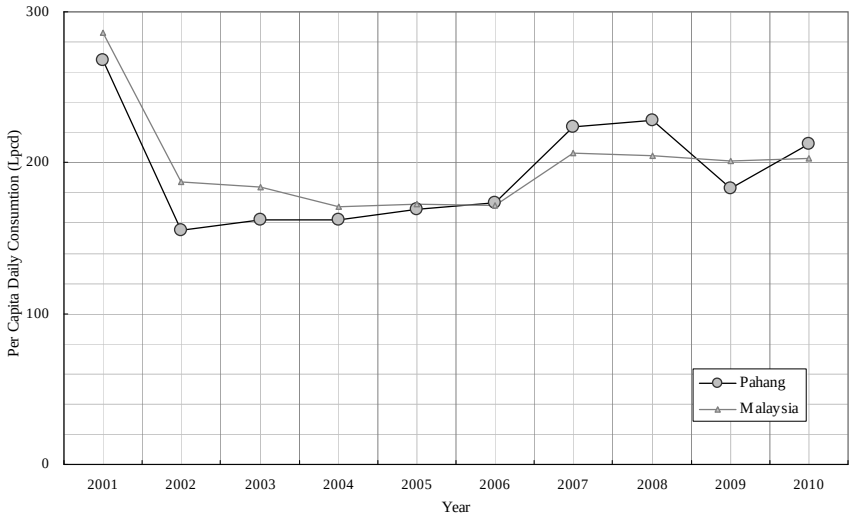


Source: ex-JBA Pahang

Figure II-1.8 Proportional Rate of Acceptable Meters by ex-JBA District

Progressions of meter replacement seem to have different depending on ex-JBA District. The worst two districts of Bera and Maran in Pahang state were improved (11 points from 33 % to 44 % and 14 points from 25 % to 39 %); however Temerloh had almost the same proportional rates (3 points from 34 % to 37 %).

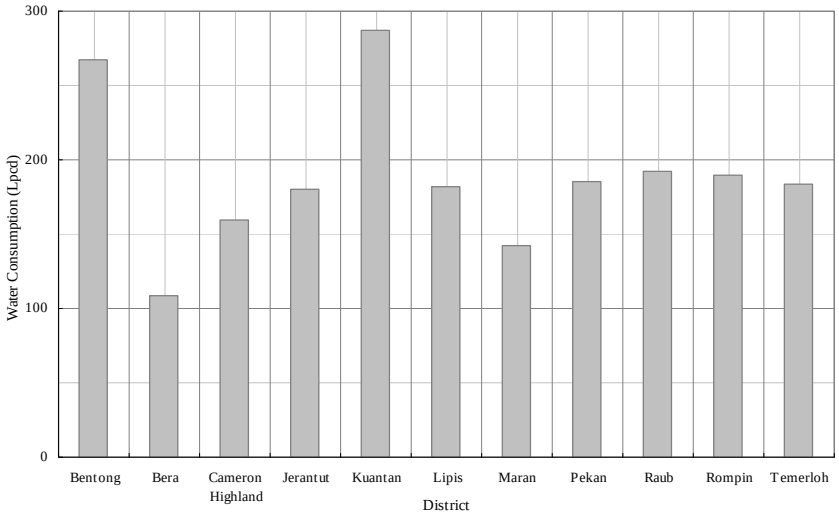
Under the said meter situation, per capita water daily consumption in entire ex-JBA Pahang was recorded at 212 Lpcd (litter per capita day) according to MWIG 2010. **Figure II-1.9** shows the transition of average water consumption of Pahang in Lpcd (litter per capita day) from 2001 to 2010. It should be noted that only the value in 2001 is quite higher than other years.



Source: MWIG

Figure II-1.9 Average Domestic Consumption in ex-JBA Pahang

On the other hand, the study team estimated water consumptions in each ex-JBA Districts as shown in **Figure II-1.10** using domestic accounts, domestic billing volume and average population per HH. Among ex-JBA Districts, water consumption in Temerloh was estimated at 181 Lpcd. It is noted that these figures in Lpcd include meter in-accuracy and/ or error.

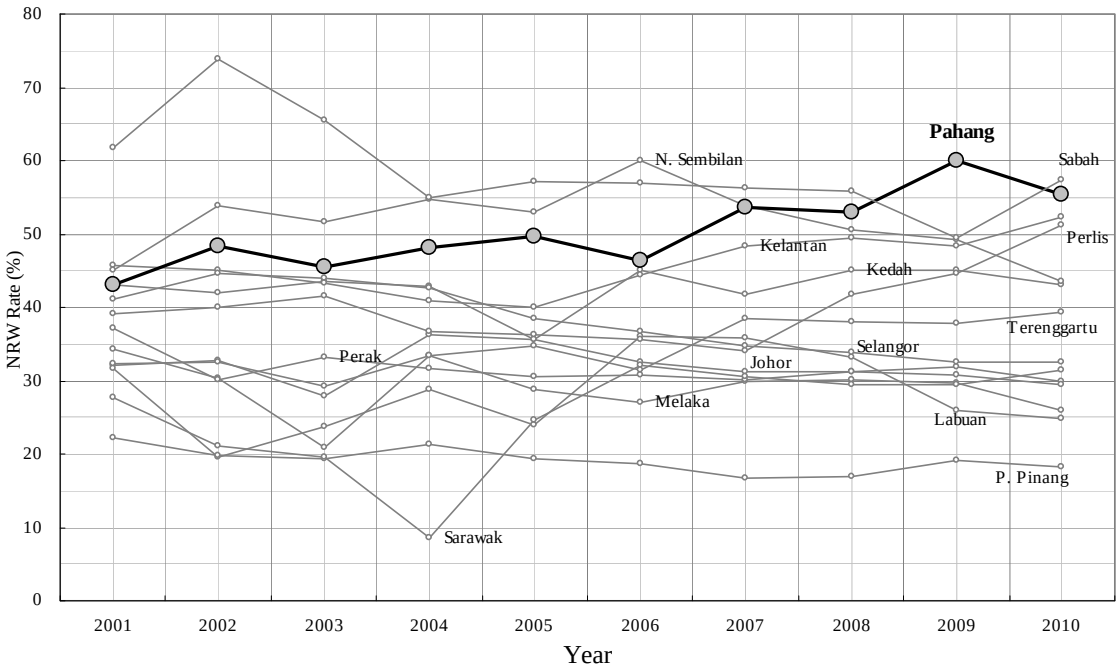


Source: PAIP

Figure II-1.10 Average Domestic Consumption in ex-JBA Districts

(4) NRW

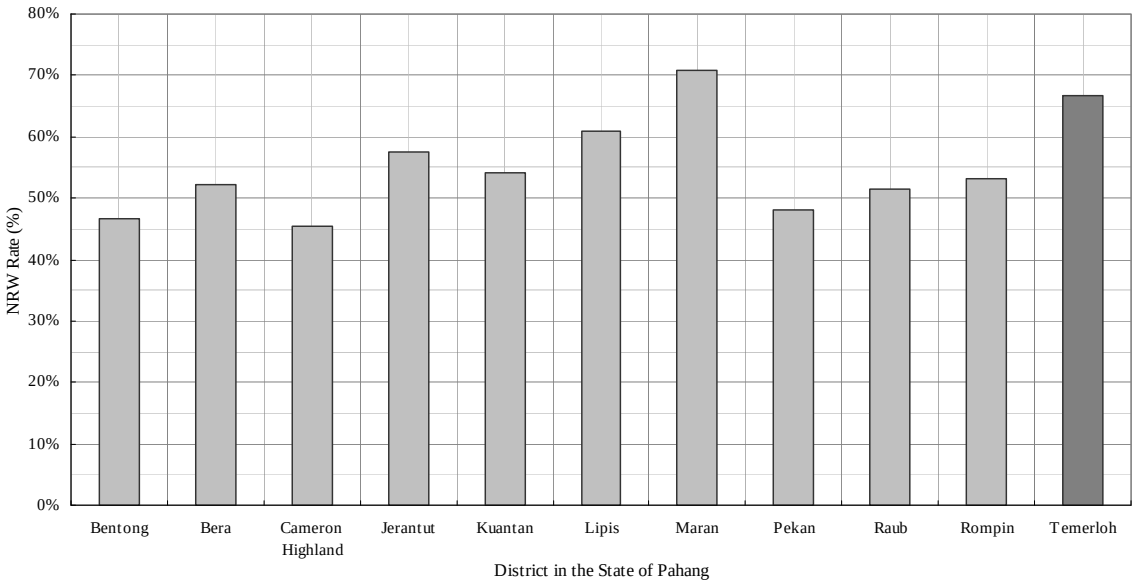
The medium term trend in Pahang' NRW compared to the average in other states in most of the last 10 years is shown in **Figure II-1.11**. This clearly highlights the need for significant reductions in Pahang NRW.



Source: MWIG

Figure II-1.11 NRW Rate of each State in Last 10 Years

Figure II-1.12 compares the NRW rates of each ex-JBA District in 2010. NRW rate of 66.73 % in ex-JBA Temerloh was higher than the state average of 55.39 % in 2010.



Source: PAIP

Figure II-1.12 NRW Rates in each ex-JBA District (2010)

Ex-JBA Pahang transferred an on-going project to PAIP, which has a scope of the NRW Reduction using budgets allotted from the Federal Government. Status of the said project as of February 2012 is tendering stage and the Tender Documents were distributed to the candidate tenderers. According to PAIP verbally, form of candidate tenderers may be consortium of major and local contractors in Malaysia. Brief contents of the project are;

- Project Site: Districts of Kuantan and Lipis
- Contract Period: 3 years
- Scope of Works: Replacement of Service Connections and Distribution Pipelines
- Objectives: Baseline Survey with consent and Reduction 15 % of NRW Rate
- Payment: At piece rates periodically according to the Work in progress

1.5 Call Centre

- Operation of the Call Centre at the head office
  Telephone: 4 lines
  Staff: 4 members by 2 shifts
  Working hour: 07:00~23:00 (Saturday, Sunday and holiday are off)
- District call centers operated by 1 staff (one shift) respectively were cancelled in December 2010.
- Through an online system, the information received is shared with district offices which are responsible for field response
- The response situation by ex-JBA can be monitored by customers through a website.
- The number of complaints received at ex-JBA Pahang is 100 calls/day on average, but 1,000 calls/day at the time of a big burst and leak, etc. which occurs four to five times per annum.

Table II-1.15 Number of Complaints Received by Ex-JBA Pahang/ (2011)

	Total	Billing	Burst, leak, etc.
Received	30,656	10,036	20,620
Solved	30,388	10,036	20,352

Source: PAIP

- The commencement and disconnection of water supply are also handled at respective district

offices.
- The number of complaints received at ex-JBA Temerloh is 20 calls/day on average, but 50 calls/day at the time of a big burst and leak, etc. which occurs a few times per annum.
- The board attached to the entrance of the district office shows the access telephone numbers of two staff in charge for daytime and nighttime, respectively to receive the complaints and information on bursts and leaks during a night, day-off, etc.

As stated above, the system to receive calls on leak, etc. at any time has been established, which makes a quick response possible and is effective in NRW reduction

1.6 Proposed Managerial Improvement

(1) Form of Organization and Assets Management

Ex-JBA Pahang was corporatized on the 1st day of February 2012 with organization name replaced by PAIP.

Departments of general affairs and management/ operation are required to secure the necessary staffs for rational works, while department of revenue (especially for meter reading, billing and tariff collection) needs to re-set the efficient system institutionally. Candidate items of institutional improvement would be;
- Although a large personnel reduction is implemented (357 employees or approximately 23% of total employees), the details of divisions are unknown and it is necessary to check the working status after a personnel reduction
- An extra bonus in accordance with progress: enhance the staff's incentives
- Periodical responsible area shuffling of meter reader: reduction of meter reading error
  In this regard, the shift of meter readers has been already partly applied to condominiums, etc. and the field staff understands the situation as a problem and commences remedial measures..
- Commission to out sourcing: financial retrenchment (cost reduction)

Although the water assets should be transferred to PAAB in the earliest time in accordance with the national basic policy, a comprehensive consideration will be required including tariff revision, subsidy and so on.

(2) Financial Improvement

1) Basic idea
Eventually, the company aims to hold all assets, raise the fund including the capital expenditure as a self-accounting private company, manage the business sustainably, and to operate water and sewerage services integrally. For this purpose, in accordance with the policy of the Federal Government, the company makes the effort on awareness enlightenment of stakeholders, increase the water tariff step by step and realize the tariff level based on the idea of full cost recovery, obtaining the customers' understanding

2) Items to be added in turn to the cost breakdown at respective stages of tariff revision
- OPEX : Traditional A (Sales cost) plus B (General operating cost)
  A: Power cost, chemical cost, O&M cost of plants, etc., vehicle and equipment, diesel fuel and so on
  B: Personnel cost, outsourcing cost and commission for tariff collection, and so on

- Incremental expenditure when the O&M cost in A is properly managed.
- Expenditure to replace all water meters of seven years or older.
- Depreciation and payment interest
- The cost to replace old pipes
- Proper profit to be secured providing for future facility provision, etc. as the company to sustain the sound management

3) Some cases assumed in the study of tariff level

Case 1: No Holding of assets (OPEX and 30% of the facility lease fee are considered in calculation.)
Case 2: No holding of assets (OPEX + 100% of the facility lease fee are considered in calculation.)
Case 3: Holding of assets (OPEX and depreciation cost are considered in calculation.)
Case 4: Holding of assets (OPEX, depreciation cost, interest fee and capital maintenance cost are considered in calculation.)

In addition to the above four cases, there are some cases considering the reduction of OPEX through NRW reduction

Case when NRW will be 30% (the target in 2017)
Case when NRW will be 20% (the target in 2022)

4) Other considerations

(a) Meter-related expenses

In other states such as Melaka, Pulau Pinang, etc., meters are initially installed with the burden of the water company and replaced within a valid period. The accounting procedure of this cost is

- New installation: payment for procurement and installation cost → increase of asset → include the depreciation cost in the cost
- Replacement: include the procurement and installation cost in the cost based on the trade method

In the State of Pahang, a water meter is initially installed with the burden of the applicant (customer). Two steps are set for the accounting procedure of this cost

- First step: Existing meters of the customer are replaced with the cost of the company: CAPEX
- Second Step: Meters are replaced at the time of valid expiry after owned by the company: Full cost is listed in the OPEX

(b) Pipe installation cost

- New installation: Capital expenditure
- Replacement of existing pipes:
  Same size: OPEX.
  Size increase: It is possible to include it in the CAPEX partly.

5) Present tariff system is categorized into 11 by use for example; domestic, commercial, industrial, etc. As a phased improvement plan, following transition measures are proposed for certain projection of tariff income and establishment of management foundation.

- 1st step: Number of tariff classification will be reduced.
- 2nd step: Categorization of tariff system will be re-examined (e.g. by pipe diameter).

6) For reference, the trial calculation is done for Case 3 and Case 4 in the above 3)

(a) Assumption

The data is based on the statement of accounts under the accrual principle and MWIG for 2010. The calculation is done as of February 1, 2012, the foundation of the corporatized company.

(b) Data of JBA Pahang

- Production volume (2010): 966,000 m^3/day＝352,587,000 m^3/yr
- Accounted-for water volume (2010): 432,000 m^3/day＝157,625,000 m^3/yr
- No. of connections: 308,570 (domestic) + 42,187 (others)＝350,757
- OPEX unit cost: 0.45 RM/m^3
- Average sales unit price: 0.86 RM/m^3

- Average domestic water consumption: 31 m^3/month × 0.546 RM/m^3 = 16.93 RM/m^3
- Average other water consumption: 81 m^3/month × 1.780 RM/m^3 = 144.15 RM/m^3
- Revenue (water tariff): 135,666,000 RM/year
- OPEX (Present water distribution cost):
  (Production cost: RM 110,096,000) + (Personnel Cost: RM 32,620,000)
  + (Other administrative cost: RM 7,828,000) = (Total: RM 150,544,000)
- CAPEX (Depreciation cost): RM 65,224,000
- Loan:
  (Year end price of fixed asset:RM 1,614,462,000) + (End-of-period price of construction in process account: RM 645,884,000) = (Total: RM 2,260,346,000)
- Payment interest (In case of an interest rate of 2%) = RM45,207,000 per annum
- Capital upkeep cost (Proper profit to be maintained for providing for future facility development and sustaining the sound management as a company)
  3% of net book value: RM798,581,000 × 0.03＝RM23,957,000
  (Assumed that the tariff is revised every three years and the price inflation rate is 1% per annum)

(c) Trial for tariff revision

Case 3

OPEX	RM 150,544,000
Depreciation cost	RM 65,224,000
Total cost	RM215,768,000

Accounted-for water volume (2010)
157,625,000 m^3/year

Unit Price=1.37 RM/m^3 (Approx. 1.59 times of the present unit price of 0.86 RM/m^3)
=Total cost / Accounted-for water volume (2010)
=RM 215,768,000 / 157,625,000 m^3/year

Example

For domestic：	0~18 m^3	0.37 RM/m^3 → 0.59 RM/m^3
	18.1~45 m^3	0.79 RM/m^3 → 1.26 RM/m^3
	45.1 m^3~	0.99 RM/m^3 → 1.57 RM/m^3

Average water consumption (31m^3/HH/month)
16.93 RM/m^3→ 27.0 RM/m^3
For Commercial 1.45 RM/m^3→ 2.31 RMm^3

Case 4

Total cost	RM 215,768,000
Payment interest	RM 45,207,000
Capital upkeep cost	RM 23,957,000
Full cost	RM 284,932,000

Accounted-for water volume (2010)
157,625,000 m^3/year

Unit Price= 1.81 RM/m^3 (Approx. 2.10 times of the present unit price of 0.86 RM/m^3)
=Full cost / Accounted-for water volume (2010)
= RM 284,932,000 /157,625,000 m^3/year

(3) Customer Services

Leakage and meter accuracy are causes of income loss. Leakage loss up to the meter shall be charged to PAIP. In this regard, reform of connection system and of off-set drawings and documents management shall be improved.

Based on the system and regulations of water service installation, the meter cost should be borne by the company since the time of new connection and included in the administrative jurisdiction.

1) Administration section
   Independence of the state government as a private company and establishment of the proper management system to take over the works from the state government corresponding to change of the accounting system to the accrual principle.
2) Meter reading and billing section
   Reduction of the staff for meter reading and billing below the national average and the database construction of the basic information such as meter location at individual houses, meter reading route, etc.) on meter reading works as the company's shared information
3) Tariff collection section
   Abandonment of the money on deposit, which is the money to be returned in future but not an income, and generates the wasteful cost occurred in the process of billing, collection and repayment.

(4) Human Resources Development

Water supply is indispensable public utility works as one of basic infrastructures for social activities likewise electricity, gas and communications. For sustainable operation of service provision daily 24 hours and annually 365 days, following experts with knowledge, skill and experiences are required to promote.

- Managerial Staffs: Accounting, Personnel Affair, Customer Services, etc.
- Technical Staffs: Civil, Electric, Mechanical, Chemical, etc.

Requirements of stakeholders to this sector are diversified from day to day. Human resources for appropriate correspondence shall be promoted intentionally and systematically by PAIP.

(5) Awareness by Public Relations

Realization of appropriate tariff for autonomous management needs an awareness of users. Stakeholders are classified into various groups such as beneficiary, negatively affected party, mayor and assembly, financing agency, community, etc.

Concrete tackles are as follows:

- Site visit to water treatment plants, service reservoirs, water quality laboratory, etc. which should be done separately by each groups so that the customers feel them in hand and deepen their understanding of water services
- Opening of water seminar to inform simply that water is supplied with the cost as well as the power supply and such cost is covered by the water rate.
- Opening of regular events such as water week, anniversary of water supply foundation, and contest on poster, composition, photo, etc. on water supply
- Transmission of information through the internet, regular publication (news on water supply and so on) and others

2 Situation of Study Area: Temerloh District

Temerloh district is composed of 10 zones (called as "Mukim" in Malay) with district center at Temerloh town as shown in **Figure II-2.1**. This district with land area of 2,471 km^2 is located inland, center of which is located at area extending over 4 zones of Bangu, Mentakab, Perak and Songsang. On the other hand, other towns and many villages are scattered within the district.

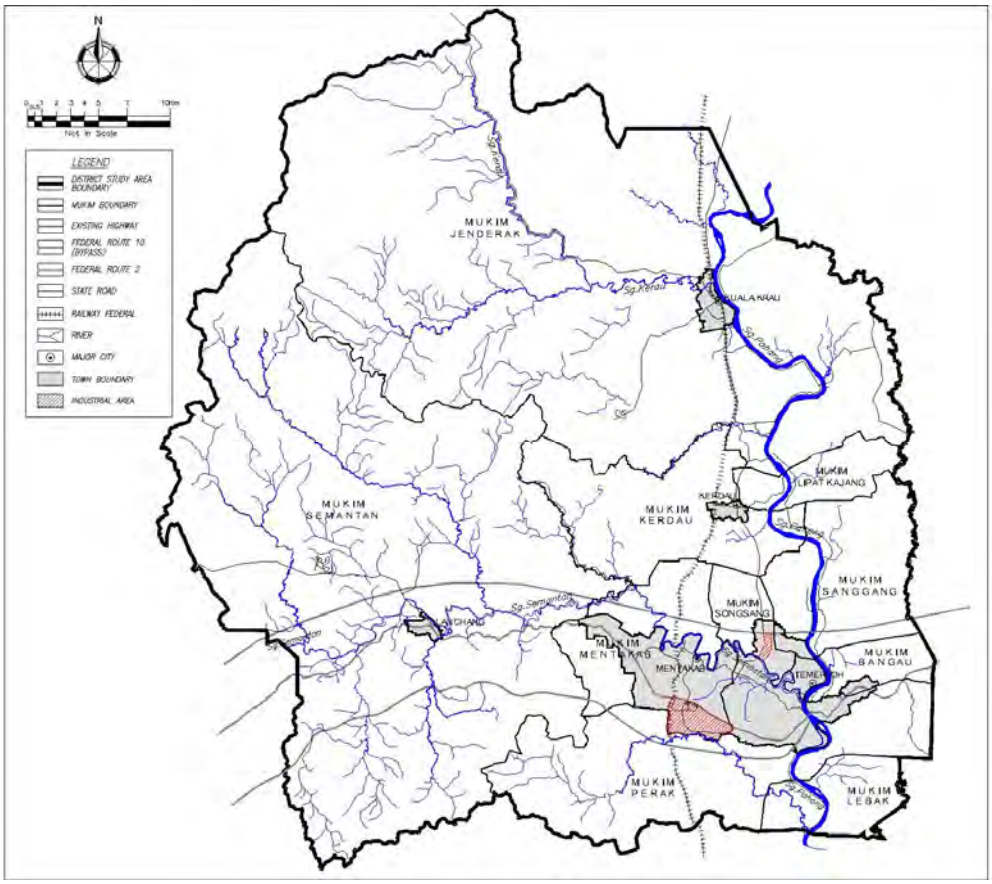


Figure II-2.1 Map of Temerloh District

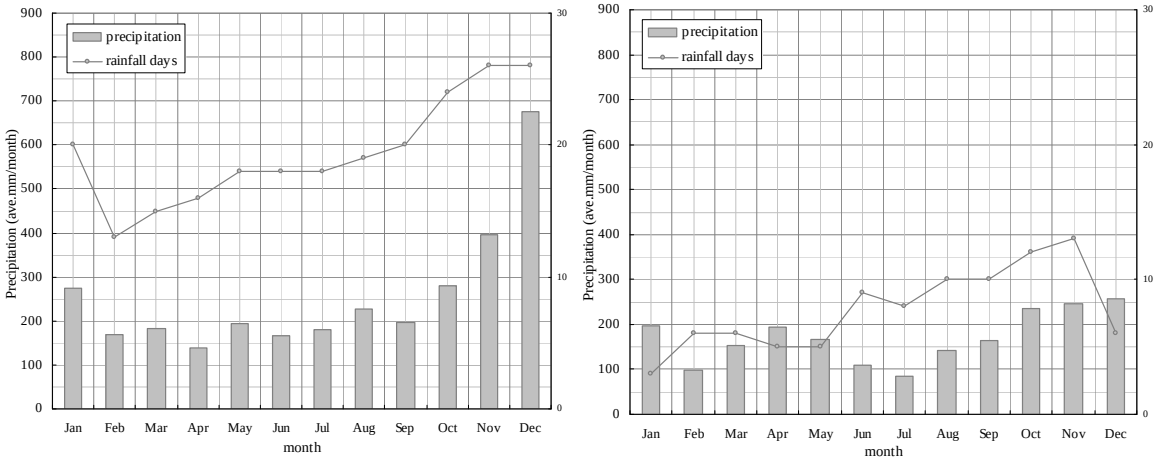
2.1 Natural Conditions

Temerloh district is located at inland of Pahang state and near to the watershed boundary. District center of Temerloh is placed at nearly the middle portion between Kuantan as a state capital and Kuala Lumpur as a national capital.

(1) Meteorology

The state of Pahang is categorizes as a tropical monsoon. Average annual precipitations of years 2006 to 2010 were estimated at 3,077 mm/year in Kuantan and at 2,051 mm/year in Temerloh. Average monthly temperatures in high and low were observed at 33 and 23 Celsius at both stations in Kuantan and Temerloh. Seasonal variation of temperatures can not be seen significantly but relatively hot in May until August and cool in November until February.

Figure II-2.2 shows monthly precipitation and rainfall days (with more than 1 mm/day) at stations in Kuantan and Temerloh. Monthly precipitations at coastal Kuantan and inland Temerloh have a different climate patterns especially from November to December in rainy season. Gap of monthly precipitations between Kuantan and Temerloh in rainy season would be the same difference of annual precipitations in both towns.



Source:

Figure II-2.2 Monthly Precipitation and Rainfall Days: Kuantan (left) and Temerloh (right)

(2) Topography and Geology

This district has a hilly surface land which is undulated moderately with relatively north western high and south eastern low. Along the rivers of Pahang with its tributaries, narrow valley plain (corresponding to service areas of PAIP) can be observed with elevation of about 60 to 110 meters. Topographic map including urban (town) area is shown in **Figure II-2.3**.

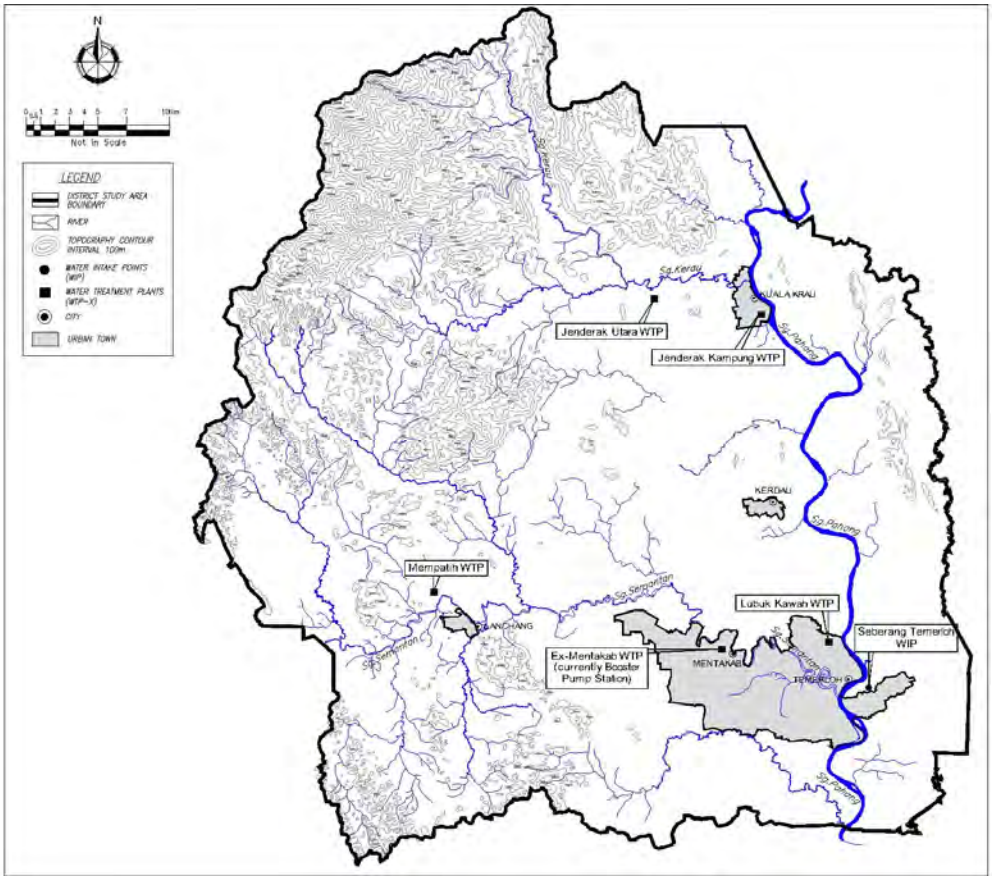


Figure II-2.3 Topographic Map of Temerloh

The geology of study district is as diverse as its topography. Simplicity, most of the limestone areas underlain by the Tertiary age or elder rocks have karstic terrain. The areas underlain by the

younger limestone is also varied, wherein the formation is observed to be hard, steep slopes have developed and gentle slopes where the limestone is fragmental and porous. This younger age formations are distributed at east-southern part of the district. In the west-northern part of the district, outcrops of various volcanic rocks are observed such as pyroclastic and conglomerate. Intrusive rocks are also found at the higher portion of mountain ranges. The geological map is shown in **Figure II-2.4**.

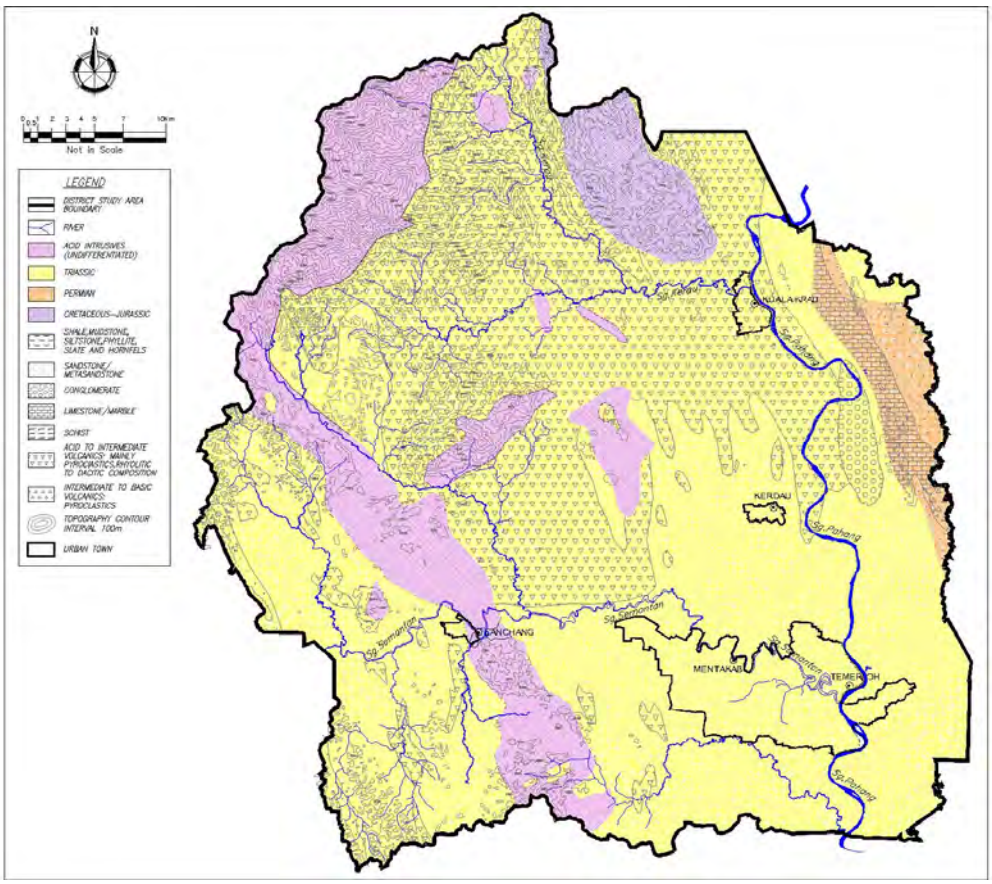


Figure II-2.4 Geological Map of Temerloh

The corrosion index on the surface soil was not studied yet. Generally, the surface soil may have an alkalinity characteristics in the limestone or limy rocks area and slightly acidic in volcanic area. In this regards, pipes made of DCIP and HDPE would be acceptable to use for any piping works. However, distribution pipes made of mild steel are not proposed to use for new installation and replacement only in Sementan town because of corrosive soil expected.

(3) River Network System

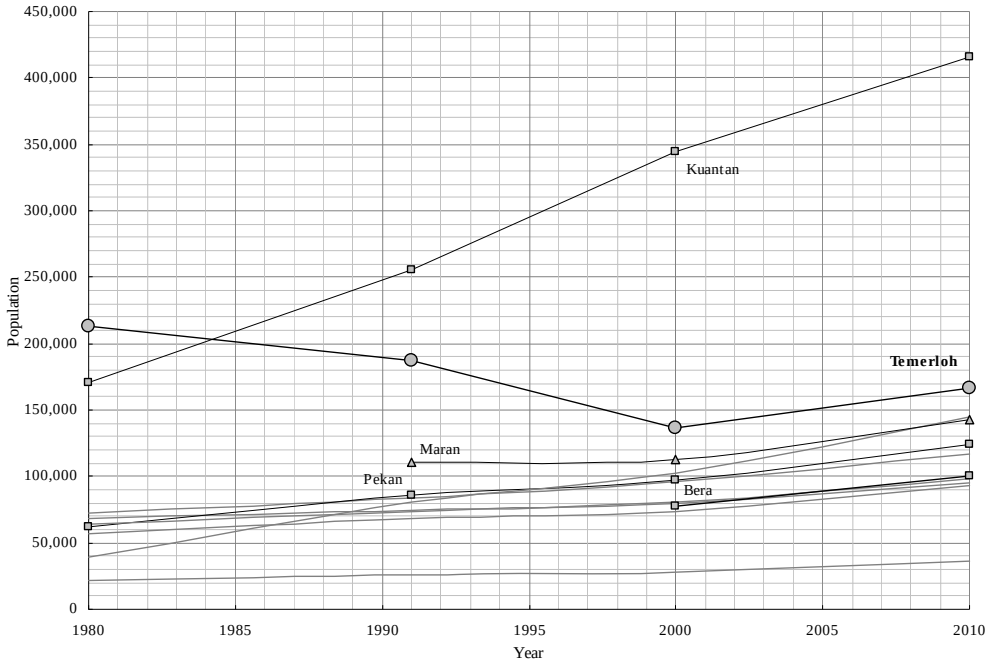
Main river system in the district is covered by Pahang River that has drainage pattern of dendritic form with its tributaries and flows across the district from north to south. Among the said tributaries, Sementan River is the largest tributary in terms of flow rate scale that flows from the west along the national road No.2 and has been merged into Pahang River at Temerloh town. River network map is referred to **Figure II-2.3**, the topographic map.

2.2 Socio-economic Conditions

(1) Population

The national population censuses have been conducted at years of 1980, 1991, 2000 and 2010 respectively by the federal department of statistics. **Figure II-2.5** indicates the populations of dis-

tricts in Pahang.



Source: Department of Statistics Malaysia

Figure II-2.5 Population of Districts in Pahang (Census)

Present Temerloh district has been re-organized administratively twice below.

- Re-setting at 1980: District of Maran was newly established composing of portions from previous districts of Temerloh and Pekan.
- Division at 1991: District of ex-Temerloh was divided into new district of Bera and present district of Temerloh.

Populations before and after the said re-organization in relating districts indicate increasing. It means that the decreasing of population in Temerloh may be caused of the administrative re-organization.

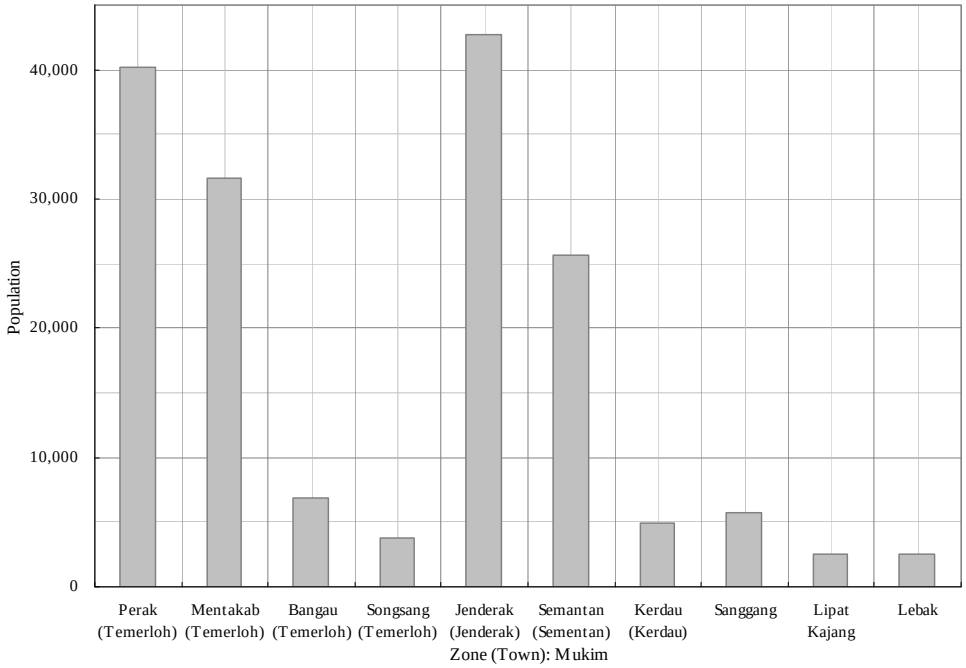
Table II-2.1 shows the current situation of population growth rate comparing national, state and district. Populations are identified as positive growth but its annual rates may get dull year on year in the levels of national and state. Temerloh district and city are both the 2nd population scale next to Kuantan district and city within the state of Pahang.

Table II-2.1 Population Growth using Estimated and Census Population

Administration		Estimated Annual Growth*1			Pop. and HH in 2010 Census ('000)
		A: 2007 - 08	A: 2008 - 09	B: 2009 - 10	
Pop.	Entire Malaysia	2.04%	2.08%	1.27%	28,250.4
	State of Pahang	1.99%	2.00%	1.19%	1,534.8
	District of Temerloh	0.85%	0.84%	0.97%	166.5
HH		NA	2.71%	2.64%	46.6

Source: National Census Office (Web-site)
Note*1: A was estimated using Censuses at 1991-2000, while B was estimated using Censuses at 2000-2010.

Zonal populations were not published officially. According to data collected from the zonal 10 office, **Figure II-2.6** indicates the distribution of zonal populations in the district of Temerloh. It is noted that city name in parenthesis correspondences to 4 urban names in Temerloh district.



Source:

Figure II-2.6 Estimated Population by Zones in Temerloh 2010

The statistics information of census includes the household numbers (hereinafter called as "HH") in the district level. Total number of HHs in Temerloh was counted at 46,600 in the Census 2010. The HHs growth rates in the Temerloh district has been estimated more than 2 %/year since 2008.

As statistical information, the average person per HH in Temerloh was estimated at 3.57 capita/HH in 2010 and may be decreased year by year. The smallness of family population in Temerloh is the 2nd next to Bentong in the state of Pahang and the 4th among 133 districts in Malaysia.

(2) Commerce and Industry

The town of Temerloh is recognized as a main internal point from Kuala Lumpur to Kuantan and international point from Singapore to Bangkok. In this regard, the distribution industry has been developed in Temerloh town.

Recently, industrial areas in small scale have been developed in towns and near to the interchange of highway and along the national road No.10. There is no information relating to forms of commerce and industry in the district office of Temerloh.

(3) Transport

Town of Temerloh is located at the junction of the National roads No.2 and No.10. Parallel to the national road No.2, new highway was constructed and operated since 2006. The National railway is also passing along the National road No.10 since year 1923.

There are many vehicles passing the highway and national road No.2 for the shuttle service of conveyance between Kuantan port and Kuala Lumpur for mainly chemical goods. Kuantan port has been managed by Federal Government established at 1974. The bypass road along the national road No.2 was also constructed at 2008. Significant traffic congestion in the town can not been seen even in morning and evening.

(4) Communication

Telecommunication by mobile-phone is available in the water supply area of JBA Temerloh except for some mountain areas. Therefore, it is possible to monitor flow, pressure, etc. by simple telemeters using mobile-phone radio

2.3 Existing Water Supply Facilities

(1) Historical Background and Major Problems

Water supply services in Temerloh had been started since 1978 with Jenderak Utara Water Treatment Plant (hereinafter called as "WTP") for supplying to reclamation farms in northern part of the district. Since then, a further 5 WTPs were constructed and have been operated.

Presently, total 5 WTPs exist out of 6; 4 WTPs are under operation and remaining 1 WTP was newly constructed and completed on August 2011 with test operating of 1 year. Non operational Mentakab WTP was replaced by booster pump station since 1980' due to sufficient water supplying from Lubuk Kawah WTP. Ex-JBA Pahang has groped the re-operation plan of the Mentakab WTP for expected demand of Sementan in future. **Table II-2.2** shows technical information of functional 5 WTPs in 2010.

Table II-2.2 Technical Information of WTPs under ex-JBA Temerloh in 2010

Year	Intake River	Capacity of WTP (in m^3/day)			No. of distribution facilities				Service Area		
		Name	Design	Actual	GR	ET	BT	BP	T	V	I
1978	Kray	Jenderak Utara	22,700	4,481	1	0	2	0	3	5	2
1982	Pahang	Lubuk Kawah	80,800	100,314	7	3	0	2	36	51	21
1991	Pahang	Jenderak Kampung	8,200	8,024	1	0	3	0	4	21	5
1991	Semantan	Mempatih	9,100	5,477	2	0	0	0	2	10	3
2011	Pahang	Seberang Temerloh	22,700	-	2	0	1	1	16	19	3
Total: as of Dec-2011			143,400	118,296	13	3	6	3	61	106	34

Source: *ex-JBA Temerloh*

Legend: GR is ground reservoir, ET is elevated tank, BT is balancing tank and BP is booster pump station, respectively. V is village, T is small town in the city and I is large consumer (industrial and/ or housing development). Number of storage and service areas under Seberang Temerloh was belonging to Lubuk Kawah in 2010.

Ex-JBA Pahang and Temerloh recognize the major problems of water supply system in Temerloh below.

- Extreme high rate of NRW: 64.88 % in 2010
- Low service pressure: Numerical values have never been assessed.
- Disqualified water quality: -ditto-
- Delayed repair and maintenance: -ditto-
- Slow and complex formalities for new connecting: -ditto-

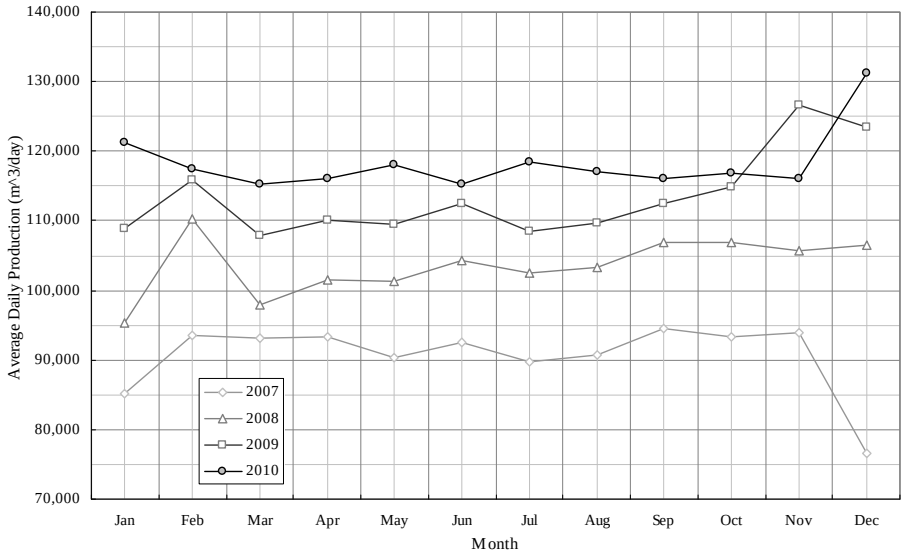
Other notes from meetings and site visits based on verbal discussions and observations include:

- Treated water quality failures with respect to turbidity and coliform etc. mainly occur on the treated water from the 2 package plants;
- In Malaysia, the priority is given to the quantity over the quality
- The operators at the water treatment plants have less knowledge of water treatment.
- Losses in conventional WTP at Jenderak Utara estimated to be about 10 %, with losses on package plant estimated to be higher. Note that there is no flow meter on efficient water pipe from package plant;
- Performance of Contractor carrying out operation and maintenance of plant is poor;
- In new contractor responsible for maintenance of water supply pipes for 6 months form,

but there is no as built drawing;
- Quality control of construction in some cases poor and regulations for pipes crossing roads not followed strictly;
- Quality control of HDPE pipes from one or more of the 5 approved suppliers is unsatisfactory;
- No materials testing section in PAIP Temerloh.

(2) Water Intake and Water Treatment Plant

Figure II-2.7 indicates average daily production of ex-JBA Temerloh in each month of 2007 to 2010. Amount of annual production in ex-JBA Temerloh has been increased every year.



Source: PAIP Temerloh

Figure II-2.7 Average Daily Production in ex-JBA Temerloh ()

Table II-2.3 shows the average daily production from each WTP in ex-JBA Temerloh. Treated water from each WTP can not be re-allotted between neighboring distribution systems, because each WTP is connected through distribution network pipelines. In this regard, the load factor of WTP may exceed 100 % depending on the water demand in its distribution system if the communication pipes between each system are closed by valves.

Table II-2.3 Average Daily Production from each WTP in ex-JBA Temerloh (2010)

Year	Average Daily Production (m^3/day)					Annual Growth
	Jenderak Utara	Lubuk Kawah	Jenderak Kampung	Mempatih	Total	
2007	2,604	77,207	7,374	3,301	90,486	-
2008	4,011	85,894	8,001	5,881	103,788	14.7 %
2009	5,321	94,667	7,745	5,622	113,355	9.2 %
2010	4,481	100,314	8,024	5,477	118,296	4.4 %

Source: PAIP Temerloh

All raw water have been taken from Pahang River or its tributaries namely Kray River and Sementan River. Flow capacities of the Pahang River and its tributaries were not studied yet. According to ex-JBA Pahang and Temerloh, probability of river flows may be enough for demand until 2025. Regarding raw water quality of river water, pollutions caused by industrial mining activity and agricultural chemicals were not reported.

There may be no crisis of water sources and overall treatment capacity if the rate of NRW (about 64 %) can be improved better than current situation.

Treatment method at all WTPs is rapid filtration after coagulation and sedimentation process. Raw water is treated in due order from receiving well, cascade aeration, horizontal baffled channel flocculator, sedimentation (horizontal flow, tube settler and their combination) and rapid filtration. **Table II-2.4** indicates the technical information as of December 2011 and **Figure II-1.12.8** shows the treatment systems.

Table- II-2.4 Treatment Systems at 5 WTP (as of December 2011)

WTP		No.1 Convention System		No.2 Convention System		Compact System	
Year	Name	Design	Actual	Design	Actual	Design	Actual
1978	Jenderak Utara	9,100	9,100	-	-	13,600	0
1982	Lubuk Kawah	35,400	44,400	45,400	55,600	-	-
1991	Jenderak Kampung	4,100	4,100	4,100	4,100	-	-
1991	Mempatih	3,200	3,200	-	-	5,900	5,900
2011	Seberang Temerloh	11,350	4,550	11,350	4,550	-	-

Source: PAIP Temerloh
Note: The compact system at Jenderak Utara constructed at 1991 is not operated due to water quality problem.

Figure II-2.8 Water Treatment Systems of Conventional (left) **and Compact** (right)

Coagulant is poly-aluminum chloride (called as "PAC") and aluminum sulfide. Disinfection has been done by direct injection of chlorine gas into the outlet pipe of treated water at all WTPs so as to keep a certain concentration corresponding to an amount of water supply but not corresponding to water quality. As a result the residual chlorine is not settled. Other treatments of raw water are addition of silica fluoride sodium and pH control by calcium hydroxide. Injectors for pH control in

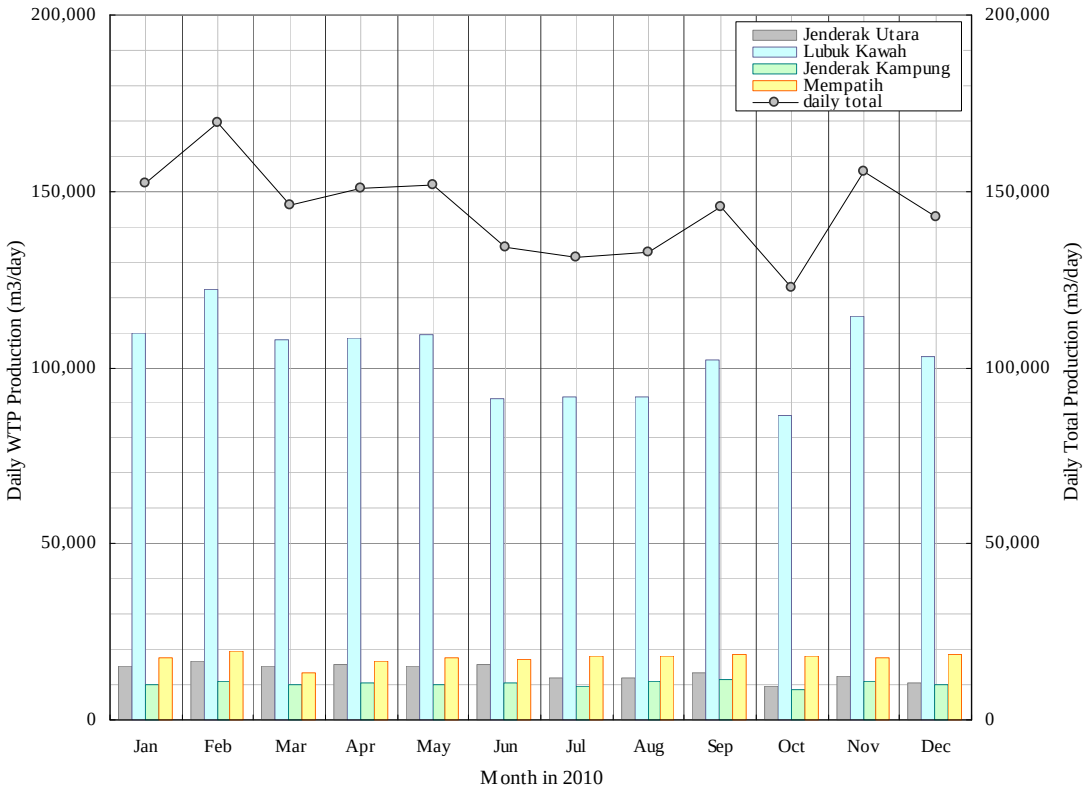
some WTPs are observed as malfunction. At some WTPs ph control is not done because of machine malfunction

Although the backwash of rapid sand filters are designed with a period of 72 hours, the filtration head loss meter is not used (almost out of order or not used even though being provided) and the backwash is done with interval of 24 hours through visual monitoring of filter water level. All settled sludge is manually discharged. The latest water treatment plant is provided with automatic sludge discharge units which are not used due to unknown how to handle.

Drainage water of washing and sedimentation sludge is treated by sun drying in lagoons in the latest WTP and discharged directly to the river in the other WTPs.

There are flow meters at the inlet pipes to and outlet pipes from the WTPs. The amounts of intake and distribution have been manually monitored and recorded twice a day. Water loss of the treatment process was not estimated as a part of water balance study.

Figure II-2.9 indicates daily production in WTP and total by monthly base. Annual average production in 2010 was 144,334 m^3/day with a maximum average production of 169,281 m^3/day in February and a minimum average production of 122,664 m^3/day in October. Production in 2010 was higher than the design capacity, assuming that the compact plant at Jenderak Utara WTP and new Seberang Temerloh WTPs were not operational.



Source: PAIP Temerloh

Figure II-2.9 Monthly Average Production by WTP and Total in 2010

As such the production reserve margin was negative during this period (amount of production was larger than that of design capacity). For the state of Pahang the production reserve margin in 2010 was 18.8 % and therefore with regards to the recent situation Temerloh compares unfavorably with the situation in the state as a whole.

In the Operations Department of ex-JBA Temerloh, technicians and general workers are engaged at each of the existing WTPs with the exception of Jenderak Utara and Jenderak Kampung, where only general workers are employed. Day to day operation including minor maintenance of Jenderak Utara is carried out by a sub-contractor. The number of general workers engaged at each of the WTPs is not proportional to the capacity of the WTP.

(3) Storage Facilities and Water Distribution Network

Distribution pipe networks are divided with 5 WTPs. Each system was connected by adjoining pipes with stop valves (normally opened). There are not full records or drawings of pipelines but staffs in ex-JBA Temerloh know the schematic diagram of the systems.

Each WTP has individual distribution pipe network and is located at higher elevation than most service area. Therefore, treated water is rationally supplied by gravity. Several booster pump stations are operated where the service area is located at terminal and/ or higher elevation. Nevertheless, the low supply pressure zones are still observed according to the pressure monitoring at fixed points.

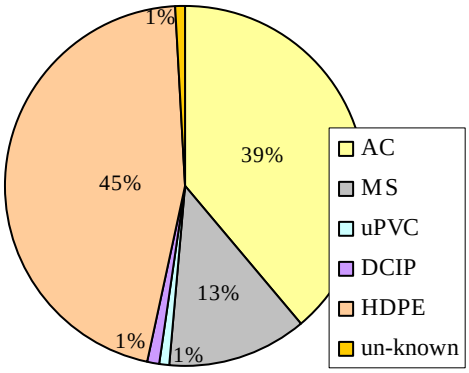
Table II-2.5 summarizes the pipe length and material in Temerloh as of December 2011 and for the state of Pahang in 2010. The information for Temerloh is from two sources (1) GIS and (2) Head Office Records. There are some insignificant differences between the data from the two sources.

Table II-2.5 Summary of Pipe Materials and Length in ex-JBA Temerloh and Pahang

Type of Pipe Material	Temerloh				Pahang	
	GIS		Record		MWIG	
	Length	Proportion	Length	Proportion	Length	Proportion
	km	%	km	%	km	%
AC	384.60	39.0	402.60	43.1	4,184	39.3
MS	124.06	12.6	105.85	11.3	1,984	18.7
uPVC	6.23	0.6	6.23	0.7	678	6.4
DCI	11.55	1.2	11.50	1.2	217	2.0
CI	-	-	-	-	88	0.8
HDPE	452.46	45.8	388.26	41.6	2,775	26.1
ABS	-	-	1.50	0.2	-	-
Others	-	-	-	-	712	6.7
Un-known	8.58	0.9	-	-	-	-
Total	987.48	100.0	933.94	100.0	10,638	100.0

Source: PAIP Temerloh
Note: All data are as of December 2011.

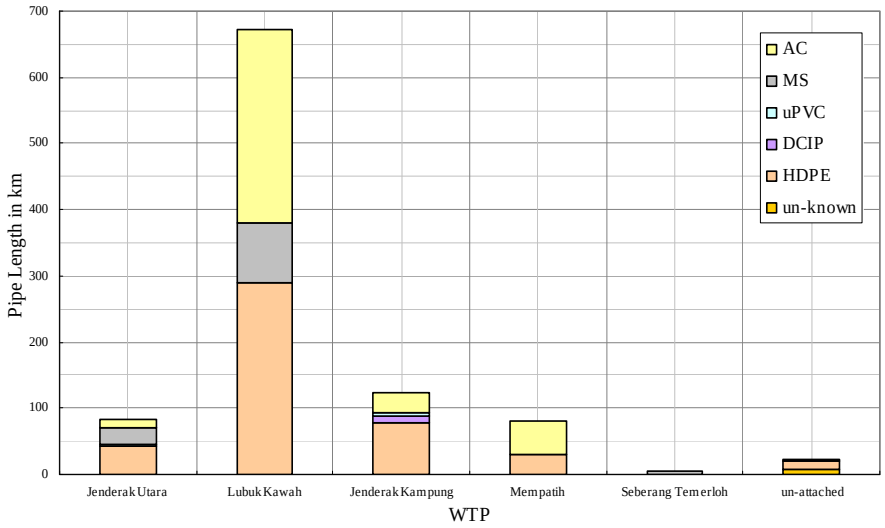
Figure II-2.10 shows the proportion of distribution pipes by materials using GIS data. Pipe length made of HDPE, AC and MS materials have a proportion of 97.7 % in total length.



Source: PAIP Temerloh

Figure II-2.10 Proportion of Pipe Length by Materials in Temerloh

Figure II-2.11 shows the pipe length by material in each service area of WTP.

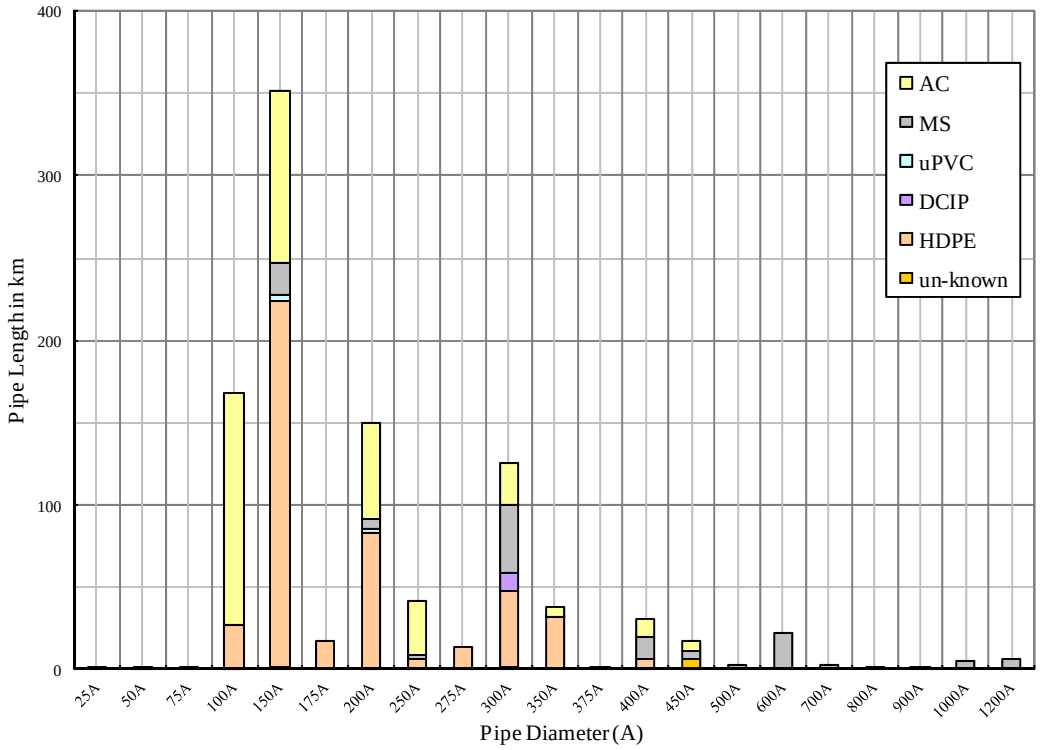


Source: PAIP Temerloh

Figure II-2.11 Pipe Length and Materials in each WTP area

The proportional rate of 63 % was installed by AC pipes in the area served by Mempatih WTP and approximately 43 % in the area served by Lubuk Kawah WTP. These rates are higher than 39% of the whale Temerloh. Putting AC pipes to use for water supply was banned in Malaysia since the middle of 1990s.

Figure II-2.12 shows the pipe length by materials in each diameter. High proportions of AC pipe are observed at diameters of 100A (about 84 % of AC) to 250A.



Source: PAIP Temerloh

Figure II-2.12 Pipe Length and Materials by Diameter

Table II-2.6 indicates the pipe lengths by materials and diameters in each service area of WTPs.

The GIS has been managed under the IT Department of Corporate Unit, a staff of the Section inputs verified data and analyses technical information. Distribution pipes at Temerloh district has been completed to input but following information are still lacking.

- Positioning Relation between Pipes and Road (off-sets)
- Elevation at Node (pipe junction)
- Type of Pipe (some un-known material)
- Installation Year (before 2002)
- Details of the distribution systems
- HHs Service Installations including customer information and service pipe connection, etc.
- Maintenance Records (pipe repair, pipe breaks, valves and hydrants, etc.)

The main conclusions from the above are as follows:

1. The percentage of AC pipes in Temerloh (39%) is similar to that for Pahang State;
2. The percentage of HDPE pipes in Temerloh is significantly higher than in Pahang State.

Table II-2.6 Distribution Pipe Database by GIS in ex-JBA Temerloh (unit of pipe length in m)

Pipe ID		1978 22,700 m^3/day	1982 80,800 m^3/day	1991 8,200 m^3/day	1991 9,100 m^3/day	2011 22,700 m^3/day	un-attached	Entire System
Type	Dia.	Jenderak Utara	Lubuk Kawah	Jenderak Kampung	Mempatih	Seberang Temerloh		
1. AC	75A	-	-	-	982	-	-	982
	100A	209	105,934	15,810	18,984	-	-	140,937
	150A	-	85,064	1,764	16,887	-	-	103,716
	200A	12,245	40,854	5,084	-	-	-	58,183
	250A	166	17,605	16	14,115	-	-	31,902
	300A	-	18,726	6,708	-	-	-	25,434
	350A	-	6,142	-	-	-	-	6,142
	400A	123	10,610	-	-	-	-	10,733
	450A	-	6,574	-	-	-	-	6,574
	Sub-T	**12,743**	**291,510**	**29,381**	**50,968**	**-**	**-**	**384,602**
2. MS	50A	-	163	-	-	-	-	163
	100A	-	432	-	-	-	22	454
	150A	2,749	16,151	467	-	278	306	19,950
	200A	5,146	525	-	-	92	78	5,841
	250A	2,529	-	-	-	188	37	2,753
	300A	15,657	23,944	158	-	-	754	40,513
	350A	-	-	-	-	104	-	104
	375A	-	-	-	-	-	337	337
	400A	-	12,042	-	-	747	-	12,790
	450A	-	4,375	-	-	-	-	4,375
	500A	-	2,020	-	-	-	-	2,020
	600A	-	20,625	-	-	333	561	21,518
	700A	-	-	-	-	2,586	-	2,586
	800A	-	137	-	-	-	-	137
	900A	-	308	-	-	-	-	308
	1000A	-	4,498	-	-	-	-	4,498
	1200A	-	5,705	-	-	-	-	5,705
	Sub-T	**26,081**	**90,926**	**625**	**0**	**4,328**	**2,096**	**124,056**
3. uPVC	150A	-	-	3,620	-	-	-	3,620
	200A	2,611	-	-	-	-	-	2,611
	Sub-T	**2,611**	**0**	**3,620**	**0**	**0**	**0**	**6,231**
4. DCIP	300A	-	-	11,548	-	-	-	11,548
	Sub-T	**0**	**0**	**11,548**	**0**	**0**	**0**	**11,548**
5. HDPE	25A	-	-	-	-	-	29	29
	50A	-	-	-	-	-	146	146
	100A	3,056	17,984	2,108	3,011	-	319	26,477
	150A	30,236	157,048	26,995	6,813	-	1,987	223,079
	175A	1,700	7,645	7,733	-	-	-	17,078
	200A	6,457	21,693	37,562	13,115	-	3,294	82,122
	250A	1,144	-	-	5,075	-	-	6,220
	275A	-	5,218	3,026	-	-	5,588	13,832
	300A	-	42,977	-	2,378	-	721	46,076
	350A	-	30,384	-	-	-	651	31,035
	400A	-	6,373	-	-	-	-	6,373
	Sub-T	**42,593**	**289,322**	**77,423**	**30,393**	**0**	**12,733**	**452,464**
6. Un-known	100A	0	-	-	-	-	323	323
	150A	-	530	-	-	-	366	896
	200A	-	-	-	-	-	282	282
	300A	-	-	-	-	-	1,120	1,120
	400A	-	-	-	-	-	31	31
	450A	-	-	-	-	-	5,925	5,925
	Sub-T	**0**	**530**	**0**	**0**	**0**	**8,047**	**8,578**
Grant-T		84,029	672,289	122,596	81,361	4,328	22,876	987,479

Source: PAIP Temerloh

Note: GIS was introduced in 2008 and data was up dated several times. This data was obtained on 8 December 2011.

Telemetric monitoring system using broadband tele-communication was installed at 5 reservoirs of ex-JBA Temerloh in 2008. This system was malfunctioned since October 2011 (cause analysis was not studied by ex-JBA). There are several types of water storage facilities below.

- Reservoir: 16 sites ground or elevated for gravity supply
- Balancer: 6 sites ground or elevated for demand buffer
- Booster: 3 sites ground receiver for pump supply

Some of the storage facilities have been connected to two WTPs. Ex-JBA Temerloh has classified the storage facilities into 5 groups for each WTP. Totally, 25 storage facilities with volume of 39,719 m^3 have been operated to control the appropriate water pressure. As shown in **Table II-2.7**, overall volume of storage is estimated at 7 hours equivalent to the overall production of WTP as of December 2011.

Table II-2.7 Capacity of Storage Facilities (As of December 2011)

WTP	Production	Storage		
	Amount in m^3/day: A	No. of Facility	Volume in m^3: B	Volume in hrs: B/ A
Jenderak Utara	9,100	3	2,241	5
Lubuk Kawah	100,000	12	27,407	6
Jenderak Kampung	8,200	4	3,960	11
Mempatih	9,100	2	3,311	8
Seberang Temerloh	9,100	4	2,800	7
Overall	135,500	25	39,719	7

Source: PAIP Temerloh
Note: Water shortage areas are not defined due to complex distribution networks and scattered small service areas.

There are not off-set maps of service connection in PAIP Temerloh Branch. Standard for service connection (distance, elevation, etc. to the user) were not managed well in PAIP.

Branch pipes from distribution pipe (by type and diameter) to service connection are mainly installed using “Clamp Saddle.” Majority of pipes for service connection is made of HDPE and uPVC. Currently, service pipe made of stainless steel (SUS-304) is also installed. Depth of pipe installation is quite shallow according to site study; pipes would be damaged easily.

For independent houses the service pipe stands up from road and a meter is installed with shutoff valve. Water meter is installed individually for HH connection, while some union meters are installed for stores in building. Leakage at some service pipes before water meter was observed. Type of water meter is mainly rotary piston (volumetric type called as “Kent”) for small diameter and some impeller type (similar to Japan).

Period of meter replacement is standardized at maximum 7 years, but it is not regulated for both provider and user. Because of non-committal ownership to the service connection, metering error due to age and inadequate installation is one of important issue.

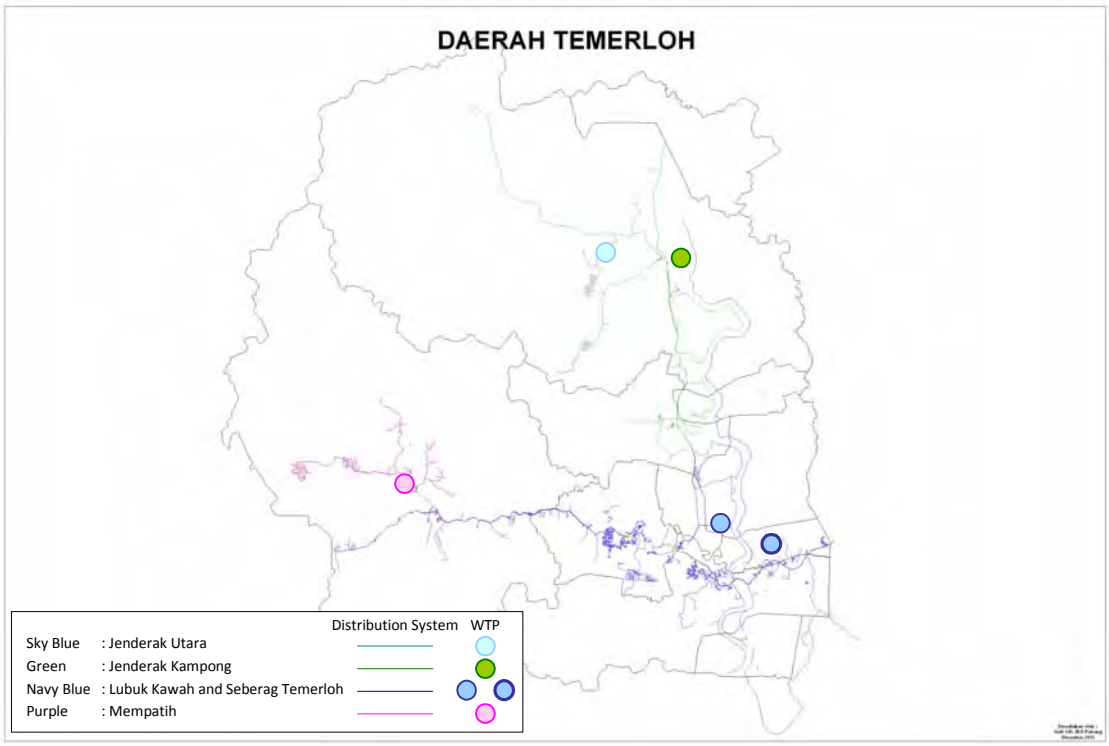
(4) Water Supply Services

There is no other water supply provider either public or privately owned in the district of Temerloh. According to the ex-JBA Temerloh as a sole public water supply provider, number of service connections was counted at about 45,000 in December 2010. This number of subscribers includes not only domestic users but also other consumers such as commercial, industrial, governmental, religious, etc.

Water supply coverage may be roughly estimated using the numbers of HHs and subscribers. On this condition, the study team estimated service coverage simplistically at 85.7 % for entire

Temerloh district.
The whole distribution network is complicated with complex and hybrid water supply system due to patchwork expansion since 1991 (service areas were merged). Type of service areas are classified into 3 categories such as town, village and bulk (industrial and/ or housing development area).

The said service areas are scattered along the national road No.2 and No.10. **Figure II-2.13** presents the distribution pipeline network in Temerloh with zonal boundary. In this figure, colors of distribution pipeline indicate the water supply from each WTP below.



Source: ex-JBA Pahang

Figure II-2.13 Distribution Pipeline Network in Temerloh (as of Dec-2011)

Table II-2.8 indicates the number of service areas which are classified by WTP attachment and types.

Table II-2.8 Types and No. of Service Area in Distribution System under the WTP

Year	Intake River	Capacity and Production of WTP (in m^3/day)			Type of Service Area		
		Name	Design	Actual	Town	Village	Bulk
1978	Kray	Jenderak Utara	9,100	9,100	3	5	2
1982	Pahang	Lubuk Kawah	81,800	100,000	36	51	21
1991	Pahang	Jenderak Kampung	8,200	8,200	4	21	5
1991	Semantan	Mempatih	9,100	9,100	2	10	3
2011	Pahang	Seberang Temerloh	22,700	9,100	16	19	3
Total (as of December 2011)			130,900	135,500	61	106	34

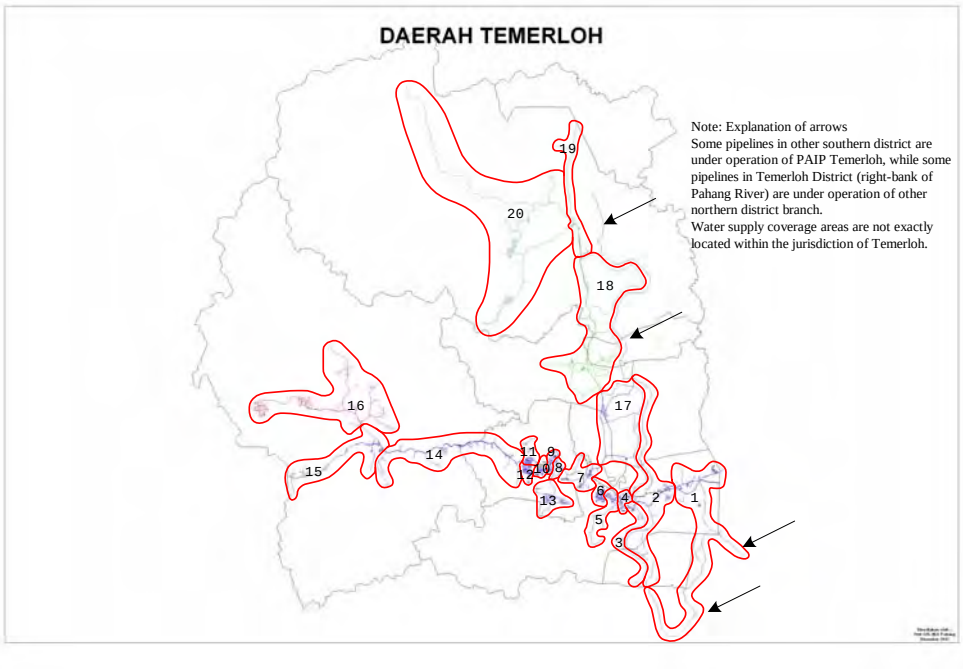
Source: ex-JBA Temerloh
Note: Design capacity of non-operating WTP is excluded. Seberang Temerloh WTP is under trial operation.

Ex-JBA Temerloh has set up the billing zones in each service area at the same introduction time of E-Water system. There are 20 billing zones in Temerloh as shown in **Table II-2.9** and **Figure II-2.14**. Meter reading is carried out by zone with all 17 meter readers (excluding 1 chief) respectively. It means that one round reading takes 20 days in month.

Table II-2.9 Billing Zones by Distribution Systems

Name of WTP for Service Area (Distribution System)	Number and ID Name of Billing Zones
Lubuk Kawah WTP and Seberag Temerloh WTP	16: Zones-1 to -15 and -17
Mempatih WTP	1: Zone-16
Jenderak Kampong WTP	2: Zones-18 and -19
Jenderak Utara WTP	1: Zone-20

Source: PAIP Temerloh



Source: ex-JBA Pahang

Figure II-2.14 Location of Billing Zones in Temerloh District (as of Dec. 2011)

Table II-2.10 indicates the accounts in billed and collected by each zone of ex-JBA Temerloh in 2009 and 2010. Regarding the all accounts in December 2010; (1) 44,748 was registered, (2) 44,742 was billed and (3) 42,197 was collected, respectively.

To comparing the Temerloh collection rates at 89 % by tariff amount in **Tables II-1.9** (Temerloh in 2010) and at 94 % by accounting number in **Table II-2.10** (Dec.-2010), there seems to have some possibilities of large quantity consumers who did not pay the water tariff.

Table II-2.11 indicates the numbers of aging meter with its proportional rates in ex-JBA Temerloh. According to this table, both numbers of younger and older meters were increased every year. Additionally, proportional rates of acceptable meters were also slightly improved.

Figure II-2.15 indicates the secondary information in Table above. It is necessary to replace meters with not less than 7 years old as planned and urgently.

Table II-2.12 shows data from the E-WATER billing system in Temerloh for 2010 and part of 2011.

As of December 2011, approximately 8,700 water meters or almost 20 % of the total water meters in Temerloh are damaged. Where meters are damaged, billing is based on an estimate (E) or average (A). Average readings are calculated based on an average of the previous three months for which there was a normal (N) reading carried out.

Table II-2.10 Number of Accounts in Billed and Collected by Temerloh Billing Zones

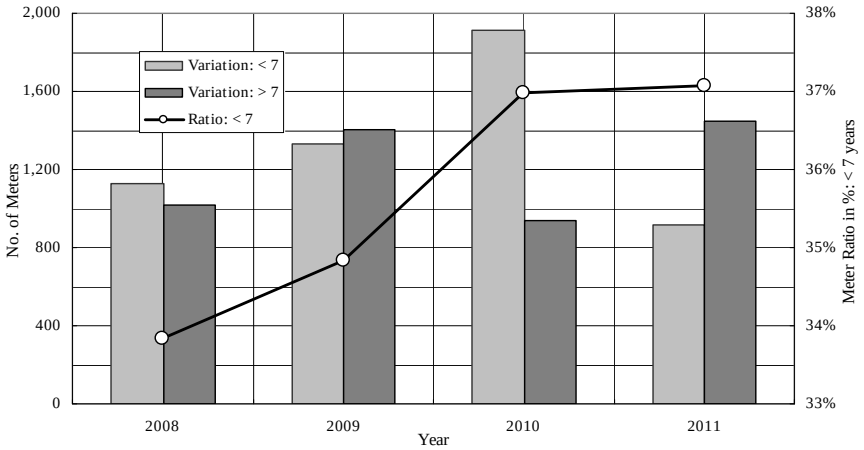
Billing Zone	December 2009						December 2010					
	Domestic Account			Non-domestic Account			Domestic Account			Non-domestic Account		
	billed	collected	rate	billed	collected	rate	billed	collected	rate	billed	collected	rate
1	2,571	2,416	94 %	171	162	95 %	2,822	2,642	94 %	189	175	93 %
2	2,149	2,042	95 %	219	208	95 %	2,452	2,304	94 %	232	218	94 %
3	1,629	1,548	95 %	427	401	94 %	1,655	1,555	94 %	438	407	93 %
4	1,285	1,208	94 %	859	798	93 %	1,285	1,277	99 %	949	892	94 %
5	2,624	2,441	93 %	458	435	95 %	2,765	2,571	93 %	482	457	95 %
6	3,681	3,423	93 %	144	136	94 %	3,716	3,455	93 %	145	137	94 %
7	1,724	1,620	94 %	301	285	95 %	1,709	1,606	94 %	362	340	94 %
8	2,762	2,596	94 %	186	174	94 %	2,827	2,685	95 %	188	178	95 %
9	1,465	1,391	95 %	937	890	95 %	1,467	1,393	95 %	936	889	95 %
10	2,323	2,206	95 %	90	85	94 %	2,317	2,201	95 %	89	84	94 %
11	1,950	1,791	92 %	252	236	94 %	1,960	1,842	94 %	249	234	94 %
12	2,938	2,732	93 %	70	67	96 %	2,932	2,765	94 %	84	78	93 %
13	993	943	95 %	444	412	93 %	993	943	95 %	490	455	93 %
14	1,634	1,535	94 %	200	188	94 %	1,634	1,535	94 %	202	191	95 %
15	1,390	1,306	94 %	184	172	93 %	1,459	1,386	95 %	190	178	94 %
16	1,019	968	95 %	60	57	95 %	1,013	962	95 %	70	66	94 %
17	1,644	1,562	95 %	155	145	94 %	1,675	1,574	94 %	157	147	94 %
18	1,526	1,434	94 %	160	152	95 %	1,585	1,505	95 %	168	159	95 %
19	1,049	996	95 %	204	193	95 %	1,068	1,014	95 %	210	199	95 %
20	1,465	1,391	95 %	88	84	95 %	1,483	1,408	95 %	95	90	95 %
Total	37,821	35,549	94 %	5,609	5,280	94 %	38,817	36,623	94 %	5,925	5,574	94 %

Source: PAIP Temerloh

Table II-2.11 Meter Age in ex-JBA Temerloh

Category	Item	2007	2008	2009	2010	2011
Primary Information:	Meter Age < 7	11,486	12,614	13,943	15,855	16,769
(1) Statistical No. of Meter and	Meter Age ≥ 7	23,650	24,667	26,072	27,010	28,455
(2) Proportion of Younger Meter	Total No. of Meter	35,136	37,281	40,015	42,865	45,224
at the end of December	Meter Ratio: < 7	33%	34%	35%	37%	37%
Secondary Information:	Meter Age < 7	-	1,128	1,329	1,912	914
(1) Variation No. of Meter by Age	Meter Age ≥ 7	-	1,017	1,405	938	1,445
between Years before and concerned	Total No. of Meter	-	2,145	2,734	2,850	2,359

Source: PAIP Head Office



Source: PAIP Temerloh

Figure II-2.15 Meter Variation and Proportional Mater Rate

Table II-2.12 E-WATER Data of ex-JBA Temerloh in 2010 and 2011 (Jan - Sep)

Identification				Year			
Items	Formula	unit		2010		2011 (Jan-Sep)	
				Quantity, No./ %			
Amount of Reading	-	m^3		10,972,483		11,143,446	
Revenue by Water Tariff	-	RM		10,727,259		10,823,633	
Accounts	I+II	No.	%	44,233	100.0	45,173	100.0
Accounts Not Read	I	No.	%	669	1.5	0	0.0
Accounts Read (to be broken down)	II=N+E+A	No.	%	43,564	98.5	45,173	100.0
Normal Account Reading	N	No.	%	40,349	92.6	35,493	78.6
Estimated Account Reading	E	No.	%	473	1.1	982	2.2
Average Account Reading	A	No.	%	2,073	4.8	8,698	19.2

Source: ex-JBA Temerloh

It is noticeable that the percentage of accounts for which bills have been prepared in based on estimated or average (especially) readings in 2011 is much higher than in 2010

Current targets and performance in 2011 (Jan-Nov) of ex-JBA Pahang for meter readings PI codes are shown in **Table II-2.13**. In Temerloh, the above targets for N, E and A have not been met in 2011, whereas the target for E was almost met.

Table II-2.13 Targets and Performances of Meter Reading PIs in 2011

Code of PI	Target in 2011	Latest PIs in 2011 (Jan-Nov)	
		Ex-JBA Pahang	Ex-JBA Temerloh
Meter Reading Rate	99% ± 1 %	99.66 %	100.0 %
Rate of N Category	95% ± 5 %	85.16 %	78.6 %
Rate of E Category	< 2 %	4.51 %	2.2 %
Rate of A Category	< 4 %	10.36 %	19.2 %

Source: ex-JBA Pahang and Temerloh

The most common reason in Temerloh for billing to be based on "A" or "E" is damaged meters, accounting for more than 90 % of the cases. Inaccessible meters, due to locked gates or barriers accounted and dirty meter dials accounted for about 5 % and 2 % of the cases respectively. Bad weather prevented meter readings being carried out in some months, noticeably in the months of January and March 2011, when about 5 to 6 % of all meters were not read.

Age of meters in Pahang state is grouped in year of "0-7" or ">7", rates of which are 46.6 % and 53.4 %, respectively. Meters in normal status may indicate most likely the underestimate volume.

2.4 Water Quality Management

(1) National Standard for Drinking Water Quality

The present National standard for drinking water quality (hereinafter called as "NSDWQ") defines the maximum contents of 47 parameters composing of the 4 groups and 4 parameters + 1 combination of the additional standard for "Quality Assurance Program 2011 (hereinafter called as "QAP")" with permissive frequency rate.

< NSDWQ >

- Group-1: T-Coli, E-Coli, Turbidity, Color, pH, Residual-Cl
- Group-2: TDS, CCE, Cl, NH_3-N, NO_3-N, Fe, F, TH, Al, Mn and MBAS
- Group-3: Hg, Cd, As, CN, Pb, Cr, Cu, Na, Mg, Zn, SO_4, Se, Ag, Mineral Oil, $CHCl_3$ and Phenol
- Group-4: Aldrin, DDT, H&HE, Methoxychlor, Lindane, Chlordane, Hexa-chloro-benzene, 2,4-D, Biocides: Total, Alpha Ray and Beta Ray

Even though clean water does not meet the standard, water supply is not stopped except for the case of runoff of toxic matters or oil or detection of abnormal smell, etc. of which the judgment relies on human five senses

< QAP >

- E-coli + Residual-Cl (< 0.2 %), E-coli (< 0.4 %), NTU (< 2.0 %), Residual-Cl (< 2.3 %) and Al (< 10.0 %)

(2) Monitoring and Control System

Instrumentation equipments for water quality examination are not installed or malfunctioned excluding the latest WTP of Seberang Temerloh in which it is not used due to unknown how to use. Operation staffs have examined the major parameters using simple instruments only for reporting. In this regard, real-time measures are not taken corresponding. to the water quality (mainly turbidity) variation. A water quality monitoring/management system has not been established

(3) Examination Parameter

All of the 5 WTP have its laboratory in the same compound for following the ex-JBA standard as shown in **Table II-2.14**.

Table II-2.14 Water Quality Examination at the WTP

Examination Parameters		Frequency	Remarks
Physical	NTU, pH	2 to 6 times a day	Some regents were expired. No chemist.
Chemical	Al, Residual-Cl, Fe, F		

Source: Prepared by the Study Team

Note: Other physical and chemical parameters have been examined monthly at the ex-JBA laboratory in Kuantan. Bacteriological parameters have been examined monthly at the DOC laboratory in Kuantan.

Major physical parameter of turbidity (NTU) is monitored at WTP. A pentagonalex jar tester is equipped at the latest Seberang Temerloh WTP (see **Figure II-2.16**). Although the standard combination ratio table of coagulant is distributed to respective WTPs from the ex-JBA Pahang but the jar tester and standard combination ratio table of coagulant are not in fact used. The record of on-site examination results is prepared for statistics but not for water quality control. There is no licensed chemist in the ex-JBA Temerloh.

Figure II-2.16 Laboratory at WTP of Seberang Temerloh (test operation from Aug-2011)

The physical and chemical parameters (NTU, TCU, pH, residual chlorine, coliform groups and coliform) are examined at the Laboratory of ex-JBA Pahang (Kuantan) with a frequency of 0.5 to 3 times per month.

20 parameters (TDS, NH_3-N, NO_3-N, Fe, Mn, Al, F, Hg, Cd, As, Pb, Cr, Zn, Aldrin/Dieldrin, DDT, H&HE, Methoxychlor, Lindane, Chlordane, Endosulfone) are outsourced to Water Quality Labora-

tory of the Health department of the State Government in Kuantan with a frequency of 3 to 4 times per month.

Examination was done only 3 to 4 times in 2007 for heavy metals such as Hg, Cd and As, and 3 to 4 times from 2007 to 2010 for Pb, Cr and Zn, and 7 parameters of agrichemical (Aldrin/Dieldrin - Endosulfone).

(4) Current Water Quality

< Raw Water >

- High NTU and low EC were examined at all/some WTPs due to rainy season in December to February. Since alkalinity is low in such water quality, an adequate coagulation performance may not be obtained even though coagulant is fed appropriately.

< Treated Water >

- Total coliform (several times per year) was detected at all WTPs in 2007-09.
- E-coliform (once or twice a year) was detected at Lubuk Kawah and Mempatih WTPs in 2007-08.
- E-coliform QAP (0.7 %) was exceeded its permissive rage of 0.4 %/year in 2011.
- NTU (less than 10 times annually) and NTU QAP (10 %) were exceeded at all WTPs
- Al was detected being over the limitation at all WTPs (several times per year) and QAP also being over (20 % of frequency).
- Residual-Cl was detected being lower than the standard and being over the QAP permissive range (7 %/year).
- Heavy metal and agricultural chemical were not detected at all WTPs.

< Tap Water >

There will be a possibility of ocular crisis on waterborne diseases causing of Total-coliform and E-coliform being detected in treated water at WTP. Major causes of detection may be breakthrough of suspended substance during the treatment process. Therefore, operation of WTP and/ or treatment process should be improved. Examination parameters relating to agricultural chemicals are limited to organo-chlorine pesticides, while other chemical parameters such as organo-phosphorus pesticides have never been examined yet.

As the factor of frequent occurrence of excess over the water quality standards, it may be based on the idea that the operator prioritize the quantity to the quality in Malaysia and water supply is not stopped even though there is a water quality problem in treated water at WTPs Because of QAP standard, ex-JBA staffs may have a sense of security even if the exceeded contents within permissive frequency of QAP. Consequently, there would be a possibility to avoid the strict control of treatment process such as formatting of dosing handling. Although it will take time to solve this problem, aiming at the compliance with the standards, the standard shall be limited to the drinking water quality standards without QAP limitation, however it should be pointed to reduce the level of permissive frequency for the time being.

2.5 Non-Revenue Water

NRW rate in entire ex-JBA Pahang was recorded at more than 50 % since 2007. Ex-JBA Pahang has analyzed that the following factors would be caused of high NRW rate.

- Huge amount of leakage from the aged AC distribution pipes, most of which were recognized as passing more than 40 years after installation, and
- Metering in-accuracy, such as meter error and reading error.

In the former factor, the deteriorated distribution pipe has been not replaced sufficiently due to budgetary limitation. On the other hand in the latter factor, the aged meter with underrated metering

has been not calibrated or changed due to discrepancy of un-satisfied regulation between standard and obligation with penalty, and also budgetary limitation.

(1) Definition and Applied Data

Rate of NRW being defined by International Water Association (hereinafter called as "IWA") is estimated a percentage of non-revenue water to distribution amount (referred to **Table II-2.15**).

Table II-2.15 Definition of Water Balance in IWA

<table>
<tr><td rowspan="10">Intake Amount</td><td rowspan="9">Production Amount</td><td rowspan="3">Authorized Water</td><td rowspan="2">Authorized Revenue Consumption</td><td>Billed and Metered Consumption</td><td rowspan="2">Revenue</td><td>Billed water including outstanding and bulk water to other system</td></tr>
<tr><td>Billed and Un-metered Consumption</td><td>Revenue water from other account such as maintenance cost, etc.</td></tr>
<tr><td rowspan="2">Authorized Non-revenue Consumption</td><td>Un-billed and Metered Consumption</td><td rowspan="6">Non-revenue</td><td>Arbitration water such as hydrant, poverty measures, etc.</td></tr>
<tr><td>Un-billed and Un-metered Consumption</td><td>O/M water loss such as blow-off and so on</td></tr>
<tr><td rowspan="6">Water Loss</td><td rowspan="2">Apparent (Commercial) Losses</td><td>Un-authorized Consumption</td><td>Non-revenue water due to illegal connection and so on</td></tr>
<tr><td>Metering In-accuracies</td><td>In-sensitivity and error of water metering</td></tr>
<tr><td rowspan="3">Real (Physical) Losses</td><td>Leakage on Pipelines</td><td>Leakage from pipe connection and fittings including damaged pipes</td></tr>
<tr><td>Leakage and Overflow from Storage Facility</td><td>Leakage and overflow due to facility deterioration and miss-operation</td></tr>
<tr><td>Leakage on Service Connection</td><td>Leakage from distribution pipe up to water meter</td></tr>
<tr><td colspan="5">Water Loss by Treatment Process</td><td>Water loss due to treatment process; backwashing, brow-off, etc.</td></tr>
</table>

Source: IWA Web-site

Ex-JBA Pahang has gathered following data for estimation of NRW rate.

- Distribution: measurement at outlet pipe from each WTP twice a day recording and monthly summing
- Consumption: summing meter reading amount at each billing zones, monthly

Basically, regulation system relating to water meter is not enough to work in Malaysia. Due to the institutional defect that periodical replacement of water meters is not mandatory, accurate water consumption can not be measured.

The cost of service installation is charged to applicants. In accordance with the following demarcations for installation of service connection, ex-JBA Pahang does not have responsibility to secure the meter reading accuracy. Consequently, ex-JBA Pahang couldn't get into replacement of damaged meters, even a meter reader found the meter with un-reading conditions.

- Applicant can select the materials and installation contractor,
- Ex-JBA can not replace meter and service pipe without acceptance of user, and
- Ex-JBA bears the replacement cost if meter accuracy is judged as improper by ex-JBA.

Ex-JBA Pahang has adopted following operation measures (guidelines) with due consideration of current situations. In 2011, number of meters categorized in "Estimate" and "Average" is counted at about 20 % of total number.

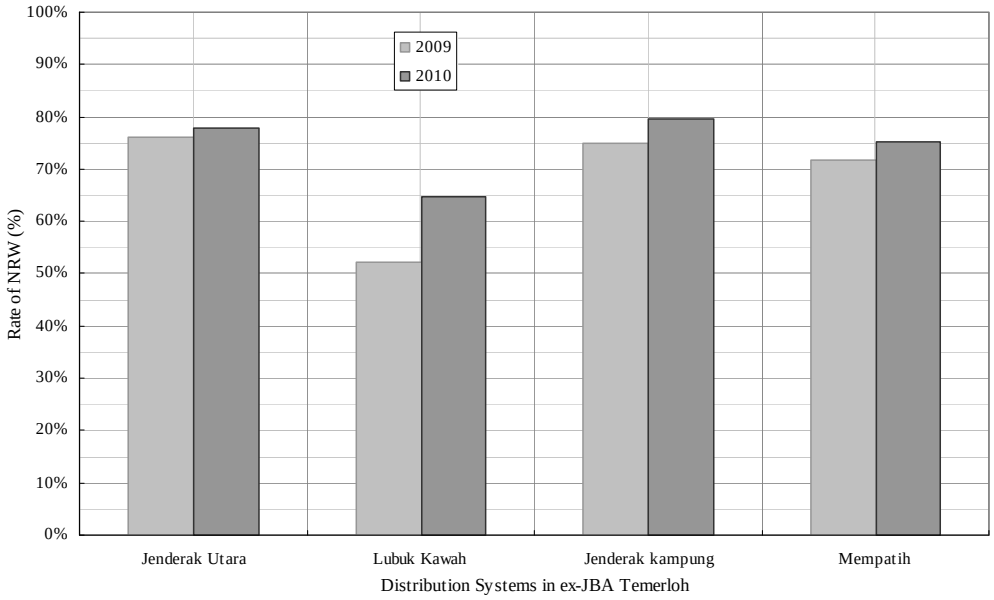
- Average: Not readable: average of latest 3 months in normal reading
- Estimate: Not measurable: estimated by ex-JBA criterion of use and capita/HH

- Normal: Readable: reading value

Additionally, worked meter is judged as "Normal" and ex-JBA can not replace the meter even it is aged. Such aged meters were found during the site visit with more than age of 20 years. The normal meters may have less volume reading due to deterioration by age. Ex-JBA has recognized this kind of problem but no solution of counter measures.

(2) Rate of Non-Revenue Water

Ex-JBA Temerloh has operated 4 WTPs until July 2011 since the new WTP (Seberang Temerloh) started the one-year test-operation from August 2011. **Figure II-2.17** compares the NRW rates of 4 distribution systems in 2009 and 2010. NRW rates in 2010 were increased at all of 4 systems.



Source: ex-JBA Temerloh

Figure II-2.17 NRW Rates in each WTP System of ex-JBA Temerloh (2010)

Table II-2.16 shows the monthly NRW rate in each distribution system served by WTP. NRW in Temerloh in the above period is higher than the average NRW in Pahang State during 2007 to 2010 (ranging from 52.8 % to 59.9 %). It is noted that WTP at Seberang Temerloh has distributed treated water to service areas since August 2011 for 1 year testing under its contract. Distribution amounts of the WTP were added into the production amount of Lubuk Kawah WTP.

Table II-2.16 Monthly NRW Rate by Distribution System in ex-JBA Temerloh (2011)

Month	Distribution System under WTP					Overall
	Jenderak Utara	Lubuk Kawah	Jenderak Kampung	Mempatih	Seberang Temerloh	
Jan	75.1	59.5	75.3	75.0	Under Construction	61.9
Feb	76.5	67.1	55.7	75.0		67.4
Mar	76.9	64.5	77.6	76.6		66.6
Apr	78.9	60.7	78.5	57.9		62.8
May	81.9	61.6	76.3	78.3		64.7
Jun	78.2	62.5	77.7	79.4		65.3
Jul	80.2	60.5	77.3	79.3		63.9
Aug	87.4	61.9	77.7	81.6	Integrated to Lubuk Kawah	66.1
Sep	80.0	53.4	74.0	73.7		57.9
Average	80.2	61.4	75.3	76.4		64.1

Source: ex-JBA Temerloh

There are some inconsistencies in the NRW data in the areas served by WTP, such as the following:

1. NRW in the area served by Jenderak Kampong was 55.7 % in February 2011, compared to between 74.0 % and 78.5 % in the other months. However in the same month the system input volume (water produced) was 161,900 m^3, compared to between about 240,000 m^3 and 260,000 m^3 in the other months.
   Metered billed consumption in February 2011 was approximately 71,700 m^3, which was significantly higher than in the remaining months and the overall average per month of 60,000 m^3.
   Possible reasons for the inconsistencies in the data include;
   (1) problems with the treated water production meter,
   (2) high water consumption by one or more users in February 2011,
   (3) incorrect data on metered billed consumption,
   for example due to estimates in consumption where meters are damaged.

2. NRW in the area served by Mempatih was 57.9 % in April 2011, compared to between 73.7 % and 81.6 % in the other months. However in the same month the system input volume (water produced) was 109,090 m^3, compared to between about 180,000 m3 and 260,000 m^3 in the other months.
   Metered billed consumption in April 2011 was approximately 46,000 m^3, which was similar to that for the months of January to March and May to August 2011 (ranging from about 41,000 m^3 to 50,000 m^3).
   There was a significant increase in metered billed consumption in the month of September 2011, with a total consumption of about 68,000 m3, which is approximately 36 % higher than the maximum monthly production in other months.
   Possible reasons for the inconsistencies in the data are similar to those for the area served by Jenderak Kampong.

3. The monthly system input volume in the Mempatih was identical in August and September 2011.

Daily NRW in the distribution system (m^3/day/km) is shown in **Table II-2.17** based on; (1) NRW in the period between January and September 2011, (2) the total pipe length in the GIS system as of December 2011 and (3) the total pipe length from other records. Both figures in Temerloh are significantly higher than the corresponding figure (50 m^3/day/km) for the state in 2010.

Table II-2.17 Daily NRW in the Distribution System

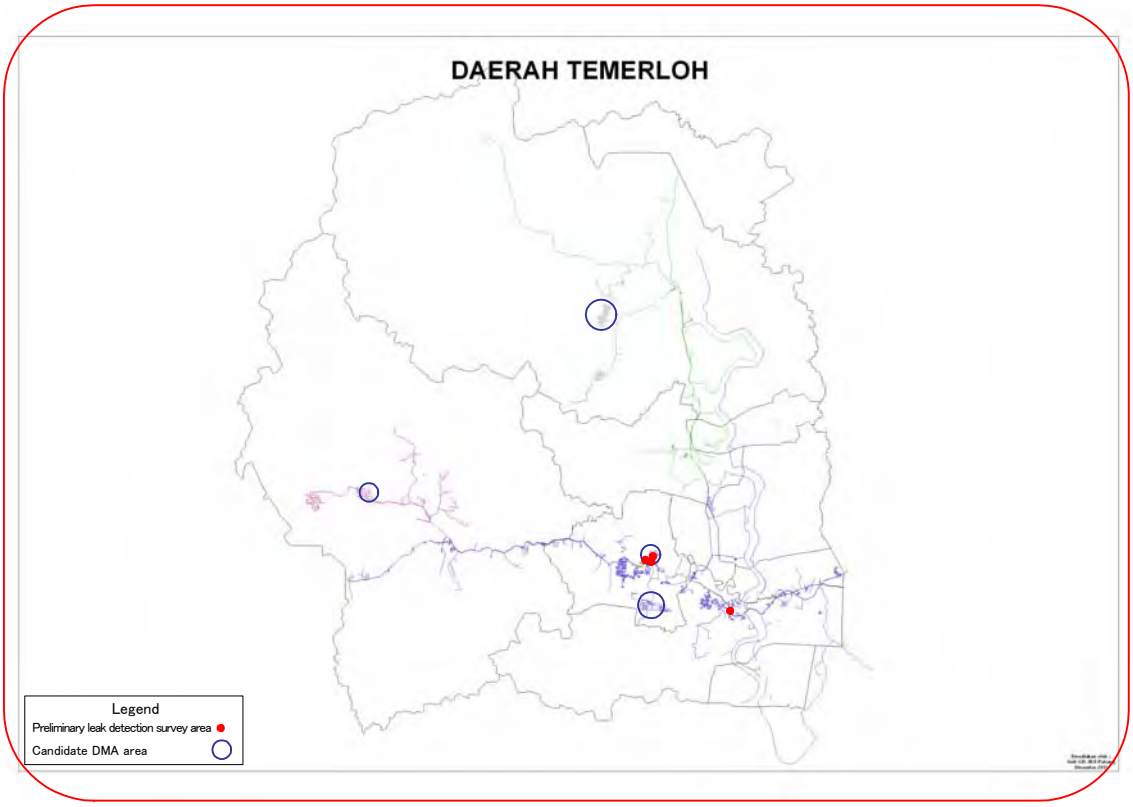
Ex-JBA	2010		2011
	GIS	Record	GIS
Pahang	50.0 m^3/day/km	Not available	Not available
Temerloh	81.1 m^3/day/km	78.7 m^3/day/km	83.2 m^3/day/km

Source: Estimated by the Team using information of ex-JBA Pahang and Temerloh.

(3) Leak Detection by the Study Team

The Study Team conducted a preliminary leak detection survey by contacting a acoustic bar and time-integral type leak detector to a customer's meter at two sites in Temerloh (residential) and Mentakab (commercial) during the first field survey and two sites at Mentakab (domestic and commercial) during the second field survey as shown in **Figure II-2.18** and **Figure II-2.19**.

The criteria for site selection are the small service area with high densities of population and meter connection. At the four sites with about 4 km long distribution pipes in total, the survey took about two and half hours by three staff. The number of points surveyed counted 300 locations as shown in **Table II-2.18**.



Source: Prepared by the Study Team

Figure II-2.18 Location Map of Leak Detection Sites

Figure II-2.19 TS Leak Checker: Time Integral Type Leak Detector

Out of 300 points, experts found the following alleged leaks by this activity. Based on the experiences of TSS experts, the number of actual leaks was estimated as shown in Table II-2.18.

Table II-2-18 Leak Detection by the Study Team

Detection method	No. of locations surveyed	Cause of leakage	No. of leaking site
Leakage Sound	136 locations (under-ground)	Underground	10 locations (estimated number baced on experience)
Surface Leakage	4 locations (surface)	Surface	4 locations
Illegal Connection	2 location (illegal connec-tion)	Illegal	2 location Branch pipe from the up-stream of a meter

Source: Prepared by the Study Team

As a result of this experimental detection activity, totaled 16 locations of leakage and un-billed consumption were identified. This detection rate is quite higher than that in normal case at ordinary urban water supply areas. Leak detection work would have effective performances in terms of cost and time when the full-scale activities are planned and implemented.

Through this pilot study namely a preliminary leak detection survey, 14 leaks and two illegally-connected meters found, although the leaking points are not identified. Taking into account the extent of survey areas, the leaking points were too much in comparison the percentage in the ordinary survey. If the leak detection survey will be carried out systematically, the high possibility to obtain a great output can be expected in consideration of both survey cost and time

In these surveys, many false-leaking noises likely caused by water use especially in the shopping area were detected, but most meters didn't work with no movement in the meter's dial. This fact suggests that a measuring error is substantially big due to defects in meters.

(4) Plan and Achievement of NRW Reduction

In recent years, replacement of AC pipes has been proceeded to reduce the NRW by ex-JBA Temerloh. Progress and proposal is shown in **Table II-2.19**. Ex-JBA Temerloh proposed to ex-JBA Pahang the RMK-10 which includes the pipe replacement works unimplemented fully in the RMK-09 due to budgetary constraints.

Table II-2.19 NRW Reduction Projects by Pipe Replace in ex-JBA Temerloh

Project	Period	Replaced Length	Proportion to total Pipe length
RMK 09	2006-2010	21.4 km	0.45 %/year
RMK 10	2011-2015	25.4 km	0.55 %/year

Source: ex-JBA Temerloh

The numbers of leak repairs are recorded in pipe maintenance report obtaining from ex-JBA Pahang. **Table II-2.20** shows the said repair numbers.

Table II-2.20 NRW Reduction Activities by Pipe Repair in ex-JBA Temerloh

Breakage Pipe	2007	2008	2009	2010	2011 (Jan-Nov)
Distribution pipe	639	686	737	485	471
Connecting pipe	1,936	3,073	3,619	2,282	1,862
Total	2,575	3,759	4,356	2,767	2,333

Source: ex-JBA Pahang

Table II-2.21 shows the numbers of program and implementation of replacement of damaged meters, up to the end of 2011. As such performance with respect to the target was poor in Temerloh; however this may have been due to priority being given to other districts where the percentage of damaged meters is higher than in Temerloh, also considering budgetary constraints. Distribution of meters to the District Offices is allocated by the Head Office and District Offices do not have authority to

purchase meters.

Table II-2.21 NRW Reduction Project by Meter Replace in ex-JBA Temerloh

Area	Proposed in 2011: A	Replaced in 2011: B	Proportion Rate: B/ A
Pahang	30,000	12,600	42 %
Temerloh	7,668	844	11 %

Source: PAIP Head Office and Temerloh

Examination of existing meters is not carried out unless requested by the customer, in the case of complaining about the water bill. It is reported that water consumption has increased after replacement of meters.

District metered areas (hereinafter called as "DMA") were set up once for trial activity to measure the minimum night flow (see Figure II-2.18) but continuation of this activity was abandoned because of budgetary constrain and shortage of manpower.

2.6 Proposed Technical Improvement

(1) Basic Points for Planning

Basic points for PAIP Temerloh are described below.

- Water Quality: Treated water quality shall be improved to meet the drinking water quality standard.
- NRW Reduction: High rate of NRW shall be reduced as much and earlier as possible by implementing proactive replacement of deteriorated pipes (including AC) and planned leakage control work.
- Service Pressure: Service areas with lower water pressure shall be dissolved by adopting proper allocation of treated water and reasonable improvement of pipeline networks.
- RW Increasing: Amount of revenue water shall be increased as much and as early as possible by replacing failure meters and remedying illegal connections.
- Rationalization: Management of the water supply utility shall be improved efficiently by integrating current information systems (GIS and E-Water).

(2) Water Treatment Plant

Among treatment processes, complete removal of suspended substances is focused for water quality improvement. Although coliform was detected in the clean water examination, coliform will not be detected as a result, since the effect of bacteria in suspended substances is also excluded through suspended substances removal. For this improvement concept, following measures shall be considered;

- Instruments: appropriate testing, periodical calibration, proper repair, replacement, etc. and periodical procurement of reagents
- Turbidity : continuous measurement of turbidity at 3 locations (raw water/ clarified water/ treated water) with automatic turbidity meter
- Parameters: addition of alkalinity measurement for proper adjustment of coagulant feeding
- Ph control : addition of caustic soda or hydrated lime, including functional equipment for mixing and injecting to control ph for good coagulation

Upon completion of above measures, operation procedures and/ or standards also should be improved for real time correspondence to meet the various water qualities. Sufficient removal of inorganic matters such as suspended substances can be expected. Following attentions are due consid-

eration for operation of WTP.

- Examination: shortening of examination interval
- Chemical feeding: proper dose of coagulants and chlorine in accordance with examination results
- Filtration Rate: proper interval of backwashing, slow-down and slow-start
- Training Conduct the training to the present operators on water treatment corresponding to the present status of respective water treatment plants

As a future target of water quality management, following advanced process should be studied.

- Automatization: operation system including water quality monitoring, chemical dosing by feed-forward and feed-back information
- Process: advanced treatment of ozone and activated carbon (called as BAC)

For development and operation and maintenance of facilities, since the staff with skill and knowledge is required for mechanical and electrical equipment, water quality examination, etc. Programming and steady implementation of human resource development is proposed.

(3) Distribution System

Following viewpoints are conceptually extracted according to the site visit at facilities of PAIP Temerloh.

- Application of Topographic Features
- Conversion of Distribution System
- Severance of Transmission and Distribution
- Establishment of Specific Zoning

< Application of Topographic Features >

Topography of service area is undulated on hilly surface, slopes of which are western side to the town proper at south-eastern side in district. Transmission and distribution networks would be re-structured applying the gradual slope with pressure control using pressure reducing valve, etc. for energy saving.

< Conversion of Distribution System >

Treated water is distributed by gravity, mainly via elevated tanks. It will be effective for water supply in rural area (low population density) with due consideration of saving energy. However in urban area with high population density, it is difficult to keep proper pressure during high consumption time by gravity system.

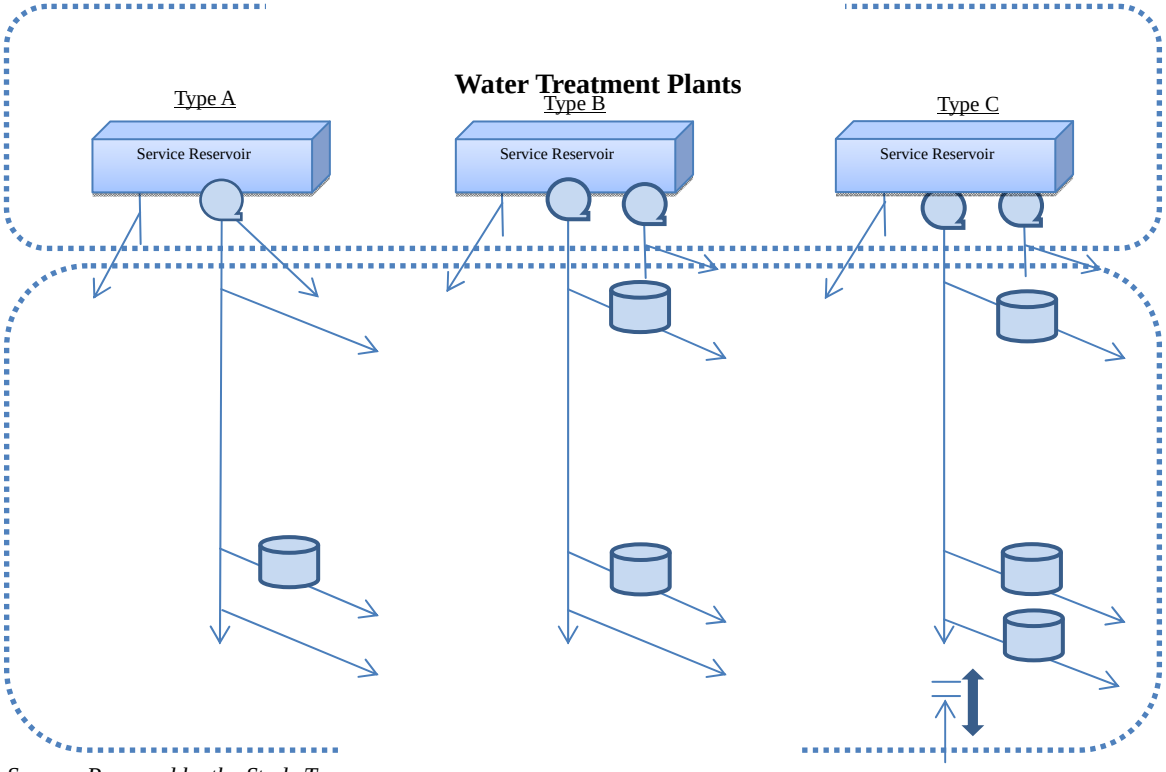
Consequently, of reservoirs and distribution pumps would be required to operate in high populated service areas in accordance with hourly factor of demand value.

< Severance of Transmission and Distribution >

Transmission facilities have a purpose to allot the stabled treated water from WTP to service area fairly, while distribution facilities have a purpose to stable supply the potable water to users. It is quite difficult to have quick responses to the accidents and/ or normal variations when present facilities with different purposes are intermixed.

Figure II-2.20 show the types of water distribution systems. In JBA Temerloh, Type A and Type B are mainly used. However, it is advisable to approach Type C as early as possible at the time of new installation or replacement of pipes. In the demand-increasing densely-populated area, the

change to a pump operation system should be also considered.



Source: Prepared by the Study Team

Figure II-2.20 Form of Water Distribution Systems

Except for some water treatment plants, the distribution pipes are not separated from the transmission pipes and single pipes is used for both transmission and distribution in some cases. In case of augmentation or replacement of facilities, it is important to separate the distribution pipes from the transmission pipes.

Presently, some parallel transmission and distribution pipelines are installed for each purpose. On the other hand, several service areas receive the un-stable pressure for examples of extremely high or low supply pressures, because some service area received the water directly from transmission pipeline. Additionally, flexible operations would not be applied with due consideration of bad influences to the service area.

< Establishment of Specific Zoning >

Low supply pressure zones are presented in some areas. The best measure to this solution would be to establish the specific zoning for independent water supply. Improvement of entire distribution networks may be costly because most of pipes shall have a larger diameter for hydraulic balancing. Additionally, it will take a long term to have a solution of this low pressure zone; it means that provider shall correspond to the complaints for a long period. In this regard, early solution focusing on specifically low pressure zone would be effective for total management also.

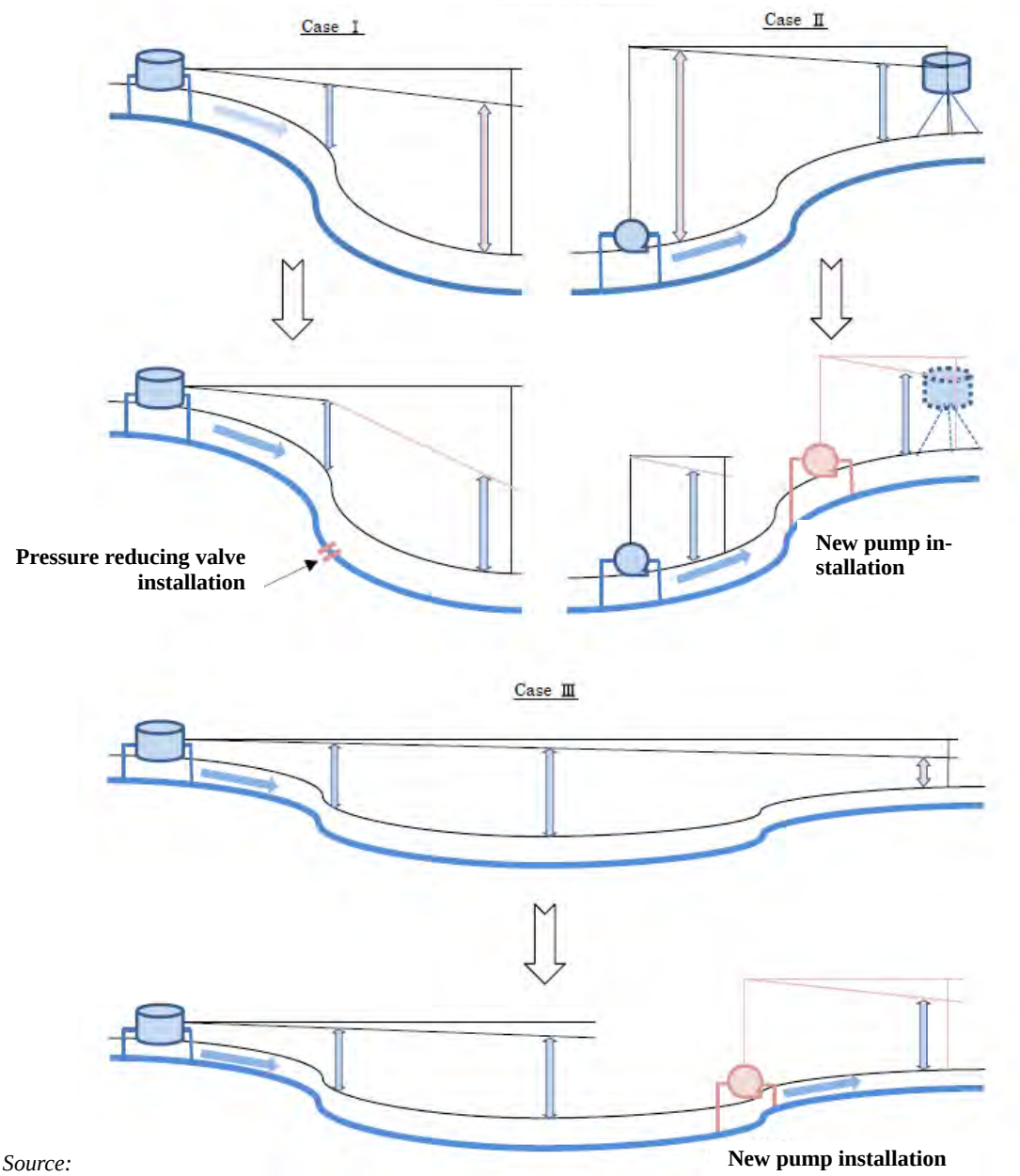
Such low pressure zones may be located at higher elevation area and/ or terminal of network. Booster pump station is a general measure, because of low cost and fast installation.

Low pressure zones at network terminal may have causes of poor pipeline hydraulically, improper location of reservoir, low water level in reservoir or both of them. Basically, gravity supply is applied in Temerloh. Therefore, complex causes may be not solved within short time. For this measure, booster and/ or inline pump would be recommended in the period until the full-scale

measures are implemented.

While for the cause of low distribution pressures at the terminal of the water distribution area, various cases such as the defects in a water distribution network, defects in water distribution sources like a service reservoir or their combination are considered. As the gravity systems from elevated reservoirs is mainly used in the ex-JBA Temerloh area, the complex causes are expected and it seems difficult to remove such causes in the short-term. For this reason, it is better to correspond the use of small booster pumps same as the high level area, till the thorough solutions such as the change in distribution system (pump operation), distribution pipe provision, etc. will be taken.

Figure II-2.21 shows the example of water pressure adjustment. The gravity system is effective from the viewpoint of energy efficiency but indispensably requires the pump installation to adjust water pressure elaborately.



Source:

Figure II-2.21 Example of Water Pressure Adjustment

(4) Service Installations

Following improvement points are considered in the view points of NRW reduction at Temerloh.

- Branch Portion from Distribution Pipe
- Materials of Service Pipe under the Road
- Service Pipe to Meter Connection
- Meter
- Measures against Long Service Pipes
- Service Connection with Receiving Tank
- Registration of Materials

< Branch Portion from Distribution Pipe >

At present in JBA Pahang, the ferrule with saddle is used at the branching part by directly drilling a hole on the distribution pipe and attaching a ferrule with saddle, which is not the drilling method with non-suspension water. However, the use of a ferrule with saddle and sub-valve is recommended to improve the branching method from water distribution pipes with the following reasons:

Reasons

- Through practices, the handling procedures become easy with less error in the drilling work.
- In case of the drilling work without non-suspension water, it may bring the washout of excavation materials due to bad workmanship, takes time in branching work and increase the excavation volume.
- In operation and maintenance, the response to a leak between a branching part upstream of a meter and a meter can be minimized due to the existence of a sub-valve..

< Materials of Service Pipe under the Road >

The best material of service pipes is stainless steel (e.g. SUS-304). Usual material of HDPE would be also acceptable for the mean time due to financial constrain of provider and residents. It should be selected as HDPE with dual layers. Flexibility, light-weight and impact-resistance of HDPE are distinctive features. Additionally, installation ability is also better with limited fittings. However, in the congested utilities underground, HDPE pipe is fragile while installation.

When the distribution pipes are planned and implemented to replace, service pipes branching from the distribution pipes should be replaced together, because most leaks occur on service pipes.

< Service Pipe to Meter Connection >

To reduce the number of fittings would be effective to reduce leakage and to facilitate installation of service pipes and water meters. For example, recommended materials made of SUS-304 are; (1) corrugated tube and (2) stop valve with expansion and flexible mechanical joint.

< Meter >

Reduction of NRW caused by meter in-accuracy would be required to implement periodical replacement of meters. For this activity, criterion of 7 years replacement interval shall be regulated with penalties.

JBA Pahang has an intention to use the impeller type meter in future.

When the impeller type meter is installed with a slope, the loads of all gears are received by a horizontal shaft but not a pivot, resulting in the trouble in accurate measurement by an increase of

bearing resistance. The obligation to install a meter horizontally should be clearly specified in the installation guidelines, etc.

Also meter of impeller type has an in-accuracy when it is not installed horizontally.

Implementing standard and inspection shall be considered when the drawing of service connection is standardized.

Replacement of Meters

- It is recommended that the replacement of meters will be implemented in the model project based on the following ideas:
- Target area shall be the whole service area by PAIP Temeloh.
- The review was done based on the situation of JBA Temerloh as of January 2012.
- The model project shall be implemented with two phases of which a period is five years for each.
- All meters shall be normal and has below seven years old within first five years.
- The replacement work of meters shall be done with the same pace for each month, taking into account the leveling of works.
- During the first five years, the meters shall be newly out of order at the same pace as that in 2011.

Table II-2.22 No. of Meters (as of January 2012)

		Pahang State	Temerloh District
A	Total	364,000	45,000
B	Meter out of order	39,360	9,240
C	Normal meter (A-B)	324,640	35,760
D	Over 7 years (C÷２)	162,320	17,880
E	Belo w 7 years (C÷２)	162,320	17,880
F	Replacement record（/month）	1,080	60
G	No. of new meters out of order（/month）	1,560	150

Based on the above idea, the number of meters to be replaced within five years is approximately 39,000 units.

< Measures against Long Service Pipes >

For reduction of NRW and improvement of repair ability of service connection, measures of (1) adoption of manifold pipes and (2) installation of a stop valve at the boundary between private land and public road are needed.

< Service Installations with Receiving Tank >

Normally, large consumers such as hotel and condominium receive the water at receiving tank. Stocked water in ground tank will be transferred to higher tank by user's pump for gravity supply to tenants or pumped to tenants directly.

Since overflow from the tank is charged to users because it is after the metering, usually water suppliers have no influence. However, in view point of water saving, it is recommended to implement compulsorily periodical inspection of receiving tanks, standardization of specification of float valves and its installation methods, and qualifying system for contractors.

< Registration of Materials >

Presently, applicants select the materials of service installations. Water quality and pressure resistance problems may be occurred causing of "no standard and/ or regulation." Materials shall be designated by the Federal Government and authorization will be given to the supplier.

Uniform quality and design of service installations would solve the complicated maintenance within the building.

(5) Information Systems

As part of the information management system, 4 systems have been installed or operated in ex-JBA Pahang.

Table II-2.23 Information Management System

System	Purpose
Geographic Information System	Facilities management, assets management
Telemetric Monitoring System	Facility operations, water supply services
E-Water	Meter reading, measurement, billing, collection, etc.
E-Complaint	Customer services

< GIS >

Technical information of water supply facilities in Temerloh is available only paper materials with hand writing of rough schematic diagram. Accumulated data of facility construction, operation and maintenance are almost none. In this regard, many staffs are needed to work and rational operation and maintenance are quite difficult. Consequently, sustainable and steady water supply, therefore, would be difficult to secure.

Pipe drawing in each district with 2-D positioning (no elevation) from GIS can be printed out at PAIP Pahang. However, geographic information of pipeline and road including grid coordinates may have a low accuracy; some pipelines and roads are not correctly inputted or miss-recording. Asset values of all pipes may account for more than 70 % of whole facilities. Maintenance of pipes is most important works of water utility for security of user's lifeline. Highest priority shall be given to the pipes with required parameters.

Detailed information of pipe installation is quite limited such as (i) depth of back-filling above pipe top, (ii) pipe diameter, (iii) pipe materials including type of fittings, (iv) off-set positioning and so-on. Therefore, installation data of pipes shall be recorded during a period of constructions; expansion, replacement, repair and service connection.
Parallel to this data input, tacit knowledge information from experienced persons (like a walking dictionary) in PAIP Temerloh shall be digitized because historical age of Temerloh water supply is 30 years or more. This work would be a shortest way to complete GIS.

It will take a long term work until completion of GIS input with accurate information, empirically one round of pipe replacement may be required with due consideration of pipe life. Key point of successful completion on this works, obligation rule and its consideration for quality control of output information from the contractor shall be set up at first.

< Water Supply Operation System >

Up to date, pressure indicators at 50 fixed points were installed but flow meter is not systematically installed yet. Water levels at 9 reservoirs (out of 25 in total) were monitored by telemetric instruments but its operation is malfunctioned since October 2011.

Introduction of entire water supply operation system on facility monitoring, data acquisition and its operation would most effective method for rational and sustainable water supply in terms of service level and cost saving. It will also be useful for NRW reduction measures. This system is called as Supervisory Control and Data Acquisition "hereinafter called as SCADA" composing of integrated computer and communication devices.

Various data will be measured and monitored from any facilities, and qualified control and instruction could be managed using analyzed information. Introduction and operation of this system would be a final goal in long term plan because of costly and massive initial works required.

Considering the current situation of PAIP Temerloh, a telemetric monitoring system with following items is minimal requirements for future effective operation of facilities in Temerloh. Monitoring stations will be installed at Temerloh Office and each WTP.

• Flow meters at outlet pipes from all WTPs	Existing A transmission device (radio LAN) will be added.
• Level meters (5 location on average for a service reservoir) and integral outflow meters (25 location in total)	New installation of flow meters with transmission devices (public radio for telephone)
• Pressure meters at 3 terminals of each distribution network(15 location in total)	New installation of water pressure meters with transmission devices (public radio for telephone)
• Parent station at water treatment plants (5 locations)	New installation with internet-available PCs)
• Parent station at ex-JBA Temerloh District Office (One location)	Same as the above

3 Plan on NRW Reduction

Rate of NRW in Temerloh has been stagnated at higher level reaching more than 60 % recently. Reduction measures of NRW were implemented with limited scopes due to deficit in budget and lack of staffs. In this regard, the aims of this study are:

- To design the sound finance with reviewing of current tariff system for project implementing, and
- To draw up the rational implementing plan of NRW reduction project.

3.1 Basic Plan

Basic concepts of reduction on the high rate of NRW are how to minimize the NRW-related items as shown in **Table II-3.1**.

Table Ⅱ-3.1 Kinds of NRW Reduction Measures and Its Term Required

NRW Reduction Measures	Activities	Term S&M	Term L
Measures against Real Losses			
Leakage			
Pipelines			
Piping drawings	Making of exact piping drawings	○	
Zoning	Design & installation of DMAs & LMBs	○	
MNF Measurement	Grasp of leakage & its distribution	○	
Leak Detection	Utilization of leak detectors	○	
Leak Repair	Adoption of optimum repair method	○	
Pipe Rearrangement	Systematization of water supply area & block formation pipe replacement		○
Facilities			
Leak Detection	Leak detection of civil engineering facilities	○	
Leak Repair	Adoption of optimum repair method	○	
Facility Rearrangement	Rearrangement of pumping stations & distribution reservoirs & their optimum operations		○
Measures against Apparent Losses			
Theft of Water			
Survey	Detection of illegal connections	○	
Notification & Persuasion	Negotiation with thieves	○	
Repair	Disconnection of illegal connections, installation of customer meters	○	
Fine & Penalty	Collection of fine & imposing penalty	○	
Meter Error			
Customer Meters			
Survey	Abstraction of defect meters	○	
Replacement	Relocation of meters and adjustment of meter position	○	
Bulk Meters			
Survey	Abstraction of defect meters	○	
Installation &Replacement	Installation of necessary meters, replacement of defect meters, relocation of meters and adjustment of meter position	○	
Meter Reading Error			

	Replacement of Meters	Adoption of easy-to-read meters, improvement of meter installation location	○	
	Remote Meter Reading System	Introduction of remote meter reading system		○
Data Handling Error		Careful work procedures and programming checks		
Measures against Unbilled Authorized Consumption				
Public Use		Review of unbilled water for public use	○	
Institutional Use		Improvement of drainage work for flushing		○
Fundamental Measures				
Data Management				
	Data Acquisition and Recording	Abstraction, acquisition & record of data	○	
	Data Analysis	Pipe network analysis, prediction of leakage & NRW rate, & improvement of NRW reduction measures	○	
	Construction of Integrated Information System	Introduction of GIS, customer information system, SCADA system & Management Information System		○
Planning				
	Planning of Pipe Rearrangement	Abstraction of pipes to be replaced, establishment of pipe replacement planning	○	
	Planning of Water Supply Operation System	Introduction of optimum water pressure & flow management system		○
	Structural Rearrangement	Structural planning (organization, staffing, work methods)	○	
	Prediction of Leakage Rate or NRW	Cost-benefit performance analysis	○	
	Consolidation of Legal System	Strength of penalties for water theft & intentional meter mis-reading, &award system for excellent staffs, qualification system for plumbers etc.	○	
Education and Training				
	Staff (including contractors) Training	Technical training & moral enhancement training	○	
	Enhancement of Public Awareness	Utilization of public relations & hearings, publicity and education	○	
Study/Research Development		Study on non-revenue water reduction, technology development		○

Abbreviations

DMZ: District Metered Zone

DMA: District Metered Area

LMB: Leakage Monitoring Block

GIS: Geographic Information System or Mapping System

SCADA: Supervisory Control and Data Acquisition

Source: Prepared by the Study Team

S&M: Short & Medium, L: Long

However, it is impossible to implement all the measures in this Project from the viewpoint of cost, manpower and period. Therefore, the Project will be implemented focusing on the following items:

Major Methodologies of Measures mentioned above are;

- DMA installation — Water leaks and thefts are efficiently detected and repaired by installing the Extended DMAs and ordinary size pilot DMAs and monitoring the

	flow therein. By reducing the measuring errors composed of meter error, meter-reading error and data handling error, such results will be applied to the NRW reduction work in the general areas.
• NRW reduction survey	Based on the data obtained at the DMAs, leaks etc. will be efficiently repaired.
• Old pipe replacement	to replace the deteriorated distribution and service pipes with screening criteria on age, materials and other factors.
• Meter Replacement	Apparent losses will be reduced through the replacement of meters which are out of order or become old in a planned and proper way (in accordance with Malaysian Sewerage Industry Guidelines)

TSS, one of member companies belonging to the study team, has developed technically and owns the special instrument; namely "Time Integral Type Leak Detector." The said instrument has an excellent peculiarity which makes a high probability of area identifications with much leakage without measuring minimum night flow, which needs costly DMA setting. Proposed this plan was prepared with due consideration of effective use on this type of instrument.

(1) Objective

In the Project Plan, mobilizing the rich experience and knowledge of the Tokyo Metropolitan Government on NRW reduction and aiming at halving the currently high NRW rate of more than 60% in the foreseeable future, how much the cost will be required and as a result what extent of the effect (benefit) will be obtained are studied. In general, the water tariff has been controlled low neglecting the cost in Malaysia. Even though any way will be taken, the effect over the cost cannot be expected in the calculation of the benefit to the cost under the situation of the Malaysian water sector involving many old facilities, therefore how big is the difference between them were clarified.

- To reduce the rate of NRW as much as possible close to 30 % with best efforts.

(2) Target Year

The objective of this proposed plan will be achieved within 5 years as a milestone after the project commenced.

(3) Scope of Work

Following "Scopes of Work" are proposed;

• To install the extended DMAs within each WTP:	5 sites
• To install the pilot DMAs for trial survey:	4 sites
• To conduct the NRW survey at general areas	The whole area
• To introduce a simplified telemetering system	1 Set (parent: 6 stations + children: 45 stations)
• To replace water meters:	Replacement of all defective and/or old meters
• To replace the old distribution and service pipes	Replacement corresponding to the service life of pipes
• To repair leaks:	All of surface leaks and detected underground leaks (1 master and 5 terminals)
• To conduct training:	Training for PAIP staff

Note: Meter replacement, pipe replacement and leak repair may be outsourced during the implementation stage but included in this Study for the benefit-to-cost analysis.

3.2 Basic Design

(1) Establishment of DMAs

The enlarged DMA will be established at 5 sites in each WTP. Zones in 3 WTPs of Jenderak Utara, Jenderak Kampung and Mempatih would be the same to current distribution system in each WTP. The service area by Seberag Temerlow WTP currently under the trial operation is set by reducing the water distribution area of Lubuk Kawah WTP, namely the left bank area of the Pahang River bounding an aqueduct across the Pahang River.

For the time being, normal DMA would be established at 4 sites (more or less) for trial case study to extract the basic information for ascertainment of directions on NRW reduction. Candidate sites shall have;

- High population density,
- Relatively old distribution pipes being installed, and
- Service connections being counted at about 3,000 to 5,000 (equivalent to about 10,000 to 15,000 of population served).

JBA Temerlow has an experience in the past to set the DMA at two blocks and conduct a pilot leak survey. One of them will be preferentially included in the ordinary size DMAs. In addition, the area that the Study Team conducted a pilot leak survey and found a higher percentage of leaks than that of ordinary leak survey was also selected to set one block of DMAs. Furthermore, two more DMAs were set at the industrial estate and the water distribution area by Jenderak Utara WTP which was the oldest WTP in JBA Temerloh.

The four DMAs were set at the following areas:

- Felda Bukit Damar area
- Kaw Perind Mentakab area
- Mentakab Kampung area (Chinese New Village)
- Jenderak Utara area

Felda Bukit Damar area was used as the DMA by JBA Temerloh itself and the remaining three areas were newly selected in this Study.

Designs and materials of DMA would be standardized during the first stage activity with due research on the marketability of sub-contractors and suppliers in Malaysia.

(2) Replacement of Distribution and Service Pipes

Current distribution pipelines with total length of about 990 km have following features;

- Material (% in L): HDPE (46 %), AC (39 %), MS (13 %) and each DI/ uPVC/ Un-known (1 %)
- Max. Diameter: 400A of HDPE, 450A of AC, 1,200A of MS, 300A of DI, 200A of uPVC and 450A of Un-known
- Installation Year: recent years after 2002 (66.5 km in 9 years: 6.7 % in total of 987.5 km)

If the aged pipe is defined as 20 years or older, pipes being installed before 1990 would be a target for replacement. On the hypothesis that average length of distribution pipes have been installed and/ or replaced since beginning of 1983, the aged pipe would be estimated at 330 km in total length.

Presently, about 5 km in length of pipes have been replaced annually. On the condition that a pipe life is 30 years at a maximum, required replacement length is estimated at 33 km/year (330 km/10 years; considering the newly occurred aged pipes during replacing.). Actual life of pipe is depending on the materials varying from 20 to 30 years ranges. The priority of replacement shall be considered to apply AC pipelines with elder age.

Regarding pipe materials for replacement, it would be designed comprehensively with due consideration of costs on material, installation ability and life for cost recovery. One of recommended material is DCIP because of its life and maintenance costs. Pipes with materials of uPVC and HDPE are also acceptable if financial constrain is judged as non-feasible for DCIP. However, in such cases, it is necessary to replace at least 4% of the total pipeline length (approximately 40 km) per annum, since the service life of uPVC and HDPE pipes is about 25 years. In case of DCIPs, the replacement of pipes is allowed to be 1% of the total pipeline length (approximately 10 km) per annum due to a average service life of 100 years.

For any cases, approximately 85% of the total length of present distribution pipelines are shared by HDPE and AC pipes, JBA Temerloh is required to replace at least more than 40 km long per annum, taking into account the total length with more than 20 years old pipelines and a service life of pipes.

AC pipes shall be replaced with high priority because of durability reason. Additionally, pipelines within prone area of large scale leakage will be commenced at the very beginning. Annual average number of leakage during 2007 and 2010 is 635 For reference, the number of leaks by pipe material and cause are summarized in **Table II-3.2** and **Table II-3.3** for November 2011. The 80% of leaks occurred in AC pipes by piping material and more than 70% of leaks occurred by burst by cause. Although the percentages to the total pipeline length are 46% for HDPE and 39% for AC, respectively, the accident percentage is rather higher in AC pipes. It is obvious that the priority of pipe replacement is given to AC pipes.

As the water service is the apparatus industry, especially the replacement and operation and maintenance of water pipes is the question that inevitably arises and it is indispensable to guide so as to make a record on various data during the pipeline maintenance work in consideration of future plan at any time.

Table II-3.2 Number of Leak Repairing Work by Pipe Size and Type (As of November 2011)

Dia.(mm)	Type			
	AC	HDPE	MS	Total
355	0	1	0	1
250	1	0	0	1
225	0	1	0	1
200	8	0	1	9
160	0	1	0	1
150	8	0	0	8
110	0	5	0	5
100	17	0	0	17
total	**34(79%)**	**8(19%)**	**1(2%)**	**43**

Table II-3.3 Number of Leak Repairs by Pipe Type and Cause (As of November 2011)

Type	Causes					
	Burst	Corrosion of bolts and nuts	Vertical crack	Lengthwise crack	Others	Total
AC	29	0	4	0	1	34
HDPE	2	5	0	0	1	8
MS	0	0	0	1	0	1
total	**31(72%)**	**5(12%)**	**4(9%)**	**1(2%)**	**2(5%)**	**43(100%)**

In principle, service pipes shall be replaced together with distribution pipes when distribution pipes are replaced.

< Reference Comments from the Team Expert >

AC pipe is estimated at 385 km in total length. Among this length of 385 km, diameters of 75A to 250A is 336 km, while 300A to 450A is 49 km, respectively. Annual replacement length is designed at 10 km/year, but it will take about 40 years for overall activity.

In case of the replacement of AC pipes, a series of works such as removal, conveyance and disposal of AC pipes should be done properly, because there is a fear of incidence of health trouble such as lung cancer, etc. by absorbing the asbestos dust (Health trouble by drinking potable water passing through AC pipes is not admitted according to "WHO Drinking Water Guidelines 2004".).

(3) Human Development

The Project aims at NRW reduction, however, the wide human development for the staff is also necessary including not only the technical aspect but also managerial aspect of water services regarding the subjects on what kind of measures are required for NRW reduction and what kind of policies are required for that purpose

3.3 Implementation Plan

(1) Schedule on Working Stages

Following action plans in each working stage are proposed on condition that project period of 5 years.

< Stage-I: the 1st year >

- Preparation of the entire action plans,
- Preparation of the works (office, warehouse, etc.),
- Establishment of the special purpose company (hereinafter called as "SPC") and the project management unit (hereinafter called as "PMU") at PAIP,
- Preparation of distribution pipeline drawings,
- Designing of enlarged DMA at 5 sites,
- Establishment of pilot DMAs at 4 sites,
- Commencement of activities for NRW reduction, and
- Practice of staff training

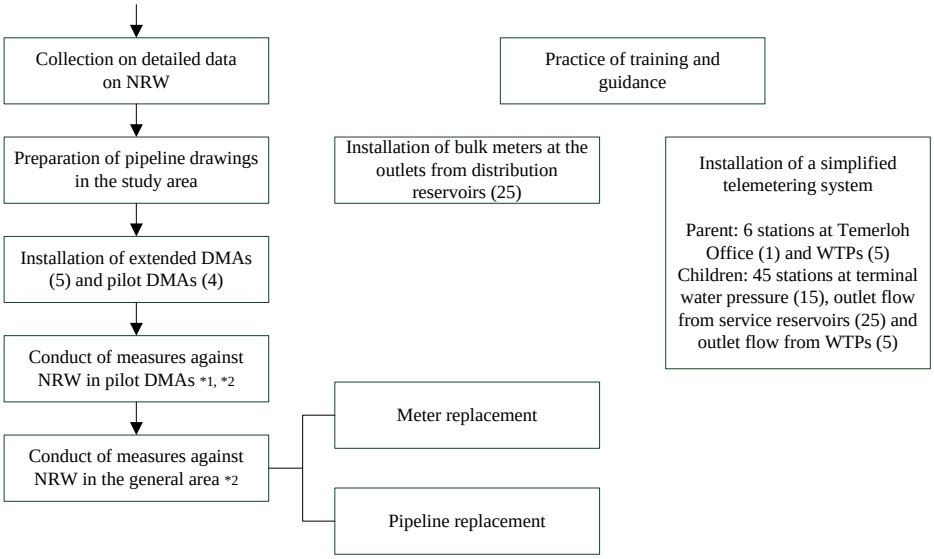
< Stage-II: the 2nd to 5th years >

- Preparation of distribution pipeline drawings in the expanding areas for NRW reduction measures,
- Installation of a simplified telemetering system,
- Continuation of activities for NRW reduction, and
- Continuation of training

Contents of activities for NRW reduction would be composed of;

- Leak detection and repair,
- Finding and remedying illegal connections,
- Replacement of distribution and service pipes in much leakage areas,
- Replacement of meters,
- Control of water supply pressure,
- Correction of meter error by replacement,
- Reduction of meter error and educational training for reduction of data handling errors, and institutional renovation

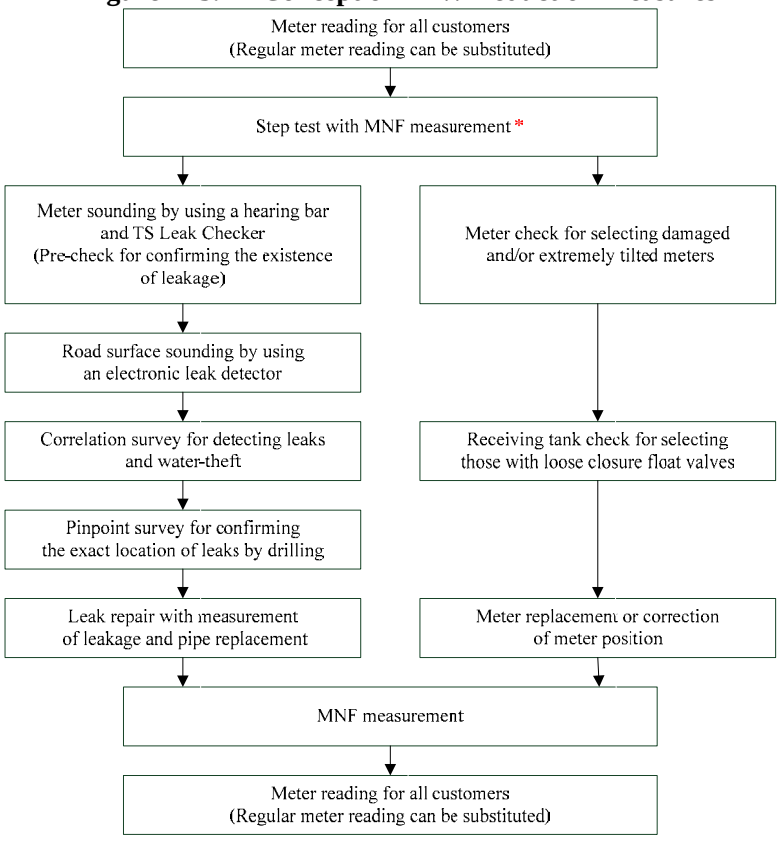
The concept of the entire works and measures for NRW reduction in the pilot area and general area are shown in **Figure II-3.1 to Figure II-3.3**.



*1: Conduct a certain level of pipe and meter replacement
*2: Including leak repairs

Source: Prepared by the Study Team

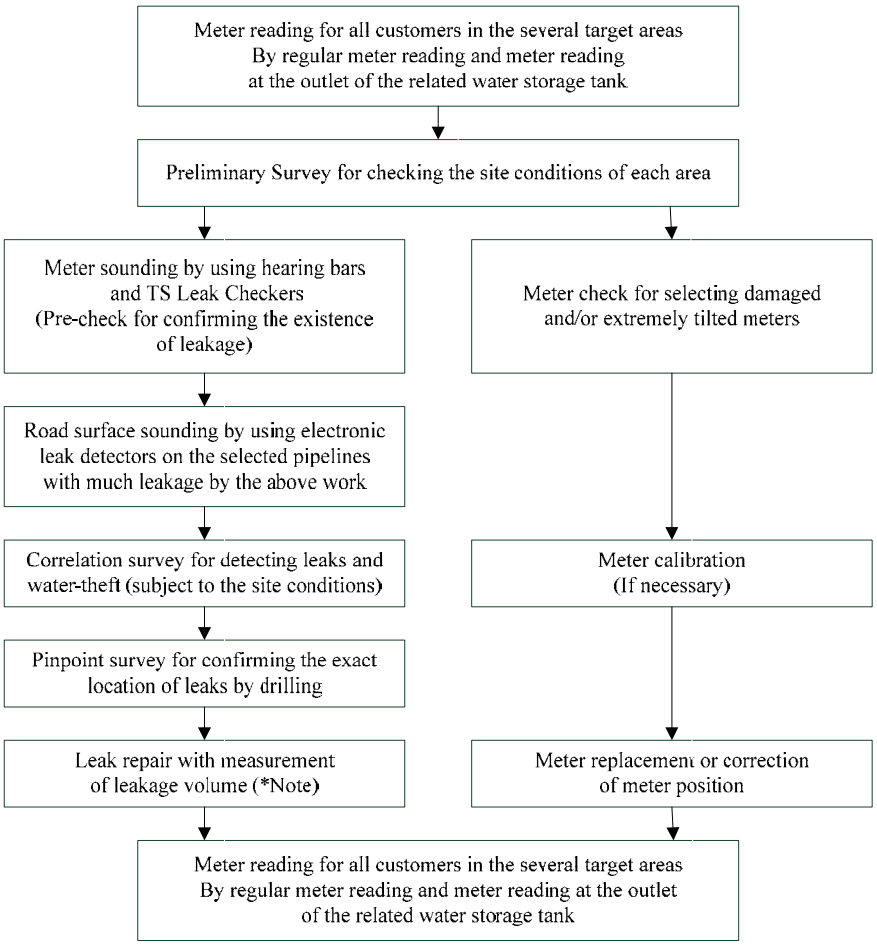
Figure II-3.1 Concept of NRW Reduction Measures



Note: * Two times

Source: Prepared by the Study Team

Figure II-3.2 NRW Reduction Procedures in Pilot DMAs



Note: Pipe replacement work is carried out separately from this work.

Source: Prepared by the Study Team

Figure II-3.3 NRW Reduction Procedures in General Areas

(2) Form of Contract and Project Organization

Although it is assumed that the NRW reduction work shall be undertaken under the performance–based contract by the Special Purpose Company (SPC) to be established by Sumitomo and MMC as the core, the concrete implementation form shall be fixed taking into account the business scale expected. However, the object of performance shall be limited to of NRW reduction rate only but not include other indicators such as the number of leak detection and repair, etc. On the other hand, the Project Management Unit (PMU) shall be established within the PAIP to accept such contract.

The SPC will address to the NRW reduction works in Temerloh District for the time being. When the business will be placed in orbit, the SPC will extend the business horizontally bringing other areas than Temerloh in view and then vertically to not only the NRW reduction work but also the overall operation and maintenance work of water services, furthermore, to the entire management of water services. Anyhow, the SPC will start the business as a trigger for NRW reduction work in Temerloh and aim to expand the business area to the entire Pahang State and then to other states than Pahang in turn in the future.

(3) Project Design Matrix

The target for NRW reduction shall be 30% for the first five years (the substantial working period is over four years). Assuming that the NRW reduction rate is 62% at the commencement of work, the targets by component of the NRW reduction rate are shown below.

- Reduction of Leakage including Replacement of Pipes: 20 % (40%)
- Minimization of Metering In-accuracy: 8 % (16%)
- Correction of Illegal Connections: 2 % (3%)
- Unbilled measured water 0 % (3%)

Total NRW reduction rate 30 %

Note:
Figures in parentheses shows the estimated component percentages to the present water distribution amount.

The long-term NRW reduction is set at 20% ten years after the commencement of measures. After that, since the environment surrounding the business will be expectedly changed largely, the working contents for NRW reduction shall be reviewed and the targets for the NRW rate shall be reset corresponding to the social environment and improvement status of financial conditions at that time.

Based on the tentative targets, project design matrix will be prepared for common understanding and management between PAIP and SPC.

(4) Project Monitoring by PIs

Relating to the project activities proposed above, following PIs in **Table II-3.4** would be estimated periodically as an activity for project monitoring. Baseline values shall be the previous year statistics in principle but will be settled through the detailed survey in the first year.

When assuming the commencement of the business from 2013, project indicators are as shown in **Table II-3.4**.

Table II-3.4 Progress Management of NRW Reduction Project using PIs

Monitoring PIs	2012	2017
Proportion of Meter with less than 7 years	60 %	100 %
Proportion of Pipe with younger than 2002	(7) %	20 %
NRW Rate	(60) %	30 %

Source Prepared by the Study Team

Note: The PIs values other than the NRW rate are affected by the policy of PAIP (investment amount in material and equipment and managerial endeavor) and are not directly concerned with the Project but are shown for reference.

(5) Expanding the Project Scale, and Deepening the Involvement in the Project

- KeTTHA, aiming to develop the water infrastructure and provide the services at the same level as the advanced countries, is considering to build a close relationship with Tokyo having world-leading expertise and to continuously implement the development of human resources and capability through trainings (both OJT and off-the-job training).
- Although the staff of PAIP has participated in this team, it is rather realistic and effective to promote the development of human resources and capability as a part of the concrete Project by establishing the organization responsible for NRW reduction project within PAIP, which makes the technology transfer possible. If the involvement of the Japanese-side is not only for NRW reduction project but also for overall operation and maintenance or the entire water management, the technology transfer and development of human resources will become even more feasible.
- If the Japanese-side is involved in the entire water management, transfer of various ‘know-how’ should become even more feasible, besides the transfer of literal technological aspects. In Tokyo, the latest information on water management, facility tour, exhibitions, exchange of opinions with the consumers, awareness building activities for consumers, enhancement of customer service centers, or improvement of customer satisfaction through water quality management, etc. are announced through the media. The understanding of consumers have improved through

these activities, which as a result, charge revisions which were implemented in the past have been accepted, thus securing adequate water rate and maintaining a financially sound water management. The most significant issue concerning the water sector in Malaysia is the inadequacy of revenue which has direct link with low water rate. In order to resolve this issue, a deeper involvement of the Japanese-side in the entire water management through a joint project is the most effective way. This can be achieved by steadily transferring what Tokyo has implemented in the past to the daily water management operations in Malaysia.

Reference:

As the countermeasure for reducing non-revenue water, bids are implemented locally in each state of Malaysia. In January 12, 2012, bids were also announced for Kuantan and Pekan of Pahang State. The contents of these bids is the good case study to propose the NRW reduction project. Outline of the bid are as follows:

1) Conditions for the Bidding Qualifications

- Experience in NRW reduction project/s in Malaysia. The total contract amount shall be RM 10 million or more.
- Experience in GIS or hydraulic pressure model, as well as knowledge in NRW
- Qualified in all related fields such as NRW, GIS, hydraulic pressure model, software, SCADA, etc.

2) Overview of the City Water of Kuantan

- Total length of water pipes (approx.): 2,200 km
- Number of households connected to city water: 117,000 households (110 DMAs & 45 Pressure Management Area (PMA))
- Water supply volume: 140.86 million cu. m/ year
- Consumption volume of billed water: 71.60 million cu. m/ year
- Rate of NRW at present: 54.12% (baseline to be discussed separately)

3) Scope of Work of Contractor

- The NRW rate shall be reduced by 15% from the agreed baseline, or 25% from the current rate; either of the higher rate shall be achieved. However, replacing the main pipes is not included in the scope of work. The period for achieving the target is 3 years and the target shall be 35% by reducing 15% from the agreed baseline at 50%, or, if the baseline is at 35%, then the target shall be 25%.
- GIS, hydraulic pressure model, setup of DMA/PMA, replacing water meters, inspection on water leakage, water leakage repair, and remote measurement / SCADA /
- NRW IT management system.

4) Guarantee and Bonus

- Deduction of 5% from the Performance Bond when the target is not achieved.
- Bonus is awarded when 20% or more reduction is achieved.

3.4 Feasibility

(1) Cost Estimate

The scope of the activities is classified as follows:

- Installation of extended DMAs and pilot DMAs and bulk meters at the outlets from distribution reservoirs.
- Grasp of basic data based on the NRW survey at pilot DMAs
- Survey of leaks, thefts and meter errors in the general areas
- Repair of leaks
- Meter replacement
- Replacement of service and distribution pipes
- Installation of simplified telemetering units
- Human development

The project cost is estimated in accordance with the breakdowns as listed in **Table II-3.5**.

Table II-3.5 Breakdown of Project Cost

Item	Breakdowns
Operation cost	Labor costs (personnel cost, overseas travel cost, per diem and accommodation cost, etc.), material and equipment procurement costs (leak detection survey tools, vehicles, etc.) administration costs (rental cost of SPC office, store house for materials and equipment, operation and maintenance cost, etc.), technical administration cost (NRW survey and engineering fee for training, etc.) and other expenditures (transportation cost, overheads, etc.)
Outsourcing Cost	Installation cost of DMAs (installation of extended and pilot DMAs and bulk meters at the outlets of distribution reservoirs), leak repair cost (repair of leaks from water supply and distribution pipes), pipeline replacement cost (replacement of old water supply and distribution pipes), meter replacement cost (replacement of meters out of order or old), installation cost of simplified telemetering systems (installation of parent stations, mobile units and water pressure meters)
Contingencies	Provisional expenditures for unexpected leak repair works, occurrence of additional works and variation of prices and exchange rates

What should be considered in the expenditures is how to handle the pipeline replacement cost, customers' meter replacement cost and leak repait cost. These costs are the necessary expenditures in future for sound water service operation by PIPE Pahang regardless whether the measures for NRW reduction will be taken or not. Therefore, in this report, the comparative study was done for both cases including and excluding the cost required for them in the benefit- to-cost analysis.

The Project cost is estimated at RM 33,800,000 for the case excluding the costs for pipeline replacement, etc. and RM 112,100,000 for the case including the above to implement the Project as shown in **Table II-3.6**.

Table II-3.6 Project Cost for Five Years

Item			Currency		
Category	Item	Sub-item	RM	JPY	USD
(1) SPC operation	Labour	Personnel	10,146,000		
		Personnel administration	1,015,000		
		Head office overhead	3,043,000		
		Travelling	1,027,000		
		Per diem & accomadation	3,819,000		
	Procurement of materials & eqipment	Local procurement of materials & equipment	538,000		
		Carrying equipment	767,000		
	Office expenditures	Rental	420,000		
		Office supply	93,000		
		Office maintenance	89,000		
	Conveyance & Transportation of equipment		42,000		
	Engineering cost		3,040,000		
	Overhead		6,219,000		
	Total (I)		**30,258,000**	**786,700,000**	**9,834,000**
(II) Outsourcing	DMA installation **(A)**		1,080,000		
	Simlified telemetering system installation **(B)**		2,438,000		
	Leak repair (15,200 locations)		5,970,000		
	Pipeline replacement (200 km,including water service pipes)		52,715,000		
	Meter replacement (39,000 units)		7,119,000		
	Total (II)		**69,322,000**	**1,802,400,000**	**22,529,000**
(III) Contingency	Physical contingency		2,080,000		
	Price and exchange rate valuation		10,398,000		
	Total (III)		**12,478,000**	**324,400,000**	**4,055,000**
Total (I)+(A)+(B)			**33,776,000**	**878,200,000**	**10,977,000**
Total (I)+(II)+(III)			**112,058,000**	**2,913,500,000**	**36,419,000**

(2) Effectiveness

The Project effect of NRW reduction measures can be calculated with the following Project benefits as shown in **Table II-3.7**.

Table II-3.7 Effectiveness Items of the NRW Reduction Project

Outputs (Benefits)	Protective effects
Increase of revenue water	Protection of illegal connections and improvement of meter error *[1]
Reduction of OPEX	Reduction of Leakage*[2]
Reduction of water source development containment	
Reduction of water supply facility construction containment	
Reduction of secondary damage	

Source: Prepared by the Study Team

Note*[1]: It is noted that, tariff income shall not be increased by reduction of leakage. Generally, OPEX can be saved by the said leakage reduction. In this case, benefit is estimated as "(unit water supply cost) × (leakage deducted)", where, unit water supply cost = operating cost ÷ water production volume.
Meanwhile, correction of illegal connections and improvement of metering inaccuracy can increase revenue. In this case, benefit is estimated as "(unit sales price) × (leakage deducted)", where, unit sales price = tariff income ÷ water sales volume.

Note*[2]: In this study, 4 benefits of the latter items above should not be considered. The reasons are: as for the first 3 items, the present capacity of water sources and WTPs in Temerloh District is considered to be enough for the time being, and as for the last item, exact economic benefit cannot be calculated due to a lot of

hypothetical and complicated factors.

Also, when considering the benefit of the NRW reduction project, duration of the NRW reduction effect is considered. Then, the final befits are calculated as below:

< I: Benefit by Replacement of Distribution/ Service Pipes >

Since a service life of non-metal pipes is estimated as 25 years, its continuation effect is conservatively assumed at 20 years.

- Unit water supply cost (RM/m^3) × Unit leakage reduced (m^3/km) × Pipe length replaced (km/year) × Duration period of leak protection effect (20 years) = RM 19,800,000 (5 years)

< II: Benefit by Correction of Illegal Connection and Metering In-accuracy >

The period required by the next finding and correction, if being left, is assumed as 5 years, taking into account the fact that meter trouble and meter error is left in Temerloh.

- Unit sales price (RM/m^3) × Unit leakage reduced (m^3/spot) × Number of correction (spots/year) × Duration (5 years) = RM 34,000,000 (5 years)

< III: Benefit by Leakage Control Work >

As for the detection/repair of underground leaks, the effective period from underground leakage changing to surface leakage is assumed as 3 years, which is also corresponding to the general leakage survey action cycle. As for the repair of surface leaks, the effective period is assumed as half year on average. Therefore;

- {Unit water supply cost (RM/m^3) × Unit underground leakage reduced (m^3/spot) × Number of leaks repaired (spots/year) × Duration (3 years)} + {Unit water supply cost (RM/m^3) × Unit surface leakage reduced (m^3/spot) × Number of leaks repaired (spots/year) × Duration (0.5 year)} = RM 19,300,000 (5 years)

< IV: Benefit by Duration Time for New Water Treatment and Distribution Facility Construction Containment >

The benefit is calculated assuming that the construction, operation and maintenance of the new water treatment plant, etc. will be not required by the NRW reduction. When the service life of a water treatment plant, etc. is 50 years, the duration time for plant construction containment is conservatively estimated at 30 years.

- Unit cost of water distribution (RM/m3) x Annual amount of water distribution equivalent to shortage amount from a new water treatment plant (RM/m3) x Operation period (m3/year)] + Construction cost of a new water treatment plant = RM 16,400,000 (5 years)

Note:

- When defining that distribution unit cost = annual expenses / annual distribution volume, and sales unit price = annual revenue / annual billed volume, the former is 0.455 RM/m3 while the latter is 0.86 RM/m3, respectively, according to PAIP 2010 statistics.
- Although the above unit improvement effect is calculated based on the actual performance on site for a long period, they are estimated based on the annual NRW reduction volume obtained through long TSS's experience, since there is no actual value at this moment in PAIP.
- For the construction and operation and maintenance cost of the new water treatment plant, they are estimated based on the refurbishment and operation and maintenance cost at Mentakab Water Treatment Plant which is currently out of service. Assuming that the NRW rate is maintained as it is without any improvement, the water demand and supply will be tight a few years

later and the water shortage of 6,600 m^3/day will occur 10 years later. In terms of benefit calculation, a daily average water distribution of 3,300 $m^{3/}$day for the initial five years is assumed for convenience.

Table II-3.8 Calculation Sheet for NRW Reduction Effect (Benefit)

(Unit: '1000m3/yr)

Year	Distribution	Billed amount	NRW (%)	NRW	Leak	Pipe repl. length protected	Impact amout by the left	underground leak	Underground leak protected	Impact amount by the left	No. of repairs for underground dist.pipe (cases)	No. of repairs for underground service pipe (cases)	Surface leak protected	Impact amout by the left
2011	44,160	15,867	64	28,293	18,391	Negligible		16,551	Negligible					
2012	44,515	16,026	64	28,490	18,518	Negligible		16,667	Negligible					
2013	42,594	16,186	62	26,408	17,246	690		15,521	1,479		214	818	1,725	
2014	38,018	16,348	57	21,670	14,584	583		13,126	2,706		331	1,266	1,458	
2015	31,752	16,511	48	15,241	10,646	426		9,582	3,806		186	711	1,065	
2016	26,057	16,676	36	9,380	6,691	268		6,022	3,751		82	313	669	
2017	24,061	16,843	30	7,218	5,165	207		4,649	1,494		25	98	517	
5-yrs total						2,173	43,466		13,236	39,708	837	3,206	5,433	2,717
2018	23,303	17,011	27	6,292	4,341	174		3,907	3,907		30	115	434	
2019	22,909	17,182	25	5,727	3,838	154		3,454	3,454		30	116	384	
2020	22,537	17,353	23	5,183	3,354	134		3,019	3,019		40	151	335	
2021	22,327	17,527	22	4,800	3,013	121		2,712	2,712		27	104	301	
2022	22,128	17,702	20	4,426	2,680	107		2,412	2,412		32	123	268	
5-yrs total						689	13,781		15,503	46,510	159	609	1,723	861
10-yrs total											996	3,815		

Year	No. of repairs for surface leak on dist. Pipes (cases)	No. of repairs for surface leak on service pipes (cases)	Theft protected	Impact amout by the left	Meter error protected	Impact amout by the left	Operating exp. Reduction profit (RM)	Profit by tariff revenue increase (RM)	5-yrs total profit	New WTP construction protected	Profit by new WTP construction protected	Profit by new WTP construction protected	5-yrs profit (RM)	5-yrs profit (RM)
2011							(0.455RM/m3)	(0.86RM/m3)			(0.455RM/m3)	(Estimated from Temerloh data)		
2012							(Dist. Unit cost)	(Sales unit price)			(Dist. Unit cost)			
2013	641	2,455	175		624									
2014	542	2,076	237		1,840									
2015	396	1,516	598		1,893									
2016	249	953	335		1,570									
2017	192	735	22		614									
5-yrs total	2,019	7,734	1,366	6,832	6,542	32,710	39,080,258	34,006,639	73,086,898	12,045,000	5,480,475	11,000,000	16,480,475	89,567,373
2018	161	618	9		93									
2019	143	546	6		56									
2020	125	477	5		54									
2021	112	429	4		38									
2022	100	381	4		37									
5-yrs total	640	2,452	28	140	279	1,396	27,824,391	132,033	29,145,424	24,090,000	10,960,950	0	10,960,950	40,106,374
10-yrs total	2,660	10,187						10-yrs total	102,232,321			10-yrs total profit	27,441,425	129,673,746

(10-yrs total profit)

Based on the above study, the benefit that PAIP Temerloh will receive from the Project implementation is shown in **Table II-3.9** From the table, the profit by the Project implementation is estimated at RM 89,500,000 in total for five years. As a result, the net balance by deducting the project cost from the benefit by the Project implementation is RM 21,829,000 for five years in case that the pipeline replacement cost, etc. are excluded, while RM 54,003,000 in deficit in case that the pipeline replacement cost, etc. are included.

Table II-3.9 Income and Expenditure by Project Implementation (Five Years)

Difference between Project Cost & Expenditure	Cost			Remarks
	RM	JY('1,000)	USD	
(A) Benefit by Project Effect				
(1) Pipe Replacement	19,800,000			Service pipes and distribution pipes 200 km
(2) Correction of Theft & Meter Error	34,000,000			Meter 39,000 units
(3) Leak Repair	19,300,000			15,200 points
(4) Construction Containment of New Water Treatment Plant	16,500,000			Cap.: 6,600 m^3/day
Subtotal (1)+(2)+(3)+(4)	89,600,000	2,330,000	29120,500	
(B) Project Cost 1: Excluding all the costs	33,511,000	871,300	10,891,000	Refer to **Table II-3.1**
(C) Project Cost 2 : Including all the costs	111,793,000	2,906,600	36,333,000	

Balance: (A) - (B)	55,089,000	1,458,700	18,229,500	
Balance: (A) - (C)	-22,193,000	-576,600	-7,212,500	

(3) Consideration of the calculation result on the benefit-to-cost

It is undoubtedly possible to reduce the present NRW rate of 60% at PAIP Temerloh to 30% five years later, if the technology of TSS will be adopted.

In addition, in the five-year benefit-to-cost calculation, it is confirmed that the benefit exceeds the cost by RM 21,829,000 in case that the pipe replacement cost, etc are excluded. However, in case of the inclusion of all the costs, it is regrettably identified that there will be RM 54,003,000 in deficit as expected from the beginning.

The biggest cause is attributed to the water tariff that has been controlled abnormally low (approximately 0.9 RM/m^3 in PAIP compared with 8.1 RM/m^3 (210 JY/m^3) in Tokyo). Of course, if the minimum-required subsidy is appropriated by the Goverment to operate the water service soundly, it cannot be denied due to one of policies of the Government. However, it is clear that the investment in necessary facilities has not been adequate due to less subsidiary amount in fact and the regular replacement of high percentage of old pipes and old meters has been neglected which is evidenced by the high NRW rate above all.. If the NRW rate will be left, it will result in not only the further deterioration of the NRW rate but also the unsound water service management due to a decrease of revenue and an increase of expenditures and in turn the lowering of customer service.

As a conclusion, since the benefit will largely exceed the cost in the proposed NRW reduction project, though the pipe replacement cost, etc are excluded, it is better to implement the proposed NRW reduction project as early as possible and increase the water tariff step by step, putting an effort on the improvement of customer services in parallel from the mid- and long-term viewpoint.

For example, even though the present water tariff will be increased by 2.1 times based on the self-accounting principle, it will be still low from the general level in the world, but the marginal advantage can be easily collectable through the implementation of the NRW reduction project, even in case of the inclusion of all the costs. In addition, it is the best plan to procure the initially-required fund with the most reasonable way including the JICA loan with a low interest or the finance from the other public fund and so on.

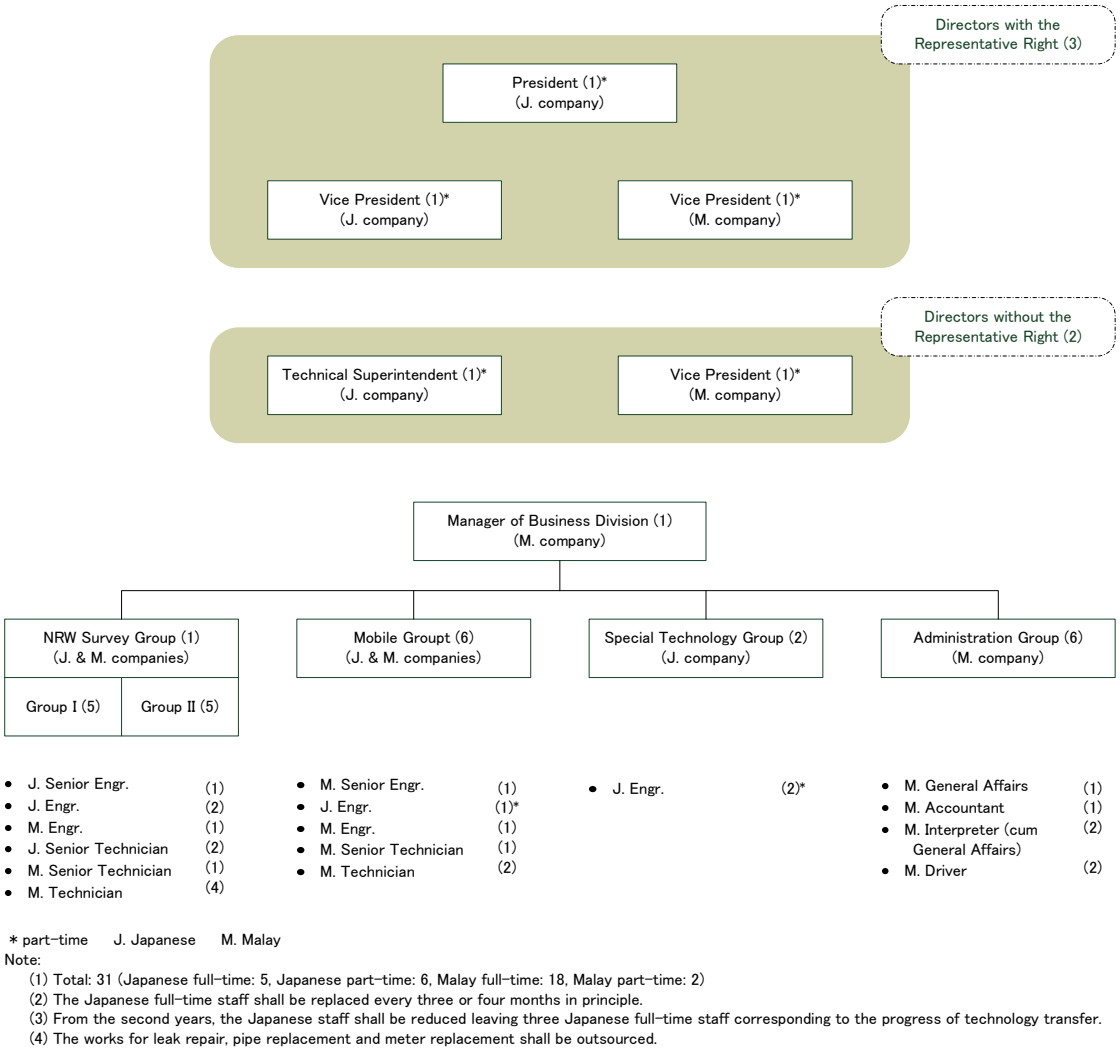
Through the early commencement of the proposed MNRW reduction project and the stepwise increase of water tariff, the declaration of the Malaysian Govenment to join the advanced industrial countries by the year of 2020 can be surely achieved in the water sector.

(4) Establishment of SPC

In this report, it is assumed that the Special Purpose Company (SPC) focusing on the NRW reduction project in Temerloh water supply as the immediate target will be established with an investment of both the Japanese and Malaysian companies and implement the Project. At this moment, due to the speciality of NRW measures, the plural companies specialized in the particular field will presumably join the SPC from both Japan and Malaysia.

The capital of the SPC is assumed at approximately 30 % of the first year contract amount or RM 4,000,000 but the details is the issue to be studied in future including the contribution pro rata, etc.

Figure II-3.4 shows the concept of the SPC organization which is the basis for the estimation of the above Project cost.



Source: Prepared by the Study Team

Figure II-3.4 Conceptual Organization of SPC

(5) Project Plan

The overall plan of the Project is assumed at ten years, but the initial five-year business plan is shown in **Table II-3.8**.

(6) Features of the Proposed Project

To conduct the thorough NRW survey, the DMAs are installed in the entire area or substantially most areas in general. But this method results in not only a huge amount of the DMA installation cost but also the manpower requirement for the Night Minimum Flow (MNF) measurement to be conducted in the DMAs, which are inefficient. To avoid such situation, the installation of DMAs are limited to only four locations, and through the conduct of the thorough NRW fact-finding survey, various kinds of data will be collected and based on the data therefrom, the routes with much leaks is selected using the time-integral type leak detectors developed by TSS to reduce the leakage survey cost and make an efficiency better.

TSS has not only an experience and technology that the NRW rate of 80% during the disorder time after the World War II has been reduced to 4% in Tokyo, but also a performance that at the pilot area with the total distribution pipe length of 10 km in one big city in Southeast Asia where the working conditions are very bad, the NRW rate of 28% was reduced by 4% with four staff only for three

weeks. There is presumably no contractor for NRW reduction except for TSS who can achieve such very low NRW rate during a short-term and has a high capacity to calculate the fine benefit-to-cost mentioned-above, based on the knowledge and experience

3.5 Environmental and Social Considerations

The main scopes of project are;

- To establish DMAs,
- To replace service installations and distribution pipes, and
- To work leakage control.

To examine the advantages and dis-advantages for each work, necessity of (i) land alternation and (ii) existence of protected areas were compared. Beside, (iii) other conceivable major environmental and social impacts were identified quantitatively. **Table II-3.10** shows the comparison of major conceivable environmental and social impacts for each work.

Table II-3.10 Comparison of Major Conceivable Environmental and Social Impacts

Alternatives	Establishment of DMAs	Pipe Replacement	Leakage Control
Land Alternation	No settlement is required.	No settlement is required.	No settlement is required.
	Negative	Negative	Negative
Protected Area	None.	None.	None.
	Negative	Negative	Negative
Major Impacts	Construction environment will be affected within limited site and period.	Construction environment will be affected along the pipeline and limited period.	None.
	Positive	Positive	Negative

Source: Prepared by the Study Team

In order to assess likely significant environmental and social impacts, the conceivable adverse environmental and social impacts by the proposed works were preliminary identified. The impacts of social environment, natural environment and pollution/ contamination were classified as following rating in accordance with JICA Guidelines for Environmental and Social Considerations (2004).

A: Significant impact is expected,
B: Some impact is expected to some extent,
C: Extent of impact is unknown (a further examination is needed), and
D: No impact is expected (IEE/ EIA is not necessary).

The conceivable environmental and social impacts by the proposed “establishment of DMAs” and “pipe replacement” were preliminary examined taking into account laws and regulations, collected information and the present status of the area where the proposed works in the water supply project will be carried out.

The preliminary scoping matrix for the said works was presented in **Table II-3.11**.

In this regard, the project is to be judged as “Category B” in accordance with “JICA Guidelines for Environmental and Social Considerations” since the impact of the project is considered to be less compared to the case of “Category A.”

Table II-3.11 Conceivable Adverse Environmental and Social Impacts

Item			Rating and Reasons	
Social Impacts	1	Involuntary Resettlement	D	The proposed works will be constructed in public roads.
	2	Local Economy of Employment and Livelihood	D	The project will not affect the living conditions and livelihood of residents with local economical conditions.
	3	Land use and Utilization of Local Resources	D	The project will not affect land use, utilization of water resources and the local economy.
	4	Social Institutions such as Regional Severance	D	In the project area there are no ethnic minorities or indigenous peoples
	5	Existing Social Infrastructures and Social Service	D	Traffic congestion is not supposed as number of vehicles and working areas will be small.
	6	Poor, Indigenous and Ethnic Groups	D	There are no poor, indigenous and ethnic groups in the project area.
	7	Misdistribution of Benefit and Damage	D	Bias distribution of damage and benefit is not supposed.
	8	Cultural Heritage	D	There is no cultural heritage in the project area.
	9	Local Conflict of Interest	D	Land use is not supposed.
	10	Water Use	D	The project should reduce the quantity of water.
	11	Sanitation	D	This project will not cause negative impact.
	12	Infectious Diseases of HIV/ AIDS	D	Infectious diseases will not be generated by the construction works.
	13	Accidents	B	It is necessary to make an arrangement for dealing with construction accidents and handling accidents of construction machines and vehicles.
Natural Environment	14	Topography/ Geology	D	Impacts to topography and geology will not be supposed.
	15	Soil Erosion	D	This project will not cause soil erosion.
	16	Groundwater	D	There is no groundwater extraction in this project.
	17	Hydrological Situation	D	There are no connections from the proposed project to watercourses.
	18	Costal Zone	D	The project site is located at inland.
	19	Flora, Fauna and Biodiversity	D	Construction site is limited on existing road.
	20	Meteorology	D	Small scale construction will not affect on climate.
	21	Landscape	D	There will not be any impacts on the landscape.
	22	Global Warming	B	Greenhouse gas will be discharged during the construction period.
Pollution/ Contamination	23	Air Pollution	B	Degradation of air quality is supposed on a temporary basis by operation of construction machines and vehicles.
	24	Water Pollution	B	Water pollution may be caused by discharged water derived from the construction sites, construction machines and vehicles and worker's camp.
	25	Soil Contamination	B	Soil pollution which may be caused by oil spills from construction machinery is supposed.
	26	Waste	B	Construction waste soils and scrap woods will be produced.
	27	Noise and Vibration	B	Noise and vibration caused by construction works, operation of construction machines and vehicles are supposed.
	28	Land Subsidence	D	Construction works which may cause land subsidence are not supposed.
	29	Offensive Odor	D	Construction works which may cause bad odor are not supposed.
	30	Bottom Sediment	D	Construction works which may give adverse impact is not supposed.

Source: Prepared by the Study Team

The followings are legislation related to the project.

- EIA Procedures and Requirements in Malaysia 1974, Department of Environment (hereinafter called as "DoE"), Ministry of Natural Resources and Environment
- EIA Guidelines for Groundwater and/ or Surface Water Supply: Environmental Quality Acts 1974/ 1985/ 1996/ 1998/ 2001/ 2007, DoE, Ministry of Natural Resources and Environment
- Environmental Quality Acts A-127 1978, with its Amendment Act A-1315 2000, DoE, Ministry of Natural Resources and Environment
- Environmental Quality Regulation, PU A-280 1978 and PU A-309 2000, DoE, Ministry of Nat-

ural Resources and Environment

EIA process was formally established by virtue of the Federal Government (DoE, Ministry of Natural Resources and Environment). In the sector of water supply, the EIA report shall be required for the new development of water source and the new construction of water treatment plant since there will be impacts to the surrounding environments. Although this project may not be required to prepare an EIA report since the project involves a replacement works of existing pipes.

The factors of environmental and social impacts accompanied by replacement of service and distribution pipes are considered as below.

- Air pollution: dust, emission gas, etc.
- Wastes: excess soil, debris, etc.
- Noise and vibration
- Traffic near construction sites

In construction stage of the project, the typical impacts mentioned above may occur, although they are temporal. The PMU and the SPC are required to take countermeasures in order to minimize the impacts through proper management of the project.

Monitoring shall be carried out in cooperation with the PMU and the SPC. **Table II-3.12** shows a provisional monitoring plan to be conceivable at this moment and its finalization will be required by the PMU in cooperation with the SPC. Construction environment shall be embodied in "Implementation Plan" to be prepared by the SPC and "Management Plan" to be prepared by the PMU.

Table II-3.12 Provisional Monitoring Plan

<table>
<tr><th colspan="2">Identification</th><th colspan="4">Measurement (SPC)</th><th colspan="2">Monitoring Frequency (PMU)</th></tr>
<tr><th>Category</th><th>Item</th><th>Status</th><th>Application</th><th>Method</th><th>Place</th><th>Weekly</th><th>Monthly</th></tr>
<tr><td rowspan="2">Noise</td><td>Construction Machinery</td><td rowspan="10">To be recorded daily at every subject sites during the project period. Staffs from the PMU will supervise the activities.</td><td rowspan="5">Guidelines and Regulations including its amendments, under DoE, KeTTHA</td><td rowspan="4">Meter</td><td rowspan="5">Near the site where construction machinery is being used.</td><td rowspan="10">Daily records will be analyzed every week statistically by the PMU.</td><td rowspan="10">Monthly meeting will be held at JBA Pahang at Kuantan. Joint site visit will be done according to the meeting result.</td></tr>
<tr><td>Generator</td></tr>
<tr><td rowspan="2">Vibration</td><td>Construction Machinery</td></tr>
<tr><td>Generator</td></tr>
<tr><td>Air Pollution</td><td>Emission Gas</td></tr>
<tr><td></td><td>Dust</td><td>Visual and Smell</td></tr>
<tr><td rowspan="3">Wastes</td><td>Fragments</td><td rowspan="3">Local Authorities</td><td rowspan="3">Visual</td><td rowspan="2">The site where pipe laying works were completed.</td></tr>
<tr><td>Debris</td></tr>
<tr><td>Excess soil</td><td>The circumference site where pipe laying works are on-going.</td></tr>
<tr><td rowspan="2">Traffic</td><td>Signboard</td><td colspan="4"></td></tr>
<tr><td>Traffic Guard</td><td colspan="4"></td></tr>
</table>

Source: Prepared by the Study Team