NATIONAL DEVELOPMENT PLANNING AGENCY (BAPPENAS)
MINISTRY OF PUBLIC WORKS (PU)
BALI PROVINCIAL GOVERNMENT

THE PREPARATORY SURVEY ON APPLICATION OF WASTEWATER RECLAIMING IN SOUTHERN BALI WATER SUPPLY SYSTEM IN THE REPUBLIC OF INDONESIA

FINAL REPORT

VOLUME II

MAIN REPORT

JUNE 2012

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

TOYOTA TSUSHO CORPORATION
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THE PREPARATORY SURVEY ON APPLICATION OF WASTEWATER RECLAIMING IN SOUTHERN BALI WATER SUPPLY SYSTEM IN THE REPUBLIC OF INDONESIA

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ABBREVIATION

Abbreviation	Description
ACP	Asbestos Cement Pipe
APBD	Anggaran Pendapatan dan Belanja Daerah
APBN	Anggaran Pendapatan dan Belanja Negara
AMDAL	Analisis Mengenai Dampak Lingkungan
ANDAL	Analisis Dampak Lingkungan
BALH	Bali Environmental Board
BAPEDAL	Badan Pengendalian Dampak Lingkungan
BAPPEDA	Badan Perencanaan Pembangunan Daerah
BAPPENAS	Badan Perencanaan Pembangunan Nasional
BKPM	Badan Koordinasi Penanaman Model
BLU	Badan Layanan Umum
BLUPAL	Badan Layanan Umum Pengolahan Air Limbah
BOT	Build, Operate and Transfer
BPPSPAM	Badan Pendukung Pengembangan Sistem Penyediaan Air Minum
BPS	Badan Pusat Statistik
BTDC	Bali Tourism Development Corporation
BUMD	Badan Usaha Milik Daerah
BUMN	Badan Usaha Milik Negara
BUPI	Badan Usaha Penjaminan Infrastruktur
C/P	Counterpart
CPI	Comsumer Price Index
DCIP	Ductile Cast Iron Pipe
DGHS or Cipta Karya	Direktorat Jenderal Cipta Karya, Kementerian Pekerjaan Umum
Dinas PU	Dinas Pekerjaan Umum Provinsi Bali
DPRD	Dewan Perwakilan Rakyat Daerah
DSCR	Debt Service Coverage Ratio
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement, and Construction
F/S	Feasibility Study
GOI	Government of the Republic of Indonesia
GOJ	Government of Japan
GRP	Glassfiber Reinforced Plastic
HDPE	High-Density Polyethylene
IUCN	International Union for Conservation of Nature
IDC	Interest During Construction
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
KA-ANDAL	Kerangka Acuan - Analisis Dampak Lingkungan
KKPI	Komite Kebijakan Penyediaan Infrastruktur
M/P	Master Plan
MM	Minutes of Meeting
MDG	Millennium Development Goals
NPV	Net Present Value
O&M	Operation&Maintenance
P3CU	PPP Center Unit
PAC	Poly Aluminium Chloride

Abbreviation	Description
PDAM	Perusahaan Daerah Air Minum
PPP	Public Private Partnership
PT PII （IIGF）	PT. Penjamina Infrastruktur Indonesia (Indonesia Infrastructure Guarantee Fund)
PT SMI	PT SARANA MULTI INFRASTRUKTUR (PERSERO)
PT TB	PT. Tirta Artha Buana Mulia
PU	Kementerian Pekerjaan Umum
PVC	Polyvinyl Chloride
RENSTRA	Rencana Strategi
RKL	Rencana Pengelolaan Lingkungan
RPJMN	Rencana Pembangunan Jangka Menengah Nasional
RPJPN	Rencana Pembangunan Jangka Panjang Nasional
RPL	Rencana Pengelolaan Lingkungan
PreFS	Pre-Feasibility Study
SEA	Strategic Environmental Assessment
SOP	Standard Operating Procedures
SPAM	Sistem Penyediaan Air Minum
SPC	Special Purpose Company
UKL	Upaya Pengelolaan Lingkungan
TOR	Terms of Reference
UNEP	United Nations Environment Programme
UPL	Upaya Pemantauan Lingkungan
UPT	Unit Pelaksana Teknis
VAT	Value Added Tax
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background

Bali is one of the famous tourist spots in Asia. The regional economy relies on the tourism industry and wet rice agriculture. Denpasar City and Badung Regency located in southern Bali are developing as a center of tourism and commerce and their population is increasing rapidly. The growth in the economy and population is increasing the water demand.

However, infrastructure development lags behind the economic and population growth. Problems of water shortage and river water pollution hinder the sustainable economic development in Bali Province.

A study conducted by Japan International Cooperation Agency (referred as JICA), entitled "The Comprehensive Study on Water Resources Development and Management in Bali Province", hereinafter referred to as JICA Study 2006, reported the following conclusions on water supply and water demand:

- The available water resource potential in Denpasar City is zero. There are no new water sources that can be developed within the city and water shortage will occur in the city.
- There is available water resource potential in Badung Regency and Gianyar Regency. Although the water resources can be developed, this must be carried out with care.
- Denpasar and the surrounding areas composed of Denpasar City, Badung and Gianyar Regencies, form one economic zone. The region has limited water resources but has a high demand therefore additional water resources must be developed. A comprehensive water supply plan for the entire region should be prepared instead of developing individual water supply systems for each area.

The above conclusions imply that a large amount of time and money will be required to develop water resources in the Study Area, requiring the understanding of local administrative processes and possible issues that may arise with the people living in the region.

Large amounts of groundwater have been used for mitigating water shortages. Overuse of groundwater has led to dry wells and salt water intrusion in coastal areas. These adverse groundwater conditions are becoming more obvious recently. The Bali provincial government has raised the groundwater use tax to conserve groundwater as an important future water resource.

A sewerage development project has been carried out using Japanese ODA loan in Denpasar City and the surrounding area where population densities are the highest in the Province. The collected wastewater is treated at the Suwung Wastewater Treatment Plant (WWTP); the treated amount is about 10,000 m^3/day, or 115 L/s. The treated wastewater is discharged to the sea. The second phase of the sewerage development project expands the service area with an increase in house connections and extension of the trunk sewers. The third phase will expand the capacity of the WWTP to 51,000 m^3/day (590 L/s). Further treatment by advanced processes can reclaim the treated wastewater as an additonal resource to supplement the increasing water demand.

The effective use of treated wastewater from the Suwung WWTP (reclaimed water) has been studied by Indonesian governments, but a reclaimed water project has not yet been realized due to provincial and city financial constraints. Japanese companies composed of Toyota Tsusho Corporation, Nihon Suido Consultants Co. Ltd, and METAWATER Co. Ltd., proposed to JICA to study the possibility of structuring a reclaimed water use project in southern Bali area as a Public-Private Partnership (PPP) Project.

The present study mission conducted the preparatory survey under the JICA study scheme for PPP projects. The scope of work and survey conditions on the preparatory survey for the reclaimed water use project in Southern Bali was discussed and agreed between Indonesian Governments and the preparatory survey team of JICA, and summarized in the Minutes of Meeting (M/M). The M/M is exchanged by both

parties on December 1st, 2011. Based on the M/M, JICA prepared the TOR for the preparatory survey on the reclaimed water use project in Southern Bali and selected the survey team composed of staff from the Japanese companies, Toyota Tsusho Corporation, Nihon Suido Consultants Co. Ltd, and METAWATER Co. Ltd. The survey team has started the survey work based on the TOR prepared by JICA.

1.2 Objectives of the Survey

The objectives of the Preparatory Survey are to prepare a basic project plan for reclaimed water use in Southern Bali and to assess the appropriateness, effectiveness, and efficiency of the project, under the assumption of using Japanese ODA financing sources and the Indonesian PPP infrastructure assistance scheme.

1.3 Survey Area

The survey targets the Southern Bali area covering Denpasar City and Badung Regency, where a stable source of reclaimed water can be supplied by a water transmission pipeline or other reasonable transportation means, after further treatment at the reclamation facility in the Suwung WWTP in Denpasar.

Figure 1.3.1 Survey Area

1.4 Survey Outline and Schedule

This survey was conducted in stages as shown in Figure 1.4.1. The survey schedule is shown in Figure 1.4.2.

The basic approach and methods were discussed with JICA and described in the Inception Report in December 2010. The contents of Inception Report were explained to Indonesian Governments on January 2011 before starting the First Survey in Indonesia.

In the first field survey, the purpose and demand for reclaimed water use were established based on data and information collected in this survey. The project scope for reclaimed water supply in Southern Bali in Indonesia under the framework of PPP was formulated and confirmed in this survey. The results of the first field survey were put together in the Interim Report prepared during the First Study in Japan.

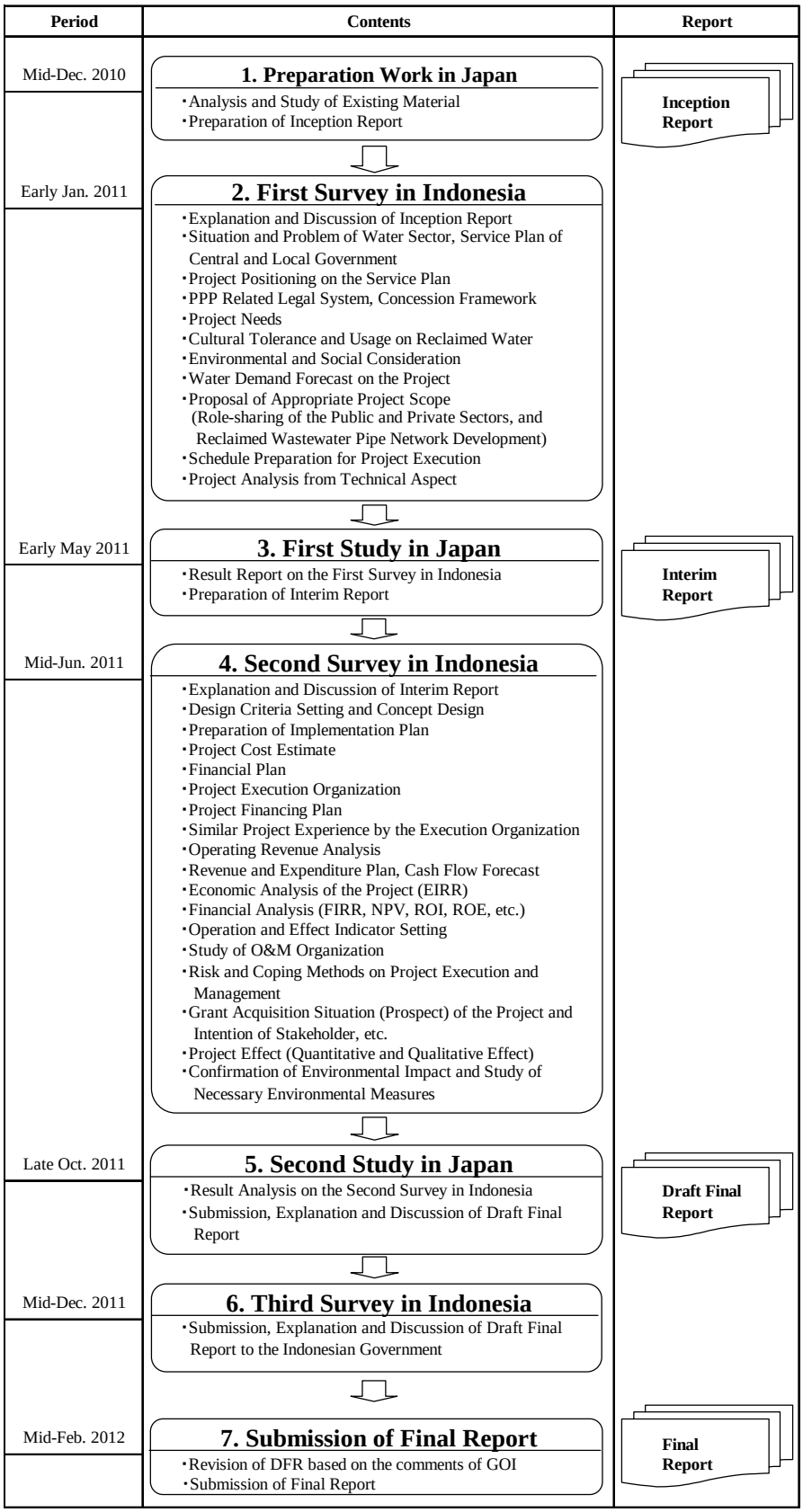


Figure 1.4.1 Survey Contents and Approach

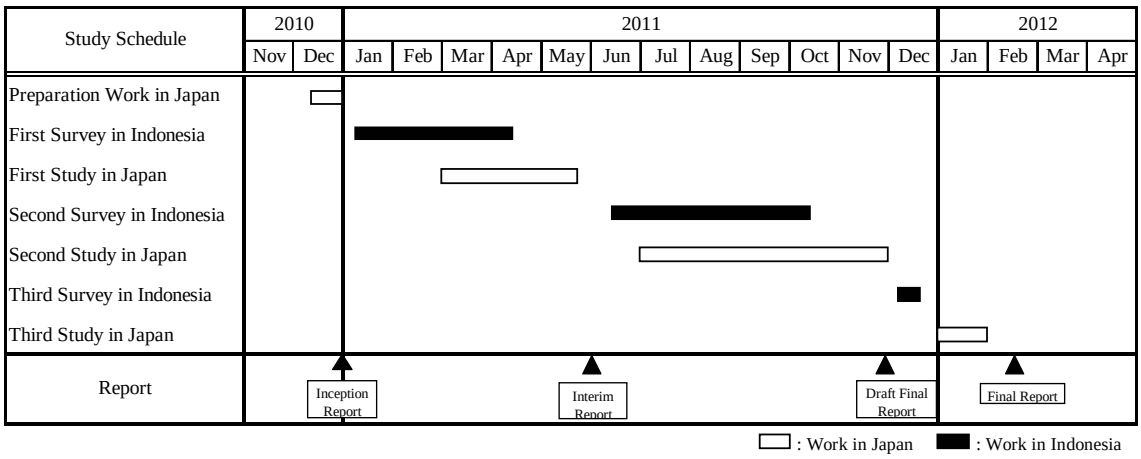


Figure 1.4.2 Survey Schedule

In the Second Survey in Indonesia, the JICA survey team estimated the potential demand for reclaimed water, studied and adapted the reclaimed water supply system for Southern Bali, and studied the feasibility of public and private sector partnerships from various perspectives. The Survey includes preparation of a preliminary facility design, project cost estimate, project implementation and organization plan, and assessment of the financial and economic feasibility. The environmental and social considerations were studied based on the Indonesian Environmental Legislation and JICA Guideline for Environmental and Social Considerations (Version of April 2010). A stakeholder meeting was also conducted.

1.5 Survey Organization and JICA Team Member

Organization for implementing the survey is shown in the following figure.

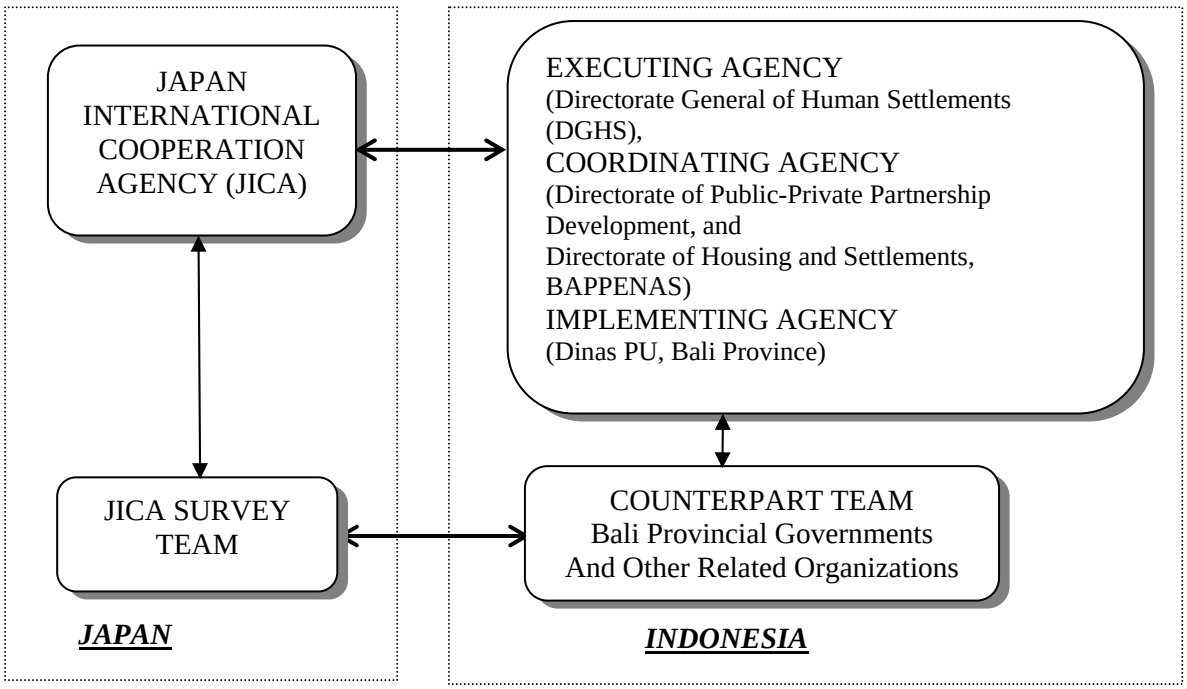


Figure 1.5.1 Survey Organization

CHAPTER 2

PRESENT CONDITIONS IN SOUTHERN BALI

CHAPTER 2 PRESENT CONDITIONS IN SOUTHERN BALI

2.1 Natural Conditions

2.1.1 Location

Bali Island is located at the westernmost of the Lesser Sunda Islands, lying between Java Island to the west and Lombok Island to the east, and is located at latitude between 8° and 9°, with the Bali Sea to the north and the Indian Ocean to the south. Bali province is one of the country's 33 provinces, with the provincial capital Denpasar towards the south of the island.

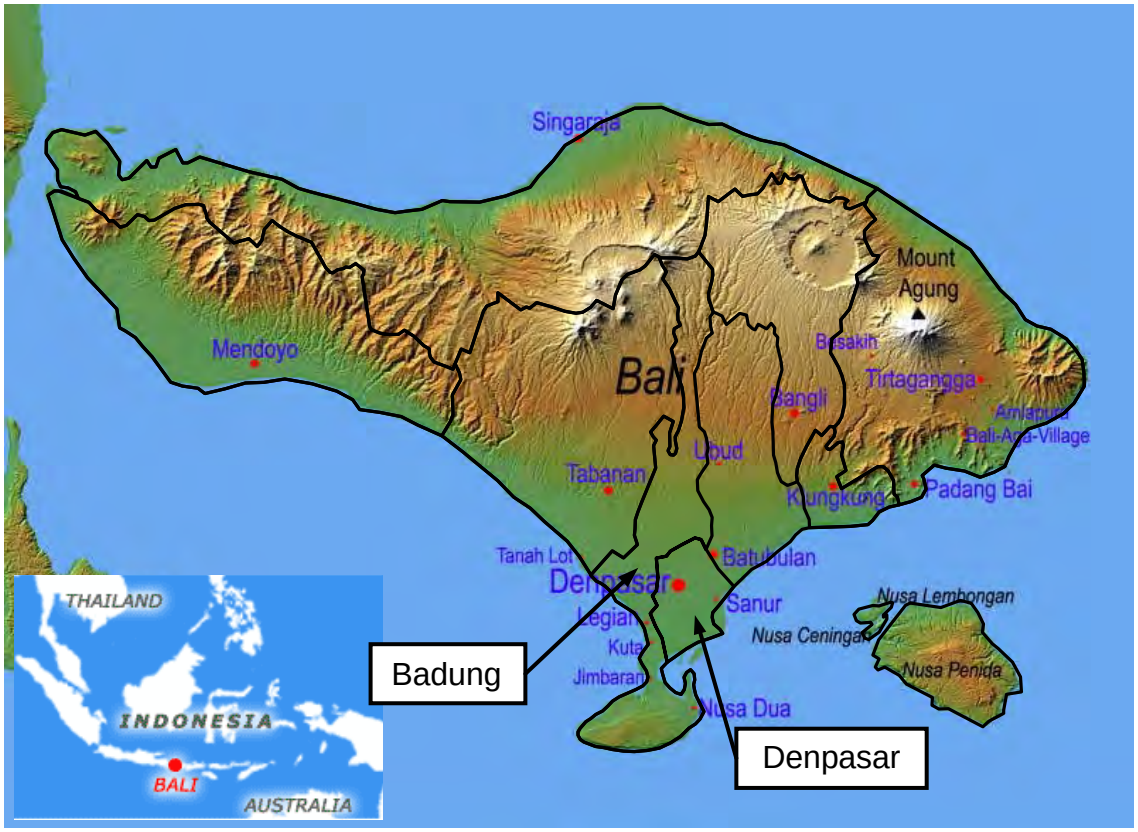


Figure 2.1.1 Location of Bali Island

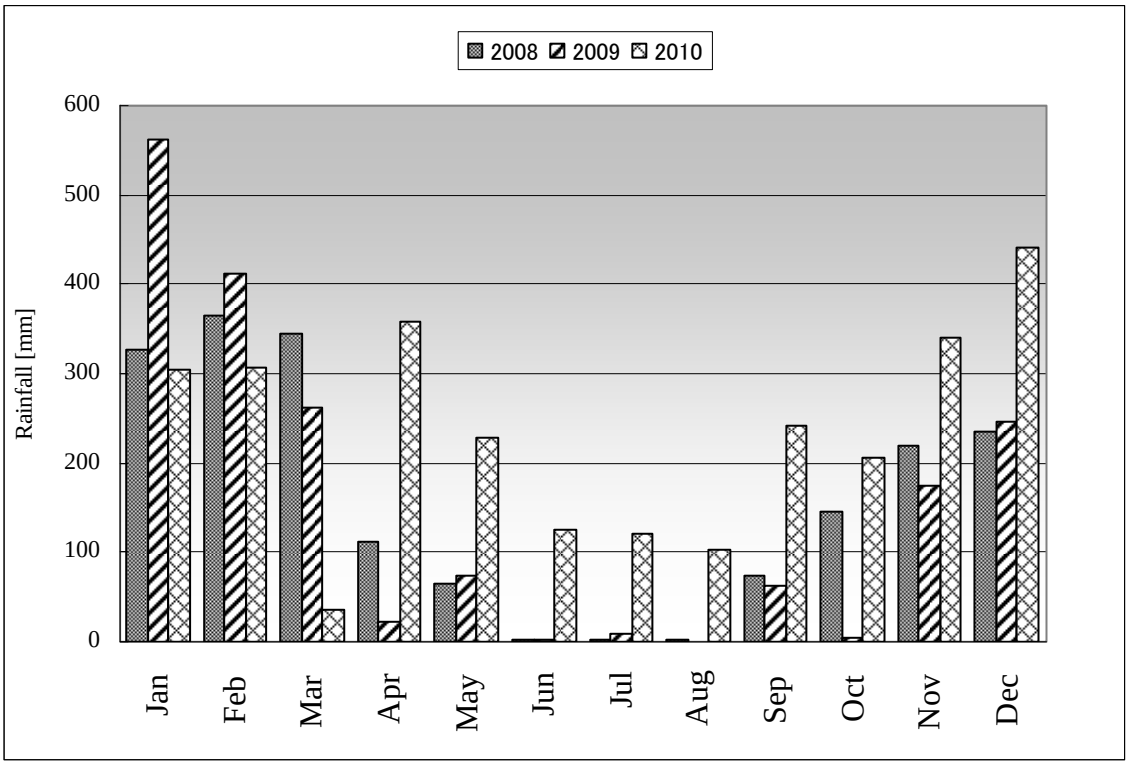
2.1.2 Topography

Bali Island covers an area of 5,633 km^2, measuring about 90 km from north to south and less than 140 km from west to east. A mountain chain stretches from west to east, splitting the island into two parts. Mount Agung, an active volcano that last erupted in March 1963, is the highest peak of the island with a height of 3,142 m. The northern side of the mountain is fairly steep, creating a narrow lowland along the coastal area. Meanwhile, the southern slopes are relatively moderate, forming a fertile plain that has become the main center of Balinese culture. This alluvial plain in the south is watered by shallow, north-south flowing rivers, which are drier in the dry season and overflow during periods of heavy rain. The Ayung River (approx 75 km) is the longest on the island. The island is surrounded by coral reefs. Beaches in the south tend to have white sand, while those in the north and west have black sand. The beach town of Padangbai in the south east has both. Some of the most beautiful white sandy beaches are in the south, including Sanur Beach, Kuta and Nusa Dua.

2.1.3 Climate

With constant fair weather throughout the year, Bali has a tropical monsoon climate, with moderate and slightly hot temperatures between 20 to 33 degrees Celsius. Rainy season is from October to March, when the western monsoon brings heavy showers and high humidity. June to September is the dry season, with low humidity and fairly cold evenings - the best time for outdoor activities.

Bali receives an annual rainfall of about 2,000 mm, and about 80% of which falls in the rainy season from October to March. The monthly rainfall in Denpasar, 2008-2010 is shown in Figure 2.1.2.



Source: Statistic Bureau Bali Province 2009, 2010, 2011

Figure 2.1.2 Record of Monthly Rainfall (Denpasar, 2008-2010)

2.2 Socio-economic Conditions

2.2.1 Population in Bali Province

The Indonesian Government conducted population censuses in 1971, 1980, 1990, 1995, 2000 and 2010. The results of these population censuses are shown in Figure 2.2.1. Population in Bali increased by an average of 1.71% per year from 1995 to 2000, but from 2000 to 2010, the increase jumped to 2.13% per year.

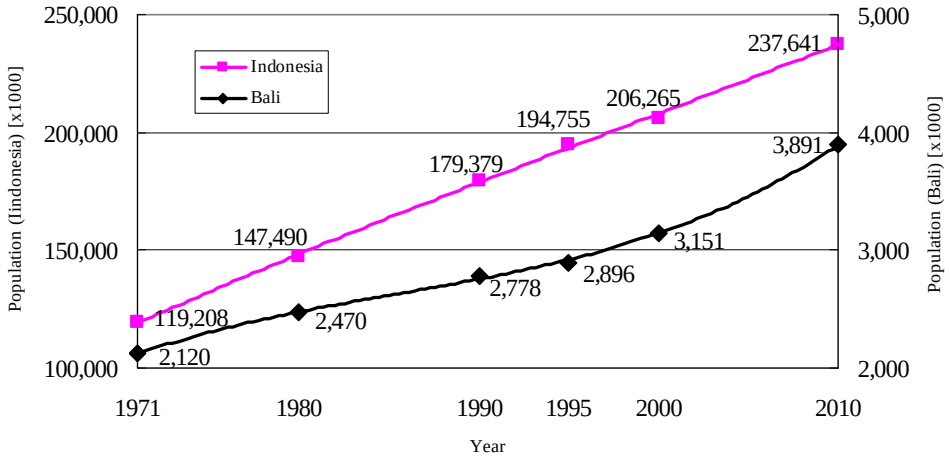


Figure 2.2.1 Population in Bali Province

2.2.2 Socio-economic Conditions

Present socio-economic conditions in Bali Province are outlined in **Table 2.2.1**.

Table 2.2.1 Summary of Present Conditions in Bali Province

Indicator	Description	Remarks
Area of Bali Province	5,634.40 Ha	0.29% OF Indonesia
Population	3,890,757	Census, May 2010
Population of Growth	2.15%	Census, May 2010
Religions	93.18% Hinduism, Islam (4.79%), Christianity (1.38%), and Buddhism (0.64%).	2002
GRDP (Growth Regional Domestic Product)	Rp.57,579,254 Billion	2009
Growth of GRDP	15.34%	2009
Rate of Inflation	8.1%	2009
Unemployment Rate	3.13%	2009
Budget	Revenue:Rp. 1,667 Billion Expenditure: Rp. 1,464 Billion	2008
Monthly Average Expenditure per Capita	Rp.562,743	2009
Infant Mortality Rate	7.32/1,000	2010
Life Expectancy	72.6 (F), 68.7 (m)	2010

Source：BPS Bali Province

2.2.3 Tourism

Bali Island is one of the most popular tourist destinations in the world. Annual number of foreign tourists from 1997 to 2010 is shown in **Figure 2.2.2**. From 1997 to 2006, the number of tourists remained roughly constant at about 1.5million, even though it decreased temporarily because of bombing incidents in 2002 and 2005. However, since then it has increased sharply and reached over 2.5 million by 2010.

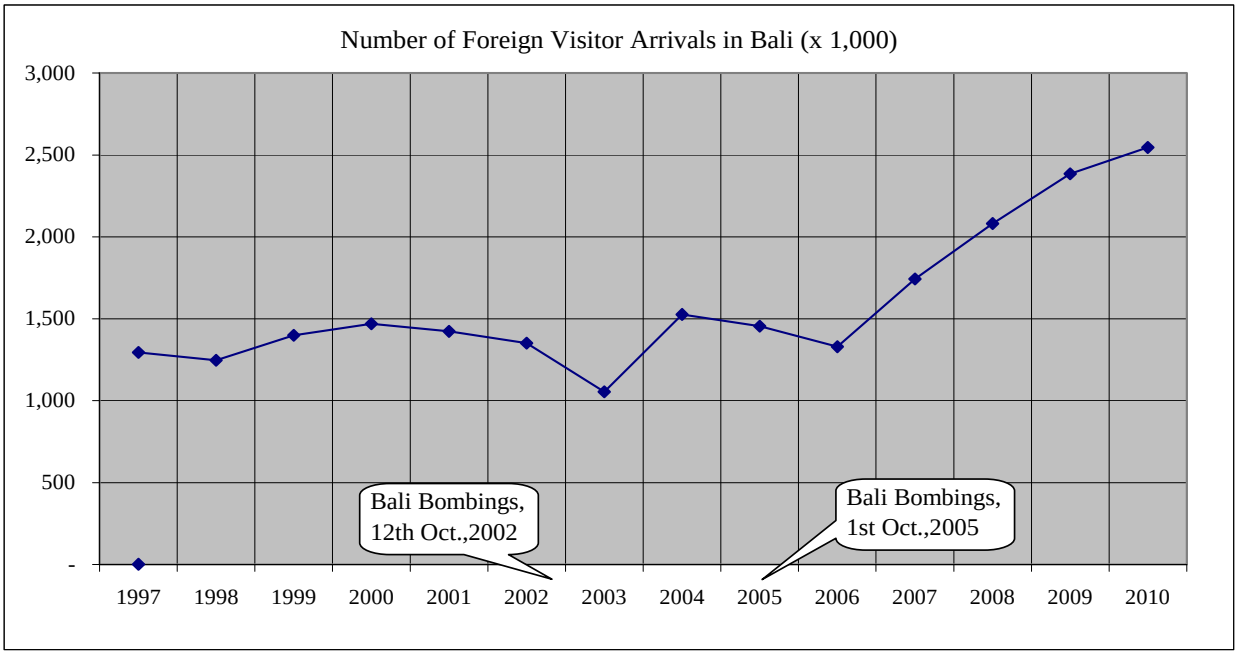


Figure 2.2.2 Number of Direct Foreign Tourist Arrivals

Source: BPS Bali Province

2.3 Policy, Goal and Strategy of Water Supply

2.3.1 National Plan

(1) Millennium Development Goal (MDG)

In the Millennium Development Goal (MDG) which had been committed in 189 countries including Indonesia, the national goal for access to safe water is set at 68.87% by 2015, from the rate of 37.73% at the base year of 1993.

Table 2.3.1 shows the access rates to safe water at the national level and for urban and rural areas, for the base and target years.

Table 2.3.1 Access Rates to Safe Water in the Base Year and the Target Year

	National	Urban Area	Rural Area
Base Year（1993）	37.73%	50.58%	31.61%
Target Year（2015）	68.87%	75.29%	65.81%

Source：BAPPENAS

It should be noted that access to safe water includes individual piped water supply systems and non-piped water supply sources. It is assumes that non-piped water supply would be protected from pollution using appropriate measures and should be more than 10 m from any potential pollution source to make them “safe”.

(2) Water Supply Sector in the National Development Plan

The National Development Planning Agency (BAPPENAS) prepares the long-term national development plan (RPJPN 2005 -2025).

The mid-term national development plan (RPJMN 2010 - 2014) is prepared from the long-term plan. Based on the mid-term national development plan, the sector national policy and the strategy plan

(RENSTRA 2010 - 2014) are prepared by the relevant ministries and government agencies. The strategy plan (RENSTRA 2010 - 2014) sets the target level for 2014, as required by the performance level set in the latest mid-term national development plan (RPJMN 2010 - 2014).

(3) Water Supply Development Plan
In the national mid-term development plan (RPJMN 2010–2014), the following issues are identified for water supply.

1) Water available for a sustainable supply is diminishing and water quality is deteriorating.
Untreated or inefficient treatment of domestic and other wastewater is the cause of water quality degradation. Inefficient water management in the areas of upper stream reaches or where water is taken and inefficient water use make developing water resources difficult. Excess groundwater use by people and industries causes groundwater depletion and degradation. It is important to consider the development of alternative solutions for water resources.

2) Water supply organizations with appropriate technical capability and sound management are limited.
According to the performance evaluation of the Public Water Supply Corporation (PDAM) in the fiscal year of 2007, only 61 of 272 PDAMs, (approximately 22%), are sound in management. About 68% of all PDAMs were running a budget deficit with a combined debt of 4.83 Trillion Indonesian Rupiah. The main reasons for the deficit situations are tariffs that are lower than the production cost in about 55% of all PDAMs, and the difficulty in maintaining appropriate human resources and securing an adequate budget.

3) Budget for water supply projects is limited.
Financing for water supply projects still depends on the central government budget. PDAMs that are not performaning well financially would have difficulty procuring funding. Private funds have not been used to ease the money shortage.

2.3.2 Provincial Plan

Provincial water supply development plans are prepared by the Bali Regional Development Planning Agency (BAPPEDA) and the Provincial Public Works Department (Dinas PU). Based on the national policy and the target of water supply development, the Provincial water supply development policy and facilities development plans are prepared, considering present conditions of water resources, the balance of water supply and demand for groundwater.

2.4 Water Administrations of Central Governments and Bali Provincial Governments

The administrative (executive) structure of the Republic of Indonesia consists of three levels: the central government, provincial government, and regency/municipality government. The relationship among the three government levels is of a hierarchical nature. The lower-level government reports to and consults with the higher-level government, to receive guidance or oversight.

At the central level, the President holds executive power, assisted by the Vice President and Cabinet. Within a province there are regencies (kabupaten) and municipalities (kota). The head of a regency (kabupaten) is the regent (bupati), and the head of a municipality (kota) is the mayor (walikota). Indonesia now comprises 33 provinces and 440 regencies/municipalities. There are several administrative levels of government under regency/municipality (kabupaten/kota); these are sub-districts (kecamatan), towns (kelurahan), and villages (desa).

Since 1999, regional governments in Indonesia have increased their autonomy following the passage of bills for two laws regarding decentralization, namely Undang-Undang 22/1999 (which provided for the

decentralization of government powers and functions) and Undang-Undang 25/1999 (which provided for revenue sharing and other financial arrangements between central and regional/local governments). Law 32/2004 and Law 33/2004 introduce important revisions to address failures in the 1999 versions. Specifically, these new laws seek to more clearly define the roles and responsibilities of the provincial and district governments provide financial arrangements for revenue sharing. There is a need for new bylaws to enable the new laws to be implemented.

2.4.1 Central Government

Central government authorities and their respective responsibilities relate to water businesses are as follows:

- Ministry of Public Health: To institute the regulation of drinking water, clean water, water for swimming pool, and public bath.

- Ministry of the Environment: To enact the regulation of effluent quality for treated water.

- Ministry of Finance: To handle budget for Public Water Service and Public Sewage Service.

  This central government authority also guarantees the tariff through PT Penjamina Infrastruktur Indonesia (PT PII) for PPP Projects and has the authority to write off debts at the PDAM.

- Ministry of Forest: To own and manage properties of mangrove in the region. To issue permits for land rental. Bali province rented the land for sewage treatment plant at a mangrove area though the Ministry of Forest.

- Ministry of Public Works: Is the national regulatory authority for the water supply and sanitation sector in Indonesia.

- BAPPENAS: Is responsible for overseeing the development plans in Indonesia, and coordinating and adjusting the ODA activities and loan projects from foreign countries (prepare the list of medium-term planned external loans and grants /Blue Book), and serves as the contact agency for Japanese ODA and Yen loan projects.

  BAPPENAS is also responsible for setting priorities among Public Private Partnership (PPP) projects and preparing the PPP Book, through discussion with Indonesia's Investment Coordination Board (BKPM) and Ministry of Finance. This organization is under the President of the Republic of Indonesia.

- Ministry of Internal Affairs: To govern local government. Bali province is managed by them.

An organization chart for the Ministry is shown in **Figure 2.4.2**. Directorate General of Human Settlement (Cipta Karya), Directorate of Program Development, Directorate of Water Supply Development, Directorate of Development of Environmental Sanitation, and BPP-SPAM govern the national administrations of water supply and sanitation.

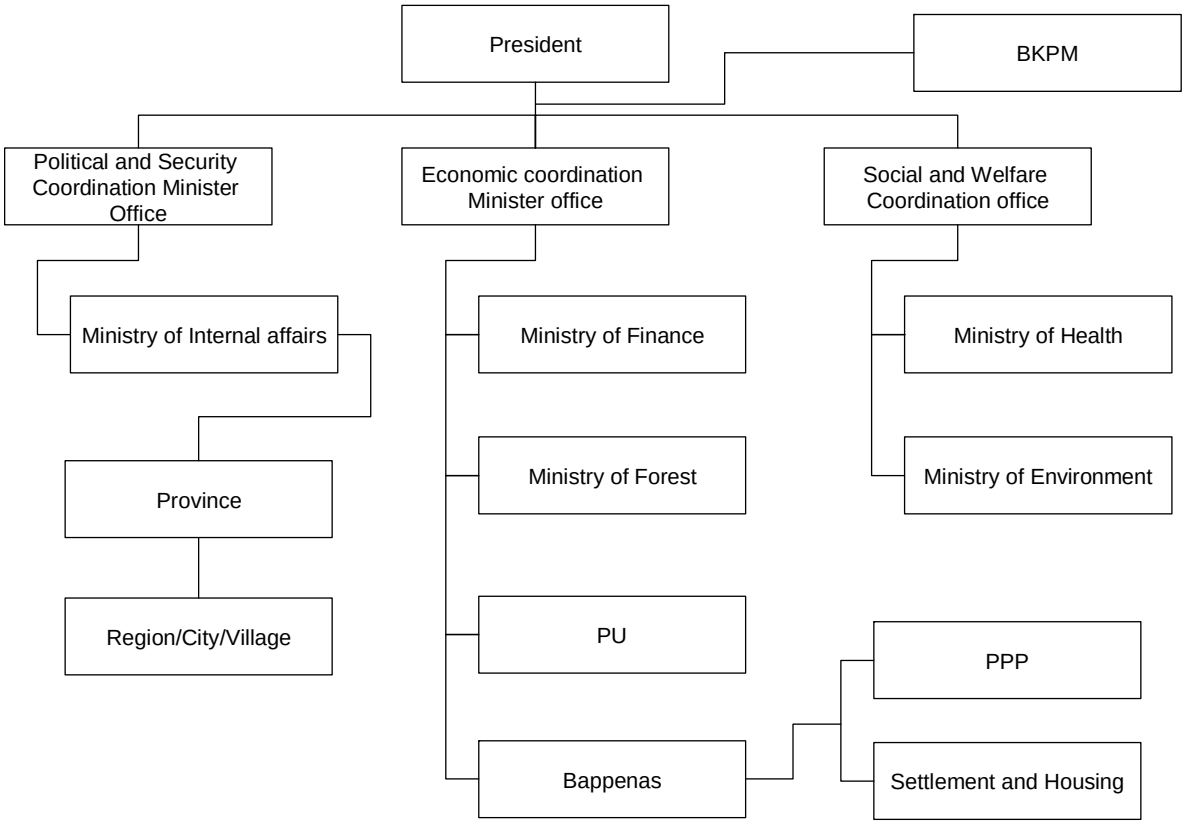


Figure 2.4.1 Central Government Authorities to Relate to Water Business in Indonesia

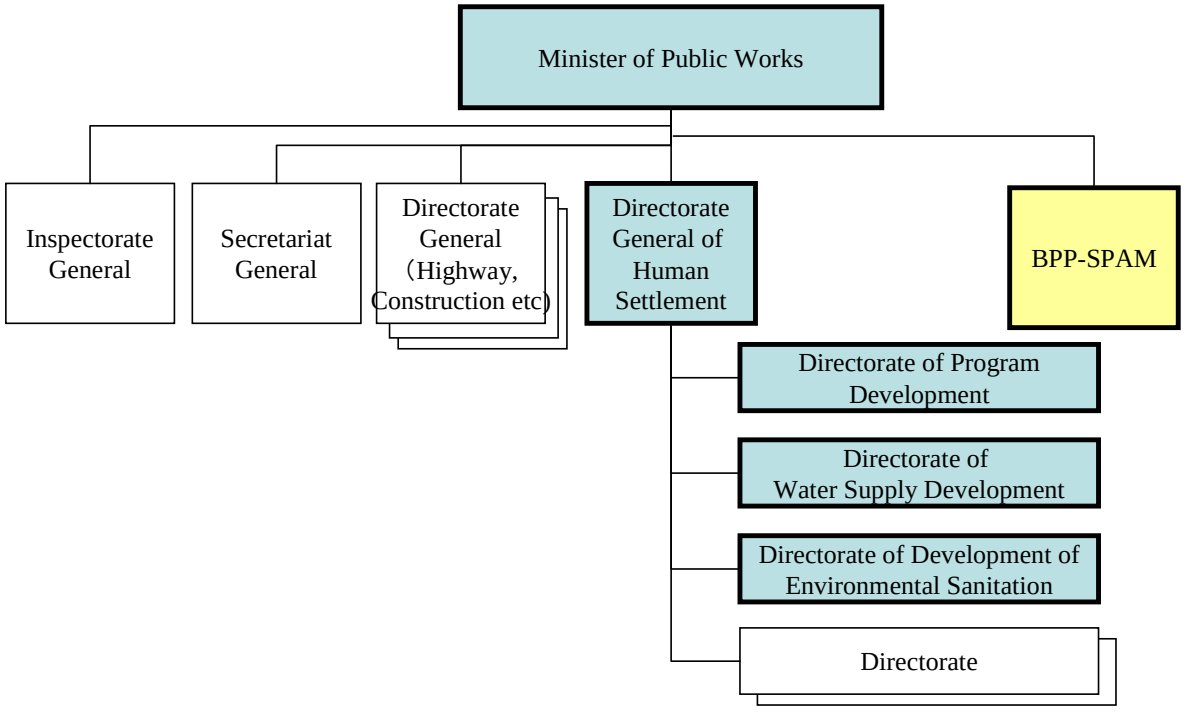


Figure 2.4.2 Simplified Organization Chart of Ministry of Public Works

2.4.2 Bali Provincial Governments

Bali Province consists of one kota (city) and eight kabupaten (regencies): Kota Denpasar, Kabupaten Badung, Kabupaten Bangli, Kabupaten Buleleng, Kabupaten Gianyar, Kabupaten Jembrana, Kabupaten Karangasem, Kabupaten Klungkung and Kabupaten Tabanan.

The Provincial and City/Regency Governments have similar organizational structures, as shown in **Figure 2.4.3**. These are the Secretary (Sekretaris), Services (Dinas-Dinas), Boards (Badan-Badan) and Offices (Kantol-Kantol) under their chief executive. In addition to the government departments, regional government-owned companies (BUMD) are established as separate enterprises.

Public Water Service (BLUPAL) is under Governor of Bali Province and at the same time it is joint venture with City of Denpasar and Budung Regency.
It operates and manages waste water treatment plant.

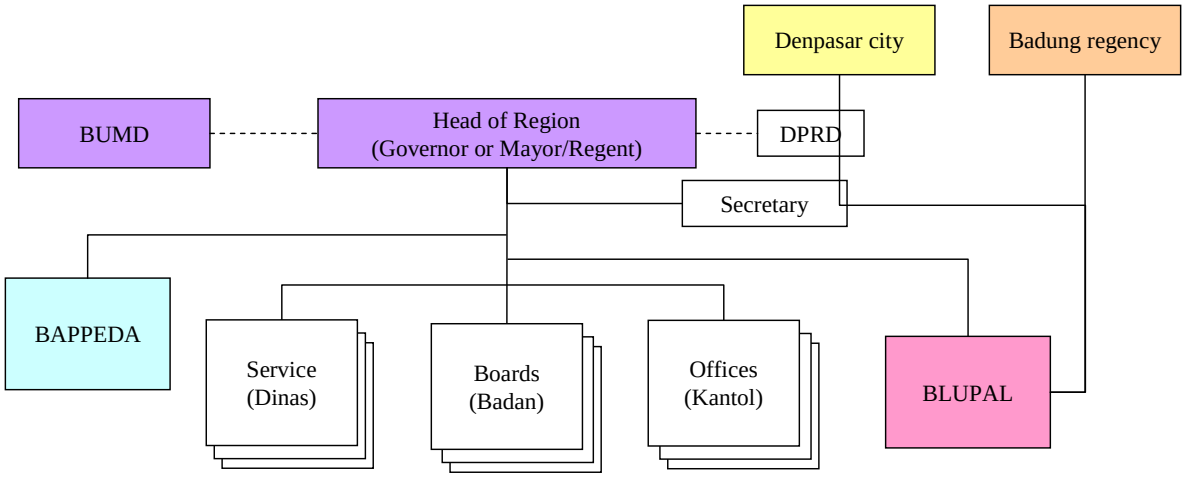


Figure 2.4.3 Simplified Organization Chart of Local Governments

We show local government authorities who are related to water business.

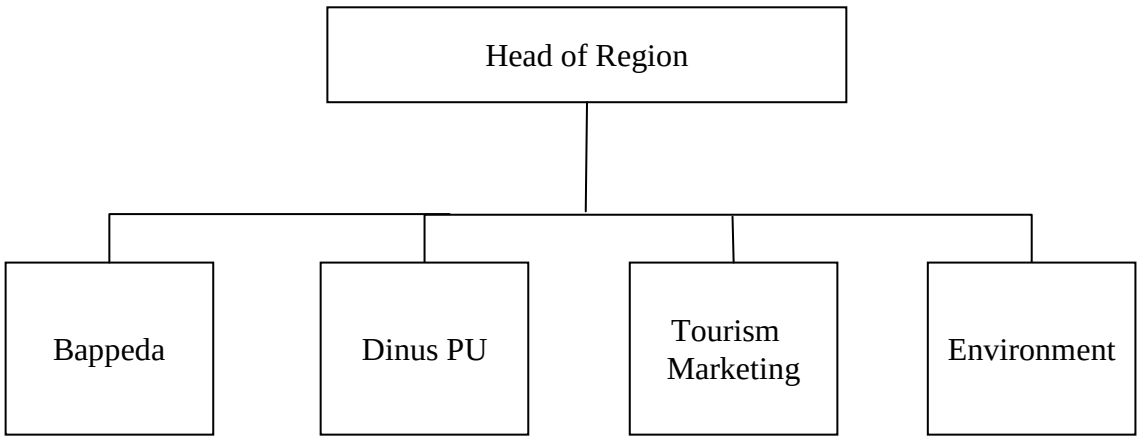


Figure 2.4.4 Bali Government Authorities to Relate to Water Business in Indonesia

- Bali Regional Development Planning Agency (BAPPEDA) is authorized to prepare the Provincial Development Plan and to set the prioritiesfor the Implementation of Projects.
- The Provincial Public Works Department (Dinas PU) is responsible for preparing the water supply plan based on the regional development plan. The organization structure is shown in Figure 2.4.5.
- Environmental Department: To enact the regulation of effluent quality for treated water.

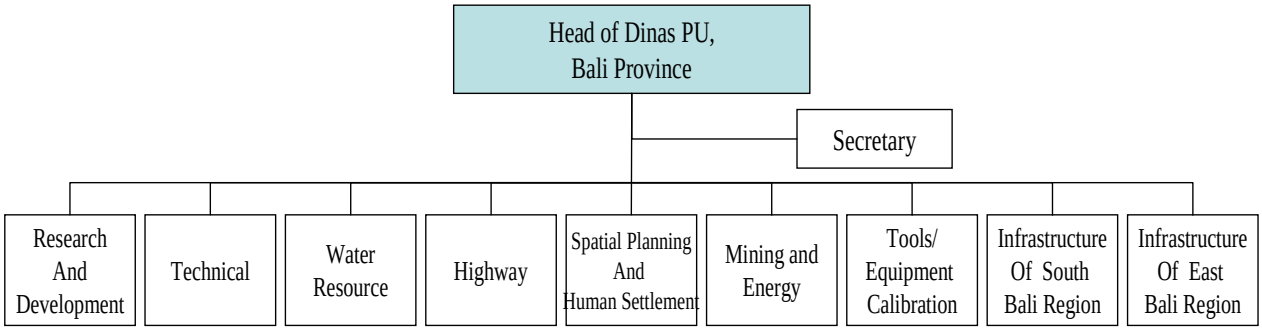


Figure 2.4.5 Organization Chart of Dinas PU, Bali Province

Water supply service for a municipality or regency is managed by a Public Water Supply Corporation (PDAM). It is a public enterprise (BUMD) which is wholely owned by municipal or regency's governments. Figure 2.4.6 shows a simplified organization chart of PDAM.

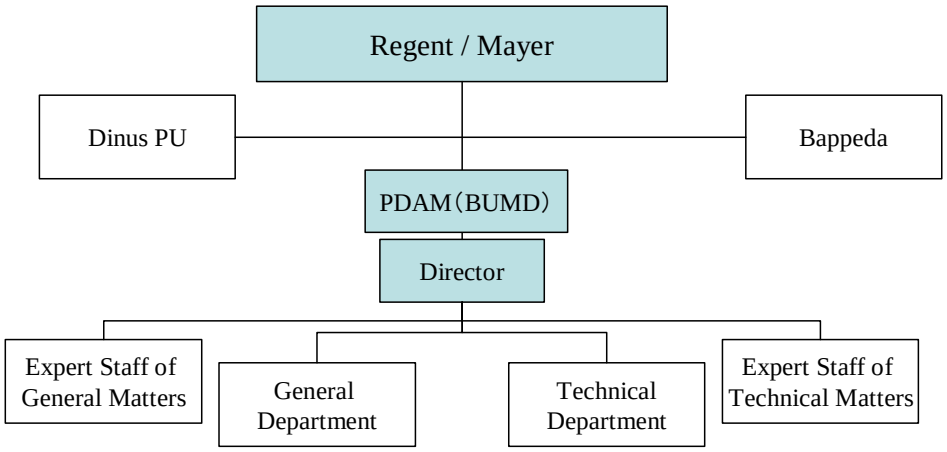


Figure 2.4.6 Simplified Organization Chart of the Example of PDAM

2.4.3 The Organization for PPP

The Province of Bali has a Public Private Partnership (PPP) Team to promote the PPP project. The Water Supply Project in South Bali (Unsolicited) a Korean company is working on is supported by the PPP Team. It is consists of Dinus PU mainly, however some part of PU is from Central Government. Bali Government has been considering setting up another PPP Team for our project.

2.5 Water Supply in Southern Bali

2.5.1 Water Supply in Denpasar City

(1) Present Water Supply Services
Basic data of water supply services in Denpasar City is summarized in Table 2.5.1.

Table 2.5.1 Basic Information of Water Supply

	unit	Denpasar	Remarks
Service Population	person	338,235	
Water Demand (Ave. Daily)	m^3/d	73,335	
Service Ratio	%	50.16	338,235/674,361 (Feb. 2011)
Per capita water consumption	lpcd	197	Assumed from revenue water and population served (2008) 27,804,948/366/408,414

Note: The figures are based on Data 2010 obtained from the PDAM

Figure 2.5.1, which is quoted from the JICA Study 2009, shows the water service situation. This information is useful to understand the water service conditions in the survey area. The intermitted water service less than 12 hours is mainly in the western area of Denpasar City. In the survey area of Southern Bali, almost all area has more than 18-hour supply, except the area north of the WWTP in which the water supply is less than 12 hours.

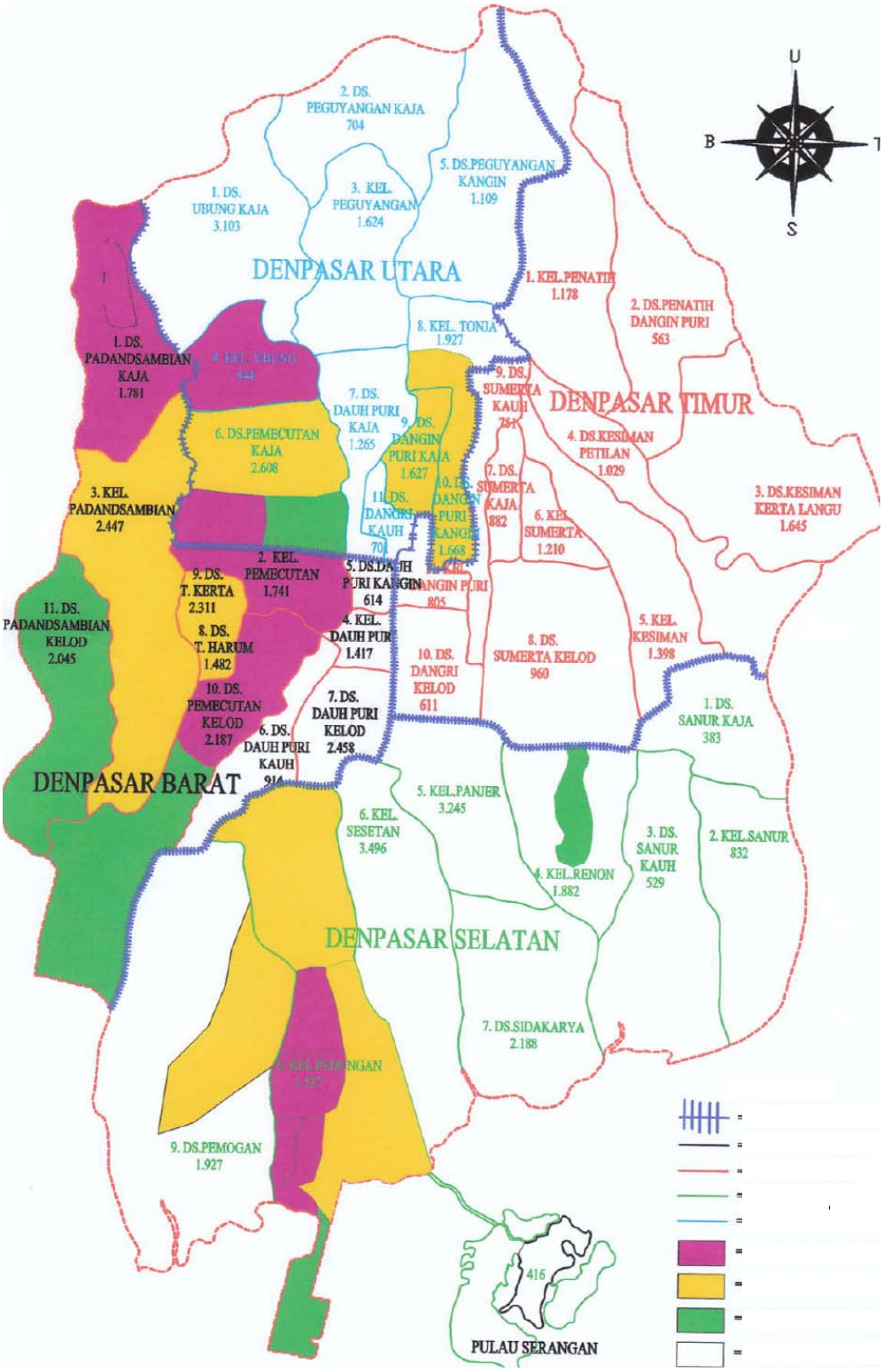


Figure 2.5.1 Intermitted Supply Area

(2) Existing Water Supply Facilities

1) Water Resources (Intake)

Water resources for water supply are river water, groundwater, and spring water. Table 2.5.2 below

summarizes the water resources and intake volumes for the water supply system.

Table 2.5.2 Existing Water Resources and Water Intake Capacity

Resources	Location	Intake	Capacity	Remarks
1) River				
Ayung River	Blusung	600 l/s	51,840 m^3/d	Ayung III WTP
Ayung River	Waribang	200 l/s	17,280 m^3/d	Waribang WTP
2) Deep well				
20 Deep Well		454 l/s	39,230 m^3/d	
3) Spring		0 l/s	0 m^3/d	
4) Total		1,254 l/s	108,350 m^3/d	

Note: The figures are based on 2010 data obtained from the PDAM

Ayung river water is used by two water treatment plants (WTPs): Ayung III WTP and Waribang WTP. It should be noted that potable water supply is not necessarily given priority over the use of water resources in Bali, where the SUBAK (Farmers Association) has much more influence.

PDAM Denpasar has constructed six deep wells since 2007 as shown below in Table 2.4.9.

Table 2.5.3 Self Expansion by PDAM Denpasar

Name	Construction	Capacity (l/s)	Remark
SB Banjar Gunung	2007	24	In operation
SB Sidakarya	2008	29	In operation
SB Pelagan	2009	15	In operation
SB Kebo Iwa	2009	8	In operation
SB in Jl. Pulau Singkep	2009	40	In operation
SB in Jl. Mahendra Data	2009	9	In operation

Note: The figures are based on Data 2010 obtained from the PDAM

2) Water Production

Water production capacity and actual production is summarized by water source in Table 2.5.4.

Table 2.5.4 Production Capacity and Actual Production in 2010

Water Source	Capacity		Production		Remark
	(l/s)	(m^3/day)	(l/s)	(m^3/day)	
1) Surface Water					The main reason why the water production is less than the capacity at each WTP is that the possible intake volume is reduced. Higher priority is given to water rights for irrigation of agriculture.
Ayung III WTP	500	43,200	488	42,160	
Package Plant*	50	4,320	37	3,200	
Waribang WTP	200	17,280	173	14,950	
Sub-total	750	64,800	698	60,310	
2) Deep Wells					The groundwater available is decreasing.
20 Wells	454	39,230	448	38,710	
3) Spring	0	0	0	0	No springs
4) Total	1,204	104,030	1,146	99,020	

Note: A package treatment plant is installed at Ayung III WTP
The figures are based on 2010 data obtained from the PDAM.

Surface water (river water) used at each WTP is treated using a rapid sand filtration process as shown below. Both aluminum sulfate and PAC are used as coagulants. The groundwater abstracted from deep wells is distributed after chlorination.

Ayung III WTP:

Pre-sedimentation ⇒ Aeration ⇒ Mixing ⇒ Flocculation
⇒ Sedimentation (Pulsator) ⇒ Rapid Sand Filtration ⇒ Chlorination

Package Treatment Plant

Pre-sedimentation ⇒ Mixing ⇒ Flocculation
⇒ Sedimentation (Tube settler) ⇒ Rapid Sand Filtration ⇒ Chlorination

Waribang WTP

Mixing ⇒ Flocculation ⇒ Sedimentation (Tube settler)
⇒ Rapid Sand Filtration ⇒ Chlorination

3) Water Reservoir

As shown in the table below, there are four existing reservoirs providing a total storage capacity of 16,500 m^3 and two reservoirs are located within the Water Treatment Plant. Tonja reservoir does not function well due to low receiving water volume and causes low pressures in the water distribution system. Water was conveyed from two deep wells and Ayung III WTP, but the groundwater is very depleted.

Table 2.5.5 Distribution Reservoir

No.	Name of Reservoir	Capacity	Remarks
1	Ayung III WTPs	10,000 m^3	Ground Type
2	Reservoir Waribang WTP	2,700 m^3	Ground Type
3	Tonja	3,400 m^3	Does not function well due to low receiving water volume and cause low pressure
4	Pohmanis	400 m^3	
	Total	16,500 m^3	

4) Treated Water Transmission Pipeline and Distribution Pipes

Information on the existing transmission pipelines are summarized by pipe material and diameter in Table 2.5.6 and Table 2.5.7. Total length of treated water transmission pipeline (dia. 250 mm to 700 mm) is only about 4 km, and 70% of these are made of steel and 30% of asbestos cement (ACP).

The existing distribution pipes are 957 km in total, including 788 km of small pipes less than 150 mm in diameter. The distribution pipes having diameters of 200 to 600 mm is 169 km in length, and about 50% and 30% of which are the PVC and ACP, respectively. The ACP was installed as part of the Colombo Plan granted by Australia in 1971.

Table 2.5.6 Treated Water Transmission Pipe

Material	Length (m)				Total Length	
	250mm	500mm	600mm	700mm	m	share
Steel pipe	2,123	180	375	120	2,798	70.0%
Asbestos cement pipe			1,200		1,200	30.0%
Total	2.123	180	1,575	120	3,998	100.0%

Note: Table is prepared by using data from PDAM as of 2009

Table 2.5.7 Water Distribution Pipe

Pipe Material	50-150mm	Main Pipe (m)				Total Length (m)
		200 - 350	375 - 600	Sub-total		
SP	-	11,734	18,061	29,795	17.6 %	
ACP	-	40,928	8,213	49,141	29.0 %	
DCIP	-		3,492	3,492	2.1 %	
PVC	-	81,343	3,124	84,467	49.9 %	
SGP	-	2,381		2,381	1.4 %	
ACP, GIP, PVC, PE	787,504					
Total	787,504	136,386	32,890	169,276	100 %	956,780

Note: Table is prepared by using 2009 data from PDAM

5) Drinking Water Supply Project

PDAM Denpasar distributes the water, called clean water, but not drinking water. However, following a regulation (Peraturan Pemerintah Republik Indonesia No.16 Tahun 2005), PDAM Denpasar has started the distribution service of drinking water originated from deep wells to 415 houses around Subita's road in Sumerta area from 1st of July 2008.

6) Measures for Non Revenue Water Reduction

The NRW ratios during the last 10 years and projection to 2012 are shown in Table 2.5.8, quoted from the JICA 2009 Report. The estimated NRW as of 2011 is 29.36%, which is much higher than the projected rate of 20.69%. The reason for the high NRW ratio should be investigated.

Table 2.5.8 NRW Ratio of PDAM Denpasar

Year	2002	2003	2004	2005	2006	2007	2008	2011	2012
%	22.83	20.14	17.62	21.05	24.62	22.60	22.90	20.69	20.00

Source: JICA Study 2009

2.5.2 Water Supply System in Badung Regency

(1) Present Water Supply Services

The existing water supply services in the project area, which are normally available 24 hours in all areas, are summarized in Table 2.5.9.

Table 2.5.9 Water Supply Conditions in PDAM Badung

Item	unit	PDAM Badung	PT.TB	PDAM Badung + PT.TB	Remarks
Population		281,426	102,727	384,153	
Service Population		186,744	98,394	285,138	
Water Demand (Ave. Daily)	m^3/d	22,759	54,033	76,792	
Service Ratio	%	66.4	95.8	74.2	PDAM Badung only 186,744 / 281,426 PDAM Badung + PT.TB 285,138 / 384,153
Per capita consumption	lpcd	111		142	Assumed from revenue water and population served (2011): PDAM Badung only 18,248,000 / 164,316 PDAM Badung + part of PT.TB 35,772, 000 / 251,940

Note: The figures are based on 2010 data obtained from the PDAM

PT Tirta Arta Buana Mulia (PT.TB) is a special purpose company (SPC) which provides water supply service in the southern Bali area under the concession contract for the BOT Project. PT.TB is composed of three private companies (owning 55% of the shares in total) and PDAM Badung (owning 45%). The concession contract is effective for 20 years and will be expired by the end of year of 2012. And then the services will be done by PDAM Badung.

(2) Existing Water Supply Facilities

1) Water Resources (intake)

Water from rivers and dams is used as a water source for three WTPs. Nine springs and 22 deep wells are

also used. The water intake volumes of these water sources are listed below:

Table 2.5.10 Existing Water Resources and Water Intake Capacity of PDAM Badung

Resources	PDAM	Intake Capacity		Intake Location
1) River	PT.TB	600 l/s	51,840 m^3/d	Ayung River
	PDAM Badung	300 l/s	25,920 m^3/d	Badung River, Estuary Dam [1)]
Sub-total		900 l/s	77,760 m^3/d	
2) Deep Well	PDAM Badung	344 l/s	29,720 m^3/d	
	PT.TB	25 l/s	2,160 m^3/d	
Sub-total		369 l/s	31,880 m^3/d	
3) Spring	PDAM Badung	99 l/s	8,560 m^3/d	
4) Total		1,368 l/s	118,200 m^3/d	

Note: 1) Estuary Dam is located at the downstream of Badung river. All water from Estuary WTP is delivered to PTTB)
The figures are based on 2010 data obtained from the PDAM

2) Water Production

PT.TB operates Ayung I & II Water Treatment Plant (WTP) and one deep well. PDAM Badung operates the others including the Estuary WTP and 22 deep wells and 9 springs.

Table 2.5.11 Production Capacity and Actual Production of PDAM Badung in 2010

Water Sources	Capacity		Production		Remarks
	(l/s)	(m^3/d)	(l/s)	(m^3/d)	
Surface Water					The main reason why the production at Ayunug I & II WTPs is less than the capacity is that the water intake volume is reduced.
Ayung I & II WTP	600	51,840	420	36,290	
Estuary WTP	300	25,920	318	27,480	
Sub-total	900	77,760	738	63,770	
Deep Wells					Groundwater pumped is less than the capacity of facility because available groundwater is decreasing every year.
PDAM Badung	344	29,720	286	24,710	
PT.TB	25	2,160	25	2,160	
Sub-total	369	31,880	311	26,870	
Spring					
PDAM Badung	99	8,560	94	8,120	
Total	1,368	118,200	1,143	98,760	

Note: The figures are based on Data 2010 obtained from the PDAM

The production of deep wells increased from 275 l/s (23,760 m^3/day) from 20 wells in 2007 to 311 l/s (26,870 m^3/d) from 22 wells in 2011.

Surface water (river water) used at each WTP is treated using a rapid sand filtration process. At the Estuary WTP, an aeration process is added. A filtration process is applied for the removal of iron (Fe) and manganese (Mn) from groundwater.

Ayung I & II WTP:

Rapid Mixing ⇒ Flocculation ⇒ Sedimentation (Tube Settler)
⇒ Rapid Sand Filtration ⇒ Chlorination

Estuary WTP

Aeration ⇒ Mixing ⇒ Flocculation ⇒ Sedimentation (Pulsator)
⇒ Rapid Sand Filtration ⇒ Chlorination

for Groundwater (Deep Well)

Chlorination ⇒ Filtration (Fe and Mn Removal) ⇒ Chlorination

3) Water Reservoir
The existing reservoirs are listed in the following table.

Table 2.5.12 Water Distribution Reservoir of PDAM Badung

No.	Name of Reservoir	Locations	Capacity
1	Blusung	Ayung I & II WTPs	8,000 m^3
2		Estuary	1,000 m^3
3	Teluk Benoa	Teluk Benoa	1,000 m^3
4	Simpangan	Simpangan	1,000 m^3
5	Ungasan	Ungasan	1,000 m^3
6	UPA	Bualu Nusa Dua	3,000 m^3
7	UPA	Bualu Nusa Dua	1,500 m^3
	Total		15,500 m^3

4) Transmission pipes
About 39.4 km of transmission pipes, with diameters between 75 mm and 600 mm, convey treated water to the reservoirs. The information is summarized in Table 2.5.13. Pipes having the diameter above 350 mm are asbestos cement pipes. The treated water transmission pipe of PT.TB is summarized in Table 2.5.14.

Table 2.5.13 Treated Water Transmission Pipe of PDAM Badung

Diameter (mm)	Length (m)	Remarks
75 – 300	30,842	GWI, PVC, AC
350	1,593	AC
450	1,900	AC
550	658	AC
600	4,488	AC
Total Length	39,481	-

Source: JICA Study 2009

Table 2.5.14 Treated Water Transmission Pipe of PT.TB

Diameter (mm)	Length (m)	Remarks
300	300	
400	16,861	5,625 m ACP
450	3,900	
500	16,400	15,000 m DCIP
600	10,819	8,319 m GRP
700	4,070	GRP
1000	3,000	GRP
Total	55,350	

Note: Table is prepared by using data from PDAM as of 2009
ACP: Asbestos cement pipe, DCIP: Ductile Iron Pipe, GRP: Glass-fiber Reinforced Pipe
Source: JICA Study 2009

ACP were installed under the Colombo plan. The length of ACP is 16,124 m in total, including PT.TB. DCIP were installed under previous JICA projects and are in very good condition.

5) Distribution Pipes
The distribution pipes are summarized by type of pipe material for PDAM Badung in Table 2.5.15.

Table 2.5.15 Distribution Pipe of PDAM Badung by Pipe Material, excluding PT.TB

Pipe Material	50-150mm	Main Pipes				Total	
		200-350mm	400-600mm	sub-total		length (m)	%
GIP	12,531	0	0	0	0.0%	12,531	2.3%
SP	0	6,162	0	6,162	9.9%	6,162	1.1%
PE	6,787	0	0	0	0.0%	6,787	1.3%
ACP	0	0	0	0	0.0%	0	0.0%
DCIP	0	0	0	0	0.0%	0	0.0%
PVC	461,083	55,971	0	55,971	90.1%	517,054	95.3%
SGP	0	0	0	0	0.0%	0	0.0%
Total	480,401	62,133	0	62,133	100.0%	542,534	100.0%

Note: Table is prepared by using data from PDAM as of 2009

Pipes having diameter less than 150 mm are 480 km in length. About 89% of the pipes are 542 km in length. ACP is not used for distribution pipes.

Information on diameter and length of distribution pipes for PT.TB is summarized in Table 2.5.16. The pipe material is PVC.

Table 2.5.16 Distribution Pipe of PT.TB (PVC)

Diameter (mm)	Length (m)
25	3,443
40	12,018
50	90,058
75	67,678
100	53,368
150	39,225
200	13,485
250	31,734
Total	311,009

Source: JICA Study 2009

(3) Pilot Project for Supplying Drinking Water

In 2008, PDAM Badung started distributing drinking water from deep wells to around 1,200 houses in the Anggunan area, Panglan area, Tegal Saet Area and Green Lot Area following the promulgation of regulation PPRI No.16 Tahun 2005.

(4) Measures for Non Revenue Water Reduction

The levels of NRW in the PDAM Badung over the last 4 years, and future projections to 2012, are shown in Table 2.5.17 below. The present NRW (as of 2008) is assessed at 21.9%. PDAM Badung aims to reduce NRW to 20% by the target year of 2012. The estimated NRW as of 2011 is 20.6%. These figures do not include those of PT.TB. The NRW ratio of PT.TB is about 22% as of 2010.

Table 2.5.17 NRW Ratio of PDAM Badung

Year	2005	2006	2007	2008	2009	2010	2011
%	23.80	22.50	22.20	21.90	21.90	21.40	20.60

Source: JICA Study 2009

2.6 Water Supply Plans in Bali Prepared by Previous Studies

2.6.1 Review of Previous Studies

The following three previous water development studies are reviewed.

- The Comprehensive Study on Water Resources Development and Management in Bali Province (hereinafter referred to as JICA Study 2006)
- Feasibility Study SPAM SARBAGITAKU. (hereinafter referred to as F/S Report 2008)
- Preparatory Study for Southern Bali Water Supply Development Project (hereinafter referred to as JICA Study 2009)

The water demand and supply plans in these studies for Denpasar City and Badung Regency are specifically reviewed to understand the situations of water shortage in Southern Bali and the water demand and future water supply capacities required for the waterworks facilities.

(1) Water Demand Projection

Table 2.6.1 and Table 2.6.2 summarize the projected water demand to 2025 in the F/S 2008 and JICA Study 2006, respectively. Table 2.6.3 is a summary of the water demand projected to 2015 in the JICA Study 2009, in which the same figures of future population, population service ratio, per capita domestic water demand and the non-revenue water (NRW) ratios in the F/S 2008 are applied in the projections.

Table 2.6.1 Water Demand Projections by the F/S 2008

Unit: (L/s)

PDAM		2005	2010	2015	2020	2025
Denpasar		1,085	1,184	1,683	1,691	1,696
Badung	Badung*	557	639	881	881	881
	PT.TB	452	608	849	1,094	1,338
	Sub-total	1,009	1,247	1,730	1,975	2,219
Total		2,094	2,431	3,413	3,666	3,915

Note: The * shows that PDAM Badung service area but excluded PT. TB service area
Source: the F/S 2008

Table 2.6.2 Water Demand Projections by JICA Study 2006

Unit: (L/s)

PDAM		2005	2010	2015	2020	2025
Denpasar		1,180	1,577	1,986	2,396	2,805
Badung	Badung*	273	399	549	700	851
	PT.TB	444	604	849	1,094	1,338
	Sub-total	717	1,003	1,398	1,794	2,189
Total		1,897	2,580	3,384	4,190	4.994

Note: The * shows that PDAM Badung service area but excluded PT. TB service area
Source: JICA Study 2006

Table 2.6.3 Water Demand Projections by JICA Study 2009

Unit: (L/s)

PDAM		2005	2010	2015
Denpasar		1,142	1,441	1,768
Badung	Badung*	268	386	488
	PT.TB	225	225	300
	Sub-total	493	1,003	1,398
Total		1,635	2,444	3,166

Note: The * shows that PDAM Badung service area but excluded PT. TB service area
Source: JICA Study 2009

Figure 2.6.1 shows a comparison of future water demand projects by three studies.

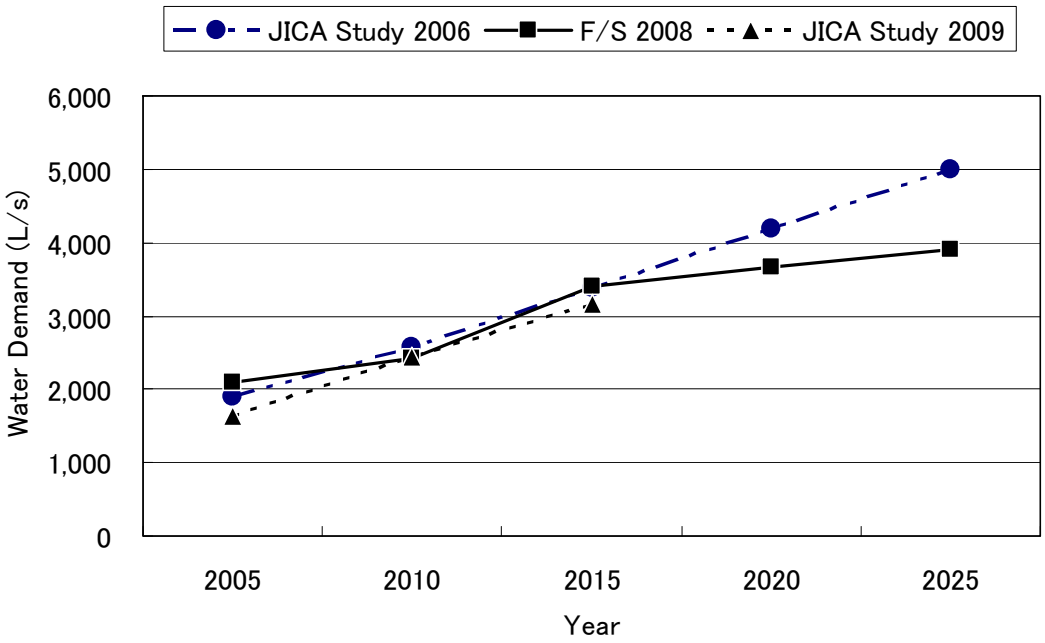


Figure 2.6.1 Comparison of Water Demand Projections

By 2015, the three water demand projections would be around 3,100 to 3,400 L/s. But the projections for 2025 show a difference of 1,000 L/s. The basis for the demand projections were reviewed to clarify the reason for this difference.

(2) Review of Basis used in the Water Demand Projection

1) Population Projection in Southern Bali

Because the domestic water demand is estimated based on the population served, the population projection is reviewed first. Tables 2.6.4 and 2.6.5 show the results of the population projections from 2010 to 2025 for Southern Bali (Denpasar City and Badung Regency) in the F/S 2008 and the JICA Study 2006. The population record of BPS (Statistic Center) Bali Province, based on the registered population, is also listed in each table for reference. Figures 2.6.2 and 2.6.3 illustrate the population projections for Denpasar City and Badung Regency, respectively, including the statistic data.

Table 2.6.4 Population Projection of Denpasar City (Kota)

Source	2000	2005	2010	2015	2020	2025
F/S 2008	532,000	575,000	619,000	667,000	721,000	774,000
JICA Study 2006	532,000	600,000	704,000	778,000	865,000	951,000
BPS Record	532,440	574,955	788,589	-	-	-

Table 2.6.5 Population Projection of Badung Regency (Kabupaten)

Source	2000	2005	2010	2015	2020	2025
F/S 2008	346,000	375,000	402,000	444,000	493,000	542,000
JICA Study 2006	346,000	379,000	425,000	460,000	500,000	540,000
BPS Record	345,863	374,377	543,332	-	-	-

The F/S 2008 makes a downward revision of the projection made by the JICA Study 2006, considering the actual population records from 2000 to 2007. The review in the JICA Study 2009 commented that the projections of future population for each Kota/Kabupaten given in the F/S 2008 were appropriate, through the comparison of the population projections made in the JICA Study 2006 and past records of BPS of

2000 and 2005.

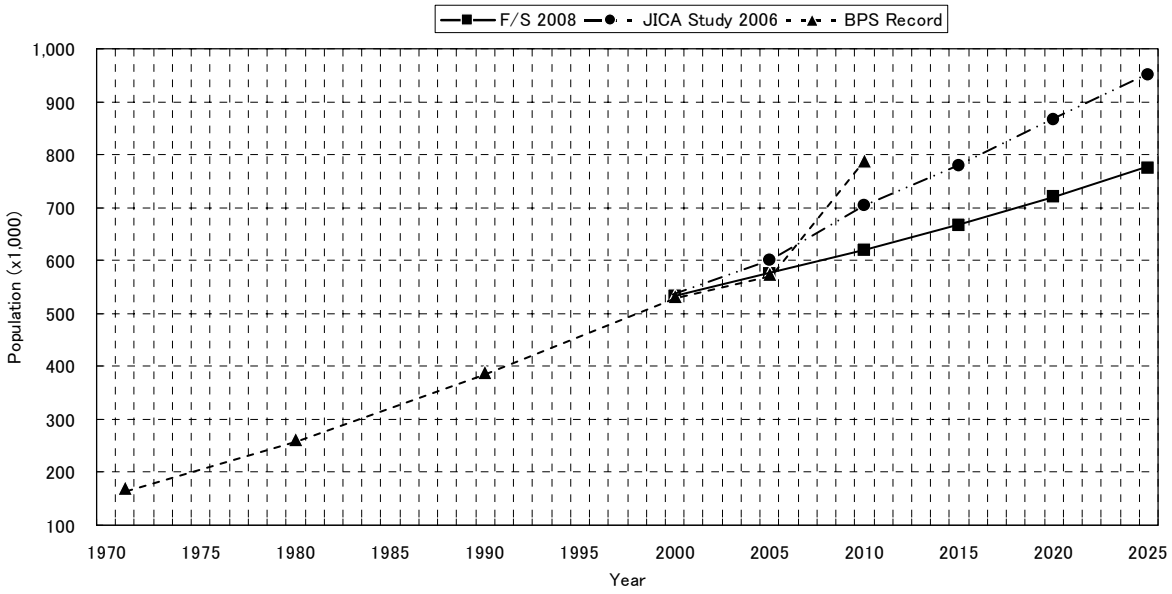


Figure 2.6.2 Population Projection of Denpasar City (Kota)

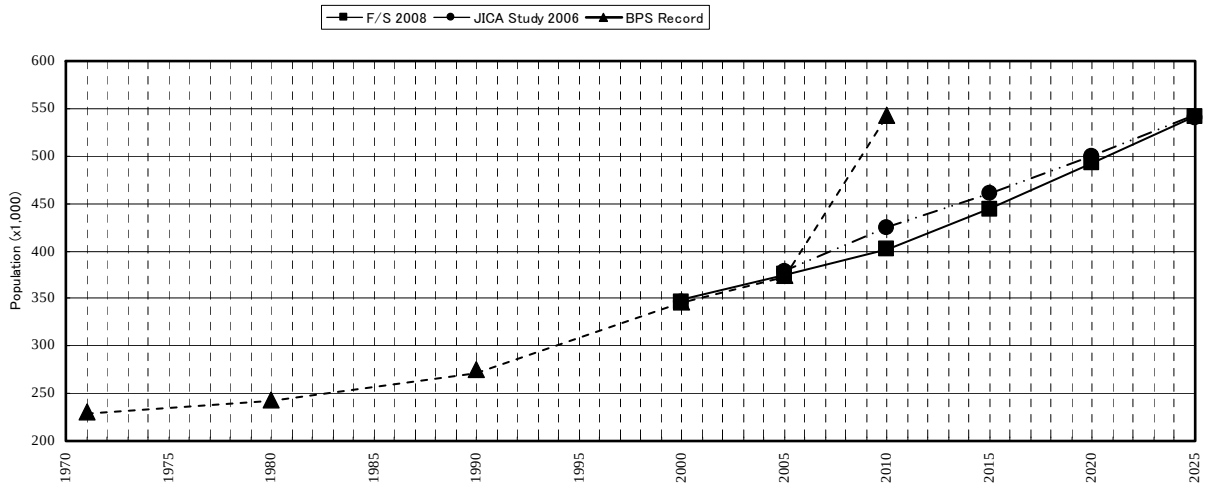


Figure 2.6.3 Population Projection of Badung Regency (Kabupaten)

However, the census data of 2010 shows that the actual population is much higher than the projected population. This population increase rate shows higher than before and the tendency is considerably different. The main reason is that more people are emigrating from the islands around Bali province to seek employment in Bali Island where the economy is good.

2) Per capita water demand

Per capita domestic water demand (liters per capita per day: lpcd) is an important design parameter for estimating future total domestic water demand. The per capita domestic water demands used in the water demand projection are summarized in Table 2.6.6.

JICA Study 2009 applied the figures from F/S 2008, except in the case of PT.TB. In the F/S 2008, the actual domestic water consumption data (billed amount) are used to set the per capita domestic water demand, considering difficult situations of water resources development. It means that the future demands

projected in the F/S 2008 are at the same level as present water supply conditions as of 2007. Therefore, the per capita domestic water demand for Badung, excluding PT.TB service, are set as low as 109 lpcd.

On the other hand, the water demand projection by PT.TB does not use the per capita domestic water demand, it uses the ratio to the entire water demand of PDAM Badung. Therefore, the per capita domestic water demand at that time is not mentioned in the F/S 2008 Study.

Table 2.6.6 Per Capita Domestic Water Demand Applied in the Projection (lpcd)

PDAM	F/S 2008 (based on 2007 water consumption data)	JICA Study 2006		
		2004	2010	2025
Denpasar	185	210	220	220
Badung	109	170	180	210
PT.TB	Not applicable	200	210	210

Note: JICA Study 2009 used the figures of the F/S 2008

While in JICA Study 2006, the per capita domestic water demands are set considering peoples' living standards improvement and the Indonesian water supply design guideline. The per capita domestic water consumption for the year 2004:was 213 lpcd in Denpasar; 146 lpcd in Badung; and 202 lpcd in PT.TB.

The domestic water demand of 185 lpcd in Denpasar used in the F/S 2008 is 16% lower than that of 220 lpcd in the JICA Study 2006. While the domestic water demand of 109 lpcd in Badung used by the F/S 2008 is half of the demand of 210 lpcd used by the JICA Study 2006. The domestic water demand set by the F/S 2008 are fixed at the present water consumption level in view of the difficult situations of water resources development. The actual domestic water demand could be set at a higher level considering the improvements in peoples' living standards.

3) Water Supply Service Ratio

Table 2.6.7 shows future water supply service ratios set in the F/S 2008 and JICA Study 2006. In order to achieve the urban area target of 87% set in MDGs, the F/S 2008 recommends higher service ratios than that used in the JICA Study 2006.

Table 2.6.7 Future Service Ratio (lpcd)

PDAM	F/S 2008		JICA Study 2006		
	2010	2015	2004	2010	2015
Denpasar	67.9 %	78.2 %	45 %	55 %	60 %
Badung	64.5 %*	74.4 %*	35 %	45 %	53 %
PT.TB	-	-	65 %	70 %	80 %

Note: The * means that the figures only for Badung not include those for the PT.TB service area.

From the figures presented in Table 2.6.6 and Table 2.6.7, a planning strategy could be characterized as follows:

In the F/S 2008 and JICA Study 2009, water supply service will be provided to more people, but the supply volume would maintain the status quo. While in the JICA Study 2006, water supply volume would satisfy the peoples' urban life, though population serviced would expand moderately.

Presently the PDAM Denpasar and PDAM Badung steadily expand their service area to install the water distribution network. It seems that PDAMs are following the planning strategy of the F/S 2008.

4) Water Losses (Leakage Ratio)

Due to lack of flow measurements at the outlets of water treatment plants and of service reservoirs, as well as at the customers' service connections, it is difficult to accurately identify the non-revenue water (NRW) in the existing water supply system. Therefore, it is assumed that the non-revenue water (NRW) ratio which is used for the water demand projection would be equivalent to the maximum figure for water

losses (leakage ratio).

5) Seasonal peak factor

Water demand generally fluctuates throughout the year. Water treatment facilities are usually designed based on daily maximum flow. However, the water demand discussed in this section is applying daily average flow. It is usually multiplied by the seasonal peak factor (the ratio of the daily maximum water demand to the daily average water demand) to determine the daily maximum flow.

The seasonal peak factor is normally estimated by analyzing monthly fluctuations in historical trends. Table 2.6.8 shows the peak factors recorded in PDAM Denpasar in the F/S 2008. However, the peak factor was not considered in estimating the future water demand. One of the reasons is that the future water demand in Southern Bali will be severely constrained due to the limited availability of water resources.

Table 2.6.8 Seasonal Peak Factor of Denpasar

	2005	2006	2007
Maximum (L/s)	916	947	947
Average (L/s)	868	857	887
Peak Factor	1.06	1.10	1.07

Source: F/S 2008

6) Domestic and Non-domestic Water Consumption Ratio

The non-domestic water demand is projected based on the domestic and non-domestic water consumption ratios in the F/S 2008 and JICA Study 2006.

Table 2.6.9 shows the domestic and non-domestic water consumption ratios used in the F/S 2008, which are based on actual billed consumption records in 2007.

Table 2.6.9 Domestic and Non-domestic Consumption in 2007

PDAM	Unit	Consumption		
		Domestic	Non-domestic	Total
Denpasar	m^3/year	21,944,154	5,482,936	27,427,090
	%	80%	20%	100%
Badung	m^3/year	5,606,576	1,807,316	7,413,892
	%	75%	25%	100%

Source: F/S 2008

In the case of JICA Study 2006, the ratios between domestic water and non-domestic water supply are set as shown in Table 2.6.10. The ratio of the non-domestic water demand portion in Denpasar is increasing slightly, while the ratio in Badung is fixed. The ratio of the non-domestic water demand portion in PT.TB is increasing.

Table 2.6.10 Domestic and Non-domestic Water Demand Ratio Set in JICA Study 2006

PDAM	Ratio	2005	2010	2015	2020	2025
Denpasar	Domestic	79%	78%	77%	76%	76%
	Non-Domestic	21%	22%	23%	24%	24%
Badung*	Domestic	86%	86%	85%	85%	85%
	Non-Domestic	14%	14%	15%	15%	15%
PT.TB	Domestic	52%	47%	41%	47%	35%
	Non-Domestic	48%	53%	59%	63%	65%

Note: The * means that the figures only for Badung not include those for the PT.TB service area.
Source: JICA Study 2006

(3) Review of Required Water Supply Capacity Proposed by the Previous Studies

In the previous water supply studies, total water supply capacities required to meet the water demand are calculated by the difference between the water demand and the present and future water supply capacity of piped water supply system. Table 2.6.11, Table 2.6.11 and Table 2.6.13 summarize the calculated results in the F/S 2008, JICA Study 2006 and JICA Study 2009, respectively. The required water supply capacity calculated in the previous studies is summarized in Table 2.6.14 and Table 2.6.15 for comparison.

If there is a large increase in water demand, the supply capacity should increase proportionally. The required water supply capacity proposed in F/S 2008 and JICA Study 2009 is below half of that proposed in JICA Study 2006. This is because the water supply plan is proposed under suppressed water demand conditions as described in the review of water demand projection: the per capita domestic water demand is set at the current water supply level without considering any improvement of living standard in the future, though the difficulty of water resource development is considered and the improvement of the domestic water service ratio is regarded as important.

The base water supply capacity used for calculating the above-mentioned water supply capacity was compared with the present water production of 2010 (shown in Table 2.5.4 and Table 2.5.11). First, in F/S 2008, the actual water production is set at1,146 L/s (Table 2.5.4), which is almost same figure, while the water supply capacity for Denpasar City is set at 1,184 L/s (Table 2.6.11). The water supply capacity of 1,251 (=643+608) L/s set in Table 2.6.11 is almost same as the actual water production of 1,143 L/s in Table 2.5.11 for Badung Regency. In other words, the water supply capacity set in the plan is same as the present water supply capacity.

Second, in JICA Study 2006, the water supply capacity of 1,115 L/s set in Table 2.6.12 is slightly lower than the actual water production of 1,146 L/s for Denpasar City. The water supply capacity of 946 (=296+650) L/s set in Table 2.6.12 is also a little lower than the actual water production of 1,143 L/s for Badung Regency.

Finally, in JICA Study 2009, the water supply capacity of 1,184 L/s set in Table 2.6.13 is slightly lower than the actual water production capacity of 1,146 L/s for Denpasar City. The water supply capacity of 643 L/s set in Table 2.6.13 is about 60% only of the actual water production of 1,143 L/s for Badung Regency. The comparison with the record and demand forecast of the survey showed that the increase of water supply capacity is not necessary until 2015 in Badung Regency. However, as mentioned above, water demand here is set with the expectation that there would be limited water resources, therefore, water shortage could be expected.

Table 2.6.11 Water Demand and Required Supply Capacity by the F/S 2008

Unit: (L/s)

PDAM	Item	2005	2010	2015	2020	2025
Denpasar	Demand	1,085	1,184	1,683	1,691	1,696
	Supply Capacity	1,085	1,184	1,184	1,184	1,184
	Balance	**0**	**0**	**-498**	**-507**	**-512**
Badung	Demand	557	639	881	881	881
	Supply Capacity	609	643	643	643	643
	Balance	**52**	**4**	**-238**	**-238**	**-238**
PT.TB	Demand	452	608	849	1,094	1,338
	Supply Capacity	630	813	917	917	917
	Balance	**178**	**205**	**68**	**-177**	**-421**
Total	Demand	2,094	2,431	3,413	3,666	3,915
	Supply Capacity	2,324	2,640	2,744	2,744	2,744
	Balance	**230**	**209**	**-669**	**-922**	**-1,171**

Note: Totals and balances do not necessarily correspond to exact calculated results due to rounding errors.
Source: F/S 2008

Table 2.6.12 Water Demand and Required Supply Capacity by the JICA Study 2006

Unit: (L/s)

PDAM	Item	2005	2010	2015	2020	2025
Denpasar	Demand	1,180	1,577	1,986	2,396	2,805
	Supply Capacity	1,115				
	Balance	**-65**	**-462**	**-871**	**-1,281**	**-1,690**
Badung	Demand	273	399	549	700	851
	Supply Capacity	296				
	Balance	**23**	**-103**	**-253**	**-404**	**-555**
PT.TB	Demand	444	604	849	1,094	1,338
	Supply Capacity	650				
	Balance	206	+46	-199	-444	-688
Total	Demand	1,897	2,580	3,384	4,190	4.994
	Supply Capacity	2,061				
	Balance	**164**	**-519**	**-1,323**	**-2,129**	**-2,933**

Source: JICA Study 2006

Table 2.6.13 Water Demand and Required Supply Capacity by JICA Study 2009

Unit: (L/s)

PDAM		Item	2005	2010	2015
Denpasar		Demand	1,142	1,441	1,768
		Supply Capacity	1,085	1,184	1,184
		Balance	**-57**	**-927**	**-584**
Badung	Badung*	Demand	268	386	488
	PT.TB	Demand	292	285	374
	All Badung	Above Demand Total	560	671	862
	All Badung	Supply Capacity	609	643	643
		Balance	**49**	**-28**	**-219**
Total		Demand	1,702	2,112	2,630
		Supply Capacity	1,694	1,827	1,827
		Balance	**-8**	**-285**	**-803**

Note: Totals and balances do not necessarily correspond to exact calculated results due to rounding errors.
Source: JICA 2009 Study

Table 2.6.14 Summary of Required Water Supply Capacity in the Previous Studies

(Unit: L/s)

PDAM		2015	2020	2025
JICA Study 2006	Denpasar	871	1,281	1,690
	Badung	452	848	1,243
	Total	1,323	2,129	2,933
F/S 2008	Denpasar	498	507	512
	Badung	409	415	659
	Total	669	922	1,171
JICA Study 2009	Denpasar	584	N.A	N.A
	Badung	219	N.A	N.A
	Total	803	N.A	N.A

Table 2.6.15 Summary of Required Water Supply Capacity in the Previous Studies

(Unit: m^3/d)

PDAM		2015	2020	2025
JICA Study 2006	Denpasar	75,250	110,680	146,020
	Badung	39,050	73,270	107,400
	Total	114,300	183,950	253,420
F/S 2008	Denpasar	43,030	43,800	44,240
	Badung	35,340	35,860	56,940
	Total	78,370	79,660	101,180
JICA Study 2009	Denpasar	50,460	N.A	N.A
	Badung	18,920	N.A	N.A
	Total	69,380	N.A	N.A

(4) Water resource development plan related to the proposed water facility plan

To secure the above-mentioned required water supply capacity, each survey proposes the following water supply facility plan to take water from surface water resources.

In JICA Study 2006, construction of water supply facilities which have the intake capacity of 1,800 L/s (155,500m3/day) from Ayung Dam, 300 L/s (25,900m3/day) from Petanu River, and 300 L/s (25,900m3/day) from Penet River, with a total of 2,400 L/s (207,400m3/day) by 2025 is proposed.

In F/S 2008, construction of water supply facilities which have the intake capacity of 1,000 L/s (86,400m3/day) from Petanu River and 500 L/s (43,200m3/day) from Penet River, with a total of 1,500 L/s (129,600m3/day) by 2025 is proposed.

In JICA Study 2009, construction of water supply facilities which have the intake capacity of 300 L/s (25,900m3/day) from Petanu River and 300 L/s (25,900m3/day) from Penet River, with a total of 600 L/s (51,800m3/day) by 2015 is proposed.

2.6.2 Situation and Trend of Water Supply Projects in Southern Bali

The following three (3) water supply projects are listed as plans for mitigating the water shortage in Southern Bali in the official documents of the Indonesian government. The project outlines are summarized in the following paragraphs. Figure 2.6.4 presents the volume and the locations of water treatment plants to be developed in each plan.

The biggest issue in the water supply projects is the difficulty in developing appropriate surface water resources under the limited water intake volume. Surface water resources development generally requires huge investment and a long time line to realize, specifically to settle issues among stakeholders with

respect to the environmental and social environmental considerations. Therefore, the water supply projects including water resources development should be considered as a long-term measure to solve the water shortage situations in Southern Bali.

(1) Klungkung Regency (Tukad Undaa) Water Supply, Bali

In the PPP Book, "Public-Private Partnerships Infrastructure Projects in Indonesia 2010-2014" by Ministry of National Development Planning/National Development Planning Agency (BAPPENAS), this project is listed as one of the Priority Projects;

- Project outline: Raw water will be taken at Tukad Unda in Klungkung Regency, which then treated in Water Treatment Plant (WTP) with capacity of 1,000ℓ/s. Bulk water supply from the WTP is planned for Badung at 700ℓ/s and for Denpasar at 300ℓ/s through 40 km of treated water transmission pipeline.

- PPP Investment project: Form of Contract: BOT, Estimated Project value: US$ 43.50 million, Government Contract Agency: Klungkung Regency

- Schedule: Tender: 2011, Contract Signing: 2011, Land Acquisition: 2011-2, Construction: 2012, Operation: 2013

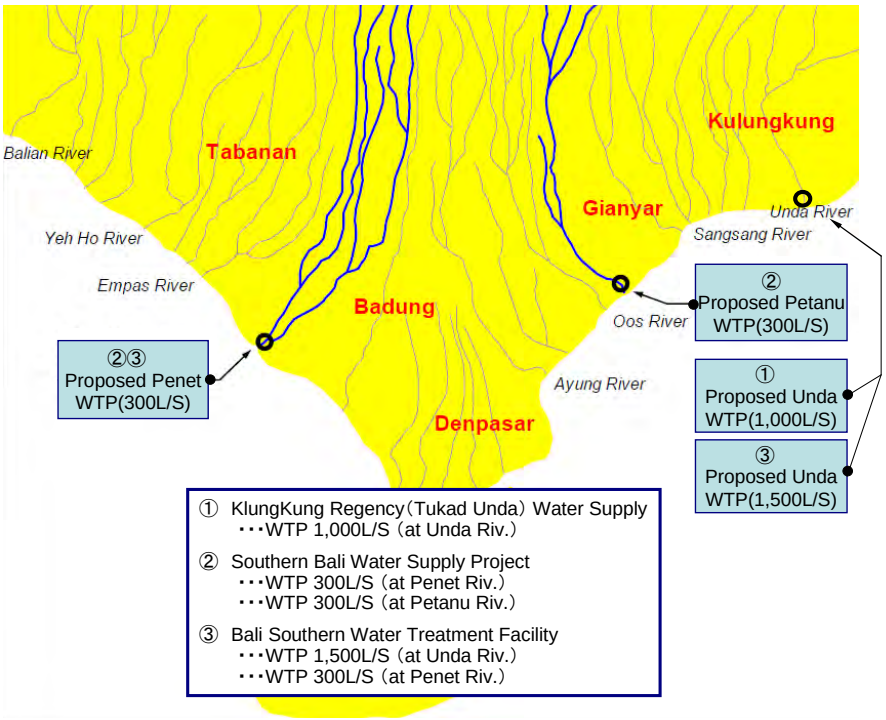


Figure .2.6.4 Water Supply Projects in Southern Bali

(2) Southern Bali Water Supply Project

In the Blue Book, "Project and Technical Assistance Proposals 2006-2009" by Ministry of National Development Planning/National Development Planning Agency (BAPPENAS), this project is listed in the part of the "Project Assistance".

This project is aimed to expand and rehabilitate the existing water supply. Project cost is estimated at US$ 57,500,000, of which US$ 50,000,000 are assumed to be funded by Soft Loan of the foreign government. Executing Agency: Ministry of Public Works.

(3) Bali Southern Water Treatment Facility

The third project combines the first project and a part of the second project.

This project is introduced to the participants from abroad as one of the 16 PPP projects in 2011 at Indonesia International Infrastructure Conference and Exhibition 2011 (April 12-14, 2011). Estimated Project Investment value is US$ 59.10 million and Government Contracting Agency is Bali Provincial government.

This project is aimed to supply bulk water to Denapsar, Badung etc, after water treatment of surface water taken at Tukad Unda at a rate of 1,500ℓ/s and taken from Penet river at a rate of 300ℓ/s.

A feasibility study on implementing the third project as a PPP project is currently being conducted by a Korean group under an agreement with the Bali Provincial government. Any information on the results or progress of the feasibility study has not been shared yet.

2.7 Reclaimed Water Utilization Plan in Southern Bali and Its Positioning

Medium- and short- term measures are required to mitigate the water shortage situations in Southern Bali, in support of the water supply projects. As one of the measures, the effective use of the treated wastewater at Suwung WWTP in Denpasar is expected to be realized. The reports on efficient re-use of the effluent of Suwung WWTP prepared by Bali Provincial Government and Cipta Karya of PU are summarized below.

2.7.1 Pre-feasibility Report Prepared by Bali Provincial Government on Suwung WWTP Effluent Utilization as Raw Water for Reclaimed Water Supply (October, 2008)

The summary of presentation material[1] of the report is shown below.

1) User and amount of water
Tap water (drinking water) of 100 L/s (8,640m^3/day) is required in the surrounding area of the WWTP. The breakdown is as follows.

- Benoa Harbor: 15 L/s (1,300 m^3/day)
- Water demand prospect for the resort development plan (BTID: Turtle Island Development) in 2010: 75 L/s (6,480 m^3/day)
- Residents of Serangan Island: 10 L/s (860 m^3/day)

2) Reclaimed water supply system
This water supply system produces reclaimed water at 100 L/s at the reclaimed water treatment facility to be established in the WWTP.The reclaimed water would be transmited via 200-400 mm transmission pipes to a reservoir to be installed in the service area.

The reclaimed water treatment facility would consist of a) Aeration tank, b) Pre-chlorination, c) Bio-filter (rotating disk contact tank), d) VAF (Valve&Filter), e) Activated carbon treatment tank, f) Ultrafiltration (UF) membrane, and g) Post-chlorine treatment.

3) Project cost and O&M cost
Total project cost is 65,500 million rupiahs. Total construction cost is 62 billion rupiahs, and the breakdown is 42 billion rupiahs for water treatment facility, and 20 billion rupiahs for transmission and distribution pipes. In addition, 3,500 million rupiahs are estimated for design cost and administration cost.

[1] Presentation Material ”WWTP Suwung Effluent Utilization As Raw Water Drinking Water Treatment Installation, October 2008”

O&M costs consist of electricity, chemicals, personnel, administration, and redemption costs. Unit production cost is estimated at Rp.2,300/m^3.

4) Business plan
The plan is formulated to be implemented over 11 months: facility design starts from January 2009, operation starts from December. The breakdown is as follows.

- Planning design: from January to April, 2009 (4 months)
- Construction of treatment facility: from May to October, 2009 (6 months).
- Construction of transmission pipe: from July to September, 2009 (3 months).
- Construction of distribution pipe: from August to November, 2009 (4 months).
- Construction supervision: from May to November, 2009 (7 months).

5) Economic benefits of reuse of WWTP effluent
If the treated water quality is equivalent to tap water (drinking water), the treated water could be used by residents. Moreover, the O&M cost of the treatment facility can be covered by the added value created, which can contribute to the mitigation of water shortage in the area.

6) Items to be considered
The following items to be considered are:

- Available land is limited for the construction of the reclaimed water treatment facility at the WWTP site.
- O&M cost of the selected filtering technology is high.
- The O&M of the facility requires special attention, skills and knowledge.

2.7.2 Pre-feasibility Study Report by Cipta Karya of PU on Waste Water Re-use from Suwung WWTP, Denpasar, Bali (2009)

(1) Background

In Indonesia, the difficulty to preserve water resources is increasing. Water supply services cannot be improved because urbanization has progressed rapidly and the demand for water is growing. Surface water, such as the rivers, near cities is polluted and groundwater quality is being affected by salt water intrusion. It is becoming difficult to secure water sources located near the water demand point. Furthermore, it is increasingly difficult to secure a stable and continuous supply from these water sources at the quantity required because of climate change. Therefore, a huge investment would be required for the construction and O&M of water supply systems fed from new water sources.

In view of this situation, the Ministry of Public Works is investigating the effluent of 11 domestic WWTPs (Banjarmasin, Cirebon, Bandung, Yogyakarta, Balikpapan, Surakarta, Medan, Parapat, Jakarta, Denpasar, and Tanggerang) with the main objectives of mitigating the difficult water supply and demand situation due to the shortage of water sources, relieving the nutrient loading from effluent discharged to the water environment, water pollution control, and promoting groundwater conservation by reuse of WWTP effluent.

(2) Study report on waste water re-use from Suwung WWTP, Denpasar[2] [3]

The study report on waste water re-use from Suwung WWTP, Denpasar examines the technical and

[2] "Waste Water Re-Use From IPAL Suwung, Denpasar, Bali", Directorate General of Human Settlements, Ministry of Public Works. (Summary which was translated into English)
[3] "RINGKASAN EKSEKUTIF, Bantek Pra FS & Penyusunan Konsep Desain Pemanfaatan Ulang Air IPAL Suwung Denpasar", (Executive Summary, Technical Assistance Pre FS & Preparation of Concept Design of Re-use of Water of WWTP Suwung Denpasar)

financial feasibility of using WWTP effluent as an alternative source of clean water as well as related environmental social considerations. The objectives, result and expected effect of the study are as follows.

1) Objectives
   - To re-use the effluent from WWTP as one of the alternative water sources.
   - To overcome the lack of water sources for drinking water.
   - To evaluate the feasibility of wastewater reuse.

2) Result and expected outcomes
   - It is expected that the amount of water intake from surface water or groundwater will be reduced by using the WWTP effluent as an alternative water source of clean water.
   - The local government and local residents would benefit from a larger and more sustainable water supply system.
   - The best method for treating the WWTP effluent shall be determined.

3) Basic strategy to reuse the WWTP effluent

According to a stakeholder survey carried out during the pre-feasibility study, the responses were as follows: i) “I will use the reclaimed water if it is clean.” 56 %, ii) “I hesitate to use.” 26.4%, and iii) “I do not want to use it for religious reason and others." 17.6%. On the other hand, in the private sector, it was "I do not want to use" 50%, and “I will use.” slightly 13.3%.

Considering these results, the pre-feasibility study proposed by a combination of two systems to treat and reuse WWTP effluent. A schematic outline of the WWTP effluent reuse plan is shown in Figure 2.7.2.

① WWTP effluent would be treated at a reclaimed water treatment facility (20L/s, 1,700m^3/day), stored at a reservoir (500m^3), then transmitted to the PDAM reservoir to supply Benoa harbor and Serangan island with drinking water .

② WWTP effluent (80L/s, approximately 6,900m^3/day) would be pre-chlorinated and transmitted to a main reservoir (1,500m^3) and distributed from there to three service reservoirs (500m^3) through transmission pipes (Diameter: 150mm, HDPE pipe, Pipe Length: 2,500-3,600m) . Water from the four reservoirs would be distributed to the demand point in the city area by water trucks, and used for non-consumption uses such as watering lawns and gardens and hydrant water.

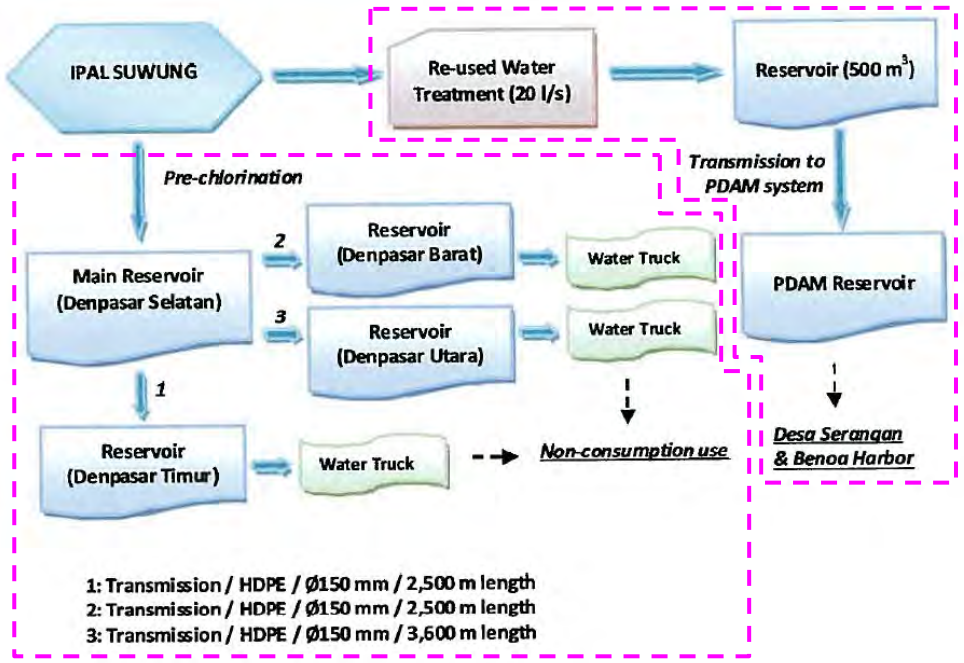


Figure 2.7.2 Proposed Reuse of Denpasar WWTP Effluent by Public Works

Moreover, the study also included a proposal to supply Denpasar city with WWTP effluent treated at the reclaimed water facility (100L/s, 8,640m^3/day) and stored at a reservoir (1,500m^3) to supply to the PDAM reservoir.

Although the above-mentioned reclaimed water utilization plan was formulated, the potential to use most of the reclaimed water as drinking water source was also studied. Two potable water reuse alternatives were examined: i) Direct reuse and ii) Indirect reuse.

Direct reuse would consist of supplying Benoa harbor and new residents of Serangan Island with water from the reclaimed water treatment facility after further treatment at a potable water treatment facility.

Indirect reuse would consist of discharging water from the reclaimed water treatment facility to the Estuary dam where it would be used for swimming or recreation and could be abstracted to supply a potable water treatment plant. Although indirect reuse is mentioned as a possibility in the report there are no concrete details given.

4) Proposed reclaimed water treatment technology

The following processes are selected as the reclaimed water treatment technology.

① Oil separation, ② Coagulation tank, ③ Flocculation basin, ④ Settling basin, ⑤ Filtration basin, ⑥ Sterilization pond, ⑦ Sludge treatment facility

The above-mentioned processing technology is proposed noting that water quality meeting potable water standards can be secured. The alternatives proposed in the selection process are as follows. Storage or transportation method is mentioned inside the parentheses.

The advantage and disadvantage of each process are compared, and Alternative 2 is selected.

i) Physical and chemical treatment process

Alternative 1: Coagulation, Aeration, Sedimentation and sand filtration, Activated carbon filtration, Minerals supply (Storage)

Alternative 2: Coagulation, Aeration, Coagulation, Flocculation, Sedimentation, Sand filtration

(Storage)
Alternative 3: Coagulation, Sand filtration (Storage and transportation by pipe or track)
Alternative 4: Coagulation (Storage, fire hydrant)

ii) Membrane filtration process
Alternative 5: Coagulation, Aeration, Sedimentation, RO module, Storage

5) Business implementation schedule
This study has been carried out in 2009, and the plan to hold a briefing session to the persons concerned (Socialization) in 2011, and pilot project and construction of the facility in 2012 are proposed.

6) Organization
An alternative that PDAM plays a role of operator of the facility is proposed.

7) Cost
19 billion rupiahs for the construction and construction supervision of the facility, and 1 billion rupiahs for dealing with social considerations are estimated in 2009 project cost.

2.7.3 Comments on the Contents of Above-mentioned Study Report

1) Comment on the report by Bali Provincial Government
The report is unclear in the following points such that the feasibility of the project cannot be evaluated. In paticular, the study on whether the reclaimed water would be accepted as a source of drinking water at the resorts (a major consumer), has not been carried out.

- Water demand calculations are not shown. How the reclaimed water is used in Benoa harbor is not mentioned. Details of the resort development plan which becomes the major consumer are not clear.
- Although the plan calls to use the reclaimed water as a source of drinking water for the residents of Serangan Island, there is no supporting material to show that the water would be suitable for domestic consumption.
- The water quality of the treated effluent are not shown and there is no evidence to support that the proposed reclaimed water treatment process can meet drinking water standards.
- Total project cost estimate is very low. O&M cost including redemption cost is very low at Rp. 2,300/m^3.
- The business implementation schedule is set to be completed in 11 months from the facility design to construction supervision. There is a question whether this can be realistically be achieved or not.

2) Comments on the study report by Cipta Karya of PU
This report proposes to reuse the WWTP effluent as drinking water after advanced treatment at the reclaimed water treatment plant, or to use it for irrigation and fire hydrant water after chlorination. Feasibility of the business cannot be evaluated in the following respects.

- It is the plan to supply the reclaimed water produced at the reclaimed water treatment facility to the residents of Benoa harbor and Serangan Island. The actual water quality studies are not shown. Reclaimed water needs to attain the water quality equivalent to drinking water.
- In the study to use the reclaimed water as a drinking water source, there is a part which mentioned RO membrane process. However, the main treatment process proposed is a conventional sand filtration process and there is no supporting data to show whether the water quality would meet drinking water standards.
- Although a whole year is estimated as the briefing session to the persons concerned in the business implementation plan, only one year is estimated for the construction of the pilot facility

and permanent facility. Therefore the schedule is considered to be unrealistic

- The project cost made up of construction cost and construction supervision cost, is very low. O&M cost and the result of financial analysis are not shown. Financial feasibility and proposed tariff are also not shown. Therefore, the financial feasibility of the project is not clear.

CHAPTER 3

LEGAL FRAMEWORK OF PPP INFRASTRUCTURE INVESTMENT IN WATER SECTOR IN INDONESIA

CHAPTER 3 LEGAL FRAMEWORK OF PPP INFRASTRUCTURE INVESTMENT IN WATER SECTOR IN INDONESIA

3.1 Laws & Regulations on Implementation of the Development of Water Supply

In accordance with the laws and regulations, development of water supply was transferred to the local governments. However, sectoral programs that were expected to contribute to the water resources conservation efforts were not integrated nor adequately optimized due to weak coordination among Provinces, among City and Regencies in the same Province or among PDAMs in neighborhood. Then, to solve these institutional problems, in 2004, Law No.7 on Water Resources and, in 2005, Government Regulation No.16 on Development of Drinking Water Supply was enacted. Furthermore, in 2007, Ministry of Public Work enacted Regulation No.18/PRT/M on Implementation of Development of Drinking Water Supply System as a guideline of planning, implementation and management of Water Supply System.

Besides, in view of the limited budget and financial situation of regional governments, Presidential Regulation No. 67 was enacted in 2005 to implement the Development of Water Supply System by the cooperation of Public Private Partnership in order to utilize money and technologies of Private sectors and this Regulation was amended two times in 2010 and 2011. Based on this Regulation, the State Minister of National Development Planning enacted Regulation on General Guidelines for the Implementation of Cooperation between Government and Business Entity in Infrastructure Provision in 2010 and Ministry of Public Work issued the Regulation No. 12/PRT/M/2010 on the Cooperation Guidelines for the Development of Water Supply System.

In order to improve the water quality, Ministry of Public Works enacted Regulation No. 6/2011 on Guidelines Use of Water Resources which specifies guidelines on maintaining quality of the water resources, development of waste water treatment technology and water recycling.

3.1.1 Law on Water Resources

Use of water resources, surface water and groundwater, are regulated by the Governmental Regulation No. 7 of 2004, as follows;

(1) Water Resources

The water is all water found on, above, or below land surface, including surface water, water soil, rain water, sea water on the ground.

(2) Right to use Water

Right to use water consists of following two licenses;

1) Water utilization license
The right to use water is obtained, without permission, to fulfill the basic daily needs for individuals and for agricultural activities of the people who live in the area of the irrigation system. However, permission by the Government or regional government is required if the way to utilize the water may change the natural condition of the water sources, if it may fulfill the need of a group for water in a large quantity or if it may be used for people's agricultural activities outside the existing irrigation system.

2) Water business license
Water business license can be given to individuals or Business Entities with the permit from the Government or regional government in line with their authority.

(3) Drinking water business using water sources

Development of drinking water provision system shall become the responsibility of the Government and regional government. State owned corporation and/or regional owned corporation shall become the operator of the development of drinking water provision system, and, cooperatives, private business entities, and the public can play a role in the implementation of the development of drinking water provision system.

Further details are stated in the Government Regulation No.16 of 2005.

3.1.2 Regulation on Development of Drinking Water Supply System

In order to implement the provision in Article 40 of Law No.7 of 2004 on Water Resources, the Government of Indonesia enacted the Governmental Regulation No.16 of 2005 on Development of the Drinking Water Supply System of which outlines are as follows;

(1) Development of drinking water supply system

- Realization of good-quality drinking-water management and service at an affordable price
- Realization of balanced interest between consumers and service providers.
- Realization of efficiency enhancement and drinking-water services availability.

(2) Authority and responsibility of development of drinking water supply system

- The development of drinking water supply system becomes responsibility of the government and regional governments.
- The organization of drinking water supply system development is done by BUMN or BUMD specially established for the development of drinking water supply system. BUMN is state-owned enterprise and BUMD is regional administration-owned enterprise. In case of BUMN or BUMD being unable to enhance the quality and quantity of drinking water supply service, BUMN or BUMD on the basis of approval of the board of supervisors / commissioners can involve cooperatives, private business entities and/or communities in the organization.
- In case of BUMN or BUMD being unable to realize drinking water supply service needed by communities, the government or regional government can build private drinking water supply service company, partly or wholly.

(3) Participation of cooperatives, Private Business Entities and Communities

Cooperatives and/or private business entities can participate in the organization of drinking water supply system development in regions, areas or zones, not yet accessible by service of BUMN / BUMD, by establishing the organization particularly for business in the provision of drinking water supply system. The involvement of cooperatives and/or private business entities is done on the basis of the principle of fair competition through tender.

Guidelines on procedures for tender are further regulated by Ministry of Public Work Regulation No.18/PRT/M/2007 and Ministry of Public Work Regulation No. 12/PRT/M/2010.

(4) Others

The fostering of regional governments in the development of drinking water supply system is realized by the government. The fostering of BUMN or BUMD is executed by the government and/or regional governments.

Agreements on organization and licensing related to drinking water management already made or issued before the stipulation of this government regulation shall be declared remaining effective until the agreements or licenses expire.

(*) Business license given to PT Tirta Artha Buana mulia (PT TB) in the drinking water supply service in Southern Bali will expire on December, 2012. PDAM Badung has 45% equity share in PT TB.

3.1.3 Regulation on Implementation of the Development of Water Supply

(1) Ministry of Public Work Regulation No.18/PRT/M/2007

This Regulation is a guideline on Implementation of the Development of Drinking Water Supply System (SPAM) from planning stage to evaluation after construction and implementation.

1) Implementation

The project company can be in the form of central/regional governmental company, cooperation, private entity, and/or society which conduct the implementation of the development of drinking water supply system.

2) Feasibility Study

The feasibility study of the development of SPAM shall be conducted in order to determine the feasibility level of the proposed development of SPAM within the relevant service area in terms of technology aspect, environment, social culture, economic, institution, and financial

The Feasibility Study of the development of SPAM shall be conducted based on the Master Plan and review of financing sources.

3) Public Private Partnership (“PPP”) in the development of SPAM

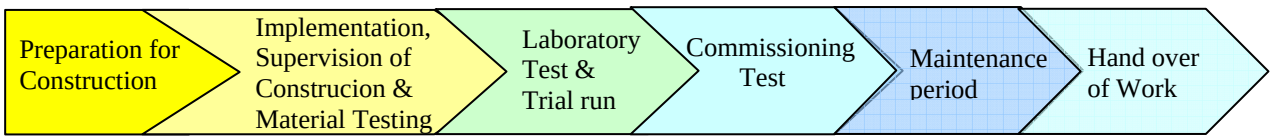
In the event that the development of SPAM is conducted trough PPP scheme then the feasibility study shall be prepared either by government and/or initiator. The feasibility study shall also review risk allocation and shall be used as tender document for the PPP. Detail procedures of Procurement (Tender) are regulated in the Ministry of Public Work Regulation No. 12/PRT/M/2010 “The Cooperation Guidelines for the Development of Water Supply System”.

4) Technical planning of the development of SPAM

Technical planning shall be detailed on the development of SPAM within city or area which include raw water unit, production unit, distribution unit, and service unit. The technical planning shall be conducted in accordance with the master plan, result of the feasibility study, construction implementation schedule, and certainty on the financing sources and the result of technical consultation with the relevant technical agency. The planning shall also consider the integration with the development of sanitation infrastructure and facility.

5) Construction of SPAM

Implementation of the Construction shall be conducted based on the result of the technical planning of SPAM and construction of SPAM shall be conducted by the Project Company which can be carried out by itself or trough construction service provider.



6) Management of SPAM

SPAM shall be managed by establishing implementation organization which shall be composed of Operation and utilization activity and Administration and institutional activity.

7) Reporting Obligation

- Project Company shall provide performance report of the development of SPAM to the regional government every month.
- Project Company shall provide performance report of the development of SPAM to the Minister through BPP-SPAM quarterly.
- Project Company shall provide financial report and performance report which has been audited by the authorized institution to the government with copy to BPP-SPAM

(2) Ministry of Public Work Regulation No. 12/PRT/M/2010 on the Cooperation Guidelines for the Development of Water Supply System

This Regulation is established as a Guideline of Implementation of the Development of Water Suppy System under the cooperation between Government and Business Entity, based on the State Minister of National Development Planning Regulation No. 4 of 2010 on General Guidelines for the Implementation of Cooperation between Government and Business Entity in Infrastructure Provision.

The development of SPAM shall be conducted by central and regional government. In carrying out their duties, central and regional government may establish State Own Enterprise/Regional Own Enterprise as the implementer of the development of SPAM and involve Business Entity to participate in the implementation for the development of SPAM

The Contracting Agency of SPAM will be Minister of Public Work for cross province, Governor for cross regency within province or Regent/Mayor for regent/city. Governor or regent/mayor may delegate its authority as Contracting Agency to Regional Secretary (SEKDA) or head of agency or officials

Other details will be described in Section 3.2 Legal Framework of PPP Infrastructure Investment in Indonesia.

3.1.4 Study in Legal Aspect about Supply of Reclaimed Wastewater through PDAM

Pursuant to Government Regulation No. 16/2005, water supply services shall be carried out by a relevant region-owned enterprise. Mostly, every region in Indonesia has established PDAM to undertake this service (including for water supply services in Badung and Denpasar). The terminology of PDAM is the abbreviation of "Regional Company for Drinking Water". With this label, there is a question whether PDAM is allowed to purchase non-drinkable clean water for water supply services other than for drinking.

Under G.R. No. 16/2005, drinking water is defined as "drinking water for households, which shall meet health requirements and drinkable with or without any treatment process". With this understanding, one

can conclude that it is the intention of the G.R. No. 16/2005 for the government (including municipal governments) to be able to provide drinking water for the community. This regulation, however, does not provide any limitation if the government is willing to provide additional services, i.e. to provide clean water for purposes other than for drinking.

To address the question whether PDAM is allowed to purchase water and sell it for purposes other than for drinking, one shall refer to the power granted to such PDAM based on its statutory/ corporate documents. Individual assessment shall be made against each PDAM in question (in this case PDAM Denpasar and PDAM Badung):

(1) PDAM Denpasar.

Based on the Denpasar City's Regional Regulation No. 3/2009, the main function of PDAM Denpasar shall provide drinking water supply services to the community. There are, however, several clauses in this Regulation No. 3/2009 which indicate that PDAM is allowed to provide clean water for purposes other than for drinking.

Such articles are:

- Article 2 para (c) which sets out that one of PDAM Denpasar functions is to provide services to the community, particularly in relation to the fulfillment of the needs of the community for 'drinking' which is healthy and meets the applicable requirements.

The notion 'particularly for the needs of drinking water' may be interpreted that there are other services which can be provided by PDAM.

- Article 5 para (b) which sets out that the function of PDAM Denpasar includes providing services, generating revenues from the sale of 'water' which can cover all costs necessary in carrying out the 'drinking water supply system'.

The term as provided in this paragraph refers to just 'water'. This may be interpreted that PDAM Denpasar is allowed to carry out business of sale of clean water (other than drinking water) in addition to its main function, i.e. to provide drinking water for the community.

(2) PDAM Badung

In Article 4 para (d) of the Badung Regency's Regional Regulation No. 6/2005, it is mentioned that one of the function of PDAM Badung shall provide services to the community for fulfillment of the needs of 'clean water'. Furthermore, in Article 4 para (d), the other function of PDAM Badung is to control the use of water equally and efficiently as well as to prevent the wild extraction of water subject to the prevailing laws and regulations.

Pursuant to the above analysis, it may be understood that both PDAM Denpasar and PDAM Badung are allowed to purchase and sell clean water for purposes other than for drinking.

3.1.5 Laws & Regulations on Water Supply Development and Financial Recovery of PDAMs

Followings are present prevailing main laws and regulations concerning Water Supply Development and Governmental Support for Financial Recovery of PDAMs

Table 3.1.1 Laws & Regulations on Water Supply Development (excluding PPP Framework)

	Law/Regulation	Outline
1)	Minister of Public Works Regulation No. 48 of 1990 Management of Water and Water Source in River Area	This regulation stipulates the distribution of authority on the management of water and water source in river area.
2)	Minister of Public Works Regulation No 49 of 1990 Procedures and License Requirements for Utilization of Water and Water Source	Any utilization of water and water source for particular needs, especially for utilization that may affect the water system balance, shall be subject to obtaining of the required license from the authorized party(ies).
3)	Ministry of Health Regulation No. 416 of 1990 Water Quality Monitoring	This regulation principally governs the requirement for drinking water, clean water, swimming pool water and public bath water. However, the provision for drinking water has been revoked and declared invalid by the enactment of Ministry of Health Regulation No. 907/MENKES/SK/VII/2002 as amended by Ministry of Health Regulation No. 492 of 2010 on Requirement for Drinking Water Quality.
4)	Minister of Public Works Regulation No 63/PRT/1993 River and Border Line, River Utilization Area, River Control Area and Used River	This regulation stipulates the utilization of river and its surroundings area, and the related licenses required for such utilization.
5)	Minister of Forestry Regulation No. 52/Kpts-II/2001 Guidelines for River Flow Area Management	This regulation is a guideline for central / regional government to stipulate policies of utilization to the community in the River Flow Area. Such a guideline is explained in the Attachment of this regulation
6)	Government Regulation No. 82 of 2001 the Management of Water Quality and Water Pollution Control	The management of water quality and water pollution control may be conducted by third party in accordance with the prevailing laws and regulations.
7)	Ministry of Environment Decree No. 112 of 2003 Domestic Wastewater Quality Standard	Domestic Wastewater consists of wastewater form business and/or real estate activities, restaurant, office, trade, apartment and dormitory.
8)	Law No.7 of 2004 Water Supply	This Law defines the responsibility and authority of central / regional government with regard to; a. control of water resources b. development of water supply system c. approval of granting the right to use water to individual or project company. State/ regional owned enterprise shall be the implementer of the development of water supply system, cooperation, private, and society can participate in the development of water supply system. The development of water supply system shall be integrated with the development of sanitation infrastructure and facilities.

	Law/Regulation	Outline
9)	Government Regulation No. 16 of 2005 the Development of Water Supply System ("SPAM")	Raw water shall meet the quality standard for supply of drinking water in accordance with the prevailing laws and regulations. Production unit is an infrastructure that can be used to process raw water into drinking water through physical, chemical, and/or biological treatment. The final waste of the water treatment process into drinking water must be treated before being discharged into water sources and open areas.
10)	Ministry of Public Work Regulation No. 18/PRT/M/2007 the Implementation of the Development of Drinking Water Supply System	This regulation stipulates the implementation of the development of drinking water supply system (**"SPAM"**) covering planning, construction implementation, management, maintaining, rehabilitation, supervising, and/or evaluating physically and non-physically of the water supply.
11)	Ministry of Public Work Regulation No. 16/PRT/M/2008 National Policy and Strategy in the Development for Settlement of Residential Waste Water Management	This Regulation is a guidline in the development of residential waste water in order to acquire the national target for the management of residential waste water through planning, programming, financing, and sustainable implementation, effectively and efficiently.
12)	Government Regulation No. 42/2008 Water Resources Management	Water resources management policy shall includes conservation aspect, utilization of water resources, control on destructive force of water, and water resources information system prepared by taking into account the condition of each region. Relevant ministers or regional governments shall conduct water saving efforts to prevent from water crisis. The saving efforts among others: a. To implement progressive tariff; b. To utilize water efficiently and effectively for all kind of purposes; c. To prevent from losses or leaks at the water resources, piping or transmission, water treatment plant, distribution networks and service unit; d. To develop and implement water saving technologies; e. To implement repeated use of water by recycling the water that has been used f. To provide incentives for those who conduct water saving; g. To provide disincentives for those who conduct wasting of water
13)	Ministry of Public Works Regulation No. 22/PRT/M/2009 the Guidelines for the Preparation of Utilization of Water Resources	This regulation is intended as the guideline for central / regional governments, and water resources organizers for the purpose of developing water resources management pattern of the river area in accordance with its authority and responsibility.

<table>
<tr><td></td><td>Law/Regulation</td><td>Outline</td></tr>
<tr><td>14)</td><td>Ministry of Public Work Regulation
No. 12/PRT/M/2010
the Cooperation Guidelines for the Development of Water Supply System</td><td>This is a Guidline for Implementation of Development of SPAM under PPP frame work which was established based on the State Minister of National Development Planning Regulation No. 4 of 2010 on General Guidelines for the Implementation of Cooperation between Government and Business Entity in Infrastructure Provision.</td></tr>
<tr><td>15)</td><td>Ministry of Health Regulation
No. 492 of 2010
Requirement for Drinking Water Quality</td><td>This Regulation specifies Drinking water quality with regard to microbiology, chemical and radioactive in order to secure the drinking water to meet the requirements of physics for health.</td></tr>
<tr><td>16)</td><td>Ministry of Public Works Regulation
No. 6/PRT/M/2011
Guidelines of Use of Water Resources</td><td>This regulation states a Guideline for maintaining the quality of Water Resources to keep Water Quality Standard.

Quality of Water resources shall be maintained through prevention of water pollution by means of:
a. development of collection network and Waste Water Treatment Plant (“WWTP”);
b. monitoring and evaluation on water quality
c. implementing O&M of tidal marsh reclamation network according to the guidelines & manuals
Also, to prevent water pollution, it defines users’ obligations to process waste water before discharge into water sources as follows;

<table>
<tr><td></td><td>User</td><td>Type of WWTP</td></tr>
<tr><td>a</td><td>large number of group</td><td>centralized domestic WWTP</td></tr>
<tr><td>b</td><td>industry</td><td>WWTP within/ouside of Industrial area</td></tr>
<tr><td>c</td><td>hospital</td><td>WWTP for hospital</td></tr>
<tr><td>d</td><td>hotel</td><td>WWTP for hotel</td></tr>
<tr><td>e</td><td>other business</td><td>WWTP for business activity</td></tr>
</table>

Result of the processing shall be periodically reported by users to licensors of water resources with copy to related institutions in environmental management and water resources management;

Water Recycling shall be carried out by water user groups in large numbers, hotel, hospital, and industry by developing of water recycling installation.</td></tr>
</table>

Table 3.1.2 Law & Regulation on Financial Recovery of PDAMs

	Law/Regulation	Outline
1)	Ministry of Public Works Regulation No. 294/PRT/M/2005 BPP-SPAM (BADAN PENDUKUNG PENGEMBANGAN SISTEM PENYEDIAAN AIR MINUM)	With this regulation, BPP-SPAM was established as an Agency with the intent to assist the Government in achieving the objectives of the Development of Drinking Water Supply System (SPAM) include: a. realization of management and service quality drinking water at an affordable price; b. achieve a balanced interest between consumers and providers of services; and c. achieving increased efficiency and coverage of drinking water services.
2)	Minister of Home Affairs Regulation No. 23/2006 Techincal Guidelines and Procedures for Setting Water Tariff for PDAM	This Regulation specifies Basic Tariff Policy of which summary are as follows a. Tariff for the basic needs of drinking water must be affordable by the community whose income is equal to the provincial minimum wage, the tariff shall not exceed 4% of residential expenditure. b. The income for PDAM shall meet the cost recovery principle, the full cost recovery shall be obtained by calculated the minimum average tariff equal to the basic costs. For the development of drinking water services, the average tariff shall cover the basic costs added by reasonable profit. The reasonable profit shall be 10% of the productive assets amount. c. To achieve effective use of water, progressive tariff shall be charged to customers whose consumption exceeds the basic needs of drinking water standards.
3)	Minister of Finance Regulation No. 120/PMK.05/2008 Debt Restructuring of PDAM, Foreign Loans, Investment Fund Account and Regional Development Account	This Regulation is enacted on PDAM Debt Restructuring. In comparison to the previous regulations for the restructuring of PDAM arrears, this Regulation sets out much more simplified procedure and more inclusive participation requirements. Furthermore, it allows for the complete write-off on non-principal arrears (interest and penalties) for financially unhealthy PDAMs or a debt-equity swap of non-principal arrears for healthy PDAMs. This Regulation also puts forth 3 pre-conditions for obtaining MOF approval. a. PDAM must put in place cost recovery tariffs. b. leadership of the PDAM must be appointed through a transparent fit-and-proper test. c. PDAM must compile a Business Plan which sets forth the proposed restructuring of the overdue debts. This Regulation offers a good opportunity for PDAMs to deal with overhanging loans once and for all, and, in doing so, open the doors for new investment.

	Law/Regulation	Outline
4)	Minister of Finance Regulation No. 153/PMK.05/2008 Debt Restructuring of PDAM, Foreign Loans, Investment Fund Account and Regional Development Account	The Regulation states the settlement of the State receivable accounts arising from Forwarding Foreign Loan, Investment Fund Account and Regional Development Account which is distributed by the government to local government. The settlement intends to; a. optimize the completion of Arrears; b. help local governments resolve Arrears on loans c. opens the opportunity for Local Governments to invest. Criteria for Loan Restructuring shall be elimination of all Arrears of Non Principal; or combination of removal of part of Non Principal Arrears and Debt Swap.
5)	Presidential Regulation No. 29/2009 Provision of Guarantees and Interest subsidy by the Central Government in Accelerating to Supply Drinking Water	GOI initiated this Presidential Regulation with the intention of increasing the commercial viability of PDAMs to enable them to access subsidised loans through private sector lending institutions. The strategy is significant as there are currently 375 recognised water enterprises (including PDAMs) across Indonesia requiring various levels of technical and financial support. (1) In order to accelerate provision of drinking water supply, the Central Government shall provide: a. guarantee on settlement of PDAMs loans to banks b. subsidy on interest charged by banks. (2) In the event that PDAM defaults on partial or entire liabilities that are due based on a loan agreement, the Central Government shall bear 70%. Each provision of Central Government guarantees shall be initiated with a principal agreement (umbrella agreement) between the Central Government through the Minister of Finance, Local Government and PDAM, which shall include the following statement of the Governor/Mayor/Regent a. willingness to bear a burden of 30% from Local Government Budget and/or convert a burden of 30% as the Local Government debt to the Central Government b. willingness for deducting the General Allocation Fund (DAU) and/or Profit Sharing Fund if the Local Government fails to pay the loan. (3) In the context of investment lending to PDAM, the bank shall set assessment criteria in accordance with banking regulations and the Minister of Public Works shall provide guidelines regarding technical feasibility of investment projects proposed by PDAM. (4) The interest rate of the investment loan facilitated by the bank to the PDAM shall be determined based on the central bank's rate plus 5% (five percent) with the following provisions: a. an interest rate suitable with the central bank's rate shall be borne by PDAM

	Law/Regulation	Outline
		b. the difference of interest rate above Central Bank's rate within no higher than 5% shall be a subsidy borne by Central Government.

3.2 Legislative System of PPP Infrastructure Investment in Indonesia

3.2.1 Legal Framework for PPP Infrastructure Investment

The present legal framework of PPP infrastructure provision consists of the following 3 parts;

(1) Legal framework of license and cooperation agreement (as shown ① in the Figure 3.2.1).

Presidential Decree No. 67/2005 as amended by No. 13/2010 and No. 56/2011, provides a general framework for Private Sector Participation in infrastructure provision. This legislation identifies two forms of Private Sector Participation (partnership and licensing) and specifies that the project company must be selected through open tender. Further, it specifies that tariffs have to be set for full cost recovery and provides for a subsidy to cover public service obligations if tariffs exceed consumers' ability to pay.

(2) Institutional structure to accelerate PPP infrastructure investment, (KKPPI, P3CU)
(as shown ② in the Figure 3.2.1).

The institutional structure within the Government for dealing with PPP projects has been reinforced through legislation. Presidential Decree No. 42/2005 strengthened the National Committee for the Acceleration of Infrastructure Provision (KKPPI) as a high-level entity, advising to the President on infrastructure. Coordinating Ministry for Economic Affairs (CMEA) enacted three Regulations to supports the KKPPI and to specify the guidelines on the detail procedures.

(3) Risk Management framework by the government guarantee and government support
(as shown ③ in the Figure 3.2.1).

Ministry of Finance (MOF) Regulation No. 38/2006 provides for the creation of a Risk Management Unit within MOF was issued to ensure that risks of individual PPP projects will be appropriately allocated between the public and private sector.

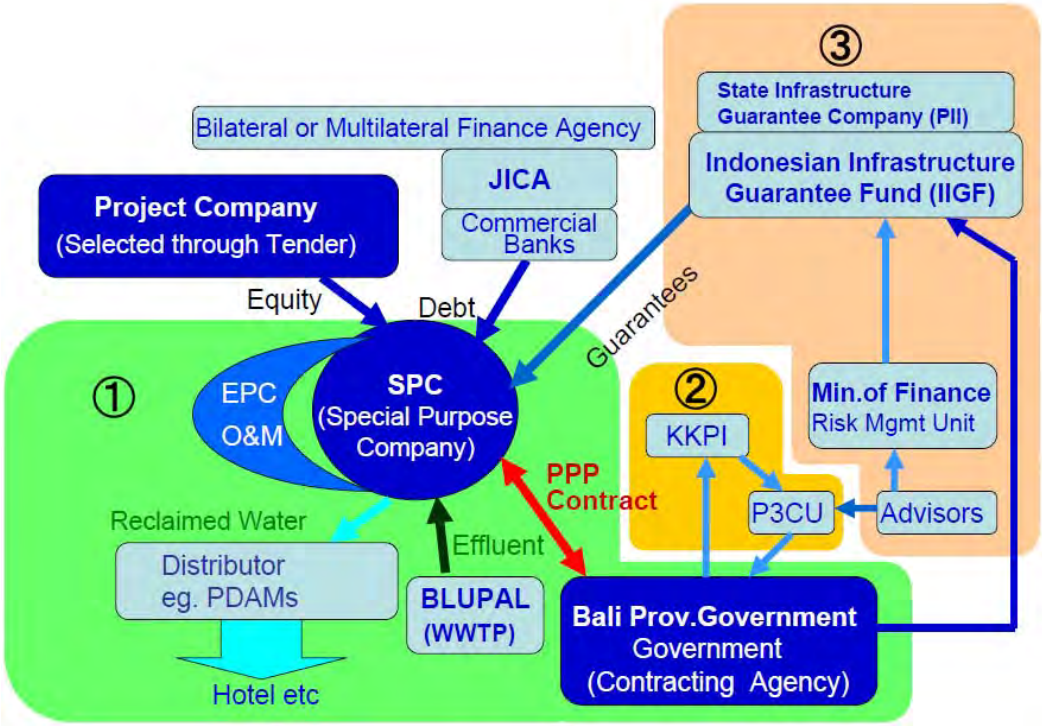


Figure 3.2.1 Legal Framework of PPP Infrastructure Investment

3.2.2 License & Cooperation Agreement under PPP Legal Framework

The prevailing PPP regulatory framework is Presidential Regulation No. 67/2005 as amended by No. 13/2010 and No. 56/2011. The authority to enter into PPP contract is governed under the Law No. 7/2004 and shall be based on the guideline in the Minister of Public Works Regulation No. 12/2010.

(1) Contracting Agency

The Minister of Public Works Regulation No. 12/2010 specifies the responsibility & obligations of the Contracting Agency and who should be the Contracting Agency.

1) Responsibility & Obligations of the Contracting Agency

- To implement planning, preparation, transaction of the project and management of the contract
- To establish tender committee, determine tender winner and establish evaluation team

2) Who should be the Contracting Agency

- Minister of Public Works if the service area of the Cooperation for Development of Water Supply System is cross province;
- Governor if the service area of the Cooperation for the Development of Water Supply System is cross regency/city in one province
- Regent/Mayor if the service area of the Cooperation for the Development of Water Supply System is located in one district/city.

(2) Requirement of Procurement of the Project Company.

Pursuant to Article 18 of Presidential Regulation 67/2005, the Project Company shall be procured through public open tender.

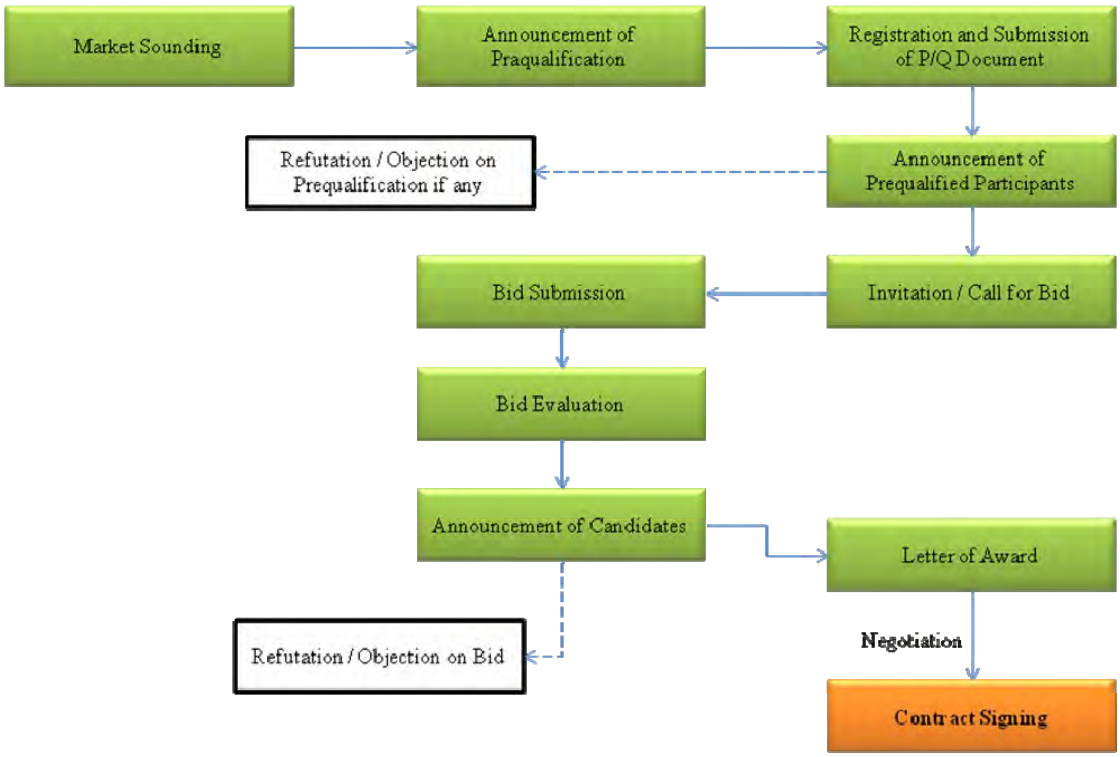


Figure 3.2.2 Procurement Process of Project Company

(3) PPP Contract (Cooperation Agreement)

The winning bidder in the tender and the Contracting Agency shall execute a Cooperation Agreement in accordance with the Presidential Regulation No. 67/2005. The following are several important points that have to be included in the Cooperation Agreement:

- Performance bond.
  In the event the project needs a land acquisition, the calculation of performance bond will be based on the cost paid by the Project Company to procure the land.

- Tariff and adjustment mechanism
  In relation to the sectorial law of the project, the tariff adjustment mechanism shall be in accordance with Minister of Home Affairs Regulation No. 23/2006.

- Rights and obligation, including risk allocation

- Minimum service standard

- Share transfer
  Shares transfer before the project is commercially operated (can only be done after have an approval and in accordance with the criteria sets out by the Contracting Agency, noted that such shares transfer does not delay the operation schedule of the project).

- Usage and ownership of the infrastructure asset

- Transfer of the asset
  Prior to the transfer, the asset shall be appraised by appraisal team. The appraisal team cost shall be borne by the mutual agreement between the Project Company and the Contracting Agency

(4) Project Company (SPC)

Project Company (SPC) shall be formed as an Indonesian legal Entity, therefore, if a foreign entity is awarded with the contract then such foreign company is obliged to form an Indonesia legal entity in accordance with the prevailing laws and regulations.

(5) Financial Close

There is an obligation imposed to the Project Company to obtain a financial close. The financial closing shall be reached at the latest of 12 months after the signing of the Cooperation Agreement. Such period may be extended if the source of default is not from the solicitor. In the event the solicitor failed to obtain the financial close, the Cooperation Agreement may be terminated and the performance bond of the Cooperation Agreement shall be disbursed.

(6) Unsolicited Proposal for Project

1) Initiator of the Unsolicited Project

Pursuant to the Presidential Regulation No. 67/2005 as last amended by Presidential Regulation No. 56/2011 the Initiator for the Unsolicited Project is a private business entity which may in the form of Limited Liability Company, State-owned Enterprise, Regional-owned Enterprise or cooperatives which by definition limited to Indonesian legal entity. However, Presidential Regulation No. 56/2011 has introduced the term of Foreign Legal Entity in order to give wider definition and to open the possibility of

foreign company to participate as the Initiator of Unsolicited Project.

2) Criteria as Unsolicited Proposal

The prevailing regulations on PPP provide the opportunity for business entity to propose and initiate a PPP project. To propose such project, the initiator must provide certain documentation, provided however, that such proposal shall meet eligibility criteria as set out in this Regulation.

To be deemed as an unsolicited proposal, the project proposal shall meet the following eligibility criteria:

- The project has not been included in related sector master plan.
- Technically integrated with related sector master plan.
- Financially and economically feasible
- Does not need any government support in the form of fiscal contribution.
- Fiscal contribution is a financial supports that are given by the Government, i.e. support in the form of direct financial support. The solicitor is required to assure the government that the project does not need any fiscal contribution from government.

3) Submission of the Unsolicited Proposal

An Unsolicited Proposal to be submitted by the Initiator to the Contracting Agency shall cover several documents including (1) feasibility study, (2) modality concept, (3) financing scheme including the source of such financing, and (4) bidding plan which shall include the time frame and evaluation criteria. The status of "Initiator" can only be granted after the full set of documents has been accepted by the Contracting Agency. In practice, before the Initiator submits a complete set of documents, usually the Contracting Agency and the Initiator make some sort of Memorandum of Understanding or a Comfort Letter, confirming that such potential Initiator will be given the opportunity to do the study and submits the Unsolicited Proposal once the study is finished

4) Compensation

The Contracting Agency shall review the Unsolicited Proposal. If the project meets the eligibility criteria, then Contracting Agency can accept such project and the project can be tendered out. The Initiator shall be compensated by the Contracting Agency, in the form of:

- Additional points

  In the event that the Initiator is intending to participate in the tender for such project, then the Initiator can be given additional point of maximum 10% of the total score. This method, however, can only be applicable if the evaluation method is using weighing system (instead of lowest tariff system)

- Right to match

  If the evaluation method is using lowest tariff system, then the Initiator can be given the right to match, i.e. the right of the Initiator to match the best price/ lowest tariff proposed by the other bidder. The right to match shall be exercised within a period of 30 days after the best price/ lowest tariff in the tender has been announced

- Purchase of the proposed project

  If the Initiator is not intending to participate in the tender, then the Initiator can sell the project to the Contracting Agency. The payment shall be made, however, by the winning bidder to the initiator

(7) Governmental Support and guarantee

1) Governmental Support

Government Support refers to a fiscal or non-fiscal support/ contribution provided by the Contracting Agency and/or Minister of Finance in order to enhance the financial feasibility of the project. Government is allowed to give support to the project in the form of licensing, land acquisition, partial construction and other form of support in accordance with the applicable sector laws and regulations.

Pursuant to the Presidential Regulation No. 67/2005, the government may provide support in the form of tax incentives and/or fiscal contribution based on the request from the Contracting Agency to the Minister of Finance. There are, however, regulatory issues in place, which make it difficult to realize fiscal contribution support (e.g. in the form of providing Viability Gap Funding) to the project. An Unsolicited Project cannot obtain support in the form of fiscal contribution.

Support in other form, e.g. utilization of government assets, licensing and so on shall follow the laws and regulations prevailing to it which can be also applied to the Unsolicited project.

2) Government Guarantee

In order to promote investment in infrastructure sector, the Government of Indonesia has established Indonesia Infrastructure Guarantee Fund (IIGF) through the formation of PT Penjaminan Infrastruktur Indonesia (PT PII). Originally, PT PII was established for the purpose of providing guarantee for certain political risks, which usually involve the action or omission of the government (e.g. tariff adjustment risks, land acquisition delay, and breach of contract by the government) and certain commercial risks (e.g. demand risks).

To obtain a guarantee from IIGF, a proposal shall be submitted in accordance with IIGF's guideline (Infrastructure Guarantee Provision Guideline of March 2011) by the Contracting Agency, and not by the Initiator or the Project Company.

3) There are four stages required for a guarantee to be issued by IIGF as illustrated below;

- Consultation /Guidance
  to explore value of a guarantee to the proposed project and to prepare for further steps.

- Screening of the project
  if information on the project in a Screening Form meets the screening requirements.

- Appraisal on
  - feasibility of the project from legal, technical, economic and financial aspects, as well as environmental and social
  - ability of the Contracting Agency to fulfill its financial obligations

- Guarantee Structuring
  to determine the structure of guarantees as well as preparing the terms and conditions for the guarantees, such as guarantee tenor, coverage of risks and financial obligations

Figure 3.2.3 shows the procedures in four stages which are required for a Guarantee to be issued by IIGF.

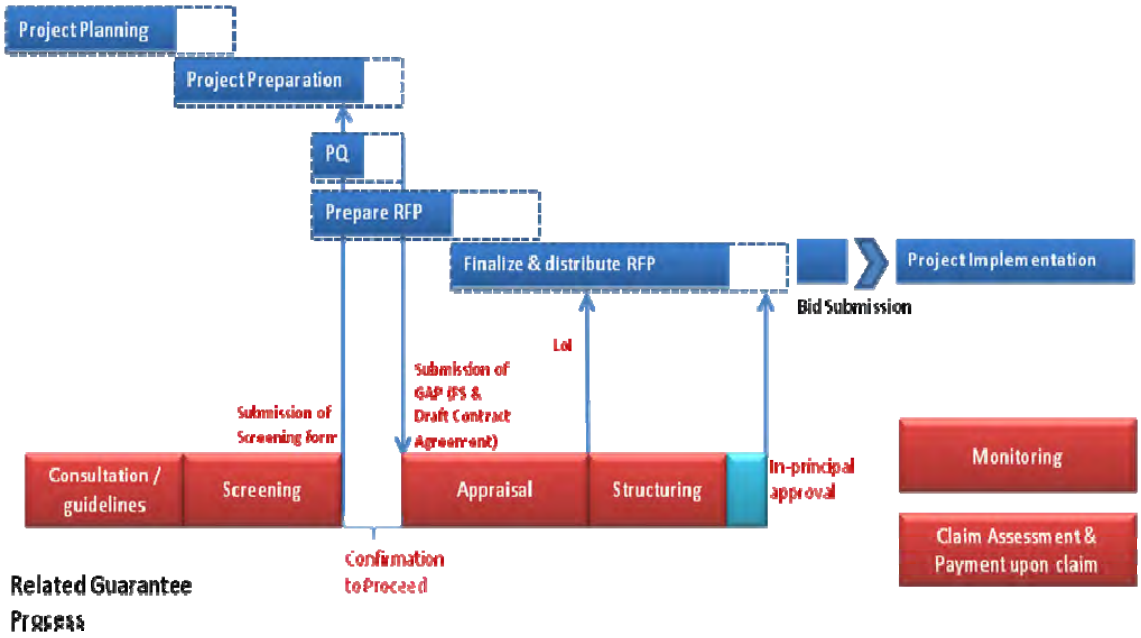


Figure 3.2.3 IIGF - Related Guarantee Process

4) Eligibility Criteria, Risks and Appraisal Process

The figure 3.2.4 shows the general eligibility criteria, risks and appraisal process by IIGF:

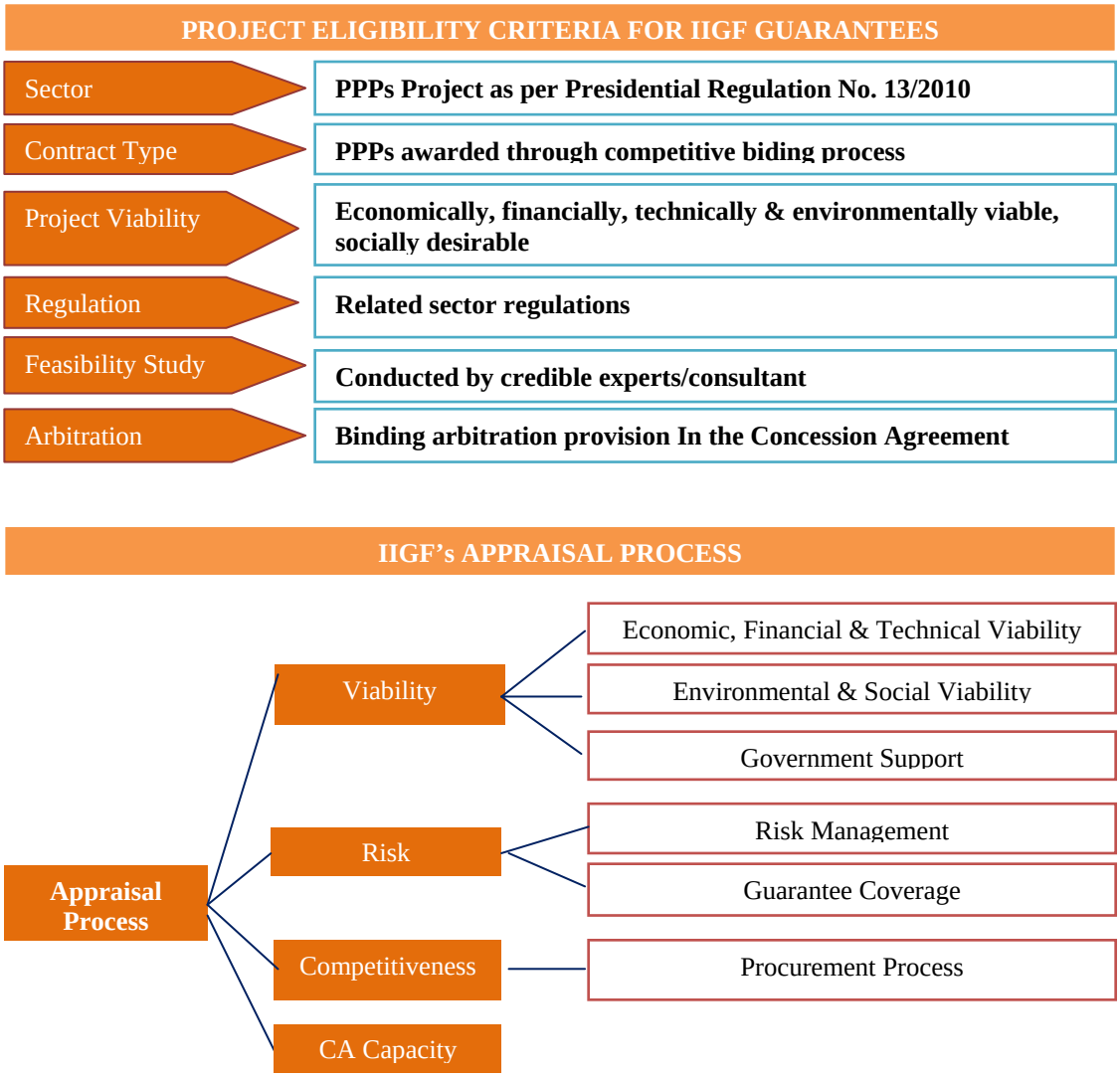


Figure 3.2.4 IIGF – Currently Available Guarantee Structure

5) Guarantee Fee

Guarantee fee of the IIGF shall be borne by the Project Company.

Guarantee Fee consists of two fees,

- One-Time fee: approximately 50 basis point or 0.5% of the project value
- Recurring fee: approximately 75 basis point or 0.75% of the maximum exposure guarantee

6) Involvement of IIGF in the project

IIGF's involvement shall start in the preparation of the project. However, such involvement is limited to consultation for the preparation of the project. During the tender process, bidder may conduct consultation with IIGF, so that related parties could have same understandings regarding the risks of the project.

(8) Comparison between Solicited Project and Unsolicited Project

1) Process of Implementation of Cooperation Agreement

i) Solicited Project

The Contracting Agency shall, in principle, implement the whole procedures, except for implementation of the project to be done by Project Company under BOT contract.

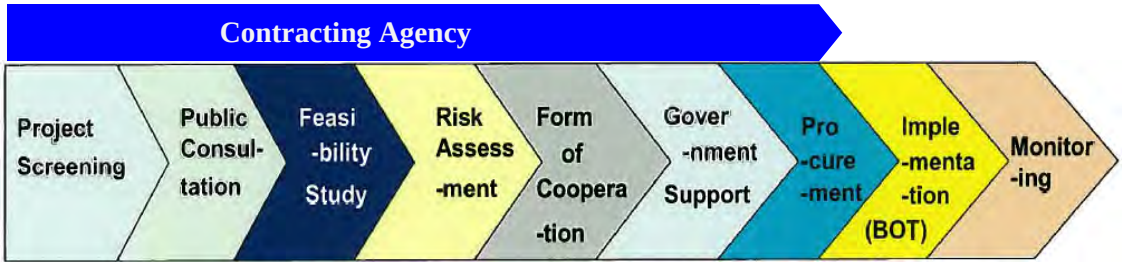


Figure 3.2.5 Process of Implementation of Cooperation Agreement (Solicited Projects)

ii) Unsolicited Project

Initiator shall plan and implement the complete feasibility study including preparation of a draft of the tender documents.

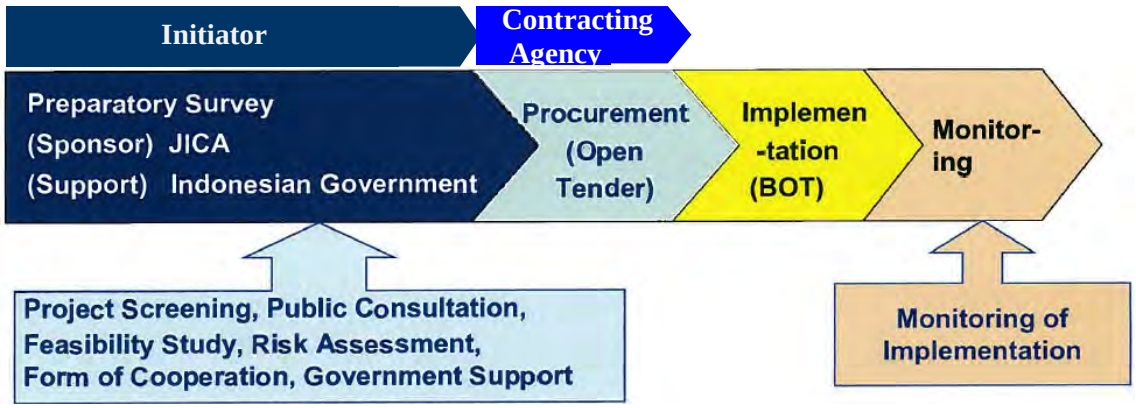


Figure 3.2.6 Process of Implementation of Cooperation Agreement (Unsolicited Projects)

2) Government Support and Guarantee

Government Support in a form of fiscal contribution cannot be applied to Unsolicited Project, although Government Guarantee and Government Support in a form of non-fiscal contribution can be applied to Unsolicited Project.

3) Approach and negotiation with PT PII regarding Government Guarantee

PT PII will only deal with the Contracting Agency. However, if it is unsolicited project, then the Initiator may also conduct the consultation with PT PII based on the MOU between the Contracting Agency and the Initiator.

3.2.3 Law & Regulations related to implementation of PPP projects

There are several applicable laws and guidelines needed to be followed when establishing PPP projects. These laws and guidelines will be applicable depending on the context. Followings are list of the laws and regulations which are assumed to be concerned with implementation of Development of Water Supply System under PPP legal framework.

Table 3.2.1 Legal Framework of PPPInfrastructure Investment Provision

	Law/Regulation	Outline
1)	Presidential Regulation No. 67/ 2005 No. 13/ 2010 (1st amended) No. 56/ 2011 (2nd amended) Cooperation between Government and Business Entity in Infrastructure Provision	This Regulation stipulates objective, principle and general provisions of the Cooperation between the Government and the Business Entities in implementation of the Infrastrucure provision.. By the amendment No.13/2010, implementation of the project by initiator are added as Unsolicited project with its required criteria and compensation. Furthermore, the amendment No.56/2011 introduced to give wider definition and to open the possibility of Foreign company to participate as the initiator of unsolicited project. The Government Contracting Agency may be at the regional or national level, Minister/Chairman of the Institute/Head of the Region. A PPP projects may be based on either a government license (operational Permit) or a Cooperation Agreement. To accelerate PPP Infrastructure Investment projects in view of the significance in improving the social benefits, the government support in the form of fiscal and non-fiscal contributions and government guarantee may be provided and improving the low financial feasibility. But, the government support in the form of fiscal contributions cannot be applied to Unsolicited Project.
2)	Coordinating Ministry of Economic Affairs Regulation No. 4/ 2006 Evaluation Methodology for PPP Infrastructure Projects require Government Support	This Regulation consists of; - Guidelines of application procedures for PPP Infrastructure Investment project which require the government support. - Guidelines to establish the committee to evaluate such PPP Infrastructure Investment projects are stipulated.

	Law/Regulation	Outline
3)	State Minister of National Development Planning Regulation No. 3 of 2009 Guidelines for the List Arrangement of the Prospective Projects between Government and Business Entity in Infrastructure Provision	This Guideline requests the Contracting Agency to submit to the State Minister of Development Planning following documents and information; 1) Project Preparation Plan and its Brief Description covering; a. Pre-feasibility study including legal aspect review, technical evaluation, social benefit & cost analysis and fnancial analysis; b. Risk review; c. Government support review (if needed); d. Agreement modality/form review; 2) (In case of Unsolicited projects) Unsolicited Project Proposal which shall cover: a. fulfilling the requirements in Presidential Regulation No. 67/ 2005; b. pre-feasibility study which confirm the project technically, legally and financially feasible; c. outcome of the risk identification and its allocation; d. cooperation form which has been identified; e. necessity of the government support which has been identified.
4)	State Minister of National Development Planning Regulation No. 4 of 2010 General Guidelines for the Implementation of Cooperation between Government and Business Entity in Infrastructure Provision	This is the General Guideline for the implementation of the infrastructure projects under PPP framework. Relevant Ministries shall establish their own Guideline for implementation of their projects under PPP framework based on this Guideline. The Contracting Agency shall be responsible to implement the project at each stage as illustrated below; a. Preparation stage, Project identification, Project selection and priority determination. b. Pre-feasibility study preparation, preliminary review, review of readiness and final review. c. Transaction stage, planning and implementation of the Tender and execution of the Cooperation Agreement. d. Implementation management stage, planning and implementation of the cooperation agreement
5)	Ministry of Public Work Regulation No. 12/PRT/M/2010 the Cooperation Guidelines for the Development of Water Supply System	This is the Guidline for Implementation of Development of Water Supply System under PPP frame work, based on the State Minister of National Development Planning Regulation No. 4 of 2010.

Table 3.2.2 Legal Framework on the Committee to accelerate PPP Infrastructure Investment

	Law/Regulation	Outline
1)	Presidential Regulation No. 42/ 2005 No. 12/ 2011 (Amended) Committee for Provision of Infrastructure Acceleration	With this Regulation, the committee (KPPI) was established to accelerate PPP Infrastructure Investment provision. The provision in Regulation No. 42/2005 was partly amended by No. 12/2011.
2)	Coordinating Ministry of Economic Affairs Regulation No. PER-01/M.EKON/05/2006 Organization and Work Committee for the Acceleration of Infrastructure Provision	Guidelines of organization and procedures of the committee, (KPPI) accelerating PPP Infrastructure Investment provision.
3)	Coordinating Ministry of Economic Affairs Regulation No. PER-03/M.EKON/06/2006 Procedures, Method and Criteria for Preparation of Project Priority List	Guidelines of criteria and procedures to determine the priority list of PPP Infrastructure Investment provisions
4)	Coordinating Ministry of Economic Affairs Regulation No. PER-04/M.EKON/06/2006 Project Evaluation Procedures	Guidelines of evaluation procedures of the PPP Infrastructure provision which require government support

Table 3.2.3 Legal Framework of Government Guarantee and Government Support

	Law/Regulation	Outline
1)	Ministry of Finance Regulation No. 38/PMK.01/2006 Provisional Guidelines on Risk Control and Management of Infrastructure Provision	This Guidelines covers; a. scope of risk management b. Types of risks and nature of Government Support; c. Criteria for provision of Government Support in risk management; d. Procedure for provision of Government Support; e. Procedure for allocation of funds for risk management in provision of infrastructure f. Reporting and oversight. The following risks shall be mitigated by risk sharing scheme between Government and Business Entity; 1) Political risk attributable to policies, actions, decisions by Government or State/Regional entities, such as risk of legal or regulatory change, risk of Revision of laws or regulations, currency convertibility restriction 2) Project performance risk ・Risks due to delay in the land acquisition caused by the Government or price increase of the land, for which extention of the concession period and/or other compensation approved by the Minister of Finance (MOF) can be provided. ・Operational risk, such as delay in operation, delay in tariff adjustment, annulment of tariff adjustment, lowering of initial tariff or inappropriate change of output specification by Contracting Agency causing loss of revenue, for which extention of the concession period and/or other compensation approved by MOF can be given. ・Demand risk, for which a financial compensation and/or other compensation approved by MOF can be given
2)	Government Regulation No. 66/ 2007 No. 75/ 2008 (amended) PT SMI Establishment	With this Regulation, a state-owned Infrastructure Financing Institution, PT Sarana Multi Infrastruktur (SMI) was establishment in order to attract private investors to finance the project.
3)	Presidential Regulation No. 9/ 2009 Establishment of State-owned Infrastructure Financing Institution	With this Regulation, “PT Infrastructure Indonesia Finance” (IIF) was established by PT SMI with other shareholders including World Bank, ADB, the International Finance Corporation (IFC). PT SMI operations will focus on small and medium enterprises, whereas PT IIF will focus on larger infrastructure projects.
4)	Government Regulation No. 35/ 2009 Establishment of a limited liability company, “PT Penjaminan Infrastructure Indonesia” (PII)	Establishment of a limited liability company, “PT Penjaminan Infrastructure Indonesia” (PII) to administer the guarantees for PPP Infrastructure Investment projects. PT PII shall act as guarantor (guarantee provider) to the private sector for various infrastructure risks. The start-up capital of PT PII by equity participation from the State Revenue and Expenditure Budget of the 2009 Budget Year is Rp1,000,000,000,000.00 (one trillion rupiahs).

	Law/Regulation	Outline
5)	Presidential Regulation No. 78/ 2010 Government Guarantee in PPP Infrastructure Investment provision	Government Guarantee to PPP Infrastructure Investment projects shall be provided under the control by Minister of Finance through the state-owned enterprise. 1) Government guarantee will be given to the risk which: a. could be more controlled, managed or prevented from happen, or absorbed by Contracting Agency than by the Company; b. Sourced from the Contracting Agency; and/or c. Sourced from government other than the Contracting Agency. 2) Before implementation of procurement (tender) of Business Entity, the Contracting Agency shall submit to Indonesian Infrastructure Guarantee Fund (IIGF) the Guarantee Proposal containing; a. risk allocation between the Contracting Agency and Business Entity to be included in the Cooperation Agreement; b. the Government Support to be given to the project; c. coverage of the proposed guarantee, such as type of the risk to be guaranteed, extent of the financial obligation to be guaranteed; and Guarantee period in stage of the project preparation, the project construction and project operation. d. Risks matrix of the project, Cooperation Agreement draft and Financial projection of the project which shall be attached with. 3) The Guarantee Proposal shall be evaluated in view of the following; a. if Such proposal are arranged according to this regulation; b. if the project is feasible technically and financially; c. if the Cooperation Agreement contain the minimum provisions set out in Article 5 paragraph (1) of this regulation; d. if the amount of the proposed guarantee does not exceed the ability of IIGF. e. In the event the amount of the proposed guarantee exceeds the ability of IIGF, Minister of Finance may participate in the guarantee provision in evaluating the risk allocation proposal in the Guarantee Proposal. 4) Soon after the Cooperation Agreement signed. Guarantee Agreements shall be signed by IIGF as Guarantor and Project Company as the Guarantee Receiver which shall contain the guarantee coverage agreed by the parties, the management of the Guarantor obligation to Guarantee Receiver, dispute resolution. 5) Project company may submit a claim to the Guarantor in the event of: a. Project company has received a notification from the Guarantor stating that Contracting Agency declare his inability to perform the financial obligation. b. Contracting Agency does not pay the bills submitted by Project Company.

	Law/Regulation	Outline
6)	Ministry of Finance Regulation No.260/PMK.011/2010 implementation of guarantee in PPP infrastructure projects	This Regulation is a guideline of implementation of guarantee in PPP infrastructure projects based on above Presidential Regulation. 1) Allocation of the budget for reimbursement claims, claim procedures for the reimbursement & guarantee payment, mechanism of recourse settlement and value of the guarantee fee shall be regulated in accordance with the principles of the risk control and management of the State Budget, 2) Guarantee on the cooperation project are (1) Government guarantee to be conducted based on the Government guarantee agreement or (2) IIGF to be conducted based on their guarantee agreement. 3) Infrastructure guarantee shall be provided in the manner of: a. guarantee only by IIGF covering the whole or partial risk of one cooperation project; or b. guarantee collectively by IIGF and Government for different infrastructure risks in one cooperative project. 4) Collective guarantee only can be provided in the following condition; a. The equity of IIGF is not enough to provide a guarantee to realize the purpose of infrastructure guarantee; b. IIGF does not have any agreement with any multilateral financial institution, or even if there is any facility provided, such facility does not enough or inadequate to facilitate the guarantee; c. Any endeavor to fulfill such equity of IIGF could not be conducted yet. 5) The criteria of the infrastructure project to be guaranteed; a. The project is technically and financially feasible; b. To the risk which: ・ caused by an act or omission of the Contracting Agency or Government; ・ caused by the Contracting Agency's policy or Government ・ caused by the unilateral decision of the Contracting Agency or Government ・ caused by Contracting Agency's breach of contract 6) Project Company may submit a claim based on the guarantee agreement after fulfilling the conditions set out in Article 11 of the Presidential Regulation No. 78 of 2010. Such claim will be evaluated by the Guarantor Company and shall be included in claim examination minutes signed by Project Company and the Guarantor Company.

Table 3.2.4 Law & regulation on Land Acquisition

	Law/Regulation	Outline
1)	Law No. 5/ 1960 Basic Agrarian Law	The foundation for Indonesia's law regarding rights to land and land use is set out in the Basic Agrarian Law of 1960 and its underlying regulations. Property law in Indonesia is complex and needs to be understood in context. Basic Agrarian Law of 1960 was designed to unify property law partly inherited from Dutch colonial rule and party derived from customary (adat) law. Although the Basic Agrarian Law of 1960 defines a number of different rights to land and requires registration of those rights.
2)	Law No. 20/ 1961 Land Development	President has the right to revoke the title on land rights, only for public purposes, despite this Law is rarely applied this revocation is subject to certain conditions i.e. after negotiations have failed to reach agreement.
3)	Government Regulation No. 24/1997 Land Registration	This regulation stipulates the guidelines of land registration. In case Project Company will use the land which belongs to Ministry of Forestry, this regulation may not be related to the project.
4)	Government Regulation No 16 of 2004 Land Usage Arrangement	This regulation stipulates that the usage for particular land, namely (a) land belongs to existing rights whether it has been registered or not; (b) land belongs to communal right in accordance with the prevailing laws and regulation, shall be in accordance with the regional spatial plan and its regulations and maintain its surrounding environment.
5)	Presidential Regulation No. 34/2003 National Policy in Land Sector	This regulation stipulates the distribution of government responsibility in land sector to central and municipality government. One of the affairs that become municipality government responsibility is to give location permit.
6)	Presidential Regulation No. 36/ 2005 No. 65/ 2006 (amended) Land Acquisition for Public Interest Development Implementation	In case Government Support may take the form of land acquisition, it shall be conducted prior to project tendering. Depending on the financial viability of the PPP project, the Business Entity may be required to reimburse all of part of the land acquisition cost. Such requirement will be stated in the tender documents. In order to accelerate land acquisition, the government shall set up a committee for land acquisition, which then commissions an independent land appraisal to determine the price of land and compensation. In case the committee and land owner cannot agree on compensation, the committee may instruct the respective government institution to deposit the compensation to district court, which provides the government with a right of way over the land. Once the government has designated an area for an infrastructure project, any party who intend to purchase land within the area must obtain prior approval from the government.

	Law/Regulation	Outline
7)	Head of National Land Agency Regulation No. 3/ 2007 Detail guideline based on the Presidential Regulation No. 36/ 2005 and No. 65/ 2006 (amended).	This Regulation specifies the procedures of submission of the application for the land acquisition to the land acquisition committee and the guideline on the appraisal. Physical construction may take place after the transfer of title to land rights has been concluded or after the money has been entrusted in the district court.
8)	Governmental Regulation No. 6/2006 No. 38/2008 (amended) State/Regional Asset Management	The governor/mayor/regent is the authorize holder of the regional asset management. The regional secretary is the regional asset manager. Regional asset can be utilized in form of Lease, Borrow and use, Joint operation or Built-operate-transfer (BOT)/ built-transfer-operate (BTO) in accordance with the provisions in this regulation.
9)	Minister of Home Affair Regulation No. 17 of 2007 Technical Guidelines for Regional Asset Management	Basically there is no new provision regarding the form of regional asset utilization, except for the type of lease of property other than explained in the Government Regulation No. 6/2006 above.

Table 3.2.5 Law & regulation on Concession, Regional Development, Implementation

	Law/Regulation	Outline
1)	Law No. 18/ 1999 Construction Services	The work of construction services performed based on the principle of fair competition through the selection of service providers by way of public or limited tender. Service user is prohibited to use affiliated service provider without tender process.
2)	Government Regulation No. 41/1993 Road Transport	The implementation of the project shall consider this road transport regulation in transferring goods to the project location. The road transport shall consist of transport of common goods; dangerous goods; container, and heavy equipment.
3)	Law No. 32/2004 No. 8/2005 (amended) No.12/2008 (amended) on Regional Government	Regional development planning shall be determined in integration with national development planning, implemented by Regional Development Planning Agency. Provision of public facilities and infrastructure falls into the province as well as regency/city regional government authorization.
4)	Government Regulation No. 29/2000 No. 59/2010 (amended)	The selection of service providers which include the construction planner, contractor, and contractor and construction supervisor by the service user shall be conducted by public tender, limited tender, direct selection, or direct appointment.

	Law/Regulation	Outline
5)	Ministry of Home Affairs Regulation No. 43 of 2000 Guidelines for the Cooperation between Regional Company with Third Party	This regulation is a guideline on implementation of the cooperation with third party to be conducted by a Regional Company with regard to purpose, form of the cooperation and the respective obligation and responsibility.
6)	Government Regulation No. 65/2005 Minimum Service Standard	The determination and implementation of Minimum Service Standard is conducted in order to carry out the Province and Regency/City regional government mandatory matters with regard to the basic services in accordance with laws and regulations.
7)	Government Regulation No. 38/2007 Governmental Affairs Distribution	This regulation stipulates the government affairs distribution, whereas the environment and public works affair is set out as a mandatory affair that shall be managed by provincial and municipality government.
8)	Government Regulation No. 50/2007 Regional Cooperation with Third party	Governor/Mayor/Reagent of the Regional Government may cooperate with any third party in the form of cooperation agreement on any governmental matters in its authority or in the provision of public service. The execution of the cooperation agreement may be assigned to the Regional Work Unit (SKPD).
9)	Ministry of Home Affairs Regulation No. 22 of 2009 Technical Guidelines of Regional Cooperation	In order to facilitate the cooperation between regional government and third party, the regional government shall form a Regional Cooperation Coordination Team (TKKSD) to prepare the cooperation. Such coordination team may form a technical team to prepare the technical material related to the object of the cooperation.
10)	Government Regulation No. 68/2010 Community Participation in Spatial Planning	This regulation stipulates the guidelines of community participation in each stage of spatial planning and government obligation in involvement of the community, especially in the related stakeholder of the area.

Table 3.2.6 Law & regulation on Governmental Organization

	Law/Regulation	Outline
1)	Law No. 1/ 2004 State Treasury	The property of public service agency (BLU) is a state/regional property which shall not be separated and shall be managed as well as utilized fully to carry out its activities. BLU earnings from service will be treated as original regional/state revenue. BLU may obtain a grant or donation from public or any other agency. Such earnings and grant or donation can be used to finance its expenditures.
2)	Minister of Home Affair Regulation No. 61 of 2007 Technical Guidelines for the Financial Management of Regional Public Service Agency (BLUD)	The BLUD minimum service standard may be proposed by the Head of BLUD. The revenue from any form of cooperation will be treated as BLUD revenue BLUD may conduct a cooperation with other party, in the form of: a. Operation cooperation, in the form of contract through a collective management arrangement and operational process with profit sharing based on the parties agreement; b. Lease, whereas other party may utilize the BLUD asset or in reverse, for a particular period; c. Other business activities that will support BLUD function and duties, whereas the BLUD may cooperate with other party to gain revenue without degrade the public service quality. BLUD shall not transfer or remove its fix assets, unless approved by the authorize party. Such asset shall have twelve (12) months of useful life to be utilized by BLUD or public.

Table 3.2.7 Law & regulation on Investment, Establishment of SPC

	Law/Regulation	Outline
1)	Law No.25/2007 Capital Investment	Foreign Investment shall be in the form of a Limited Liability Company under the Indonesian laws.
2)	Law No.40/2007 Limited Liability Company	This law regulates the requirements and conditions to be required to establish Limited Liability Company in Indonesia.
3)	Head of BKPM Regulation No. 12 of 2009 Guidelines and Procedures on Investment Application	The authorized agency to implement the service in investment is Regional Investment Agency for licenses. This regulation covers guideline of the procedures to make Registration, to obtain Principal permit and to be given to Business license. This regulation also covers the guidelines for non-fiscal facilities, if applicable, such as Producer Importer's Identification Number ("APIP"), and also fiscal facilities related matters, such as Import duty facility upon machine importation and upon importation of goods and raw materials.
4)	Head of BPS Regulation No. 57/2009 Standard Classification of Economic Activities Indonesia	This regulation provides the classification of business activity to comply with negative list for foreign investment.

Table 3.2.8 Negative List (Closed Business Area & Conditionally Open Business Area)

	Law/Regulation	Outline
1)	Presidential Regulation No. 76/ 2007 No. 77/ 2007 No. 111/ 2007 (amended) No, 36/ 2010 (amended)	Regulation on the maximum foreign ownership in a company carrying out an infrastructure business. In case of piped-water supply, the maximum equity participation by foreign business entities in a special purpose company (SPC) shall be 95%. Reserved only for micro, small, medium and cooperative for construction work that uses simple technology and/or low risk and/or value of work up to Rp 1.000.000.000,00 for: a. water transmission pipelines; b. pipe water wells; c. waterways, ports, dams and other waterworks; d. plumbing work (drain work, including sewerage); e. isolation works (electricity cables, water, heater, sound). Foreign capital ownership up to 95% for utilization of drinking water. Foreign capital ownership up to 67% for construction work that uses simple technology and/or low risk and/or value of work over Rp 1.000.000.000,00 for: a. water transmission pipelines; b. pipe water wells; c. waterways, ports, dams and other waterworks; d. plumbing work (drain work, including sewerage); e. isolation works (electricity cables, water, heater, sound). Foreign capital ownership maximum 55% for business services / construction consultation services for: a. integrated engineering services and water works project management and sanitation with finished acceptance system; b. trade retail of water transportation; c. survey on land / soil layers (rock) and the survey on water at the surface and within the the earth. d. Foreign capital ownership maximum 45% for salvage services and/or underwater works. 100% domestic capital for utilization activity of water environment in forest area.

Table 3.2.9 Dispute Resolution

	Law/Regulation	Outline
1)	Law No. 30/ 1999 Dispute Settlement	Parties to an agreement have the right to determine the procedure for dispute settlement and the forum to settle the dispute such as arbitration either in Indonesia or outside Indonesia, or Indonesian court. The law does not otherwise distinguish between domestic and international arbitration, though the procedures for enforcing domestic and international arbitration awards differ. The law is not based on the UNCITRAL Model Law, but incorporates many principles of the Model Law. The Government has ratified the New York Convention of 1958 on Recognition and Enforcement of Foreign Arbitral Awards. Based on this convention, foreign arbitral awards can be enforced in Indonesia.

CHAPTER 4

UNDERSTANDING THE RECLAIMED WATER DEMAND IN SOUTHERN BALI AND WORLDWIDE EXAMPLES OF RECLAIMED WATER USE

CHAPTER 4 UNDERSTANDING THE RECLAIMED WATER DEMAND IN SOUTHERN BALI AND WORLDWIDE EXAMPLES OF RECLAIMED WATER USE

4.1 Estimating Reclaimed Water Demand

To understand the reclaimed water demand in the Southern Bali, followings have been done:

1) Interview surveys on reclaimed water use

2) Estimation of potential reclaimed water demand

A demand survey was conducted to understand the potential for usage and demand of reclaimed water in southern Bali. Facilities which are potential users of reclaimed water were identified in Denpasar City and Badung Regency. Facility managers were interviewed to complete a survey questionnaire.

The potential reclaimed water demand was calculated using the information gathered in the survey questionnaire and from referrences.

4.2 Demand Survey on Reclaimed Water Use

4.2.1 Survey Target and Survey Method

(1) Survey Target

The survey targeted the following facilities: airport, power plant, Benoa Harbor, large scale luxury hotels, golf courses, new resort developments, and large shopping malls. The managers in charge of the water supply and drainage operations at these facilities were interviewed on the expected uses and demand for reclaimed water, following questions prepared in a questionnaire. Table 4.2.1 shows some of the expected uses of reclaimed water at these target facilities.

Table 4.2.1 Some Expected Uses of Reclaimed Water

Target	Some Expected Uses of Reclaimed Water
Airport	- Watering the green space and toilet flushing in the terminal facility. The volume for toilet flushing water is expected to be significant because of the large number of users.
Power Plant	- Cooling, watering, and toilet flushing in the administration building.
Benoa Harbor	- Washing and cleaning by the marine product processing company. - Cleaning of ships and as the ballast water.
Large-scale luxury hotels (Four and Five star hotels)	- Watering the garden and toilet flushing.
Golf courses	- Watering.
New resort development (Serangan Island)	- Watering the green space, toilet flushing and others, if facilities such as hotels are constructed.
Large Scale Shopping Malls	- Toilet flushing and watering.

Households and small stores were not included in the survey. Their demand for reclaimed water is expected to be low, which would not justify the cost of installing a separate system for its distribution. Around the Denpasar WWTP where the reclaimed water treatment facility would be built, there are no industries which would use a large amount of reclaimed water. The only industry in the survey is the marine product processing company in Benoa Harbor.

Figure 4.2.1 shows the location of the target area and facilities for the demand survey. The Legian area was excluded from the demand survey, because there are few large-scale and luxury hotels where significant amount of watering would be required for green areas and gardens.

(2) Interview Survey Method

The reclaimed water demand depends on the water quality and the cost charged. The survey looked at three levels of reclaimed water quality:

Level 1 : Reclaimed water that can be used for drinking and cooking.

Level 2 : Reclaimed water quality is not suitable for drinking and cooking but is acceptable for showering, hand washing, toilet flushing, filling pools and ponds, and watering gardens.

Level 3 : Reclaimed water can be used for parks and gardens only.

The level 1 is set to understand the interviewee's images to the reclaimed water. The cost charged for reclaimed water depends on the type and scale of the treatment process, the transmission facility and the pumping facility. The tariff would be calculated based on the construction and O&M costs. However these costs were not known when the interview survey was initiated. In addition, the cost for the installation of receiving tank for the reclaimed water and indoor dual water supply piping system is not known. Therefore, the interviewees were not questioned on their willingness to pay or the maximum installation cost that they would be willing to bear.

The interview survey obtained the following details in order to better understand existing reclaimed water use and the potential future demand as well as establish the physical implications (plumbing modifications) and costs to potential users:

- water source
- demand by type of use
- size of water supply facilities and service piping arrangements
- plumbing and drainage details
- wastewater treatment facilities
- installation costs
- O&M costs

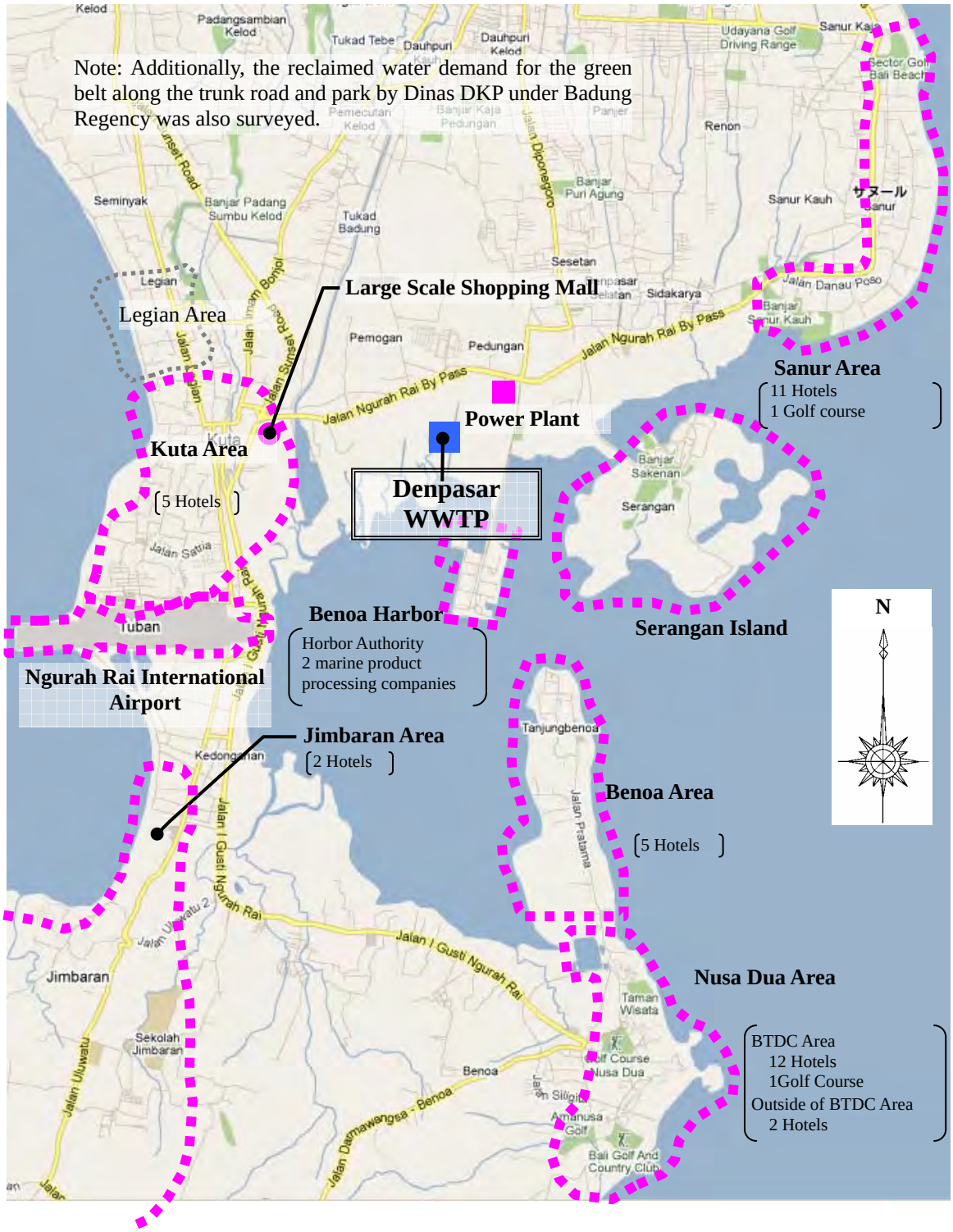


Figure 4.2.1 Location of the Target Area and Facilities of the Demand Survey

4.2.2 Results of the Survey

There is very little or no demand for level 1 reclaimed water, since the use of reclaimed wastewater, for drinking and cooking is not deemed acceptable by those questioned and interviewed. Therefore, the survey report focuses mainly on the demand for level 2 and 3 reclaimed water.

(1) Power Plant (Indonesia Power)

The power plant is located near the Denpasar WWTP where the reclamation facility would be built and therefore would be a good candidate to use the reclaimed water. However, its power generation system does not need a huge amount of cooling water and the power plant is already using its own treated water for watering its gardens and green spaces. The plant manager indicated a willingness to buy level 2 treated water if the charge would be less than Rp.228/m^3 which is the same rate as the groundwater tax the power plant is currently paying. Unfortunately, the charge for level 2 reclaimed water would likely be higher.

(2) Ngurah Rai International Airport

The airport relies on the groundwater from its own deep well, supplemented with a small amount of water from PDAM. Currently sewage at the airport is treated and then discharged directly into the sea. . There is a plan to expand the terminal and to improve the treatment facility to produce effluent that can be used for watering green spaces, toilet flushing, and cooling. This supply of treated effluent would fully satisfy the demand for the various uses therefore the airport's demand for level 2 and 3 reclaimed water could be limited.

On the other hand, groundwater quality may become a problem, or there may be changes in the regulations regarding groundwater use, or maintenance issues may arise affecting the financial viability of continued reliance on this source as the main water supply. The airport also obtains some water supply from PDAM Badung which cannot always meet its demand. Therefore, the airport may still be a potential customer for reclaimed water in the future.

(3) Benoa Harbour

Benoa Harbour could be a good candidate to use the reclaimed water as ship ballast water and for ship cleaning. The harbor authority is requesting water supply from PDAM Denpasar, but PDAM is not able to meet its demand fully. The facilities in the harbor are using groundwater. This situation may not change while the groundwater charge is at a very low rate of Rp.1,216/m^3 (as of January 2011). Although there is a plan for the future development of the harbor and the water demand is expected to increase, the harbor's water supply plan was still not well defined at the time of the survey nor at the time of the follow up after the survey. Benoa Harbor could still be a promising user when the water supply plan for future developments would be established.

The marine product processing company is using water for washing and cleaning fish. However, level 2 and 3 reclaimed water would not be suitable for these purposes.

(4) Golf Courses

There are two golf courses in the survey area: the Grand Bali Beach Golf Course in the Sanur area (9 holes) and the Bali Golf and Country Club in the Nusa Dua area which is in the Bali Tourism Development Cooperation (BTDC) area where the national tourism project has been developed.

Level 2 reclaimed water could be considered for use in toilets and showers at the clubhouse and level 3 for use on the course. However, a dual pipe system would be required to supply level 2 water and the supply may not be able to meet the demand for use on the course.

The Grand Bali Beach Golf Course in the Sanur area is already using treated water from the adjoining Inna Grand Bali Beach Hotel for watering the golf course. In case of emergency, water from the nearby river could be used for a limited time. Therefore, there would not be much demand for level 3 reclaimed

water.

The sewage from the Bali Golf and Country Club in the Nusa Dua area is treated at the BTDC WTTP. The treated water (hereinafter referred to as BTDC irrigation water) is sold as recycled water. During the dry season, the golf course needs about 500 m^3/d for watering, of which 100 m^3/d come from the reservoir on the golf course and the rest is sourced from the BTDC irrigation water with any shortfall made up by groundwater. If the reclaimed water is to replace this groundwater use, the amount would only be 70 m^3/d (refer to Table 4.2.2 for this calculation). The golf course would only consider purchasing the reclaimed water for this purpose if the cost is less than the cost of BTDC irrigation water at Rp.6,812/m^3.

(5) Large Hotels

1) Hotels surveyed in the five areas
Some of the hotels surveyed in each of the areas are listed below.

i) Sanur Area
In the Sanur area, there are approximately ten large hotels (four or five star) with many guest rooms, and large gardens, and therefore a potentially high demand for reclaimed water. The managers at two of the hotels were interviewed in this survey: the Bali Hyatt Hotel (five star) and the Sanur Paradise Plaza Hotel (four star).

ii) Nusa Dua Area
The Nusa Dua area was developed by BTDC as a national tourism project (hereinafter referred to as BTDC area). The Club Med is located near the BTDC WWTP, the Ayodya Resort and Novotel Nusa Dua are located further away, with the Melia Bali Villas Resort located in between. Other hotels were also surveyed in this area.

The Nikko Bali Resort and Spa, which has a large number of guest rooms, is the only hotel surveyed outside of the BTDC area.

iii) Benoa Area
The three large hotels (Melia Benoa, Bali Tropic Resort and Spa, and Conrad Bali Resort) surveyed in the Benoa area are located near the BTDC WWTP.

iv) Jimbaran Area
The Bali Intercontinental and Four Seasons Resort were the two large hotels surveyed in this area.

v) Kuta Area
The Bali Dynasty Resort and Hard Rock Hotel Bali were two of the hotels surveyed in this area.

2) Results
Many interviewees accepted that level 2 reclaimed water could be used for toilet flushing but they were concerned with the negative image of reclaimed water even if the water quality was good. They were also deterred by the necessity of installing the indoor dual pipe system and would only consider using reclaimed water if the cost for installation is subsidized and if the tariff is reasonable.

Three hotels: the Marriott Hotel (250 rooms), the Royal Kamuela Hotel (50 rooms), and the Laguna Villa (50 rooms) will be constructed by the end of 2011, providing an increase of 350 rooms in the BTDC area. In addition, the construction of three facilities: Villa NW-2 (20 rooms), N-5 (200 rooms), and the convention hall (5000 seats) are also scheduled. Outside the BTDC in the Nusa Dua area, three hotels (Mulia, Ritz Calton, Kedung New Wall Hotel) and one villa will be built in the future.

If these facilities are built, there will be a further increase in the water demand. Promoting the use of level

2 reclaimed water at these new hotels would ease the pressure on the limited water resource and contribute to its efficient usage.

The demand for level 3 reclaimed water in the BTDC and surrounding areas may be non-existent because there is already a good supply from the BTDC irrigation water scheme (Table 4.2.2) and the customers' are satisfied with this service.

Table 4.2.2 Amount of BTDC Irrigation Water Supplied to Each Facility (2009)

NO	NAMA INVESTOR	AIR IRIGASI TH 2009 (VOLUME DALAM M3)												TOTAL TH 2009
		JAN	PEB	MAR	APRIL	MEI	JUNI	JULI	AGST	SEPT	OKT	NOP	DES	
1	Club Med	47,00	-	-	4.352,00	6.012,00	5.681,00	7.095,00	8.334,00	2.718,00	6.981,00	4.381,00	1.808,00	47.409,00
2	NDBH (PT. Sejahtera Ind)	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Melia Bali	488,00	94,00	4,00	1.761,00	1.979,00	1.690,00	5.082,00	9.036,00	5.916,00	8.423,00	7.860,00	7.130,00	49.463,00
4	Hotel Putri Bali	-	-	-	-	-	-	-	-	-	-	-	-	-
5	Sheraton Nusa Indah/NDGI	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Grand Hyatt	-	-	1.324,00	-	3.346,00	4.786,00	7.690,00	8.566,00	5.143,00	7.601,00	4.952,00	1.414,00	44.822,00
7	PT. KAKL/Sheraton Lagoon	-	-	-	-	-	-	-	-	-	-	-	-	-
8	PT. Banigati Betegak	-	-	-	-	-	-	-	-	-	-	-	-	-
9	PT. Bali Nusadewata Villaqe	-	-	-	-	-	-	-	-	-	-	-	-	-
10	PT. Chikara Inti Bahagia	-	-	-	-	-	-	-	-	-	-	-	-	-
11	Bali Golf & C. Club	-	-	-	23.000,00	15.000,00	11.000,00	10.500,00	575,00	1.000,00	10.200,00	16.500,00	19.500,00	107.275,00
12	PT. Inti Putra M/Bali Desa	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Metafora (LOT SW2)	-	98,00	101,00	127,00	318,00	546,00	879,00	1.776,00	820,00	1.098,00	582,00	611,00	6.956,00
14	Sentral Telephone	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Melia Benoa/Citra Rapi	162,00	128,00	392,00	1.154,00	1.059,00	1.103,00	996,00	270,00	215,00	220,00	99,00	157,00	5.957,00
16	Hann Restaurant/PT. BSS	-	-	-	-	-	-	-	-	-	-	-	-	-
17	Hotel Grand Bali/Intersis	-	-	-	-	-	-	-	-	-	-	-	-	-
18	Conrad Bali Resort/OIB	705,00	267,00	911,00	1.971,00	4.862,00	1.756,00	4.712,00	5.363,00	2.453,00	5.144,00	3.500,00	1.300,00	32.944,00
19	Villa Kayu Manis/Blok S/Partha Stana	33,00	3,00	67,00	275,00	334,00	547,00	570,00	529,00	524,00	468,00	478,00	209,00	4.037,00
20	St. Regis/PBRI (S-6)	-	-	1.583,00	3.304,00	1.216,00	2.369,00	6.349,00	6.753,00	7.800,00	11.019,00	9.590,00	7.198,00	57.181,00
21	Common Area	233,00	2.193,00	6.668,00	9.910,00	17.727,00	12.948,00	22.356,00	37.109,00	21.681,00	27.544,00	22.580,00	7.742,00	188.691,00
22	GPL	-	-	-	-	-	-	-	-	-	-	-	-	-
23	Bali Tropic	-	-	-	-	-	-	-	-	-	539,00	49,00	13,00	
24	Proyek N-5	98,00	-	-	-	-	-	-	112,00	1.053,00	211,00	244,00	368,00	2.086,00
	TOTAL	1.766,00	2.783,00	11.050,00	45.854,00	51.853,00	42.426,00	66.231,00	78.423,00	49.323,00	79.448,00	70.815,00	47.450,00	546.821,00

(6) Serangan Island

The development of Serangan Island started in 1994 but was interrupted with the collapse of the Suharto government in 1998. The island was expanded from 100 ha to 400 ha by land reclamation. This development was advanced without obtaining consensus from the residents. The lack of support by the residents has not been resolved. Moreover, the Bali provincial government has experienced difficulties with the sale of the reclaimed land (almost vacant at present) to a company in Singapore. In addition, the planned bridge connecting the island to Benoa peninsula has not been approved because the Benoa harbor and airport authorities are opposed.

Given all the above challenges, the demand for reclaimed water from Serangan Island cannot be included at this time.

(7) Large Shopping Malls

There are five large shopping centers in Denpasar City and Badung Regency. The biggest is Mal Bali Galleria. It uses approximately 30 m^3/d for toilet flushing and 30 m^3/d for watering its gardens and could be a candidate to use reclaimed water. However, they would only be willing to pay Rp.1,000-2,000/m^3 for level 2 reclaimed water and would have no demand for level 3 reclaimed water for watering their gardens since they are using free river water for this purpose at present.

(8) Green Belt along Main Road and Park

The green belt along the trunk road and the park near Dinas DKP under the administration of Badung Regency could use reclaimed water for watering green spaces. Dinas DKP uses the river water for free. The water from the Mati River used for the gardens in the Nusa Dua and Kuta areas is not really suitable for watering because it has high salinity. During the dry season, the volume of the water decreases, and the suspended solids content increases. Therefore, if the reclaimed water were cheaper than the groundwater, Badung Regency could use about 60 m^3/d (about five round trips a day with two tank trucks each carrying 6m^3 per trip). However, the groundwater tax has been reduced to about Rp.1,000/m^3 therefore the level 3 reclaimed water charge may not be able to compete with the lower cost of groundwater.

4.2.3 Future Developments in the BTDC Reclaimed Water Supply Business and PDAM Badung's Irrigation Water Facility

The outlook for expansion in the existing BTDC reclaimed water supply business in the Nusa Dua area and in PDAM Badung's irrigation water facility is described below.

(1) BTDC Reclaimed Water Supply Business

BTDC is a state owned company established in 1973 under the jurisdiction of the Ministry of State Owned Companies and has to follow Bali provincial laws. The Finance Ministry owns the stocks but the properties in the BTDC area belong to BTDC. Hotels and other businesses lease the land from BTDC under 50-year contracts. The number of rooms from the 13 hotels in the BTDC area adds up to around 4,000 with another 500 to be constructed in the future.

Although the planned design capacity of the BTDC WWTP is 10,000 m^3/day, the volume treated at present is around 5,000 m^3/day on average, and peaks at 6,000m^3/day. Forty per cent of the effluent, about 2,400 m^3/day, receives further treatment (facility design capacity = 3,000 m^3/day) and is sold as BTDC irrigation water. BTDC is now advancing the plan to improve the WWTP and reclaimed water treatment facility as a BOT business.

If BTDC implements the improvement project, BTDC will continue the service of supplying irrigation and reclaimed water. Therefore it is necessary to pay attention to this future development.

(2) Irrigation Water Facility by PDAM Badung

There are three distribution systems currently supplying water to the hotels in the BTDC area: 1) system for PDAM water; 2) system for PDAM irrigation water; and 3) system for BTDC irrigation water. The distribution system for the PDAM irrigation water which is laid almost parallel to the system for PDAM water, is hardly used since the well which provides the water went dry ten years ago.

It would be possible to lower the initial investment by using the existing facility if the irrigation water distribution facility can be repaired and used for the reclaimed water supply.

4.2.4 Cultural Acceptance of Reclaimed Water

The survey looked at the acceptance and demand for three levels of reclaimed water quality.

1) Level 1: Possible to use for drinking
Even if the quality of the reclaimed water meets potable water quality standards, all the interviewees rejected its use for drinking and cooking.

2) Level 2: Possible to use for all purposes except drinking and cooking
This level of reclaimed water is safe for direct contact with human skin and poses no health risks even if accidental ingestion occurs. Most interviewees who were managers of water utilities would still have difficulty using this level 2 reclaimed water for the intended purposes, while some others said that they would have no problems if the water quality meets the government standards. The managers were also concerned with the difficulty of implementing the indoor dual pipe system because they still equate level 2 quality with conventional reclaimed water appropriate only for toilet flushing.

3) Level 3: Irrigation water suitable for landscaping and gardening purposes
All the interviewees were familiar with the quality and uses of level 3 reclaimed water because irrigation water from the BTDC system and effluent from internal wastewater treatment facilities are already being used.

4.2.5 Summary of the Demand Survey Results

The observations gathered by the survey and the possible follow up actions on the demand for level 2 and level 3 reclaimed water are summarized below.

(1) Level 2 reclaimed water demand

Observations

- Many interviewees found that having to install a separate piping system would be a deterrent for the use of level 2 reclaimed water because they would have difficulty allocating the budget to install a dual piping system for water mainly used for flushing toilets.
- In the survey area, there was no precedent of any indoor dual piping system being installed.
- Although the hotel facilities have faced a shortage of water for all uses and would welcome measures to alleviate the problem, the managers were still wary of the image that reclaimed water would only be suitable for flushing toilets. They would not be making the full use of this new resource.
- The new building programs, such as the hotels and conference hall in Nusa Dua and the surrounding areas would increase the water demand. However, as described in Chapter 2, water supply capacity can only be increased if there is a suitable and large enough source of water. Therefore, this area may need to use reclaimed water because of there is already so much pressure on the water resource.
- Groundwater in Nusa Dua and the surrounding areas is gradually being depleted and becoming saline therefore reclaimed water will be needed to ensure a stable water supply.
- The airport and harbor facilities are mainly using groundwater and are expected to face water supply problems in the future. Reclaimed water could be the alternative to replace groundwater sources as well as supplement the supply to avoid shortages. However, the survey cannot estimate this potential demand because the water supply plans for these facilities have not been formulated. The power plant, golf courses, and large shopping malls would not have a demand for level 2 reclaimed water since a business case cannot be made for its use.
- Development plans for Seragan Island may not be forthcoming in the near future, therefore it would not be a target of the reclaimed water business.

Possible follow up actions

- There is a lack of understanding on the quality of level 2 reclaimed water and its uses other than for toilet flushing. The acceptance of its higher quality and broader uses could increase the demand.
- A Public Relations (PR) plan would be useful to improve the public perception of reclaimed water. PR measures could make use of the pilot plant installed by METAWATER Co. Ltd. at the Suwung WWTP, and partner with the Bali provincial government in the implementation.
- At the airport and harbor facilities, the demand for reclaimed water could increase if there is a

restriction on the use of groundwater. It would be useful to coordinate with the authorities in promoting the use of level 2 reclaimed water, while the water supply plans are being formulated.

(2) Level 3 reclaimed water demand

Observations

- The golf courses and large hotels use the effluent from their own wastewater treatment facilities, and rain water and nearby river water in case of emergency. They do not have immediate problems with water supply. They also use irrigation water to cover supplemental demand which does not amount to a large quantity.
- BTDC supplies reclaimed water which is used for irrigation in the Nusa Dua area and will further develop this as a BOT project.

Possible follow up actions

- The BTDC improvement plan for irrigation water supply should be monitored carefully.
- Since the Sanur area will be serviced by a public sewerage system, the hotels would eventually abandon their own wastewater treatment facilities. At that time the demand for level 3 reclaimed water for irrigation would increase and this opportunity should be explored.

4.3 Potential Demand for Reclaimed Water

4.3.1 Estimation Method

The potential demand for reclaimed water was estimated by establishing the following parameters.

1) Potential customers
These are identified as the hotels and facilities in the Nusa Dua, Benoa, Sawangan, and surrounding areas in southern Bali.

2) Actual unit water consumption in hotels
The actual unit water consumption in hotels is calculated from the following data:
① Present water consumption from hotel records obtained from the field survey.
② Present water consumption according to public water supply system records.
③ Comparison with the water consumption of seashore resort hotels in Okinawa, Japan.

3) Target usage level for reclaimed water
The potential uses for reclaimed water is examined and two case scenarios are proposed for evaluating the demand.

4) Reference hotel water consumption for each usage
The survey of seashore resort hotels in Okinawa Prefecture in Japan is reviewed, and the data used as reference for the calculation of the demand by types of use.

5) The use of reclaimed water is divided into some typical cases to estimate the potential of the reclaimed water of each case.

4.3.2 Setting Target Customer for Reclaimed Water

The existing hotels in Nusa Dua, Benoa, and Swangan areas and future hotels in Swangan area is seletected as the reclaimed water users for our survey. The demand for reclaimed water is directly related to the number of guest rooms in the hotels. The current calculation is based on 4,050 rooms in the Nusa Dua area, 2,100 rooms in the Benoa area, 700 rooms in the Sawangan area, and 1,000 rooms in the surrounding areas with hotel construction plans in southern Bali. 670 rooms of the planned rooms are

already under construction.

4.3.3 Unit Water Consumption in Hotels

(1) Estimating actual unit water consumption in hotels from survey data

Unit water consumption in hotels was examined based on data collected during the survey.
The total water consumption in all the guest rooms for 2010 was calculated by subtracting the amount of irrigation water (water for gardens) from the combined amount of water purchased from PDAM, and the amount of groundwater used. The consumption per room per day was estimated by factoring in the number of rooms and a range of occupany rates. For the occupancy rates between 70 – 90 % the average amount of water used per guest room is between 2.2-2.9 m^3/day. The water consumption is lower at 1.9-2.5 m^3/day for the Nusa Dua and Benoa areas, possibly because of the restriction in the use of groundwater to mitigate salt water intrusion or low supply capacity.

Table 4.3.1 Water Consumption per Guest Room Based on the Water Use Record minus Water for Irrigation (m^3/day)

Area	Hotel	G	Room No.	Water Used per Room (m3/day)				
				Assumed Room Occupacy Rate				
				100%	90%	80%	70%	60%
Nusa Dua	Amanusa Resort *)	5	35	**2.89**	**3.16**	**3.61**	**4.04**	4.81
	Bali Tropic Resort	4	150	1.45	1.61	**1.81**	**2.07**	**2.41**
	Inna Putri Bali *)	5	392	1.35	1.50	**1.69**	**1.93**	**2.26**
	Nusa Dua Beach Hotel *)	5	381	1.23	1.37	**1.54**	**1.76**	**2.05**
	Swiss Grand Bali *)	4	63	**1.94**	**2.14**	**2.44**	**2.77**	3.21
	The St. Regis Bali Resort *)	5	123	**1.89**	**2.10**	**2.38**	**2.71**	3.15
	The Westin Resort Nusa Dua *)	5	334	**1.78**	**1.97**	**2.22**	**2.54**	2.97
Benoa	Melia Benoa Bali	5	128	1.26	1.40	**1.58**	**1.79**	**2.09**
	Average in the above area			1.72	1.91	**2.16**	**2.45**	**2.87**
Sanur	Inna Grand Bali Beach Hotel	5	523	**4.37**	**4.86**	**5.47**	**6.25**	7.29
	Mercure Resort Sanur	4	189	1.36	1.51	**1.70**	**1.95**	**2.27**
	Puri Santrian Hotel	4	182	1.88	2.09	**2.35**	**2.70**	**3.15**
	Sanur Beach Hotel	5	428	1.70	1.89	**2.13**	**2.43**	**2.83**
	Segara Village	4	120	**3.61**	**4.01**	**4.51**	**5.15**	6.01
Jimbaran	Bali Intercontinental	5	425	**2.01**	**2.23**	**2.52**	**2.87**	3.36
	Four Seasons Resort Jimbaran	5	147	**3.07**	**3.42**	**3.82**	**4.38**	5.13
Kuta	Bali Bintang	5	401	**3.06**	**3.40**	**3.82**	**4.37**	5.09
	Bali Dynasty Resort	4	312	**2.06**	**2.29**	**2.58**	**2.95**	3.44
	Discovery Kartika Plaza Hotel	5	318	1.67	1.86	**2.09**	**2.39**	**2.79**
	Hard Rock Hotel Bali	4	418	0.72	0.80	0.90	1.02	**1.20**
	Kuta Paradiso Hotel	5	250	1.05	1.16	**1.31**	**1.50**	**1.75**
Average			5,319	**2.02**	**2.24**	**2.53**	**2.89**	3.37
Maximum				**4.37**	**4.86**	5.47	6.25	7.29
Minimum				0.72	0.80	0.90	1.02	1.20

*) BTDC : Bali Tourism Development Corporation

(2) Estimating actual unit water consumption in hotels from the public water supply records

The water consumption per guest room calculated from the amount of water supplied by PT.TB and based on the same occupancy rates, is shown in the following table. The average amount of water used per guest room is between 1.6-2.1 m^3/day at the occupancy rates of 70-90%. The unit consumption per guest room based on survey data (1.9-2.5 m^3/day) is considered to be more representative of the current unit water consumption in hotels because some hotels are also using other water sources in addition to the supply from PDAM.

Table 4.3.2 Amount of the Water Used per Room Based on Record of Water Supply to Hotels in the Nusa Dua Area (m^3/day)

Hotel	Room No.	**Supplied Volume**		**Water Supplied Per Room (m^3/day)**				
				Assumed Room Occupancy				
		(m^3/year)	(m^3/day)	100%	90%	80%	70%	60%
1	400	132,693	364	0.91	1.01	1.14	1.30	1.52
2	381	180,358	494	1.30	1.44	1.62	1.85	2.16
3	334	214,114	587	1.76	1.95	2.20	2.51	2.93
4	276	277,420	760	**2.75**	**3.06**	3.44	3.93	4.59
5	500	113,400	311	0.62	0.69	0.78	0.89	1.04
6	750	523,047	1,433	1.91	2.12	2.39	2.73	3.18
7	384	173,514	475	1.24	1.37	1.55	1.77	2.06
8	537	284,189	779	1.45	1.61	1.81	2.07	2.42
Total	3,562	1,898,735	5,203	**1.46**	**1.62**	**1.83**	**2.09**	**2.43**

Notes) Water supply amount was obtained from PT.TB.

(3) Chosen value for unit water consumption per room per day

Based on the calculation in Table 4.3.1, a unit water consumption of 2.5 m^3/room /day (at the occupancy rate of 80%) will be used to estimate the reclaimed water demand in southern Bali.

(4) Comparison with the water consumption of seashore resort hotels in Okinawa prefecture in Japan

Water consumption records for seashore resort hotels in Okinawa Japan were compared with survey results in southern Bali. The amount of water used per guest room in Okinawa was 2.0-2.3 m^3/day during a period of water shortage. Therefore, the unit water consumption calculated for southern Bali appears to be reasonable.

4.3.4 Two Cases for Reclaimed Water Use

The feasibility of two possible cases for using reclaimed water are examined in the following subsections of the report.

Case 1: Reclaimed water is used for toilet flushing, filling ponds, watering gardens (conventional type of reclaimed water use)
Case 2: Reclaimed water is also used for bathing and showering (referred to as new clean water)

Both cases exclude the use of reclaimed water for drinking and cooking.

4.3.5 Actual Water Consumption in Hotels by Types of Use

(1) Water consumption in hotels by types of use

Data on water consumption by types of use was not obtained from the hotels in this survey. Percentage of water consumption by type for southern Bali is based on reference data obtained from a 1983 survey conducted by the Ministry of Health and Welfare of Japan at seashore resort hotels in Okinawa and domestic water use data from Japan and the US .

Results of the water use survey at seashore resort hotels in Okinawa are shown in Figure 4.3.1.

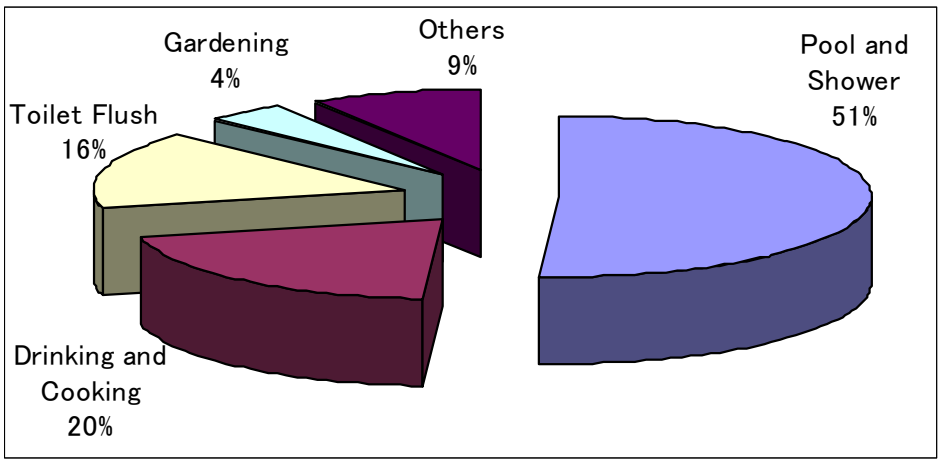


Figure 4.3.1 Percentage Water Use by Type at Seashore Resort Hotels in Okinawa

Data showing the water consumption by types of use in domestic households are also shown below for reference.

<Reference data>

Table 4.3.3 Percentage of Domestic Water Use in Japan Unit : (%)

	Kitchen	Cloth Washing	Bathing	Hand and Face Washing	Toilet Flushing	Others
Range	9 - 24	20 – 25	23 - 39	3 - 11	12 – 24	4 – 10
Average	17	22	30	7	17	7

Source: Water Facility Design Guideline 2000

Table 4.3.4 Percentage of Domestic Water Use in U.S. Unit : (%)

	Faucet	Dish Washing	Cloth Washing	Showering	Bathing	Toilet Flushing	Leakage	Others
Range	12 - 18	1 – 2	12 - 28	12 – 20	1 – 3	23 – 31	5 - 22	0 - 9
Average	15.7	1.4	21.8	16.8	1.7	26.7	13.7	2.2

Source: Wastewater Engineering Treatment and Reuse 4th Edition (AWWARF(1999))

Japanese and U.S. domestic water use data are not the same because of life style differences. But the rough distribution of water use can be considered as follows: Kitchen: 20%, Laundry: 20%, Bathing and showering: 20-30%, Toilet flushing: 15-25%, and Others: 15%.

(2) Determining the water usage ratios for southern Bali

Based on data from the Okinawa resort hotels survey, the amount of water used for flushing toilets is expected to be about 20% of the total demand. On the other hand, the figure was considered as also about 20% of the total in the case 2. The amount used for drinking and cooking is also about 20%. These ratios

shall be used when calculating the design capacity of the reclaimed water supply system.

4.3.6 Estimation of the Reclaimed Water Demand

The reclaimed water demand in 2021 for Case 1 and 2 is estimated based on the following assumptions:

(1) Unit water consumption per room

The unit water consumption per guest room is set at 2.8 m^3/day, assuming that the present amount of 2.5 m^3/day would increase by about 10 percent.

(2) Occupancy rate

The unit water consumption rate of 2.5 m^3/day corresponds to an occupancy rate of 80%. Assuming the average occupancy may rise slightly in the future, the occupancy rate is set at 85%.

(3) Proportion of reclaimed water used among other water sources

As discussed in 4.3.5(2), since reclaimed water could make up to 20% of the total water consumed, the ratio would be set at 0.2 for case 1 and 0.8 for case 2

(4) Mixing of reclaimed water and PDAM water

For case 2, it is assumed that the reclaimed water and PDAM water would be combined at the water service facility, therefore the mixing ratio is set at 50%.

(5) The estimation of the reclaimed water demand potential

Based on the aforementioned assumptions the demand for reclaimed water for the two cases would be as follows.

Case 1: 3,700m^3/day (used for toilet flushing, filling ponds, watering gardens)
Case 2: 7,400m^3/day (case 1 + bathing, showering and swimming pools)

The calculation process and the result are shown in the following table.

Table 4.3.5 Estimation of the Reclaimed Water Demand Potential (The amount that can be used)

Item	Unit	Asumed Ratio		Nusa Dua	Benoa	Sawangan	Future Plan	Hotel Total
Room Number	No.			4,050	2,100	700	1,000	7,850
Room Number Used	No.	a	0.85	3,443	1,785	595	850	6,673
Total Water Demand	m^3/day			9,639	4,998	1,666	2,380	18,683
Case 1 for Toilet Flushing	m^3/day	b	0.20	1,928	1,000	333	476	**3,737**
Non-Drinking Water	m^3/day	c	0.80	7,711	3,998	1,333	1,904	14,946
Expected Reclaimed Water to be used	m^3/day	d	0.50	3,856	1,999	666	952	7,473

* About 670 rooms among 1000 rooms in future plan are alread under construction.

Here, “a” shows the occupancy rate, “b” and “c” show the ratio which can be used as the reclaimed water for case 1 and 2, and “d” shows the mixing ratio of PDAM water and the reclaimed water.

4.4 Current Water Reuse Demand and Worldwide Examples of Reclaimed Water Use

4.4.1 Global Water Reuse Demand Forecast

It is estimated that he world's fresh water resources total 35 million km^3. This is 2.5% of the total water on the planet. Consumption by humans is estimated to be 3,769 km^3/yr. About 369 km^3/yr of the water used is collected as wastewater but only160 km^3/yr is treated. The amount actually available for reuse is approximately 129km^3/yr however only 7.1 km^3/yr is in fact reused.

The water reuse demand can be divided according to the level of treatment, or quality of water required for restricted applications such as domestic leisure, agriculture, industry or aquifer recharge. The report "Water Reuse Market 2005-2015" published by Global Water Intelligence forecasts global additional water reuse until 2015(Table 4.4.1).

Table 4.4.1 Global Additional Water Reuse until 2015

Total up to 2005	7.1 km^3/yr = 19,424,000 m^3/d
Total of 2006-2010 (additional)	13,309,000 m^3/d
Total of 2011-2015 (additional)	21,744,000 m^3/d

This table depicts that total global water reuse capacity will grow to 32,733,000 m^3/d by 2010 and 54,477,000 m^3/d by 2015. Figure 4.4.1 and Figure 4.4.2 indicate the water reuse growth by region and by level of treatment respectively.

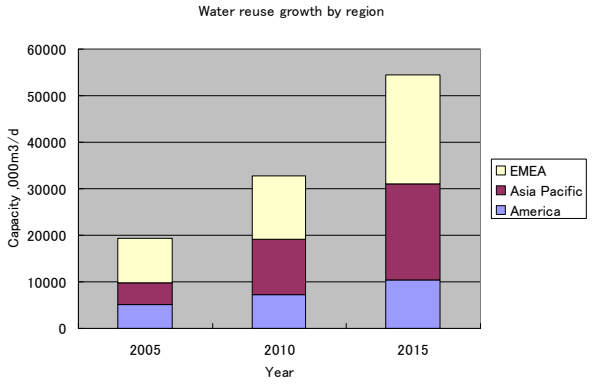


Figure 4.4.1 Demand Forecast by Region

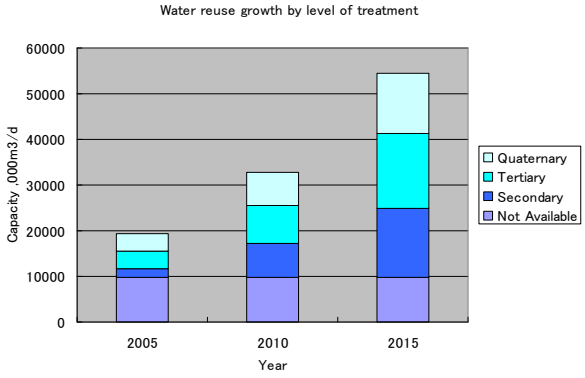


Figure 4.4.2 Demand Forecast by Treatment Level

Note 1: EMEA means Europe, Middle East and Africa

Note 2: DEFINITION of"Quaternary Treatment" is the use of a double membrane process. This might involve microfiltration or ultrafiltration for pre-treatment before reverse osmosis or nanofiltration.

4.4.2 Worldwide Examples of Reclaimed Water Use

The following is the case study of actual water reuse application in the world. As described in the below, there is no case of direct potable reuse in the world.

(1) Orange County Water District (OCWD), California: ***USA***

The state of California and its neighbors are experiencing rapid population growth. It is also a low rainfall, relatively dry state and frequently afflicted by drought. Raw water sources are generally diminishing. Its water supplies are heavily dependent on sources facing competition from neighboring and upstream states. Groundwater supplies are becoming unsustainable as abstraction exceeds replenishment and in some places underground sources are threatened by seawater intrusion.

1) Application
The main application is indirect potable reuse and seawater intrusion barrier (Figure 4.4.3). The project name is called as Orange County Ground Water Replenishment System (GWR system).

Before the GWR system, OCWD had originally operated Water Factory 21 (WF21). WF21 began operating in 1976pumping reclaimed water into coastal aquifers, blended with raw water and then treated again for potable use. Orange County has a population over 2 million, and sources 75% of its supplies from groundwater. The aims of WF21 were to reduce dependence on sources beyond OCWD's jurisdiction and to increase groundwater reserves to prevent over abstraction and seawater intrusion.

The original WF21 was operated until 2008 then replaced by an even larger facility dubbed the GWR System. The GWR System will serve a larger seawater barrier system by injection and percolation and produce a higher quality meeting "bottled water" quality standard .

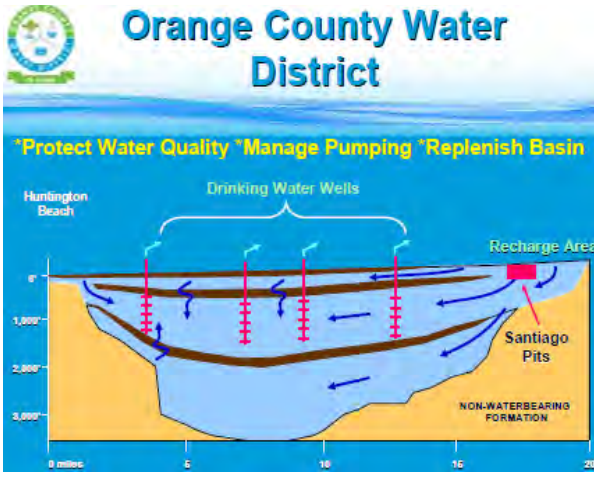


Figure 4.4.3 Seawater Intrusion and Barrier Wells

2) Size of Water Reuse
265,000 m^3/d in 2008

3) Level of Quality Required
Higher quality bottled water standards (The process produces high-quality water that exceeds all state and federal drinking water standards.)

4) Cost
The estimated capital cost of the WF21 and GWR systems is 487 million USD.
The estimated annual O&M cost for the WF21 and GWR systems is 22.9 million USD/yr

5) Outline of the Process and Technology
The GWR System uses MF, RO and UV disinfection. Reclaimed water is recharged through wells.

6) Relevance to the Project
In the case study of typical large-scale reclaimed water project in the United States, there might be possibility to learn about the administration, facility management, operation & maintenance and public participation.

(2) NEWater: ***Singapore***
Singapore has a population of 4.31million. Total renewable resources are 0.7km^3/yr and current total abstraction is 0.5km^3/yr. Wastewater treated is 0.489km^3/yr (almost 100%).
Singapore's option for large scale water reuse stems from its dependence on its neighbor Malaysia for half its raw water. The other half is from rainfall. The island's small surface area means its rainfall catchment potential is quite limited. It has two 50-year supply agreements with Malaysia: the first Johor Agreement expires in 2011, the second in 2062. Singapore has been anxious to reduce its reliance on Malaysia and

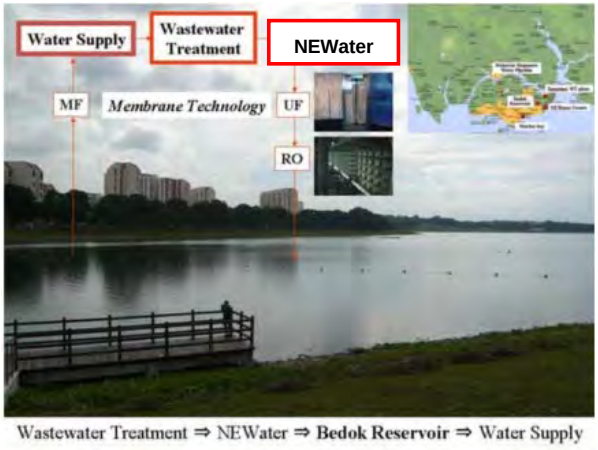


Figure 4.4.4 Bedok Reservoir

achieve 100% self-sufficiency.

1) Application
Singapore's reuse program goes under the name of NEWater. NEWater is safe for potable use but the program recommended a procedure known as planned indirect potable use (planned IPU), instead of directly supplying for potable use. Planned IPU involves blending NEWater with raw reservoir water (see Figure 4.4.4), and then subjecting the blended water to the same conventional water treatment process. There were three reasons for doing this: first, the process would re-introduce trace minerals that had been removed during the RO process; second, reservoir storage would provide additional safety beyond the advanced technologies used to produce NEWater; and third, it would make it easier for NEWater to gain public acceptance.

2) Size of Water Reuse
204,500 m^3/d in 2006 (NEWater infrastructure consists of four plants: Bedok, Kranji, Selector and Ulu Pandan.) In addition the Ulu Pandan factory also includes a 46,000 m^3/d ultrafiltration plant producing low grade water for washing and cooling purposes.

3) Level of Quality Required
NEWwater is under the supervision of the Public Utilities Board (PUB). The water quality standards stipulate: Turbidity <5NTU, pH Value 7.0-8.5, Hardness <30 mg/L, Chloride ion <30 mg/L, Al <0.1 mg/L, Cu <0.05 mg/L, Fe <0.05 mg/L, Zn <0.1 mg/L, Total Coliform Bacteria Counts= not detectable /100 mL.

4) Cost
The estimated water reuse operating expenditure is 7 million USD/yr.

5) Outline of the Process and Technology
NEWater uses MF, RO and UV disinfection. Reclaimed water is discharged to surface reservoirs.

6) Relevance to the Project
In the case study of typical large-scale reclaimed water project in Asia, there might be possibility to learn about the administration, facility management, operation & maintenance and public participation.

(3) ***Cyprus***, Europe
Average annual rainfall in Cyprus is 465mm. Cyprus was projected to exhaust all readily available groundwater and surface water by 2010. Water reuse is used in tourist areas for landscaping and agricultural irrigation. Also, the tourism industry has resisted wastewater discharges to the sea because it is its biggest asset. A delay in an outfall project for Larnaca eventually lead to the resuse of its wastewater.

1) Application
Cyprus has two main wastewater treatment plants, Larnaca and Ajia Napa-Oaralimni WWTP, and reuses 80% of its wastewater for irrigation. Both WWTP' effluent is used for irrigation of agricultural land at Dromolaxia and Paralimni Village where corn, alfalfa and potato are cultivated. An average agricultural area of 200ha is being regularly irrigated. The reclaimed water is also used by the hotels, international Airport and Larnaca Municipality for the irrigation of gardens, parks and fields during summer season.

2) Size of Water Reuse
8,500 m^3/d (Larnaca WWTP) and 12,000 m^3/d (Ajia Napa-Oaralimni WWTP) in 2003

3) Level of Quality Required
The Larnaca WWTP effluent average qualities are BOD 2.6 mg/L, COD 56 mg/L, SS 1.7 mg/L, pH 7.5, T-N 8.5 mg/L, NH_3-N 2.4 mg/L, NO_3-N 6.9 mg/L, P 0.6 mg/L, total E.Coli 5/100 mL.

4) Cost
The total cost of the Larnaca WWTP project is 50 million Euro, out of this 9.3 million Euro is for the tertiary treatment plant, reuse network and pumping station. The reclaimed water production cost is

around 0.5 Euro/m^3. The total cost of the Ajia Napa-Oaralimni WWTP project is 14.4 million Euro, out of this 5.9 million Euro is for the tertiary treatment plant, reuse network and pumping station. The reclaimed water production cost is around 0.3 Euro/m^3.

5) Outline of the Process and Technology
Both WWTP have a secondary treatment processes (Oxidation Ditch) followed by sand filtration for tertiary treatment.

6) Relevance to the Project
In the case study of typical reclaimed water project in Europe, there might be possibility to learn about applicable case study.

(4) Veurne-Ambacht, Flanders: ***Belgium***
The north region of Belgium is known as Flanders. Like most of Belgium, Flanders relies heavily on groundwater extraction for potable water supply. Flanders is highly industrialized and is also home to intensive agriculture. These factors have led to severe over-extraction of many important aquifers leading to the threat of seawater intrusion. In 1990, the Flemish government established the water utility company "Aquafin" to establish and operate advanced WWTP in Flanders.

1) Application
Reclaimed water is used for recharging aquifers to prevent seawater intrusion. The WWTP at Wulpen provides effluent to the reclaimed water treatment plant at Torreele, which produces a total of 2.5 million m^3/yr. The treated water is then added to an infiltration basin where it filters through the sand dunes to the groundwater, which feeds the local potable water supply. Potable water supply is the responsibility of the local utility Intermunicipal Water Company of the Veurne Region (IWVA) who traditionally takes raw water from a quaternary layer below the sand dunes.

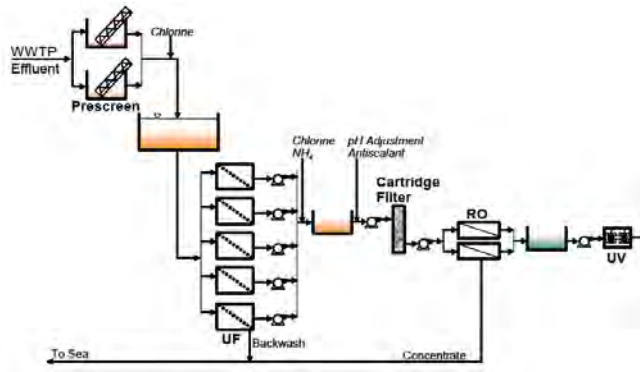


Figure 4.4.5
Schematic Diagram of Torreele Treatment

2) Size of Water Reuse
7,000m^3/d in 2002 (2.5 million m^3/yr). This contributes about 40% to the potable water supply.

3) Level of Quality Required
Stringent standards were set for the quality of the infiltration water, especially nutrient content. Infiltration water standards is pH >6.5 and <9.2, Temperature 25^{o}C, Conductivity 1,000µS/cm, Total hardness <40 mg/L, Na 150 mg/L, T-P 0.4mg/L, NO_3 15 mg/L, NH_3 1.5 mg/L, SO_4 250 mg /L, Chloride 250 mg/L.

4) Cost
The total investment cost was 6 million Euro.

5) Outline of the Process and Technology
The Torreele plant uses UF, RO and UV disinfection. See Figure 4.4.5 for a schematic diagram of the Torreele plant. An infiltration pond (70 cm deep, 1.8 hectare) receives treated water where it percolates over a period of 40 days to reach the aquifer, with the sand medium providing additional filtration.

6) Relevance to the Project
In the case study of typical reclaimed water project in Europe, there might be possibility to learn about applicable case study, administration, facility management, and operation & maintenance.

(5) ***Kuwait***, Middle East

In common with other GCC states, Kuwait is heavily dependent on seawater desalination for water production. Water is taken from brackish underground aquifers. In the mid-1990s, The Government of Kuwait decided to reconsider their approach to water resources management.

The new approach involved constructing a privatized BOT facility at Sulaibiya to treat wastewater for non-potable use. The facility was procured by a 30-year BOT concession of a 375,000 m^3/d facility to recover municipal wastewater from Kuwait City and the surrounding area. The Slaibiya project was inaugurated in March 2005.

1) Application

The use of reclaimed water is currently limited to agricultural and industrial applications, though it may possibly be used for a variety of other purposes such as gardening and for washing cars and buildings. In addition, it may be used to recharge underground aquifers to create reserves. The Government of Kuwait is committed to buying all the output of reclaimed water from the Sulaibiya Wastewater & Reclamation Plant. Reclaimed water is currently supplied to farms in the north of Kuwait. A pipeline to transport water to farms in the Wafra region in the south of the country is under construction. The Ministry of Public Works (MPW) is also planning to use up to 45,000 m^3/d of water from Sulaibiya for aquifer recharge project.

2) Size of Water Reuse

375,000 m^3/d in 2005. This capacity can be expanded to 600,000 m^3/d during the 30-year concession period.

3) Level of Quality Required

The specifications of the reclaimed water produced from the Sulaibiya plant exceed the World Heath Organization (WHO) standards for potable water.

4) Cost

Construction cost (375,000 m^3/d) was 150 million KWD (Kuwait Dinar).

5) Outline of the Process and Technology

The main treatment steps contain the following facilities: UF, RO and chlorination disinfection.

6) Relevance to the Project

In the case study of typical large-scale reclaimed water project in Middle East, there might be possibility to learn about applicable case study, administration, facility management and operation & maintenance.

(6) Several Cities in ***Japan***

Japan has a population of 127.3 million. The climate is generally wet with high humidity. Water reuse is strictly for non-potable purposes. The main driver of water reuse is population density. The high population concentrations in Japan's big cities have put growing pressure on the surrounding water resources. Rather than seeking to develop additional supplies, the approach has been to reuse existing resources with application ranging from smaller individual building recycling systems to larger scale watershed schemes. Water reuse is thus one way of limiting treated water discharge.

1) Application

Japan has also been a pioneer in reusing water for toilet flushing in large apartment blocks, having started the practice in the 1960s. Individual recycling systems often incorporate an on-site WWTP and membrane bioreactor for water recycling. In some cases, these systems serve individual buildings, in other cases; several buildings are connected to a block-wide wastewater facility. Approximately 1,500 individual and block-wide water reuse systems are in operation in Japan and around 71 million m^3/yr of reclaimed water is used. In Tokyo and Fukuoka, a dual pipe system (potable water and reuse water piping) is now mandatory for buildings with floor areas of 3,000 m^2 to 5,000 m^2. Figure 4.4.6 shows typical water reuse applications for effluent from the Shibaura WWTP in Tokyo Metropolitan Government.


Figure 4.4.6 Miscellaneous Water Reuse of WWTP

2) Size of Water Reuse
In case of the Shibaura WWTP, total water reuse capacity is 11,300 m^3/d in 2010.

3) Level of Quality Required
Japan's toilet flushing water criterion is that there should be no detectable fecal coliform.

4) Cost
The construction cost for the expanded facility of 7,000 m^3/d at the Shibaura WWTP completed in early 2010 was approximately 19 million USD. The water charge of the reclaimed water from the WWTP is 260 yen/m^3 which appears to be determined on the basis of political considerations.

5) Outline of the Process and Technology
The Shibaura WWTP uses bio-filter, pre-ozone and ozone-resistant MF.

6) Relevance to the Project
In the case study of typical reclaimed water project in Japan, there is higher possibility to learn about applicable case study, administration, facility management and operation & maintenance.

(7) Santee Lakes, California: ***USA***

1) Application
Santee Lakes Recreation Preserve (Park) is a beautiful recreational facility owned and operated by Padre Dam Municipal Water District. It is located strategically within San Diego County. The lakes within this park were formed as part of an innovative water reclamation system. Its seven lakes, which contain approximately 82 surface acres of water, were formed by sand and gravel mining in the dry stream bed of Sycamore Canyon as part of the District's original water reclamation program. All of the water used to fill the lakes and irrigate around them is recycled. Two million gallons of water each day is recycled at the Water Reclamation Facility located 2 miles north of the Recreation Preserve. About 50% of the reclaimed water is sold for use at golf courses, city parks and schools. The remaining water flows through Santee Lakes and creates a recreation area that greets more than 650,000 visitors annually.

2) Size of Water Reuse
7,570 m^3 / day

3) Level of Quality Required
Padre Dam's Santee Lakes Water Reclamation Facility treats sewage treatment plant effluent to stringent "Title 22" standards which allow for full body contact, such as swimming or waterskiing, where accidental ingestion is assumed.

4) Cost
In April 2002, Board of Directors approved 21 Projects for the 21st Century, a $10.7 million mater plan for Santee Lakes to bring extreme athletes, families and children to the most exciting destinations in San Diego County for fitness and competition, family recreation, and special events.

5) Outline of the Process and Technology
Sewage from the Santee Lakes community undergoes secondary treatment followed by gravel bed filtration and disinfection.

6) Relevance to the Project
In the case study of typical reclaimed water project in West region of USA, there is higher possibility to learn about applicable case study, administration, facility management, operation & maintenance and public participation.

(8) Sydney Olympic Park, Sydney: ***Australia***
Sydney's Olympic Park Water Reclamation and Management Scheme (WRAMS) was built for the 2000 Olympic games. This fully automated A$13 million (US$10 million) water scheme provides 800,000m^3 / yr of treated effluent and stormwater for all non-drinking purposes around the Olympic site.

1) Application
Sydney's Olympic Park's water saving and recycling initiatives play a major role in the protection of local waterways and helping to maintain a sustainable supply of drinking water for Sydney into the future. Recycled water is safe for all specified uses, such as: toilet flushing, washing clothes, washing pets, watering gardens (including vegetables), lawns and parks, fire fighting, irrigations of parkland and playing fields, etc.

2) Size of Water Reuse
7,500 m^3/ days

3) Level of Quality Required
Recycled water is produced and monitored to meet quality standards set by New South Whales (NSW) Department of Health and the NSW Recycled Water Committee Guideline (1993).

4) Cost
Between 1992 and 2000, the NSW Government allocated $137 million for remedial action to clean up polluted areas. The remediation policy at the time was to safely contain and where possible treat, waste on site, rather than relocating it to other places.

5) Outline of the Process and Technology
Sydney Olympic Park uses MF (0.2mm) + RO + Chlorine disinfection.

6) Relevance to the Project
In the case study of typical reclaimed water project in Oceania, there is higher possibility to learn about applicable case study, administration, facility management, operation & maintenance and public participation.

(9) Rouse Hill Recycled Water Plant, Sydney: ***Australia***
New South Wales (NSW) has a population of 6.7 million, with 4.2 million living in state capital Sydney, Australia's largest city. The city is at the heart of one of the fastest growing areas of Australia. State-owned utility, Sydney Water Corporation, has operated under a commercial framework since 1995. It provides water services for the city. Its assets are worth A$14 billion (US$10.9 billion) and it has annual capital expenditure of A$500 million (US$390 million).

1) Application
The Rouse Hill Recycled Water Scheme is the largest residential water recycling scheme in Australia. It treats wastewater to such a high standard that it can be returned to homes to be reused on gardens and for toilet flushing. The scheme began in 2001. It supplies recycled water to over 60,000 people and serves an area of 13,300 hectares. The main benefit of using recycled water in the Rouse Hill area is that it can save

large amounts of water, helping to support a sustainable drinking water supply for the future.

2) Size of Water Reuse
27,000 m^3 / day

3) Level of Quality Required
Sydney Water supplies recycled water to meet or exceed the water quality standards outlined in the relevant national recycled water guidelines. NSW Health advised Sydney Water on the health aspects of recycled water use and quality.

4) Cost
Sydney Water in partnership with Sydney Water Corporation, John Holland, Thompson Controls, and GHD delivered the Rouse Hill Recycled Water Plant at a cost of $60 million

5) Outline of the Process and Technology
Rouse Hill uses a tertiary treatment wastewater treatment process consisting of sand filtration + UV + chlorination and an advanced treatment process using MF + UF + RO. See Figure 4.4.7 for further details.

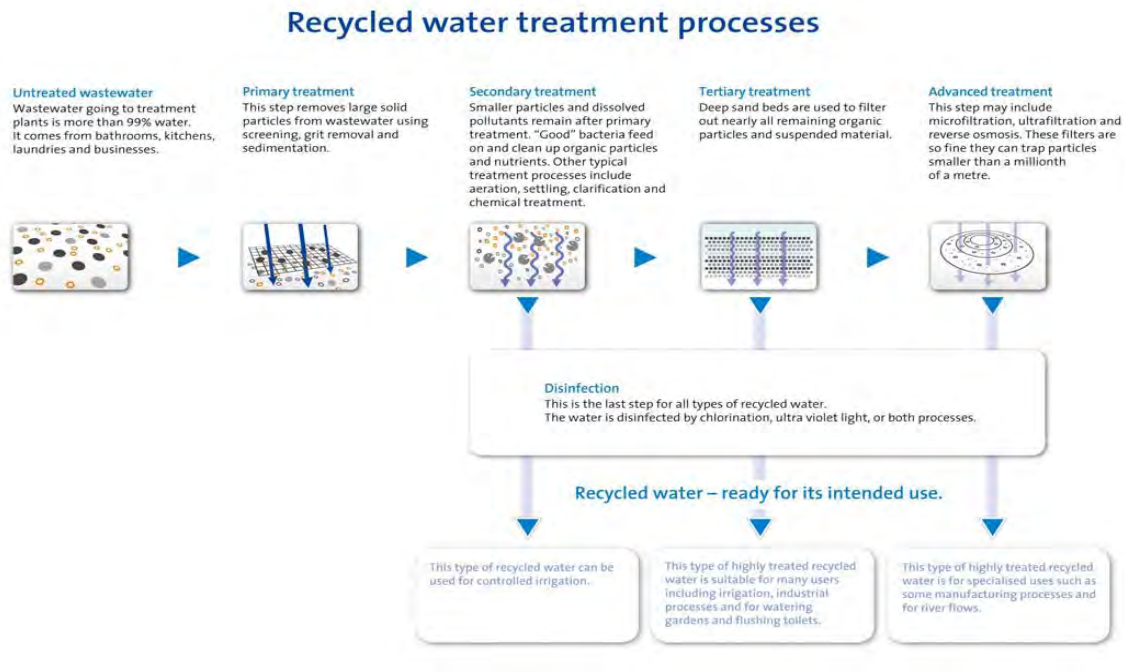


Figure 4.4.7 Recycled Water Treatment Process.

6) Relevance to the Project
In the case study of typical reclaimed water project in Australia, there is higher possibility to learn about applicable case study, administration, facility management, operation & maintenance and public participation.

References
1. "Water Reuse Market 2005-2015 (A Global Assessment & Forecast)" published by Global Water Intelligence and "Water Reuse" Metcalf & Eddy/AECOM
2. "Municipal Water Reuse Markets 2010 (Analysis, forecasts and inventory)" published by Global Water Intelligence
3. Mehul Patel, P.E. GWRS Process Manager (2010)"The GWR System – Indirect Potable Reuse as a

New Water Source”Orange County Water District
4. PUB, http//www.pub.gov.sg/water/newater
5. Despo Fatta“Good Practice Example on the Utilization or Treated Wastewater for Irrigation Purposes” University of Cyprus Civil and Environmental Engineering Department
6. Emmanuel Van Houtte, Johon Verbauwhede (2006)“Operational experience with indirect potable reuse at the Flemish Coast”Desalination 218

CHAPTER 5

EVALUATION OF THE RECLAIMED WATER TREATMENT PROCESS

CHAPTER 5 EVALUATION OF THE RECLAIMED WATER TREATMENT PROCESS

5.1 Evaluation Policy and Method

The use of reclaimed water is expanding around the world. Especially in the U.S.A., Australia and other countries where water is actively recycled, the reclaimed water quality standards are established and enforced. In considering recycling water it is important to examine the raw and target water quality, and then select an optimum treatment process not only in terms of economics but also from the viewpoint of the stable and efficient operation of water reuse facilities.

This chapter discusses the treatment processes to be selected mainly from the viewpoint of water quality.

5.2 Raw Water (Secondary Effluent)

5.2.1 Treatment Capacity

The Denpasar Wastewater Treatment Plant (Suwung WWTP) was built with Japanese ODA (yen loans), and its treatment capacity is 51,000m^3/day. The second phase of the collection system is currently under construction, and according to the information received from the WWTP, the flow rate as of May 2011 was approximately 25,000 m^3/day. However, based on data from the ultrasonic flow meter installed in July 2011, the influent flow rate during August was much lower ranging from 4,865 m^3 to 9,063 m^3/day (average 6,084 m^3/day). In order to verify the flow meter data, the WWTP calculated influent flow rates from pump running times and obtained results that ranged from 5,861 m^3 to 9,491 m^3/day (average 6,804 m^3/day). August being a very dry period with very little rain may explain the significantly lower flow rates compared to May. The flow rate during other seasons, especially the rainy season is unknown at this moment. The JICA survey team will obtain data from the WWTP and will study flow patterns further, however large fluctuations in the influent flow rate are expected.

5.2.2 Treated Water Quality at Denpasar Wastewater Treatment Plant (IPAL Suwung)

(1) Water Quality Data for the Existing Wastewater Treatment Plant

The following data (Table 5.2.1) provided by IPAL Suwung, shows the treated water quality of IPAL Suwung. The treated water was tested and analyzed by a third party once a month. This treated effluent is the proposed source of raw water for the water reuse system.

Based on the data, both BOD (6.8～48.75mg/l) and COD (20.0～172.8mg/l) show big fluctuations in value which implies that the treatment process is unstable. The factors that could contribute to the instability include the following: 1. The difference in influent quantity and quality during dry and rainy seasons. 2. the WWTP is currently under construction. 3. Operating conditions for the aerator might be unstable; however the effect it has on water quality parameters is unclear.

The targeted effluent BOD after the completion of the third phase of wastewater collection is 30 mg/l. At this stage, the quality of the treated effluent will at certain times not meet the provisional effluent quality standard. The WWTP will have to achieve a stable operation and consistent effluent quality in the near future if a reclaimed water system is to be implemented.

The BOD and TSS values of the secondary effluent in many developed countries are generally less than 30 mg/l with some other regions setting even stricter water quality control target values. The Tokyo Metropolitan Government Bureau of Sewerage set the BOD and TSS control values of the secondary effluent at 10 mg/l or less at almost all their wastewater treatment plants.

When selecting a water reuse treatment process, it is essential to take into account the quality of the effluent from IPAL which would be the raw water source, and aim for timely achievement of stable conditions.

Table 5.2.1 Water Quality Data Provided by IPAL Suwung

Parameters	Raw Water Inflow	Standard	Measurement							
	Nov-09		Jul-09	Nov-09	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10
Temperature '©	29.6	38	30	29.4	31.2	29.8	28.2	30	31	29
TDS mg/l		2000	566	478	491	487	465	484	519	456
TSS mg/l		100	33	58	43	33	23	16	32	13
pH	7.3	6-9.	-	8.1	7	8	7.2	8	6.8	7
Fe mg/l		5	0.4	0.3	0.3	0.2	0.3	0.2	0.3	0.1
Mn mg/l		2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Cu mg/l		2	0.01	-	0.004	0.004	0.008	-	-	0.02
Zn mg/l		5	0.09	0.06	0.03	0.03	-	-	-	1
Cn mg/l		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
H_2S mg/l		0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F mg/l		2	0.7	0.12	0.7	0.7	0.2	0.2	0.2	0.9
Cl_2 mg/l		1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
NH_3 mg/l		1	25.7	-	5.3	29.5	101.5	4.4	6.6	8.3
NO_3-N mg/l		20	5.6	3.2	1.1	4.6	1.4	2.1	2.8	0.5
NO_2-N mg/l		1	0.1	0.1	0.06	0.06	0.06	0.06	0.02	0.8
BOD mg/l	70.3	50	37.2	44	39.8	28.4	35.3	32	14.4	42
COD mg/l	156	100	48	111	54.8	67.2	53	40	30	172.8
MBAS mg/l		5	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenol mg/l		0.5	0.003	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Oil mg/l		10	0	7	0	0.2	0	0	0	2
Sulphate mg/l		400	66.7	48.9	43.4	16.4	48.6	19.3	18.2	57.8
DO mg/l	0.3	1	4.8	4.2	4.5	4.5	5.4	3.6	2.7	5.1
PO_4^- mg/l		5	47.8	13.8	0.2	3.4	3.4	3.4	5.1	0.6
Cl^- mg/l		600	94.5	143.6	96	95.8	68.7	65.2	712.1	68.2

Parameters	Standard	Measurement									
		Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Sep-11
Tempreture	38	30.0	29.0	29.0	28.0	29.0	29.0	29.0	29.0	28.0	29.0	30.0
TDS mg/l	2000	474.0	393.0	333.0	390.0	430.0	441.0	511.0	505.0	547.0	525.0	535.0
TSS mg/l	100	24.0	22.0	56.0	45.0	39.0	57.0	111.0	30.0	41.0	65.0	67.0
pH	6-9.	7.0	7.0	7.2	7.8	7.0	7.5	8.0	7.0	7.0	7.0	7.0
Fe mg/l	5	0.06	0.14	0.28	0.1	0.12	0.19	0.23	0.07	0.06	0.34	0.14
Mn mg/l	2	N.D.	N.D.	0.022	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cu mg/l	2	0.0326	N.D.									
Zn mg/l	5	1.0456	0.1932									
Cr6+ mg/l		N.D.	N.D.									
Total Cr mg/l		N.D.	N.D.									
Hg mjg/l		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	<0.0005	<0.0005	<0.0005	<0.0005
Pb mg/l		N.D.	N.D.									
Cn mg/l	0.05	<0.05	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05			
H_2S mg/l	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	0.286	0.880	<0.01	<0.01	<0.01	<0.01
F mg/l	2	0.83	1.30	0.05	0.98	0.86	1.01	0.19	0.54	0.52	0.70	0.56
Cl_2 mg/l	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.5	0.5	<0.01
NH_3 mg/l	1	8.8	4.9	3.85	4.0	7.6	11.45	1.17	8.00	21.7760	17.743	17.886
NO_3-N mg/l	20	4.471	3.102	1.062	5.512	5.114	2.992	3.113	0.180	0.223	1.377	2.471
NO_2-N mg/l	1	0.016	0.016	0.014	6.120	0.014	0.049	0.009	0.023	0.069	0.022	0.031
BOD mg/l	50	40.8	26.09	41.0	10.17	6.8	8.4	9.6	12.8	36.78	48.75	42.50
COD mg/l	100	102.0	58.8	68.4	41.6	20.8	20.0	22.2	48.6	83.0	72.4	68.6
MBAS mg/l	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.0438	0.1588
mg/l	0.5	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0193	<0.01
mg/l	10	1.2	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0
Sulphate mg/l	400	15.846		188.53	19.538	21.00	24.00	32.0	30.0	58.344	37.015	36.225
DO mg/l	1	5.3		4.5	3.6	4.2	4.4	4.0	3.8	2.6	3.04	2.22
PO_4^- mg/l	5	0.7		1.0	2.1	1.30	1.50	1.50	0.4	0.5	0.1668	1.1217
Cl^- mg/l	600	71.61		44.53	41.72	58.56	50.66	50.36	54.83	84.79	123.26	93.32
MPN Coli /100ml		17,000	540,000	110	1,600	35,000	540,000	140,000	540,000	720,000	170,000	490,000
MPN Fecal Coli /100ml		3,500	70,000	26	540	12	540,000	600	540,000	490,000	79,000	330,000

(2) Water Quality Data of the Survey of Feasibility Study

The JICA survey team began the analysis of treated effluent at the Denpasar wastewater treatment plant (IPAL Suwung WWTP) from June 2011 after conducting the test operation of the pilot reclamation plant. Test results are shown in Table 5.2.2. The survey team compared test data to monthly analysis data received from the Plant even though it was understood that doubts remained as to the reliability of values for water quality analysis conducted on Bali Island. As a result, monthly values of TSS and BOD varied from two to three times and COD varied 1.2 to 1.5 times. The data shows that fluctuation in water quality is not only seasonal (especially dry and rainy season), but also daily. Moreover, the test parameters for color and UV 254, which is not measured by the WWTP exceeded normal standards. The degree of color exceeded 100 TCU once in a while and compared to the secondary effluent of an advanced country, the value is very high. The values for UV 254 are two to five times higher than those at the Shibaura Water Reclamation Center in Japan. From this, we can understand that it is not easy to process reclaimed water.

Table 5.2.2 Analysis of Effluent Water Quality at Denpasar Wastewater Treatment Plant

WATER QUALITY	**Secondary Effluent**									
PARAMETER	UNIT	Jun-11	Jul-11	Jul-11	Aug-11	Aug-11	Aug-11	Aug-11	Sep-11	Sep-11
Temperature	℃	27.8		26.6	27.4	26.6	27.3	27.2	27.4	27.3
pH		7.34		7.92	7.42	7.44	7.02	6.98	6.91	6.94
DO	mg/L	4.28		6.29	4.53	4.37	4.25	4.32	2.75	3.44
T-COD	mg/L	78		58	82	66	64	76	120	104
T-BOD	mg/L	23.9		18.7	33.8	32.0	27.2	8.5	19.6	15.6
Nitrate(NO_3-N)	mg/L	1.442	0.168	0.167	0.147	0.271	0.331	0.883	0.504	0.611
Nitrate(NO_2-N)	mg/L	0.024	0.014		0.003	0.330	0.077	0.024	0.047	0.075
TSS	mg/L	346	59	20	39.0	36.0	33.0	26.0	58.0	38.0
Phosphat(PO_4)	mg/L	0.4	2.6	2.7	0.7505	1.3305	1.8296	1.1872	1.7432	3.5348
UV 254		0.125	0.222	227.000	0.271	0.288	0.29	0.278	0.41	0.3547
Color(TCU)		79.0	68.0	98.0	159.0	214.0	182.0	240.0	174.0	224.0
Turbidity(NTU)		14.5	13.2	0.170	20.600	25.600	28.200	29.600	55.500	40.600
Ammonium (NH4)	mg/L		16.067	15.5564	21.5327	13.8200	15.8250	15.8250	17.3500	25.482

5.3 Target Quality for Reclaimed Water

5.3.1 Case Studies Worldwide

The target quality for reclaimed water can differ greatly depending on the intended use, such as for irrigation as in some overseas countries or being returned to groundwater aquifers (after reverse osmosis treatment) as in Orange County Water District in California.

Standards and regulations of reclaimed water quality are established for various usages, such as for agricultural use (food crops and nonfood crops), irrigation, landscaping, industrial, groundwater recharge, etc. respectively, by the Environmental Protection Agency and some individual states in the U.S. and Australia. Generally, reclaimed water quality regulations require that the protection of public hygiene, utilization of the control area, requirements for use, aesthetic elements, economic factors, etc. be considered.

Reclaimed water quality standards in Japan are divided into four categories and applied as shown in the "Manual for sewage reclaimed water quality standards and others." (2005) summarized in Table 5.3.1, which has been prepared by the Japanese Ministry of Land, Infrastructure, Transport and Tourism based

on non-potable applications.

Table 5.3.1 Technical Standards for the Use of Reclaimed Water

Indicators	Toilet flushing	Sprinkling	Landscape use	Recreational use
E. Coli	Not detected / 100 mL	Not detected / 100 mL	Total coliform: 1000CFU/100mL[1)]	Not detected / 100 mL
Turbidity	2 or less (target value)[2)]			2 or less[2)]
pH	5.8 – 8.6			
Appearance	Not unpleasant			
Color	N.A.	N.A.	40 or less	10 or less
Odor	Not unpleasant			
Treatment	Sand filtration			Coagulation and sand filtration
Residual chlorine	free: 0.1 mg/L or combined: 0.4 mg/L	free: 0.1 mg/L or combined: 0.4 mg/L[3)]	N.A.	free: 0.1 mg/L or combined: 0.4 mg/L[3)]
Notes	1) Provisional criteria 2) Unit: mg-kaolin equivalent /L 3) Not applicable for cases in which long-term effects of disinfection is unnecessary			

* Standard application points: Residual chlorine is at the liability demarcation point, and the other items are at the exit of the water reuse facility.
* Cited from the "Manual of sewage recycled water quality standards, etc." prepared by the Japanese Ministry of Land, Infrastructure, Transport and Tourism

In general, reclaimed water tends to be easily accepted when it is applied to the irrigation of parks, golf courses, cemeteries, gardens and plants as well as for use in sprinkling, fountains, fire protection water and toilet flushing. However, the acceptance of reclaimed water even for toilet flushing is not necessarily easy if it can cause the outbreak of harmful insects of the chironomus genus (kind of buzzer midge) or if the water has a color, turbidity or odor. The acceptance level varies greatly between individuals, and it is fully conceivable that while some people will accept reclaimed water without any concern, others will not easily accept it.

In the past in Japan, there were many reports of visual discomfort from the color, turbidity and chironomus insects in the toilet flushing water of buildings, as well as the water's unpleasant odor. In response to these complaints, the criteria for the quality of reclaimed water shown above were established.

The Tokyo Metropolitan Government Bureau of Sewerage, which supplies reclaimed water to many buildings, sets the control target values of the reclaimed water quality at the Shibaura Water Reclamation Center to turbidity of 1 or less and color of 3 or less as shown in the Table 5.3.2. These target values are stricter than those specified for non-potable water in the manual prepared by the Japanese Ministry of Land, Infrastructure, Transport and Tourism. In order to achieve a color of 3 NTU or less, ozonation or an equivalent process is necessary, and completely achieving this target quality using only a combination of coagulation, sedimentation and sand filtration is expected to be extremely difficult. Since the membrane installed after ozonation requires ozone resistance, the Tokyo Metropolitan Government Bureau of Sewerage participated in a three year collaborative study of ozone and ceramic membrane filtration, and it then adopted this new technology when it expanded (7,000 m^3/day) the Shibaura Water Reclamation Center. This facility has been operating without trouble for more than one year since operation started in April 2010.

Table 5.3.2 The Control Target Values of the Reclaimed Water Quality of The Tokyo Metropolitan Government Bureau of Sewerage

	The control target values for recreational water established by the Ministry of Land, Infrastructure, Transport and Tourism
E.Coli	Undetected
Turbidity	1 or less
pH	5.8-8.6
Appearance	Not unpleasant
Color	3 or less
Odor	Not unpleasant
Residual Chlorine	Free residual chlorine 0.1mg/L or Combined residual chlorine more than 0.4mg/L
Facility Standard	Same or higher quality facility as coagulation, sedimentation and sand filtration facility

5.3.2 Target Water Quality of Southern Bali

In Indonesia, a standard for reclaimed water quality has not yet been established. The Ministry of Land, Infrastructure, Transport and Tourism is playing a major role, with support from the Japanese government, in developing the basic standards and guidelines for reclaimed water. The water quality control target values can be set after the standard is established. Before this is accomplished, the water quality control target values will be examined based on the applicable existing standards.

Moreover, the current survey and feasibility study does not cover potable water applications of reclaimed water including indirect potable use such as groundwater recharge to aquifers; the survey covers only non-potable applications. Therefore, it is not necessary to apply the very high water quality standards associated with potable water applications.

Meanwhile, many of the tourists in Bali come from developed countries including Europe and the U.S., so it is highly possible that there will be complaints about the color, turbidity, odor and insects, such as members of the genus chironomus, especially when reclaimed water is used at hotels and the airport. Therefore, it is conceivable that a relatively high level of water quality might be required.

Taking into account the Balinese environment and results achieved with the water quality standard targets in Japan, we consider it desirable to use the same control target values (the stricter effluent standards for recreational water established by the Ministry of Land, Infrastructure, Transport and Tourism) adopted at the Shibaura Water Reclamation Center for the reclaimed water in this project.

5.4 Selection of Treatment Process

5.4.1 Comparison of the Treatment Processes considering Target Reclaimed Water Quality

Many countries around the world, such as the United States (California) and Singapore, use the RO membrane treatment process, which allows the removal of dissolved components such as salts, when recharging groundwater aquifers and in indirect recycling for potable applications.

The survey team may not recommend the RO membrane treatment process for this project because

groundwater recharge and indirect potable water use is not being considered and also because the process has a very high start up and operating cost (especially electric power) and would thus compromise the economic feasibility of the project. On the other hand, as described above, to consider the needs of Bali, it may be desirable to apply the target value of water quality management by the Bureau of Sewerage Tokyo Metropolitan. Moreover, considerable treatment would be required to bring the effluent from the Denpasar wastewater plant to an acceptable quality. Therefore, the processes such as the biofilter, ozonation and ceramic membrane filtration process used at the Shibaura Water Reclamation Center in Tokyo will be evaluated. This process may allow the treatment of low quality wastewater treatment plant effluent to obtain reclaimed water with a higher quality.

The proposed treatment process is less expensive than RO and able to provide high quality reclaimed water as such, but compared to RO, the quality is low. In the graph shown below, the proposed treatment process is positioned among conventional technologies as a new reclaimed water process.

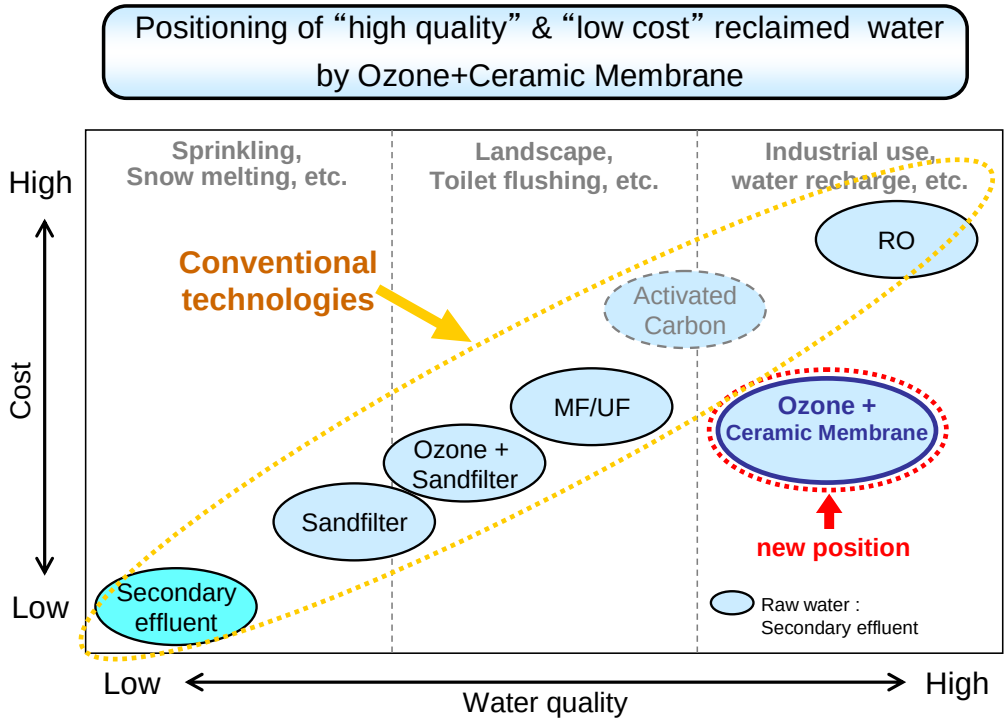


Figure 5.4.1 Positioning of Ozone + Ceramic Membrane Compared to Conventional Technologies

5.4.2 Proposed Treatment Process and Verification by Pilot Plant

The process adopted at the Shibaura Water Reclamation Center in Tokyo is shown in Figure 5.4.2, and the function and purpose of each unit process and treatment equipment is described below.

1) Biological filter facility
This facility uses a physical and biological process to remove nitrogen which is in high concentrations (nitrous acid), solids, organic substances, and other substances contained in the WWTP effluent. This facility is required because the removal of nitrogen is practically impossible at subsequent stages of the treatment process which deal with the removal of solids and organic substances (BOD). The bio-filter would also help to reduce the amount of ozone injection and coagulant addition at subsequent stages of treatment.

2) Ozonation equipment
Ozone is a very reactive gas that can oxidize bacteria, moulds, organic material and other pollutants found

in water. It can not only reduce BOD and COD, but also decompose color and smell. Furthermore, it is expected that the surface property of micro solids in raw water is modified by ozone and thus facilitates the coagulation process.

3) Coagulation equipment
Generally, micro solids exist in the effluent from sewage treatment plants, and cause filter blockage. The micro solids in raw water are coagulated into coarse particles to prevent filter blockage.

4) Ceramic membrane equipment
Ultrafiltration (membrane filtration) has much higher clarification and disinfection ability than sand filtration generally used on reclaimed water. Ceramic membranes with a pore size of 0.1 micrometer can remove bacteria, protozoan, impurity and suspended matter with a size greater or equal to 0.1 micrometer.

5) Feature of the combined system
By using ozone and coagulation in combination with the ceramic membrane, the system can be operated stably with a high filtration rate, and at a lower cost. This is because it can control the pressure difference between films in the ceramic filtration process by making the micro solids in raw water coagulate easily first by ozone injection, then by coagulating the micro solids into coarser particles.

Figure 5.4.1 shows the process adopted at the Shibaura Water Reclamation Center in Tokyo.

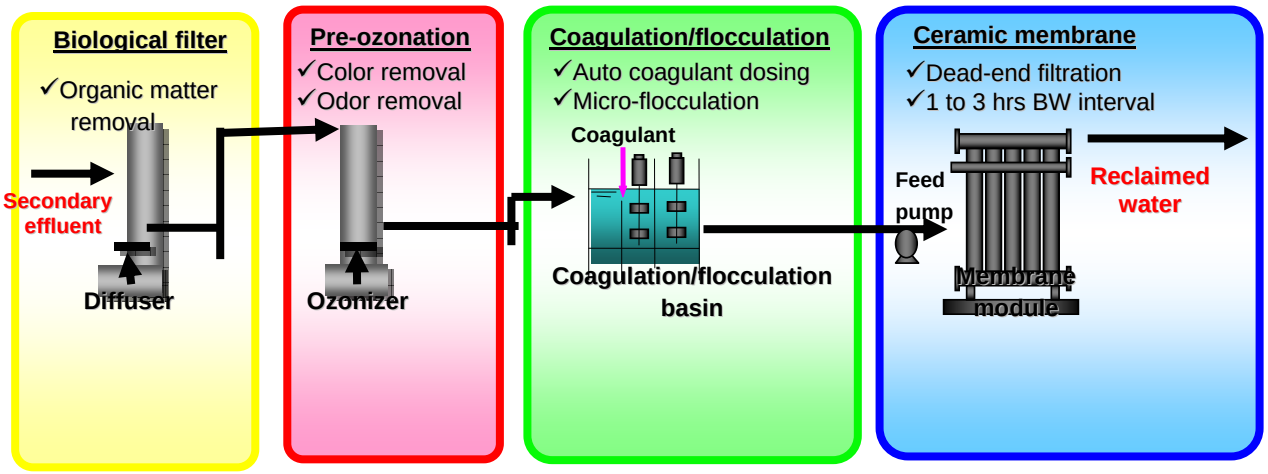


Figure 5.4.2 Process Flow at the Shibaura Water Reclamation Center

Thus, this reclaimed water production equipment can produce high quality water by combining the oxidization and bactericidal action of ozone, the coagulation of micro solids, and the filtration removal of bacteria, suspended substance and other matters. However, since the raw water conditions can affect the operating condition of the facility and the reclaimed water quality, test runs must be performed at the site.

Verification result at present
By using test equipment, the survey team studied the quality of reclaimed water and water quality control target values through trial runs (biological filtration process + Ozone + Coagulation + Ceramic Membrane Filtration).

The results of local pilot test carried out in 2011 indicates that above mentioned recreational use standard as well as the management standard of City of Tokyo can be accomplished. However, the number of data acquisition is only seven (7) times, which is not too many times and the results of some of local water quality analysis is still unreliable. Also, there is a need to change the operating conditions during the dry season when water quality deteriorate, therefore, it will be necessary to conduct more water quality

analysis before the detailed design stage. Tests should include parameters in the proposed standard that were not tested during the pilot test. More data may help customers accept reclaimed water and will improve the design to ensure a safe supply.

1. “Water Reuse” published by Metcalf & Eddy/AECOM, written by Takashi Asano, Franklin L. Burton, Harold L. Leverenz, Ryujiro Tsuchihashi, George Tchobanoglous

CHAPTER 6

ALTERNATIVES FOR A RECLAIMED WATER SUPPLY SYSTEM

CHAPTER 6 ALTERNATIVES FOR A RECLAIMED WATER SUPPLY SYSTEM

6.1 Basis for setting Alternatives

The reclaimed water produced at the reclamation plant described in Chapter 5 will be transmitted to receiving tanks of hotels through reclaimed water transmission facilities (pumps and transmission pipeline), distribution facilities (a distribution reservoir and distribution pipes) and service connections (service pipes and meters). Required service connections vary depending on the designated uses of the reclaimed water. This study considers two types of reclaimed water uses.

(1) Conventional Reclaimed Water Uses

Conventional reclaimed water uses include the following four applications,

- toilet flushing,
- cleaning of cars,
- cooling, and
- landscaping/gardening.

Reclaimed water is not used for drinking, cooking, laundry, bathing and showering. The above mentioned reclaimed water uses are called “conventional” because they are practiced and well-established in many countries. The reclaimed water supply for these conventional uses is referred to as “Conventional Reclaimed Water Supply System” in this preparatory survey.

(2) Reclaimed Water Use other than drinking, cooking an dish-washing water as “New Clean Water”

The second type of reclaimed water use includes bathing, showering and laundry in addition to the four conventional uses, but not drinking, cooking and dish washing. The reclaimed water, whose quality is good enough for this type of reclaimed water uses, is referred to as “New Clean Water” in this preparatory survey.

The preparatory survey team originally tried to identify a reclaimed water project targeting the conventional reclaimed water use, the Case 1. However, when the team reported the results of reclaimed water demand survey, interview survey, described in Chapter 4, the Indonesian side requested the team to survey the demand for covering more wider intended uses. After reviewing the Indonesian reports on the reclaimed water projects, described in Chapter 2, and discussing with Indonesian parties concerned, the Case 2, covering wider reclaimed water intended uses such as bathing and showering, is set as an alternative case.

In Indonesia, Ministry of Health Regulation of (No. 416/1990), which shows water quality standards for different types of water uses, defines the intended uses of “Drinking Water” and “Clean Water” in the first article in Chapter I, as follows.

- Air minum (Drinking Water): Needed for health maintenance, and can be drunk directly
- Air bersih (Clean Water): Needed for healthy daily life, and can be drunk with boiling

The Water provided by PT.TB distribution reservoirs is the drinking water (Air minim) in the eyes of law, but almost of all the water is called as Clean Water (Air bersih), and the water is not drink directly without boiling. It is a fact that many people buy bottled drinking water from commercial water vendors.

6.2 Description of Alternatives

6.2.1 Alternatives

The following two alternatives are set for the reclaimed water supply system in the preparatory survey.

- Case 1: Conventional Reclaimed Water Supply System
- Case 2: New Clean Water Supply System

The target users of the reclaimed water in both cases are the hotels in Nusa Dua, Benoa and Sawangan as explained in Chapter 4.

The design flows of reclaimed water system for each case are shown in table below, which are prepared based on the potential reclaimed water demands estimated in section 4.3.6.

Table 6.2.1 Design Flows of Reclaimed Water Systems

Item	Case 1	Case 2	Remarks
Treatment Capacity (Maximum daily flow)	4,500 m^3/day	9,000 m^3/day	
Distribution (Average daily flow)	4,100 m^3/day	8,200 m^3/day	
Customers' use (Average daily flow)	3,700 m^3/day	7,400 m^3/day	Water loss of 10% is assumed.

The required system configuration for each case is explained in the following subsections.

6.2.2 Case 1: Conventional Reclaimed Water Supply System

In Case 1, the main reclaimed water uses are toilet flushing and car washing. Reclaimed water is already supplied by BTDC for gardening in the hotels in Nusa Dua. Major hotels in Sawangan and Benoa are already using the effluent from their own wastewater treatment facilities for gardening. Therefore, the unmet reclaimed water demand for landscaping and gardening at the hotels is expected to be low.

In Case 1, the existing pipes used to deliver PDAM water for cleaning, car washing, cooling and landscaping inside hotel premises could be used to supply the reclaimed water for the same purposes. However, for flushing toilets, which is considered to be the largest reclaimed water demand, the installation of new service pipes to each guest room and main buildings having toilets is unavoidable as shown in Figure 6.2.1. In Case 1, the existing service pipes to guest rooms are required for supplying PDAM water to each guest room (separately from the reclaimed water) for bath, shower, etc. In simple terms, the conventional reclaimed water supply system is a dual service pipe system.

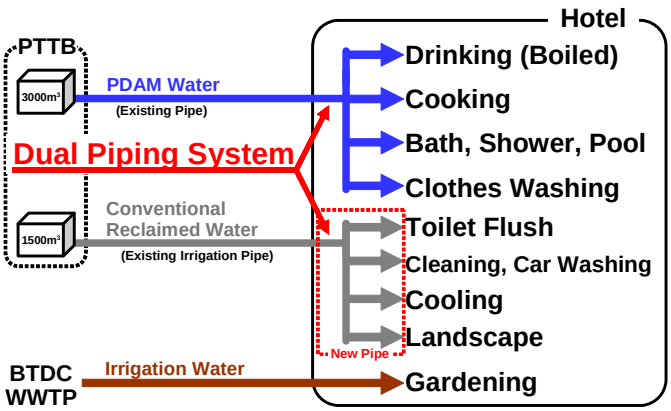


Figure 6.2.1 Conventional Reclaimed Water Supply System (Dual Service Pipe System)

How to renovate the existing water service pipes in the hotels is considered for both cases based on field surveys and collected drawings of hotels. The standard renovation model for Case 1 is shown in Figure 6.2.2. In this case, the contents and construction costs of the renovation are studied based on the assumption that the volume of reclaimed water supply to each hotel is 20% of the total water volume supplied to the hotel as explained in Chapter 4. The green lines in the figure show the pipes for the reclaimed water while the blue lines and red lines are for unheated PDAM water and heated PDAM water, respectively.

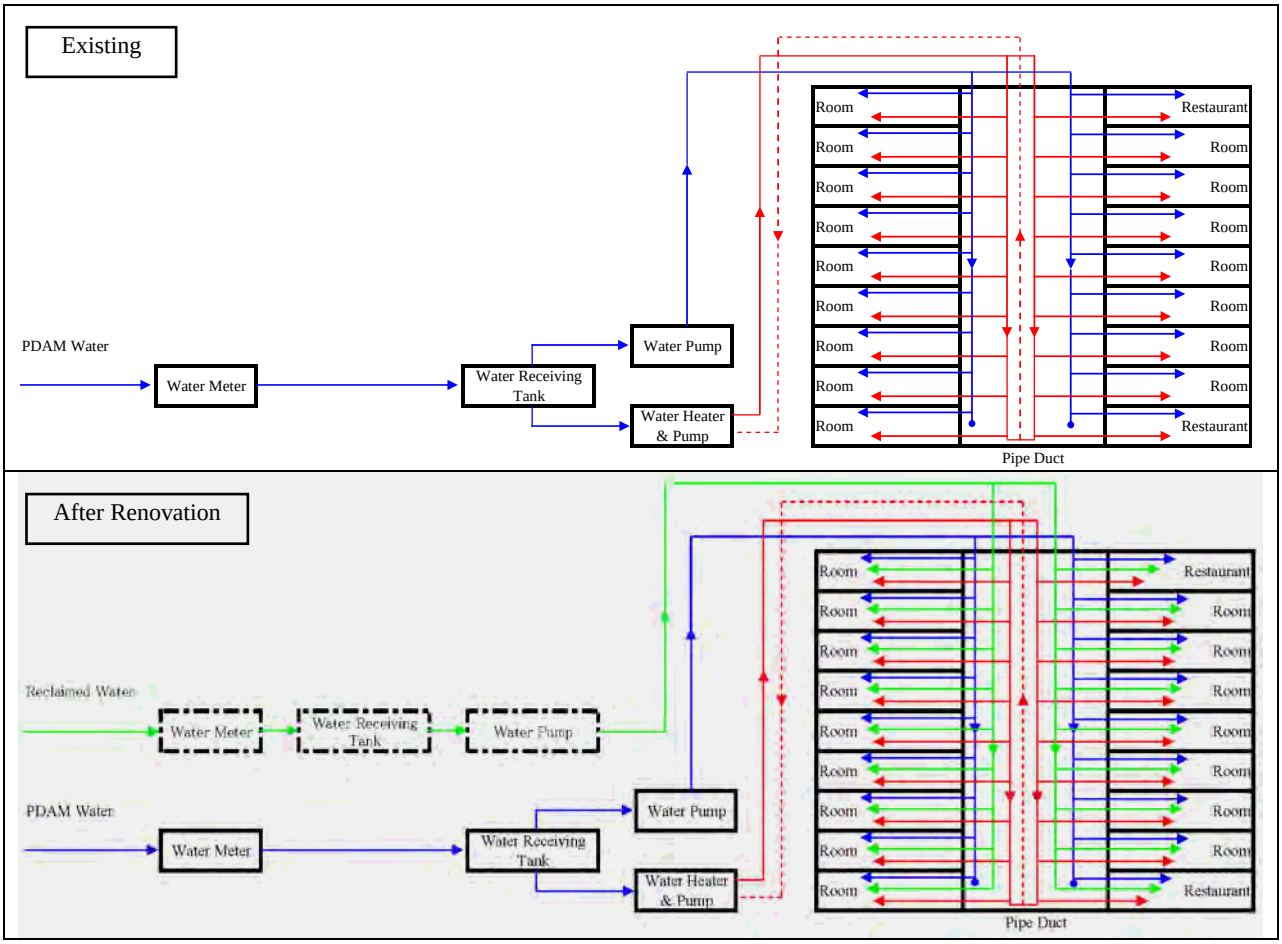


Figure 6.2.2 Standard Renovation Model for Establishing the Dual Service Pipe System (Case 1)

Some hotels in the target areas have their own treatment facilities to improve the quality of the water supplied by PDAM. Figure 6.2.3 shows an optional renovation model considered for these hotels.

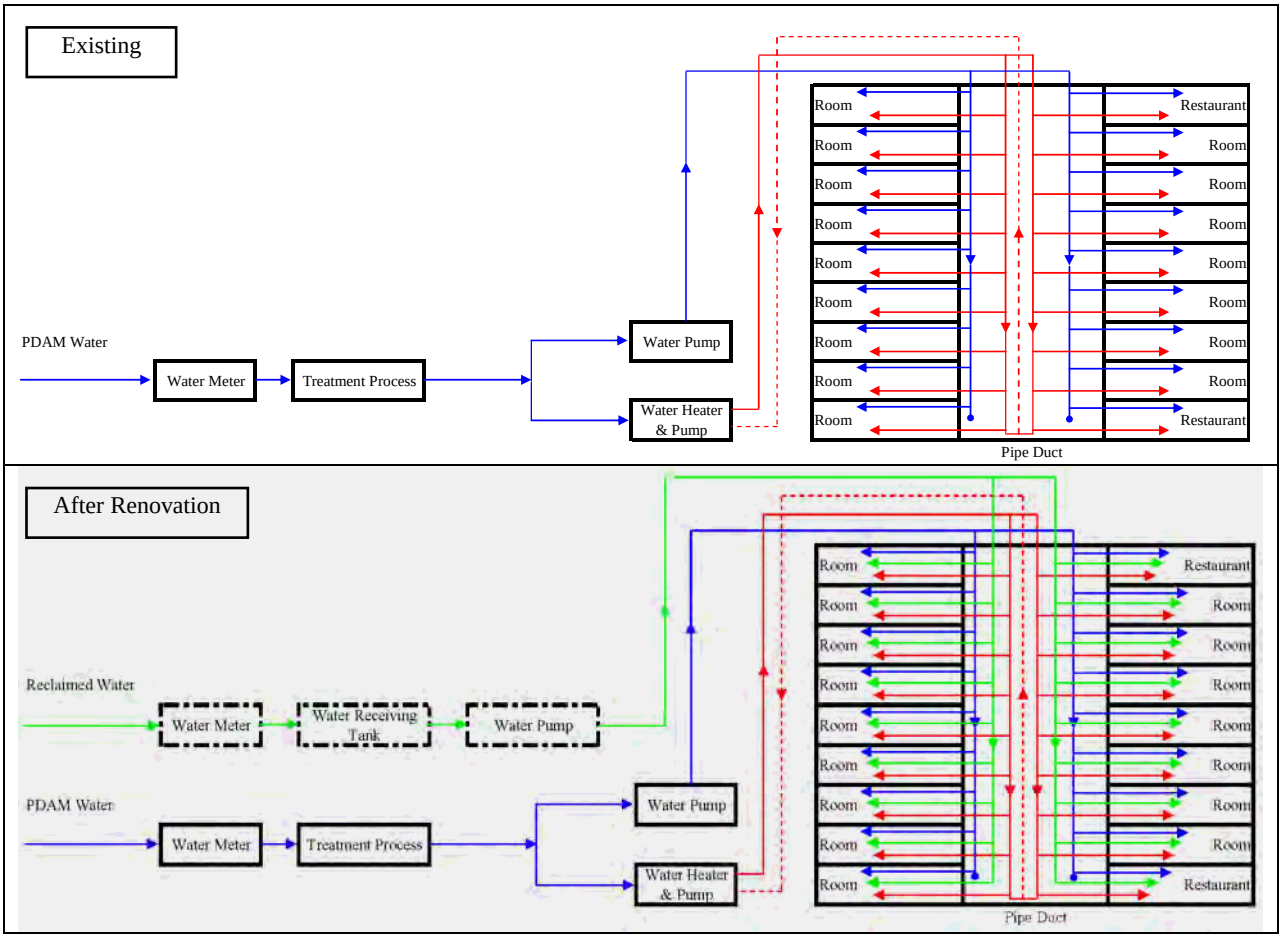


Figure 6.2.3 Optional Renovation Model for Establishing the Dual Service Pipe System in the Hotels treating PDAM Water (Case 1)

6.2.3 Case 2: New Clean Water Supply System

In Case 2, in which the reclaimed water is used for bathing and showering, as well as for the conventional uses, the reclaimed water volume required in hotel rooms is significantly larger than that of Case 1.

Consulting Bali government's wish to use the reclaimed water, the Case 2 is prepared to supply the reclaimed water mixed with PDAM water by use of existing service pipe system in the hotels. The PDMA water and bottled water for drinking and cooking is supplied by another system as shown in Figure below.

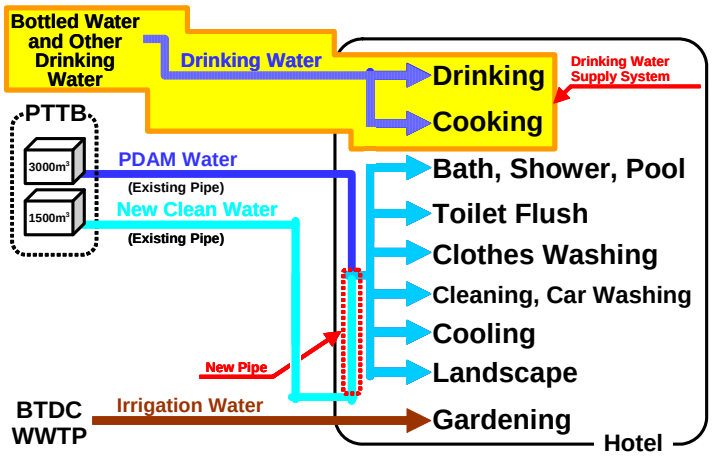


Figure 6.2.4 New Clean Water Supply System

Figure 6.2.5 shows the standard renovation model for Case 2. In this case, the contents and construction costs of the renovation are studied based on the assumption that the reclaimed water supply to each hotel is 40% of the total water supplied to the hotel (the half of non-drinking/cooking water (80%) because 50% is mixed with PDAM Water) as explained in Chapter 4.

If the amount of drinking/cooking water used in the restaurants is 20% of the total water supplied (the same condition explained in Chapter 4), the size of the new reservoir and the pipes, and the capacity of the new pump required at each hotel to send drinking/cooking water to their kitchens are the same as those for supplying the reclaimed water in Case 1 (20% of total water supply). Therefore, the estimated renovation costs of Case 1 are used to estimate the costs of establishing the separate drinking and cooking water supply system for the kitchens in case 2.

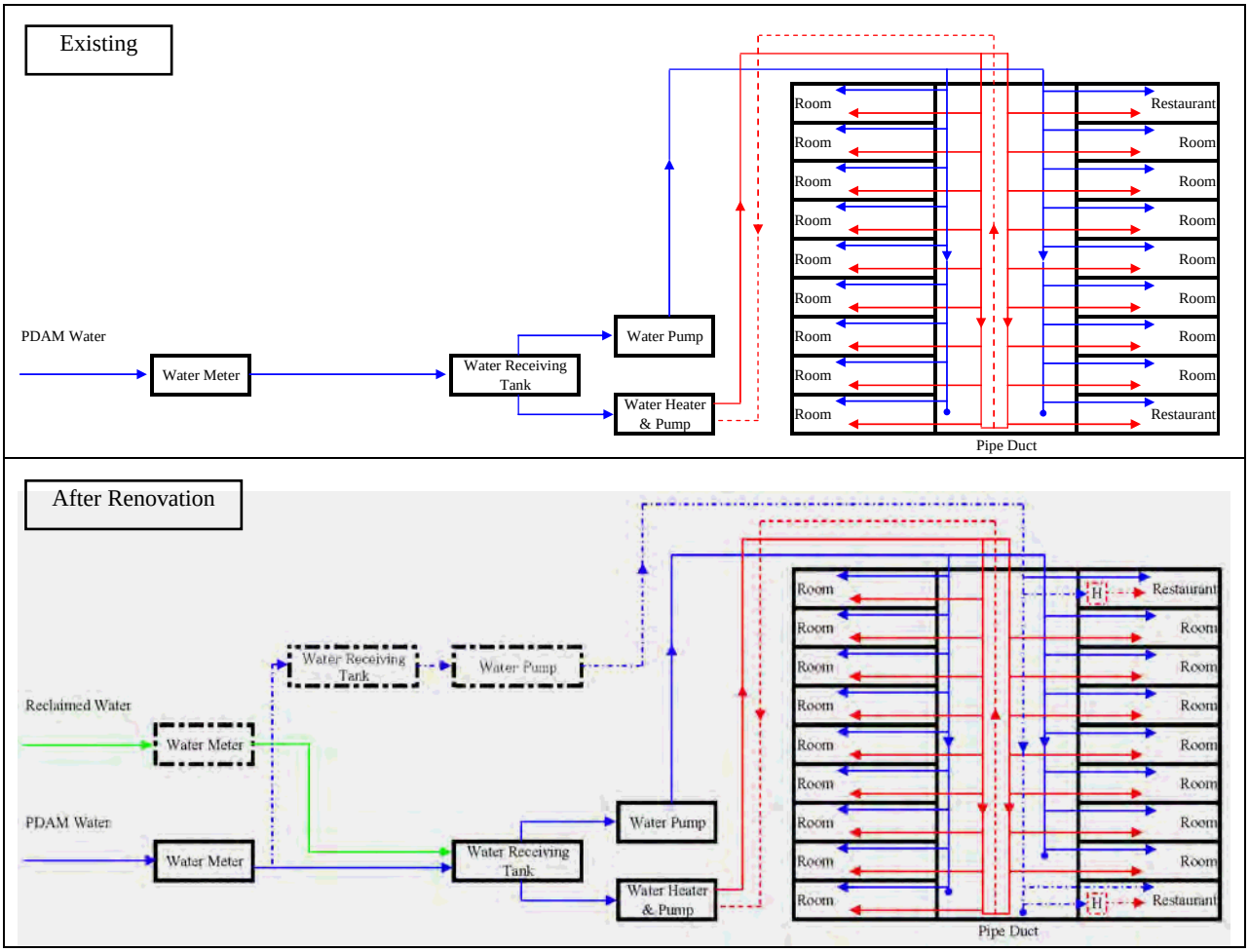


Figure 6.2.5 Standard Renovation Model for Establishing New Clean Water Supply System (Case 2)

As it was for Case 1, some hotels in the target areas have their own treatment facilities to improve the quality of the water supplied by PDAM. Figure 6.2.6 shows an optional renovation model of Case 2 considered for these hotels.

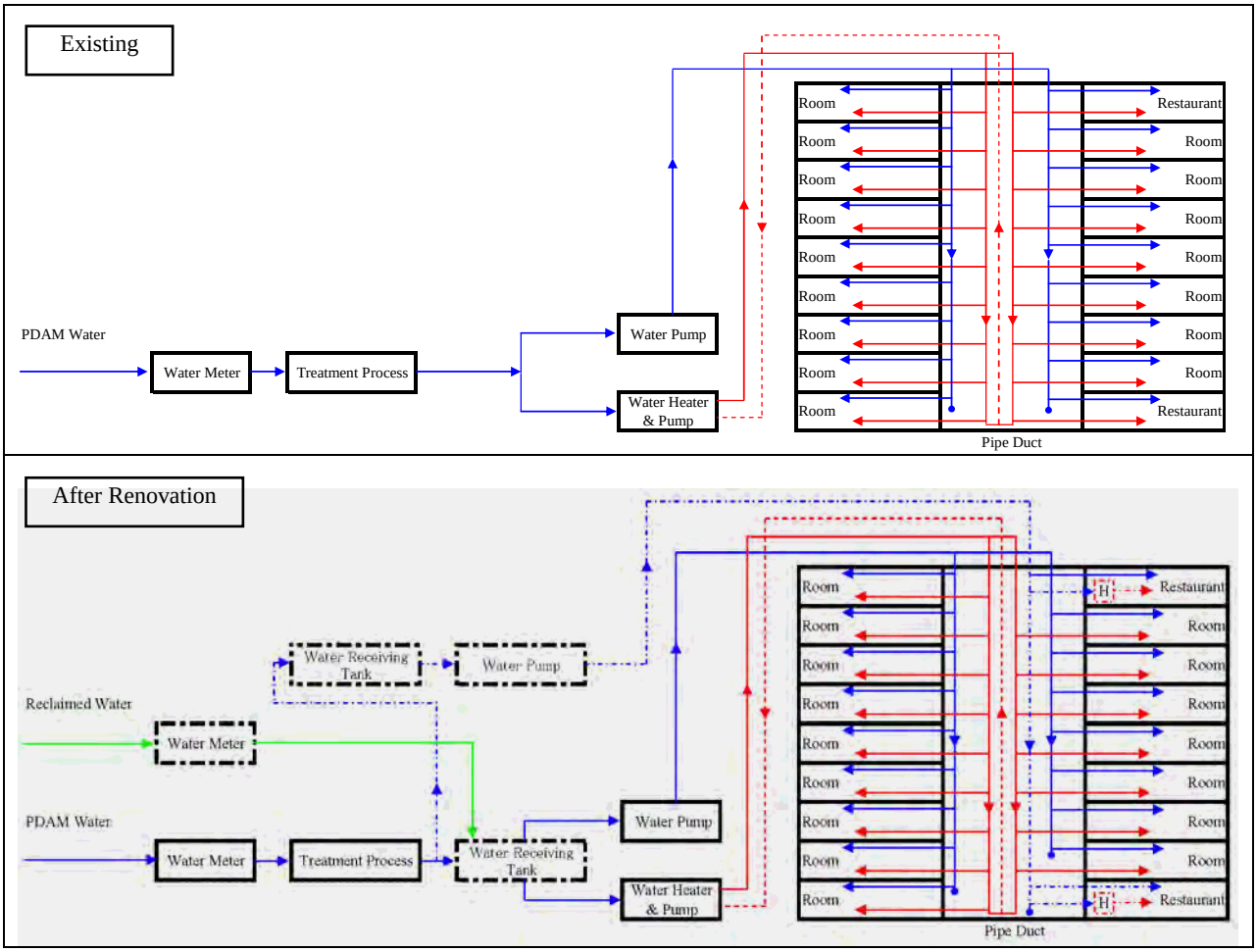


Figure 6.2.6 Optional Renovation Model for Establishing New Clean Water Supply System in the Hotels treating PDAM Water (Case 2)

6.3 Unit Price for the Renovation of Water Service Pipes

The unit price for the renovation per guest room is prepared for estimating the required costs for the renovation of water service pipes in chapter 10.

6.3.1 Material used for Unit Cost Estimation

The renovation cost per room is calculated here for each case as the unit cost of renovating water service pipes. The unit prices are then used to calculate construction costs of the project in (3).

N hotel provided the survey team with a detailed plumbing diagram which shows their relatively complex water service pipe system. In the calculation of the unit prices, their service pipe system is referred to as the base model on which the renovation is designed to calculate the model renovation costs per room for Case 1 and 2. The conditions of N hotel used for the calculation of the unit prices are as follows.

- Number of Rooms : about 400 rooms
- Building Layout : Main Building (3 floors), Northern Building (6 floors), Southern Building (5 floors), Coast Building (14 floors)
- Number of Internal Restaurants : 6 Restaurants

・Total Volume of Water Consumption : about 1,000 m^3/day
- Water Volume for Toilet : about 200 m^3/day (20%) (Capacity of new pump in Case1)
- Water Volume for Drinking : about 200 m^3/day (20%) (Capacity of new pump in Case2)
- Water Volume for Non-drinking : about 800 m^3/day (40%)
(including 400 m^3/day of the reclaimed water in Case2)

6.3.2 Calculation of the Renovation Unit Price for Case 1

The model renovation costs for Case 1 are calculated based on the renovation plan shown in Figure 6.2.2 and summarized in Table 6.3.1. The unit price per guest room for renovation is about 3,700 thousands IDR/room (= 1,492,270,000 / 400).

Table 6.3.1 Renovation Costs for Establishing Conventional Reclaimed Water Supply System (Dual Service Pipe System) in the Model Hotel (Case1)

Item	Quantity	Unit	Unit Price (IDR)	Cost (IDR)
Installation of reclaimed water service pipes	2,420	m	370,000	895,400,000
Construction of water receiving tank for the reclaimed water	1	Set	488,870,000	488,870,000
Installation of water meter for the reclaimed water	1	Set	8,000,000	8,000,000
Installation of water meter for the reclaimed water	1	Set	100,000,000	100,000,000
Total Cost				1,492,270,000

6.3.3 Calculation of the Renovation Unit Price for Case 2

The model renovation costs for Case 2 are calculated based on the renovation plan shown in Figure 6.2.5 and summarized in Table 6.3.2. The unit price per guest room for renovation is about 2,500 thousands IDR/room (= 990,830,000 / 400). These results show that the required costs of the renovation in Case 1 is approximately 1.5 times higher than that in Case 2.

Table 6.3.2 Renovation Costs for Establishing New Clean Water Supply System in the Model Hotel (Case2)

Item	Quantity	Unit	Unit Price (IDR)	Cost (IDR)
Installation of reclaimed water service pipes	920	m	363,000	333,960,000
Construction of water receiving tank for the reclaimed water	1	Set	488,870,000	488,870,000
Installation of water meter for the reclaimed water	1	Set	20,000,000	20,000,000
Installation of water meter for the reclaimed water	1	Set	100,000,000	100,000,000
Installation of water heater for the reclaimed water	6	Set	8,000,000	48,000,000
Total Cost				990,830,000

CHAPTER 7

PROPOSED PROJECT SCOPE

CHAPTER 7 PROPOSED PROJECT SCOPE

7.1 Purposes of the Project

The proposed projects are planned to supply the reclaimed water to the hotels in Nusa Dua, Benoa and Sawangan. The project purposes are to provide PDAM water equivalent to reclaimed water volume to the domestic users in Southern Bali as well as solving the water shortage at the hotels.

7.2 Reclaimed Water Bulk Supply System

The reclaimed water bulk supply system proposed for this project consists of a series of facilities from the reclamation plant to the existing distribution reservoir in Nusa Dua. The latter once used for storage of irrigation water, would be used instead for the reclaimed water. Figure 7.2.1 shows a general layout plan of the reclaimed water bulk supply system and the outlines of the system are further explained in the following sections.

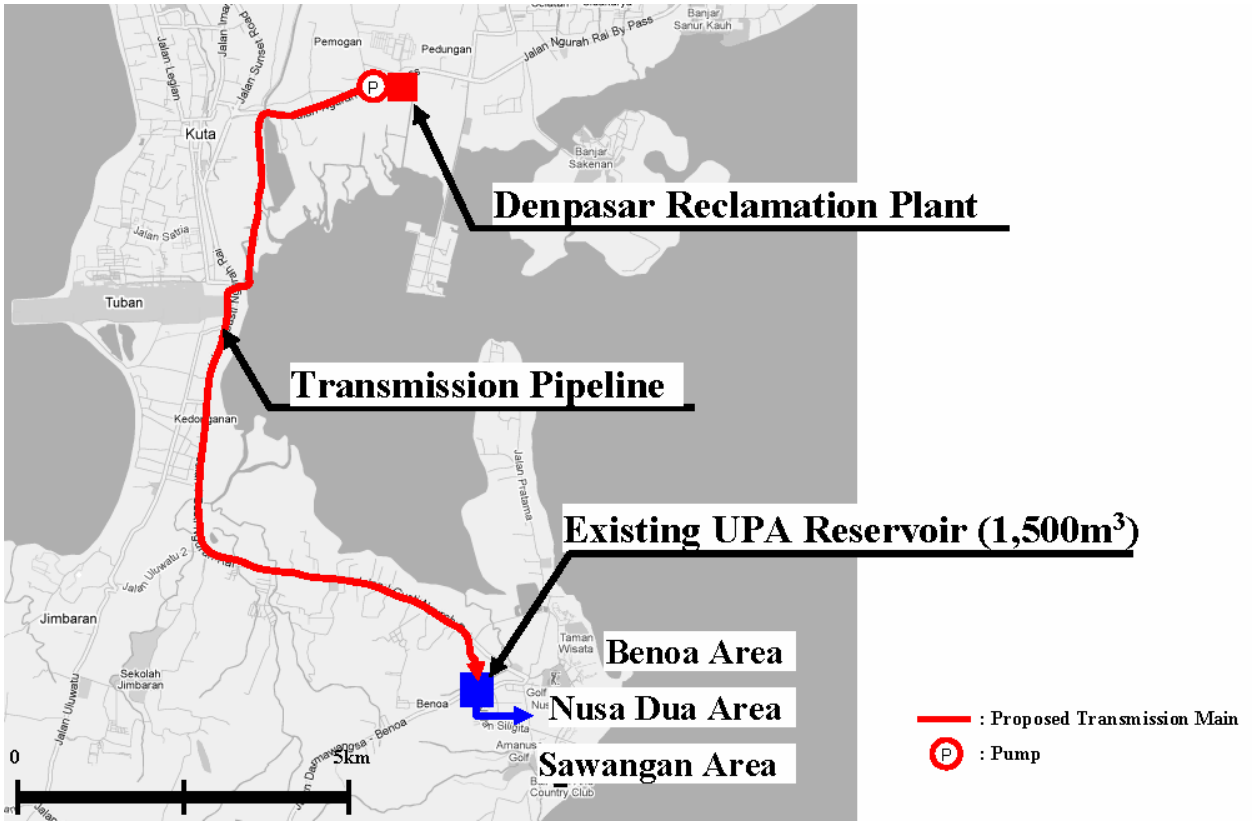


Figure 7.2.1 General Layout Plan of the Reclaimed Water Bulk Supply System

7.2.1 Design Flows and Capacity of Facility

The design flows of the bulk supply system from the reclamation plant to the existing distribution reservoir are set based on the reclaimed water supply plan as follows.

Table 7.2.1 Design Flows for the Reclaimed Water Facilities in Case 1 and Case 2

Design Flow	Case 1	Case 2	Remarks
Maximum Daily Flow	4,500 m^3/day	9,000 m^3/day	For design of reclamation and transmission facilities

Average Daily Flow	4,100 m^3/day	8,200 m^3/day	For O&M of reclamation, transmission and distribution facilities
Maximum Hourly Flow	4,950 m^3/day	9,900 m^3/day	For design of distribution pipes
Maximum Supply Flow	9,000 m^3/day	18,000 m^3/day	For design of service pipe system in hotels. The flow is set at twice of the maximum daily flow.
Average Supply Flow	3,700 m^3/day	7,400 m^3/day	Water loss, about 10% of average daily flow, is assumed at distribution and service pipes

The design maximum daily flow is used to decide the capacity of the reclamation plant. The design maximum daily flow is set at 110% of the design average daily flow. The design maximum hourly flow is set at 120% of the design average daily flow, based on the Indonesian design guideline. The design maximum flow for service pipes in the hotels is set at 200% of the design maximum daily flow. The supply volume finally delivered is set at 90% of average daily flow, assuming water loss about 10% of the average daily flow.

7.2.2 Reclamation Plant

The required reclamation process is discussed in Chapter 5. Figure 7.2.2 shows the proposed reclamation process. The planned design capacity of the reclamation plant for Case 1 and Case 2 is 4,500 m^3/day and 9,000 m^3/day, respectively.

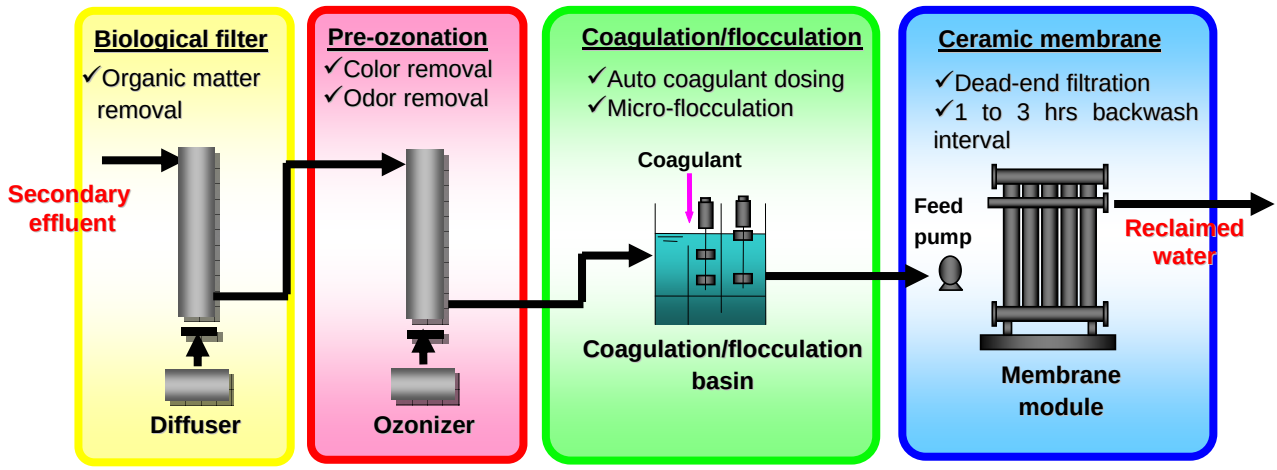


Figure 7.2.2 Proposed Reclamation Processes

7.2.3 Reclaimed Water Transmission Facilities

The reclaimed water transmission facilities proposed consist of transmission pump facilities and the reclaimed water transmission pipeline. The general layout of these facilities is shown in Figure 7.2.1.

Since the existing reservoir to be used for the reclaimed water is located at higher ground than the reclamation plant, transmission pump facilities are required to convey the reclaimed water from the reclamation plant to the reservoir. The transmission pipeline would be a pressure pipeline made of high-density polyethylene(HDPE) and about 16 km in length.

7.3 Reclaimed Water Distribution and Service Facilities

The reclaimed water distribution and service facilities consist of the distribution reservoir, trunk distribution pipes, branch distribution pipes and service pipe facilities. The existing distribution reservoir and the existing distribution pipe network available for the reclaimed water supply in Nusa Dua belong to PDAM Badung as mentioned in Chapter 6. These facilities will be used after being rehabilitated.

The existing distribution pipes available for the reclaimed water supply in Nusa Dua are installed parallel to the other distribution pipes used to supply PDAM water. These distribution networks should not be interconnected. It is important that these distribution networks be completely independent from each other. The installation of new distribution pipes is planned to supply the reclaimed water to Benoa and Sawangan.

Improvements to service pipe facilities within the hotels' premises were discussed in Chapter 6. It is proposed that the hotels be responsible for renovating existing service pipe facilities to use the reclaimed water.

CHAPTER 8

CONCEPT DESIGN, IMPLEMENTATION PLAN, AND OPERATION PLAN OF RECLAIMED WATER TREATMENT FACILITY AND RELATED FACILITY

CHAPTER 8 CONCEPTUAL DESIGN, IMPLEMENTATION PLAN, AND OPERATION PLAN FOR RECLAIMED WATER TREATMENT, TRANSMISSION AND DISTRIBUTION FACILITIES

8.1 Design Flow and Target Water Quality

8.1.1 Design Flow

The design flow for the reclaimed water treatment facility shall be set as follows. The volume of the reservoir and receiving tank at the hotel should be able to absorb the daily fluctuation of water (hourly maximum flow). Leakage in transmission pipe is not considered.

Table 8.1.1a Design Flow (Case 1)

	m^3/day	m^3/hour	m^3/sec
Average daily flow	4,100	171	0.047
Maximum daily flow	4,500	188	0.052
Maximum hourly flow	4,950	206	0.057

Table 8.1.1b Design Flow (Case 2)

	m^3/day	m^3/hour	m^3/sec
Average daily flow	8,200	342	0.095
Maximum daily flow	9,000	375	0.104
Maximum hourly flow	9,900	413	0.115

8.1.2 Target Water Quality

At present in Indonesia, water quality standards for water reuse are not well developed. As mentioned in Chapter 5, it is desirable to consider the situation in Indonesia, especially in Bali, and borrow from the experience in Japan in setting the design water quality. The reclaimed water quality at the Shibaura Water Reclamation Center would be used as a point of reference (The control target values for recreational water established by the Ministry of Land, Infrastructure, Transport and Tourism). Therefore, design water quality (Both Case 1 and Case 2) shall be set as follows.

The design water quality is a target value since the effluent of the Denpasar WWTP fluctuates largely compared to the effluent of WWTP in general in terms of both quality and quantity.

Table 8.1.2 Target Quality of Treated Water

Item	Target Water Quality
E.Coli	Undetected
Appearance	Not unpleasant
Turbidity	1 or less
Color	3 or less
Odor	Not unpleasant
pH	5.8～8.6
Residual Chlorine	Free residual chlorine 0.1mg/L or Combined residual chlorine more than 0.4mg/L

8.2 Design Criteria for Facilities

In this section, the design criteria are summarized in consideration of Chapter 4 to Chapter 7.

8.2.1 Reclaimed Water Treatment Facility

(1) Reclaimed water treatment process

The basic process of the proposed reclaimed water treatment facility as shown in Figure 8.2.1, would follow the process used in the Tokyo Shibaura Water Reclamation Center.

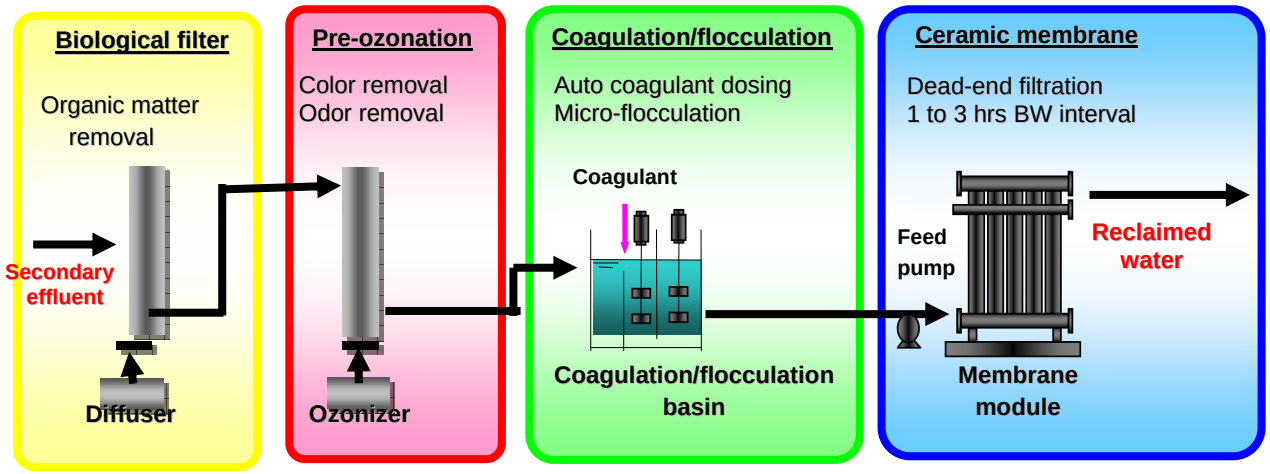


Figure 8.2.1 Outline of Reclaimed Water Treatment Process

(2) Design criteria of the reclaimed water treatment facility

The design criteria of the reclaimed water treatment facility are set as follows.

Location:	Inside of the Denpasar WWTP, or adjoining area
Raw water:	Effluent of Denpasar WWTP
Design Capacity:	Case 1: 4,500 m^3/day (= 3.125 m^3/min = 52.1 L/s)
	Case 2: 9,000 m^3/day (= 6.250 m^3/min = 104.2 L/s)
Treatment Method:	Biological Filtration Process → Ozone → Coagulation → Ceramic Membrane Filtration
Disinfection equipment:	To be prepared in the final process
Power supply:	General power line from PT. Indonesia Power
Emergency generator:	For backup at the time of power failure
Civil and architectural facilities:	Of earthquake-resistant construction, with the foundation designed to counteract liquefaction and N value of 30 or more.

(3) Design criteria of other equipment

Design criteria are set as follows from the result of water quality analysis and the information from the pilot plant project.

1） Pretreatment (raw water) equipment

A coarse screen with 10 mm spacing in addition to the strainer with 1.5 mm spacing is required because the effluent of the Denpasar WWTP contains many impurities.

2） Biological filter equipment
The design filtration rate would be 40 m/day which is the filtration rate of the aerobic filter bed used for secondary treatment. This is much lower than the 120 m/day filtration rate of the biological filter for tertiary treatment generally adopted in Japan.

3） Ozonation equipment
The design maximum ozone injection rate would be 20 mg/L, and retention time at ozone reactor would be 10 minutes.

4） Coagulation equipment
Retention time for the coagulation process would be 5 minutes.

5） Ceramic membrane equipment
The design flow velocity would be 4 m/day.

8.2.2 Reclaimed Water Transmission Facility

Generally, the water transmission facility is designed to meet the maximum daily flow. The reclaimed water supply system in this project, also in the case of larger flow rate as Case 2, there is an enough capacity of reservoir as shown below. Therefore, hourly fluctuation is considered for reservoirs and receiving tanks at each hotel. The reclamation water treatment facility, transmission pumps and transmission pipe shall be designed to meet the maximum daily flow.

<The water balance in the reservoir: Case 2>
Maximum inflow to the reservoir = Maximum daily transmission flow = 9,000 m^3/d=375 m^3/h
Maximum outflow from the reservoir = Maximum hourly distribution flow ＝ 9,900 m^3/d = 413 m^3/h
Difference between the maximum inflow and the maximum outflow = 38 m^3/h
Suppose the water level of the reservoir is full (1,500 m^3), it can supply the maximum hourly flow for 39.5 h (1500 m^3÷38 m^3/h＝39.5 h).
In fact, it is thought that the maximum hourly outflow does not continue for 39.5 hours. Therefore, the reclamation water treatment facility, transmission pumps and transmission pipe shall be designed to meet the maximum daily flow.

(1) Reclaimed Water Transmission Facility

It is necessary to construct a pumping facility to transmit water from the reclaimed water treatment facility to the existing UPA reservoir which is at a higher elevation.

Location:	Inside the Denpasar WWTP, or adjoining land	
Type of fluid:	Reclaimed Water	
Design flow:	Maximum daily flow of Case 1:	4,500 m^3/day
	Maximum daily flow of Case 2:	9,000 m^3/day

(2) Transmission pipe

Route:	Mainly along the public road from the Denpasar WWTP to the UPA reservoir, except where pipe laying is difficult or at river crossings.
Type of fluid:	Reclaimed water
Design flow:	Same as reclaimed water transmission facility
Pipe material:	Pipe material available in Bali, such as DI Pipe, HDPE Pipe, etc.
Pipe laying method:	Mainly open cut method, other methods when required.

8.3 Reclaimed Water Treatment Facility

8.3.1 Conceptual Design

The reclaimed water treatment process has mainly six steps: (1) raw water pumping; (2) biological filtration; (3) ozonation; (4) coagulation/flocculation; (5) membrane filtration; and (6) transmission and chlorination. Each step requires the equipment to perform the functions as shown in Table 8.3.1.

Table 8.3.1 Facilities of Treatment Process

Building Name	Facility Function	Equipment
【1】Raw Water Pump Building	Raw Water Lifting	Dust Removing Screen
		Raw Water Pump Well
		Electrical Panel Room (Upper Part of the Waterway)
【2】Biological Filtration Process Building	Biological Filtration	Raw Water Tank
		Biological Filtration Transmission Pump Room
		Biological Filtration Tank
	Common and Others	Warehouse
		Workshop (for Case 2)
		Parking Lot
【3】Ozonation Building	Ozonation Coagulation/Flocculation	Filtered Water Tank
		Ozone Reactor and Backwash Pump Room
		Ozone Contactor Tank
		Ozone Treatment Unit
		Coagulation/Flocculation Tank
	Chlorination (Treated Water Transmission Process)	Microfiltered Water Tank
		Transmission Pump Room
		Sodium Hypochlorite Storage Tank
	Common and Others	Monitoring Room
		Workshop (for Case 1)
		Laboratory and Preparation Room
		Staff Room
【4】Membrane Filtration Building	Membrane Filtration	Filtration Room
		Drainage Tank
		Ozonation Equipment Room
		Blower Room
	Common and Others	PLN Room
		Substation
		Generator Room
		Electrical Panel Room
【5】Others	Common and Others	Guard Post, Gate, Fence
		Raw Water Pipe
		Drainage Pipe

*Transmission pipe is described in 8.4.

(1) Facility Layout
The facilities are laid out to meet the needs of the treatment process.

1) Raw water pump building
The raw water pump building needs to be located where it can pump the effluent from the Denpasar WWTP to the reclaimed water treatment plant continuously at a stable rate. It would be built at the

location marked in red in Figure 8.3.1, according to the following conditions:

- Intake point downstream of the junction of the discharge pipe from the two finishing ponds of the WWTP to ensure a stable flow of the effluent (highlighted in blue).
- The pump building would be as close to the intake point as possible. Within the existing Denpasar WWTP site (highlighted in pink) but away from the future expansion area (highlighted in green) and away from the overhead high voltage lines (highlighted in yellow).

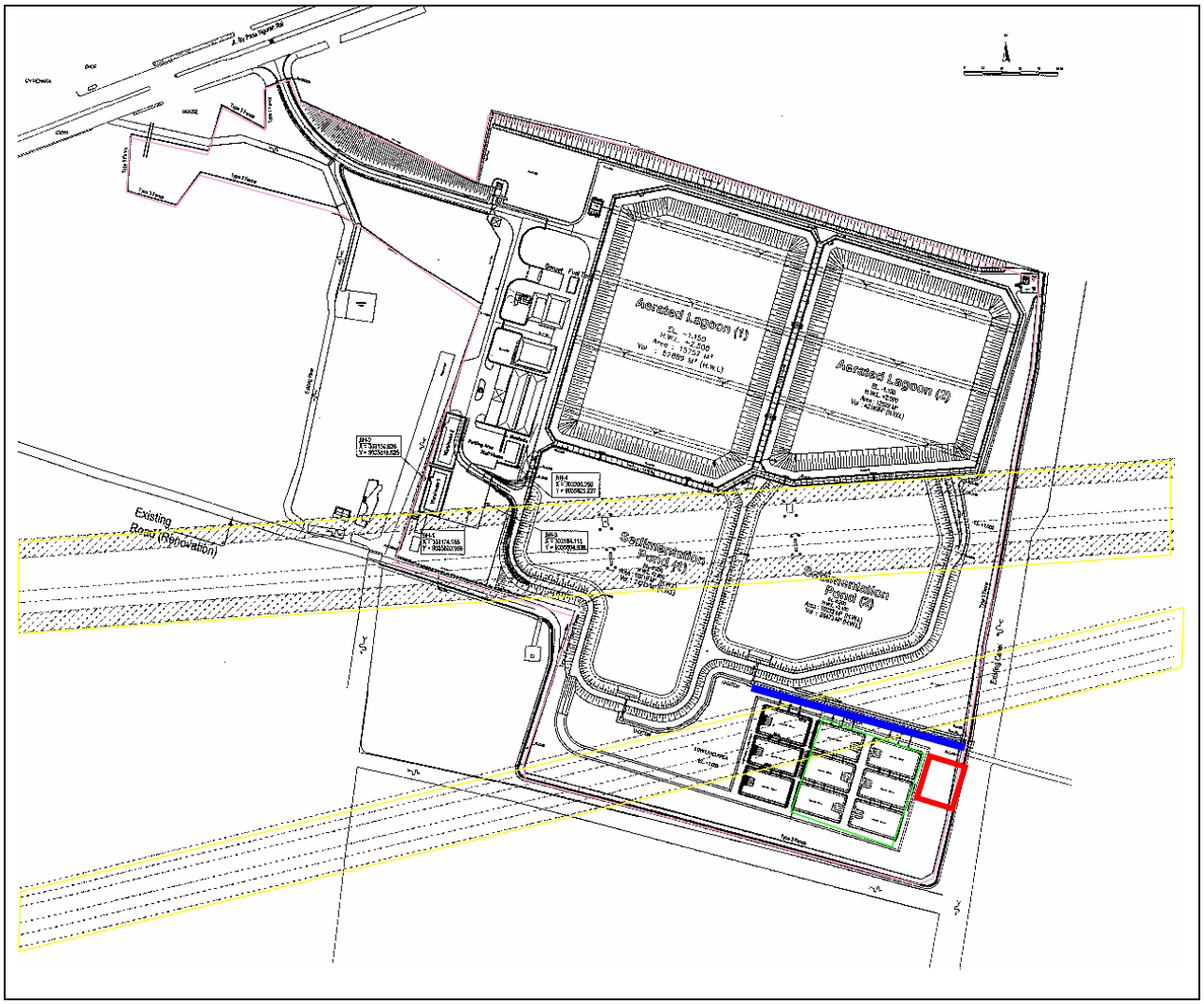


Figure 8.3.1 Layout of Raw Water Pump Station

2) Other facilities

The facilities for biological filtration, ozonation, and membrane filtration would be in one location outside the Denpasar WWTP site (highlighted in red in Figure 8.3.2) according to the following conditions:

- Proximity to the raw water pump building (highlighted in blue).
- Outside the existing Denpasar WWTP site (highlighted in pink).
- Away from the future expansion area of the Denpasar WWTP (highlighted in green).
- Away from the overhead high voltage lines (highlighted in yellow).
- Away from the holy spring near the Denpasar WWTP (highlighted in light blue).

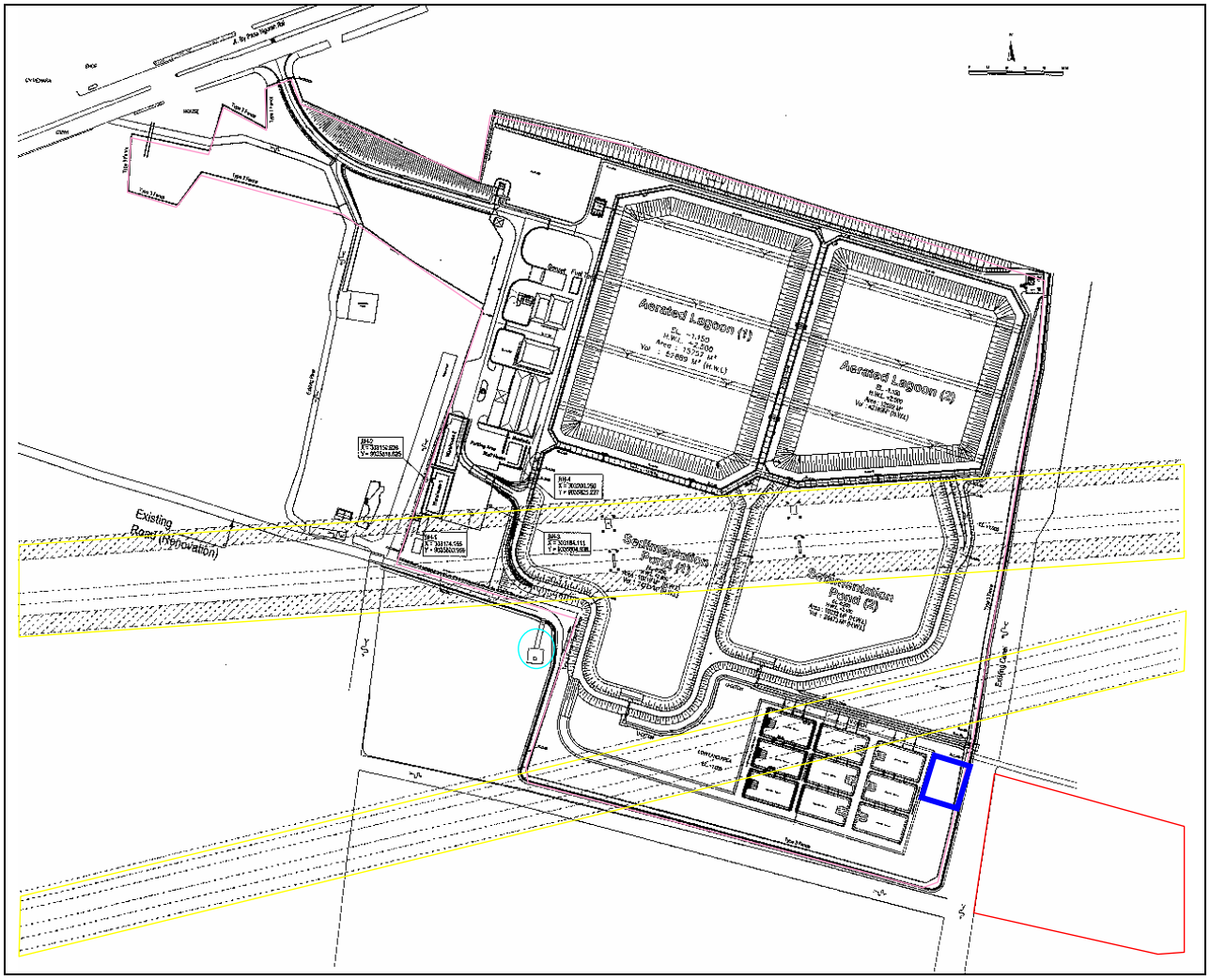


Figure 8.3.2 Layout of Reclaimed Water Treatment Plant

3) Design Ground Elevation

The planned site for reclaimed water treatment facility is marshy with thick mangrove forests. The ground elevation varies between -0.5m and + 1.0m MSL. The elevation near the existing Denpasar WWTP is +1.20 m, but around the substation and administration building, the elevation is around +1.50m to +1.60m. Therefore, the ground elevations of the reclaimed water treatment plant would be set to +1.60 m, to be well protected from high tide and tsunami..

(2) Raw Water Pump Building

1) Water Intake Level

The water intake level was set as follows from the section of the existing discharge channel (Figure 8.3.3) and the present water level.

- H.W.L. (High Water Level): +1.000 M
- D.W.L. (Design Water Level): -0.050 M

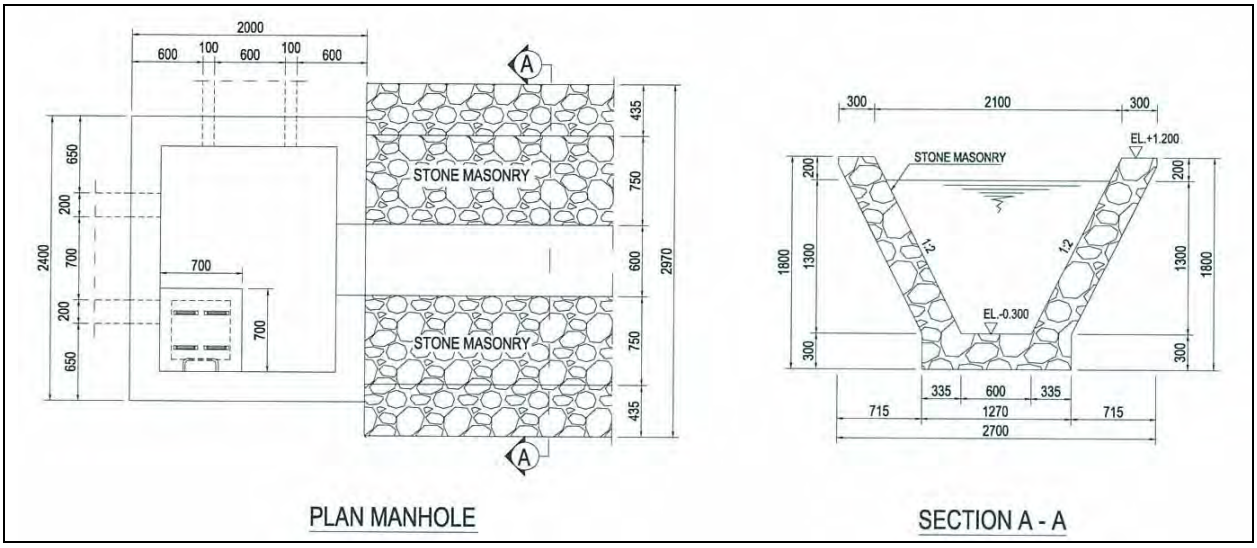


Figure 8.3.3 Structural Drawing of Existing Effluent Channel

2) Facility planning

The elevation of the foundation around the facility is +1.20 m. The slab level of the first floor of the building would be at +2.00 m to avoid flooding and to accommodate the pump building (at +1.80 m), electric building (at +1.80 m), and administration building (at +2.02 m) and. The main rooms and equipment in the raw water pump building are as follows. The drawing of the raw water pump building is shown in Figure 8.3.4.

・ Screen

Two screens one at each waterway would be installed to catch and remove large particles before the raw water comes into the pump well. Since there would not be much inflow of sand to cause pump wear, no grit chamber would be installed.

・ Raw Water Pump Well

A pump well (the size of Case 1: 3.8 m in length, 3.0 m in width, and 2.5 m deep, Case 2: 5.2 m in length, 3.0 m in width, and 2.5 m deep) would be constructed to house pumps including a stand-by which would pump from the effluent to the reclaimed water treatment plant. (The pump capacity is including washing water) The pump specification as follows,

Raw water pump (Case 1): Capacity 4.1 m^3/min x 2 pump (including one standby)
(Case 2): Capacity 4.1 m^3/min x 3 pump (including one standby)

・ Electrical Room(also for pump and screen)

The on-site electrical room of 6 m x 8 m (approximately 50 m^2) would house the screen and the upper part of raw water pump well, with an attached shed to protect the electrical panel from rain, and a hook or hoist for pulling up the raw water pumps (submerged pumps).

3) Foundation

The geotechnical data indicates that a bearing pile foundation would be required because the support layer is around 21m below the surface. The depth of bearing piles would be 20 m including the depth of embedment.

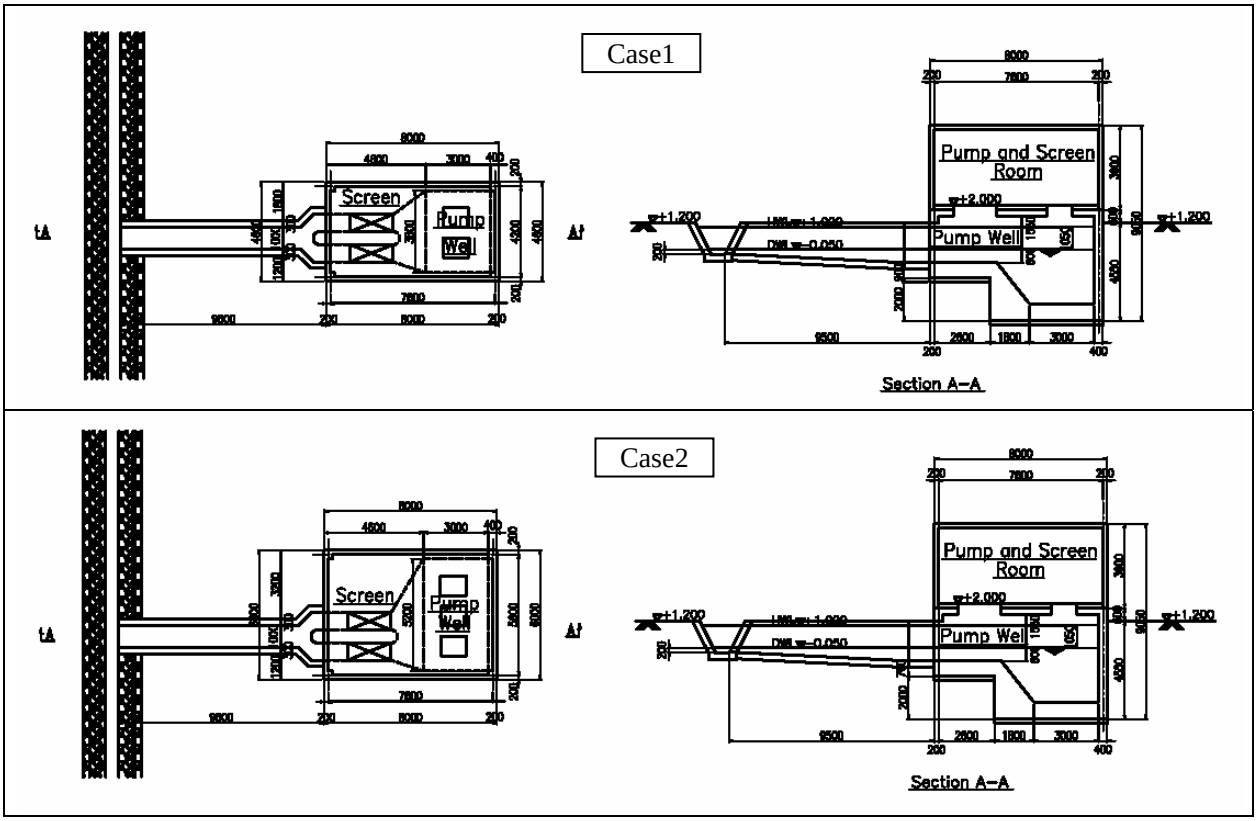


Figure 8.3.4 Plan and Section of Raw Water Pump Station

(3) Biological Filtration Process Building

1) Facility planning

The main rooms and equipment of the biological filtration process building are as follows. The drawing of the biological filtration process building is shown in Figure 8.3.5.

・ Raw Water Tanks

The raw water tank receives the water from the raw water pump building. Two tanks would be required to maintain the continuous operation when one is shut down for maintenance. The volume of the tank would be around 18 m^3 (3.3m in length x 2.7m in width x 2.0m in water depth).

・ Biological Filtration Transmission Pump

The biological filtration transmission pumps pump up from the raw water tank to the biological filter. The discharge contains the volume necessary for backwash in the reclamation process. The pump specification as follows,

Biological filtration transmission pump
(Case 1): Capacity 4.1 m^3/min x 2 pump (including one standby)
(Case 2): Capacity 4.1 m^3/min x 3 pump (including one standby)

The pump room would be 6.2 m in length, 9.2m in width in order to accommodate the three pumps.

・ Biological Filtration Tank

The biological filtration tank specification as follows,

Biological filtration tank (Case 1): 6.1m in length x 6.1 in width x 4.0 in water depth x 4 tanks
(Case 2): 6.1m in length x 6.1 in width x 4.0 in water depth x 8 tanks

There would be 8 tanks each approximately 6.1 m long x 6.1 m wide x 4.0 m deep. The depth of 4.0 m is extended to 6.90 m to take into account the higher water level if clogging occurs.

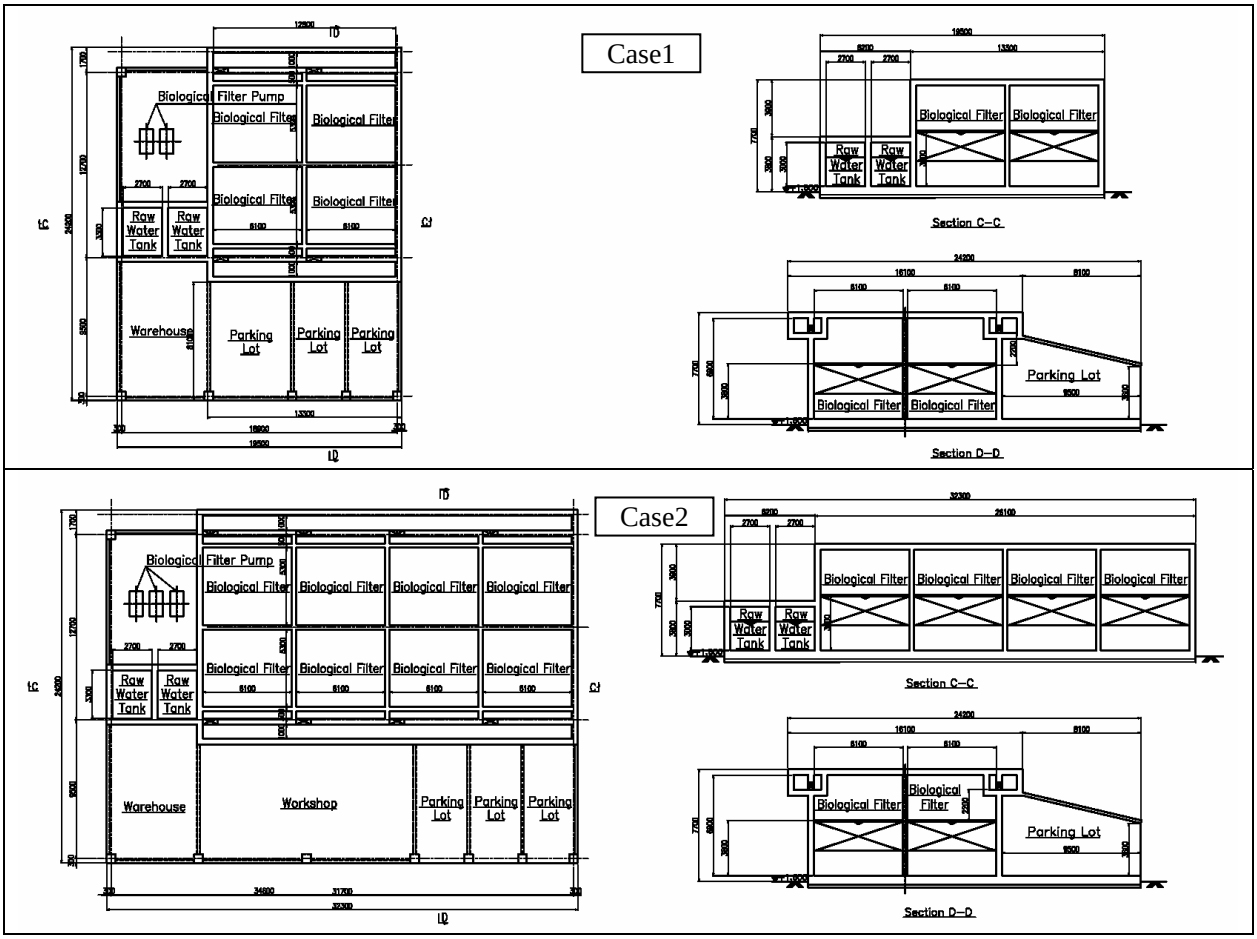


Figure 8.3.5 Plan and Section of Biological Filtration Process Building

・ Warehouse

Spare parts and equipment are stored in a warehouse approximately 55 m^2 (9.5 m x 6.0 m).

・ Workshop

A workshop would be required for making adjustments and simple repairs of the equipment such as pumps and others. This room of Case 1 in the ozonation building is approximately 90m^2 (7.0m x 13.0m). The Case 2 in the biological filtration building is approximately 140m^2 (9.5m x 14.6m).

・ Parking Lot

There would be indoor parking for three vehicles.

2) Foundation

The geotechnical data indicate that a bearing pile foundation would be required because the support layer is around 21m below the surface. The length of bearing pile would be 20 m including the depth of embedment. The same foundation also applies for the ozonation and membrane filtration buildings.

(4) Ozonation Building

The main rooms and equipment of ozonation building are as follows. The drawing of the ozonation building is shown in Figure 8.3.6.

・ Filtered Water Tank

This tank receives the treated water from the biological filter building. The volume of the tank in both cases would be around 300 m^3 (15.0 m long x 6.3 m wide x 3.3 m deep).

・ Ozone Reactor and Backwash Pump Room

Ozone reactor pump conveys the treated water from the biological filtration tank to the ozone reactor. The backwash pump backwashes the biological filter. The specification of the pump is as follows.

Ozone reactor pump (Case 1): 3.4 m^3/min x 2 pumps (including one stand-by)
(Case 2): 3.4 m^3/min x 3 pumps (including one stand-by)
Backwash pump (Case 1): 16.8 m^3/min x 2 pumps (including one stand-by)
(Case 2): 16.8 m^3/min x 3 pumps (including one stand-by)

The pump room is 100 m^2 to accommodate all pumps.

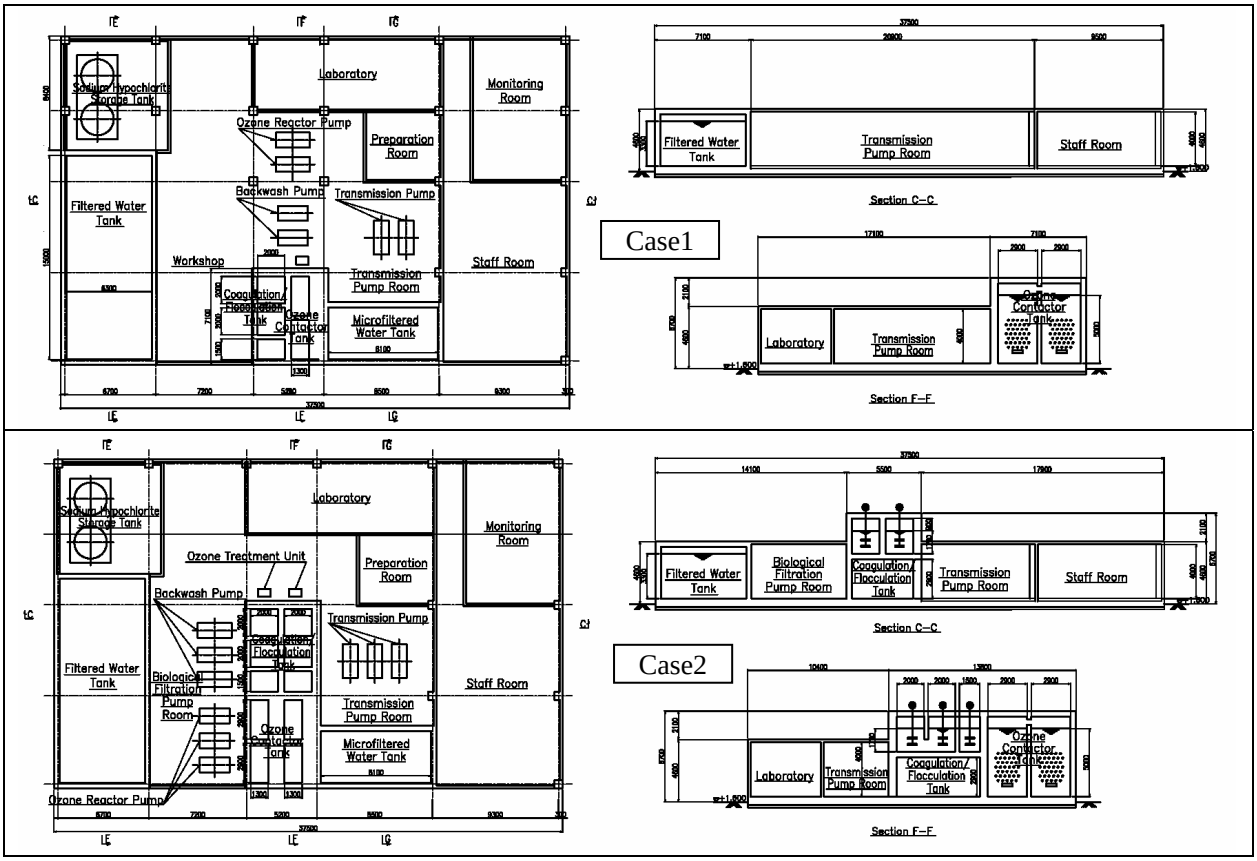


Figure 8.3.6 Plan and Section of Ozonation Building

・ Ozone Contactor Tank

The dimension and number of ozone contactor tank is as follows.

(Case 1): Approximately 2.9 m long x 1.3 m wide x 5.0 m deep x 4 tanks (2 tanks x 1 line)
(Case 2): Approximately 2.9 m long x 1.3 m wide x 5.0 m deep x 2 tanks (2 tanks x 2 lines)

The inside of the ozone contactor tank is exposed to strong oxidation reaction, and would be covered by a corrosion-proof internal coating.

・ Surplus Ozone Treatment Unit

The surplus ozone treatment unit would be installed next to the ozone contactor tank to remove the surplus ozone. One unit is would be installed for each line.

・ Coagulation/Flocculation Tank

Coagulant is added to the treated water in the coagulation/flocculation tank after the ozone reaction and the contents mixed and allowed to flocculate.

(Case 1): Approximately 5.5 m in length (1.5m+2.0m+2.0m) x 2.0m in width x 1.7m depth x 1 line
(Case 2): Approximately 5.5 m in length (1.5m+2.0m+2.0m) x 2.0m in width x 1.7m depth x 2 lines

・ Micro filtered Water Tank

The micro filtered water tank stores the micro filtered water. The capacity of the tank is approximately 60 m^3 (8.1m in length x 3.8m in width x 2.0m in depth).

・ Transmission Pump Room

The transmission pump transmits the treated water from the reclaimed water treatment facility to the reservoir of PDAM about 16 km away. The specification of the pump is as follows.

Transmission pump (Case 1): 3.4 m^3/min x 2 pumps (including one stand-by)
(Case 2): 3.4 m^3/min x 3 pumps (including one stand-by)

The dimension of the pump room is 8.8 m in length and 7.8 m in width to accommodate all pumps.

・ Sodium Hypochlorite Storage Tank

This tank stores the sodium hypochlorite to be added in the treated water to provide the disinfection effect. Two tanks with the capacity of about 10 m^3 would be installed.

・ Control Room

The control room would have an area of 70 m^2 (10.4 m in length x 6.8 m in width) to house the equipment for receiving and monitoring the operating data from the raw water pump building, reclaimed water treatment facility, and PDAM reservoir.

Laboratory and Preparation Room

Laboratory and preparation room is where the daily water quality tests of the inflow and outflow of the reclaimed water treatment facility are carried out. The area of the laboratory would be 70 m^2 (13.7 m in length x 5.2 m in width) and the preparation room 30 m^2 (5.5 m in length x 5.2 m in width).

・ Staff Room

The staff room with an area of 120 m^2 (13.2m in length x 9.0m in width) is designed for ten people, the number of staff required to operate the reclaimed water treatemnt facility at all times.

(5) Membrane Filtration Building

The main rooms and equipment of the membrane filtration building are as follows. The drawing of the membrane filtration building is shown in Figure 8.3.7.

・ Filtration Room

Following equipment is installed in the filtration room.

<Case 1>

Microfiltration (ceramic filter) unit: 1 sets
Tanks for the chemicals for filter washing and dosing pump: 2 sets
Membrane filter pump: Flow Rate: 3.4 m^3/min

	Quantity:	2 (including one stand-by)
Drainage pump:	Flow Rate:	2.0 m^3/min
	Quantity:	2 (including one stand-by)

<Case 2>

Microfiltration (ceramic filter) unit:		2 sets
Tanks for the chemicals for filter washing and dosing pump:		2 sets
Membrane filter pump:	Flow Rate:	3.4 m^3/min
	Quantity:	3 (including one stand-by)
Drainage pump:	Flow Rate:	2.0 m^3/min
	Quantity:	3 (including one stand-by)

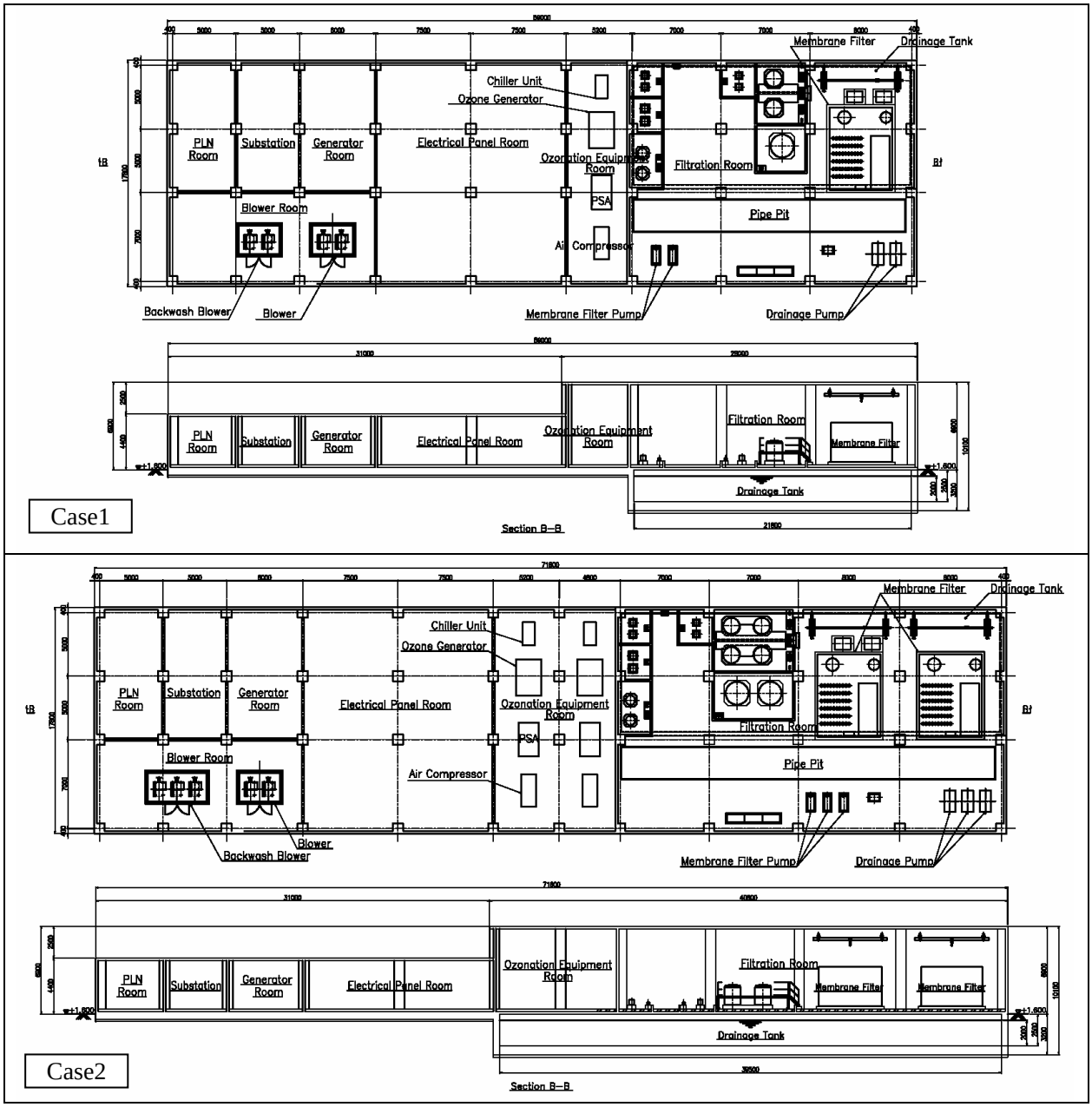


Figure 8.3.7 Plan and Section of Membrane Filtration Building

・ Drainage Tank

The drainage tank receives the backwash from the microfiltration device, and the water from filter

chemical washing after neutralization before these are pumped at a fixed volume to the inflow pumping station of the Denpasar WWTP. The tank capacity of Case 1 is about 400 m^3 (21.8m in length x 9.3m in width x 2.0m in depth). The capacity of Case 2 is about 550 m^3 (29.8m in length x 9.3m in width x 2.0m in depth).

・ Ozonation Equipment Room

The ozonation equipment room houses two ozone generators and a chilling unit. The area of one line would be approximately 85 m^2. Therefore the dimension of Case 1 is 17.0m in length and 5.2m in width, Case 2 is 17.0m in length and 10.0m in width.

・ Blower Room

The blower room approximately 110m^2 (16.0m in length x 7.0m in width) houses the blowers for the biological filtration tank:

Blower	(Case 1):	22.2 m^3/min (Air Volume) x 2 (including one stand-by)
	(Case 2):	22.2 m^3/min (Air Volume) x 3 (including one stand-by)
Backwash Blower (Both Case):		37.2 m^3/min (Air Volume) x 3 (including one stand-by)

・ PLN Room

The PLN room of about 50 m2 (10.0m in length x 5.0m in width) is where the power line from the electricity company enters the facility.

・ Substation

The substation is a room of approximately 50 m^2 (10.0m in length x 5.0m in width) where the incoming high voltage electricity is transformed to low voltage used in the facility.

・ Generator Room

The generator room approximately 60m^2 (10.0m in length x 6.0m in width) houses the generator which provides the power for the minimum required equipment for treatment and transmission at the time of a power failure.

・ Electrical Panel Room

The electrical panel room of approximately 250 m^2 (17.0m in length x 15.0m in width) houses control panels for the various kinds of equipment in the facility.

(6) Other facilities

These include the following:

・ Guard Post, Gate, and Fence

There would be a guard post and gate for controlling access to the facilities. A fence would also be constructed along the perimeter of the property.

・ Raw Water Pipe

The raw water pipe transmits raw water from the raw water pump building to the reclaimed water treatment facility. Pipe specification is as follows. Pipe route is shown in red in Figure 8.3.8.

(Case 1): Diameter = φ300 mm, Length = 100 m
(Case 2): Diameter = φ400 mm, Length = 100 m

・ Drain Pipe

The drain pipe transmits the washed water from the drainage tank to the inflow pumping station of the Denpasar WWTP. Pipe specification is as follows. Pipe route is shown in blue in Figure 8.3.8.

(Case 1): Diameter = φ200 mm, Length = 335 m
(Case 2): Diameter = φ300 mm, Length = 335 m

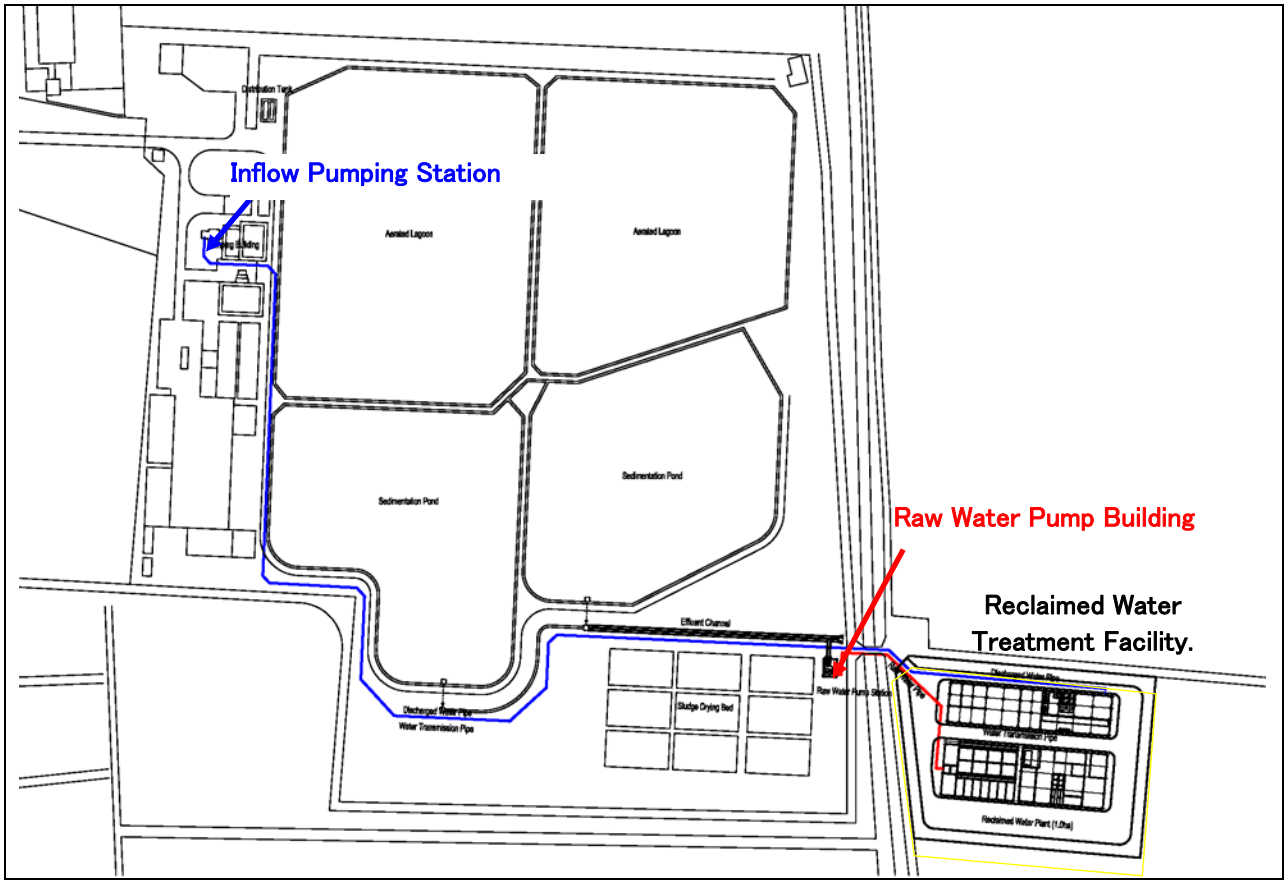


Figure 8.3.8 Layout of Raw Water Pipe and Drain Pipe

8.3.2 Construction Plan

Construction plan of the reclaimed water treatment plant is described below.

(1) Site development
The area for the construction of the reclaimed water treatment plant is marshy and thick with mangrove swamps (Figure 8.3.9). Cutting down the mangrove trees, dredging, and land reclamation are necessary to prepare the site for construction.

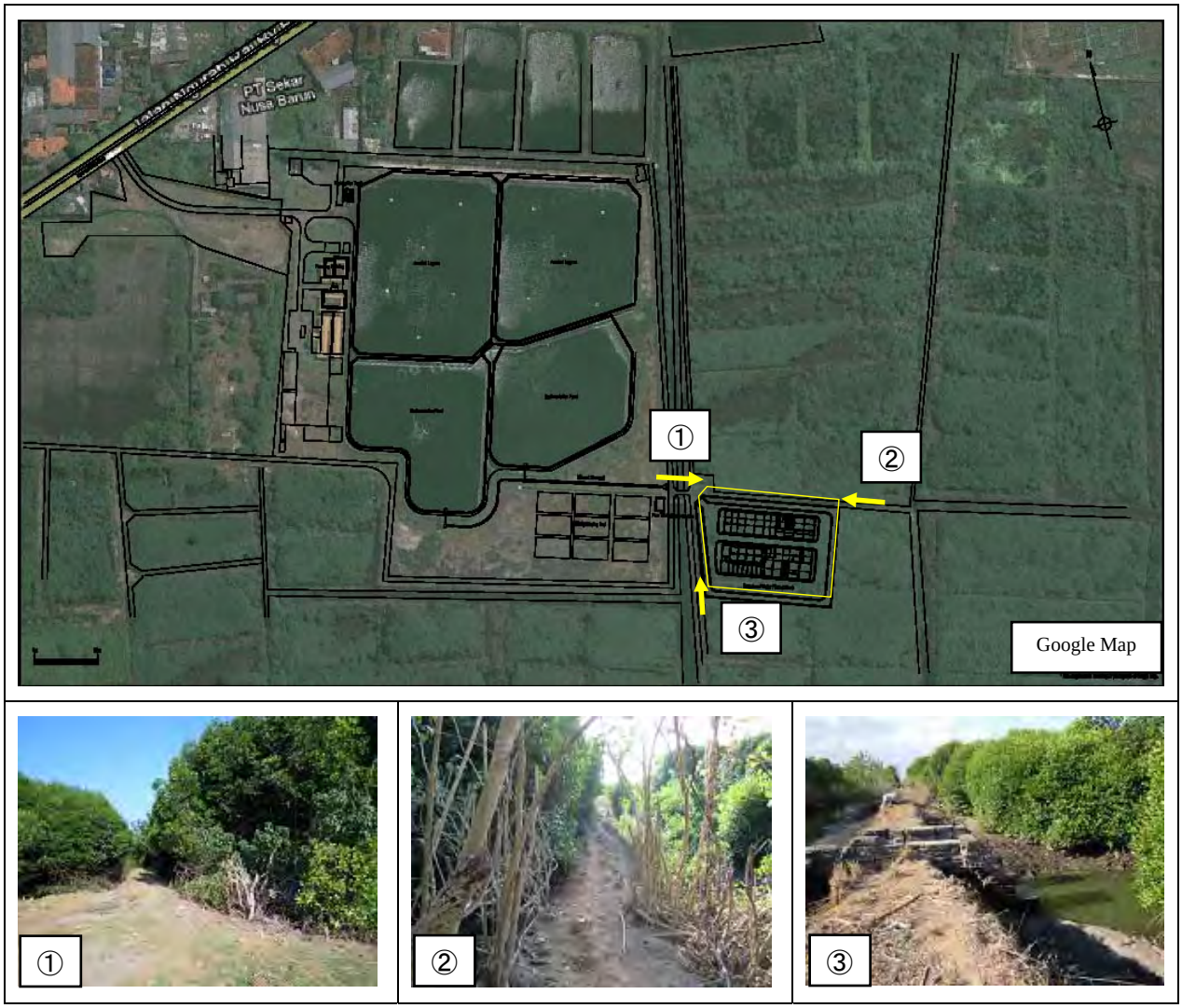


Figure 8.3.9 Situation around the Planned Construction Site

Current ground elevation is 0.0 m on average (around -0.5m to +1.0m). The following site preparation is required. (Shows the Case 2 as an example a large amount of soil)

- The site would be dredged approximately 1 m below the surface to remove any obstructions such as concrete debris, mud, and tree roots. The amount of material dredged up in the operation is expected to be around 8,600 m^3.
- The dredged area would be backfilled with 22,400 m^3 of good quality soil (purchased) to a depth of 2.6 m and graded to rise from -1.0 m at the river bank to an elevation of +1.6 m.

Total amount of dredged material plus soil removed along the river bank would add up to around 31,000 m^3 the removal of which would require 3,875 truck loads using 10 t truck (with 8m^3 carrying capacity).

N = 3,875 trucks

Therefore, an access road is required to accommodate this truck traffic (Case 2). The road would take at least five months to build under the following conditions. If the same conditions as in Case 1, the construction period of approximate 5 months is needed because it required 4.2 months in the calculation.

M = 1 month + = 4.7 months → 5 months

<Conditions of Calculation>

- Preparation period including the preparation of access road: 1 month
- Shipping and unloading time per truck: 10 minutes on average
- Number of trucks to be carried in and out per hour: 6 trucks/hour (= 60/10)
- Working-hours per day: 8 hours on average
- Working-days per month: 22 days on average

The access road cannot be built on marshland. The access would have to make use of an existing road around the Denpasar WWTP. Four options were examined and the photographs and layout are shown in Figure 8.3.10.

1) East route outside the WWTP (Red color)
The existing road width is approximately 3.3 m. This route does not lead to the trunk road since the north end is blocked by a fish farm (Photograph ③).

2) South route outside the WWTP (Blue color)
The existing road width is approximately 2.6-4 m. The road runs between the river and the fence, and there are two bridges and one holy spring (Photograph ⑤ and ⑥) along the way. Widening the road would be difficult.

3) Northeast route inside the WWTP (Pink color)
The existing road width is approximately 4 m and the road is not paved. There is no serious obstacle and construction is possible (Photograph ⑦).

4) Southwest route inside the WWTP (Green color)
The existing road width is approximately 4 m and the road is mostly not paved. The section where the road is embanked, also needs to be embanked at the time of widening (Photograph ⑧). Since the road passes along the back of the administration building of the existing WTTP, there would be noise and vibration at the time of construction (Photograph ⑨).

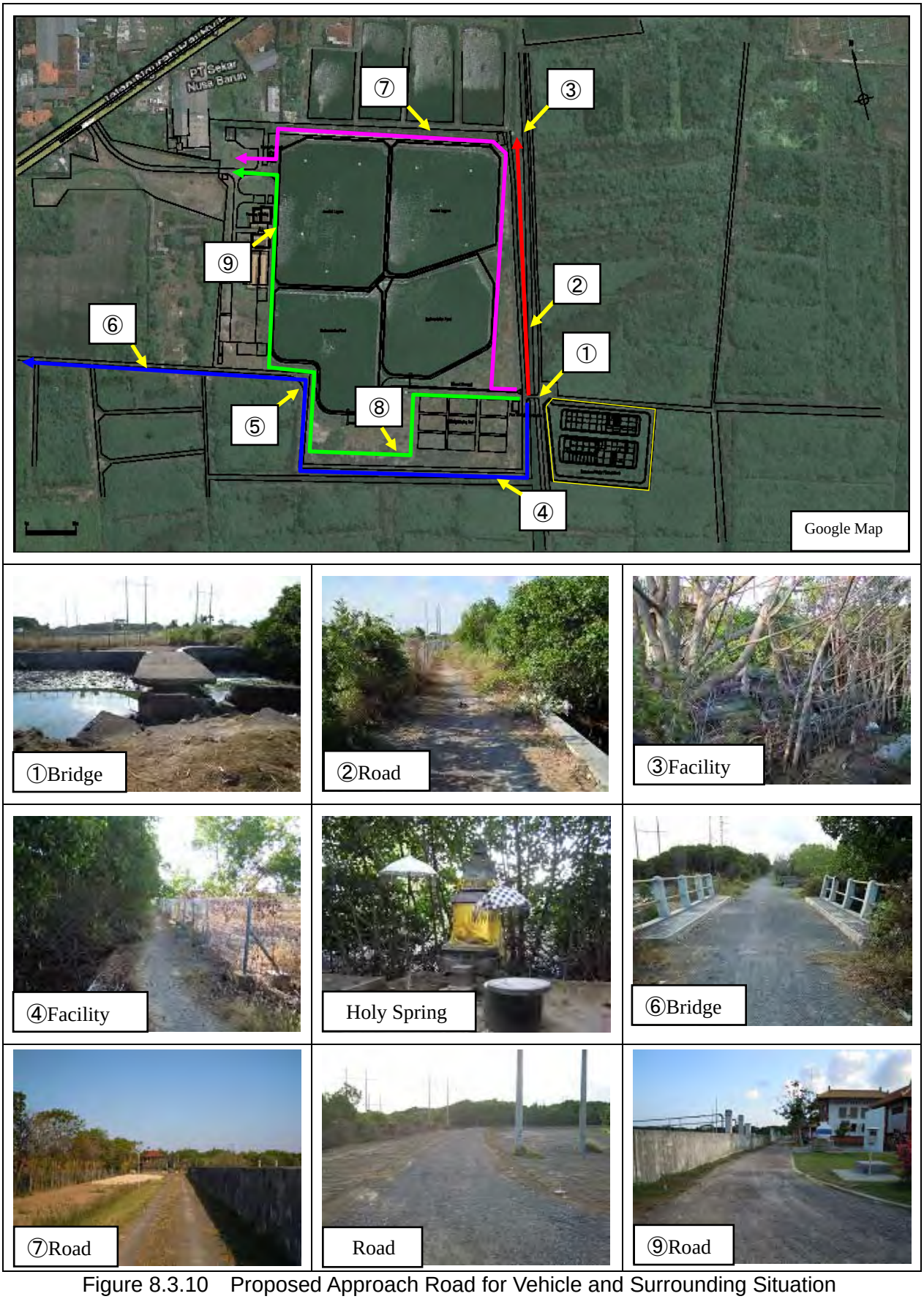


Figure 8.3.10 Proposed Approach Road for Vehicle and Surrounding Situation

Access roads have to be at least 5 m wide. Option 3) Northeast route inside the WWTP is selected since the widening of this road has the lowest impact on the existing facility.

(2) Temporary construction method
Excavation is required since the facility has underground tanks in the raw water pump building and membrane filtration building. The depth of excavation is as follows.

- Raw water pump building: 4.8 m (from G.L.+1.2m to -3.6m)
- Membrane filtration building: 3.4 m (from G.L.+1.6m to -1.8m)

The geotechnical data indicates that excavation is possible, if the slope of the excavation is around 1:1, because the ground is clay and although the ground is soft the average N value is around 1. There may be water seepage from underground springs during the excavation since the water table is -0.35 m. However, amount of water seepage is expected to be minimal and can be drained easily by pumps from clay layer.

All the treatment facilities for this project would be constructed by grading open cut method.

(3) Construction period
18 months would be required to complete the civil and architectural components of the facility construction, with the schedule as follows.

- Preparation: 1 month
- Earthwork, construction of foundation pile: 2 month
- Underground structure part construction: 3 months
- Construction of the first floor structural part: 3 months
- Construction of tank ceiling part: 3 months
- Interior and equipment (including premises road): 5 months
- Cleaning: 1 month

Another 18 months would be required for equipment set up.

- Preparation: 1 month
- Manufacture: 9 months
- Installation: 5 months
- Test run and adjustment: 3 months

8.4 Reclaimed Water Transmission Facility

8.4.1 Conceptual Design

The reclaimed water transmission facility includes the transmission pump facility and transmission pipe. The transmission pump facility (pump and pump well) is described in 8.3. Conceptual design of the transmission pipe is described in this section.

(1) Transmission pipe route
The transmission pipe route is shown in Figure 8.4.1. The length is about 15 km. The details are attached in Appendix 6.c.

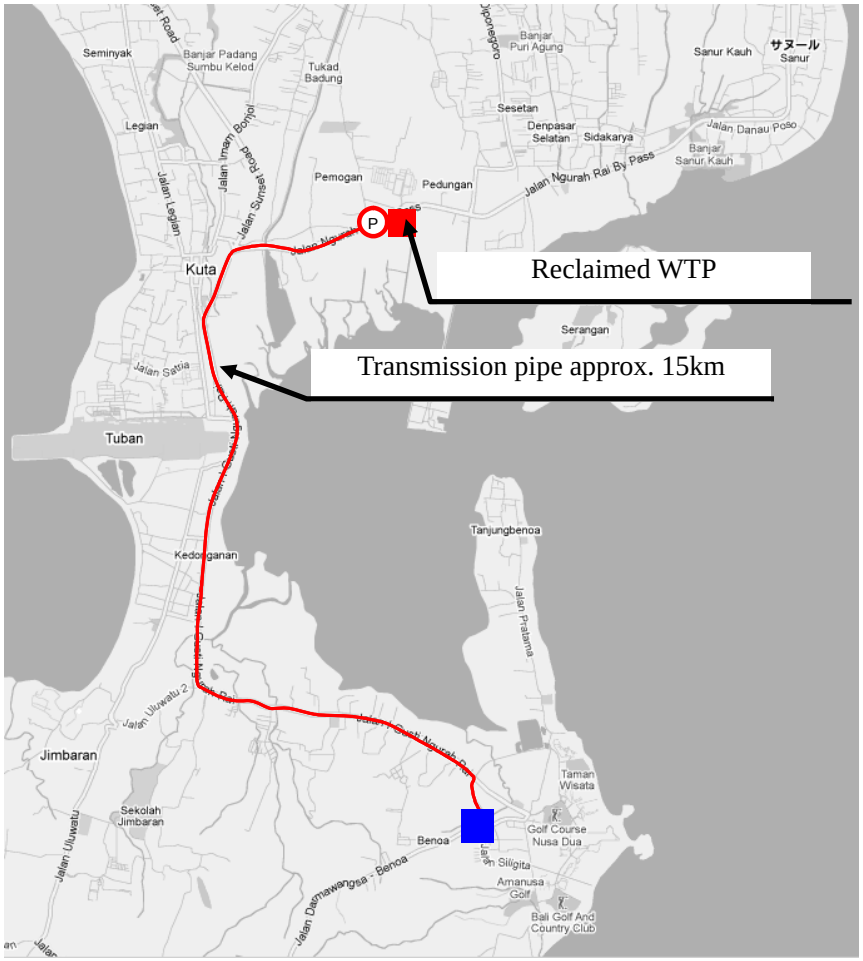


Figure 8.4.1 Transmission Pipe Route

(2) Pipe material
The following four kinds of pipes are used in Bali.

- Ductile cast iron pipe (DI pipe)
- (High density) polyethylene pipe (HDPE pipe)
- Hard vinyl chloride pipe (PVC pipe)
- Steel pipe

High density polyethylene pipe is deemed suitable for the following reasons:

- Excellent shock resistance (this is important since it is a trunk)
- Low price
- Low inner friction coefficient, which improve the pump output
- Lightweight and easy to install
- Although the material is not resistant to weather, the pipe is buried underground and not be exposed to weather elements, therefore degradation is not a concern
- No need for strong tensile yield strength, since the design inner pressure is less than 0.75MPa

A table comparing the general properties of the four types of pipe materials is shown below.

Table 8.4.1 General Properties of Transmission and Distribution Pipe Materials

	Ductile cast iron pipe (DI pipe)	(High density) polyethylene pipe (HDPE pipe)	Hard vinyl chloride pipe (HIPVC pipe)	Steel pipe
Inner friction coefficient	△	◎	◎	△
Tensile yield strength,	◎	○	○	◎
Shock resistance	◎	◎	○	◎
Acid-and-alkali-resistance	△	◎	○	△
Weather resistance	◎	△	○	◎
Earthquake resistance	◎	◎	○	◎
Installation easiness	△	◎	◎	△
Price(φ400mm)	200%	125%	100%	250%

Notes ◎:Very Good ○:Good △: Normal

(3) Selection of pipe diameter

Three cases were examined to select the suitable diameter of the transmission pipe. Construction and maintenance costs including pump facility were calculated to compare the total economical efficiency. A comparison of Case 2 as an example is show in Table 8.4.2.

Table 8.4.2 Cases of Water Pipe to be Studied (Case 2)

	Diameter	Pump Total Head	Pump Output	Quantity of Pump
Case 2-1	φ400 mm	70 m	75 kw	3 (1 standby)
Case 2-2	φ450 mm	57 m	55 kw	3 (1 standby)
Case 2-3	φ500 mm	50 m	55 kw	3 (1 standby)

The construction and O&M costs calculated for the transmission pipe length of 16.0 km constructed by open cut method are shown in Tables 8.4.3 and 8.4.4.

Table 8.4.3 Construction Cost in Each Case (Case 2, million IDR)

	Construction cost for transmission pipe	Construction cost for mechanical equipment	Construction cost for electrical equipment	Construction cost for architectural work
Case 2-1	48,752	3,089	927	51,841
Case 2-2	58,992	2,917	875	62,784
Case 2-3	69,968	2,917	875	73,760

Table 8.4.4 O&M Cost in Each Case (Case 2, million IDR/ year)

	Electricity cost	Pipe repair cost	Equipment repair cost	O&M cost total
Case 2-1	896	49	60	1,005
Case 2-2	657	59	57	773
Case 2-3	657	70	57	784

These costs are amortized over the 20 years of the project life and compared as shown in Table 8.4.5. Case 2-1 is the most cost efficient.

Table 8.4.5 Project Cost in Each Case (million IDR)

	Construction cost	O&M cost	Total
Case 2-1	51,841	20,100	71,941
Case 2-2	62,784	15,460	78,244
Case 2-3	73,760	15,680	89,440

(4) Equipment for transmission volume management
Flow meter and level meter would be installed to measure and control the transmission flow. An electromagnetic flow meter at the connecting point to the reservoir would monitor the flow into the reservoir. The level meter would detect the abnormal water level of the reservoir and stop the transmission pump.

8.4.2 Construction Plan

Most of the length of the transmission pipe would be installed under the Ngurah Rai bypass which is the trunk road. The other considerations include the following:

(1) River and drainage canal crossing
The transmission pipe crosses three big rivers and several drainage canals but it cannot be attached to the existing bridges because the bridges were not designed to carry the weight of the pipe. Therefore, the following two methods can be considered.

- Cross over the rivers and drainage canals by water pipe bridges
- Cross under the rivers and drainage canals by pipe-jacking method

The construction cost of a water pipe bridge is lower than pipe-jacking method.

(2) Traffic congestion Daytime construction would worsen the traffic congestion on the Ngurah Rai bypass. Therefore, night time construction would be considered for the section of heavy-traffic. The heavy traffic section and its present situation are shown in Figure 8.4.2.

Figure 8.4.2 The Heavy-Traffic Section and Current Situation

(3) Crossing over the power distribution cable feeding the airport

Near the airport, the transmission pipe has to avoid power distribution cables which cross the trunk road as well as two drainage canals. Using the pipe-jacking method for a section of approximately 400 m would put the transmission pipe below these obstacles and avoid causing traffic congestion in the area.

8.5 Reclaimed Water Distribution System

The reclaimed water distribution system consists of the reservoir and distribution piping. This project plans to use the PDAM Badung owned reservoir and irrigation water distribution pipe going to the Nusa Dua area.. The degree of deterioration is unclear, since they have not been used for about ten years. They have to be inspected and repaired before they can be used. New distribution pipes to the Benoa and Sawangan areas have to be installed. The location of the existing reservoir and distribution piping to the hotel in Nusa Dua area is shown in Figure 8.5.1 and Figure 8.5.2.

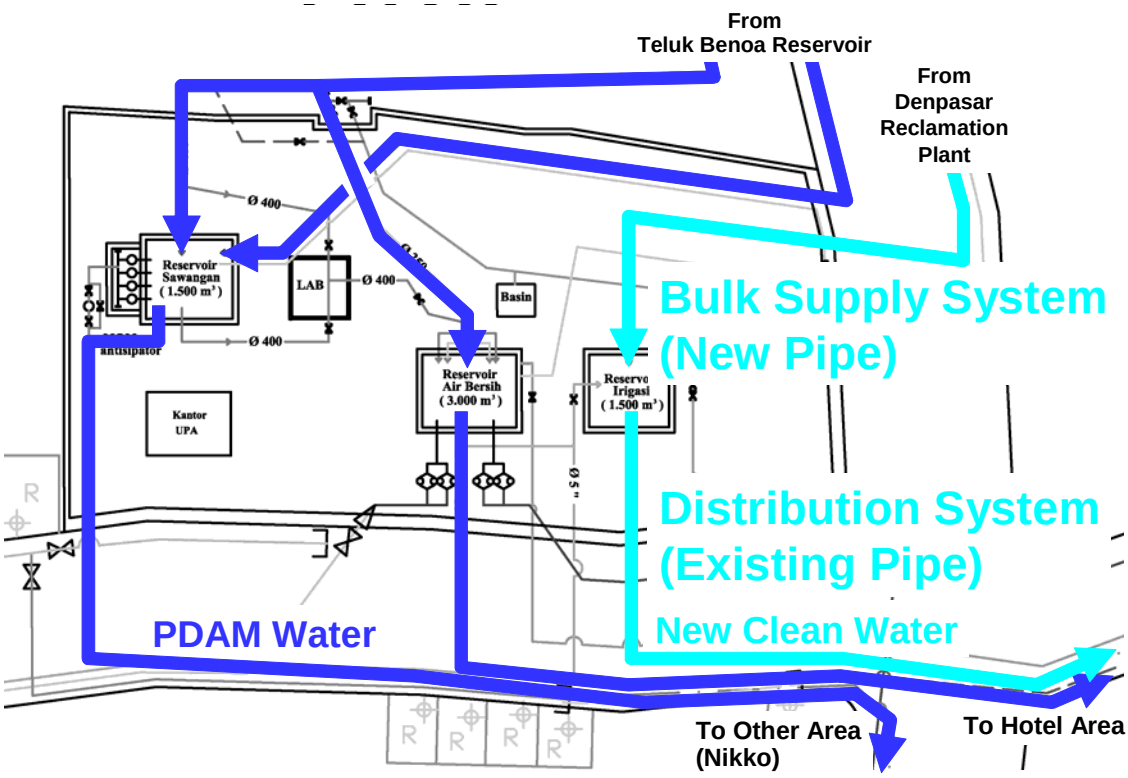


Figure 8.5.1 Existing Reservoir for Reclaimed Water and Distribution Piping

(1) Reservoir

The reservoir would buffer against the fluctuation of water demand. The reservoir has a capacity of 1,500 m^3 which can provide 39 hours of storage capacity (the difference between the hourly maximum design flow and daily maximum design flow is 38 m^3/hour). Therefore it is considered that the capacity is enough. This amount of storage is equivalent to 4 hours at the hourly maximum flow.

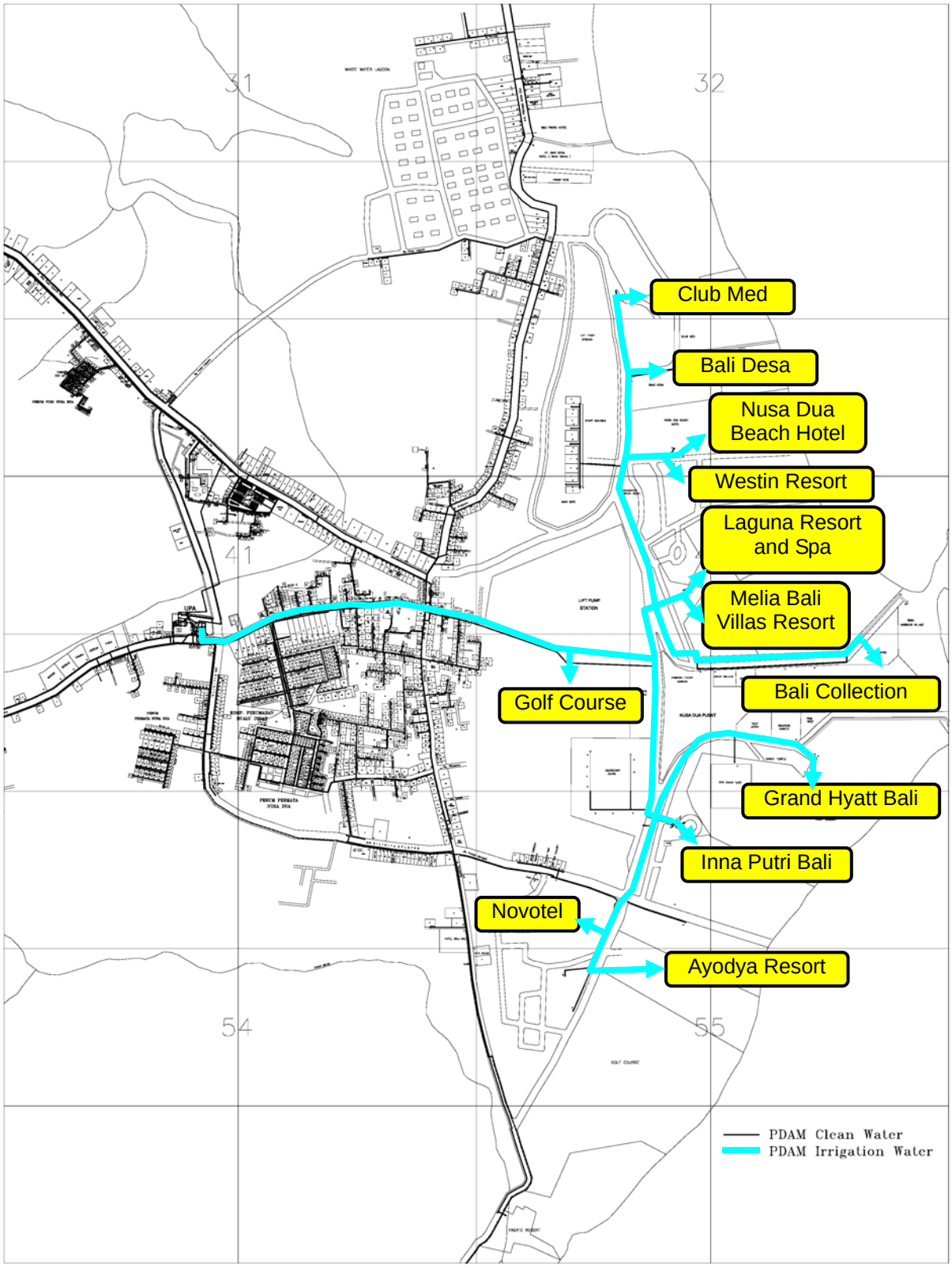


Figure 8.5.2 Existing PDAM Irrigation Water Pipe in Nusa Dua Area

The following deterioration is found in the structure of the existing reservoir. Photographs of present

condition are shown in Figure 8.5.3.

- Efflorescence (free lime) as well as cracks observed on the whole structure. The possibility of leakage when in use is high.
- Exfoliation of mortar and concrete observed inside and outside. Repair is required.

The following reinforcement and repairs are required.

- Remove degraded mortar
- Add more structural steel reinforcement (anchor fixation)
- Increase the concrete wall thickness (approximately 200 mm)
- Coat with waterproofing paint
- Install cover (to keep out air-borne matter)
- Repair miscellaneous equipment (handrail, gangway ladder, piping, etc.)

Appearance	upper part	inside

Figure 8.5.3 Present Condition of the Existing Reservoir

When the thickness of the concrete is increased, the capacity of the facility is reduced to about 1,350 m^3, but the facility can still provide 35 hours of storage (at 38 m^3/hr) and for 3.6 hours of the hourly maximum flow, as well as 4 hours of hourly maximum flow. Therefore, expansion of the reservoir would not be necessary even after the repairs.

(2) Existing distribution pipe

The existing distribution pipe cannot be checked visually because it is underground. It is necessary to conduct the following investigations and to carry out the required repairs in the future.

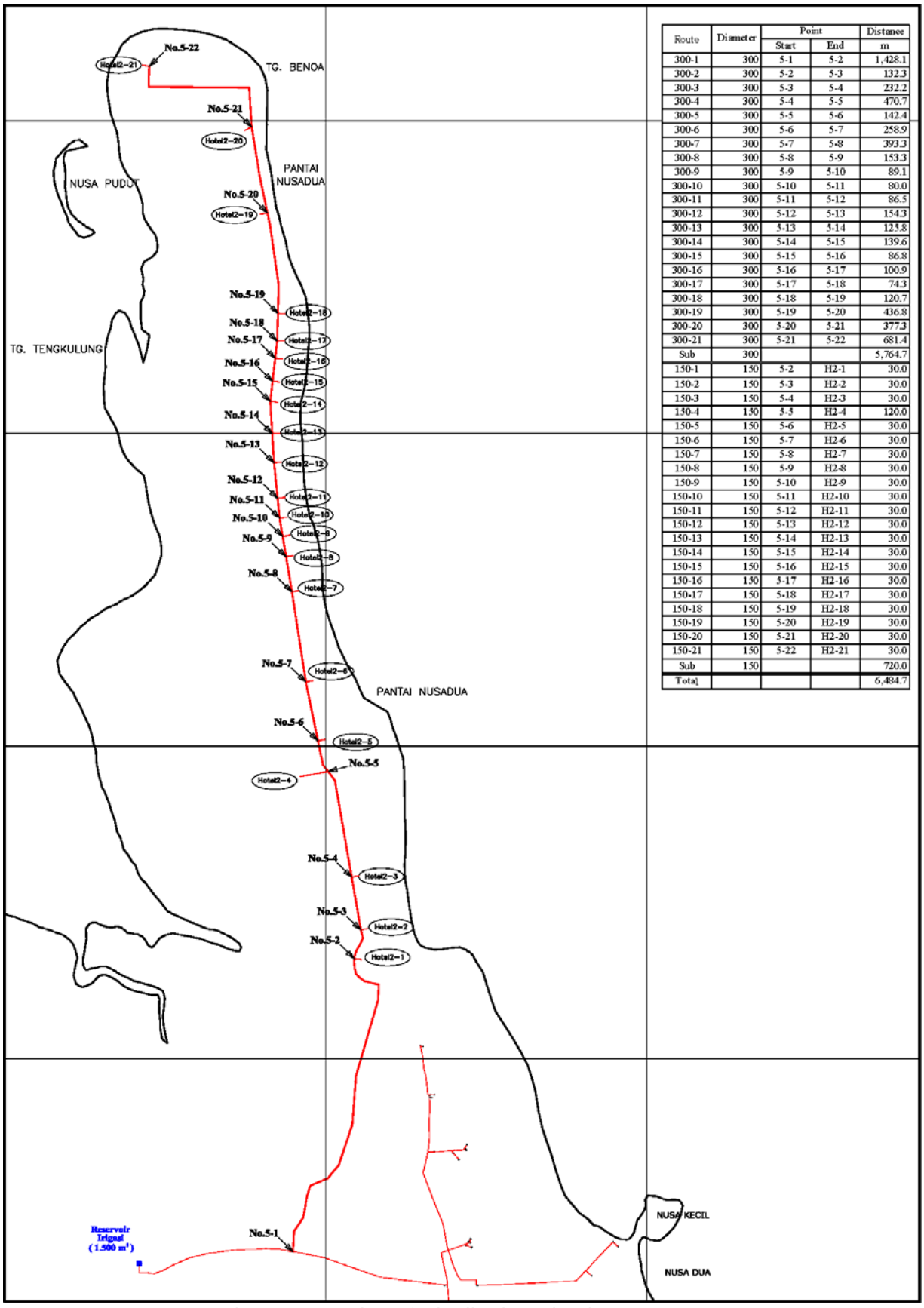
- Leakage survey
- Cleaning
- Repair stop valve
- Repair any leakage

(3) New pipe installation

New pipe installation is required to distribute to the Benoa and Sawangan areas. The outline plan of the piping is shown in Figure 8.5.4 and Figure 8.5.5. The length of new distribution pipe to each district is as follows.

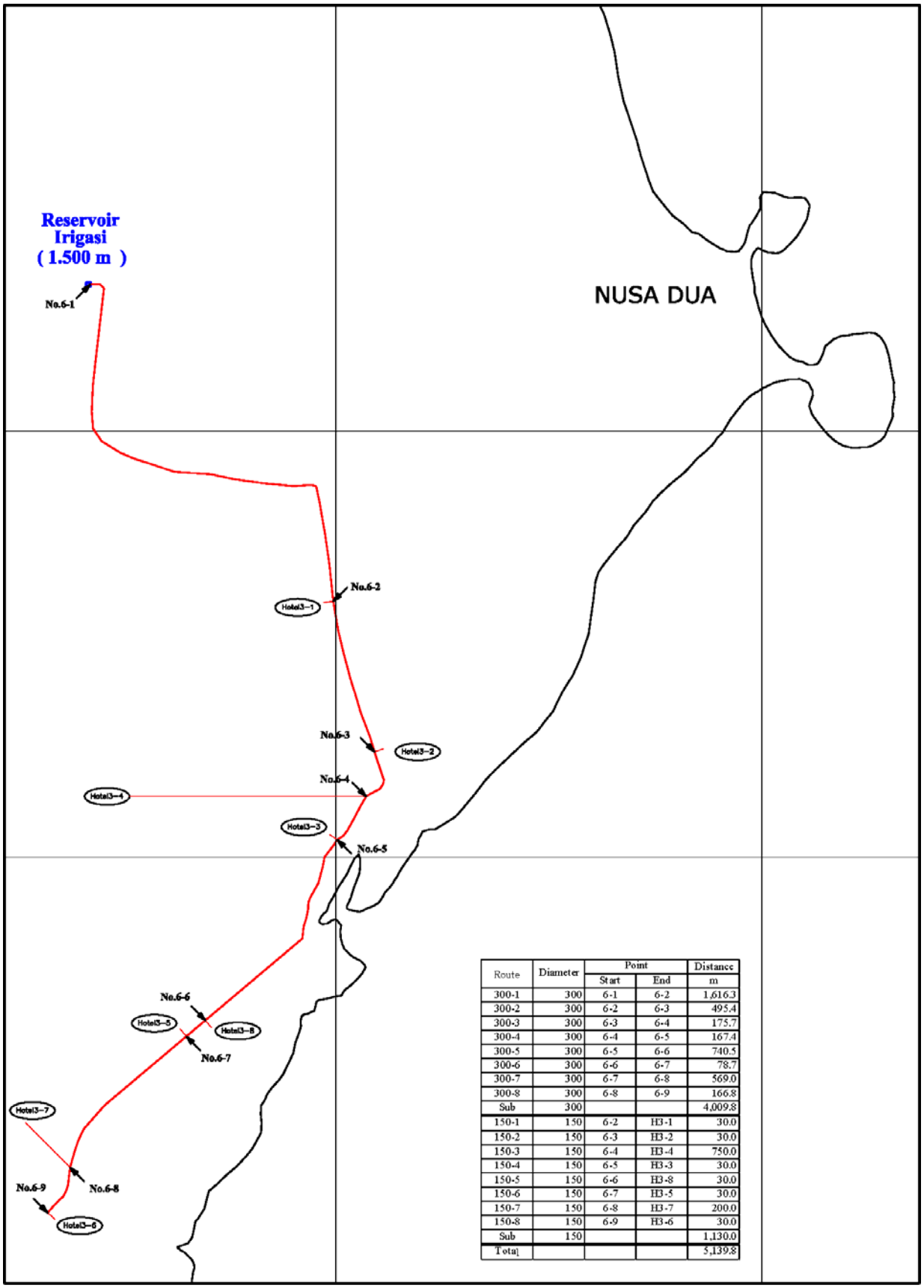
Benoa Area: Total 6,500m
(Case 1: φ200mm: 5,800m, φ100mm: 700m)
(Case 2: φ300mm: 5,800m, φ150mm: 700m)

Sawangan Area: Total 5,200m
(Case 1: φ200mm: 4,000m, φ100mm: 1,200m)
(Case 2: φ300mm: 4,000m, φ150mm: 1,200m)



Route	Diameter	Point		Distance
		Start	End	m
300-1	300	5-1	5-2	1,428.1
300-2	300	5-2	5-3	132.3
300-3	300	5-3	5-4	232.2
300-4	300	5-4	5-5	470.7
300-5	300	5-5	5-6	142.4
300-6	300	5-6	5-7	258.9
300-7	300	5-7	5-8	393.3
300-8	300	5-8	5-9	153.3
300-9	300	5-9	5-10	89.1
300-10	300	5-10	5-11	80.0
300-11	300	5-11	5-12	86.5
300-12	300	5-12	5-13	154.3
300-13	300	5-13	5-14	125.8
300-14	300	5-14	5-15	139.6
300-15	300	5-15	5-16	86.8
300-16	300	5-16	5-17	100.9
300-17	300	5-17	5-18	74.3
300-18	300	5-18	5-19	120.7
300-19	300	5-19	5-20	436.8
300-20	300	5-20	5-21	377.3
300-21	300	5-21	5-22	681.4
Sub	300			5,764.7
150-1	150	5-2	H2-1	30.0
150-2	150	5-3	H2-2	30.0
150-3	150	5-4	H2-3	30.0
150-4	150	5-5	H2-4	120.0
150-5	150	5-6	H2-5	30.0
150-6	150	5-7	H2-6	30.0
150-7	150	5-8	H2-7	30.0
150-8	150	5-9	H2-8	30.0
150-9	150	5-10	H2-9	30.0
150-10	150	5-11	H2-10	30.0
150-11	150	5-12	H2-11	30.0
150-12	150	5-13	H2-12	30.0
150-13	150	5-14	H2-13	30.0
150-14	150	5-15	H2-14	30.0
150-15	150	5-16	H2-15	30.0
150-16	150	5-17	H2-16	30.0
150-17	150	5-18	H2-17	30.0
150-18	150	5-19	H2-18	30.0
150-19	150	5-20	H2-19	30.0
150-20	150	5-21	H2-20	30.0
150-21	150	5-22	H2-21	30.0
Sub	150			720.0
Total				6,484.7

Figure 8.5.4 Plan of Distribution Pipe in Benoa Area
(Note: The diameter in the table shows the values of Case 2)



Route	Diameter	Point		Distance
		Start	End	m
300-1	300	6-1	6-2	1,616.3
300-2	300	6-2	6-3	495.4
300-3	300	6-3	6-4	175.7
300-4	300	6-4	6-5	167.4
300-5	300	6-5	6-6	740.5
300-6	300	6-6	6-7	78.7
300-7	300	6-7	6-8	569.0
300-8	300	6-8	6-9	166.8
Sub	300			4,009.8
150-1	150	6-2	H3-1	30.0
150-2	150	6-3	H3-2	30.0
150-3	150	6-4	H3-4	750.0
150-4	150	6-5	H3-3	30.0
150-5	150	6-6	H3-8	30.0
150-6	150	6-7	H3-5	30.0
150-7	150	6-8	H3-7	200.0
150-8	150	6-9	H3-6	30.0
Sub	150			1,130.0
Total				5,139.8

Figure 8.5.5 Plan of Distribution Pipe in Sawangan Area
(Note: The diameter in the table shows the values of Case 2)

8.6 Operation Plan for Bulk Reclaimed Water Supply Facilities

8.6.1 General

The Special Purpose Company (SPC) would properly maintain the facilities such as the reclaimed water treatment plant, transmission pump facility and pipelines. They would supply reclaimed water of excellent quality and in sufficient quantity to the s in a timely manner, as well as maintain a financially sound and healthy operation. This chapter discusses the operation and maintenance responsibilities of the SPC.

8.6.2 Facilities to be Maintained by SPC

Facilities to be managed by SPC are as follows:

1) Reclaimed water treatment plant
2) Transmission pump
3) Transmission pipeline

Figure 8.6.1 shows the location map of these facilities.

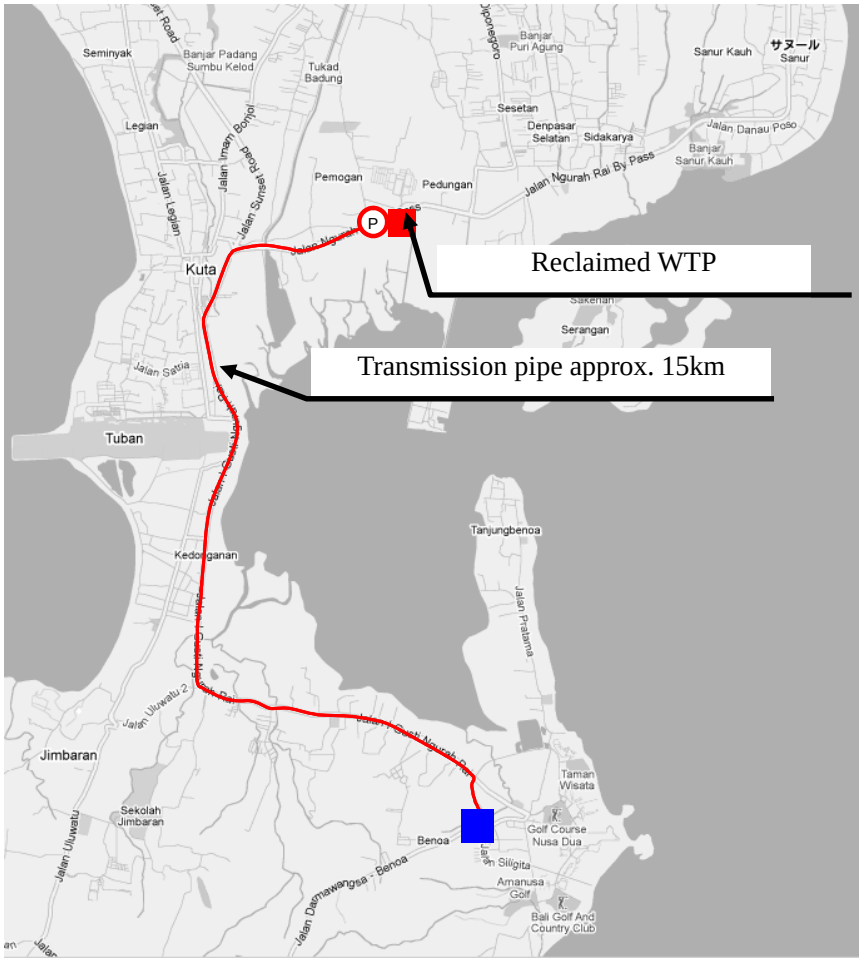


Figure 8.6.1 Location Map of the Facilities to be Maintained by SPC

8.6.3 Operation and Maintenance

Routine management consists of operations management and maintenance, which encompasses the entire spectrum of services required to ensure that the built facility performs, safely and efficiently, the functions for which it was designed and constructed. Maintenance in particular ensures that the operations are always at peak efficiency.

The experience and problems encountered would be analyzed and archived for objective assessment and future decision making on matters including maintenance scheduling, renewal, and improvement of the facility. Logging and keeping track of performance trends, would help maintain a stable management and improve efficiency.

(1) Operations management
The quantity and quality of raw water (secondary treatment effluent) for the operation of this facility are not always constant. Those values change according to the progress of sewerage development, seasonal and diurnal fluctuations, and operational conditions of the WWTP.

Therefore, it is important for the operation of the reclaimed water treatment plant to manage and control operations to adjust to the changing conditions.

The key operation is controlling the quantity and quality of water. The control method, characteristic, and reserved capacity should be carefully considered and executed properly to achieve the pre-determined values. Recording in detail any abnormal occurrences and accidents as well as recording the daily operational data is essential. An operation manual needs to be prepared based on the information.

It is also necessary to set up clear operation management targets, such as cost per unit of reclaimed water produced, and other performance indicators to ensure that the operation is indeed proceeding properly and efficiently. Examples of the items need to be tracked and managed are shown in Table 8.6.1.

Table 8.6.1 The Example of the Item Needs to be Managed

Process	Item
Intake	• Raw Water Tank Level • Intake Volume
Biological Filter	• Filter Inflow • Backwash Air Volume • Filter Tank Water Level • Filtered Tank Water Level • Filtered Water Turbidity
Ozonation	• Ozonation Tank Inflow • Generated Ozone Flow • Generated Ozone Concentration • Exhaust Ozone Concentration
Coagulant/ flocculation	• Coagulant/flocculation basin pH • Coagulant/flocculation basin Pressure • Coagulant/flocculation basin Water Level
Membrane	• Membrane Filtration Device Inflow • Membrane Filtered Water Turbidity
Transmission	• Membrane Filtered Water Tank Level • UPA Reservoir Water Level • Reclaimed Water Transmission Volume
Others	• Each Chemical Level • Each Chemical Dosage • Each Equipment Running Hour

(2) Maintenance
The objective of maintenance is to extend the facility life and reduce the life cycle cost as well as to prevent the deterioration of the facility and to maintain the designed function. Maintenance can be classified as (a) routine checks, maintenance, and repair (Table 8.6.2), and (b) improvements through diagnosis and renewal, by evaluating and improving the processes objectively.

Table 8.6.2 Items for Major Maintenance

Facility	Item
Reclaimed Water Treatment Facility	• Inspection, repair and repainting of the buildings, pipes and others. • Keeping an inventory of the chemical stockpile • Cleaning of membrane filter unit • Replacement of membrane • Regular service and maintenance of mechanical, electrical, instrumentation, monitoring and control equipment
Transmission Pipe	• Inspection and maintenance of valves, and painting of water pipe bridge and bridge-attached pipe • Leakage survey, repair, pipe internal condition survey and pipe cleaning • Inspection of pipeline and attendance of another construction

The method of maintenance varies according to the type of equipment, scale and characteristic of the facilities, and the location.

1) Preparation of operation manuals and adherence to operational procedures
The activities to check, maintain, and repair equipment and plant operations would be standardized to minimize variation and promote quality performance through consistent implementation of a process or procedure. To achieve this, it is required to prepare manuals, containing written instructions that document the routine or repetitive activity to be followed.

When there is an emergency, materials such as specifications of the facility, drawings of equipment, and water supply distribution diagrams, may be required. Therefore, there should be ready access to the drawings, statistics and repair history, and inventory of spare parts..

2) Diagnosis and evaluation of function deterioration
The facility would deteriorate after years of use. A schedule of planned maintenance actions aimed at the prevention of breakdowns and failures before they actually occur would preserve and enhance equipment reliability and prolong service life of the facilities. Workers can follow a checklist similar to one presented in Table 8.6.3, to record equipment and facility deterioration so they know to replace or repair worn parts, or adjust the processes as required.

Table 8.6.3 Function Deterioration and Symptom in the Facilities to be Managed

Classifi-cation	Concrete and Steel Structure	Conduit and Pipe	Electrical and Mechanical	Chemical Feeding	Instrumentation
Structure Material	- Neutralization - Crack, Flaking, Spalling - Joint Opening - Leakage - Deterioration of earthquake resistance - Scouring and wear-out - Corrosion (steel material and reinforcing bar) - Irregular subsidence - Unequal settling and inclination - Deformation - Deterioration	- Corrosion (thickness decrease) - Electric corrosion - Leakage - Damage, breakage, and crack - Neutralization - Deterioration of earthquake resistance - Wear-out and cavitation - Invasion - Deterioration of painting - Deterioration	- Overheat, oil leakage, water leakage - Voltage drop, power failure - Current leakage - Defective operation - Malfunction - Wear-out - Noise and vibration increase - Insulation deterioration - Deterioration of earthquake resistance - Deterioration - Failure stop - Burnout - Damage - Rust and corrosion	- Chemical leakage - Water leakage - Air leakage - Insulation deterioration - Corrosion, wear-out - Meter fluctuation - Zero point disagreement - Deterioration - Error margin increase - Deviation from the acceptable adjustment range - Defective overall accuracy - Defective operation - Failure stop - Defective chemical feeding	- Insulation deterioration - Rust, corrosion - Wear-out - Meter fluctuation - Zero point disagreement - Error margin increase - Deviation from the acceptable adjustment range - Defective overall accuracy - Defective operation - Deterioration - Malfunction - Failure stop - Software defective
Water Quality	- Inflow of hazardous material and polluted water - Mixing of dust and insect - Sedimentation, rolling up of floating matter - Deterioration, flaking off of internal coating - Generation of algae - Residual chlorine decrease	- Corrosion (red water and impurities) - Residual chlorine decrease - Generation of trihalomethane - Inflow of polluted water - Deterioration, flaking off of internal coating	- Pump stop (red water and manganese contained water) - Defective water treatment (suspended matter leakage) - Residual chlorine decrease	- Defective coagulation - Defective disinfection - Quality loss during preservation	- Defective coagulation - Defective disinfection - Pump stop
Quantity and Pressure	- Capacity shortage and high water level shortage of tank - Sand sedimentation - Blockage of inflow and exit with obstacle	- Lack of diameter - Corrosion - Air accumulation - Scale adhesion	- Pump stop - Reclaimed water treatment impossible - Deterioration of reclaimed water treatment performance	- Reclaimed water treatment impossible - Deterioration of reclaimed water treatment performance - Lack of the capacity of container	- Reclaimed water treatment impossible - Deterioration of reclaimed water treatment performance - Pump stop

Classifi-cation	Concrete and Steel Structure	Conduit and Pipe	Electrical and Mechanical	Chemical Feeding	Instrumentation
Management	- Operability degradation - Repair work is impossible. - Efficiency deterioration of water treatment, transmission and distribution	- Defective valve and gate in opening/ shutting - Impossible to suspend water supply	- Increase of breakdown frequency - Increase of breakdown recovery time - Operability degradation - Increase of workload for maintenance - Damage to the third party (Secondary accident caused by power failure and fire)	- Increase of breakdown frequency - Increase of breakdown recovery time - Operability degradation - Increase of workload for maintenance - Lack of ventilation, offensive odor - Incomplete mixing, generation of bubble	- Increase of breakdown frequency - Increase of breakdown recovery time - Operability degradation - Increase of workload for maintenance - Data missing - Defective accuracy

3) Acquisition of expertise, and improvement of skill
Maintenance staff needs to have the appropriate skills and expertise. They must be familiar with the specifications, characteristics of the operations, and be able to handle the initial responses at the time of emergency, even though many of the repairs may be eventually contracted out.

4) Proper maintenance
More frequent maintenance increases the cost of the operation but would not totally eliminate the occurrence of accidents or emergencies. Therefore, it is necessary to find the optimal level of maintenance effort appropriate for the scale of facility and characteristic of the system.

5) Collection, preservation, and utilization of maintenance data
A well kept and extended record of maintenance data is useful to have a clear understanding of the state of deterioration of the facility structures, conditions of pipes, and equipment, and the tendency of failures and accidents. The database is also important for the preparation of a renewal plan and maintenance schedule.

(3) Water quality control
The purpose of water quality control is to ensure the safety of the reclaimed water. Water quality control includes water quality monitoring from the water source to the consumer, early detection of the abnormalities of water source quality, the propriety of reclamation process, understanding the water quality fluctuation in the water supply system.

Water quality is controlled at various stages from the water source to the customer of the reclaimed water system. The water quality standard must be set, and the quality monitored, evaluated and reported. Physicochemical, microbiological and biological water quality tests would be conducted at each stage. Remedial measures would be undertaken on any deviation from the quality standard.

The SPC would prepare water quality testing plan specifying the parameters to be examined, sampling points, and testing frequency. It is important that the prepared water quality testing plan is disclosed to the customers to demonstrate accountability and transparency of this process.

8.6.4 Operation and Maintenance Staff

Securing staff with an adequate technical knowledge is necessary for the maintenance of the facility. Based on the scale of the facility, the hours of operation, and the amount of maintenance tasks, the required staff complement is shown in Table 8.6.4.

Table 8.6.4 Breakdown of Operation and Maintenance Staff

Type of Works	Number of People	Remarks
Manager	1	
Staff	Case 1: 9 Case 2: 12	Three shift operations 3 persons x 3 Shifts 4 persons x 3 Shifts
Chemist	1	
Total	**11 ~ 14**	

CHAPTER 9

IMPLEMENTATION ORGANIZATION & EXECUTING AGENCY

CHAPTER 9 IMPLEMENTATION ORGANIZATION & EXECUTING AGENCY

9.1 Cooperation Agreement Structure under PPP Legal Framework

Based on the survey result in the previous Chapters, Business Structure, Implementation Organization, Executing Agencies and Project Implementation Schedule are studied.

9.1.1 Business Structure of this Wastewater Reclaiming Project

The present laws and regulations specify two types of the business structures in implementing Water Supply Development, (1) one is the conventional type of business: Private business entity who may obtain a business concession shall sell water directly or indirectly (through PDAM) to the consumers (end users) without governmental supports and guarantees, and the other is the PPP project, where Public and Private will mutually cooperate and share the risks under the governmental supports and guarantees set in the PPP legal framework in order to implement water supply development. Firstly, study is conducted on which option is more suitable to implement this Wastewater Reclaiming project.

(1) As a commercial business by Private according to Concession

This is a commercial business to be conducted by private business entity by getting a concession to sell water to the consumers directly in order to make profits and recover the investment money. Private business entity may invest only when the project assures high return and high profitability which could absorb the anticipated risks arising from the investment and business transaction. For implementing this business, a registered company in Indonesia must be established according to the laws/regulations, but a Special Purpose Company (SPC) is not required to be set up. Should the business face big loss against the business plan, the private business entity can make decision at his sole discretion including immediate withdraw from the business by paying the penalty.

This Wastewater Reclaiming project is not a high profitable commercial business to seek high return, but is a social infrastructure project by reusing the effluent from Denpasar WWTP to produce the reclaimed water and eventually to reduce the environmental loads to the sea and seashore in Southern Bali. Due to interests of various stakeholders, it is difficult to transfer or close of the Wastewater Reclaiming facilities by sole decision of SPC.

(2) As a PPP project in the form of BOT contract under PPP legal Framework

The concepts of PPP (Public Private Partnership) is that Public and Private shall cooperate each other and share the risks, opportunity and other aspects in order to develop infrastructure projects within the limited governmental budget by introducing the money and technologies of private business entities towards social welfare promotion. For implementing PPP projects, BOT type contract is common.

BOT contracts are generally implemented by establishing a SPC as a limited liability company and the total project cost are funded by Equity of SPC shareholders and Debt of SPC from financing institutes.

When SPC borrow the loan, the project (BOT contract) itself shall be collateral and the liability of SPC shall be limited to the amount of Equity. Meanwhile, infrastructure projects are low profitable and may take more than 20 years to recover the investment money. Accordingly, BOT contract period would be more than 20 years and it is concerned that various political risks, demand risk and other risks would arise. As private companies cannot bear or mitigate such political risks and demand risk, the projects containing political risks and demand risk cannot be collateral. Therefore, BOT contracts borrowing loan by the project as collateral cannot be established. Only when governmental supports or guarantees are assured

on BOT contract in order to mitigate the risk factors affecting profitability of the project in view of its social importance, borrowing loans from banks by the project as collateral can be realized. The laws and regulations on PPP infrastructure projects are established to regulate provision of the governmental supports and guarantees. With this PPP legal framework, BOT contracts of infrastructure projects can be established.

Namely, risks of investing money and technologies by private companies and the long-term loan risk of banks against collateralized project shall be balanced with product off-take guarantees by Public. In this respect, direct sales of the reclaimed water to the end users cannot be the object of off-take guarantee by Public and it does not meet the requirements. Purchase agreement of the reclaimed water should be concluded with Public, that is, PDAMs in Badung regency and Denpasar city, and the purchase agreement shall be endorsed by off-take guarantee by the governments in the PPP contract under PPP framework. In case the security package including off-take guarantee, payment guarantee etc to be assured under PPP legal framework, banks and/or finance institutions may be able to consider long term finance to the project corresponding to the BOT contract period with favorable interest rates enabling the project be feasible.

Meanwhile, BOT contract assures not only the minimum duration required for recovering the investment money and making profits, but also it guarantees transfer to Public the assets including its operation know-how and required technical skills after ending the BOT contract. Also, in BOT contracts which are not restricted by the governmental limited budget, business plan can be established with most optimum size using advanced technologies and flexible procurement which could be resulted in saving operation cost and maintenance fees.

Accordingly, it is studied that this Wastewater Reclaiming project is implemented as PPP project in a form of BOT contract under PPP legal framework.

9.1.2 PPP Team and Contracting Agency

(1) PPP Team

Pursuant to Ministry of Home Affairs Regulation No. 22/2009, it is requested to form a Regional Cooperation Coordination Team (TKKSD), consisting of the Regional Secretary, the relevant Department or Agency, Bappeda, Legal Bureau etc, in order to facilitate the cooperation between regional government and third party.

Meanwhile, under PPP legal framework, a permanent or temporary PPP unit for the implementation of the project shall be established to coordinate the preparation, promotion and procurement of Project Company under PPP framework. When the project can be promoted by the regional government only, TKKSD may be sufficient. But, if participation of the Central Government is required, a PPP team should be established including members from the Central Government.

For further implementation of this Project, it is urgently required to determine who will be the Contracting Agency of this Project and to let the Contracting Agency establish a PPP Team by organizing the members. A PPP team shall engage in evaluation of this FS report, preparation of tender document and evaluation of bid proposals in the tender. Earlier establishment of PPP team could expedite implementation of the project.

(2) Contracting Agency

The Minister of Public Works Regulation No. 12/2010 defines the duties of the Contracting Agency in implementation of PPP projects. The Contracting Agency play an important role in implementing 1) the planning of the project; 2) the preparation of the project; 3) the procurement of the project through tender;

4) the management of contract, and also the Contracting Agency has an authority to establish tender committee, determine the tender winner and establish evaluation team.

9.1.3 Overall Structure of this Wastewater Reclaiming Project (Proposal)

(1) Structure of PPP Contract (Proposal)

A proposal of Cooperation Agreement Structure under PPP legal framework is as shown in below Figure;

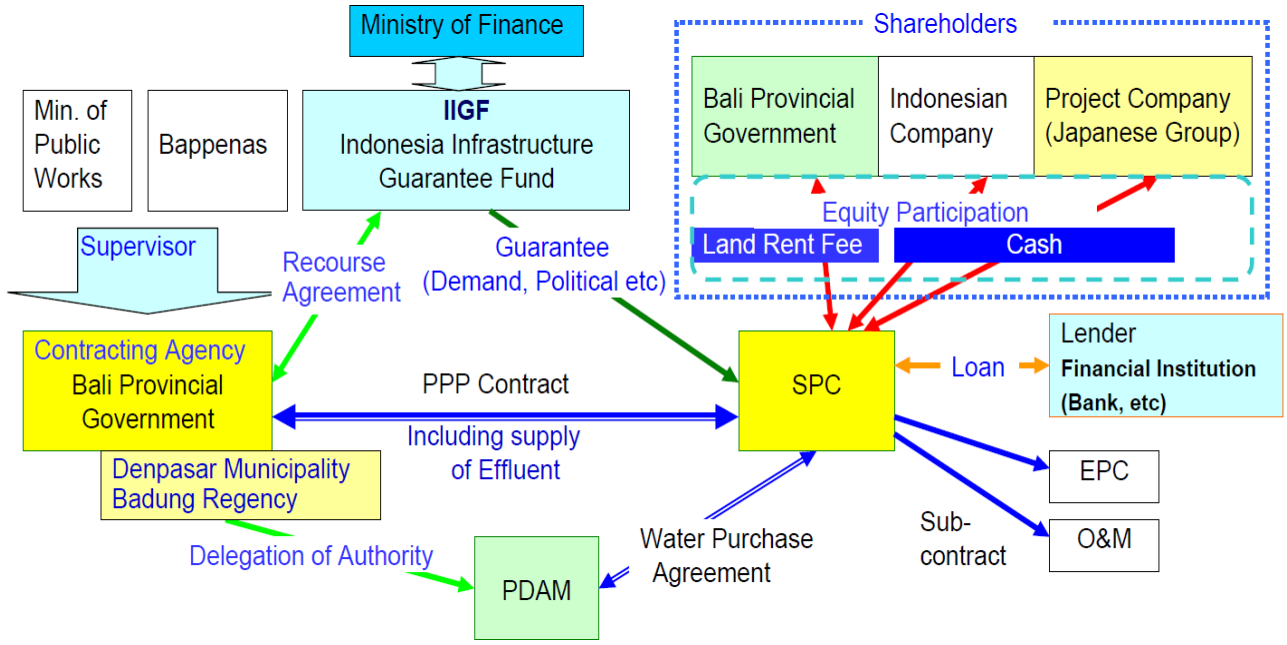


Figure 9.1.1 Proposal of the Cooperation Agreement Structure in BOT Form

As the service area of this Wastewater Reclaiming project is cross regency/city in Bali province, the Contracting Agency shall be Bali provincial government. A counterpart of the Cooperation Agreement shall be a SPC. Since a Water Purchase Agreement will be concluded with PDAMs separately from the Cooperation Agreement, following contractual arrangement shall be discussed and determined by the relevant parties.

- Participation of Denpasar municipal government and Badung regency in the Contracting Agency in order to specify in the PPP contract their wishes and obligations on off-take of the reclaimed water through PDAMs.
- To make it clear that a separate water purchase agreement by PDAMs shall be concluded according to the delegation of authority by Denpasar municipal government and Badung regency,

In order to assure due performance of the contractual obligation of the Contracting Agency and also to provide Indonesian government guarantees with the Cooperation Agreement, a Recourse Agreement shall be concluded by and between the Contracting Agency and Indonesia Infrastructure Guarantee Fund (IIGF) and also a guarantee agreement shall be concluded by IIGF with a SPC.

Meanwhile, a part of the land of BLUPAL is planned to be rent to a SPC for installation of the Wastewater Reclaiming facilities. It is legally possible that Bali provincial government can take equity participation in a SPC in the form of the assets by converting the land rent fee for BOT period to the asset value.

(2) Structure of PPP Contract (Alternative Proposal)

As stated in Chapter 7, the reclaimed water under this Reclamation Water project is planned to be supplied to Hotels etc in Nusa Dua, Benoa and Sawangan areas. In this case, the service area of this PPP contract can be considered within Badung Regency and the government of Badung Regency can be Contracting Agency as shown in below Figure. Badung government will conclude a PPP contract with SPC by undertaking off-take guarantee of the Reclaimed water and also by assuring supply of effluent under the back guarantee by Bali Provincial government. Indonesian Infrastructure Guarantee Fund (IIGF) shall guarantee performance of the contractual obligations by the Contracting Agency in the PPP contract.

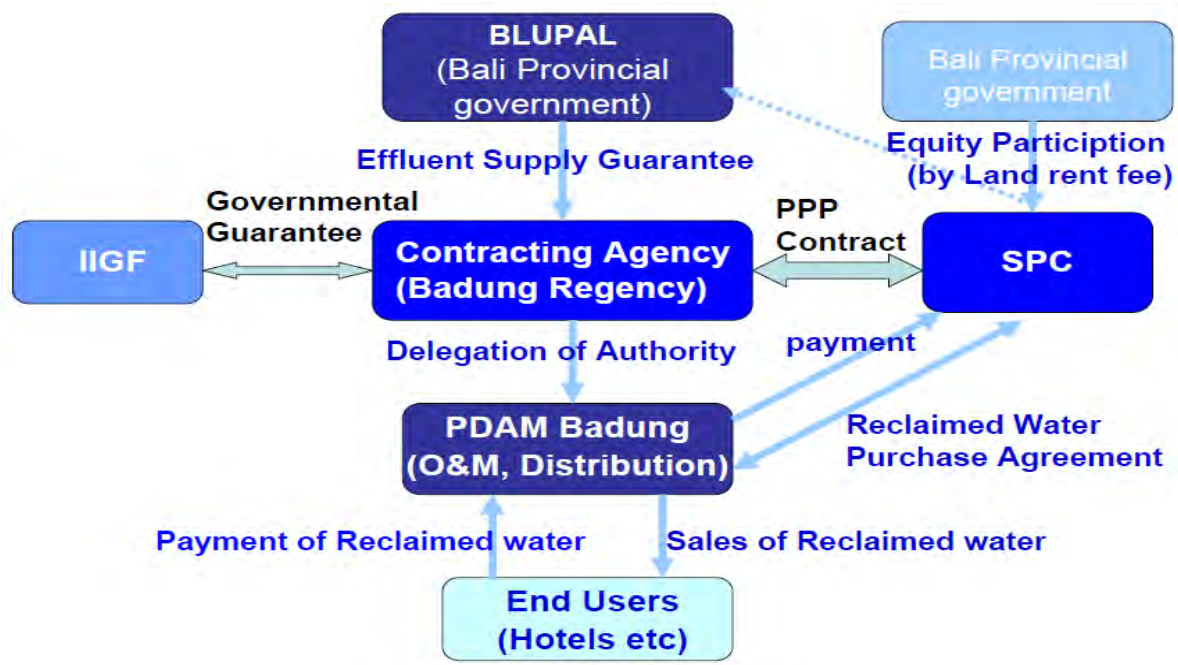


Figure 9.1.2 Cooperation Agreement Structure (Alternative Proposal)

9.2 Proposal on Executing Agencies

9.2.1 Contracting Agency

(1) Minister of Public Works Regulation (12/2010)

This Ministerial regulation specifies Contracting Agency of PPP Water project as follows;

- **Minister of Public Works** if the service area of the cooperation for development of water supply is cross province
- **Governor** if the service area of the cooperation for the development of water supply is cross regency/city in one province; and
- **Regent/Mayor** if the service area of the cooperation for the development of water supply is located in one district/city.

(2) Determination of Contracting Agency

In determining the Contracting Agency, followings points shall be taken into account;

- The service to be provided by the Project Company shall include Badung regency and Denpasar city which are located in province of Bali,
- The land for the project will be provided by provincial government of Bali,
- BLUPAL has the authority on the effluent.
- Having the administration authority on the assets which will be objects of the project

From the next Section and Chapter, study will be conducted based on the assumption that the Contracting Agency is Bali Provincial government.

9.2.2 Establishment of SPC by the Project Company

(1) Project Company

Project Company shall be selected through open tender and, when awarded, shall establish SPC as stated in Section 3.2.2.

(2) Establishment of SPC

The establishment of a limited liability company shall follow the basic requirements and procedures for the formation of a limited liability company as stipulated under the Law (40/2007). In case that there will be foreign ownership in the project company, then the establishment of the project company shall also be subject to Law (25/2007) on Investment. The followings are the summaries of the basic requirements and procedures for the formation/ establishment of a limited liability Company.

- Number of shareholders is at least two (2) companies under Indonesian Company Law.
- Minimum authorized capital for the establishment of a company shall be IDR 50 million (IDR 50,000,000) and 20% of such authorized capital shall be fully paid up upfront upon establishment pursuant to the Law 40/2007. However, in case of foreign investment, the Investment Coordinating Board (BKPM) will require a higher paid up capital which should be paid up upfront.
- Capital participation in the form of fixed assets as a substitute to participation in the form of money is possible. In this case, the "in kind" assets shall first be appraised by an independent appraiser to identify the value of the assets. Such equity participation in a form of asset by regional government may be conducted by head of the region after obtaining approval from local parliament pursuant to the Minister of Home Affairs Regulation (17 of 2007).
- The establishment of a foreign investment company shall be subject to approval from BKPM. That is, before establishment of the company, it is required to obtain a principal approval, and after the company established, it is necessary to obtain permanent business license from BKPM.

(3) Equity Participation by Bali Provincial Government in SPC

Equity participation in a form of fixed assets is legally possible. Considering that this Wastewater Reclaiming project is a new social infrastructural project to reuse the effluent from WWTP in Southern Bali, Bali Provincial government capital participation in SPC could strengthen the base of this Wastewater Reclaiming project in various points. Therefore, further study is conducted under the

assumption that Bali Provincial government would participate in equity of SPC in form of the fixed asset by converting the land use fee during BOT period to the fixed assets.

9.2.3 Purchase Agreement of Reclaimed Water

As stated in Section 9.1, under PPP legal framework, the Reclaimed water will be sold to Public, that is, PDAM Badung and PDAM Denpasar. As clarified in Section 3.1.4, it is understood that PDAM Badung and PDAM Denpasar can purchase and sell the non-drinking water.

A PPP contract is concluded between the Contracting Agency, Bali Provincial government and SPC and a water purchase agreement with PDAMs will be a separate contract. Under PPP legal framework, it is indispensable that the Contracting Agency shall assure SPC off-take guarantee and payment guarantee in the PPP contract. Such guarantee by Bali provincial government is subject to approval in the parliament of Bali Province.

9.3 Work & Responsibility Distribution between Public and Private

9.3.1 Scope of this PPP Project

The scope of both Case 1 and Case 2 which will be the objects of SPC under this Wastewater Reclaiming project shall cover receiving the effluent from Denpasar Waste Water Treatment plant (WWTP), processing by wastewater reclamation and transmission of the reclaimed water up to the delivery point to PDAMs as illustrated below; Facilities to distribute the reclaimed water to each hotel are out of the scope in this PPP contract and PDAM shall build facilities by rehabilitating and/or expanding the existing facilities as maximum as possible. It is also assumed that service pipes inside of hotels shall be modified by end users (hotels etc) not to mix the reclaimed water with clean water as illustrated in Chapter 6.

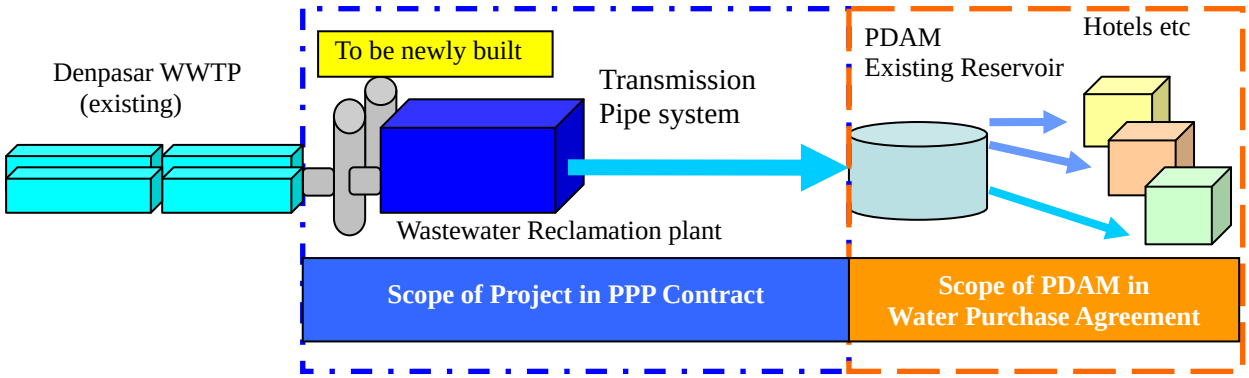


Figure 9.3.1 Example of PDAM Badung Case

9.3.2 Works & Responsibility in the PPP Contract

(1) Works & Responsibility Distribution Between the Contracting Agency and SPC

In implementation of the project, the work and responsibilities of the Contracting Agency and the SPC established by the Project Company in BOT Contract shall be distributed as shown in below Table;

Table 9.3.1 Scope & Responsibility Distribution between Contracting Agency and SPC

	Contracting Agency	SPC (Special Purpose Company)
Object	In order to cope with water shortage forecasted in near future and to reduce environmental loads, Reclaimed water produced from effluent from WWTP by advanced process will be supplied through PDAMs to Hotels in Southern Bali.	
Duties & Respon-Sibility	Stable supply of effluent with the required quality and quantity according to with the agreement	Implementation of reclaimed water supply according to BOT contract by investing money and technologies
	to endorse the water purchase agreement between PDAMs and SPC with regard to off-take guarantee and punctual payment	Finance arrangement and procurement, and repayment of the loan
	Arrangement of required Governmental Support & Guarantee under PPP framework pursuant to laws & regulations,	Payment of the guarantee fee to IIGF against their Guarantee on BOT contract
Investment	Nothing particular to invest with regard to BOT contract.	Procurement of all equipment & materials, erection, commissioning of and O&M of the complete facilities in the scope of BOT contract, but, except for the land.
Others	Operation & Maintenance of Denpasar WWTP at own cost and responsibility	Monitoring & measuring quality of the effluent of WWTP and provision of these information to BLUPAL for their required works or action

(2) Government Support and Guarantee

1) Government Support

As illustrated in Section 3.2.2, Government support in the form of a fiscal or non-fiscal contribution shall be provided by government contracting agency and/or Minister of Finance in order to enhance the financial feasibility of the project and Government is allowed to give support to the project in the form of licensing, land acquisition, partial construction and other form of support in accordance with the applicable sector laws and regulations. But, in case this Project is to be implemented as Unsolicited, government support in the form of non-fiscal contribution shall be only provided and fiscal support shall not be provided.

2) Government Guarantee

As illustrated in Section 3.2.2, the Government guarantee through IIGF shall be provided under PPP legal framework. Consultation with IIGF can be conducted only by the Contracting Agency, but, in case of the Unsolicited project, the initiator may participate in such consultation or may start consultation with IIGF based on this Preparatory Survey report if a MOU has been signed between the Contracting Agency and the Initiator according to the present prevailing laws and regulations.

9.4 Tender Procedure to Select Project Company

All Indonesian PPP projects are subject to competitive procurement. Following is a structured process that will typically include prequalification. Detailed procedure shall follow to Ministry of Public Work Regulation (12/PRT/M/2010) “the Cooperation Guidelines for the Development of Water Supply System”.

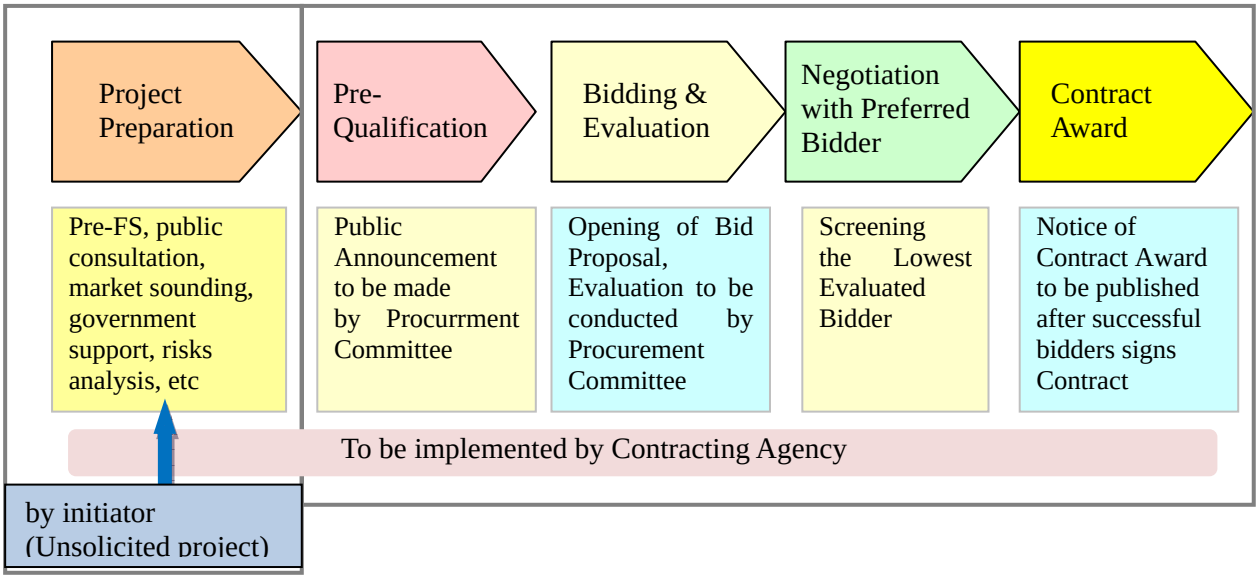


Figure 9.4.1 Procurement Process of PPP Contract

9.4.1 Implementation Process of Procurement

As stated in Chapter 3, Section 3.2.2, Clause (8), there are two types of the project implementation processes, one is "Solicited" project where all the procedures, except for BOT contract execution, are implemented by Contracting Agency and the other is "Unsolicited" project where complete feasibility study including preparation of tender documents draft is planned and executed by private companies as initiator. Solicited project is common, but, as this Reclamation water project is considered eligible as Unsolicited project fulfilling the required conditions as clarified below, Implementation process of procurement are illustrated based on "Unsolicited" project.

(1) This Project is Unsolicited

In view of the following fact and fulfilling the four criteria as the Unsolicited project stated in Chapter 3, Section 3.2.2, Clause (6), it can be understood that this Wastewater Reclaiming project can be considered as Unsolicted project.

i) This Wastewater Reclaiming project is not included in the Master Plan. A group of Toyota Tsusho Corp. and METAWATER Co., Ltd. proposed a new idea of reuse of effluent from Denpasar WWTP by Japanese advanced reclamation technologies and they proposed to Bali Provincial government conducting Feasibility Study subject to agreement by JICA on subsidy of F/S cost.

ii) This Wastewater Reclaiming project can be technically integrated with the Master Plan. Reuse of the effluent can match the target of the Master Plan to reduce the environmental load and to increase supply of clean water.

iii) If technical and financial feasibility of this Wastewater Reclaiming project is verified by this F/S, it is understood that this project is Unsolicited project since other 3 conditions: i) not included in Master plan, ii) can be technically integrated with Master plan projects, iv) does not expect governmental fiscal support are fulfilled.

iv) This Wastewater Reclaiming project does not request the Governmental support in the form of fiscal contribution, although other Governmental Support and Guarantee are assumed to be provided.

(2) MOU between Contracting Agency and Initiator

In order to implement the project as Unsolicited, a MOU shall be concluded between the Contracting Agency and the Initiator which specifies rights and obligations of both parties with regard to preparation of the complete feasibility study and draft of the tender documents.

9.4.2 PPP Contract and Tender Preparation & Evaluation

(1) PPP Contract

PPP contract shall cover the whole project scope as illustrated in Section 9.3.1 including the concession of production of reclaimed wastewater and sales to the potential users in Southern Bali through PDAM Denpasar and PDAM Badung.

(2) Tender Preparation

Tender document draft will be prepared by the Initiator, Japanese company group of Toyota Tsusho Corp. and METAWATER Co., Ltd., if this project is confirmed as Unsolicited project in a MOU which shall be signed by and between the Contracting Agency and the said Japanese group. Otherwise, tender documents will be prepared by the Contracting Agency by themselves.

In the course of preparation of tender document draft, the guarantee package of the project will be discussed and determined by and between Contracting Agency and IIGF. If this project is considered to be Unsolicited project, the Initiator may participation in the consultation. Before tender, the term sheet of risk to be guaranteed by IIGF should be available and it should be reflected in the tender document.

(3) Tender Evaluation

If this project is defined as Unsolicited project in a MOU, the Initiator can be given the right to match, i.e. the right of the initiator to match the best price/ lowest tariff proposed by the other bidder in case of the tender evaluation based on the lowest tariff system, pursuant to Presidential regulation (67/2005). The tender document must state that right to match will be given to the Initiator and the evaluation method.

9.5 Operation & Maintenance Organization

9.5.1 Function & Organization of SPC

(1) Function of SPC

Special Purpose Company (SPC) established by the Project Company shall be responsible for implementation of the Planning & Construction and also responsible for Operation & Maintenance of the project. Following figure shows a main function of SPC;

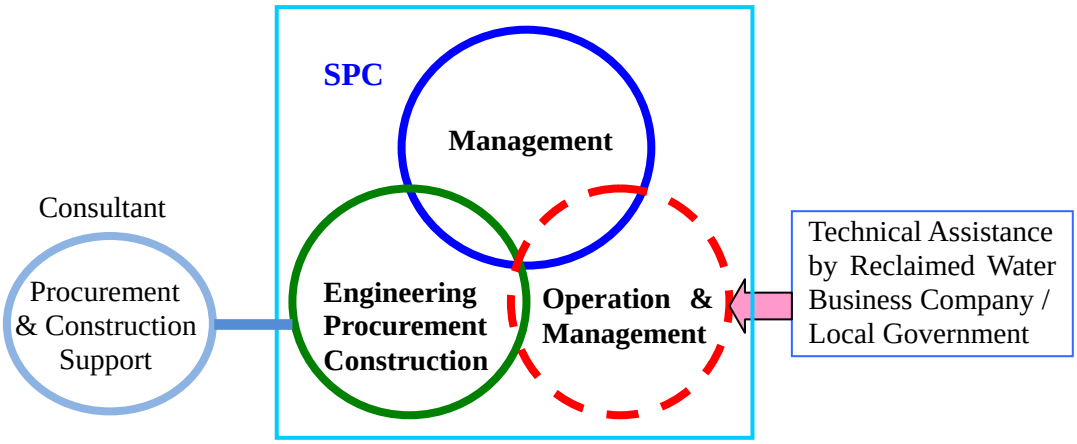


Figure 9.5.1 Function of SPC

(2) Organization of SPC

Organization of SPC for PPP contract implementation is proposed as shown below;

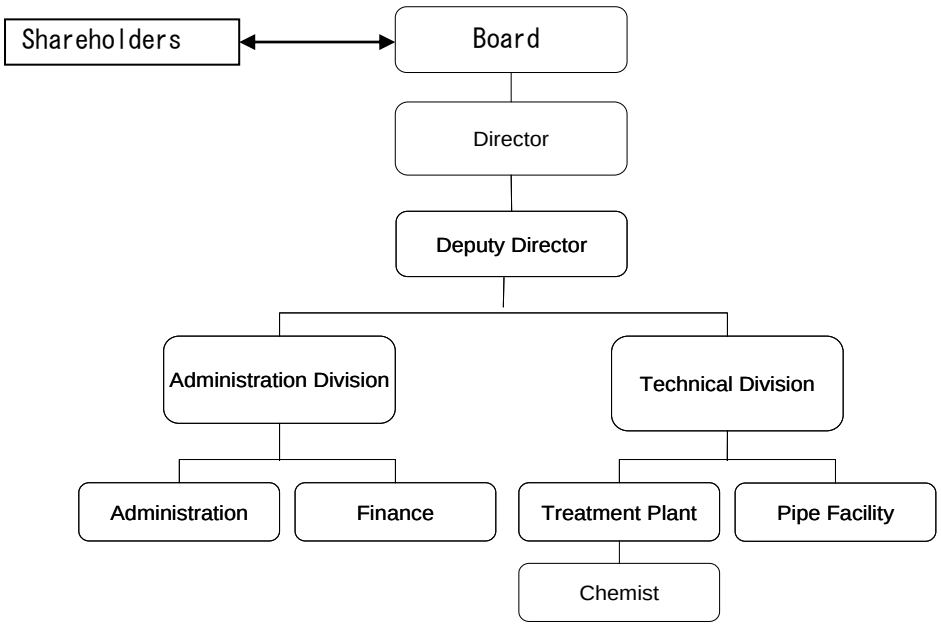


Figure 9.5.2 Organization of SPC

The function of SPC differs before operation and after start-up of operation. Before operation, main works of SPC are procurement and construction and most of the staffs are assigned for these works. After start-up of operation, Operation and Maintenance will be main works. That is, the construction sector organization for procurement and construction will be abolished and the staffs will be shifted to new organization of Operation & Maintenance.

1) Before Start-up of Operation

Construction of the wastewater reclamation plant including transmission piping facilities will be implemented according to the plan and design by SPC in order to satisfy the requirements of the Project. The plan and design shall be made considering utilization of local supply and services as much as possible except for ceramic membrane, its casing and ozonizer.

Procurement of EPC (Engineering, Procurement & Construction) contractor shall be conducted by SPC through competitive tender in Indonesia at his sole discretion. For saving the construction cost, in principle, a whole lot of the works will be sub-contracted by SPC to one general contractor on lump sum price basis. However, considering local contractors capability and local suppliers' availability, contract package of EPC shall be reviewed and determined through the study on the following points;

- To sub-contract a whole lot of works on full-turnkey basis including engineering, civil building, construction, supply and test & commissioning.
- To separate Civil building works portion.
- To conclude a separate contract for Piping transmission system
- To separate Engineering works, and then, according to outcome of the engineering, to prepare separate tender (contract) packages by splitting works of civil building, construction, supply, erection, test and commissioning into several packages.

2) After Start-up of Operation

i) Requirements for Building Operation & Maintenance Organization

In general, in case of BOT contract, Operation & Maintenance works are likely to be sub-contracted to the company who is performing and/or has good experience of similar service/works. But, since wastewater reclamation plant is new technology at present in Bali and Indonesia, it seems to be difficult to find such company having the experience.

Then, it is required that SPC should build Operation & Maintenance organization considering the following points;

- Ensuring of required staffs for operation and maintenance works
- Clarification of required competence and qualification of staffs
- A reasonable and proper deployment plan of staffs
- Clarification of authority and responsibility by job category
- Organization at emergency
- Effective Deployment plan by combining the minimum number of foreign experts/technician with the Indonesian staffs through training and technology transfer
- Dismissal of the staffs at termination of BOT contract is not so easy

ii) Collaboration with BLUPAL on O&M

More than six months period, operation and maintenance staffs of BLUPAL have been participating in the O&M works of the METAWATER's pilot test unit of Wastewater Reclamation plant built in IPAL Suwung. Although scale and size of the Wastewater Reclamation plant to be built according to this Feasibility Study is much larger than pilot test unit, it is considered that experience and knowledge acquired by BLUPAL staffs could contribute significantly to Operation & Maintenance works of this Reclamation Wastewater project.

It is proposed that SPC should seek most appropriate way of the collaboration with BLUPAL with regard to O&M of this project by selecting from the following options;

- Sub-contract of O&M works to BLUPAL on conditions that SPC shall dispatch the experts and specialists to BLUPAL for training in the initial stage.
- Joint establishment of company with BLUPAL to undertake Operation & Maintenance works of both Waste Water Treatment Plant and Wastewater Reclaiming plant.

In the meanwhile, the present status of BLUPAL is still under legal procedure to be full BLU (Pubilc Service Agency). Establishment of a joint venture with BLUPAL is subject to approval by Provincial government of Bali. A service rendering contract with BLUPAL for Operation and Maintenance works can be made under the present legal status of BLUPAL unless any new investment will arise in BLUPAL.

- On 2006, Governor of Bali, Regent of Badung and Mayor of Denpasar issued Joint Regulation of 2006 on the Joint Management of Sewerage System covering the area across the Regency of Badung and City of Denpasar and the management of BLUPAL is established under the Governor of Bali Decree No. 404/04-F/HK/2007 on the implementation of Badan Layanan Umum Pengelola Air Limbah.
- Under above Governor's Decree, status of BLUPAL is temporary BLU. According to Bali provincial government, BLUPAL will be formed to be full BLU in near future as an institution under Public Work Agency of Bali.

iii) Job Category and Work Description of O&M

Required job description for O&M of this Wastewater Reclaiming plant are as shown in below table;

Table 9.5.1 Job Category and Work Description of O&M

Work/Service	Job Category	Work Description
Operation and Maintenance, and Inspection of Facility	Facility operators, supporting staff. Electric and mechanical engineers and technicians	Operation, supervision an inspection of the facilities and Equipment, Recording, reporting and communication. Periodic inspection for electric and mechanical facilities. Maintenance and inspection for electric and mechanical equipment, and easy repair of equipment. Recording the performance in operation, maintenance, and checking. Recording of accident and customer claims.
Management and Maintenance of Facility	Technical and Professional Job by engineers and technicians	Daily checking, regular inspection and easy repair work for buildings and facilities. Management, renovation and repair of the facilities. Preparation and management of ledger.

Water Quality Monitoring and Management	Chemical and Microbiological Job by experts and technicians in Chemistry and Microbiology	Water sampling, water analysis of raw wastewater, secondary treated wastewater. Management and recording the results of water quality analysis. Feedback the water quality results to operation of treatment facilities.
Administration Work	Clerical Job	Overall Management. Personnel affairs, payroll and training for staff. Contracts. Procurement and management for materials and equipment. Documentation. Socialization activities.

9.5.2 Manpower Planning for O&M

Based on Figure 9.5.2 and Table 9.5.1, required manpower planning of this Wastewater Reclaiming project are as shown in Table 9.5.2;

Table 9.5.2 Manpower Planning for Operation and Maintenance

No.	Sector/Division	Members	Number of Personnel
1.	Management		3
		Director	(1)
		Deputy Director	(1)
		Secreatry	(1)
2.	Administration Division (Administration & Finance)		8
		Manager	(1)
		Engineer/Assistant	(2)
		Secretary	(1)
		Security staffs	(3)
		Office boy	(1)
3	Technical Division (Wastewater Reclamation Plant and Transmission Pipe System)		14
		Manager	(1)
		Engineer/Operator	(12)
		Chemist	(1)
		Total Number of Personnel	25

The above manpower plan is prepared with reference to the present O&M organization (total 17 personnel, are concurrently the O&M) of the Wastewater Reclamation plant of Tokyo Metropolitan Government at Shibaura, Tokyo in Japan, and considering the labor situation in Indonesia and the experience of similar works.

9.6 Project Implementation Schedule (Proposal)

A Project implementation schedule of this Wastewater Reclaiming project are shown as below; This schedule is prepared considering a period of coordinating, arranging funds and promotion activities. A proposed implementation schedule of the Project are as shown in Table 9.6.1.

(1) Preliminary Stage

• Bidding Process by Indonesian Government for the concession

- preparation of tender, tender document preparation, study of evaluation criteria
- tender procedures by Indonesian (Bali Province) government (prequalification, bidding, contract negotiation)

• Preparation for Establishment of organizations such as SPC (by bidders) bid preparation, preparation for SPC establishment

• Financing Arrangement, Cordination of Government Support & Guarantees

• Contract document preparation, Conclusion of PPP Contract, fulfilling Contract effectuation conditions

• Promotion activities for users' understanding to the reclaimed water use

(2) Acquisition of Permission/Approval

• An environmental license (EIA approval to be obtained by the Contracting Agency first, but, final obligation to get approval belongs to the Project Company)

• Purchase agreement of the reclaimed water (bulk supply contract with PDAM)

• Finance Closing

• IIGF guarantee

• Conclusion of SPC Shareholders Agreement and obtaining of BKPM's approval on establishment of SPC

• Hand over of the land to SPC for use of BOT contract period

(3) Construction (Construction Plan only)

(Works by SPC)

• Detail design and engineering

• Selection of EPC Contractor (tender)

• Construction of reclamation plant

• Construction of reclaimed water transmission facilities (civil and architectural works for flowadjusting reservoir and pumping facilities, and installation work of transmission pipes)

• Installation of pump equipment

(Works by PDAM)

• Rehabilitation of existing reservoir and distribution pipe mains

• Consruction of new distribution pipes

• Connection of distribution pipes main to existing service piping system of Hotels

(Works by End users)

• Improvement of the existing service piping system inside of Hotels

Table 9.6.1 Draft Implementation Schedule of the Project

Description	2012				2013				2014				2015				2016			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Preliminary Stage																				
Bidding Process by Indonesian Government (Bali Province)																				
・Tender Preparation, Tender Documents, Bid Evaluation Method/Criteria																				
・Tender Process (Prequalification, Bidding, Evaluation)																				
Preparation for Establishment of SPC																				
Procurement of Finance & Governmental Suppot/Guarantee																				
PPP Contract Preparation/Concluding & Its Effectuation																				
Socialization Activities to Stakeholders on use of Reclaimed Water																				
Acquisition of Permission / Approval																				
EIA Approval (Environmental Permission)																				
Reclaimed Water Bulk Sales Agreement with PDAM																				
Finance Closing																				
Recourse Agreement & Guarantee Agreement with IIGF																				
Concluding of SPC Shareholder Agreement & License Approval from **BKPM**																				
Hand Over Land to SPC																				
Construction Works																				
Detailed Design																				
Tendering for Selection of EPC Contractor																				
Construction Work of Reclamation Plant																				
Construction Work of Reclamed Water Tansmission Facilities																				
Manufacturing of Equipment (Pumps & Mechanical/Electrical Equipment)																				
Installation of Equipment (Pumps & Mechanical/Electrical Equipment)																				
Improvement Work of Existing Reservoir, Distribution Mains and Pipes (by PDAM)																				
Installation of New Distribution Pipes (by PDAM)																				
Connection Work of Distribution Mains and Pipes (by PDAM)																				
Improvement Work of Service Pipes and Related Facility (by End Users)																				
Reclaimed Water Supply Service																				

CHAPTER 10

PROJECT COST ESTIMATE

CHAPTER 10 PROJECT COST ESTIMATE

10.1 Components of the Project Cost

The four main cost components of the reclaimed water supply project cost are construction, engineering services, taxes, operation and maintenance (O&M). These are further categorized as shown in the following table.

Table 10.1.1 Components of the Project Cost

Main Item	Detail Item
【1】Construction	(A) Site Preparation
	(B) Reclamation Plant Construction
	(C) Transmission Pipe Installation
	(D) Distribution Reservoir Reconstruction
	(E) Distribution Pipe Rehabilitation and Installation
	(F) Renovating the Service Pipe Facilities in Each Hotel
【2】Engineering Services	(A) Detailed Design, Construction Supervision, Other Surveys, etc.
	(B) Capacity Building
	(C) Publication and Education-related
【3】Tax Charges	(A) Value-added Tax (VAT)
	(B) Import Tax
	(C) Surface Water Use Tax
【4】Operation and Maintenance (O&M)	(A) Personnel
	(B) Electricity
	(C) Chemical
	(D) Fuel
	(E) Water Quality Testing
	(F) Repair and Replacement of parts and equipment
	(G) Office expenditures
	(H) Treated Water Use Rate

10.2 Cost Estimate Conditions

Most of the unit prices were calculated from the "DAFTAR HARGA SATUAN" prepared by DINAS PU in Bali province, based on the construction cost of the pilot reclamation plant, the construction cost of the sewerage development currently undertaken by BLUPAL, etc. The detail list of the unit prices for construction is shown in Table 8.b.4 in Appendix 8. The water of Case 1 is used for toilet flushing and Case 2 is used for non-potable water. Both the project cost of Case 1 and Case 2 are estimated individually. The conditions of the cost estimate such as currency exchange rate are as follows.

- Project implementation period (Operating period) : BOT for 25 years (2016 - 2040)
  : Operation period is 23 years
- Currency exchange rate : 1 IDR = 0.00909 JPY
- Price escalation rate (Local currency) : 5.3% (6.8% for construction period)
  (Foreign currency) : 1.8% for construction period

The currency exchange rate is that of August 2011. The average price escalation rate of the local currency for the last five years (2006 ~ 2010) was calculated from "Situation base data for foreign countries" available on the web page of the Japanese Foreign Ministry. The price escalation rate for foreign currency was set with reference to the results of a survey for accommodating JICA Loans in 2010.

The cost for replacement of assets or reconstruction of facilities during the life of the project is not applicable because the service lives of the facilities as shown below are longer than or equal to the

operating period of the project (about 20 years).

・Civil structure : about 50 years
・Architectural structure : about 30 years
・Mechanical and electrical facilities : about 20 years

10.3 Construction Costs

Construction costs are calculated for all the facilities required for the project, from the reclamation plant to the renovation of service pipe facilities in each hotel. As explained in Chapter 7, the responsibility for constructing and renovating these facilities is divided between SPC, PDAM Badung and the hotels; and the associated costs are calculated separately for these parties. Construction costs under SPC's responsibility consist of site preparation, reclamation plant construction and transmission pipeline construction. Construction costs under PDAM's responsibility consist of distribution reservoir reconstruction, rehabilitation of the existing distribution network and installation of new distribution pipes. The construction costs under the responsibility of each hotel consist of renovation of their service pipe facilities. The detail of each construction cost item is explained in the following.

Table 10.3.1 Responsible Organization of the Each Component

Items	SPC	PDAM	Hotels
(A) Site Preparation	○		
(B) Reclamation Plant Construction	○		
(C) Transmission Pipe Installation	○		
(D) Distribution Reservoir Reconstruction		○	
(E) Distribution Pipe Rehabilitation and Installation		○	
(F) Renovating the Service Pipe Facilities in Each Hotel			○

(1) Site Preparation

Site preparation consists of the following:

・Improvement of the access road to the reclamation plant site
・Cutting down of mangrove trees, digging up of soft soil and removal of concrete debris
・Land reclamation and leveling using purchased soil

The land for the reclaimed water supply plant will be provided by the Bali Provincial Government as a precondition of this PPP project (the Bali Provincial Government needs to apply to the Ministry of Forestry for the license to use the land).

(2) Reclamation Plant Construction

This cost category covers the construction of the pump facility to convey the secondary effluent from Denpasar WWTP, biological filtration facility, ozonation facility, membrane filtration facility and transmission pump facility. The breakdown by facility type is shown as follows.

1) Main plant construction (civil engineering and architectural works)
・Raw water pumping station
・Biological filtration process building
・Ozonation process building
・Membrane filtration process building
・Site work

・Vehicle purchase
・Connection charge for electrical service

2) Mechanical and Electrical Facility

・Mechanical equipment (including installation)
・Electrical equipment (including installation)

(3) Transmission Pipe Installation

The transmission pipe from Denpasar WWTP to the existing UPA distribution reservoir would be constructed in four sections, using different pipe installation methods, according to the level of traffic congestion and the ease of pipe installation at the location. The total cost for the transmission pipe installation the sum of the pipe installation costs for each section. The length of each road section is shown below.

・Open cut method (daytime work : about 7.5 km)
・Open cut method (nighttime work : about 7 km from Badung River to Sama River)
・Water pipe bridge method (crossing of river and drainage canal)
・Pipe jacking method (around the airport about 400 m)

(4) Distribution Reservoir Reconstruction

The existing reservoir does not have a roof and has many cracks and evidence of water leakage. The cost for reconstruction would cover the following:

・Crack repair
・Waterproofing
・Roof construction

(5) Distribution Pipe Installation

The distribution pipe installation cost would cover the following:

・Rehabilitation of the existing distribution pipes in Nusa Dua
・Installation of new distribution pipes in Benoa
・Installation of new distribution pipe in Sawangan

(6) Renovation of Service Pipe Facilities in the Hotels

The renovation cost is required to use reclaimed water in the hotels. The unit cost of renovation is calculated in Chapter 6.

<Summary of Case 1>
The renovation cost would establish a system to supply the reclaimed water to the toilet in each room or floor.

<Summary of Case 2>
The renovation cost would establish a system to supply the reclaimed water which is mixed with PDAM water and a separate system to supply drinking and cooking water to the restaurants inside the hotels.

(7) Total Construction Cost

The total construction costs calculated on the conditions by each facility and responsible agency explained above is shown in Table 10.3.2 (Case 1) or Table 10.3.3 (Case 2).

Table 10.3.2 Construction Cost of Case 1
(1) Construction Cost by Each Facility

Item	IDR (×1,000)			JPY (×1,000)
	LC	FC	Total	Total
【A Site Preparation】				
Site Preparation	5,968,887	0	5,968,887	54,257
【B Reclamation Plant Facility】				
Structure Construction				
Raw Water Pump Building	976,400	0	976,400	8,875
Biological Treatment Building	5,455,191	0	5,455,191	49,588
Ozonation Building	7,942,297	0	7,942,297	72,195
Membrane Filtration Building	12,454,956	0	12,454,956	113,216
Site Work	3,598,539	0	3,598,539	32,711
Vehicles	2,070,000	0	2,070,000	18,816
Connection Charge for Electricity	631,250	0	631,250	5,738
Sub Total (1)	33,128,632	0	33,128,632	301,139
Mechanical and Electrical Facility				
Mechanical Equipment	28,027,620	24,004,951	52,032,571	472,976
Electrical Equipment	35,613,810	0	35,613,810	323,730
Sub Total (2)	63,641,430	24,004,951	87,646,381	796,706
Total	96,770,062	24,004,951	120,775,013	1,097,845
【C Water Transmission Pipe】				
Water Transmission Pipe	44,144,600	0	44,144,600	401,274
【D Distribution Reservoir】				
Distribution Reservoir	3,449,933	0	3,449,933	31,360
【E Distribution Pipe】				
Distribution Pipe for Nusa Dua	3,342,380	0	3,342,380	30,382
Distribution Pipe for Benoa	10,285,000	0	10,285,000	93,491
Distribution Pipe for Sawangan	8,465,200	0	8,465,200	76,949
Total	22,092,580	0	22,092,580	200,822
【F Renovation of Service Pipe Facilities in the Hotel 】				
Renovation Cost	29,230,000	0	29,230,000	265,701
Total	29,230,000	0	29,230,000	265,701

(2) Construction Cost by Responsible Agency

Item	IDR (×1,000)			JPY (×1,000)
	LC	FC	Total	Total
SPC Total Construction Cost	146,883,549	24,004,951	170,888,500	1,553,376
PDAM Total Construction Cost	25,542,513	0	25,542,513	232,181
Hotel Total Renovation Cost	29,230,000	0	29,230,000	265,701
Grand Total Construction Cost	201,656,062	24,004,951	225,661,013	2,051,259

Table 10.3.3 Construction Cost of Case 2

(1) Construction Cost by Each Facility

Item	IDR (×1,000)			JPY (×1,000)
	LC	FC	Total	Total
【A Site Preparation】				
Site Preparation	6,507,139	0	6,507,139	59,150
【B Reclamation Plant Facility】				
Structure Construction				
Raw Water Pump Building	1,224,468	0	1,224,468	11,130
Biological Treatment Building	9,387,773	0	9,387,773	85,335
Ozonation Building	8,823,814	0	8,823,814	80,208
Membrane Filtration Building	14,261,371	0	14,261,371	129,636
Site Work	4,357,294	0	4,357,294	39,608
Vehicles	2,070,000	0	2,070,000	18,816
Connection Charge for Electricity	631,250	0	631,250	5,738
Sub Total (1)	40,755,971	0	40,755,971	370,472
Mechanical and Electrical Facility				
Mechanical Equipment	33,402,949	34,308,417	67,711,366	615,496
Electrical Equipment	35,613,810	0	35,613,810	323,730
Sub Total (2)	69,016,759	34,308,417	103,325,176	939,226
Total	109,772,730	34,308,417	144,081,147	1,309,698
【C Water Transmission Pipe】				
Water Transmission Pipe	56,218,200	0	56,218,200	511,023
【D Distribution Reservoir】				
Distribution Reservoir	3,449,933	0	3,449,933	31,360
【E Distribution Pipe】				
Distribution Pipe for Nusa Dua	3,342,380	0	3,342,380	30,382
Distribution Pipe for Benoa	13,326,700	0	13,326,700	121,140
Distribution Pipe for Sawangan	10,757,200	0	10,757,200	97,783
Total	27,426,280	0	27,426,280	249,305
【F Renovation of Service Pipe Facilities in the Hotel 】				
Renovation Cost	19,750,000	0	19,750,000	179,528
Total	19,750,000	0	19,750,000	179,528

(2) Construction Cost by Responsible Agency

Item	IDR (×1,000)			JPY (×1,000)
	LC	FC	Total	Total
SPC Total Construction Cost	172,498,069	34,308,417	206,806,486	1,879,871
PDAM Total Construction Cost	30,876,213	0	30,876,213	280,665
Hotel Total Renovation Cost	19,750,000	0	19,750,000	179,528
Grand Total Construction Cost	223,124,281	34,308,417	257,432,698	2,340,063

10.4 Engineering Services

10.4.1 Cost of Detailed Design, Construction Supervision and Surveys

This cost is calculated as the sum of the following cost items.

・Detailed design
・Construction supervision
・Project management during construction
・EIA implementation
・Additional ground and geological surveys
・Inspection of the existing distribution reservoir and distribution pipes (originally used for irrigation)

The detailed design and construction supervision costs are calculated based on the estimated required man-months (MM) of foreign and local engineers as shown below, including office expenses, etc.

・Foreign Engineer : 86 MM
・Local Engineer : 275 MM

10.4.2 Capacity Building and Promotion

The capacity building costs of this project is not expected. The capacity building is considered on job training (OJT) through design, construction and O&M after operation because the capacity building is conducted through the operation at the pilot reclamation plant in Denpasar WWTP. The costs of public relations and education-related are excluded from the total project cost because it is a precondition of the project that the major part of the promotion should be finished before the confirmation of the reclaimed water demand at the target hotels.

10.5 Tax Charges

The following taxes are estimated as part of the project cost.

(1) Value-added Tax (VAT)

VAT is estimated at 10% of the local currency portions of the project cost.

(2) Import Duty

The import tax depends on the items to be imported but the import tax is about 10% of the total price of the equipment to be imported, based on the experience with the construction of the pilot reclamation plant. According to the investigate and examine the results with the support of the tax consultant office in Indonesia, there is a possibility that the reclaimed water project will be exempted from import tax if import duty exemption as stipulated in the Ministry of Finance Regulation No. 101/PMK.04/2007 is

applicable to this Project. Contents of the tax consultant office are shown below.

1) Minister of Finance defines in the provision, exempt from import duties pertaining to the import of raw materials and equipment to be used to prevent environmental pollution. Exemption shall be applied to the waste disposal or industry companies. These equipments can be used for other purposes or be transferred to others with the permission of the Directorate General of Customs, if the equipments were used as intended for two years from the import.

2) Definition of "waste" is the relevant provision has not been specified. In addition, the SPC to the management of the reclaimed water project is unclear whether the applicable to “waste disposal company” under such provision, but this project is considered to be business in line with the spirit of the law. Therefore the local tax office in Indonesia recommended that the SPC submits an application for the approval of the import tax exemption to the Ministry of Directorate General of Taxation with the following documents after the project approval.
   - Investment Coordinating Board approval
   - Tax ID card issued by the Revenue Department
   - Registered businesses VAT (PKP)
   - Details of materials and equipments (amount, type and specifications)
   - Letter of recommendation by the Ministry of the Environment and Environmental Committee (It describes that these equipments entail no adverse consequence to the environment during the waste treatment and these are recommended the materials and equipments for using to waste treatment.)

Application for approval of import tax exemption is after the establishment of SPC, but the project costs in this survey are exempt from import tax as a prerequisite for the calculations.

(3) Surface Water Use Tax

The surface water use tax will be imposed on the Indonesian law (28/2009), if the water is use as a water source of tap water. The operation and tax rate are defined by the local government regulations. The taxable water is only surface water and groundwater on these regulations, but there is no provision for the treated wastewater from secondary treatment.

Table 10.5.1 Laws, Regulation and Tax Rate for Water Source

	Water source	Laws and regulations	Tax rates
1	Surface water	Regulation of Bali (16/2009, Revision 1/2011)	10% of water price
2	Ground water	(In case of Badung Regency) Regulation of Badung Regency (1/2011)	20% of water price

The definition of surface water in Indonesian law (7/2004, GR42/2008) has been defined as "all the water on the ground", but the definition in Bali regulations (1/2011) has been defined as excluding the seawater on the land and sea. Therefore the use of seawater in the state of Bali is not subject to taxation.

According to the results of request to investigate and examine the law firm and tax consultant offices in Indonesia about whether the surface water should be regarded as treated wastewater, it is necessary to confirmation and agreement of the relevant agencies of Bali government but they think that there is unreasonable to tax the treated wastewater as surface water from the following two reasons.

1) The treated wastewater has been discharged to the sea so that this water isn’t used in fact. The treated wastewater is the seawater rather than the surface water if it is dared to classify.
2) The treated wastewater does not have a valuation from the viewpoint of taxation.

Based on the above-mentioned expert opinion, the treated wastewater is considered as a tax-free advance

in this survey.

10.6 Approximate Project Cost

The approximate project cost including indirect costs and price escalation during the project period is shown in Tables 10.6.1 (Case 1) and 10.6.2 (Case 2).

The physical contingency is set at 10 % of the sum of construction costs and engineering services costs. The price escalation contingency is set as explained in Section 10.2.

Table 10.6.1 Approximate Project Cost for Case 1

(1) Project Cost for SPC

		Total Cost (×1,000)			
		LC	FC	Total	
		IDR	JPY	IDR	JPY
【1-1】	**Construction Cost**				
(A)	**Site Preparation**	**5,968,887**		**5,968,887**	**54,257**
(B)	**Reclamation Plant Facility**	**96,770,062**	**218,205**	**120,775,013**	**1,097,845**
	Architectural and Civil Work (without vehicle and connection charge)	30,427,382		30,427,382	276,585
	(Vehicle and Connection Charge)	2,701,250		2,701,250	24,554
	Mechanical and Electrical Work	63,641,430	218,205	87,646,381	796,706
(C)	**Water Transmission Pipe**	**44,144,600**		**44,144,600**	**401,274**
	Construction Cost	**146,883,549**	**218,205**	**170,888,500**	**1,553,376**
【1-2】	**Price Contingency**	**26,239,793**	**9,928**	**27,332,018**	**248,448**
【1-3】	**Physical Contingency**	**17,312,334**	**22,813**	**19,822,052**	**180,182**
	Sub Total (1)	**190,435,677**	**250,947**	**218,042,571**	**1,982,007**
【2-1】	**Engineering Service Cost**				
(A)	**Detailed Design, Construction Supervision**	**14,094,080**	**204,200**	**36,558,326**	**332,315**
(B)	**Capacity Building**	**0**	**0**	**0**	**0**
(C)	**Information Education Communication Campaign**	**0**	**0**	**0**	**0**
	Engineering Service Cost	**14,094,080**	**204,200**	**36,558,326**	**332,315**
【2-2】	**Price Contingency**	**1,972,114**	**7,294**	**2,774,578**	**25,221**
【2-3】	**Physical Contingency**	**1,606,619**	**21,149**	**3,933,290**	**35,754**
	Sub Total (2)	**17,672,813**	**232,644**	**43,266,195**	**393,290**
【3】	**Tax Charge**				
(A)	**VAT**	**26,130,877**	**0**	**26,130,877**	**237,530**
(B)	**Import Tax**	**0**	**0**	**0**	**0**
	Sub Total (3)	**26,130,877**	**0**	**26,130,877**	**237,530**
	Total Project Cost	**234,239,367**	**483,591**	**287,439,642**	**2,612,826**

(2) Project Cost for PDAM

		Total Cost (×1,000)			
		LC	FC	Total	
		IDR	JPY	IDR	JPY
【1-1】	**Construction Cost**				
(D)	**Distribution Reservoir**	**3,449,933**	**0**	**3,449,933**	**31,360**
(E)	**Distribution Pipe**	**22,092,580**	**0**	**22,092,580**	**200,822**
	Civil Work	22,092,580	0	22,092,580	200,822
	Construction Cost	**25,542,513**	**0**	**25,542,513**	**232,181**
【1-2】	**Price Contingency**	**5,187,878**	**0**	**5,187,878**	**47,158**
【1-3】	**Physical Contingency**	**3,073,039**	**0**	**3,073,039**	**27,934**
	Sub Total (1)	**33,803,430**	**0**	**33,803,430**	**307,273**
【3】	**Tax Charge**				
(A)	**VAT**	**3,328,464**	**0**	**3,328,464**	**30,256**
(B)	**Import Tax**	**0**	**0**	**0**	**0**
	Sub Total (3)	**3,328,464**	**0**	**3,328,464**	**30,256**
	Total Project Cost	**37,131,894**	**0**	**37,131,894**	**337,529**

(3) Project Cost for Hotels

		Total Cost (×1,000)			
		LC	FC	Total	
		IDR	JPY	IDR	JPY
【1-1】	**Construction Cost**				
(F)	**Hotel Renovation**	**29,230,000**	**0**	**29,230,000**	**265,701**
	Civil Work	29,230,000	0	29,230,000	265,701
	Construction Cost	**29,230,000**	**0**	**29,230,000**	**265,701**
【1-2】	**Price Contingency**	**5,768,416**	**0**	**5,768,416**	**52,435**
【1-3】	**Physical Contingency**	**3,499,842**	**0**	**3,499,842**	**31,814**
	Sub Total (1)	**38,498,258**	**0**	**38,498,258**	**349,949**
【3】	**Tax Charge**				
(A)	**VAT**	**3,792,142**	**0**	**3,792,142**	**34,471**
(B)	**Import Tax**	**0**	**0**	**0**	**0**
	Sub Total (3)	**3,792,142**	**0**	**3,792,142**	**34,471**
	Total Project Cost	**42,290,399**	**0**	**42,290,399**	**384,420**

Table 10.6.2 Approximate Project Cost for Case 2

(1) Project Cost for SPC

		Total Cost (×1,000)			
		LC	FC	Total	
		IDR	JPY	IDR	JPY
【1-1】	**Construction Cost**				
(A)	**Site Preparation**	**6,507,139**		**6,507,139**	**59,150**
(B)	**Reclamation Plant Facility**	**109,772,730**	**311,864**	**144,081,148**	**1,309,698**
	Architectural and Civil Work (without vehicle and connection charge)	38,054,721		38,054,721	345,917
	(Vehicle and Connection Charge)	2,701,250		2,701,250	24,554
	Mechanical and Electrical Work	69,016,759	311,864	103,325,177	939,226
(C)	**Water Transmission Pipe**	**56,218,200**		**56,218,200**	**511,023**
	Construction Cost	**172,498,069**	**311,864**	**206,806,487**	**1,879,871**
【1-2】	**Price Contingency**	**30,816,877**	**14,190**	**32,377,910**	**294,315**
【1-3】	**Physical Contingency**	**20,331,495**	**32,605**	**23,918,440**	**217,419**
	Sub Total (1)	**223,646,440**	**358,659**	**263,102,836**	**2,391,605**
【2-1】	**Engineering Service Cost**				
(A)	**Detailed Design, Construction Supervision**	**14,094,080**	**204,200**	**36,558,326**	**332,315**
(B)	**Capacity Building**	**0**	**0**	**0**	**0**
(C)	**Information Education Communication Campaign**	**0**	**0**	**0**	**0**
	Engineering Service Cost	**14,094,080**	**204,200**	**36,558,326**	**332,315**
【2-2】	**Price Contingency**	**1,972,114**	**7,294**	**2,774,578**	**25,221**
【2-3】	**Physical Contingency**	**1,606,619**	**21,149**	**3,933,290**	**35,754**
	Sub Total (2)	**17,672,813**	**232,644**	**43,266,195**	**393,290**
【3】	**Tax Charge**				
(A)	**VAT**	**30,636,903**	**0**	**30,636,903**	**278,489**
(B)	**Import Tax**	**0**	**0**	**0**	**0**
	Sub Total (3)	**30,636,903**	**0**	**30,636,903**	**278,489**
	Total Project Cost	**271,956,156**	**591,302**	**337,005,934**	**3,063,384**

(2) Project Cost for PDAM

		Total Cost (×1,000)			
		LC	FC	Total	
		IDR	JPY	IDR	JPY
【1-1】	**Construction Cost**				
(D)	**Distribution Reservoir**	**3,449,933**	**0**	**3,449,933**	**31,360**
(E)	**Distribution Pipe**	**27,426,280**	**0**	**27,426,280**	**249,305**
	Civil Work	27,426,280	0	27,426,280	249,305
	Construction Cost	**30,876,213**	**0**	**30,876,213**	**280,665**
【1-2】	**Price Contingency**	**6,240,461**	**0**	**6,240,461**	**56,726**
【1-3】	**Physical Contingency**	**3,711,667**	**0**	**3,711,667**	**33,739**
	Sub Total (1)	**40,828,341**	**0**	**40,828,341**	**371,130**
【3】	**Tax Charge**				
(A)	**VAT**	**4,020,430**	**0**	**4,020,430**	**36,546**
(B)	**Import Tax**	**0**	**0**	**0**	**0**
	Sub Total (3)	**4,020,430**	**0**	**4,020,430**	**36,546**
	Total Project Cost	**44,848,771**	**0**	**44,848,771**	**407,675**

(3) Project Cost for Hotels

		Total Cost (×1,000)			
		LC	FC	Total	
		IDR	JPY	IDR	JPY
【1-1】	**Construction Cost**				
(F)	**Hotel Renovation**	**19,750,000**	**0**	**19,750,000**	**179,528**
	Civil Work	19,750,000	0	19,750,000	179,528
	Construction Cost	**19,750,000**	**0**	**19,750,000**	**179,528**
【1-2】	**Price Contingency**	**3,897,578**	**0**	**3,897,578**	**35,429**
【1-3】	**Physical Contingency**	**2,364,758**	**0**	**2,364,758**	**21,496**
	Sub Total (1)	**26,012,336**	**0**	**26,012,336**	**236,452**
【3】	**Tax Charge**				
(A)	**VAT**	**2,562,258**	**0**	**2,562,258**	**23,291**
(B)	**Import Tax**	**0**	**0**	**0**	**0**
	Sub Total (3)	**2,562,258**	**0**	**2,562,258**	**23,291**
	Total Project Cost	**28,574,594**	**0**	**28,574,594**	**259,743**

10.7 Annual Spending Plan

Tables 10.7.1 and 10.7.2 show the annual spending plans prepared based on the proposed construction plan separately for the first and second stages of the project.

Table 10.7.1 Annual Spending Plan for Case 1

(1) Annual Spending Plan for SPC

		Total Cost (×1,000)				2012 (cost×million)			2013 (cost×million)			2014 (cost×million)			2015 (cost×million)		
		LC	FC	Total		LC	FC	Total	LC	FC	Total	LC	FC	Total	LC	FC	Total
		IDR	JPY	IDR	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY
【1-1】	**Construction Cost**																
(A)	**Site Preparation**	**5,968,887**		**5,968,887**	**54,257**	0	0	0	0	0	0	5,969	0	54	0	0	0
(B)	**Reclamation Plant Facility**	**96,770,062**	**218,205**	**120,775,013**	**1,097,845**												
	Architectural and Civil Work (without vehicle and connection charge)	30,427,382		30,427,382	276,585	0	0	0	0	0	0	15,214	0	138	15,214	0	138
	(Vehicle and Connection Charge)	2,701,250		2,701,250	24,554	0	0	0	0	0	0	0	0	0	2,701	0	25
	Mechanical and Electrical Work	63,641,430	218,205	87,646,381	796,706	0	0	0	0	0	0	31,821	109	398	31,821	109	398
(C)	**Water Transmission Pipe**	**44,144,600**		**44,144,600**	**401,274**	0	0	0	0	0	0	22,072	0	201	22,072	0	201
	Construction Cost	**146,883,549**	**218,205**	**170,888,500**	**1,553,376**	0	0	0	0	0	0	75,076	109	792	71,808	109	762
【1-2】	**Price Contingency**	**26,239,793**	**9,928**	**27,332,018**	**248,448**	0	0	0	0	0	0	10,586	4	100	15,654	6	148
【1-3】	**Physical Contingency**	**17,312,334**	**22,813**	**19,822,052**	**180,182**	0	0	0	0	0	0	8,566	11	10	8,746	12	15
	Sub Total (1)	**190,435,677**	**250,947**	**218,042,571**	**1,982,007**	0	0	0	0	0	0	94,227	124	902	96,208	127	925
【2-1】	**Engineering Service Cost**																
(A)	**Detailed Design, Construction Supervision**	**14,094,080**	**204,200**	**36,558,326**	**332,315**	0	0	0	4,366	50	89	5,785	111	163	3,943	44	80
(B)	**Capacity Building**	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0
(C)	**Information Education Communication Campaign**	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0
	Engineering Service Cost	**14,094,080**	**204,200**	**36,558,326**	**332,315**	0	0	0	4,366	50	89	5,785	111	163	3,943	44	80
【2-2】	**Price Contingency**	**1,972,114**	**7,294**	**2,774,578**	**25,221**	0	0	0	297	1	4	816	4	11	859	2	10
【2-3】	**Physical Contingency**	**1,606,619**	**21,149**	**3,933,290**	**35,754**	0	0	0	466	5	9	660	11	16	480	5	8
	Sub Total (2)	**17,672,813**	**232,644**	**43,266,195**	**393,290**	0	0	0	5,129	56	102	7,261	126	191	5,282	51	98
【3】	**Tax Charge**																
(A)	**VAT**	**26,130,877**	**0**	**26,130,877**	**237,530**	0	0	0	1,124	0	10	12,903	0	117	12,104	0	110
(B)	**Import Tax**	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0
	Sub Total (3)	**26,130,877**	**0**	**26,130,877**	**237,530**	0	0	0	1,124	0	10	12,903	0	117	12,104	0	110
	Total Project Cost	**234,239,367**	**483,591**	**287,439,642**	**2,612,826**	0	0	0	6,253	56	112	114,392	250	1,210	113,594	178	1,133

(2) Annual Spending Plan for PDAM

		Total Cost (×1,000)				2012 (cost×million)			2013 (cost×million)			2014 (cost×million)			2015 (cost×million)		
		LC	FC	Total		LC	FC	Total	LC	FC	Total	LC	FC	Total	LC	FC	Total
		IDR	JPY	IDR	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY
【1-1】	**Construction Cost**																
(D)	**Distribution Reservoir**	**3,449,933**	**0**	**3,449,933**	**31,360**	0	0	0	0	0	0	0	0	0	3,450	0	31
(E)	**Distribution Pipe**	**22,092,580**	**0**	**22,092,580**	**200,822**												
	Civil Work	22,092,580	0	22,092,580	200,822	0	0	0	0	0	0	11,046	0	100	11,046	0	100
	Construction Cost	**25,542,513**	**0**	**25,542,513**	**232,181**	0	0	0	0	0	0	11,046	0	100	14,496	0	132
【1-2】	**Price Contingency**	**5,187,878**	**0**	**5,187,878**	**47,158**	0	0	0	0	0	0	1,709	0	16	3,479	0	32
【1-3】	**Physical Contingency**	**3,073,039**	**0**	**3,073,039**	**27,934**	0	0	0	0	0	0	1,105	0	10	1,450	0	13
	Sub Total (1)	**33,803,430**	**0**	**33,803,430**	**307,273**	0	0	0	0	0	0	13,860	0	126	19,425	0	177
【3】	**Tax Charge**																
(A)	**VAT**	**3,328,464**	**0**	**3,328,464**	**30,256**	0	0	0	0	0	0	1,386	0	13	1,943	0	18
(B)	**Import Tax**	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0
	Sub Total (3)	**3,328,464**	**0**	**3,328,464**	**30,256**	0	0	0	0	0	0	1,386	0	13	1,943	0	18
	Total Project Cost	**37,131,894**	**0**	**37,131,894**	**337,529**	0	0	0	0	0	0	15,246	0	139	21,368	0	194

(3) Annual Spending Plan for Hotels

		Total Cost (×1,000)				2012 (cost×million)			2013 (cost×million)			2014 (cost×million)			2015 (cost×million)		
		LC	FC	Total		LC	FC	Total	LC	FC	Total	LC	FC	Total	LC	FC	Total
		IDR	JPY	IDR	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY
【1-1】	**Construction Cost**																
(F)	**Hotel Renovation**	**29,230,000**	**0**	**29,230,000**	**265,701**												
	Civil Work	29,230,000	0	29,230,000	265,701	0	0	0	0	0	0	14,615	0	133	14,615	0	133
	Construction Cost	**29,230,000**	**0**	**29,230,000**	**265,701**	0	0	0	0	0	0	14,615	0	133	14,615	0	133
【1-2】	**Price Contingency**	**5,768,416**	**0**	**5,768,416**	**52,435**	0	0	0	0	0	0	2,261	0	21	3,508	0	32
【1-3】	**Physical Contingency**	**3,499,842**	**0**	**3,499,842**	**31,814**	0	0	0	0	0	0	1,462	0	13	1,462	0	13
	Sub Total (1)	**38,498,258**	**0**	**38,498,258**	**349,949**	0	0	0	0	0	0	18,337	0	167	19,584	0	178
【3】	**Tax Charge**																
(A)	**VAT**	**3,792,142**	**0**	**3,792,142**	**34,471**	0	0	0	0	0	0	1,834	0	17	1,958	0	18
(B)	**Import Tax**	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0
	Sub Total (3)	**3,792,142**	**0**	**3,792,142**	**34,471**	0	0	0	0	0	0	1,834	0	17	1,958	0	18
	Total Project Cost	**42,290,399**	**0**	**42,290,399**	**384,420**	0	0	0	0	0	0	20,171	0	183	21,543	0	196

Table 10.7.2 Annual Spending Plan for Case 2

(1) Annual Spending Plan for SPC

		Total Cost (×1,000)				2012 (cost×million)			2013 (cost×million)			2014 (cost×million)			2015 (cost×million)		
		LC	FC	Total		LC	FC	Total	LC	FC	Total	LC	FC	Total	LC	FC	Total
		IDR	JPY	IDR	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY
【1-1】	**Construction Cost**																
(A)	**Site Preparation**	**6,507,139**		**6,507,139**	**59,150**	0	0	0	0	0	0	6,507	0	59	0	0	0
(B)	**Reclamation Plant Facility**	**109,772,730**	**311,864**	**144,081,148**	**1,309,698**												
	Architectural and Civil Work (without vehicle and connection charge)	38,054,721		38,054,721	345,917	0	0	0	0	0	0	19,027	0	173	19,027	0	173
	(Vehicle and Connection Charge)	2,701,250		2,701,250	24,554	0	0	0	0	0	0	0	0	0	2,701	0	25
	Mechanical and Electrical Work	69,016,759	311,864	103,325,177	939,226	0	0	0	0	0	0	34,508	156	470	34,508	156	470
(C)	**Water Transmission Pipe**	**56,218,200**		**56,218,200**	**511,023**	0	0	0	0	0	0	28,109	0	256	28,109	0	256
	Construction Cost	**172,498,069**	**311,864**	**206,806,487**	**1,879,871**	0	0	0	0	0	0	88,152	156	957	84,346	156	923
【1-2】	**Price Contingency**	**30,816,877**	**14,190**	**32,377,910**	**294,315**	0	0	0	0	0	0	12,429	6	119	18,387	9	176
【1-3】	**Physical Contingency**	**20,331,495**	**32,605**	**23,918,440**	**217,419**	0	0	0	0	0	0	10,058	16	12	10,273	16	18
	Sub Total (1)	**223,646,440**	**358,659**	**263,102,836**	**2,391,605**	0	0	0	0	0	0	110,640	178	1,088	113,007	181	1,116
【2-1】	**Engineering Service Cost**																
(A)	**Detailed Design, Construction Supervision**	**14,094,080**	**204,200**	**36,558,326**	**332,315**	0	0	0	4,366	50	89	5,785	111	163	3,943	44	80
(B)	**Capacity Building**	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0
(C)	**Information Education Communication Campaign**	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0
	Engineering Service Cost	**14,094,080**	**204,200**	**36,558,326**	**332,315**	0	0	0	4,366	50	89	5,785	111	163	3,943	44	80
【2-2】	**Price Contingency**	**1,972,114**	**7,294**	**2,774,578**	**25,221**	0	0	0	297	1	4	816	4	11	859	2	10
【2-3】	**Physical Contingency**	**1,606,619**	**21,149**	**3,933,290**	**35,754**	0	0	0	466	5	9	660	11	16	480	5	8
	Sub Total (2)	**17,672,813**	**232,644**	**43,266,195**	**393,290**	0	0	0	5,129	56	102	7,261	126	191	5,282	51	98
【3】	**Tax Charge**																
(A)	**VAT**	**30,636,903**	**0**	**30,636,903**	**278,489**	0	0	0	1,124	0	10	15,132	0	138	14,381	0	131
(B)	**Import Tax**	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0
	Sub Total (3)	**30,636,903**	**0**	**30,636,903**	**278,489**	0	0	0	1,124	0	10	15,132	0	138	14,381	0	131
	Total Project Cost	**271,956,156**	**591,302**	**337,005,934**	**3,063,384**	0	0	0	6,253	56	112	133,032	304	1,416	132,670	232	1,345

(2) Annual Spending Plan for PDAM

		Total Cost (×1,000)				2012 (cost×million)			2013 (cost×million)			2014 (cost×million)			2015 (cost×million)		
		LC	FC	Total		LC	FC	Total	LC	FC	Total	LC	FC	Total	LC	FC	Total
		IDR	JPY	IDR	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY
【1-1】	**Construction Cost**																
(D)	**Distribution Reservoir**	**3,449,933**	**0**	**3,449,933**	**31,360**	0	0	0	0	0	0	0	0	0	3,450	0	31
(E)	**Distribution Pipe**	**27,426,280**	**0**	**27,426,280**	**249,305**												
	Civil Work	27,426,280	0	27,426,280	249,305	0	0	0	0	0	0	13,713	0	125	13,713	0	125
	Construction Cost	**30,876,213**	**0**	**30,876,213**	**280,665**	0	0	0	0	0	0	13,713	0	125	17,163	0	156
【1-2】	**Price Contingency**	**6,240,461**	**0**	**6,240,461**	**56,726**	0	0	0	0	0	0	2,121	0	19	4,119	0	37
【1-3】	**Physical Contingency**	**3,711,667**	**0**	**3,711,667**	**33,739**	0	0	0	0	0	0	1,371	0	12	1,716	0	16
	Sub Total (1)	**40,828,341**	**0**	**40,828,341**	**371,130**	0	0	0	0	0	0	17,206	0	156	22,999	0	209
【3】	**Tax Charge**																
(A)	**VAT**	**4,020,430**	**0**	**4,020,430**	**36,546**	0	0	0	0	0	0	1,721	0	16	2,300	0	21
(B)	**Import Tax**	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0
	Sub Total (3)	**4,020,430**	**0**	**4,020,430**	**36,546**	0	0	0	0	0	0	1,721	0	16	2,300	0	21
	Total Project Cost	**44,848,771**	**0**	**44,848,771**	**407,675**	0	0	0	0	0	0	18,926	0	172	25,298	0	230

(3) Annual Spending Plan for PDAM

		Total Cost (×1,000)				2012 (cost×million)			2013 (cost×million)			2014 (cost×million)			2015 (cost×million)		
		LC	FC	Total		LC	FC	Total	LC	FC	Total	LC	FC	Total	LC	FC	Total
		IDR	JPY	IDR	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY	IDR	JPY	JPY
【1-1】	**Construction Cost**																
(F)	**Hotel Renovation**	**19,750,000**	**0**	**19,750,000**	**179,528**												
	Civil Work	19,750,000	0	19,750,000	179,528	0	0	0	0	0	0	9,875	0	90	9,875	0	90
	Construction Cost	**19,750,000**	**0**	**19,750,000**	**179,528**	0	0	0	0	0	0	9,875	0	90	9,875	0	90
【1-2】	**Price Contingency**	**3,897,578**	**0**	**3,897,578**	**35,429**	0	0	0	0	0	0	1,528	0	14	2,370	0	22
【1-3】	**Physical Contingency**	**2,364,758**	**0**	**2,364,758**	**21,496**	0	0	0	0	0	0	988	0	9	988	0	9
	Sub Total (1)	**26,012,336**	**0**	**26,012,336**	**236,452**	0	0	0	0	0	0	12,390	0	113	13,233	0	120
【3】	**Tax Charge**																
(A)	**VAT**	**2,562,258**	**0**	**2,562,258**	**23,291**	0	0	0	0	0	0	1,239	0	11	1,323	0	12
(B)	**Import Tax**	**0**	**0**	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0
	Sub Total (3)	**2,562,258**	**0**	**2,562,258**	**23,291**	0	0	0	0	0	0	1,239	0	11	1,323	0	12
	Total Project Cost	**28,574,594**	**0**	**28,574,594**	**259,743**	0	0	0	0	0	0	13,629	0	124	14,556	0	132

10.8 Operation and Maintenance Costs

The annual operation and maintenance costs include costs for personnel, electricity, chemicals, fuel, water quality tests, repairs and replacements, and office expenditures, as explained below. The calculations for each of the costs are shown in Section 8.e in Appendix 8.

(1) Personnel

The cost of Case 1 covers to employ 22 staffs for the management, administration, finance and technical departments. The cost of Case 2 covers to employ 24 staffs. The details are presented in Section 9.4.

(2) Electricity

The electricity cost is calculated by multiplying the unit price from electricity by the expected annual average electrical consumption of SPC. The unit price for electricity is set according to the electricity price list (2010) of PT PLN (PERSERO: Indonesian Electric Power Public Corporation).

(3) Chemicals

The annual chemicals cost for the reclamation plant consists of the costs for the following chemicals.
- Flocculant
- pH Adjuster (Acid, Alkali)
- Hypochlorous Acid
- Thiosulfuric Acid

(4) Fuel

The annual fuel cost consists of the fuel costs for the following machinery and vehicles.

- Standby generator (for monthly test operation)
- Patrol car
- Tanker truck

(5) Water Quality Test Cost

This is the outsourcing costs for the monthly and semiannually water quality tests excluding the cost of routine water quality tests in the laboratory of the reclamation plant.

(6) Repairs and Replacements

This is estimated as follows:

- Annual repair cost for civil & architectural structures: 0.1% of their total construction cost.
- Annual repair cost for mechanical & electrical equipment:1.5% of their total purchase/installation cost.
- Annual repair cost for vehicles and other machineries: 3.0% of their total purchase cost.

The replacement cost of the filtration membrane during the operation is also estimated and converted into an annual cost.

(7) Office expenditures

This cost category covers the rental cost of SPC's office in BLUPAL and the rental fee of copy machine and other office equipment.

(8) Treated Water Use Rate

Currently, the treated wastewater is expected to have worthless and no utility rate because it has been discharged directly into the sea.

(9) Indirect Cost

The indirect cost covers miscellaneous expenses, which is calculated as 10% of the total cost of (1) to (8).

(10) Tax

The tax covers value-added tax (VAT), which is calculated as 10% of the total cost of (1) to (9).

(11) Total Operation and Maintenance Costs

The total operation and maintenance costs are shown in Tables 10.8.1 (Case 1) and 10.8.2 (Case 2).

Table 10.8.1 Operation and Maintenance Costs for Case 1

Items	Cost (IDR/year)	Tax (IDR/year)	Total (IDR/year)
[A] Direct O&M Cost			
1. Personnel Cost	**2,061,600,000**	**206,160,000**	**2,267,760,000**
2. Electricity Cost	**1,746,794,076**	**174,679,408**	**1,921,473,483**
3. Chemicals and Materials	**618,379,040**	**61,837,904**	**680,216,944**
4. Fuel Cost	**187,401,600**	**18,740,160**	**206,141,760**
5. Water Quality Test	**17,800,000**	**1,780,000**	**19,580,000**
6. Repair and Replace Cost	**1,631,336,584**	**163,133,658**	**1,794,470,243**
7. Office Cost	**600,000,000**	**60,000,000**	**660,000,000**
8. Treated Water Use Rate	**0**	**0**	**0**
Sub Total A	**6,863,311,300**	**686,331,130**	**7,549,642,430**
[B] Indirect O&M Cost (10% of Direct O&M Cost)			
Sub Total B	**686,331,130**	**68,633,113**	**754,964,243**
Total Cost	**7,549,642,430**	**754,964,243**	**8,304,606,673**

Table 10.8.2 Operation and Maintenance Costs for Case 2

Items	Cost (IDR/year)	Tax (IDR/year)	Total (IDR/year)
[A] Direct O&M Cost			
1. Personnel Cost	**2,259,600,000**	**225,960,000**	**2,485,560,000**
2. Electricity Cost	**3,471,874,301**	**347,187,430**	**3,819,061,732**
3. Chemicals and Materials	**1,236,758,080**	**123,675,808**	**1,360,433,887**
4. Fuel Cost	**187,401,600**	**18,740,160**	**206,141,760**
5. Water Quality Test	**17,800,000**	**1,780,000**	**19,580,000**
6. Repair and Replace Cost	**2,060,757,696**	**206,075,770**	**2,266,833,466**
7. Office Cost	**600,000,000**	**60,000,000**	**660,000,000**
8. Treated Water Use Rate	**0**	**0**	**0**
Sub Total A	**9,834,191,677**	**983,419,168**	**10,817,610,845**
[B] Indirect O&M Cost (10% of Direct O&M Cost)			
Sub Total B	**983,419,168**	**98,341,917**	**1,081,761,085**
Total Cost	**10,817,610,845**	**1,081,761,085**	**11,899,371,930**

CHAPTER 11

PROJECT FINANCING PLAN

CHAPTER 11 PROJECT FINANCING PLAN

11.1 Equity & Debt

11.1.1 Total Project Cost and Proportion of Equity & Debt

The Project Company who will be awarded through the open tender shall establish SPC (Special Purpose Company) for execution of this Wastewater Reclaiming project and the total Project Cost shall be funded by Equity (capital) and Debt (loan from financing institutions). Proportion of equity and debt shall be 30% vs. 70% based on advice from banks in Indonesia and examples in other PPP infrastructure projects. Total amount of the Project Cost to be financed by banks shall be seventy percent (70%) of the total sum of the Project Cost by SPC in Chapter 10 and the interest during the construction period and loan grace period.

Table 11.1.1 Total Cost and Equity/Debt (Case 1 : 4,500 m^3/day, Case 2 : 9,000 m^3/day)

		Amount (IDR1,000)		Ratio (percent)		
		Case 1	Case 2	Composition		Ratio
【1-1】	**Construction cost**					
(A)	**Site Preparation**	**5,968,887**	**6,507,139**	2.0%	1.8%	109%
(B)	**Reclamation Plant Facility**	**120,775,013**	**144,081,148**	39.8%	40.5%	119%
	Architectural and Civil works	30,427,382	38,054,721			
	Vehicle and Connection charge	2,701,250	2,701,250			
	Mechanical and Electrical work	87,646,381	103,325,177			
(C)	**Water Transmission pipe**	**44,144,600**	**56,218,200**	14.6%	15.8%	127%
	Construction Cost	**170,888,500**	**206,806,487**	**56.3%**	**58.2%**	**121%**
【1-2】	**Price Contingency**	**27,332,018**	**32,377,910**	9.0%	9.1%	119%
【1-3】	**Physical Contingency**	**19,822,052**	**23,918,440**	6.5%	6.7%	121%
	Sub-total (1)	**218,042,571**	**263,102,836**	**71.9%**	**74.0%**	**121.7%**
【2-1】	**Engineering Service cost**					
	Engineering Service fee	**36,558,326**	**36,558,326**	**12.1%**	**10.3%**	**100%**
【2-2】	**Price Contingency**	**2,774,578**	**2,774,578**	0.9%	0.8%	100%
【2-3】	**Physical Contingency**	**3,933,290**	**3,933,290**	1.3%	1.1%	100%
	Sub-total (2)	**43,266,195**	**43,266,195**	**14.3%**	**12.2%**	**100%**
【3】	**Tax Charge**					
(A)	**VAT**	**26,130,877**	**30,636,903**			
(B)	**Import Tax**	**0**	**0**			
	Sub-total (3)	**26,130,877**	**30,636,903**	**8.6%**	**8.6%**	**117%**
	Total (1)+(2)+(3)					
	Total	**287,439,642**	**337,005,934**	**94.8%**	**94.8%**	**117%**
【4】	**Interest (to be financed)**					
(A)	**during construction**	**3,323,020**	**3,792,399**			
(B)	**during loan grace period**	**12,575,484**	**14,744,010**			

	Sub-total (4)	**15,898,504**	**18,536,409**	**5.2%**	**5.2%**	**117%**
	Total (1)+(2)+(3)+(4)					
	Total	**303,338,146**	**355,542,343**	**100%**	**100%**	**117%**

		Case 1 (4,500 m^3/day)	Case 2 (9,000 m^3/day)
Funding	Equity	**IDR 91,001,444,000**	**IDR 106,662,703,000**
	Debt	**IDR 212,336,702,000**	**IDR 248,879,640,000**

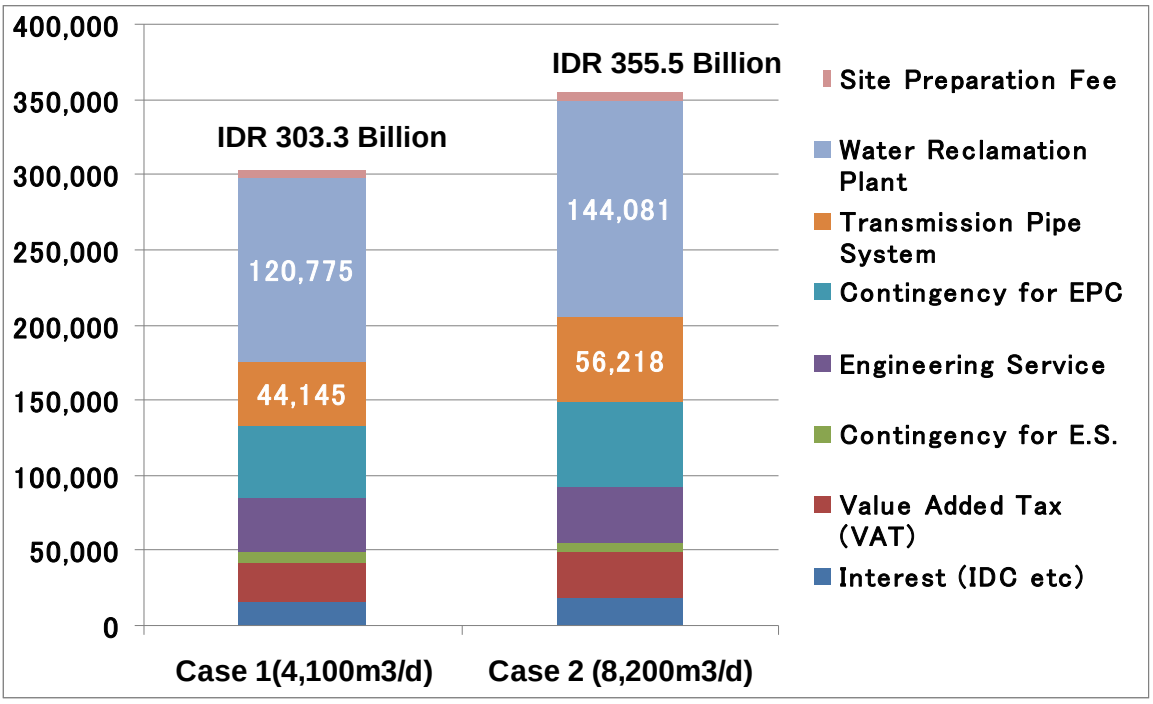


Figure 11.1.1 Total Project Cost Breakdown and Comparison of Case 1 & 2

11.1.2 Equity & Debt Details

(1) Equity Participants and Shares in SPC

It is recommended that equity participants in SPC shall be determined considering the following points;

- Pursuant to the present prevailing laws, the maximum foreign ownership in the company having the line of business in water supply services shall be 95%. Indonesian company(ies) must participate in SPC as a shareholder holding more than 5% of the capital of SPC.
- Project Company who will be awarded in open tender shall be a major shareholder of SPC holding more than 51% of the capital of SPC.
- Bali Provincial Government may participate in the form of fixed assets as a substitute to participation in the form of money by converting the land rent fee of BOT period to the assets value. Land rent fee shall be assessed based on the market price according to the present prevailing law and regulations. According to the information of a real estate agent in Denpasar, annual rent fee of the land (1.6 ha) near Denpasar WWTP is IDR 3,000,000/are. Based on this unit rate, land rent fee over 25 years BOT period can be calculated as follows;

  IDR 3,000,000/are x 1 ha x 25 years = IDR 7,500,000,000.-

The desirable equity participants in SPC under above assumption are as shown in the following table.

Table 11.1.2 SPC Shareholding Structures Plan (Case 1 : 4,500 m^3/day)

Shareholders	Amount of Equity in IDR		Shares Ratio
Project Company awarded in tender	50,235,736,000	53.9%	51%
Indonesian company	4,925,072,000	5.4%	5%
Project Company or Indonesian company	35,840,635,000	39.4%	36.4%
Sub-total	91,001,444,000	(100%)	
Bali Provincial Government	7,500,000,000	By Land rent fee	7.6%
Total	98,501,444,000		100.0%

Table 11.1.3 SPC Shareholding Structures Plan (Case 2 : 9,000 m^3/day)

Shareholders	Amount of Equity in IDR		Shares Ratio
Project Company awarded in tender	58,222,979,000	54.6%	51%
Indonesian company	5,708,135,000	5.3%	5%
Project Company or Indonesian company	42,731,589,000	40.1%	37.4%
Sub-total	106,662,703,000	(100%)	
Bali Provincial Government	7,500,000,000	By Land rent fee	6.6%
Total	114,162,703,000		100.0%

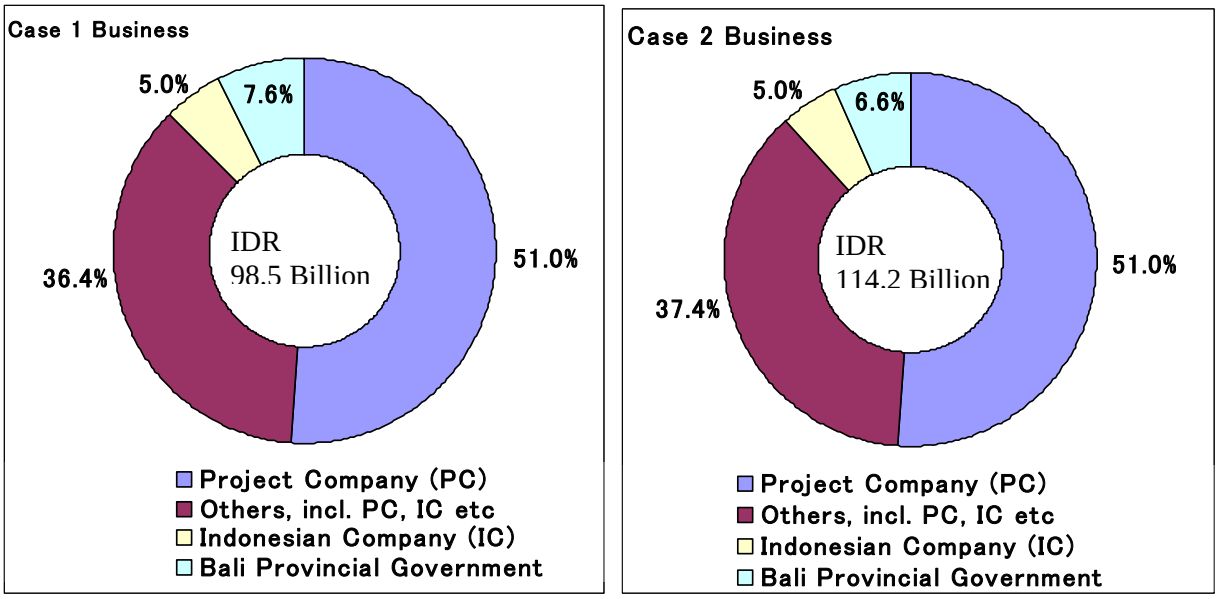


Figure 11.1.2 SPC Shareholding Structures Plan (Case 1 & Case 2)

(2) Debt of SPC from Financial Institutes

This Wastewater Reclaiming Project is assumed to be 25 years' BOT Contract and hence long-term finance corresponding to the BOT period is essential. Financial inquiries to some Indonesian banks including SMI are responded that the longest repayment period is 10 years. According to the estimated cash flow projection, it is not possible to repay the debt within 10 years and upon elapse of 10 years, there

arise financial risk whether new competitive loan can be secured.

Meanwhile, there is a new financial scheme, Private Sector Investment Finance program (PSIF) by JICA (Japan International Cooperation Agency), which intends to assist and support Japanese companies in investing in infrastructure projects in the developing countries in order to contribute to the economic development of the developing countries. Outline of this PSIF Loan are as follows;

1) Objects
- Infrastructure projects: to accelerate growth through infrastructure development for poverty reduction,
- Climate change: to prevent and reduce negative impact to the poor by climate,
- MDGs and Poverty alleviation: to projects for the poor.

2) Required conditions
- Projects shall be along the development policy of the developing countries. High effect can be expected.
- Projects can be anticipated to be achieved.
- Projects are not feasible by the loan or equity from the existing financing institutes.

3) Loan conditions are as shown in the below figure.
JICA PSIF Loan can be provided only when projects meet above objects and fulfill the conditions. Application procedure of loan is similar to those of commercial banks as illustrated in the figure.

Financial Analysis and Economical Analysis are conducted in the next Chapters under the assumption that 70% of the Total Project cost can be funded by finance from Bilateral such as JICA PSIF Loan or finance from Multilateral Agency.

Table 11.1.4 Loan Conditions of Indonesian Commercial Banks and Bilateral/Multilateral Agency

		Indonesian commercial banks	Finance from Bilateral or Multilateral Agency (JICA PSIF Loan etc)
1)	Project	Private Sector Investment	Private Sector Investment
2)	Procedures for loan application	By Private company's request Short and simple procedures	By Private company's request Short and simple procedures
3)	Loan conditions		
	Interest rate	10% - 12% p.a.	2.5% p.a.(by assumption)
	Repayment period	max. 10 years (no grace period)	max. 25 years including 5 years' grace period
	Currency of loan	IDR	Foreign Currency (Yen etc)

4) Issues to be solved if finance from Bilateral or Multilateral Agency is used.
For example, in case of JICA PSIF Loan, repayment of the loan shall be made in Yen currency. Meanwhile, SPC revenue from bulk sales of the reclaimed water is in IDR currency. Therefore, for each repayment of the loan, it is necessary to make money exchange from IDR to Yen currency. However, there is no countermeasure to exclude or absorb the exchange fluctuation risk between IDR and Yen during such 25 years long-term repayment period.

In the past three years, fluctuation of the exchange rate between IDR and Yen, and IDR and US$ are as shown in below Figure. From this Figure, range of the monthly fluctuation between IDR and Yen are smaller than that of IDR and US$. However, prediction of future exchange rate fluctuation during 25 years period is not possible and it is difficult to hedge such exchange fluctuation risk by booking. Adding enormous amount as contingency for exchange fluctuation risk without basis would distort financial

feasibility of the Project. The loan condition of repayment in foreign currency is not easy issue, nevertheless, 25 years long-term finance from Bilateral or Multilateral Agency, such as JICA PSIF loan is quite attractive and essential to materialize this Wastewater Reclaiming Project. Issue of the exchange risk should be considered as common issue to both Public and Private as PPP project and according to the PPP philosophy, both of Public and Private should seek for most optimum solution by mutual cooperation and risk sharing.

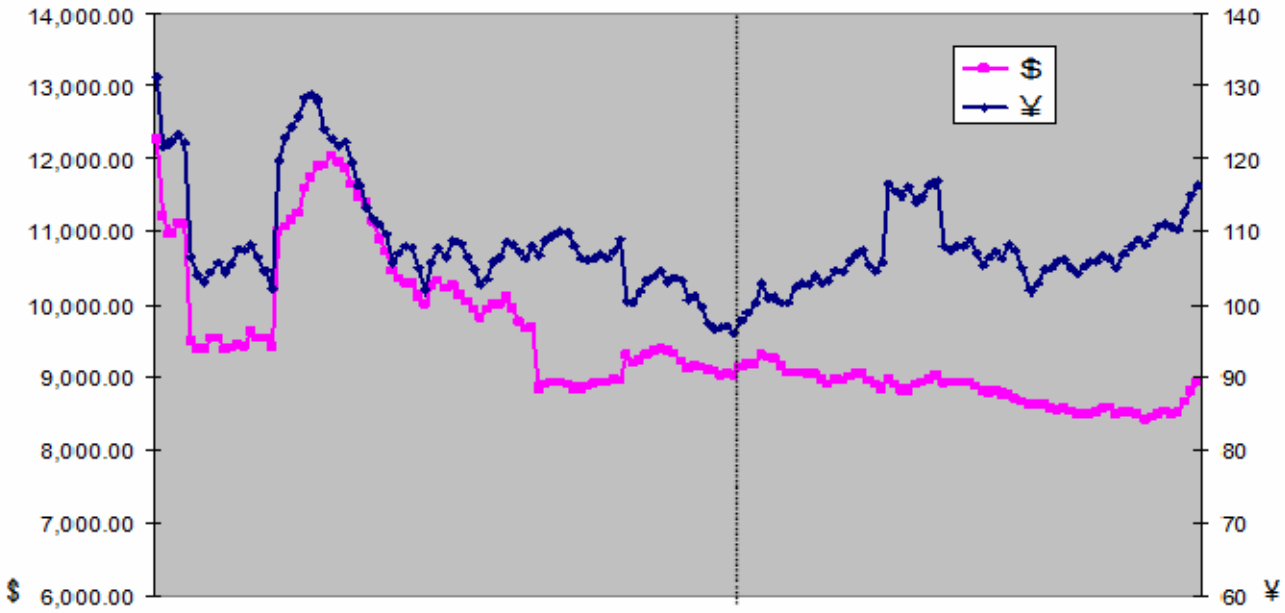


Figure 11.1.3 Exchange Rate Fluctuation during Past 3 Years (IDR/Yen, IDR/US$)

11.2 Revenue from the Project

Revenue from bulk sales of the Reclaimed Water is to be calculated by multiplying sales volume, unit sales price and duration. Through the survey, each parameter has been set as follows;

11.2.1 Annual Bulk Sales Volume of the Reclaimed Water

Based on the production volume plans of the Reclaimed Water for each Case 1 and Case 2 in the Table 6.2.1 of Chapter 6, annual bulk sales volume of the Reclaimed Water are set as follows;

Table 11.2.1 Annual Bulk Sales Volume of the Reclaimed Water

			Case 1 Business	Case 2 Business
1)	Reclaimed Water Production (maximum)		4,500 m^3/day	9,000 m^3/day
2)	Reclaimed Water Distribution (average)		4,100 m^3/day	8,200 m^3/day
3)	Annual Operating Days		365days	365days
3)	Annual Production Volume (Sales Volume)		1,496,500 m^3	2,993,000 m^3
	BOT period	First year (2016)	1,496,500 m^3	2,993,000 m^3
		Last year (2038)	1,496,500 m^3	2,993,000 m^3

Followings are assumed as pre-conditions for setting the above parameters;

・No leakage from the new water transmission piping
・Required time for inspection and maintenance of the equipment and facilities are reflected in Average daily production volume
・Under PPP framework, all produced reclaimed water shall be purchased and the off-take guarantee by Indonesian government shall be provided.
・Annual production (bulk sales) volume during 25 years period is constant.

11.2.2 Bulk Sales Price of Reclaimed Water

(1) Conditions to determine bulk sales unit price

Based on the following requirements, bulk sales unit price of the Reclaimed Water will be defined.

・lower than the tariff price of clean water to Hotels and higher than the tariff price of irrigation water to Hotels.
・Since the Reclaimed Water will be sold through PDAM to end users (Hotels), not directly, reasonable margin and expenses of PDAM shall be considered for setting the bulk price to PDAM. In this Survey, bulk sales price will be calculated under the assumed that thirty percent (30 %) of sales price to end users can cover PDAM's margin and expenses.
・Bulk sales unit price shall be affordable to recover the investment cost and O&M fees.
・Bulk sales unit price can be subject to price adjustment by change of consumer price indexes etc. (O&M fees, as well, are also subject to price adjustment by inflation rate.)

(2) Proposed Unit Bulk Sales Price

Details of each requirement are examined as follows;

1) lower than the tariff price of clean water to Hotels

Bulk sales price of the Reclaimed water should be set in-between the tariff price of clean water to Hotels and tariff price of irrigation water to Hotels in view of the Reclaimed water quality and application. The tariff prices during year of 2009 to 2012, and the tariff price forecast after 2013 are shown in below Figure. However, it is view of the end users and does not consider the cross-subsidy condition for PDAM.

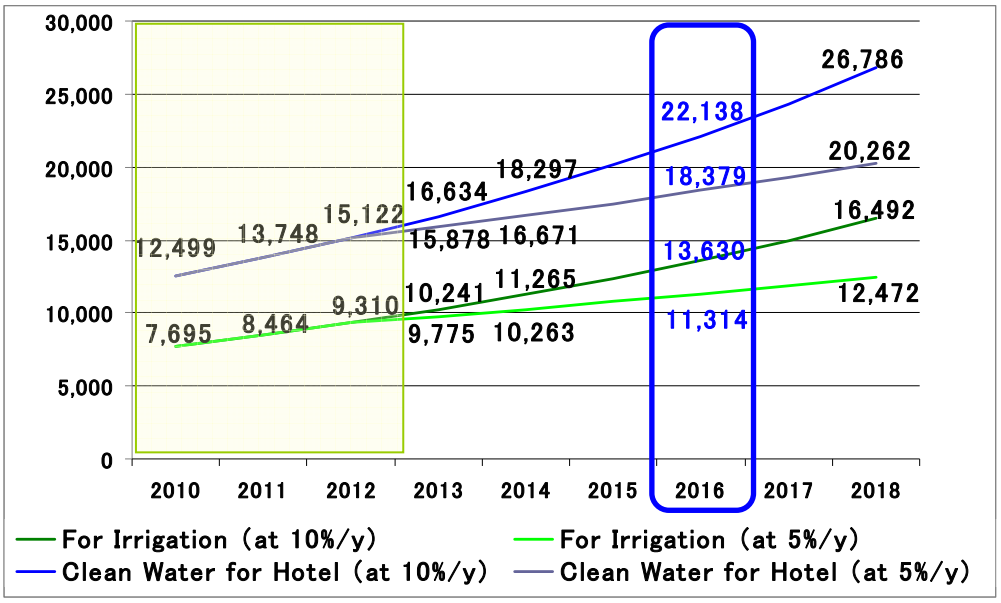


Figure 11.2.1 Tariff Rates (Hotel) Change and Prediction of PDAM Badung

Table 11.2.2 Change of Tariff Rates to Hotel of PDAM Badung (Actual and Prediction)

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Irrigation Water	7,695	8,464	9,310	10,241	11,265	12,391	**13,630**	14,993	16,492
	7,695	8,464	9,310	9,775	10,263	10,776	**11,314**	11,879	12,472
Clean Water	12,499	13,748	15,122	16,634	18,297	20,126	**22,138**	24,351	26,786
	12,499	13,748	15,122	15,878	16,671	17,504	**18,379**	19,298	20,262

Note: Upper Column of Irrigation water and Clean water is based on 10% annual increase and the Lower Column is based on 5% annual increase.

2) Price Adjustment Formula according to Inflation Rate

Bulk sales price shall be subject to price escalation according to inflation rates of the materials, electricity prices etc which constitute the production cost. Figure 11.2.2 shows price adjustment formula and the corresponding parameters. This price adjustment formula has been applied to BOT contract signed in August, 2011 between PDAM Bekasi and private business entity (PT Moya Indonesia).

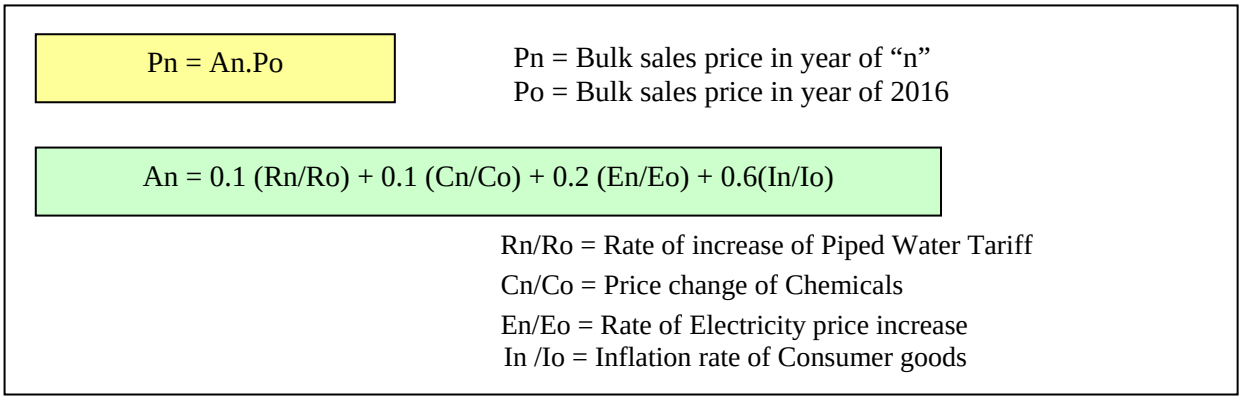


Figure 11.2.2 Price Adjustment Formula of the Tariff Rate

Furthermore, It is proposed to solve the exchange risk issue raised in previous Section 11.1.2, Clause (2) -4) by adding exchange fluctuation rate factor to the above price adjustment formula as shown below; Sharing of the exchange risk between Public and Private can be determined by setting the value of parameter B.

Pn = An x Po x (1 + B x Excgange Fluctuation Rate)

(eg.) If exchange risk is equally shared between Public and Private, parameter B will be 50%.

(3) Revenue (Operation) Period

In case of 25 years BOT Contract, revenue (operation) period will be as follows;

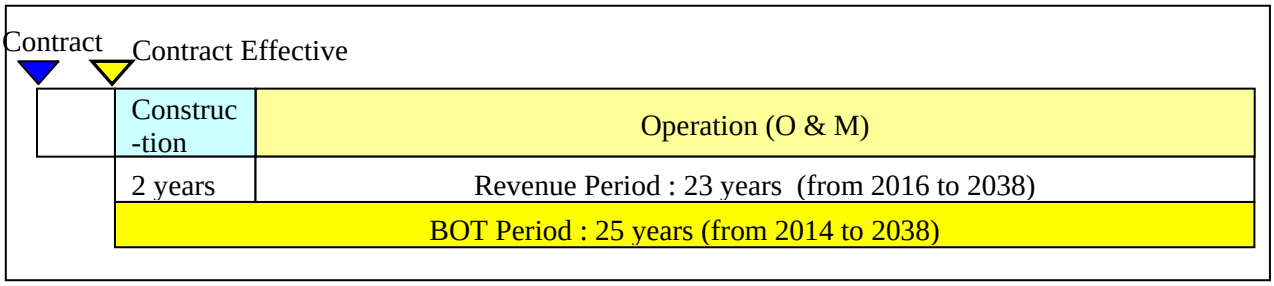


Figure 11.2.3 BOT Period and Project Revenue Period

11.3 Expenditure

11.3.1 Expenditure Items

Main expenditure items and the assumed conditions for cash flow projection are as follows;

(1) Repayment of Principal and Interest of the Debt

Based on the assumption that seventy percent (70%) of the Total Project cost to be financed by Bilateral or Multilateral Agency, such as JICA PSIF Loan, repayment of the principal and interest shall be projected in the Expenditure plan. Also, seventy percent (70%) of the interests during construction period and during the loan grace period shall be added to the finance of the above financing institute and the rest of thirty percent (30%) shall be funded by own capital of SPC.

(2) Land rent fee

Land rent fee is excluded from the Expenditure item based on the assumption that Bali Provincial government will participate in SPC as a shareholder in the form of assets by converting the land rent fee during BOT period to fiscal assets.

(3) Effluent from the Waste Water Treatment Plant of BLUPAL (IPAL Suwung)

Effluent from the WWTP is assumed to be supplied to SPC at free of charge judging from the present situation that the effluent are discharged to sea via river. Also, according to our study result in Chapter 10, Section 10.5, surface water use tax is considered not applicable to the effluent.
Note: In the Final Report Meeting on May 15 with Bali Provincial government, we understand that Dinas PU has intention to ask compensation for supply of the effluent in view of O&M cost of the WWTP.

(4) O&M fees and Administration costs

For stable and safety operation of the Reclaiming Water plant during the 25 years BOT period, O&M fees and administration costs are estimated. This estimate shall include operation and management fee of SPC and repair & replacement cost required for Operation and Maintenance of the Plant. For cost estimation, O&M fees are increased based on CPI (consumer price index) increase rate. In this Chapter and for financial analysis, average CPI during 25 years period is assumed to be 5.3%. Reference of the CPI rates is shown in Table 11.3.1.

(5) Tax (Corporate Income Tax)

According to the present prevailing law and regulations, rate of the Corporate Income tax is 25% and the Corporate Income Tax is exempted for the first 5 years. But, there is information that the tax exemption period can be extended depending on the nature or conditions of the Project. It is recommended that, in the course of implementation of the Project, further study on preferential tax and tax benefits should be conducted.

Table 11.3.1 Movement of CPI in Indonesia (Past Record and Forecast)

Key indicators	2011	2012	2013	2014	2015	2016
Real GDP growth (%)	6.5	6.3	6.5	6.6	6.5	6.4
Consumer price inflation (av; %)	5.7	5.3	6.0	5.8	6.2	6.0
Budget balance (% of GDP)	-1.2	-1.2	-0.9	-0.8	-0.5	-0.3
Current-account balance (% of GDP)	0.7	0.9	1.1	1.1	1.0	0.9
Deposit rate (av; %)	6.8	7.1	9.0	9.2	9.2	9.1
Exchange rate Rp:US$ (av)	8,699	8,658	8,683	8,666	8,516	8,414
Exchange rate Rp:¥100 (av)	10,811	10,689	10,720	10,552	10,198	10,111

Source:
"Country Forecast October 2011"
The Economist Intelligence Unit Limited
(London, UK)

Employment, wages and prices

	2007[a]	2008[a]	2009[a]	2010[b]	2011[b]	2012[c]	2013[c]	2014[c]	2015[c]	2016[c]
The labour market										
Labour force (m)	109.9	111.9	113.8	116.5	117.0	119.3	121.6	123.4	125.1	126.7
Labour force (% change)	3.3	1.8	1.7	2.4	0.4	2.0	2.0	1.5	1.4	1.3
Unemployment rate (%)	9.1	8.4	7.9	7.1[a]	6.7	6.6	6.5	6.4	6.0	5.5
Wage and price inflation (% except labour costs per hour)										
Consumer prices (av)	6.3	9.9	4.8	5.1[a]	5.7	5.3	6.0	5.8	6.2	6.0
Consumer prices (year-end)	5.9	11.2	2.8	7.0[a]	4.5	5.7	5.7	6.2	6.2	6.0
Producer prices (av)	13.9	25.7	-0.6	4.9[a]	6.8	5.9	6.9	7.8	7.9	7.7
GDP deflator (av)	11.3	18.1	8.3	8.0	6.8	6.9	7.1	7.0	7.1	5.3
Private consumption deflator (av)	14.3	13.4	4.6	5.8	6.2	5.4	5.8	5.5	5.7	5.6
Government consumption deflator (av)	10.3	14.5	11.2	8.2	5.7	5.3	6.0	5.8	6.2	6.0
Fixed investment deflator (av)	11.9	24.3	23.3	9.1	4.0	4.0	4.0	4.0	4.0	4.0

11.3.2 O&M fees and Administration cost

Based on the Operation & Maintenance Costs of Case 1 and Case 2 in Table 10.8.1 and Table 10.8.2 of Chapter 10, O&M fees & administration costs, which are escalated at annual average inflation rate of 5.3%, are scheduled to be paid as shown in below table;

Table 11.3.2 Case 1 (4,500 m^3/day) Payment Schedule of O&M Fee & Administration Cost

		2016	2017	2018	2019	2024	2029	2034	2038
1	**Direct Cost**	**7,549**	**7,950**	**8,373**	**8,815**	**11,412**	**14,774**	**19,126**	**23,516**
	Personal cost	2,268	2,388	2,515	2,648	3,428	4,438	5,745	7,064
	Electricity cost	1,921	2,023	2,131	2,243	2,904	3,760	4,868	5,985
	Chemicals	680	716	754	794	1,028	1,331	1,723	2,119
	Fuel cost	206	217	229	241	312	403	522	642
	Water qulity test	20	21	22	23	30	38	50	61
	Repair and Replace cost	1,794	1,890	1,990	2,095	2,712	3,512	4,546	5,589
	Establishiment cost	660	695	732	771	998	1,292	1,672	2,056
2	**Indirect Cost**	**755**	**795**	**837**	**881**	**1,141**	**1,477**	**1,913**	**2,352**
3	**Total**	**8,304**	**8,745**	**9,210**	**9,696**	**12,553**	**16,251**	**21,039**	**25,868**

Table 11.3.2 Case 2 (9,000 m^3/day) Payment Schedule of O&M Fee & Administration Cost

		2016	2017	2018	2019	2024	2029	2034	2038
1	**Direct Cost**	**10,818**	**11,391**	**11,995**	**12,631**	**16,352**	**21,169**	**27,406**	**33,694**
	Personal cost	2,486	2,618	2,756	2,902	3,757	4,864	6,297	7,742
	Electricity cost	3,819	4,021	4,235	4,459	5,773	7,474	9,675	11,895
	Chemicals	1,360	1,432	1,508	1,588	2,056	2,662	3,447	4,237
	Fuel cost	206	217	229	241	312	403	522	642
	Water qulity test	20	21	22	23	30	38	50	61
	Repair and Replace cost	2,267	2,387	2,513	2,647	3,426	4,436	5,743	7,061
	Establishiment cost	660	695	732	771	998	1,292	1,672	2,056
2	**Indirect Cost**	**1,082**	**1,139**	**1,199**	**1,263**	**1,635**	**2,117**	**2,741**	**3,369**
3	**Total**	**11,900**	**12,530**	**13,194**	**13,894**	**17,987**	**23,286**	**30,147**	**37,063**

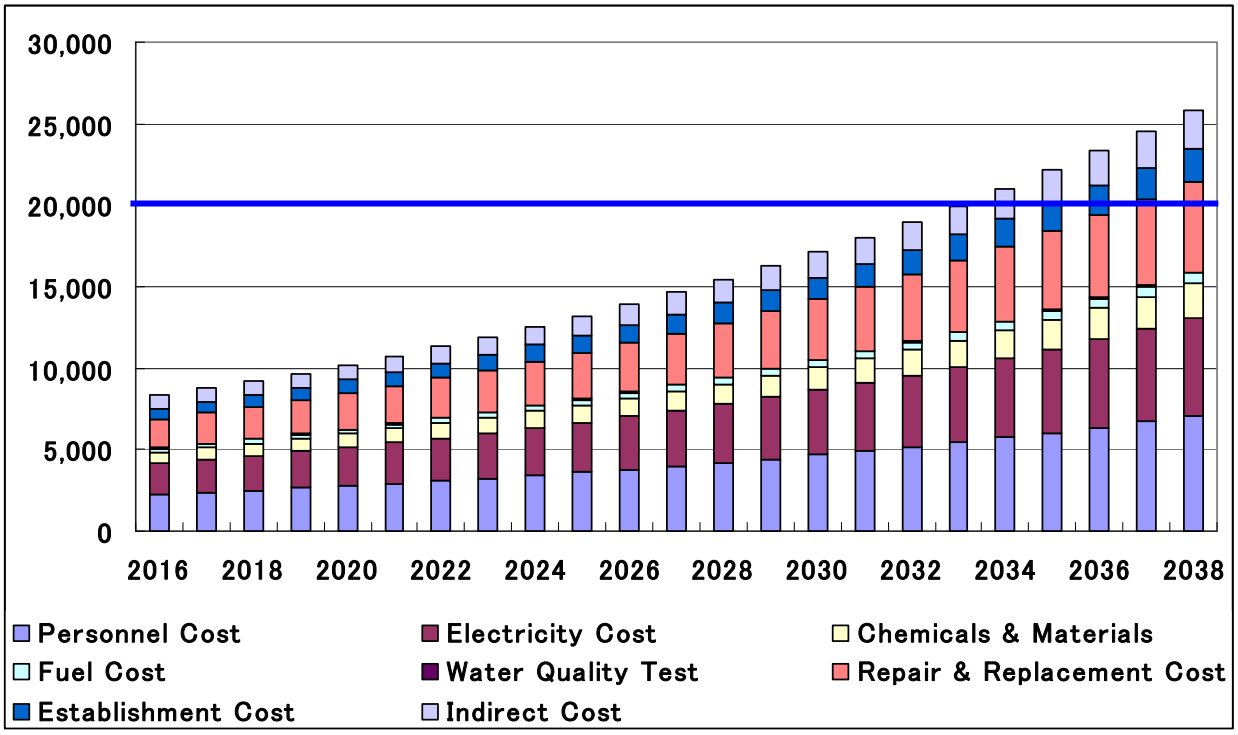


Figure 11.3.1 Case 1 (4,500 m^3/day) Payment Schedule of O&M Fee & Administration Cost

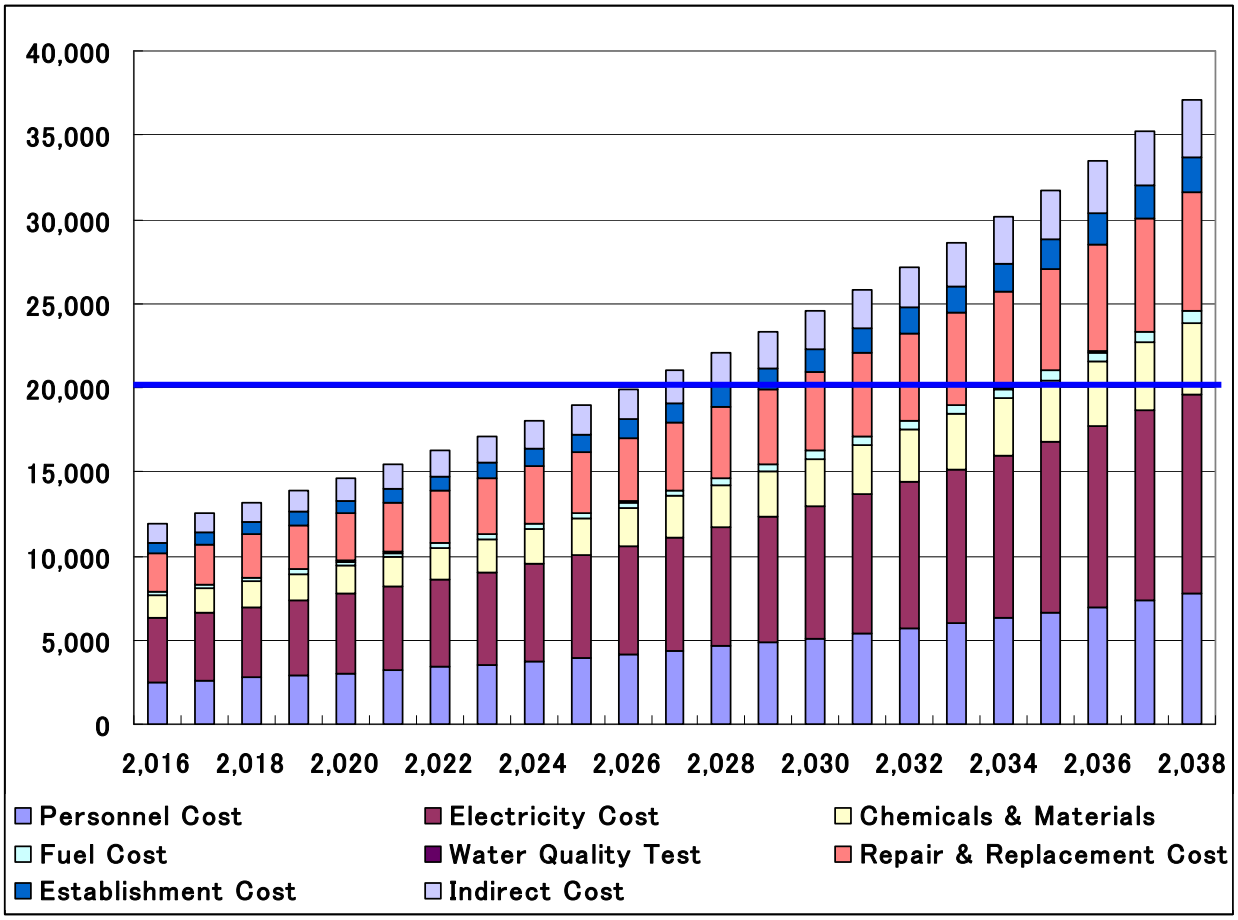


Figure 11.3.2 Case 2 (9,000 m^3/day) Payment Schedule of O&M Fee & Administration Cost

11.4 Projection of Revenue & Expenditure

Based on result of the study, Revenue & Expenditure projection of Case 1 and Case 2 Business are as shown below; Business Revenue of both Cases are calculated based on bulk sales price of IDR 12,000/ m^3 (year of 2016). In order to view the project revenue and expenditure during BOT period from the loss/profit point, differences between annual revenue and annual expenditure (O&M fees, depreciation cost, corporate income tax) are calculated as loss/profit and the ratio of the accumulated loss/profits against the total revenue is indicated as average profit rate.

11.4.1 Case 1 Business (4,500 m^3/day, Revenue Base: 4,100 m^3/day)

Since the amount of the expenditure far exceed the business revenue, Case 1 business would suffer the loss throughout BOT period (25 years). In the next Chapter, Financial Analysis of the Project is explained in details. Case 1 Business based on on bulk sales price of IDR 12,000/ m^3 would not be financially feasible.

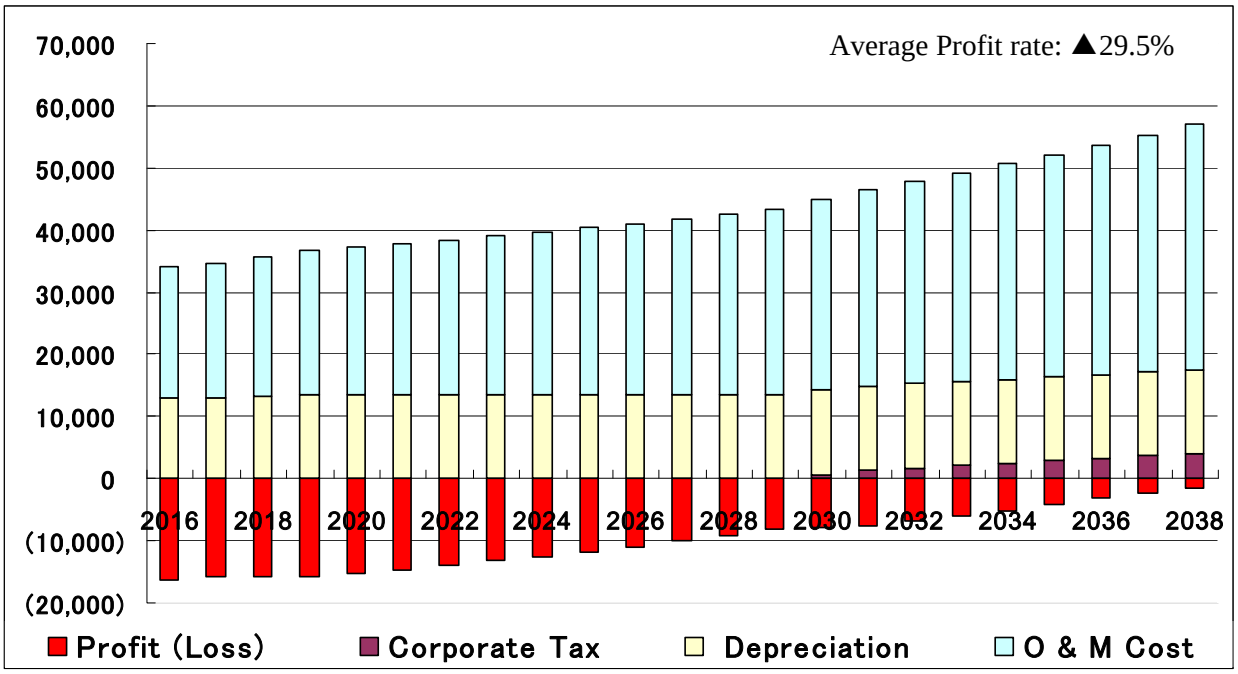


Figure 11.4.1 Case 1 Business (4,500 m^3/day) Revenue & Expenditure Projection

11.4.2 Case 2 Business (9,000 m^3/day, Revenue Base: 8,200 m^3/day)

During the first seven years, Case 2 Business would suffer loss, but, the average profit rate throughout BOT period (25 years) is 10.6%.

Case 2 Business based on on bulk sales price of IDR 12,000/ m^3 would be financially feasible covering the expenditure.

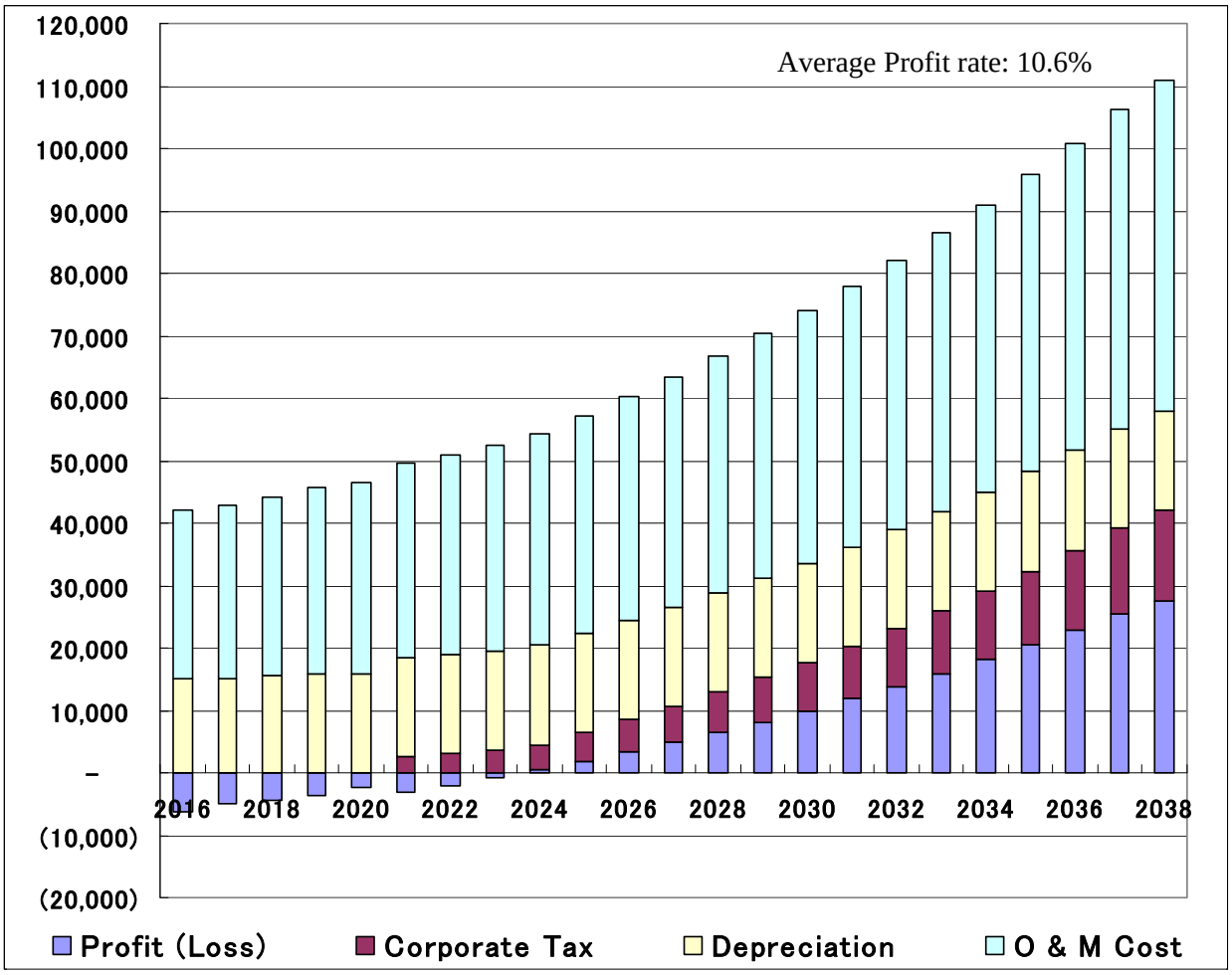


Figure 11.4.2 Case 2 Business (9,000 m^3/day,) Revenue & Expenditure Projection

CHAPTER 12

FINANCIAL ANALYSIS OF PROJECT

CHAPTER 12 FINANCIAL ANALYSIS OF PROJECT

12.1 Method of Financial Analysis and Base Conditions

For verification of the feasibility of this Wastewater Reclaiming Project, project profitability and stability shall be analyzed in view of investors (shareholders) and also in view of financing institute. In order to judge of profitability by investors, indicator of Equity IRR (Equity Internal Rate of Return) shall be applied to verify eligibility of business investment. And, from bankers' view point, indicator of Debt Service Cover Ratio (DSCR) shall be applied in order to evaluate if the cash flow has margin to repay the debt (principal and interest).

12.1.1 Steps of Financial Analysis

Firstly, bulk sales price of the Reclaimed water, which is base of the revenue, shall be studied, and then, revenue and expenditure items and the contents shall be studied in order to make cash flow calculation.

(1) Setting of Bulk Sales Price of Reclaimed Water (in year of 2016)

Based on Figure 11.2.1 and Table 11.2.2 of Chapter 11 about "Tariff Rates Change and Prediction of PDAM Badung to star Hotels", range of the tariff price of the Reclaimed Water shall be as follows;
If bulk sales price to PDAM is assumed to be 70%, the bulk sales price shall be within the following range. Accordingly, financial analysis will be conducted by calculating Equity IRR and DSCR based on the bulk sales price of the Reclaimed water to be set in between IDR 9,000/ m^3 and IDR 12,000/ m^3.

Table 12.1.1 Range of the Bulk Sales Price of Reclaimed Water (Price in year of 2016)

	Annual Rate of Tariff Increase		**Bulk Sales Price = 70% of the Tariff Price**
	at 5%	at 10%	
Maximum Price (Clean Water)	IDR 18,379/ m^3	IDR 22,138/ m^3	
Price of Reclaimed Water	**IDR 12,000 to IDR 18,000**		**IDR 8,400 to IDR 12,600/ m^3**
Minimum Price (Irrigation Water)	IDR 11,314/ m^3	IDR 13,630/ m^3	

Note: Annual rates of increase after year of 2013 are predicted based on fact that tariff rates have been increased by 10% per year.

(2) Assumption for Cash Flow Calculation

Based on result of the study in the previous Chapters, cash flow projection shall be prepared.

Table 12.1.2 Assumption for Cash Flow Calculation

	Items	Assumption
1	Total Project Cost	Table 11.1.1 (Case 1 and Case 2) of Chapter 11
2	Funding of Total Project Cost	30% by Equity of SPC, 70% by Debt of SPC
3	Loan Conditions of the Debt	Table 11.1.4 (Finance by Bilateral or Multilateral Agency) of Chapter 11
4	Interest during Construction & during loan grace period	Interest shall be calculated by the interest rate of the above Loan and seventy percent (70%) of the aggregated interest amount shall be added to the Principal of the Loan to be financed. The rest of thirty percent (30%) shall be funded by the capital of SPC.

5	Currency of the Repayment of the Debt (Principal and Interest)	Foreign Currency (Yen in case of JICA PSIF Loan). However, forecast or estimate of future exchange rates or exchange risks are extremely difficult. Exchange rate at each repayment time shall be regarded as the same as the present exchange rate (IDR 1 = 0.00909 Yen).
6	Sales volume and Revenue period	Table 11.2.1 (Case 1 and Case 2) of Chapter 11
7	Bulk sales price adjustment due to inflation rate	To simplify, inflation rate of 5.3% per year, applied to O&M fees, shall be applied as well.
8	Expenditure Items and the details	Based on the assumption in Chapter 11, Section 11.3
9	Corporate Income Tax	Pursuant to the present laws/regulations, the tax rate is 25% and the tax during the first 5 years shall be exempted.

12.1.2 Basic Conditions for Financial Analysis

(1) Equity Internal Rate of Return (Equity IRR)

Equity Internal Rate of Return (Equity IRR) is an indicator to evaluate profitability of capital investments for SPC shareholders. E-IRR is the rate at which the invested capitals equal to the net profits after all expenses and debt repayment. By using Capital Asset Pricing Model (CAPM) as evaluation criteria of the Equity IRR, the anticipated profitability rate is calculated as follows;

1) Anticipated Profitability Rate (Cost of Equity)

Based on referential data of the Table 12.1.1, parameters for the formula are set as follows;

- Risk free rate (interest rate of risk-free assets)
  Interest rate (7.2% p.a.) of 20-year Indonesian Government Bond (IDR) is to be adopted.
- Beta (regression of stock market returns versus the return of the market)
  Based on comparable companies in Singapore, China and Malaysia, the re-levered beta is 0.97.
- Market Risk Premium (MRP, difference between the return expected in market and rate of IDR)
  Jakarta composite stock price index (15.2%) – IDR (7.2%) = 8.0%

By adopting figures of above parameters, Cost of Equity (the anticipated profitability rate) is calculated as follows;

Cost of Equity (Ke) = 7.2% + (0.97 x 8.0%) = 14.96% (approx. 15%)

2) Equity Internal Rate of Return (Equity IRR)

Accordingly, Equity IRR should be more than 15% as one of the evaluation criteria of the financial feasibility for the investors. This criteria is considered reasonable comparing with the long term interest rates of the loans (12 to 14% p.a.) in Indonesia.

3) WACC (Weighted Average Cost of Capital)

Project Internal Rate of Return (Project IRR) calculation is omitted since it is not necessary in this financial analysis. For evaluation of calculation outcome of the Project IRR, WACC (weighted average cost of capital) is adopted as the evaluation criteria.

WACC is calculated by weighted average of the above Cost of Equity and Cost of debt;

Cost of Debt (Kd) is calculated as follows;

Kd = Interest rate of Debt (2.5%) x (1 – Corporate tax rate of 25%) = 1.875%

Based on the proportion of Equity (30%) and Debt (70%), WACC is calculated as follows;

WACC = Ke x 30% + Kd x 70% = 14.96% x 70% + 1.875% x 30% = 5.801%

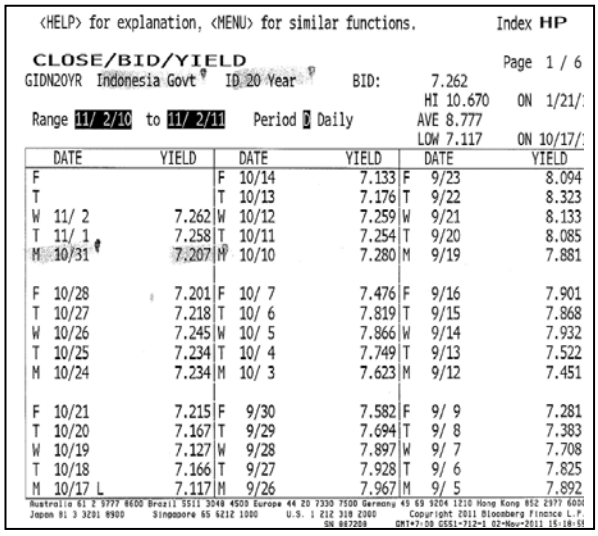
(2) DSCR(Debt Service Cover Ratio)

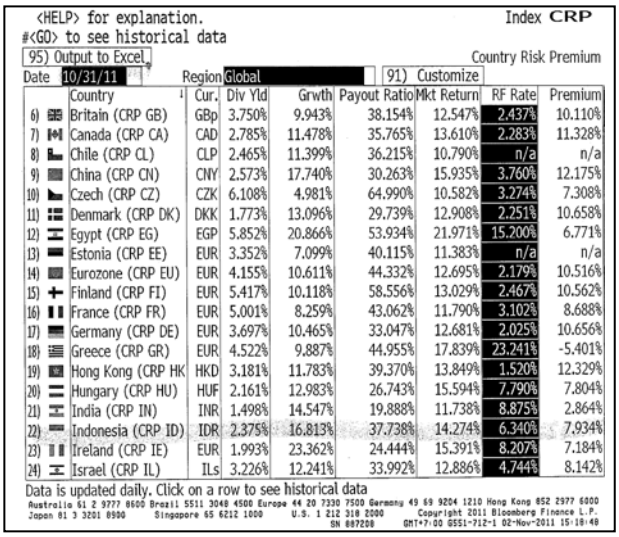
This indicator is to judge whether the cash flow amount after corporate tax can repay the principals and interests of the debt. In anycase, Value of the DSCR should be higher than 1. DSCR value of below 1 implies that cash flow would be shortage at future time to repay the debt. Unexpected fund procurement to cover the shortage would be suddenly required.

By considering the reasonable allowance, DSCR value should be more than 1.2 as the evaluation criteria of financial feasibility.

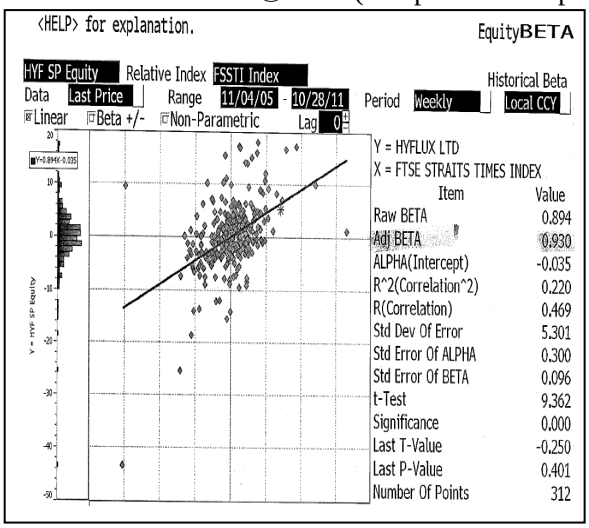
① Risk free rate (Indonesia Government Bond)

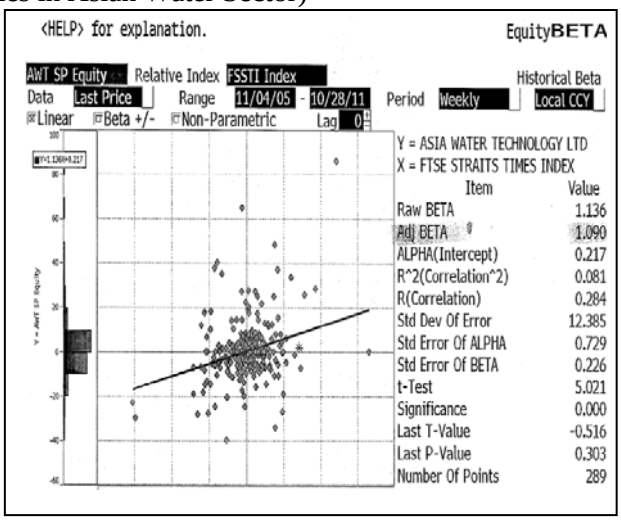
② Market Risk Prime

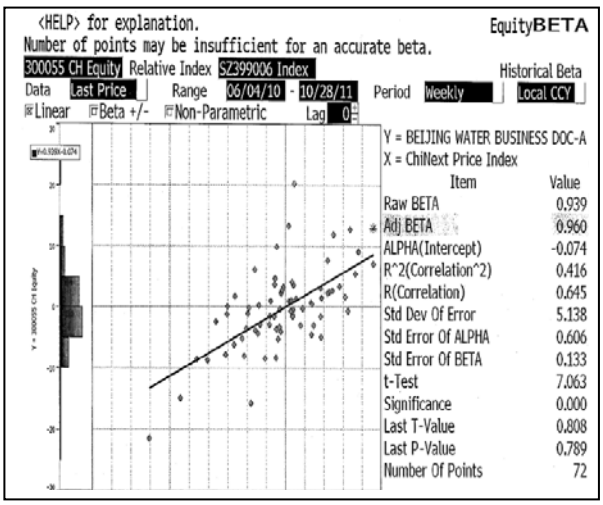




③ Beta (comparable companies in Asian Water Sector)







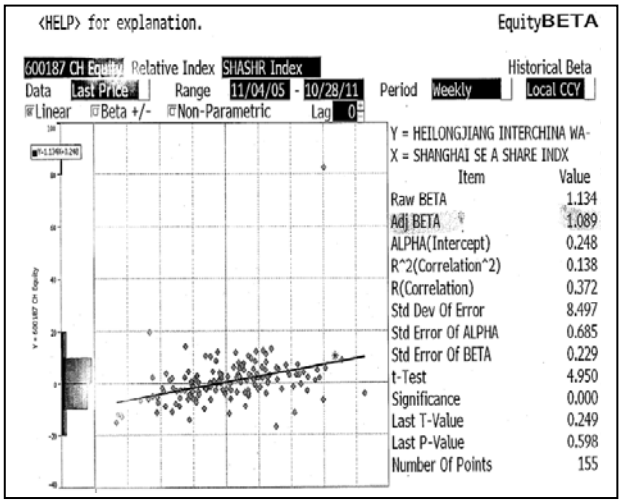


Figure 12.1.1 Parameters used for Calculation of “Cost of Capital”

12.2 Financial Analysis of the Project

12.2.1 Financial Analysis of Case 1 Business

(1) Financial Analysis based on Bulk Sales Prices under IDR 12,000/ m^3 (in year of 2016)

According to the previous Section, Equity IRR and DSCR are respectively calculated based on the bulk sales prices in between IDR 9,000/ m^3 and IDR 12,000/ m^3. But, due to the low profitability, it turns out computationally prohibitive.

In order to seek necessary conditions to make Case 1 Business feasible based on the bulk sales price of IDR 12,000/ m^3, governmental fiscal support, such as Viability Gap Fund (VGF) against the Project cost are supposed to be provided. Under this assumption, required amount of VGF to make Case 1 Business attractive to investors and financial institute are calculated as follows;

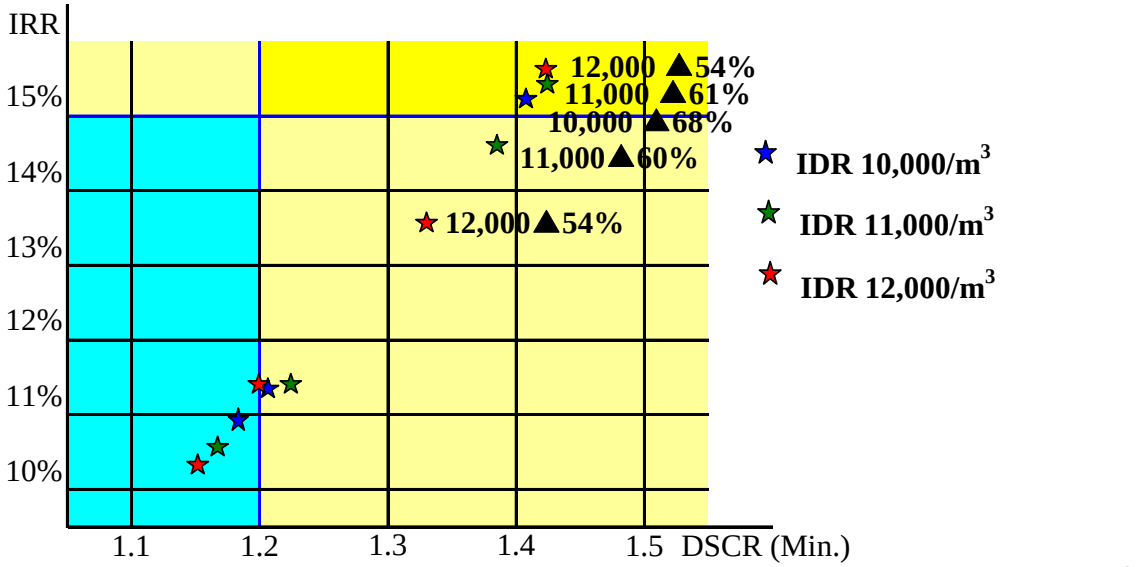


Figure 12.2.1 Financial Analysis of Case 1 (Bulk Sales Price: under IDR 12,000/ m^3)

Table 12.2.1 Financial Analysis of Case 1 (Bulk Sales Price: under IDR 12,000/ m^3)

Sales Price	**IDR 10,000/m^3**		
VGF	68%	61%	60%
E-IRR	15.03	11.4	10.96
DSCR(min)	1.41	1.21	1.19
DSCR(ave)	2.57	2.17	2.12

Sales Price	**IDR 11000/m^3**				
VGF		61%	60%	52%	50%
E-IRR		15.20	14.71	11.37	10.65
DSCR(min)		1.42	1.39	1.21	1.17
DSCR(ave)		2.59	2.53	2.16	2.09

Sales Price	**IDR 12000/m^3**				
VGF			54%	50%	43%	40%
E-IRR			15.31	13.73	11.35	10.45
DSCR(min)			1.42	1.33	1.20	1.15
DSCR(ave)			2.60	2.41	2.16	2.06

(2) Bulk sales price to be feasible without VGF

In case governmental fiscal support (VGF) is difficult to be provided against Project cost, it is necessary to increase bulk sales unit price to be IDR 19,300/ m^3 in order to keep financial feasibility of the Project as shown in below Figure & Table. As this unit price is largely deviated from the range of the considerable bulk sales unit price, it should be concluded that Case 1 Business would not be financially feasible without governmental fiscal support.

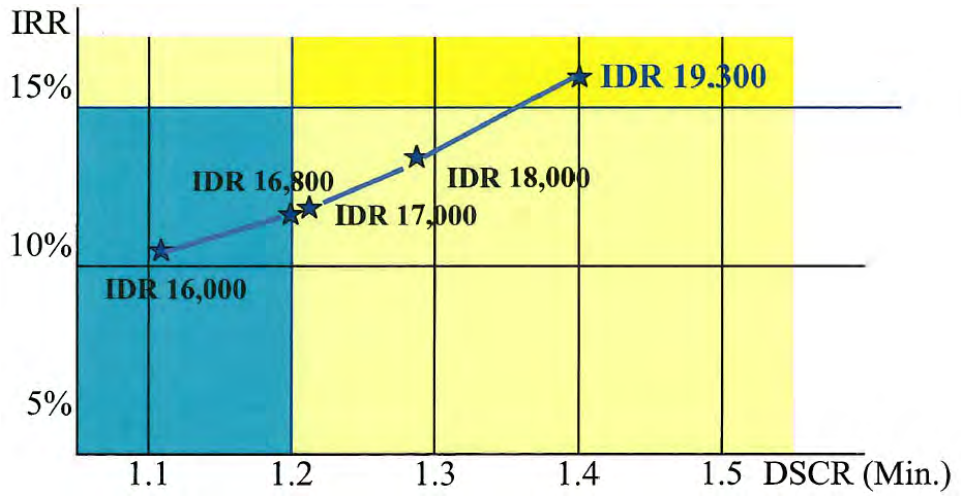


Figure 12.2.2 Financial Analysis of Case 1 (without Governmental Fiscal Support)

Table 12.2.2 Financial Analysis of Case 1 (without Governmental Fiscal Support)

Sales Price	IDR 19,300	IDR 18,000	IDR 17,000	IDR 16,800	IDR 16,000
E-IRR	15.08%	13.19 %	11.66 %	11.34 %	10.03 %
DSCR(min)	1.40	1.29	1.21	1.20	1.12
DSCR(ave)	2.56	2.35	2.18	2.15	2.02

(3) Study on Governmental fiscal support (VGF)

1) Identification of Viability Gap

In general, cash flow from the sales revenue based on the present tariff by government is likely to be insufficient to make profits against the investment and also to recover the capital costs as expected by the market. It would be due to the existence of gap between the cash flow by the actual tariff and the required cash flow expected by investment. Because the tariff rates are usually determined by governmental policies, it is not so easy to set the tariff to recover the production costs. Even if the social benefits and economical feasibility of the Project are verified, such gap could not be eliminated only by the efforts of Private business entities based on market principles. With such situation, it is said that existence of Viability Gap can be identified.

2) Necessity of Governmental Fiscal Support (VGF) to eliminate Viability Gap

It is said that the governmental law about VGF is in the final stage of the study by the Ministry of Finance of Indonesia in order to promote smoothly development of the PPP infrastructure projects by inviting the investment money and technologies of the Private business entities. In principle, social infrastructure shall be developed by the budget of the central government and/or regional government and the service

fees should be determined to be fully borne by the beneficiaries. But, most of the social infrastructure projects can be realized by partial support of the central government and/or regional government against construction cost or service fees. Project cost must be verified to be reasonable and competitive. But, in case of existence of the Viability Gap being identified in the Project, it is adequate that governmental fiscal support would be provided.

3) Reasonability of Provision of VGF to Case 1 Business

In case of Case 1 Business, demand (production) volume is a half of Case 2 Business, but, total project cost is merely approximately 15% smaller than Case 2 Accordingly, production cost is resulted in higher and the financial analysis concludes that government fiscal support is required to make the project financially feasible.

However, utilization of the effluent from Denpasar WWTP would bring following social benefits in addition to coping with the future water shortage as alternative water supply source.

- Effluent from Denpasar WWTP is currently discharged into sea via river. The organic and inorganic components contained in the effluent would be environmental burden to sea and sea shores. But, through the advanced process of the Water Reclamation plant and also by establishing water recycle, such environmental burden could be largely reduced. It is considered very important to reduce the environmental burden to sea and sea shores, the tourism resources in Nusa Dua area of Bali Island.
- Meanwhile, underground water is used due to supply shortage of the piped water. Continuous use of underground water would be in future a cause of land subsidence and contamination of the underground water mixed with salt. It is significantly important that replacement of underground water by the Reclaimed water could reduce use of the underground water.
- Beginning of the Reclaimed water use even if its application is limited to toilet flushing could be quite beneficial as social test, education and socialization activity towards establishing water recycle system.

It is advised that reasonability of VGF provision to Case 1 Business should be judged through the further study and evaluation of above social benefits in various aspects.

4) Governmental Support to Case 1 Business other than VGF

Governmental support provided as follows, instead of VGF, could be sufficiently effective;

- As seen from the financial analysis of Case 2 Business in the next Section, if demand volume increase to be doubled, i.e. 9,000 m^3, production cost of the Reclaimed water could be reduced and the Project would be feasible to recover the production cost without VGF based on the bulk sales price of IDR 12,000/ m^3 (in year of 2016). Furthermore, if Reclaimed water production volume is increased to, for example, 15,000 m^3 / day, in proportion to the increase of Denpasar WWTP operating capacity, Reclaimed water production cost could be reduced by scale merits and bulk sales price reduction could be considered.
- If joint study by Bali provincial government, Denpasar municipality and Badung Regency are conducted on application of the Reclaimed water, positioning of the Reclaimed water in total water supply system and restriction of underground water use, it would be possible to accelerate use of the reclaimed water and thus to increase the demand volume.

12.2.2 Financial Analysis of Case 2 Business

(1) Financial Analysis based on Bulk Sales Prices under IDR 12,000/ m^3 (in year of 2016)

As well as Case 1 Business, Equity IRR and DSCR are respectively calculated based on the bulk sales prices in between IDR 9,000/ m^3 and IDR 12,000/ m^3 and outcome of the calculation as follows;
If the bulk sales price is IDR 12,000/ m^3, Equity IRR is calculated as 15% and DSCR is 1.39. Hence, financial feasibility of Case 2 Business has been verified.

The Total Project cost and O&M fees in Chapter 10 are based on the present basic plan and available data and cost reduction might be possible by the review in the course of detail design and engineering in the Project implementation stage. Under this assumption, financial analysis has been conducted how much bulk sales price could be lowered if the Total Project cost could be reduced.

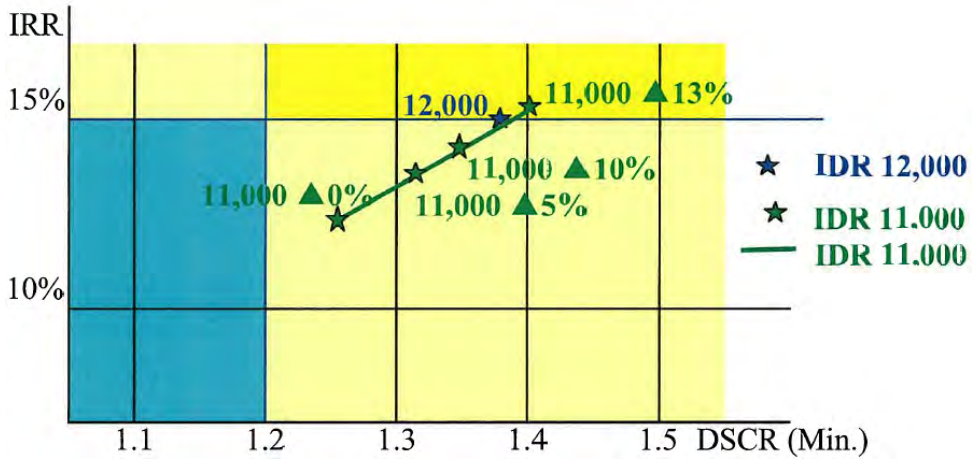


Figure 12.2.3 Financial Analysis of Case 2 (Bulk Sales Price: under IDR 12,000/ m^3)

Table 12.2.3 Financial Analysis of Case 2 (Bulk Sales Price: under IDR 12,000/ m^3)

Sales Price	IDR 12000/m3			
Cost Down	0%			
E-IRR	15.00			
DSCR(min)	1.39			
DSCR(ave)	2.55			
Sales Price	IDR 11000/m3			
Cost Down	0%	5%	10%	13%
E-IRR	12.49	13.43	14.45	15.10
DSCR(min)	1.26	1.31	1.36	1.40
DSCR(ave)	2.27	2.37	2.49	2.56

(2) Sensitivity Analysis

1) Construction Cost (Cost Overrun)

Result of the sensitivity analysis against cost increase due to Cost overrun is as shown in below Table. Cost overrun may arise due to unexpected expenditure against the implementation plan, additional expenses to recover the delay in construction and also additional expenditure related to the delay. Values of DSCR in both cases satisfy the required condition of 1.2. In case of below 5 % cost increase, Equity

IRR would be decreased by less than 0.8 %, which would not give immediate impact leading to disruption of business continuity. But, In case of more than 10 % cost increase, Equity IRR would be decreased by above 1.5 %, which would require immediate review of the business execution (any other cost increase factor, possibility of cost reduction, countermeasure to increase the revenue) and action according to the result of the review.

Table 12.2.4 Sensitivity Analysis of Case 2 Business (Cost Overrun)

Amount of Cost Overrun	Equity Internal Rate of Return (Equity-IRR)	Debt Service Cover ratio (DSCR)	
		Minimum	Minimum
0%	15.00 %	1.39	2.55
5% increase	14.21 %	1.35	2.46
10% increase	13.46 %	1.31	2.37

2) O&M Fees

Result of the sensitivity analysis against unexpected increase of O&M fees exceeding the inflation rate in the business plan is as shown in below Table. Values of DSCR in the three cases satisfy the required condition of 1.2. As value of Equity IRR in the three cases would be decreased by less than 0.6 %, impact leading to disruption of business continuity seems low.

Table 12.2.5 Sensitivity Analysis of Case 2 Business (O&M Fee Increase)

Increase of O&M fees	Equity Internal Rate of Return (Equity-IRR)	Debt Service Cover ratio (DSCR)	
		Minimum	Average
0 %	15.00 %	1.39	2.55
2 % increase	14.81 %	1.38	2.53
4 % increase	14.61 %	1.37	2.50
6 % increase	14.41 %	1.36	2.48

3) Exchange Rate Fluctuation Risk

In this financial analysis, it is assumed that exchange rate between IDR and Yen would be constant. Following is the result of sensitivity analysis against occurrence of appreciation of Japanese Yen (Yen) against Indonesian Rupees (IDR) constantly during BOT period. In the following three cases, values of DSCR satisfy the required condition of 1.2 and value of Equity IRR would be decreased by less than 0.5 %, impact leading to disruption of business continuity seems low. However, as actual exchange rate fluctuation would not occur as assumed in the three cases, it would be necessary to analyze under more complicated conditions.

Table 12.2.6 Sensitivity Analysis of Case 2 Business (Exchange Rate Fluctuation Risk)

Exchange Rate Fluctuation (IDR / Yen)		Equity Internal Rate of Return (Equity-IRR)	Debt Service Cover ratio (DSCR)	
Annual Rate of Appreciation of Yen	Exchange Rate in year of 2038		Minimum	Average
No increase	IDR 1 = 0.00909 Yen	15.00 %	1.39	2.55
1 %	IDR 1 = 0.00707 Yen	14.85%	1.36	2.41
2 %	IDR 1 = 0.00549 Yen	14.68%	1.33	2.26
3 %	IDR 1 = 0.00447 Yen	14.49%	1.30	2.10

CHAPTER 13

ECONOMIC ANALYSIS & EVALUATION

CHAPTER 13 ECONOMIC ANALYSIS & EVALUATION

This Wastewater Reclaiming Project is a bulk supply business of the reclaimed water for non-drinking application purpose to the end users (Hotels) through PDAM Badung. Meanwhile, by supply of reclaimed water, total water supply capacity of PDAM is substantially increased and PDAM can supply the increased water constantly and safely to the households in the district where the piped water are currently not supplied yet. By this additional supply of piped water to the community, it is expected that life of the inhabitants could be comfortable and healthy.

Furthermore, from piped water supply shortage, hotels are currently forced to partially use underground water in spite of anxiety about saline ground water by mixing with seawater etc and land subsidence. It is expected that replacement of underground water by the reclaimed water could dispel the anxiety and could bring good effects on hotel management and development of tourism industries. It is also expected that the environmental loads to sea and seashores could be reduced by re-using the effluent from WWTP instead of discharging the effluent to sea. Analysis and evaluation of the expected economical benefits are conducted in this Chapter.

13.1 Method of Analysis and Economical Benefits

13.1.1 Method of Analysis

In order to assess the economic viability of the project, the replacement cost approach is adopted to calculate EIRR.

The alternative quantifiable items considered in this analysis are set as follows:

- Electricity and Pump Cost to be paid by the inhabitants to get water from deep wells in case that piped water with the volume equivalent to the reclaimed waster is not supplied
- Cost for purchasing bottled water by the inhabitants
- Promotion in the tourism

13.1.2 Economical Benefits

Based on Section 13.1.1, estimated economic benefit for each item is calculated as below;

(1) Electricity and Pump Cost

Household normally uses 0.5 kW pump for one hour per day. Electricity cost (IDR 750/kWh) of one person for one month is calculated in the amount of IDR 11,250. A pump cost is estimated as IDR 4.1 million and divided by usable period for 10 years, which cost IDR 34,283/month/HH. As average family number in a household is assumed to be 6 persons, it is calculated for IDR 5,714/month/person. Total electricity and pump cost is calculated as IDR 16,964/month/paerson. As water supply is assumed 180 litter per person per day in Badung district in 2010, the cost for self supply water is calculated as IDR 3,141/m^3.

Then, in order to get same volume of water equivalent to supply of the reclaimed water, expenditure (economic benefit) is calculated as follows;.

Table 13.1.1 Annual Cost of Electricity & Pump for Water Production

		Production Capacity	Produced Water	Annual Cost (benefits)
1	Case 1 Business	4,500 m^3/day	4,100 m^3/day	IDR 4,700 Million
2	Case 2 Business	9,000 m^3/day	8,200 m^3/day	IDR 9,401 Million

(2) Cost for purchasing bottled water

It is assumed that, in average, one person consumes 3 litters/day of Bottled water. As 20 litter bottled water costs IDR 13,000, it is calculated that, in average, one person pay for Bottled water IDR 1,950/day. Assuming that 1/3 of the people in the area purchase 20 litter bottled water, cost is calculated as IDR 650/day/person and IDR 19,500/month/person. Water supply volumes of 4,100 m^3/day and 8,200 m^3/day can cover about 22,777 persons and 45,555 persons respectively if 180 litters per day are consumed by one person. Then, economic benefit is calculated as below;

Table 13.1.2 Purchase Cost of Bottled Water

	(Produced Water)	Number of People	Annual Cost (benefits)
1	Case 1 Business (4,100 m^3/day)	22,777 persons	IDR 5,330 Million
2	Case 2 Business (8,200 m^3/day)	45,555 persons	IDR 10,660 Million

(3) Tourism

More comfortable environmental circumstances can increase value of the tourism in Bali and may contribute to revenue increase of the tourism industries. In 2010, 2,546,000 people came to Bali Island from abroad and average staying period per tourist is 3.78 days. According to the SAPROF report on Water Supply project in Southern Bali, one tourist, in average, paid IDR 836,342/day during his stay. Annual revenue of the tourism industries is calculated as IDR 8,048,855 million.

This Wastewater Reclaiming project contributes to promotion of the tourism industries in Bali by advanced treatment and reuse of the effluent from Denpasar WWTP. With this Project, the effluent would not be discharged directly to the sea and consequently it can protect the beautiful seashores, sea water and surrounding natural environments. Also, the increased water supply by PDAM will improve living infrastructure. If such contribution is considered to be equivalent to 0.4% of the annual revenue, economic benefits can be calculated as IDR 32,195 million.

Total economic benefits by accumulating above (1), (2) and (3) is calculated as below;

Table 13.1.3 Total Sum of Annual Economic Benefits Unit: IDR 1 million

	(Produced Water)	(1)	(2)	(3)	Annual Cost
1	Case 1 Business (4,100 m^3/day)	4,700	5,330	32,195	IDR 42,225 Million
2	Case 2 Business (8,200 m^3/day)	9,401	10,660	32,195	IDR 52,256 Million

(4) Intangible Economic Benefits

Other than the quantified economic benefit mentioned above, there is an intangible Economic Benefits. But, because of lack of reliable data, technical difficulty or negligibility of benefits, such intangible Economic Benefits are not included in EIRR calculation. If those benefits are included in the EIRR calculation, the EIRR would be higher.

The intangible benefits to be produced by this Project are as follows;

- Health benefits
- Amenity benefits

1) Health Benefits

The general health condition of the population is considered to be good as a whole. However, in the "Without this Project", deterioration of sanitation services may increase and it may intensify the risks to public health. The risks to public health may lead to potential loss in opportunity cost of labor and may increase in health insurance cost caused by increase of medical bills, which can be considered as the economic loss in the case of "Without Project". As it is difficult to estimate such economic loss which may occur in future, mitigation of the risk to public health is considered as intangible economic benefits.

2) Amenity benefits

Amenity benefits brought by safe and stable water supply are indispensable for comfortable and healthy living and it may lead to increase in real estate value. Especially, in newly developed areas, it is confirmed that the real estate value will be orders of magnitude higher than in the pre-project situation. As well as Health Benefits, this Amenity Benefits cannot be estimated and shall be treated as intangible economic benefits. However, total economic benefits through this Project should be evaluated by including these intangible economic benefits.

13.1.3 Economic Costs

(1) Investment Costs

By adding or deducting the following costs to the Total Project Cost of the Wastewater Reclaiming project, investment cost for the economic analysis will be calculated. For calculation of investment costs for Case 1 and Case 2 Business, the values in Table 10.6.1 and Table 10.6.2 in the Chapter 10 shall be applied. The table below shows this calculation and its result;

Table 13.1.4 Calculation of Investment Costs

		Case 1 Business (4,500 m^3/day)	Case 2 Business (9,000 m^3/day)
		(Unit: IDR 1 million)	
1	Total Project Cost (excluding Contingency/Tax/VAT) (Total Project Cost)	**207,446,827** (287,439,642)	**243,364,813** (337,005,934)
	(In which, amount of the Contingency/Tax/VAT)	(△79,992,815)	(△93,641,121)
2	Rehabilitation of the exiting reservoir, distribution piping by PDAM	**25,542,513**	**30,876,213**
3	Partial rearrangement of internal piping by end users (Hotels)	**29,230,000**	**19,750,000**
4	Additional Investment by PDAM to supply equivalent volume of water to households (economic analysis purpose) Number of People	**12,891,782** 22,777 persons	**25,784,130** 45,555 persons
1)	(piping extention) IDR188,000/m x 2m x (people)	(8,564,152)	(17,128,680)
2)	(connection fee) IDR190,000/connection x (people)	(4,327,630)	(8,655,450)
	Total Investment Cost	**275,111,122**	**319,775,156**

(2) O&M Fee

O&M Fee shown in the Tables 10.8.1 and 10.8.2 of the Chapter 10 shall be applied. But, VAT shall be deducted for economic analysis.

Table 13.1.5 O&M Fee (without Tax/VAT)

		O&M Fee (without VAT)	O&M Fee (with VAT)
1	Case 1 Business (4,500 m^3/day)	**IDR 7,549,642,430/year**	IDR 8,304,606,673
2	Case 2 Business (9,000 m^3/day)	**IDR 10,817,610,845/year**	IDR 11,899,371,930

13.2 Economical Evaluation of the Project

For evaluating economic analysis of this Wastewater Reclaiming Project, economical IRR (EIRR) shall be calculated. Table 13.2.1 show the EIRR of the Project as the calculation result

Table 13.2.1 Economic Analysis of Project Evaluation (EIRR) Unit: IDR 1 Million

	Total cost of Investment	O&M Fee	Total Cost	Benefits	Net Benefits	EIRR
Case 1 Business (4,500 m^3/day)	275,112	173,641	448,752	1,013,400	564,648	12.91%
Case 2 Business (9,000 m^3/day)	319,775	248,805	568,580	1,254,144	685,564	13.65%

(Details are as per Table 13.2.2 and Table 13.2.3)

The above calculation of EIRR does not consider Intangible Economic Benefits to be produced by this Project. Considering the intangible economic benefits in Section 13.1 of this Chapter, this Wastewater Reclaiming Project can be considered feasible in economical aspects.

Table 13.2.2 Economic Analysis of Case 1 (4,500 m^3/day) Project - (EIRR)

Unit: Million IDR

Year	Investment Cost					Benefits	Net Benefits
	Project Cost	PDAM Hotels	Replacement Cost	O&M fee	Total Cost	benfits	
2013	(9,791)				(9,791)		(9,791)
2014	(105,400)	(21,909)	(3,868)		(131,176)		(131,176)
2015	(92,256)	(32,864)	(5,157)		(130,277)	42,225	(88,052)
2016			(3,868)	(7,550)	(11,417)	42,225	30,808
2017				(7,550)	(7,550)	42,225	34,675
2018				(7,550)	(7,550)	42,225	34,675
2019				(7,550)	(7,550)	42,225	34,675
2020				(7,550)	(7,550)	42,225	34,675
2021				(7,550)	(7,550)	42,225	34,675
2022				(7,550)	(7,550)	42,225	34,675
2023				(7,550)	(7,550)	42,225	34,675
2024				(7,550)	(7,550)	42,225	34,675
2025				(7,550)	(7,550)	42,225	34,675
2026				(7,550)	(7,550)	42,225	34,675
2027				(7,550)	(7,550)	42,225	34,675
2028				(7,550)	(7,550)	42,225	34,675
2029				(7,550)	(7,550)	42,225	34,675
2030				(7,550)	(7,550)	42,225	34,675
2031				(7,550)	(7,550)	42,225	34,675
2032				(7,550)	(7,550)	42,225	34,675
2033				(7,550)	(7,550)	42,225	34,675
2034				(7,550)	(7,550)	42,225	34,675
2035				(7,550)	(7,550)	42,225	34,675
2036				(7,550)	(7,550)	42,225	34,675
2037				(7,550)	(7,550)	42,225	34,675
2038				(7,550)	(7,550)	42,225	34,675
Total	(207,447)	(54,773)	(12,892)	(173,641)	(448,752)	1,013,400	564,648
						EIRR	**12.91%**

Table 13.2.3 Economic Analysis of Case 2 (9,000 m^3/day) Project - (EIRR)

Unit: Million IDR

Year	Investment Cost					Benefits	Net Benefits
	Project Cost	PDAM Hotels	Replacement Cost	O&M fee	Total Cost	benfits	
2013	(9,791)				(9,791)		(9,791)
2014	(105,400)	(20,250)	(7,735)		(133,386)		(133,386)
2015	(128,174)	(30,376)	(10,314)		(168,864)	52,256	(116,608)
2016			(7,735)	(10,818)	(18,553)	52,256	33,703
2017				(10,818)	(10,818)	52,256	41,438
2018				(10,818)	(10,818)	52,256	41,438
2019				(10,818)	(10,818)	52,256	41,438
2020				(10,818)	(10,818)	52,256	41,438
2021				(10,818)	(10,818)	52,256	41,438
2022				(10,818)	(10,818)	52,256	41,438
2023				(10,818)	(10,818)	52,256	41,438
2024				(10,818)	(10,818)	52,256	41,438
2025				(10,818)	(10,818)	52,256	41,438
2026				(10,818)	(10,818)	52,256	41,438
2027				(10,818)	(10,818)	52,256	41,438
2028				(10,818)	(10,818)	52,256	41,438
2029				(10,818)	(10,818)	52,256	41,438
2030				(10,818)	(10,818)	52,256	41,438
2031				(10,818)	(10,818)	52,256	41,438
2032				(10,818)	(10,818)	52,256	41,438
2033				(10,818)	(10,818)	52,256	41,438
2034				(10,818)	(10,818)	52,256	41,438
2035				(10,818)	(10,818)	52,256	41,438
2036				(10,818)	(10,818)	52,256	41,438
2037				(10,818)	(10,818)	52,256	41,438
2038				(10,818)	(10,818)	52,256	41,438
Total	(243,365)	(50,626)	(25,784)	(248,805)	(568,580)	1,254,144	685,564
						EIRR	**13.65%**

CHAPTER 14

ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

CHAPTER 14 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

14.1 Tasks of Environmental and Social Considerations in this Preparatory Survey

This reclaimed water supply project has been reviewed according to Indonesian environmental laws and regulations and JICA's latest guidelines for environmental and social considerations (April 2010) to ensure that it is environmentally and socially sound and sustainable.

As already explained in Chapter 6, two alternative reclaimed water supply systems (Case 1: Conventional Reclaimed Water Supply System and Case 2: New Clean Water Supply System) have been set for comparison in the preparatory survey. Case 1 is for conventional reclaimed water uses such as toilet flushing. Case 2 is for new reclaimed water uses involving direct skin contact. As for the considerations of environmental and social aspects, these two cases are compared in 14.4.2 and 10.b (1) of Appendix 10. As a result, Case 1 is evaluated to be preferable in regard to environmental and social aspects. However, during the second survey period in Indonesia, Case 1 is evaluated to be less feasible than Case 2 as a PPP project because of its difficulties in installing the dual pipe systems in target hotels and its necessity of subsidy from local government. Therefore, Chapter 14 and its relevant appendixes (Appendixes 9 to 11) explain the results of Initial Environmental Examination (IEE) and other relevant tasks for Case 2 that requires more cautious of environmental and social considerations. In addition, the project evaluation in Chapter 15 includes the comparison of the risks related to environmental and social considerations between Case 1 and Case 2.

Prior to this survey, the reclaimed water supply project was ranked Category B in JICA's project classification which determines the level of environmental and social considerations required. Category B projects have potential impacts on the environment and society which are less adverse than those of Category A. Generally, these impacts are site-specific; few if any are irreversible; and in most cases, normal mitigation measures can be designed more readily than for Category A. The survey confirms this project as Category B because no major irreversible negative impacts, such as large scale involuntary settlement and loss of endangered or rare species, will be caused by the project. However, there are several potential negative social impacts of moderate significance, such as interruption of traffic flow due to the installation of transmission and distribution pipes. The results of environmental screening are shown in 10.a of Appendix 10 (Environmental Effect Study Report).

The steps taken in conducting the review of environmental and social considerations are summarized in Table 14.1.1. The description of project components and site maps are found in Appendix 9 (Detailed Project Activity Plan). As noted in the approved minutes of the December 1, 2010 meeting between the Indonesian government and JICA, the survey team was requested to prepare the detailed project activity plan and the Environmental Effect Study Report (Appendix 10) as appendices.

Table 14.1.1 Review of Environmental and Social Considerations

Steps	Tasks	Part of the Survey Reports covering the Task
1	Describe the project components, including provision of site maps*.	9.c and 9.d of Appendix 9 (Detailed Project Activity Plan)
2	Screen for all potential environmental and social impacts to determine the categorization of the project.	10.a of Appendix 10 (Environmental Effect Study Report)
3	Confirm which laws and regulations are relevant to the environmental and social considerations required in Indonesia and Bali Province for PPP projects.	Section 14.2 (Related Laws and Regulations in Indonesia and Bali Province)
4	Confirm the existing procedures for environment appraisal, including Environmental Impact Assessment (EIA) for PPP projects in Indonesia.	Section 14.3 (Procedure of Environmental Appraisal for PPP Projects in Indonesia)
5	Conduct Strategic Environmental Assessment (SEA) and alternative analyses.	Section 14.4 (Summary of Initial Environmental Examination) and10.b to 10.d of Appendix 10 (Environmental Effect Study Report)
6	Conduct Environmental Scoping for Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA).	
7	Evaluate the significance of the potential negative impacts and identify mitigation measures.	
8	Consider environmental monitoring for reclaimed water quality, traffic congestion, etc.	
9	Discuss with the Indonesian and Japanese sides and conduct a stakeholder meeting for public consultation.	
10	Prepare a draft TOR for the EIA required for the project implementation.	Section 14.5 (Preparation of a Draft TOR for the EIA) & Appendix 11 (A Draft TOR for the EIA)
11	Reconfirm the environmental and social considerations using JICA's Environmental Checklist.	Section 14.6 (Reconfirmation using JICA's Environmental Checklist)

14.2 Relevant Laws and Regulations in Indonesia and Bali Province

The EIA procedure in Indonesia was established in 1986 by Government Regulation No.29. The current EIA procedure in Indonesia is known as AMDAL (Analisis Mengenai Dampak Lingkungan). AMDAL is based on Law No.32/2009 on the protection and environmental management concerning the impact of activities (revised from Law No.23/1997) and Government Decree No.27/1999 regarding EIA procedure on the commission and supervision of EIA. Article 23 of Law No.32/2009 stipulates the criteria for the businesses and/or activities which are required to conduct environmental impact assessment. Required contents of EIA documents are stipulated in Article 25 of the law. The Ministry of Environment also released the following national EIA regulations in 2000.

1) Ministry Decree No.2/2000 on the guidelines for EIA evaluation
2) Ministry Decree No.3/2000 on the plans, activities and programs which must be followed in EIA (which was revised into Ministry Decree No.17/2001)
3) Ministry Decree No.4/2000 on the guideline of EIA for sustainable settlement activities
4) Ministry Decree No.5/200 on the EIA guidelines for wetland development
5) Ministry/Head of Environmental Impact Management Agency (BAPEDAL) Decree No.8/2000 on the community participation and transparency of information about EIA
6) Ministry/Head of BAPEDAL Decree No.9/2000 on the guidelines for EIA study

In June 2010, the State Ministry of National Development, National Development Planning Board (BAPPENAS) issued the General Guidelines for Cooperation between Government and Business Enterprise in the Provision of Infrastructure, which states the required EIA procedure for PPP projects.

The review of environmental and social considerations for this reclaimed water supply project in Southern Bali would follow the procedures described under the relevant national and local regulations listed in Tables 14.2.1 and 14.2.2.

14.3 Procedures of Environmental Appraisal for PPP Projects in Indonesia

The common procedure of environmental appraisal in Indonesia is explained in 14.3.1. The additional public consultations required by the general guidelines for PPP projects are explained in 14.3.2. The sharing of EIA-related responsibilities between DINAS PU/Bali Provincial Government and SPC is explained in 14.3.3.

14.3.1 Common Procedure of Environmental Appraisal in Indonesia

Figure 14.3.1 shows the common procedure for environmental appraisal in Indonesia. As seen in this figure, the proponent of the private sector or government project would submit the required legal documents to the Appraisal Committee for EIA. The required legal documents are the Letter of Agreement regarding the project from the local government and/or a letter providing information on the project sites from the land authority. The Letter of Agreement may include suggestions on the implementation of EIA. In the case of the reclaimed water supply project in Southern Bali, the Letter of Agreement from the Governor of Bali is required.

The Appraisal Committee for EIA can be led by the environmental management agency at the national, province or district level, depending on the location of the project sites. The members of the committee include local leaders, representatives from government agencies, academics, and relevant associations.

Table 14.2.1 National Regulations Relevant to the Reclaimed Water Supply Project

Organization	Regulation	Relevance
Law of the Republic of Indonesia	No.5/1960 on Basic Regulation of Agrarian/land Ownership Affairs	Land ownership and land acquisition procedures for implementing activities.
	No.5/1990 on Conservation of Biological Resources and Ecosystems	Analysis of biological resources and ecosystems that exist in the area of planned activities.
	No.36/1992 on Health	Potential health problems at every stage of activity
	No.7/2004 on Water Resources	Potential damage to water resources due to activities
	No.32/2004 on Regional Governance	Aspects of governance at provincial and district levels
	No.33/2004 on Fiscal Balance between the Central Authorities and Local Government	Authority of local government at provincial and district levels
	No.38/2004 on Roads	Activities using road and the impact on transportation
	No. 22/2009 on Road Transport	
	No.26/2007 on Spatial Planning	Spatial location of activities
	No.18/2008 on Waste Management	Waste management aspects of activities
	No.10/ 2009 on Tourism	Facilities to support tourism activities
Indonesian Government Regulation	No.41/1999 on Air Pollution Control	Possibility of air pollution due to activities
	No.74/2001 on Management of Hazardous and Toxic Materials	Management plan for hazardous materials
	No.82/2001 on Water Quality Management and Control of Water Pollution	Possible impact on water quality in the vicinity of planned activities
Regulation of BAPPENAS	No.4/2010 on the General Guidelines for Cooperation between Government and Business Enterprise in the Provision of Infrastructure	EIA Procedure for PPP projects and the sharing of EIA-related activities between government and business enterprise
Decree of the Minister of Environment	No.KEP-49/MENLH/XI/1996 on Standards Vibration Levels.	Possible impact during construction
	No.40/2000 on Guidelines for the Administration of EIA Appraisal Commission	Environmental document appraisal
	No.110/2003 on Guidelines for Estimating Load Capacity of Water Pollution at Water Sources	Measuring the impact of effluent on the environment
	No.111/2003 on Guidelines, Requirements and Licensing Procedures for Disposing Wastewater into Water or Water Sources	Wastewater treatment required during the construction and operation of the project
	No.112/2003 on Domestic Wastewater Quality Standards	Action plans for the management of domestic waste
	No.114/2003 on Guidelines for Water Use Classification	Determining the classification of reclaimed water
	No.115/2003 on Guidelines for Water Quality Status	Water quality conditions in the area of activity
	No.45/2005 on Guidelines for Environmental Management and Environmental Monitoring Reporting	Implementation of environmental management plan and environmental monitoring plan
Regulation of the Minister of Environment	No.8/2006 on Guidelines for EIA Preparation	Procedure of preparing EIA documents
	No.11/2006 on Types of Business Plan and/or Activity requiring EIA	The screening guideline for conducting EIA or UKL/UPL
	No.5/2008 on EIA Appraisal Commission Working Procedure	The EIA process at the technical level
Regulation of the Minister of Public Works	No.49/1990 on Procedures and Requirements for Water Use Permit and/or Water Resources	Utilization of water resources for activity
Regulation of the Minister of Health	No.907/MENKES/SK/VII/2002 on Drinking Water Quality and Monitoring Procedure	Condition of the water used for public interest
	No.416/1990 on Standards and Supervision of Water Quality	
	No 492/2010 on Drinking Water Standard	
Decree of the Head of BAPEDAL	No.56/1994 on Guidelines for Impact Assessment	Evaluation of significant impacts in EIA studies
	No.8/2000 on Community Involvement and Information Disclosure in EIA	Procedure for the announcement and screening of proposals, suggestions and objections from the public regarding planned activities

Table 14.2.2 Local Regulations related to the Reclaimed Water Supply Project in Southern Bali

Organization	Regulation	Related Covered Matters
Regulation of Bali Province	No.4/2005 on Pollution Control and Environmental Destruction	The local standard for environmental data
	No.8/2007 on Environmental Quality Standards and Criteria	Various quality standards such as waste, noise, odor, emissions of motor vehicles and others which should be met in the implementation of planned activities
	No.16/2009 on Spatial Planning of Bali Province	Spatial planning aspects of the region of Bali
	No.3/2004 on Tax for Groundwater and Surface Water Usages.	Price of using groundwater and surface water in Bali
	No.16/2009 on Baseline Price for Groundwater Utilization	Assessment of the condition of ground water in Bali
Regulation of Denpasar Municipality	No.38/2010 on Tax Tariff for Groundwater Usage	Reduced groundwater tax after the decentralization of the tax collection from Bali Provincial Government and wastewater reclamation at each facility such as hotel
Regulation of Badung Regency	No.1/2011 on Tax for Groundwater Usage	Reduced groundwater tax after the decentralization of the tax collection
	No.16/2011 on Tax Tariff for Groundwater Usage	

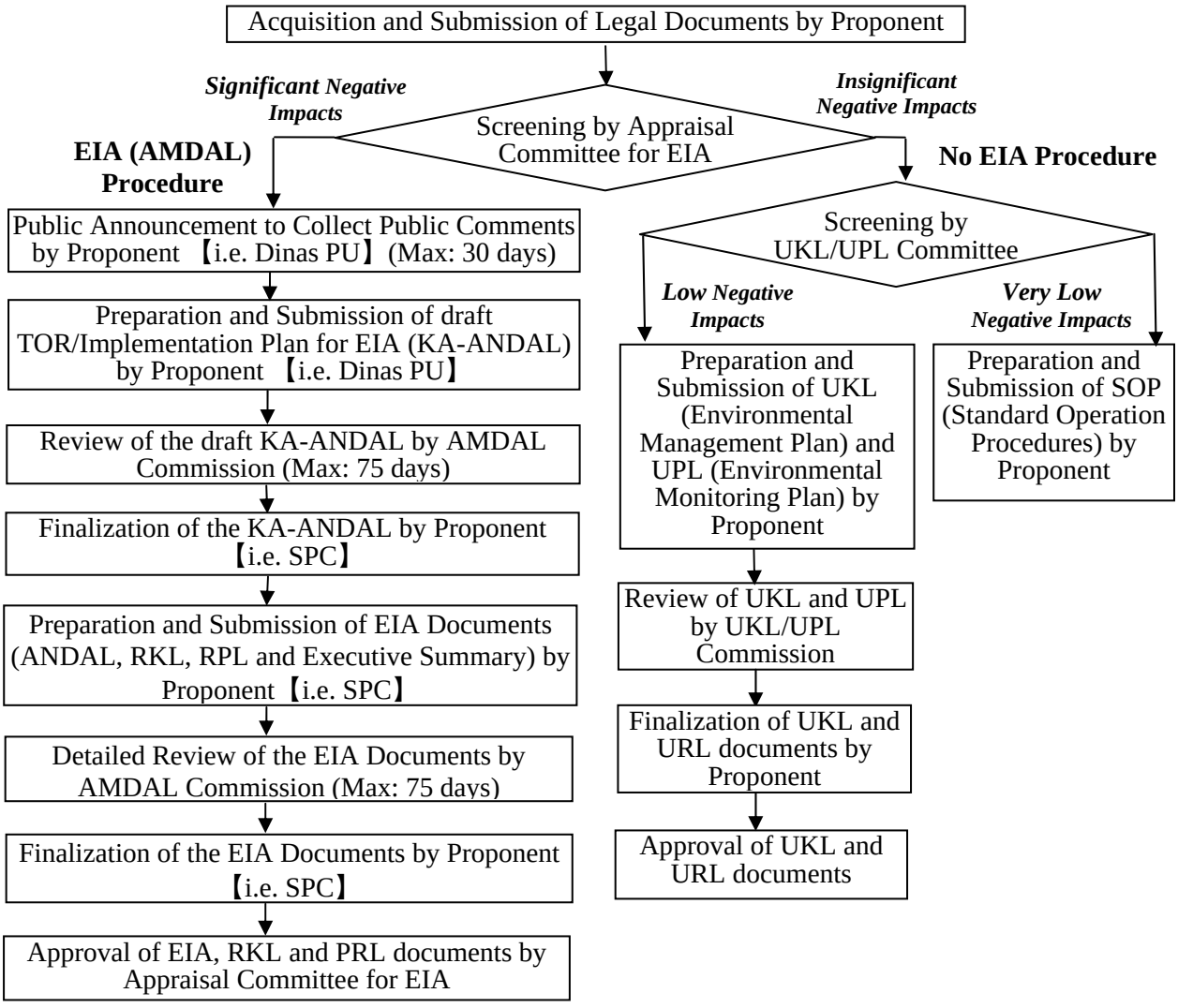


Figure 14.3.1 Procedure of Environmental Appraisal in Indonesia

The Environmental Board of the Bali Provincial Government (BALH) is the responsible environmental management agency for the reclaimed water supply project because the project sites are in Denpasar City and Badung Regency.

The Appraisal Committee for EIA will decide whether or not an EIA (AMDAL) is required. This decision would be based on the significance of expected negative impacts. The Appraisal Committee can also take into consideration the suggestions regarding the necessity of EIA if these are included in the Letter of Agreement from the local government.

According to the Regulation of the Ministry of Environment (No. 11/2006) (more specifically, Article 13, Point H), any projects which involve the installation of water transmission pipe equal to or longer than 10 km are required to go through the EIA process. The water transmission pipeline to be installed in this PPP project is more than 10km. Therefore, EIA is required for this PPP project.

The proponent would prepare a draft Kerangka Acuan ANDAL (KA-ANDAL), which is a draft Terms of Reference (TOR) /implementation plan for the EIA, based on the comments collected through public announcements (Max: 30 days for commenting) as seen in Figure 14.3.1. The draft KA-ANDAL would be submitted to the AMDAL Commission. It would identify potential environmental impacts of the project and explain selected measures for public engagement at the community level and for media announcements (e.g. through local newspaper), according to Head of BAPEDAL Decree No.8/2000. The EIA study and public consultations would be carried out by at least three consultants who are certified by the Indonesian consultant association on EIA. The review of the draft KA-ANDAL by the AMDAL Commission would take 75 days at the maximum. The proponent would finalize the KA-ANDAL based on the recommendations from the AMDAL Commission and prepare the EIA documents. The EIA documents include the main report (known as ANDAL), environmental management plan report (known as RKL), environmental monitoring plan report (known as RPL) and executive summary report.

After receiving the recommendations on the EIA documents from the AMDAL Commission, further discussions with the stakeholders is required in order to receive construction permit for the project from the head of the Appraiser Committee of EIA. The Appraiser Committee may approve the EIA documents or request further study and/or public consultation regarding controversial issues. They may also reject the proposed project if they decide that the expected impacts are unacceptable, in which case the proponent may revise or abandon the proposal. Final decisions on the project would be reviewed by the Ministry of Environmental at the national level, the Governor at province level, and the Head of District (Bupati or Walikota) at the district/city level.

If a proposed project does not require EIA (AMDAL), according to the Appraiser Committee, a simpler procedure called UKL/UPL procedure would be used, unless the expected negative impacts are very low or nonexistent. The UKL/UPL procedure requires the submission of UKL (environmental management plan) and UPL (environmental monitoring plan). The UKL/UPL commission would review the documents and conduct a field survey to verify the facts of the project. If the expected negative impacts are very low or nonexistent, only the Standard Operating Procedure (SOP) would need to be submitted.

14.3.2 Public Consultations Required by the General Guidelines for PPP Projects

According to the general guidelines for cooperation projects (i.e. PPP projects) issued in 2010 by BAPPENAS, PPP projects shall be implemented as follows:

a. Planning Stage
b. Pre-feasibility Study Stage
c. Transaction Stage
d. Implementation Stage

The general guidelines explains that the responsible government entity of a PPP project, which is Dinas PU/Bali Provincial Government in this case, would conduct public consultations during the planning, pre-feasibility study and transaction stages (these public consultations are different from the socialization which the proponent has to conduct during EIA). The public consultations at the planning stage would solicit concerns regarding the benefits and impacts of the proposed project. The public consultations at the pre-feasibility study stage would verify the social and environmental compliance with applicable rules and to obtain views regarding the appeal and feasibility of the project options. The public consultations at the transaction stage would obtain views from the stakeholders, investors and financing institutions. At the implementation stage, the business entity, which is the SPC in this case, is responsible for conducting the EIA which includes the socialization.

The general guidelines also states that the responsible governmental entity may obtain assistance from independent consultants to carry out the planning, pre-feasibility study, transaction and the supervision and control of the implementation. Therefore, independent consultants may conduct the public consultations during the planning, PreFS and transaction stages.

14.3.3 Sharing of EIA-related Responsibilities

In PPP projects, the proponent in the EIA procedure as illustrated in Figure 14.3.1 changes from the responsible government entity to the business entity at the signing of the PPP contract. According to the general guidelines, the responsible government entity (i.e. DINAS PU/Bali Provincial Government in the case of this project) needs to submit a pre-feasibility study to the Infrastructure Assurance Business Enterprise (BUPI). This pre-feasibility study needs to contain an environmental and social study, including the IEE and the determination of the institution responsible for land acquisition. The results of IEE would be used as a basis for the preparation of the draft KA-ANDAL.

The responsible government entity is responsible from the delivery of the project activity plan to the environmental management agency (i.e. BALH in case of this project) to the preparation and stipulation of the draft KA-ANDAL during the pre-feasibility study stage. The project activity plan can be prepared based on the detailed project activity plan in Appendix 9. In this preparatory survey, a draft TOR for the EIA (see Appendix 11) was prepared in English, based on the results of the IEE, and would be used for preparing the draft KA-ANDAL. DINAS PU/Bali Provincial Government needs to prepare the draft KA-ANDAL in Indonesian and submit this to BALH.

At the implementation stage, the implementation management unit from DINAS PU/Bali Provincial Government should take into account the need for public consultation in the preparation of implementation management plan. During the pre-construction period, the implementation management unit would monitor SPC's preparation of KA-ANDAL and AMDAL.

The SPC will be responsible for fulfilling all the requirements requested by BALH regarding the KA-ANDAL completion and EIA (AMDAL) implementation. KA-ANDAL, AMDAL and environmental license approvals on the project would be submitted by the SPC to DINAS PU/Bali Provincial Government before the construction starts.

14.4 Summary of the Initial Environmental Examination

The detailed results of the Initial Environmental Examination (IEE) are explained in Appendix 10 (Environmental Effect Study Report) as requested in the M/M signed between the Indonesian Government and JICA in December 2011. This section provides a brief summary of the IEE focusing on identified moderately significant potential negative impacts. The strategic environmental and social considerations conducted at the early period of the planning for the reclaimed water supply project are explained in 14.4.1. The five alternative analyses conducted for environmental and social considerations at the later period of the project planning are explained in 14.4.2. The results of a comprehensive

environmental scoping are explained in 14.4.3. The evaluation of the moderately significant potential negative impacts and their mitigation measures are explained in 14.4.4. The required environmental monitoring is explained in 14.4.5. The results of workshops with related local government agencies and a stakeholder meeting for public consultation are explained in 14.4.6.

14.4.1 Strategic Environmental and Social Considerations

At the beginning of this survey, the environmental and social aspects of wastewater reclamation are examined to formulate a project framework which is environmentally and socially sound.

First of all, domestic water users are excluded from the potential users of the reclaimed water to ensure that the reclaimed water would not be misused for drinking. The survey on the demand for reclaimed water targeted hotels, golf courses, an airport, harbor facilities and shopping malls. Preliminarily considerations excluded the harbor facilities at Benoa Harbor from the targets of the project because their major water uses are for washing fish in the fish processing factories and multi-purpose water uses (including drinking and cooking) on ships.

The hotels in the Kuta and Legian areas are also excluded from the project. The supply of reclaimed water to the hotels in Kuta and Legian is especially difficult because the roads are narrow, the hotel locations are spread out and there is already serious traffic congestion. The construction of new transmission and distribution pipes in these areas would worsen the current situation. The installation of sewer pipes in Kuta in another Japanese ODA project was opposed by the residents. The delivery of the reclaimed water by water trucks would also worsen the traffic congestion. The hotels in Kuta and Legian are relatively small and their expected reclaimed water use would not be significant.

14.4.2 Alternative Analyses for Environmental and Social Considerations

Five alternative analyses were conducted for the environmental and social considerations. These alternative analyses are about (1) type of reclaimed water use (only for toilet flushing (Case 1) or including bathing, showering and filling swimming pools (Case 2)); (2) type of reclaimed water delivery system (through pipes or by water tank trucks); (3) route of the transmission pipes to Nusa Dua (along the existing main road, along new bridge roads to be constructed or through the mangrove forest); (4) route of the construction access road around the Suwung WWTP (four different routes); and (5) comparison with zero alternative. Each of these alternative analyses is explained in 10.b of Appendix 10. Based on these alternative analyses, the project was proposed to supply water from the Suwung WWTP to the targeted hotels in Nusa Dua, Sawangan and Benoa through the transmission pipes installed along the existing main road for uses including bathing, showering and filling swimming pools.

14.4.3 Comprehensive Environmental Scoping

Wastewater reclamation is a relatively new endeavor. The planned uses of the reclaimed water in this project include uses for bathing, showering and filling of swimming pools. The environmental scoping for this project was conducted using a comprehensive environmental scoping matrix as shown in Table 10.c.1 of Appendix 10. The following is the summary which describes the positive, moderately significant, and minor negative impacts of this project.

During the pre-construction stage, this project may face some difficulties regarding the land acquisition for the proposed water reclamation plant site and cultural acceptance of the reclaimed water. Sections (1) and (3) of 14.4.4 briefly explain the evaluation of the moderately significant negative impacts regarding the land acquisition and cultural acceptance of the reclaimed water and their mitigation measures. The positive impacts include the addition of another alternative water source in Southern Bali, the growth of eco-mind and the increase of local job opportunities.

During the construction stage, only the disruption to traffic flow during the installing of the transmission and distribution pipes is considered as moderately significant. Section (2) of 14.4.4 briefly explains the evaluation of the impact of the pipe installation on traffic and its mitigation measures. The minor negative impacts may include air pollution, noise and vibration from machines and trucks, physiographical, hydrological, biological and social impacts of land clearing and embankment at the water reclamation plant site, and negative impacts related to the inflow of construction workers to Bali. The project also has positive impacts on the income and job opportunities for the local people during the construction stage.

During the operation stage, the tourists staying in the hotels may complain if they have cultural bias towards the use of reclaimed water and have perceived health and esthetic concerns. The mitigation measures for this moderately significant negative impact are briefly explained in (4) of 14.4.4. The project may have minor negative impacts including the air pollution, noise and vibration from the installed equipment, impacts of the backwash water from the water reclamation plant on the treatment process of the WWTP and the increase of burden to the target hotels in terms of facility maintenance cost and water charge. This project also has positive impacts during its operation in reducing ground water extraction at the hotels and river water extraction by future water supply projects in Bali, reducing effluent disposal from the WWTP, reducing nutrient loads in the receiving waters, increasing local eco awareness and increasing local job opportunities.

During the post-operation stage, this project may have some minor negative impacts, which include the increase of the effluent from the WWTP, loss of job opportunities, the degradation of sanitary condition due to abandoned facilities and materials.

14.4.4 Evaluation Moderately Significant Negative Impacts Identified in the Survey and Proposed Mitigation Measures

Since this preparatory survey is limited in time, the minor negative impacts (explained in 14.4.3 and 10.c of Appendix 10) were not further evaluated in this IEE. The evaluation of the four moderately significant impacts and the consideration of their mitigation measures are briefly explained in Sections (1) to (4). Fuller explanation can be found in 10.d in Appendix 10.

During the EIA, the minor negative impacts would be further evaluated along with the proposal of their mitigation measures. The EIA would review the following evaluation on the moderately significant negative impacts and their mitigation measures.

(1) Land Acquisition for the Water Reclamation Plant Site

The proposed site for the wastewater reclamation plant is located at the edge of the Nagurah Rai Mangrove Forest Area. There are no residents or endangered, rare or economically important species in this area. According to the management plan of the Nagurah Rai Mangrove Forest Area (where land use is controlled by the Ministry of Forestry for conservation purposes) prepared by the Forestry Agency of the Bali Provincial Government in 2007, the proposed land for the water reclamation plant is within an Intensive Use Block where land use is allowed only for research, education and eco-tourism. Nevertheless, some public facilities which do not fall in this definition (e.g. the Suwung WWTP, Estuary Dam and Pesanggaran Solid Waste Dumping Site) exist in Intensive Use Blocks.

DINAS PU/Bali Provincial Government in coordination with the Forestry Agency of Bali Provincial Government needs to apply to the Ministry of Forestry for the permission to use 1 hector of land for the wastewater reclamation plant. Because this land use is for a commercial purpose, a compensation of 2 hectors of land (twice the size of the requested land) would be handed over from the Bali Provincial Government to the Ministry of Forestry as stipulated in the Regulation of the Minister of Forestry No. P.18/Menhut-II/2011. This handover of compensation land is considered as a mitigation measure against the impacts of the land use on the mangrove forest.

(2) Traffic Disruption caused by the Installation of Transmission and Distribution Pipes

The proposed route of the reclaimed water transmission pipeline runs along the existing main road (Nagurah Rai Bypass Road). Two trunk distribution pipelines from the existing reservoir in Nusa Dua to Benoa and Sawangan would also be installed. The traffic conditions at several points on the transmission pipeline route and at the inlet to Benoa on the distribution pipeline route are already heavily congested especially during commuting hours. Therefore, the installation of the transmission and trunk distribution pipelines may cause heavy traffic jams.

The proposed mitigation measures includes 1) pipe installation during night time; 2) use of a pipe jacking method; 3) traffic control at the installation sites; 4) socialization including early notification to the residents living around the installation sites; and 5) change the route for the transmission pipeline if necessary. The alternative routes for the transmission pipeline are explained in (3) of 10.b, Appendix 10.

(3) Cultural Acceptance of Reclaimed Water

The cultural acceptance of reclaimed water has been examined in the demand survey, the questionnaire survey carried out at the opening ceremony of the pilot wastewater reclamation plant and the discussions at meetings with stakeholders including the Bali Tourism Board. Although there have been many affirmative responses to the use of reclaimed water for showering, bathing and filling of swimming pools, further survey of the targeted hotels and their guests are required to confirm the level of acceptance.

The proposed mitigation measures against the potential complaints and harmful rumors about the uses of the reclamation water in the hotels include 1) disclosure of the results of the monthly and daily water quality tests on the web page of SPC; 2) socialization during the EIA, construction and operation; 3) providing reclaimed water that is better than drinking water in terms of color, odor and turbidity; 4) securing confirmation of demand from the hotels before signing the PPP contract; and 5) conducting outreach activities (study tour to the pilot plant and/or full-scale water reclamation plant, issuing of eco certificate and advertisement using posters, stickers, etc.) while waiting for the confirmation of demand and after the start of the reclaimed water supply.

(4) Potential Health Risk in the Use of the Reclaimed Water

The health risk of the reclaimed water was explained in 15.3 of the main report. Unfortunately, it is not yet confirmed that the proposed water reclamation process can meet the existing Indonesian water quality standards for pools and public baths. The health risks (including the impacts of drinking it by mistake and cross-connections with drinking water pipes) and the legal compliance of the reclaimed water in comparison with the existing water quality standards should be re-assessed in the EIA.

The proposed mitigation measures to reduce the health risk of the reclaimed water include 1) measuring water quality (external and internal tests) monthly and daily; 2) controlling residual chlorine concentration in the reclaimed water; 3) fish monitoring for risk management; 4) training the operation & maintenance staff on water quality control measures; 5) separating the responsibilities between BLUPAL, SPC and PDAM regarding water quality control; 6) stabilizing the effluent quality at the Suwung WWTP; 7) cleaning inside the existing distribution pipes; 8) inspection and enforcement of wastewater discharge standards for domestic and industrial water users; 9) construction supervision during the rearrangement of water supply facilities in the target hotels to avoid cross-connections between the reclaimed water and drinking water supply systems; and 10) clear notification to the guests in the hotels about the proper uses of the reclaimed water.

14.4.5 Environmental Monitoring

This subsection summarizes 10.e (Environmental Monitoring) of Appendix 10 (Environmental Effect Study Report). In the EIA, the SPC have to prepare an environmental monitoring plan report which would include the monitoring plans for the construction and operation stages of this project.

The environmental monitoring required for the construction stage includes the monitoring of 1) the traffic congestions at the pipe installation sites. It may also include the monitoring of: 2) the air pollution, noise and vibration; 3) the impacts of excavation; and 4) the rearrangement of the pipes inside the hotels.

The environmental monitoring required for the operation stage includes 5) water quality monitoring of the reclaimed water. It may also include the monitoring of 6) the notifications about proper use of the reclaimed water in the hotels; and 7) the complaints from the hotels and their guests.

A proposed plan for water quality monitoring is fully explained in 10.e. of Appendix 10. Table 14.4.1 shows the summary of the proposed water quality monitoring plan. BLUPAL, SPC and PDAM Badung would be responsible for the water quality tests at the different monitoring points (from the sewerage users to the reclaimed water users). All the industrial sewerage users which may be discharging toxic chemicals would be identified. The effluent from some of these industrial sewerage users can be sampled in rotation for the quarterly monitoring of industrial effluent. For monitoring of the reclaimed water users, the targeted hotels can be grouped by area in order to sample hotels from each area in rotation for the monthly water quality monitoring. As shown in Table 14.4.1, the frequency of water quality tests at the hotels can be reduced from monthly to quarterly if the number of hotels sampled at the each time is large. The drinking water and the reclaimed water are mixed in the water receiving tanks of the hotels. Therefore, the monthly water quality monitoring at the hotels would target not only the reclaimed water but also PDAM's drinking water in order to identify real causes in case that guests in the hotels complain about the quality of piped water in their guest rooms.

Table 14.4.1 Proposed Water Quality Monitoring Plan

Responsible Body	BLUPAL			SPC			PDAM Badung	
Monitoring Point	At Sampled Industrial Sewerage Users	At the Inlet of Suwung WWTP	At the Outlet of Suwung WWTP / the Inlet of the Wastewater Reclamation Plant	At the Outlet of the Wastewater Reclamation Plant		At the Existing Reservoir in Nusa Dua	At Sampled Hotels in Nusa Dua, Sawangan and Benoa	
Target water	Industrial Effluent	Raw wastewater	Treated wastewater	Reclaimed water		Reclaimed Water	Reclaimed water	Drinking water
Purpose	To avoid the interfusion of toxic materials	To control the wastewater treatment process	To confirm that the treated wastewater meets its corresponding effluent standards & to improve the effluent quality	To confirm that the reclaimed water meets its corresponding water quality standards		To check if it is polluted in the transmission pipeline	To check the final water quality of the reclaimed water and the drinking water	
Testing Laboratory	External	Internal	External	Internal	External	External	External	
Frequency	Quarterly	Daily	Monthly	Daily	Monthly	Semiannually	Monthly to Quarterly	
Water Quality Parameters	According to the discharge standards *1	Around 5 parameters *2	Around 25 parameters *3	Around 8 parameters *4	Around 14 parameters *5	Around 31 parameters *6		

Note
*1: the discharge standards for textile industry, metal coating industry, soft drink industry and hospital activities are shown in Regulation of Bali Province No.8/2007 on environmental quality standards and criteria.
*2: the around 5 water quality parameters may include BOD, TSS, DO, Temperature and pH.

*3: the around 25 water quality parameters may include those listed in the sewage effluent standards.
*4: the around 8 water quality parameters may include Smell, Clarity, Color, Oil, Turbidity, BOD, pH and Cl^-.
*5: the around 14 water quality parameters may include 6 physical parameters, 6 chemical parameters and 2 microbiological parameters as listed in Table 10.e.2 of Appendix 10.
*6: the around 31 water quality parameters may include 7 physical parameters, 22 chemical parameters and 2 microbiological parameters as listed in Table 10.e.2 of Appendix 10.

This proposed water quality monitoring plan would be revised in the EIA based on the agreement between BLUPAL, SPC and PDAM Badung regarding the sharing of responsibilities in water quality control. This agreement would be stated in the PPP contract.

The environmental monitoring plans for other environmental items such as traffic congestion would be proposed in the EIA.

14.4.6 Results of Stakeholder Meeting and Workshops

This subsection summarizes 10.f (Public Consultation) of Appendix 10. In accordance with BAPPENAS's General Guidelines for Cooperation between Government and Business Enterprise in the Provision of Infrastructure (June, 2010), a stakeholder meeting was held by the Indonesian side (DINAS PU of Bali Provincial Government and BLUPAL) on September 27, 2011 in Denpasar, Bali for public consultation. The JICA survey team supported the implementation of the stakeholder meeting in accordance with JICA's Guidelines for Environmental and Social Considerations (April, 2010).

Through stakeholder analysis and discussions with Indonesian counterparts, around one hundred stakeholders, including several from Jakarta, were invited to the meeting and seventy attended. Several stakeholders closely related to the tourist hotels were absent from the meeting. A site tour to the pilot water reclamation plant constructed by METAWATER Co., Ltd. was also conducted in the afternoon on the same day. The meeting and the site tour went smoothly. Table 10.f.4 (5 pages) of Appendix 10 shows the many suggestions, comments and questions from the participants, including suggestions collected using suggestion sheets. The responses from the survey team to questions raised by the participants are also shown in the table.

The important remarks from Indonesian and Bali's government agencies and responses from the survey team at the workshops held during the preparatory survey are summarized in Table 10.f.5 of Appendix 10. An interview with the Bali Tourism Board was conducted on October 7, 2011 in order to add to the perspectives from the hotels. The results of the interview are shown in Table 10.f.6 of Appendix 10.

The results from the stakeholder meeting, workshops and the Bali Tourism Board interview have been reflected in the planning and facility design of the project. The results can also be utilized in the future promotion, public consultation and socialization required for the implementation of the project after this preparatory survey.

14.5 Preparation of a Draft TOR for EIA

A draft Terms of Reference (TOR) for the EIA is prepared by the JICA survey team as shown in Appendix 11. The Indonesian side (DINAS PU/Bali Provincial Government) needs to review this draft TOR and modify it for the preparation of the draft KA-ANDAL; as well as translate this into Indonesian. The Indonesian side also needs to submit the TOR to the Environmental Board of the Bali Provincial Government. The preparation of the draft KA-ANDAL should follow the guidelines for the preparation of environmental impact assessment (Ministry of Environment Regulation No. 8 of 2006). The KA-ANDAL should be finalized by the SPC based on the comments given by the AMDAL commission as seen in Figure 14.3.1.

The procedure for hiring the environmental consultants for the implementation of the EIA may include:

1) public announcement about the project
2) preparation of a draft KA-ANDAL
3) completion of the KA-ANDAL
4) data collection and field surveys
5) review, evaluation and planning
6) socialization
7) preparation of the drafts of required EIA documents
8) completion of the required EIA documents
9) acquisition of environmental license for the project

The EIA process includes a) review of the reclaimed water demand; b) review of legal compliance; c) review of the environmental scoping; d) review of the alternative analyses; e) evaluation of the negative impacts; f) identification of mitigation measures; and g) preparation of the environmental management plan and the environmental monitoring plan.

14.6 JICA's Environmental Checklist

As shown in Table 14.6.1 JICA's Environmental Checklist was followed in assessing the various aspects of the environmental and social impacts of this project. The mitigation measures proposed in the IEE are only for the significant negative impacts identified in the environmental scoping. In the EIA, mitigation measures would be proposed for the minor impacts as well.

Table 14.6.1 Environmental Checklist (1/4)

Cate-gory	Environ-mental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process?	(a) N	(a) EIA reports should be prepared by SPC after the signing of PPP contract according to the Indonesian guidelines on PPP projects. The results of IEE conducted in this preparatory survey are shown in Appendix 10 (Environmental Effect Study Report). The contracting agency (Dinas PU/Bali Provincial Government) needs to prepare a KA-ANDAL in reference to Appendix 9 (Detailed Project Activity Plan) and Appendix 11 (A Draft TOR for the EIA) and submit the KA-ANDAL to the Environmental Board of Bali Provincial Government before the signing of PPP contract (see Section 14.3).
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comments from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) Dinas PU (and BLUPAL) held a stakeholder meeting on September 27, 2011 to explain the outline of the proposed reclaimed water supply project and expected environmental and social impacts of the project. The survey team prepared a table (see Table 10.f.4 of Appendix 10) showing the questions asked and suggestions put forward at the meeting or in the suggestion sheets, as well as the responses from the survey team. (b) Most of the comments from the stakeholders listed in Tables 10.f.4 and 10.f.5 of Appendix 10 were reflected in the planning and facility design of the project.
	(3) Exami-nation of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Five alternative analyses were carried for environmental and social considerations as explained in 14.4.2 and 10.b of Appendix 10.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? (b) Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	(a) N (b) -	As for (a) and (b), sodium or calcium hypochlorite, which is much safer than chlorine gas, will be used at the proposed wastewater reclamation plant. The S/W of the EIA drafted in Appendix 11 covers the re-evaluation of the safety of selected hypochlorite (including the compliance with Indonesian occupational health and safety standards) and the proposal of its mitigation measures (if necessary).
	(2) Water Quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	(a) N/A	(a) The wastewater reclamation plant will not discharge any effluent into the environment because the backwash water (from the biological and ceramic filters of the proposed water reclamation plant) goes back to the inlet of the Suwung WWTP. The impact of the backwash water on the treatment process of the WWTP is not significant because the backwash water gradually goes back to the inlet of the WWTP after being stored in a tank.
	(3) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	(a) N/A	(a) No sludge will be generated at the proposed water reclamation plant because all the backwash water from the proposed water reclamation plant goes back to the inlet of the WTTP without any sludge treatment process.

Table 14.6.1 Environmental Checklist (2/4)

Cate-gory	Environ-mental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
2 Pollution Control	(4) Noise & Vibra-tion	(a) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	(a) -	(a) The answer to this question needs to be confirmed in the EIA. The S/W of the EIA drafted in Appendix 11 covers the re-evaluation of potential noise and vibrations and the proposal of their mitigation measures.
	(5) Subsi-dence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) This project will not use groundwater. The project is expected to contribute to the reduction of excessive groundwater extraction.
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) Y	(a) The proposed water reclamation plant site is within the Ngurah Rai Mangrove Forest Area which is one of the protected areas where the Ministry of Forestry controls land uses through their land use permission process. The Forestry Agency of the Bali Provincial Government prepared the latest management plan of the Ngurah Rai Mangrove Forest Area in 2007. Therefore, the re-evaluation of the impacts of this project on the mangrove forest should be carried out based on this management plan in the EIA (see 10.c.(1) 1) and 10.d 【1】 of Appendix 10 for more information). On the other hand, the Ngurah Rai Mangrove Forest Area is neither included in the conservation areas under Ramsar nor registered in the database of conservation areas developed mainly by UN Environmental Program (UNEP) and International Union for Conservation of Nature and National Resources (IUCN) (see 10.c (2) 4] of Appendix 10). The potential impacts of installing the transmission pipeline through the mangrove forest should be re-evaluated in the EIA because the impacts of the proposed installation of the transmission pipeline along the existing main road may cause serious impacts on its traffic during the construction (see 10.c (2) 12] and 10.d【2】 of Appendix 10).
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by project will adversely affect aquatic environments, such as rivers?	(a) - (b) N (c) N	(a) The proposed water reclamation plant site is located on the edge of the Ngurah Rai Mangrove Forest Area. However, the mangrove forest at this location is already segmented due to its past use as fish ponds. (b) According to the staff of Mangrove Information Center in Denpasar and the Forestry Agency of Bali Proviontial Government, the Ngurah Rai Mangrove Forest Area does not have any habitats for rare, endangered or economically valuable species. (c) The amount of effluent discharged from the Suwung WWTP into the mangrove forest will be reduced by the operation of the proposed wastewater reclamation plant. Furthermore, the reclaimed water supply project would improve the effluent quality of the Suwung WWTP, resulting in reduced impacts on the mangrove forest.
	(3) Hydrology	(a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect surface water and groundwater flows?	(a) N	(a) The project will use only the effluent from the Suwung WWTP. The flow of the stream in the mangrove forest, into which the reduced amount of the effluent from the WWTP will be discharged, will not be changed significantly because the flow is under strong tidal influence.

Table 14.6.1 Environmental Checklist (3/4)

Cate-gory	Environ-mental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettle-ment	(a) Is involuntary resettlement caused by project implementation?	(a) N	(a) Involuntary resettlement is not necessary for the implementation of this project.
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?	(a) Y (b) N	(a) Since the installation of transmission pipeline along the existing main road was proposed in this preparatory survey, several mitigation measures including the pipe installation at night, were proposed to reduce its disruption to the traffic (see 14.4.4 【2】 and 10.d【2】 of Appendix 10). For the benefit of the hotels, mitigation measures to deal with health concerns and cultural acceptance of the reclaimed water supply were also proposed (See 14.4.4 【3】 & 【4】 and 10.d【3】 & 【4】 of Appendix 10). Although some signs of local crab harvesting were observed in the mangrove forest at the proposed wastewater reclamation plant site, there seems to be no one who earns a living by harvesting crabs at the site. This should be confirmed in the EIA. (b) This reclaimed water supply project will use the effluent from the WWTP which is currently discharged directly into the environment. Therefore this project does not have any negative impacts on the existing uses of water resources and water environments.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage?	(a) -	(a) The project sites of this reclaimed water supply project includes the Suwung WWTP, the mangrove forest next to the WWTP, existing roads including the Ngurah Rai By-pass Road, the existing pumping station/distribution reservoir at Nusa Dua and the target hotels in Nusa Dua, Sawangan and Benoa. The project seems not to damage any significant archeological, historical, cultural and religious heritages physically. However, the increase of traffic and the passing of large trucks may cause negative impacts such as noise on the cultural and religious activities at the family and community temples along the roads. The S/W of the EIA drafted in Appendix 11 includes the further evaluation of these negative impacts and the proposal of their mitigation measures.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) Y	(a) Since tourists may happen to see the construction sites for the installation of transmission, distribution and service pipes, it is important to minimize the disturbance to the landscape around the construction sites. The method and schedule of pipe installation should be considered carefully especially near or within the target hotels because the disturbance of landscape may damage the satisfaction of tourists at the hotels. These aspects should be further examined in the EIA.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	(a) N	(a) Bali Aga, the indigenous people of Bali, live in Trunyan Village and Tenganan Village in the eastern part of Bali Island and Sembilan Village in the north. Since the reclaimed water supply project targets the hotels in Southern Bali, it does not have negative impacts on the indigenous people.

Table 14.6.1 Environmental Checklist (4/4)

Cate-gory	Environ-mental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) - (b) - (c) - (d) -	The answers to these four questions regarding working conditions need to be confirmed in the EIA. The S/W of the EIA drafted in Appendix 11 includes the confirmation of these points.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) - (b) Y (c) Y	(a) The answers to this question needs to be confirmed in the EIA. The S/W of the EIA drafted in Appendix 11 includes the proposal of mitigation measures to reduce impacts during the construction. (b) The construction of the proposed water reclamation plant requires the clearing of mangrove and leveling of over one hectare of land. Although the mangrove forest to be cleared does not include any habitats for rare or endangered species, mitigation measures (offset and set-aside) including the handover of compensation land to the Ministry of Forestry should be considered in the EIA (see 14.4.4【1】 and 10.d【1】of Appendix 10). (c) Social impacts of the construction include the traffic disturbance caused by the installation of pipe and the disturbance to the residents along the roads caused by the noise, vibration and air pollution due to the transportation of construction machinery, material and wastes. The proposed mitigation measures for the traffic disturbance are explained in 14.4.4【2】 and 10.d【2】of Appendix 10.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) - (c) - (d) -	(a) In the EIA, reports need to be prepared separately for environmental monitoring plan and environmental management plan. The environmental items which may need monitoring are listed in the draft TOR of the EIA shown in Appendix 11 (i.e. water quality, traffic, noise, vibration and air pollution). As for (b), (c) and (d), parameters to monitor, method, frequency, monitoring framework, regulatory requirements, and format and frequency of reporting should be decided in the EIA. A tentative monitoring plan for the reclaimed water quality control was drafted in this preparatory survey (see 14.4.5 and 10.e of Appendix 10). This tentative monitoring plan should be revised in the EIA.

CHAPTER 15

EVALUATION OF THE PROJECT

CHAPTER 15 EVALUATION OF THE PROJECT

15.1 Operation and Effect Indicators

The proposed project is systematically examined according to a set of operation and effect indicators, shown in the document "Reference Operation and Effect Indicators (2nd Edition)" revised by JICA (Development Sector Division of the Project Development Department of JBIC at that time) in October 2011. These could be used to evaluate how the project is performing and its success in achieving the intended outcomes.

15.1.1 Definitions of Indicators and the Subcategories

The document "Reference Operation and Effect Indicators (2nd Edition)" provides the definitions for operation and effect indicators as follows.

Operation Indicators: Indicators to quantitatively measure the utilization and maintenance status of the facilities.

Effect Indicators: Indicators to clarify the project objectives and expected effects and quantitatively measure achievements.

The operation and effect indicators can be divided into basic and supplementary indicators. Basic indicators look at outcomes that are directly related to the fundamental operations and the main target objectives and the data for these are usually easy to collect. Supplementary indicators would reflect outcomes that are specific to the unique characteristics and components of the project, and usually require more effort in terms of data collection and manipulation.

Section 15 of the document (Draft) Water Supply Operation and Effect Indicators (hereinafter referred to as Reference Water Supply Indicators) is used as a reference in the selection of operation and effect indicators and sorting of these into basic and supplementary categories.

15.1.2 Operation Indicators

(1) Selection of Operation Indicators

Reference Water Supply Indicators shows the following operation indicators.

Basic Indicators: Served Population, Amount of Water Supply, Facility Capacity Utilization Rate, Non-Revenue Water Ratio, Accounted-For Water as Percent of Total

Supplementary Indicators: Leakage Rate, Quantity of Water Intake, Water Quality

The suitability of these indicators for this project is considered in the following paragraphs.

The proposed reclaimed water supply project targets resort hotels and does not serve domestic customers. The project assumes that the amount of PDAM water, equivalent to the amount of the reclaimed water supplied to the hotels, will be available for domestic customers. Based on the assumption, the hypothetical domestic population served can be calculated from the amount of the reclaimed water supply. This hypothetical domestic served population is more suitable as an effect indicator than as an operation indicator.

The Special Purpose Company (SPC) supplies the reclaimed water in bulk. The amount of reclaimed water transmitted and supplied could be an operation indicator showing the level of utilization of the facilities and their performance.

The Facility Capacity Utilization rate could be an operation indicator showing the level of utilization of facilities such as reclamation plant and transmission system.

Non-Revenue Water Ratio, Accounted-For Water as Percent of Total and Leakage Ratio can be operation indicators for understanding the operation and maintenance status of the reclaimed water distribution and retail supply which are under the responsibility of PDAM. However, these indicators are not suitable for understanding the operation and maintenance status of SPC's bulk supply as explained earlier.

Quantity of water intake is the amount of the secondary effluent supplied to the reclamation process in the Project, to confirm enough amount of the secondary effluent is supplied to the reclamation process. Insufficient amount of the secondary effluent could cause operation problems, thus this could serve as a suitable operation indicator enable to know the performance and operational conditions.

The quality of the raw water (treated effluent from the wastewater plant) and the reclaimed water should meet the Indonesian water quality standards. The degree of the compliance is selected as an operation indicator to measure the performance and maintenance status of the facilities.

Based on the above discussion, the following parameters are selected as operational indicators: the amount of the secondary effluent supplied, the amount of reclaimed water transmitted and supplied, the Facility Capacity Utilization rate, and water quality. These are further explained in the following paragraphs.

(2) Sorting into Basic and Supplementary Indicators

The following shows the classification of the operational indicators and the reasons for the classification.

Basic Indicators：Amount of the Reclaimed Water Supplied, Facility Capacity Utilization Rate
Supplementary Indicators: Amount of the Secondary Effluent Supplied, Water Quality

The amount of the reclaimed water supplied and the facility capacity utilization rate are selected as basic operation indicators because the amount of the reclaimed water supplied is a basic value for operation and maintenance and the facility capacity utilization rate can be easily calculated by comparing the actual amount of the reclaimed water supplied to its planned amount.

The amount of the secondary effluent will be used as a supplementary indicator because it reflects the supply conditions of raw water but shows indirect impacts on the operations when this supply becomes a problem.

Tests on the quality of the secondary effluent and the reclaimed water are carried out periodically. The frequency of the water quality tests is limited. Therefore, water quality would be used only as a supplementary indicator.

15.1.3 Effect Indicators

The Reference Water Supply Indicators (Draft) lists the following effect indicators.

Basic Indicator: Coverage of Water Supply

Supplementary Indicators: Water Supply Amount per Capita per Day, Coverage of Water Supply in the Administrative Area, Amount of Ground Subsidence, Revenue Collection

The suitability of these indicators to this bulk reclaimed water supply project is considered in the following sub-sections.

(1) Selection of Effect Indicators

As explained in the earlier section on operation indicators, the hypothetical domestic population served is selected as an effect indicator.

Percentage of estimated increase in the coverage of water supply as a population ratio can be calculated by dividing the hypothetical domestic served population by the population in the project implementation area. This percentage of estimated increase in the coverage of water supply is also selected as an effect indicator.

Since the reclaimed water supply project does not target domestic users, the water supply amount per capita per day cannot be an effect indicator. The water supply amount per capita per day is not necessarily increased by the increase in the reclaimed water supply amount. Therefore, the water supply amount per capita per day is not selected as an effective indicator of the project.

The main concerns regarding groundwater in the target areas are groundwater depletion and salt water intrusion, but not ground subsidence. Therefore, amount of ground subsidence is not selected as a supplemental effect indicator.

It is assumed that the contracting agency, Bali Provincial Government, pays a fee to the SPC based on the contract which guarantees the purchase of a fixed amount of the reclaimed water. Therefore, the revenue collection of the reclaimed water bulk supply cannot be an operation indicator. On the other hand, PDAM Badung would charge the hotels for their use of reclaimed water. The collected revenue, which increases as the distribution amount increases, can be an operation indicator for PDAM Badung but not for the bulk reclaimed water supply project.

However, the ratio of the actual amount of reclaimed water supplied (operation indicator) to the planned amount can be used as an effect indicator since it shows the achievement of the project objective.

The ratio of the reclaimed water to the total amount of water used at the hotels, which can be calculated based on the amounts of PDAM water, reclaimed water, groundwater, etc. used at the hotels, can be another effect indicator for PDAM Badung. Again, this ratio cannot be used as an effect indicator for the bulk reclaimed water supply project as explained earlier in the case of the revenue collection.

Consequently, the following parameters are selected as effect indicators for the project:

- Hypothetical Domestic Served Population,
- Percentage of Estimated Increase in the Coverage of Water Supply and
- Ratio of the Actual Amount of Reclaimed Water Supplied to the Planned Amount.

The first and second indicators are set for both the project implementation area and the administrative area.

(2) Sorting into Basic and Supplementary Indicators

Although Hypothetical Domestic Served Population is a direct effect indicator of the project, it requires the measurement and calculation of the amount of domestic water supply per capita per day at a certain time. Therefore, this indicator is classified as a supplementary indicator.

Percentage of Estimated Increase in the Coverage of Water Supply is also classified as a supplementary indicator because this indicator is an indirect effect indicator.

Ratio of the Actual Amount of Reclaimed Water Supply to the Planned Amount, which shows the achievement of the project, is easy to calculate. Therefore, this effect indicator is classified as a basic indicator.

15.1.4 Target Values of the Operation and Effect Indicators for the Project

Tables 15.1.1 and 15.1.2 show the selected operation and effect indicators of the reclaimed water supply project and their calculation methods and target values.

Table 15.1.1 Operation Indicators of this Reclaimed Water Bulk Supply System (Draft)

Category	Indicator Name	Calculation Method	Target Value	Purpose	Note
Project Implementation Area					
Basic Indicator	Amount of the Reclaimed Water Supplied (m^3/day)	Based on daily average flow the records for water supply (transmission) ＜on a yearly basis＞	41,00 m^3/day (Case 1) 82,00 m^3/day (Case 2)	To understand the basic operational state of the reclaimed water bulk supply project	This is also used to calculate a basic effect indicator
	Facility Capacity Utilization Rate (%)	Facility Capacity Utilization Rate of facilities (at the average supply amount) ＜on a yearly basis＞	100 %		To be applied to the reclamation and transmission facilities
Supplementary Indicator	Intake Amount of the Secondary Effluent (m^3/day)	Based on the records of daily average intake flow ＜on a yearly basis＞	Amount of the Reclaimed Water Supplied (m^3/day) plus water loss in the reclamation process	To evaluate the state of raw water securement	
	Water Quality	According to the water quality standards for sewage effluent ＜on a yearly basis, a monthly basis, seasonal basis, etc.＞	The limit values set in the water quality standards on sewage effluent.	To evaluate the adequacy of raw water quality and impacts on the water reclamation treatment process	
		According to corresponding water quality standards related to the planned uses of the reclaimed water ＜on a yearly basis, a monthly basis, seasonal basis, etc.＞	The limit values set in the water quality standards related to the planned uses of the reclaimed water for Case 1 and Case 2, respectively.	To evaluate the O&M state of the reclamation facilities	

Table 15.1.2 Effect Indicators of this Reclaimed Water Bulk Supply System (Draft)

Category	Indicator Name	Calculation Method	Target Value	Purpose	Note
Project Implementation Area (Currently PT.TB Service Area)					
Basic Indicators	Ratio of the Actual Amount of Reclaimed Water Supplied to the Planned Amount	Actual amount of the reclaimed water supplied ÷ the planned amount of reclaimed water supply（%） ＜on a yearly basis＞	100%	To understand the level of realizing the plan	
Supplementary Indicator	Hypothetical Domestic Served Population（persons）	Based on the assumption that the amount of PDAM water, equivalent to the amount of the reclaimed water supplied to the hotels, will be available for domestic customers. Dividing the amount of the reclaimed water supply by the per capita water consumption of the project implementation area.	About 18,400 persons equivalent (=3,700/0.201) for Case 1. About 36,800 persons equivalent (=7,400 / 0.201) for Case 2.	To understand the state of producing general effects of the reclamation project	Present per capita water consumption in PT.TB area is about 201 lpcd.
	Percentage of Hypothetical Increase in the Coverage of Water Supply	（Hypothetical Domestic Served Population）÷ (Population in the Project Implementation Area）×100	About 18% (= 18,400 / 102,727 x 100) for Case 1. About 36% (= 36,800 / 102,727 x 100) for Case 2.	Same as above	Total Population in PT.TB area in 2010 is 102,727
Administration Area（Southern Supply Area of PDAM Badung）					
Supplementary Indicator	Hypothetical Domestic Served Population (persons)	Base on the assumption that the amount of PDAM water, equivalent to the amount of the reclaimed water supplied to the hotels, will be available for domestic customers. Dividing the amount of the reclaimed water supply by the per capita water consumption of the project implementation area.	About 25,350 persons equivalent (= 3,700 / 0.146) for Case 1. About 50,700 persons equivalent (=7,400 / 0.146) for Case 2.	Same as above	Present per capita water consumption in PT.TB area is about 146 lpcd.
	Percentage of Hypothetical Increase in the Coverage of Water Supply	（Hypothetical domestic serviced population ）÷（population within the administration area）×100	About 7% (= 25,350 / 384,153 x 100) for Case 1. About 14% (=50,700 / 384,153 x 100)	Same as above	Total Population in southern service area of PDAM Badung in 2010 is 384,153.

15.2 Risks and Countermeasures during Implementation of the Project

15.2.1 General

The projects may encounter many risks at the various stages during their implementation and operation. These risks are identified below and carefully discussed. It is also discussed what countermeasures are taken to prevent or mitigate each risk and how each risk could be shared among responsible organizations.

Risks to the successful implementation of the projects are as follows:

- Land Acquisition Risk
- Design & Construction Risk
- Environmental Risk
- Off-take Risk
- O&M Risk
- Inappropriate Water Use Risk
- Financial Risk
- Accident & Disaster Risk
- Law & Regulation Change Risk

15.2.2 Risks and Countermeasures in the Projects

(1) Land Acquisition Risk

Land acquisition risk is if the land can be obtained without any delay for the Projet. The proposed site for the reclamation plant is part of the mangrove forest, adjacent to the Denpasar WWTP, which is under the control of the Ministry of Forestry.

This reclaimed water bulk supply project needs to receive permission from the Ministry of Forestry to use the land before the signing of the PPP contract. Any delay in securing this land would jeopardize the signing of the PPP contract.

To facilitate the timely procurement of the land use permit, the relevant government entities need to recognize this project as a public private partnership and follow the prescribed procedures. The strengthening of coordination among them is also required for implementing the project. If the land securement is delayed, efforts are required to minimize the negative impacts caused by the delay in the start of project implementation. If the financial profitability of the project is compromised due to the delay, extension of the BOT period, compensation of the financial loss by the Ministry of Finance, etc. may be considered and would require presidential decree.

(2) Design & Construction Risk

As design & construction risk, technology risk, construction completion risk and related infrastructure and utility risk are discussed for the proposed Project.

1) Technology Risk

The technology risk is such a risk, when inappropriate technology is applied the project may not be able to perform the original planned functions.

Main technical risk would be if the reclaimed water produced by the proposed reclamation process could be supplied stable and satisfy the water quality standards required for the targeted uses. In Case 2 Project, the reclaimed water to be used for skin contact such as bathing and showering, it is essential to establish water quality control and monitoring system and execution of proper operation to secure the safety of the reclaimed water. In the process of preparing the PPP contract, the contracting agency, BLUPA and SPC should clarify the reclaimed water quality standards and effluent quality stanadards of Denpasar WWTP. The PPP contract between contracting agency and SPC should states clearly that SPC will provide the reclaimed water satisfying the reclaimed water quality standards clarified and the contracting agency and BLUPAL will provide the treated wastewater (effluent) of the Denpasar WWTP meeting the effluent quality standards.

The transmission, distribution and supply facilities and equipment involve common practices with which PDAM and the hotels are very familiar. Therefore, once these facilities are properly designed and constructed, their operation and maintenance, with regular inspections, should pose no special challenges. However, it is necessary to emphasize the need for regular inspection and preventive and corrective maintenance of the rehabilitated distribution mains and to prepare for emergencies of any kind.

2) Construction Completion Risk

There is always the risk that the construction is not completed within the originally planned period or budget or that the capacity of constructed facility does not meet its required capacity.

There are two steps of construction completion of a project, mechanical/physical completion and operational completion when the project meets certain operational conditions. The EPC contractor would be responsible for conducting inspections and tests to verify these completions.

There are certain precautions that can be taken to avoid delays and unsuccessful completion of the project and to mitigate the negative impacts if such problems arise.

a. Selecting a competent EPC contractor with lots of knowledge, experience and a superb track record would be an excellent start.
b. By clearly stating the construction completion date in the contract (a date-certain construction contract) could clarify and confirm expectations and minimize the possibility of delays.
c. However, if a delay occurs, it would be useful if there is a contingency plan as well as budget in place to deal with the fallout.
d. It is also advisable to stipulate the warranty and liquidation damages in the contract, as well as taking out adequate insurance against accidents and disasters related to the transportation of equipment and the construction of facilities.

These are further explained in the following paragraphs.

The involvement of METAWATER Co., Ltd. as a JV partner and EPC contractor is expected to assure competent implementation of the design and construction of the reclamation treatment facilities and mechanical and electrical facilities. Other facilities such as civil and architectural structures and transmission pipelines can be constructed by a contractor which has sufficient experiences in constructing water supply facilities of similar size in Southeast Asia. The financial background and stability of the EPC contractors should be examined during the bidding qualification process to avoid defaults caused by any financial difficulties they may have.

The contract with the EPC contractor should specify that the EPC contractor would take the sole responsibility of handing over, by a specified construction completion date, the constructed facilities to the SPC on behalf of the consortium of contractors. The facilities would have been constructed within the fixed budget specified in the contract and be handed over in the condition that the facilities are ready to operate at full capacity immediately (i.e. turn-key ready).

Construction cost overruns should be anticipated and sufficient contingency put in place. Physical contingency, which is required for coping with changes of facility specifications and additional costs, is usually set between 5% and 10% of original construction costs. The physical contingency is set at 10% in the estimation of construction costs for the project.

By going with a fixed-price or lump sum contract, there appears to be more control on the costs and less risk of cost increase from the perspective of the buyer.

3) Risks related to Infrastructure and Utility Failures

The infrastructure and utilities required for the project include electricity, water supply, telecommunication, access roads, etc. If the facilities and equipment are not properly installed in a timely manner, the completion of the project and the operation of the facilities would be compromised.

It is important to coordinate with the relevant government agencies and complete the required permit applications to avoid any delay. It is also preferable to stipulate in the contract the monetary compensation to the SPC, if the issue of permit is delayed even though the application is submitted appropriately.

(3) Environmental Risks

Environmental adverse impacts and mitigation measures have been discussed in the previous section 14.4. In the followings, the risks which may hinder the smooth implementation and approval of the EIA on the Project will be discussed as an environmental risk.

In the reclaimed water supply project, the EIA will be conducted after the signing of the PPP contract. If the approval of the EIA is delayed, the operation period of the project during which revenue can be collected become shorter than the BOT period of 25 years, the financial integrity of the project could be compromised. For this reason, the risk related to the EIA is important from the financial aspect as well as environmental and social aspects.

In the project implementation plan, it is planned that the hotels' demand for reclaimed water and guests' cultural acceptance should be confirmed during conducting promotion activities before signing the PPP contract. In case of Case 2, the mixing ratio between the reclaimed water and PDAM water should be also discussed with the hotel's representatives during promotion and demand confirmation activities among parties concerned. The resulted hotels' demand and guests' cultural acceptance would be reviewed during the EIA process. It would take longer period for Case 2 to get hotels' and guests' acceptance to the reclaimed water supply. Any non-resolution of these issues may delay the EIA process.

At the time of the preparatory survey, it was not established Indonesian water quality standards (existing or new) should be applied to the reclaimed water. It would be easier for Case 1 to establish the water quality standards to be applied, because existing water quality standards for toilet flush purposes, i.e. Japanese Reclaimed Water Standards, could be used for establishing the Indonesian reclaimed water quality standards. But for the Case 2, it would be more difficult to establish the reclaimed water quality standards for touching skin purposes such as bathing and showering, because such reclaimed water use purpose are still challenging in the world.

The Health Agency of the Bali Provincial Government and other stakeholders are of the view that the existing Indonesian clean water standards should be applied to the reclaimed water. The existing Indonesian water quality standards for pool and public bath are used for the reclaimed water on a provisional basis, while the Japanese Ministry of Land, Infrastructure, Transport and Tourism is working with the Indonesian side to resolve this issue.

The confirmation of the water quality standards to be applied and the technical guarantee of continuous compliance with the applied water quality standards should be clarified in the PPP contract. If not, this would have to be dealt with in the EIA process and thus may cause delays. It would be more difficult for Case 2 to confirm the water quality standards and the technical guarantee of continuous compliance with the applied water quality standards.

The land use permit for the proposed site of the reclamation plant should be obtained from the Ministry of Forestry before the signing of the PPP contract. If the land use permit cannot be obtained before the start of the EIA, the completion of the EIA process would be delayed.

In case of this reclaimed water supply project, the responsibility of implementing the EIA will be transferred from the contracting agency (DINAS PU/Bali Provincial Government, is assumed) to the SPC at the signing of the PPP contract. The contract agency needs to disclose information on this project and gather public opinions, prepare a draft KA-ANDAL (which consists of TOR and Implementation Plan of the EIA) based on the collected opinions and submit the draft KA-ANDAL to the environmental management agency (BALH) of the Bali Provincial Government before the signing the PPP contract. If these tasks are delayed, the SPC's start of the EIA implementation after the signing of the PPP contract would be delayed. To avoid any delay, the environmental consultants, hired by the SPC to conduct the EIA, should assist with the tasks of the contracting agency including the preparation of the draft KA-ANDAL.

Problems that may be encountered during the EIA process include, 1) the risk of accidental ingestion of the reclaimed water cannot be evaluated quantitatively; 2) appropriate water quality control and monitoring system cannot be established; 3) understanding and support of the residents on the installation of transmission and distribution pipes cannot be obtained; and 4) the tariff for the reclaimed water supply cannot be set by consensus from the hotels. Therefore, obtaining further understanding of the stakeholders on the project is important in avoiding the delay of the project implementation and reducing the social risks such as conflict with the residents.

(4) Off-take Risk

The reclaimed water produced may not be purchased by PDAM as stipulated under the contract terms, with no fault on the part of the SPC. This would directly compromise the financial viability of the project.

The best mechanism to minimize this off-take risk is to clarify the transaction responsibility (take or pay) in the contract and to provide financial or other types of compensation, with the Financial Minister’s approval in accordance with the presidential decree, when the transaction is not implemented in violation of the contract terms.

The contracting agency, Bali Provincial Government, would take responsibility for the off-take risk of reclaimed water supply project. The contracting agency makes a purchase contract with PDAM Badung.

PDAM Badung would also add this purchase contract to their sales contract with hotels where the reclaimed water is supplied.

Hotels should also agreed the following terms:
For Case1, to construct additional service pipe system to each room to provide the reclaimed water as a toilet flushing water, including preparation of their own budget for the construction.
For Case 2, to construct a new service pipe system to provide drinking, cooking and dish-washing water to restaurants, bars and other kitchens in hotel premises by their own budget, and to conduct the staff training, any preventive measures and activities, emergency measures to the hotel customers.

(5) O&M Risks

The risks associated with the failure of infrastructure and utilities is already explained in (2) 3). The other risks affecting the operation and maintenance of the project involves securing adequate raw water and having sufficient capability.

1) Failing to Secure Adequate Amount of Raw Water

There may be the possibility that the raw water (the secondary effluent from the WWTP in case of this project) of sufficient quality and quantity required for the operation cannot be secured as planned.

Measures to minimize this risk include a) obtaining confirmation and guarantee from the Bali Provincial Government and its agencies on their support of the project; and b) to structure the PPP contract to better allocate or minimize the risks. For example, a put-or-pay contract for a long period can be made between the supplier of the raw water and the SPC.

2) Insufficient Capability

The operations could be scaled back or running inefficiently because of the shortage of qualified and experienced operators. A close attention on water quality control and monitoring is required for the Case 2 Project to secure the safety in use of the reclaimed water. Detail discussion on this matter will be discussed in the following inappropriate water use.

Countermeasures against this risk are a) establishment of reclaimed water quality monitoring system as well as conducting education and training programs as preventive and emergency measures by SPC, b) reservation of sufficient internal deposit for daily operation and maintenance works and periodical extensive inspection for repair., and c) taking out insurance policy against profit loss for reasons including delays in acquiring the required staff complement, as well as accidents and disasters.

(6) Inappropriate Water Use

In Case 1, the reclaimed water is supplied separately from the PDAM water supply system completely. If any cross connections between the reclaimed and the PDAM water systems could be avoided by a proper construction with careful inspection, the inappropriate water use could be happened or protected. To avoid the cross connections, careful inspection to the construction of reclaimed water transmission pipe and hotels' service pipe systems with protection measures such as confirmation of proper pipe connections using tracers.

While for Case 2 reclaimed water supply, the reclaimed water (more specifically the mix of the reclaimed water and PDAM water) could be used unintentionally and inappropriately for religious practices, direct drinking, drinking after boiling (including the use for coffee, tea, etc.), cooking and mouth washing (including the use for brushing teeth and gargling). The inappropriate use and mitigation maeasues are discussed in the following.

The hotels usually provide complementary free water bottles in the guest rooms for drinking, etc. After they start using the reclaimed water for non-drinking purposes, they could increase the supply of bottled water or install large water dispensers in the guest rooms. Further measures should include placing the water dispensers at convenient locations, such as next to the sink in the bathroom, providing dispensers for hot water for making coffee, tea or instant noodle.

Hotel guests come from all over the world. They speak different languages and have various customs. The children among them are less aware of precautionary measures. Workers on the premises are also exposed to the use of the reclaimed water. Extra effort should be made to notify everyone thoroughly well about the appropriate uses of the reclaimed water. Notices with clear illustrations must be posted in the guest rooms and common areas (e.g. toilets at pools and lobby).

On the supply side, a comprehensive quality control and monitoring program to test on a regular basis, the quality of water from the beginning of the treatment process to its final delivery to the guest rooms, would provide assurance on the water quality. The residual chlorine concentration in the receiving tanks for the reclaimed water should be kept within a suitable range by adjusting the amount of chlorine injection at the reclamation plant, to control against pathogenic microorganisms.

Contamination by heavy metals is expected to be low because the raw water for the reclaimed water treatment process does not contain much industrial effluent. Nevertheless, it is advisable to monitor the effluents from factories. In the unlikely event that the reclaimed water contains trace amounts of heavy metal or organic substances, any exposure or accidental ingestion by the guests would only be for a short period during their hotel stay. But detail investigation will be required to confirm that this risk. The risk for hotel employees exposed to the reclaimed water for longer periods would be averted if they are well informed and trained on reclaimed water uses.

Other than inappropriate uses, there is a risk of cross-connection between the service pipes for the reclaimed water (more specifically the mixed water of the reclaimed water and PDAM Water) and the service pipes exclusively for PDAM Water. This could result in long term inappropriate use of the reclaimed water, resulting in health issues and loss of trust by guests and employees. Therefore it is critical that the modification of the service pipe system in the hotels be vigilantly supervised and the installed pipes checked thoroughly using tracers.

It is important to have the water quality data from the quality control and monitoring program always ready in hand, when it becomes necessary to evaluate the health impacts of inappropriate uses of the reclaimed water. The concentration of heavy metals and persistent organic substances in the secondary effluent from the Denpasar WWTP should also be established before the signing of the PPP contract. It is also important to measure these concentrations periodically during the operation period of the reclaimed water supply.

Further discussions may be required on other possible inappropriate uses of the reclaimed water, such as for washing open wounds, eyes, etc.

(7) Financial Risk

Exchange risks are 1) risks due to exchange rate fluctuation and 2) risks on conversion to foreign currencies and transfer to abroad.

The “risks due to exchange rate fluctuation” may arise a) at repayment of each installment of the loan (principal and interest) to the bank in Yen or other foreign currencies and b) with regard to the capital invested to SPC in foreign currency (Yen).

As studied in Chapter 11, exchange risk of a) will arise in relation with the loan from Bilateral or Multilateral Agencies including JICA of which terms and conditions are quite attractive only except for the currency of repayment in Yen or other foreign currencies. In order to repay the debt, SPC have to buy Yen or other foreign currencies from Indonesian banks by selling IDR which SPC earn by reclaimed water sales.. Exchange rate at each repayment would not be same the exchange rate at the time of loan agreement. This is the exchange rate fluctuation risks at the time of repayment.

Exchange risk of b) is related to equity of foreign shareholders which will be transmitted from abroad in foreign currency and will be booked and kept in IDR in the Balance Sheet of SPC since foreign currency will be automatically exchanged to IDR by Indonesian banks.

Exchange rate fluctuation risk can be hedged by exchange rate reservation. However, both exchange risk of a) and b) will arise through whole period of 25 years. It is extremely difficult to find anyone who may accept

such long term exchange rate reservation. Fluctuation factors of exchange rate are various and complicated. There are no materials to judge how much allowance should be required in minimum to mitigate exchange risks. Sometimes, due to exchange fluctuation, unexpected profit may happen to be gained. It is nearly impossible to predict future exchange fluctuation and its magnitude, positive or negative.

In the meanwhile, this Wastewater Reclamation project is assumed to be developed under PPP framework. It is appropriate that the exchange rate fluctuation risk should be shared by Public and Private. That is, the merit brought by low interest rate and longest repayment period of the loan are returned to Public through the sales price of Reclaimed water. It seems reasonable that exchange rate fluctuation risks should be shared by and between Public and Private.

The manner of sharing the exchange rate fluctuation is proposed in Chapter 11, Section 11.2.2, Clause (2)-2). It is practicable and appropriate that parameter of the exchange rate fluctuation should be added to the sales price adjustment formula to reflect the exchange rate fluctuation and also, by determining the percentage of this parameter in the sales price adjustment formula, share of the risks by each party can be defined.

Exchange risk of b) can be mitigated by pre-agreement between the shareholders with regard to distribution of the assets at the time of dissolution of SPC and assets management during SPC operation. This exchange risk is the risk of shareholders only and should be discussed and determined by them.

The above 2) risks of conversion from IDR to foreign currencies and transfer to abroad are assumed to be guaranteed by IIGF as illustrated in Chapter 3, Section 3.2.2, Figure 3.2.4 “IIGF – Currently Available Guarantee Structure” . It is understood that, in case this Wastewater Reclamation project is implemented under PPP framework, conversion to foreign currencies and transfer of the foreign currencies to abroad are assured by IIGF.

Interest rate risk will not arise under the present finance arrangement. Whole amount of the debt is planned to borrow from JICA under PSIF and its interest rate is fixed during 25 years period.

Inflation risk is related to increase of O&M cost which will be caused by increase of electricity tariff, consumer prices and wages. As shown in Table 11.4 in Chapter 11, in order to mitigate inflation risk, it should be agreed upon that bulk sales price should be subject to price adjustment by reflecting change of electricity tariff, consumer prices and wages.

(8) Accident & Disaster Risk (Force Majeure Risk)

Accidents and natural disasters could damage the reclaimed water facilities and affect their operations.

Adequate damage insurance coverage, preferably at full replacement value, would protect against losses. It is important to choose a reputable insurance company. If there is a stipulation on using a local insurance company, it is worth exploring whether joint coverage with a foreign firm could be allowed.

Risk sharing with the Bali Provincial Government and related entities. For example, the Bali Provincial Government may accept the disruption of the project caused by natural disasters, without imposing any penalty on the SPC or may provide various supports to the project.

(9) Changes to Laws & Regulations

Changes to laws and regulations may have impacts on the project. Followings are the risks to consider.

1) Legal−Permission
The Indonesian laws and regulations that pose restrictions on money exchange and money transfer may change and insuring against these changes would minimize any losses. .

2) Expropriation−Requisition−Nationalization
Changes to the laws and regulations on Expropriation−Requisition−Nationalization could allow the Indonesian Government, Bali Provincial Government or other related entity to take over the reclaimed water bulk supply project as a national property.

3) Government Contract Violation
Bali Provincial Government or its agency may violate the terms of the PPP contract. Since this risk is not foreseeable for the SPC, the Indonesian Government needs to take responsibility against the risk and guarantee the SPC compensation for loss through PT PII with Presidential decree.

15.2.3 Sharing of Risks

(1) Basic Policy

In order to make infrastructure project more efficient and effective, Article 16 of Presidential Decree No.67/2005 explains that based on the concept of risk sharing between public and private entities, the party more capable of managing the risk would take responsibility for it.

(2) Proposal for the Risk Sharing

The following table summarizes the risks and their preventive measures and the sharing of these risks. In the table, the party mainly responsible for each risk is marked with ◎ and the party partially responsible is marked with ○.

Table 15.2.1 Main Risks, Preventive Measures and Sharing of Risks

Category	Risk	Preventive measures	Risk Sharing		
			GM	SPC	PD AM
(1) Land Acquisition	Land Acquisition	• Timely and proper procedures in application to acquire the land. • Reductions in project revenue due to the delay in starting the project is compensated with government guarantee (PT PIIa).	◎		
(2) Design & Construction	Technology	• To adopt tried-and-true technologies having past operational records		◎	
	Construction Completion	• EPC contractor should have sufficient experiences of constructing reclamation plants and installing transmission pipes. • The construction contract should use a contract type which put comprehensive responsibilities on EPC contractor.		◎	
		• PDAM Badung takes responsibility for the rehabilitation of the existing distribution reservoir and network and the installation of new distribution pipes.			◎
	Related Infrastructure and Utility	• Additional electric power transmission line should be installed by the local power company （Indonesian Power） • Piped water needs to be supplied by PDAM Badung.	◎		
(3)Environmental	Environmental	• The reclaimed water demand and the capability of meeting the target water quality of the reclaimed water continuously in the long term should be confirmed before the signing of the PPP contract so that the EIA process and the acquisition of environmental license can be done smoothly. • Compliance of the local water quality standards	○	◎	
		• To establish the water quality standards for reclaimed water use	◎		
(4) Off-take Risk	Off-take Risk	• Off-take Risk should be clarified in the contract. • Loss should be compensated financially or in other form based on government guarantee.	◎		
(5) O&M Risk	Raw Water Securement Risk	• The contract should clarify that the secondary effluent having sufficient quantity and quality should be continuously and stably provided to SPC for the contracted period.	◎		
	Insufficient Capability Risk	• O&M Company established with foreign sponsor’s fund should include skilled staff from local water or sewerage utilities having experiences in wastewater reclamation.		◎	○
(6) Inappropriate Water Use Risk	Inappropriate Water Use and Accidental Ingestion Risk (for Case 2 Project only)	• Designed usages of the tap water mixed with the reclaimed water should be informed thoroughly by using notification boards and illustrations. • To provide additional free water bottles and/or install water dispensers (including those with hot water supply function)		◎	
		• To keep the concentration of residual chlorine at a suitable range at the reclaimed water receiving tanks to be installed at the hotels.			◎

Category	Risk	Preventive measures	Risk Sharing		
			GM	SPC	PDAM
		• To establish a comprehensive water quality monitoring system from sewage to the reclaimed water.		◎	○
(7) Financial Risk	Currency Exchange Risk	• Forecasting (will arise or not, its magnitude) is difficult. Pre-agreement should be concluded how to share when it arise.	◎	◎	◎
	Inflation	• Bulk sales price should be subject to price adjustment by reflecting change of electricity tariff, consumer prices and wages.	◎	◎	◎
(8) Accident & Disaster Risk	Force Majeure Risk	• To secure reinsurance from an credible international damage insurance company having a good track record.		◎	○
(9) Law & Regulation Change Risk	legal & Permit Approval Change Risk and others	• The loss caused due to political risk should be compensated or redeemed in accordance with the government guarantee (PT PII).	◎		

Additional points which are not included in the above table are as follows:

- Although each hotel is responsible for the modification of service pipe system within the hotel, it is proposed that the Bali Provincial Government and PDAM, which are the competent authorities for the instruction and supervision of this work, should be responsible for the construction completion risk.
- In Case 2 Project, the hotels are responsible for notifying guests and employees of the designed uses of tap water which contains the reclaimed water and provide free bottled water and water dispensers. The SPC and PDAM would guide and supervise these efforts as part of their customer services. Therefore it is proposed that SPC and PDAM should be responsible for Inappropriate Water Use Risk.

15.3 Comparison and Evaluation of Two Cases of Reclaimed Water Use

15.3.1 Outline of Proposed Project for Two Cases of Reclaimed Water Use

Table 15.3.1 Proposed Project Elements

Item	Case 1	Case 2
Service	Bulk Supply of Reclaimed Water to PDAM Badung	Bulk Supply of Reclaimed Water to PDAM Badung
PPP Contract	BOT-25years (Service provision period: 2016 to 2038)	BOT-25years (Service provision period: 2016 to 2038)
Reclamation facility	SPC will construct and operate.	SPC will construct and operate.
Capacity	4,500 m^3/day (Maximum daily flow)	9,000 m^3/day (Maximum daily flow)
Treatment Process	Biological filter + Ozone + Coagulation + UF (Ceramic Filter) + Chlorination	Biological filter + Ozone + Coagulation + UF (Ceramic Filter) + Chlorination
Transmission facility	SPC will construct and operate.	SPC will construct and operate.
Pump	Planned flow: 4,500 m^3/day (Maximum daily flow)	Planned flow: 9,000 m^3/day (Maximum daily flow)

Item	Case 1	Case 2
	Capacity 3.4 m^3/min, 2 units (incl. one on standby)	Capacity 3.4 m^3/min, 3 units (incl. one on standby)
Pipe	Dia. 300 mm, Length 16 km, HDPE Pipes, Pressure pipeline	Dia. 400 mm, Length 16 km, HDPE Pipes, Pressure pipeline
Raw Water	Biologically treated wastewater at the Denpasar WWTP without charge	Biologically treated wastewater at the Denpasar WWTP without charge
Customer of bulk supply	PDAM Badung	PDAM Badung
Designed Supply Volume	4,100 m^3/day (average daily flow), with the breakdown as follows: - Hotels in the Nusa Dua area: 2,120 m^3/day; - Hotels in the Benoa area: 1,100 m^3/day; and - Hotels in the Suwangan area: 830 m^3/day.	8,200 m^3/day (average daily flow), with the breakdown as follows: - Hotels in the Nusa Dua area: 4,240 m^3/day; - Hotels in the Benoa area: 2,200 m^3/day; and - Hotels in the Suwangan area: 1,760 m^3/day.
Designed Usage	3,700 m^3/day (average daily flow), with breakdown as follows: - Hotels in the Nusa Dua area: 1,060 m^3/day; - Hotels in the Benoa area: 1,000 m^3/day; and - Hotels in the Suwangan area: 800 m^3/day.	7,400 m^3/day (average daily flow), with breakdown as follows: - Hotels in the Nusa Dua area: 3,850 m^3/day; - Hotels in the Benoa area: 2,000 m^3/day; and - Hotels in the Suwangan area: 1,600 m^3/day.
Water use purposes and target customer	Toilet flushing, washing gardening etc., mainly. The reclaimed water is planned to provide to existing hotels in the Nusa Dua, Benoa, and Suwangan areas, including hotels planned in near future in the Suwangan and surrounding areas. The reclaimed water is provided mainly for toilet flushing by new reclaimed water service pipe system.	Non-drinking water purposes: bathing, showering, washing, etc., The reclaimed water is planned to provide to existing hotels in the Nusa Dua, Benoa, and Suwangan areas, including hotels planned in near future in the Suwangan and surrounding areas. The reclaimed water is mixed with the PDAM water equally (1:1) at the service pipe system in the hotels. Separate service pipe system for supplying for drinking and cooking water shall be established by the hotels.
Implementation Schedule	Financing, permits and licenses, and PPP contract will be completed in 2013. Construction would be completed in one stage from 2014 to 2015, with the supply of the reclaimed water to start in 2016.	Financing, permits and licenses, and PPP contract will be completed in 2013. Construction would be completed in one stage from 2014 to 2015, with the supply of the reclaimed water to start in 2016.
Construction Cost	Approximately IDR 225.7 billion (approximately JPY 2.05 billion)* in total. Approximately IDR 170.9 billion (approximately JPY 1.55 billion)* for SPC.	Approximately IDR 257.4 billion (approximately JPY 2.34 billion)* in total. Approximately IDR 206.8 billion (approximately JPY 1.88 billion)* for SPC.
Capital Investment by SPC	Approximately IDR 303.3 billion (approximately JPY 2.76 billion)*, including construction cost, engineering service cost,	Approximately IDR 355.5 billion (approximately JPY 3.23 billion)*, including construction cost, engineering service cost, contingencies, VAT, and

Item	Case 1	Case 2
	contingencies, VAT, and interest of loan.	interest of loan.
O&M Cost	Approximately IDR 8.3 billion/year (2016 price). (Approximately JPY 75 million /year)*. The annual O&M costs is estimated based on average annual increase in CPI of 5.3%.	Approximately IDR 11.9 billion/year (2016 price). (Approximately JPY 108 million/year)* The annual O&M costs is estimated based on average annual increase in CPI of 5.3%.
Financing		
Ratio of equity vs. loan	at 30:70	at 30:70
Equity of SPC	Investment is approximately IDR 91.0 billion (JPY 827 million)*. Japanese companies, Indonesian company, and Balinese government agency jointly establish the SPC. Balinese government agency will join the SPC to provide the land.	Investment is approximately IDR 106.7 billion (JPY 970 million)*. Japanese companies, Indonesian company, and Balinese government agency jointly establish the SPC. Balinese government agency will join the SPC to provide the land.
Debt loan	Debt loan is about IDR 212.3 billion (JPY 1.93 billion)*. Foreign loan of bilateral or multilateral agencies under PSIF is expected.	Debt loan is about IDR 248.9 billion (JPY 2.26 billion)*. Foreign loan of bilateral or multilateral agencies under PSIF is expected.
Loan conditions	Period of 25 years including grace period of 5 years	Period of 25 years including grace period of 5 years
	Annual interest rate at 2.5%. Assumed no payment of the interests during the grace period. The interests are incorporated into the original principal.	Annual interest rate at 2.5%. Assumed no payment of the interests during the grace period. The interests are incorporated into the original principal.
	Repayment of interest and principal: 40 semi-annual installments	Repayment of interest and principal: 40 semi-annual installments
Items to exclude to the proposed Project		
Distribution facilities Distribution tank and pipes	PDAM Badung shall rehabilitate the existing reservoir and pipes to be use as distribution facilities of the reclaimed water to the hotels in the Nusa Dua area. It also shall construct new distribution pipes to the Benoa and Sawungan areas. The cost shall be provided by PDAM Budung.	PDAM Badung shall rehabilitate the existing reservoir and pipes to be use as distribution facilities of the reclaimed water to the hotels in the Nusa Dua area. It also shall construct new distribution pipes to the Benoa and Sawungan areas. The cost shall be provided by PDAM Budung.
Water service pipe system in hotels	The reclaimed water service pipe system should be established in the hotels. The service pipe should be installed in each customer's rest room to provide a toilet flush water.	A separate water supply system to provide drinking water to restaurants and bars shall be constructed using their own budget. The free bottled water or water dispensers for drinking would be provided in the guest rooms and other areas of the hotel.

Note: The symbol of * indicates that the JPY price is calculated with the exchange of 1 IDR = 0.00909 JPY, on August 2011.

15.3.2 Comparison and Evaluation of Two Cases

(1) Evaluation Parameters

To compare the two cases, the following evaluation criteria are considered.

1) Technical Aspects
Simplicity of construction and installation of equipment, ease of operation and maintenance, water quality management, reclaimed water quality standards, and risks related to accidental ingestion of non-potable water.

2) Economic Aspects
Total construction cost, Project cost and operation and maintenance cost covered by SPC, and project cost.

(2) Comparison and Evaluation

The results of comparing the two cases are shown in the following table.

Table 15.3.2 Comparison and Evaluation of the Two Cases

Criteria	Case 1: Conventional Reclaimed Water Supply System	Case 2: New Clean Water Supply System
1. Technical Aspects		
1) Simplicity of Construction and Installation	The renovation of service pipes in the hotels is more difficult than the work for Case 1, because new service pipes have to be installed in each guest room to supply the reclaimed water for flushing toilets. The hotel may be required to close the operation by the renovation.	Although the installation of new service pipes to each guest room is not required, an independent service pipe system should be established to supply drinking/cooking for restaurant, bars and necessary places. The new drinking water service pipe system is easier to install because locations where modifications are required will be relatively limited.
2) Ease of O&M	Know-how accumulated in the O&M of the conventional reclaimed water supply system can be used for the O&M for Case 1 Project. Thus appropriate O&M in this case can be easily achieved.	This case is required to provide more safe reclaimed water than that of Case 1, the O&M is difficult and requires accumulation of more sophisticated technical know-how.
3) Water Quality Management	Know-how accumulated in the water quality control and monitoring the	Establishment of water quality management and monitoring system and

Criteria	Case 1: Conventional Reclaimed Water Supply System	Case 2: New Clean Water Supply System
	produced reclaimed water can be used for the O&M for Case 1 Project. An appropriate water quality management in this case can be easier than that of Case 2 Project.	their exact execution are essential to secure safety of the reclaimed water. Preventive measures against accidental ingestion or wrong usage are also required as well as emergency measures.
4) Reclaimed water quality standards	Indonesian reclaimed water quality standards for this case can be developed, refer to Japanese reclaimed water quality standards for different use purposes.	To create the reclaimed water quality standards suitable for bathing and showering requires detailed scientific studies and discussions among stakeholders, because no actual practices for such reclaimed water use purposes. The early creation of the standards is difficult.
3) Risks related to Accidental Ingestion	Risks related to accidental ingestion of the reclaimed water are quite limited as long as there are no cross-connections between the service pipes for reclaimed water and PDAM water.	Preparation and exact execution of preventive measures against accidental ingestion and wrong use of the reclaimed water are pre-requisites for the implementation of the Case 2 Project. But the accidental ingestion and wrong use could not be completely avoided.
2. Economic Aspects		
2.1 Project Cost		
1) Construction Cost	Approximately IDR 225.7 billion (approximately JPY 2.05 billion)* in total. Approximately IDR 170.9 billion (approximately JPY 1.55 billion)* for SPC.	Approximately IDR 257.4 billion (approximately JPY 2.34 billion)* in total. Approximately IDR 206.8 billion (approximately JPY 1.88 billion)* for SPC.
2) Capital Investment by SPC	Approximately IDR 303.3 billion (approximately JPY 2.76 billion)*, including construction cost, engineering service cost, contingencies, VAT, and interest of loan.	Approximately IDR 355.5 billion (approximately JPY 3.23 billion)*, including construction cost, engineering service cost, contingencies, VAT, and interest of loan.
3) O&M Cost	Approximately IDR 8.3 billion/year (2016 price). (Approximately JPY 75 million /year)*. The annual O&M costs is estimated based on average annual increase in CPI of 5.3%.	Approximately IDR 11.9 billion/year (2016 price). (Approximately JPY 108 million/year)* The annual O&M costs is estimated based on average annual increase in CPI of 5.3%.
2.2 Project Balance		
1) Sales	1,495,500 m^3/year, for 23 years	2,993,000 m^3/year, for 23 years
2) Price adjustment	Annual increase or variation rates in water supply price, chemicals, power supply, and CPI are taken into account for the	Annual increase or variation rates in water supply price, chemicals, power supply, and CPI are taken into account for the

Criteria	Case 1: Conventional Reclaimed Water Supply System	Case 2: New Clean Water Supply System
	adjustment.	adjustment.
3) other specific conditions	O&M cost will be increased based on annual increase rate of 5.3% in CPI. Corporate tax of 25%, but no apply for initial 5 years.	O&M cost will be increased based on annual increase rate of 5.3% in CPI. Corporate tax of 25%, but no apply for initial 5 years.
2.3 Financial Analysis		
1) Evaluation criteria	Financial parameter of Equity IRR >15%, and Minimum DSCR (Debt Service Coverage Ratio) >1.2 are applied to minimum requirements for showing financial feasibility.	Financial parameter of Equity IRR >15%, and Minimum DSCR (Debt Service Coverage Ratio) >1.2 are applied to minimum requirements for showing financial feasibility.
2) Analysis Results	To satisfy the above financial evaluation criteria, one of the following results should be accepted: - Reclaimed water bulk supply price of 19,300 IRD /m^3 (at 2016 price) - About 54% of total construction cost is covered by a public financial assistance (VGF), in case of the price of 12,000 IRD /m^3 (at 2016 price)	To satisfy the above financial evaluation criteria, the reclaimed water bulk supply price of 12,000 IRD /m^3 (at 2016 price) is accepted.
3) Sensitive Analysis	No sensitive analysis done because the above financial analysis results.	Sensitive analysis has done the following conditions: cost overrun on construction cost of 5% and 10% increase, O&M cost increase of 2%,4%,6%, and exchange rate increase of 1%, 2%, and 3% per year. The results show that the impact except the cost over run of 10% increase are small. The resulted financial indicators are as follows: - Decreases in Equity-IRR are within 0.5% except the case of 10% cost overrun, showing Equity-IRR decrease of 1.5%. - DSCR is maintained more than 1.2.
4) Evaluation	- The price of reclaimed water without public financial assistance is much higher than the affordable price discussed in Chapter 11. - Application of public financial assistance is the matter of Indonesian governments based on evaluation of public benefits generated by the Project.	The reclaimed price of IDR 12,000/m^3 is within 70% of the price range between the PDAM water tariff to hotels and irrigation water tariff with assumption of 10% annual increase. When the price and the sales are guaranteed, the Case 2 Project is financially feasible.
2.4 Economic Analysis		
1) Benefits	The following alternative costs, with the provision of reclaimed water at 4,100 m^3/day, are estimated as the economic benefits. - cost of pumps and power supply to obtain the same amount of water.	The alternative costs, with the provision of reclaimed water at 8,200 m^3/day, are estimated as the economic benefits.

Criteria	Case 1: Conventional Reclaimed Water Supply System	Case 2: New Clean Water Supply System
	- purchase cost of bottled drinking water. - contribution to tourism industries. Benefit: IDR 1,013,400 million	 Benefit: IDR 1,254,144 million
2) Costs	The following items are estimated as an economic cost to require a supply at 4,100 m^3/day. - overall construction cost from reclamation plant to service pipes in hotels. - costs required to install water distribution networks and to connect house connections when the same amount of PDAM water is supplied to domestic users. - O&M costs Cost: IDR 448,752 million	The items are estimated as an economic cost to require a supply at 8,200 m^3/day. Cost: IDR 568,580 million
3) Analysis Results	EIRR: 12.91% Net Benefit: IDR 564,648	EIRR: 13.65% Net Benefit: IDR 685,564
4) Evaluation	Considering intangible benefits, the economic analysis results show the Project has high economic values.	Considering intangible benefits, the economic analysis results show the Project has high economic values.

Table above shows the following results as follows:

In Case 1 Project, the proposed project is not feasible financially due to the reclaimed water demand as low as 3,700 m^3/day with the customers' affordable reclaimed water price range. It is demonstrated that the project could be financially viable when it is covered about more than 54% of total construction cost by a public financial assistance (VGF).

In Case 2 Project, in which the reclaimed water is extended to use bathing and showering purposes, the project shows the financially feasible with the customers' affordable reclaimed water price range. But this project cannot be implemented technically due to following reasons: this extended use purposes have not been practiced so far in Japan and other countries, then the reclaimed water quality standards cannot be established easily, severe water quality monitoring and control are required in the operation of reclaimed water treatment and supply facilities to provide safe reclaimed water, the safety in use of reclaimed water cannot be secured completely, and risks related to accidental ingestion and wrong use cannot be avoided completely.

CHAPTER 16

CONCLUSION AND RECOMMENDATION

CHAPTER 16 CONCLUSIONS AND RECOMMENDATION

16.1 Conclusion

It is concluded that the proposed two projects have different difficulties each to implement because of following issues:

In Case 1 Project, the proposed project is not feasible financially due to the reclaimed water demand as low as 3,700 m^3/day with the customers' affordable reclaimed water price range. It is demonstrated that the project could be financially viable when it is covered about more than 54% of total construction cost by a public financial assistance (VGF).

In Case 2 Project, in which the reclaimed water is extended to use bathing and showering purposes, the project shows the financially feasible with the customers' affordable reclaimed water price range. But this project cannot be implemented technically due to following reasons: this extended use purposes have not been practiced so far in Japan and other countries, then the reclaimed water quality standards cannot be established easily, severe water quality monitoring and control are required in the operation of reclaimed water treatment and supply facilities to provide safe reclaimed water, the safety in use of reclaimed water cannot be secured completely, and risks related to accidental ingestion and wrong use cannot be avoided completely.

16.2 Recommendation

To realize the Case 1 Project as an Indonesian PPP Infrastructure Project, it is necessary to increase the reclaimed water demand and/or to receive any public financial assistance.

First, it is recommended the following three points to increase the demand for Case 1 Project.

- To formulate promotion programs and execute continuous promotion activities on reclaimed water use through deepening the understanding of the stakeholders
- To establish reclaimed water quality standards suitable for the intended uses
- To prepare law and regulations for promoting the introduction of dual pipe system in target hotels, i.e. installation of pipes for providing the reclaimed water

1) To formulate promotion programs and execute continuous promotion activities on reclaimed water use through deepening the understanding of the stakeholders.

Increase in the reclaimed water demand is a most important issue. It is required various promotion activities to obtain the understanding and the support of the stakeholders: the needs of using the reclaimed water in the Southern Bali such as an imbalance between the water demand and water supply; reveal of groundwater problems of depletion and reduction in pollution loads to the seashore; to promote the reclaimed water use for creating a consensus to use the reclaimed water as much as possible. It is highly recommended to prepare promotion programs and to execute continuous promotion activities.

We hope that the pilot reclaimed water treatment plant constructed at the Denpasar WWTP by Metawater Co., Ltd., has played a very important role to provide an opportunity to deepen the understandings on the reclaimed water to be produced by the proposed project.

The groundwater is used in the airport, the power generation plant, the seaport, and hotels in southern Bali. But problems in groundwater such as groundwater depletion and salination are revealed in the Southern Bali. To protect the groundwater problems and to preserve the groundwater as an important water resources for future, it is highly recommended to establish any regulating regal measures in

groundwater use in the southern Bali.

2) To establish reclaimed water quality standards suitable for use purposes

At present any reclaimed water quality standards are not established in Indonesia. It is recommended to establish reclaimed water standards suitable for various use purposes as soon as possible. In order to establish the Indonesian reclaimed water quality standards, the tentative standards set in the Preparatory survey: the Japanese reclaimed water quality standards and the reclaimed water quality standards used by the Tokyo metropolitan government, would be useful.

3) To introduce legislation toward promoting installation of additional service pipe system in targeted buildings for providing the reclaimed water

Reclaimed water users (hotels in the Survey) should install a new reclaimed water service pipe system by their own budgets. It is recommended to introduce legislation toward promoting installation of additional service pipe system in the targeted buildings for providing the reclaimed water as well as establishing a special fund to assist building owners.

Finally, regarding the public financial support (VGF), a possibility to apply VGF to the proposed Case 1 Project seems very low because the final users are not domestic users but hotels of tourism industries, based on the comments of Indonesian central government. The Case 1 Project will provide benefits to the domestic users as well as the direct benefits to the hotels and tourism industries, i.e., the same volume of water to the reclaimed water could be used by the domestic users, and the Case 1Project is expected to contribute the pollutants reduction to the seashore near the Denpasar WWTP. Considering these public economic benefits, the possibility of applying the public financial support should be further discussed as well as promotion of increase in reclaimed water demand.