THE PEOPLE'S COMMITTEE OF KIEN GIANG PROVINCE
THE SOCIALIST REPUBLIC OF VIETNAM

PREPARATORY SURVEY ON WATER SUPPLY AND SEWERAGE SYSTEM PROJECT IN PHU QUOC ISLAND IN THE SOCIALIST REPUBLIC OF VIETNAM

FINAL REPORT VOLUME I EXECUTIVE SUMMARY

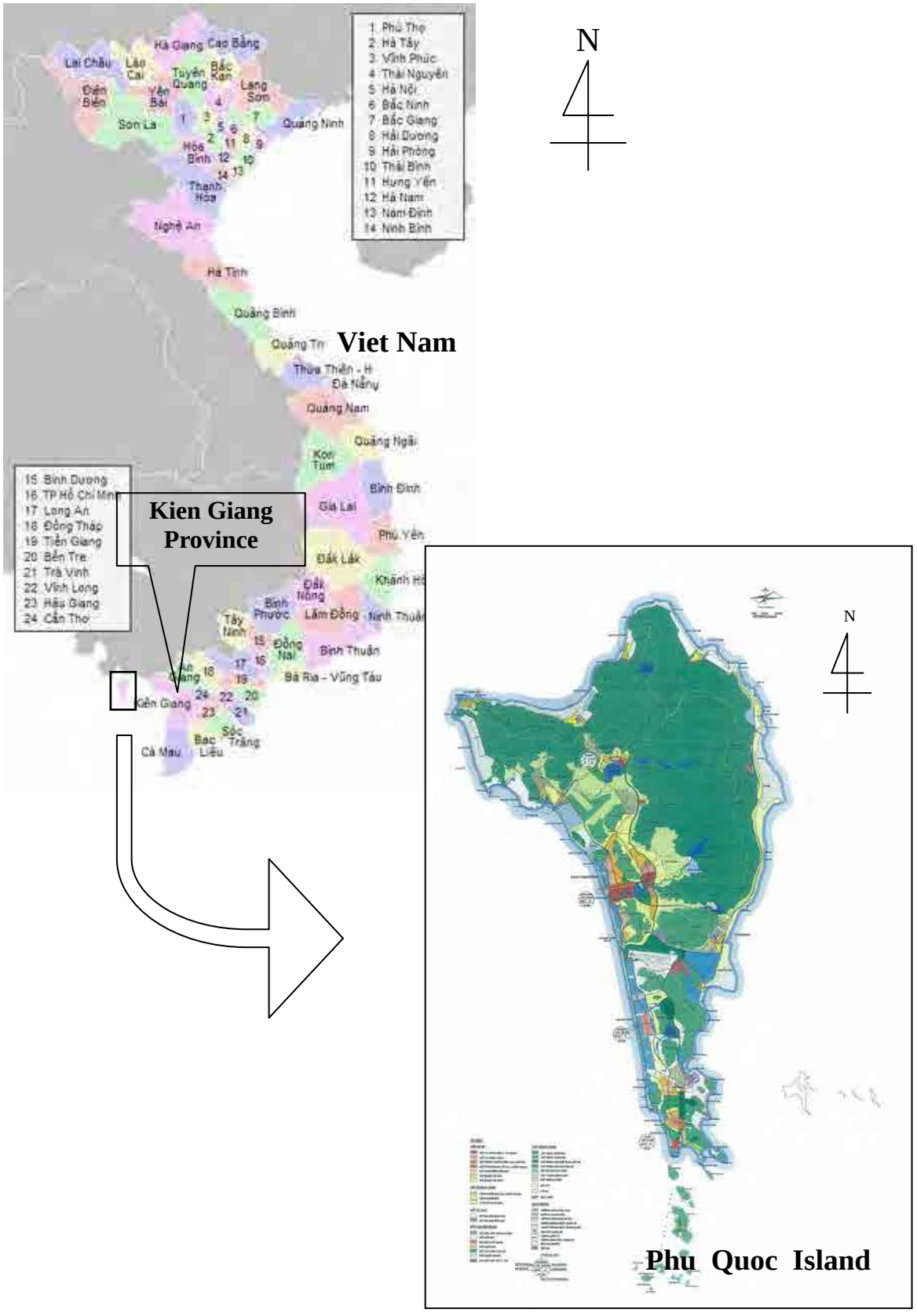
JULY 2013

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
KOBELCO ECO-SOLUTIONS CO., LTD.
NIHON SUIDO CONSULTANTS CO., LTD.

VOLUME I: EXECUTIVE SUMMARY
VOLUME II: MAIN REPORT
VOLUME III: SUPPORTING REPORT (ANNEXES)

EXCHANGE RATE (data as of February 2012)

USD 1	=	JPY 76.6
USD 1	=	VND 20,703
VND 1	=	JPY 0.0037



Location Map of Survey Area

ABSTRACT

1. Background

Phu Quoc Island belongs to Kien Giang Province in southern Viet Nam. The island, with its geographical advantages and beautiful natural environment, is promoting the developments stated in the Master Plan (Amended General Construction Master Plan for Phu Quoc Island, Kien Giang by 2030) approved by Prime Minister (Decision No.633/QD-TTg) on 11 May 2010, aiming at becoming an international center for tourism and science and technology in the South East Asian region.

The island is expected to receive 2 million tourists in 2020 and 5 million in 2030. A new international airport opened in December 2012 and the construction of the main trunk road and power supply project from the mainland are underway. There is an on-going World Bank project to expand the existing water supply area southwards from Duong Dong, at the center of the island. Water supply development has not yet started in the other development areas. There is no sewerage service on the island, and signs of water contamination are observed near Duong Dong which covers a lot of commercial and residential areas.

Water supply and sewerage service are important infrastructures critical to the economic developments on the island.

2. Proposed Water Supply Development Plan

The water supply system proposed in this project takes into consideration the water demand increase, the expanding residential area, and the progress of developments and other infrastructure projects. The water supply system would be developed in two phases as shown in **Table-1**.

It would be necessary to construct the new Cua Can impounding reservoir to secure the water source for the proposed water supply system. This impounding reservoir is a storage type reservoir constructed at low elevation at about +10 m. Water is pumped from a river with a catchment basin in the forested area of the National Park. Storage capacity of the reservoir is about 4.2 million m^3 in Phase 1 and about 10.5 million m^3 in Phase 2. Raw water for water supply is sent from the impounding reservoir to the WTP by pumping, treated by rapid filtration system, and supplied to users via the transmission and distribution systems.

Table-1 Proposed Water Supply Development Plan

Items	Phase 1	Phase 2
Target Year	2020	2030
Target Supply Areas	Cua Can、Cua Doung、	Include Ganh Dau area in Phase 1

	Duong Dong (5,000m^3/d for bulk water supply)	areas
Design Supply Vol. (daily max.)	20,000m^3/d	50,000m^3/d
Main Facilities	Impounding reservoir (with intake pump), WTP, Clear water transmission pipes: Dia.140-630mm x Length. 22km Reservoir: 4,000m^3	Intake Pump Equipment, Expansion of WTP, Clear water transmission pipes: Dia.355-630mm x Length 28km Pumping Station: 1 no.

3. Proposed Sewerage Development Plan

The sewerage development plan for this project (**Table-2**) is targeting the Duong Dong district and Cua Can area where tourism resort development is in progress. The river running through Duong Dong town is already showing signs of water pollution. Sewage disposal is one of the major problems for this area. Cua Can area is also a high priority for Phase 1 because of its resort developments.

In Phase 2, the sewerage service would be expanded to the surrounding area of Duong Dong town and urban development areas near the Cua Can impounding reservoir.

A separate sewer collection system is proposed. The STP would be constructed at a part of the tourism agricultural area inside the Cua Can resort development area. Sewage would be collected by newly installed sewer pipes and treated by the conventional activated sludge method, and then, discharged into a small river in the same area.

Table-2 Proposed Sewerage Development Plan

Items	Phase 1	Phase 2
Target Year	2020	2030
Target Areas	Cua Can, Duong Dong Existing Town (1,632 ha)	Surrounding area of Duong Dong Town, and Cua Can Urban Development Area (1,280 ha)
Wastewater Flow (Daily Ave.)	7,500 m^3/d	30,000m^3/d
Main Facilities	STP, Main Sewer: Dia.250-1,000mm x 18.2km Secondary: Dia.200mm x 9.8km, Tertiary: Dia.200mm or less x 31.3km Manhole Pump: 7 nos. Pump Station: 6 nos.	Expansion of STP Main Sewer: Dia.140-560mm x 24.0km Secondary: Dia.200mm x 3.2km Tertiary: Dia.200mm or less x 10.2km Manhole Pump: 2 nos. Pump Station: 4 nos.

4. Project Cost

The project cost for the impounding reservoir, water supply system and sewerage system are

shown in **Table-3**.

Table-3 Project Cost

VND1= JPY 0.0037

No.	Item	Phase 1		Phase 2	
		JPY (x 1,000)	VND (x 1,000,000)	JPY (x 1,000)	VND (x 1,000,000)
1	Impounding Reservoir	2,471,234	667,901	19,640	5,308
2	Water Supply System	2,632,036	711,361	3,147,505	850,677
3	Sewerage System	9,951,716	2,689,653	7,147,676	1,931,804
	Total	15,054,986	4,068,915	10,314,821	2,787,789

1) As of February 2012

5. Proposed PPP Project Scheme

5.1 Water Supply Business (BOO)

The Special Purpose Company (SPC), would construct the WTP, and operate and maintain the facilities from intake to WTP. The public sector authority would construct, operate, and maintain the other water supply facilities. This option is generally recognized as the build-own-operate (BOO) scheme.

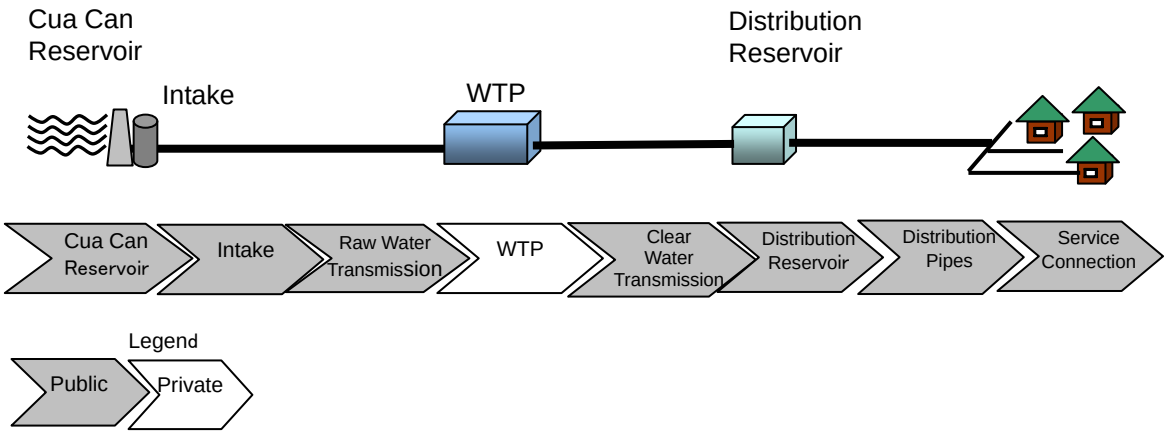


Figure-1 Water Supply BOO (Construction Responsibilities)

5.2 Sewerage Business (BOO)

The SPC would be responsible for construction, operation and maintenance of the STP, while the public sector authority would be responsible for construction, operation and maintenance of all sewer and house connections. This is categorized as a BOO scheme.

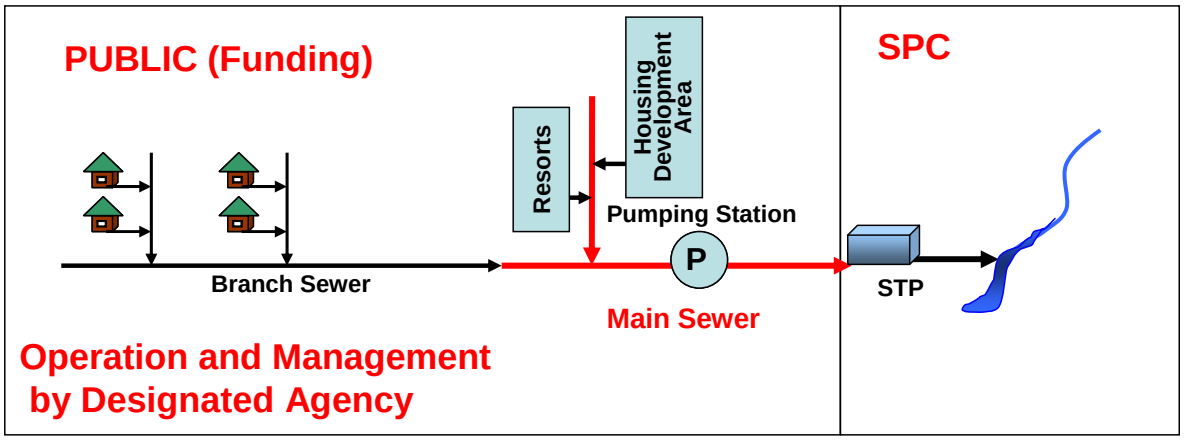


Figure-2 Sewerage BOO (Construction Responsibilities)

5.3 Financial and Economic Analysis

The BOO scheme for the WTP has the best financial feasibility and would require a 2.57 time increase in water tariff in order to have an Equity IRR ≧ 15%. The financial and economic analyses show that the entire water supply project, including both the public and private sector portions, is economically viable.

The BOO scheme for the STP as shown in **Figure-2** has the best financial feasibility. The present 10% surcharge on the water bill collected as an environment protection fee is not enough to support the sewerage system development costs. It is proposed that a hotel surcharge of 4.8 US$ be levied per tourist to secure a revenue of about 755 million JPY per year to subsidize the sewerage business, making it economically viable for implementation.

5.4 Project Implementation Schedule

After completion of this survey, fund procurement, project licensing procedures, and other related preparatory activities would follow. Construction would start in 2014 and the operation of the facilities would begin in 2017.

5.5 Undertakings and Necessary Legislation by the Vietnamese Side

Regarding the water supply business, Kien Giang Province would use government funds to build the Cua Can impounding reservoir and to cover the on-going O&M costs. KIWACO would be responsible for the procurement, construction and O&M of the facilities for transmitting clear water from the WTP, including distribution and service pipes.

Regarding the sewerage business, Kien Giang Province would be responsible for the construction, O&M and replacement of equipment at sewage collection facilities up to the STP, including house connections, sewer pipes, and pumping stations. It would also be necessary to develop a legal framework via provincial decree to collect the charges from tourists (surcharges on hotel fee) and ‘Developer’s Contribution’ for sewerage business.

5.6 Project Financing Plan

The private sector partner would source its share of the project cost from investors (capital investment - equity) and financial institutions (loan - debt). The public and private sector costs for the chosen option for the water supply and sewerage systems for Phase 1 are shown in **Table-4** and **Table-5**.

Table-4 Public and Private Cost Burden of the Water Supply Project (Phase 1)

Project	Burden	Facilities to be constructed	Construction Cost (million JPY)
Impounding Reservoir	Govt. of Viet Nam	Construction, Land acquisition & Compensation	2,471
Water Supply System	Govt. of Viet Nam	Intake, raw water transmission, clear water transmission, distribution reservoir, distribution pipe, service connection	1,192
	SPC	WTP, land acquisition & compensation	1,439 (Equity 432) (Debt 1,007)
Total Project Cost			5,102

Note: Total project cost to calculate the actual debt amount must add the interest during construction to SPC's Project Cost.

Table-5 Public and Private Cost Burden of the Sewerage Project (Phase 1)

Project	Burden	Facilities to be constructed	Construction Cost (million JPY)
Sewerage System	Govt. of Viet Nam	Main trunk sewer, pumping station, branch sewer, tertiary sewer	5,817
	SPC	STP, Sewer maintenance vehicle, land acquisition & compensation	4,134 (Equity 1,240) (Debt 2,894)
Total Project Cost			9,951

Note: Total project cost to calculate the actual debt amount must add the interest during construction to SPC's Project Cost.

Japanese companies such as KOBELCO Eco-Solutions Co., Ltd. (KESV) and Vietnamese companies are expected to be the investors in the SPC. The loan is expected to come from JICA Private Sector Investment Finance as a two-step loan through a private bank in Viet Nam.

5.7 Risk Allocation of the Project

Among the various solutions to tackling the risks, it is considered that the "Take-or-pay clause" is one of the most important factors for the success of this project.

In this survey, the projected water demand and sewage flow include the estimated infrastructure needs of the tourism industry. If the tourism business falls short of expectations,

it may happen that the actual water demand / sewage flow will also be less than the design volume. It is indispensable that the government help mitigate this kind of demand risk by having the "Take-or-pay clause", for the private companies to be interested in participating in the project.

6. Recommendations

1. The proposed water supply system development is composed of three sub-projects, namely, Cua Can reservoir construction (including intake and raw water transmission), water treatment plant construction and distribution network construction. Although it is common in Viet Nam that impounding reservoirs are planned and developed by DARD, it would be necessary to establish a special unit to manage and coordinate the implementation of the three sub-projects. This is because Cua Can reservoir is exclusively used for water supply and the three sub-projects are closely related components of the water supply system.

   In the proposed business scheme, the three sub-projects would be operated and managed separately by KGPPC, a private investor, and KIWACO. A steering committee would be required for the comprehensive coordination at each stage of the implementation, such as financing, design, tender/contract, construction and operation.

2. Sewerage system developments in Viet Nam are usually financed using the central government grants and O&M expenditure covered by the environment protection fee collected as 10% of water supply charge. Since Phu Quoc will be developed into a world class eco-tourism center, extra fee on hotel accommodation could be collected to help finance the sewerage development so that the project would be less reliant on government subsidies. In Hawaii, a 12.5% transient accommodation tax (TAT) is collected to support schools, police, infrastructure and parks. Further discussions would be required to introduce a similar financing mechanism for this project.

3. The public sector partner would be responsible for securing funding for the construction of the Cua Can reservoir and distribution system in the proposed water supply system development and the sewer network in the proposed sewerage system development. KGPPC's own source of financing may not be sufficient. It would be necessary to seek support from the central government and/or funding from donor agencies through the central government. In competing with other candidate projects for donor funding, KGPPC would have to show strong leadership, such as establishing a sector program for the joint development and management of water supply and sewerage projects. KGPPC may also wish to make special effort to discuss with relevant agencies to seek their support and assistance in this process.

Preparatory Survey
on
Water Supply and Sewerage System Project
in Phu Quoc Island, Vietnam

FINAL REPORT

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Executive Summary

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List of Abbreviations

ABC	Advanced Biological Contactor
ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
BOD	Biochemical Oxygen Demand
BOO	Build, Operate and Own
BOT	Build, Operate and Transfer
CAS	Conventional Activated Sludge
CIA	Central Intelligence Agency
COD	Chemical Oxygen Demand
DARD	Department of Agriculture and Rural Development
D/D	Detailed Design
DIP (DCIP)	Ductile Cast Iron Pipe
DPC	District People's Committee
DSCR	Debt Service Coverage Ratio
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
FC	Foreign currency
FDI	Foreign Direct Investment
FIRR	Financial Internal Rate of Return
FS (F/S)	Feasibility Study
FY	Financial Year
GDP	Gross Domestic Product
GOJ	Government of Japan
GOV	Government of Viet Nam
GSO	General Statistics Office
HDPE	High Density Polyethylene Pipe
IMF	International Monetary Fund
ISO	International Organization for Standardization
JICA	Japan International Cooperation Agency
JPST	JICA Preparatory Survey Team
KIWACO	Kien Giang Water Supply and Drainage One Member Limited Company
KGPPC	Kien Giang Provincial People's Committee
LC	Local Currency
MP (M/P)	Master Plan
NRW	Non Revenue Water
OD	Oxidation Ditch
ODA	Official Development Assistance
O&M	Operation and Maintenance
PC	People's Committee
PPC	Provincial People's Committee

PPP	Public Private Partnership
PQDMB	Phu Quoc Development Management Board
PVC	Polyvinyl Chloride Pipe
ROA	Return on Asset
ROE	Return on Equity
SBR	Sequencing Batch Reactor
SPC	Special Purpose Company
SS	Suspended Solids
STP	Sewage Treatment Plant
S/V	Construction Supervision
UASB	Upflow Anaerobic Sludge Blanket
VAT	Value Added Tax
VDB	Vietnamese Development Bank
VNAT	Vietnam National Administration of Tourism
VND	Vietnamese Dong
WACC	Weighted Average Cost of Capital
WB	World Bank
WEF	World Economic Forum
WTP	Water Treatment Plant

1. Background of the Project

Phu Quoc Island, located in the Gulf of Thailand is the largest island (593 km^2) in Viet Nam. The island is part of Kien Giang Province in the southern part of Viet Nam, about 18 km from the Cambodian coast. In 2005, Phu Quoc Development Master Plan was formulated focusing on the island's geographical advantages, rich natural environment and tourism potentials. The GDP grew from 16% in 2005 to 23% in 2009. Phu Quoc is expected to contribute to the regional economy as well as play an important role in the country's economic development. Subsequently the 2005 Master Plan was revised in 2010. The "Amended General Construction Master Plan for Phu Quoc Island, Kien Giang by 2030"was approved as the "Adjusted Master Plan of Construction of Phu Quoc Island, Kien Giang in 2030" by Prime Minister Decision No. 633/QD-TTG in May 2010. (This adjusted master plan is hereinafter referred to as the Master Plan.)

The Master Plan with target years of 2020 and 2030, lays out the step by step approach to sustainably develop the island into an upscale tourist destination and a science and technology hub in the Southeast Asian region, at the same time, carefully preserving its history and natural environment. The projected populations for 2020 and 2030 are shown in **Table 1**.

Table 1 Population Forecast by Master Plan

Year	Total Population	Urban Population	Rural Population	Tourist Number equivalent to Population	Number of Tourists
2020	340,000 – 380,000	200,000 - 230,000	80,000 – 90,000	50,000 – 65,000	2 – 3 million
2030	500,000 – 550,000	320,000 – 370,000	90,000 – 100,000	80,000 – 85,000	5 – 7 million

Duong Dong, An Thoi and Cua Can townships are designated as urban development areas, and their development policies are summarized in **Table 2**.

Table 2 Development Policies of the Three Designated Urban Areas

Urban Area	Urban Function	Target Population (Y2030)	Development Area (ha)
Duong Dong Urban Center	Government services, public services, business center, tourist service center.	240,000	2,502 ha
An Thoi	International port, tourist services, light industry, cultural center.	71,000	1,020 ha
Cua Can	Forest/Marine Protection, Agriculture, Tourist Center	26,500	329 ha

The new international airport opened in December 2012. Other major infrastructure

development projects, such as the construction of the main road and electricity supply from the mainland, are underway. The water supply and sewerage development plan is shown in **Figure 1**, and the key elements are as follows:

(1) Water Supply

The water demands on the main island of Phu Quoc for 2020 and 2030 are estimated to be 70,000 and 120,000 m^3/d respectively. Four new water impounding reservoirs would be required to meet these water demands. The water supply system to be developed would provide 68,000 m^3/d by 2020 and 103,000 m^3/d by 2030 (equivalent to 65% and 85% of the projected demands), with the balance to be supplemented by rain water and reclaimed water.

(2) Sewerage

There is no existing treatment plant for domestic wastewater in Phu Quoc Island. Human waste from each household is treated by a septic tank system with the effluent from the septic tank discharged into water bodies outside the house. Other wastewater is discharged without any treatment.

Hotels are required to have their own sewage treatment facilities to satisfy the effluent water quality standard. However effluent water quality is not monitoring regularly by KGPPC.

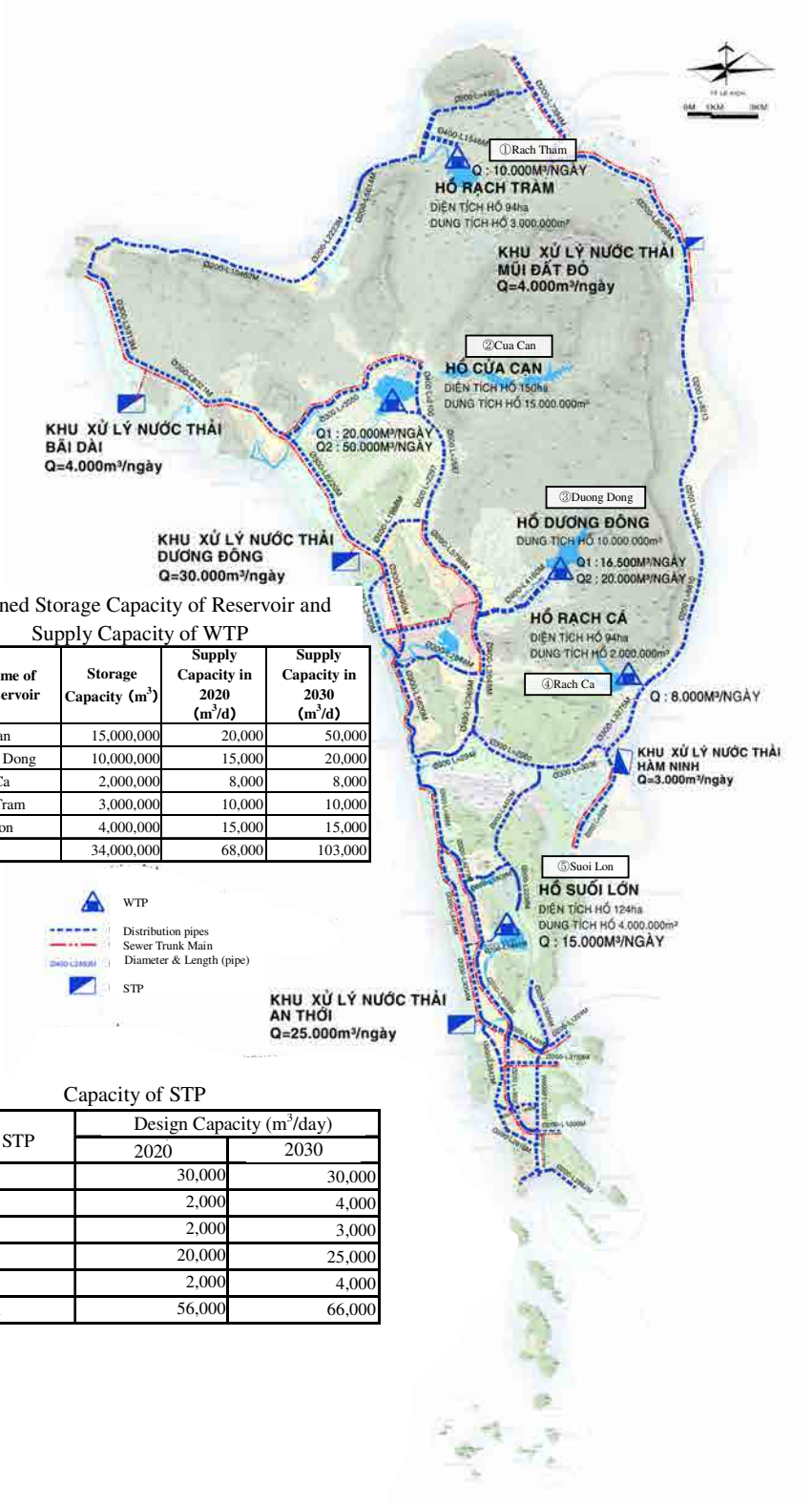
There is a sewer system in Duong Dong covering a limited area. Sewer pipes were installed during road construction. The collected rainwater and waste water from households are directly discharged into rivers or the sea.

Sewerage development would improve the present situation and mitigate the effects of increased sewage discharge by the significant increase in the projected local and tourist populations. Projected sewage quantities in the urban area of Phu Quoc Island in 2020 and 2030 as estimated in the Mater Plan are shown in **Table 3**.

Table 3 Planned Sewage Quantities

No	Wastewater	Urban Population		Formula		Sewage Quantity (m^3/day)	
	Year	2020	2030	2020	2030	2020	2030
1	Domestic(Q)	220,000	350,000	120*1×80%	150*1×80%	21,120	42,000
2	Public	-	-	10%Q	10%Q	2,112	4,200
3	Tourist	60,000	85,000	300*2×0.8	300*2×0.8	14,400	20,400
	Total					37,632	66,600

Source：Master Plan
*1: Daily water consumption per capita for domestic use
*2: Daily water consumption per capita for tourist use



Designed Storage Capacity of Reservoir and Supply Capacity of WTP

No.	Name of Reservoir	Storage Capacity (m^3)	Supply Capacity in 2020 (m^3/d)	Supply Capacity in 2030 (m^3/d)
1	Cua Can	15,000,000	20,000	50,000
2	Duong Dong	10,000,000	15,000	20,000
3	Rach Ca	2,000,000	8,000	8,000
4	Rach Tram	3,000,000	10,000	10,000
5	Suoi Lon	4,000,000	15,000	15,000
	Total	34,000,000	68,000	103,000

Capacity of STP

Name of STP	Design Capacity (m^3/day)	
	2020	2030
Duong Dong	30,000	30,000
Bai Dai	2,000	4,000
Ham Ninh	2,000	3,000
An Thoi	20,000	25,000
Mui Dat Do	2,000	4,000
Total	56,000	66,000

Figure 1 Water Supply and Sewerage Plan in Master Plan

The sewage quantities are calculated as follows:

Domestic:	: 80% of daily water consumption
Public	: 10% of domestic waste water
Tourist	: 80% of (tourist) daily water consumption

The Master Plan identifies five (5) new sewage treatment plants for Phu Quoc Island. Planned sewage quantities for 2020 and 2030 are shown in **Figure 1**.

2. Objective of the Project

Phu Quoc will be developed into a tourist resort and the population is expected to increase substantially. It is expected that private funds would be needed for the massive infrastructure investments because the government budget is rather limited. Therefore the water supply and sewerage systems in Phu Quoc will be developed as a public private partnership.

3. Water Supply System Planning

3.1 Planned Service Area

Phu Quoc Island has a water supply system (capacity 5,000 m^3/d) that targets the Duong Dong area (center of the Island). It has been operated since the year 2006. On the other hand, construction of new airport and new resort development are on the way in the suburbs of the area. A water supply expansion project is promoted by World Bank (WB) loan to supply water to the Duong Dong area and its southward Duong To area. This project would expand the existing capacity to 16,500 m^3/d.

A lot of tourist resort and housing development projects were proposed and approval procedures were carried on at Cua Can area, at the north of Duong Dong area, and western seaside of Ganh Dau area. This Project will supply water mainly to these areas.

Figure 2 shows the planned service area of this Project and that of WB project. However, in the service area of the WB project, shortage of water supply volume is a concern in the future because of restrictions in the volume of raw water. Therefore, this insufficient water volume is expected to be supplemented by bulk water supply of this Project.

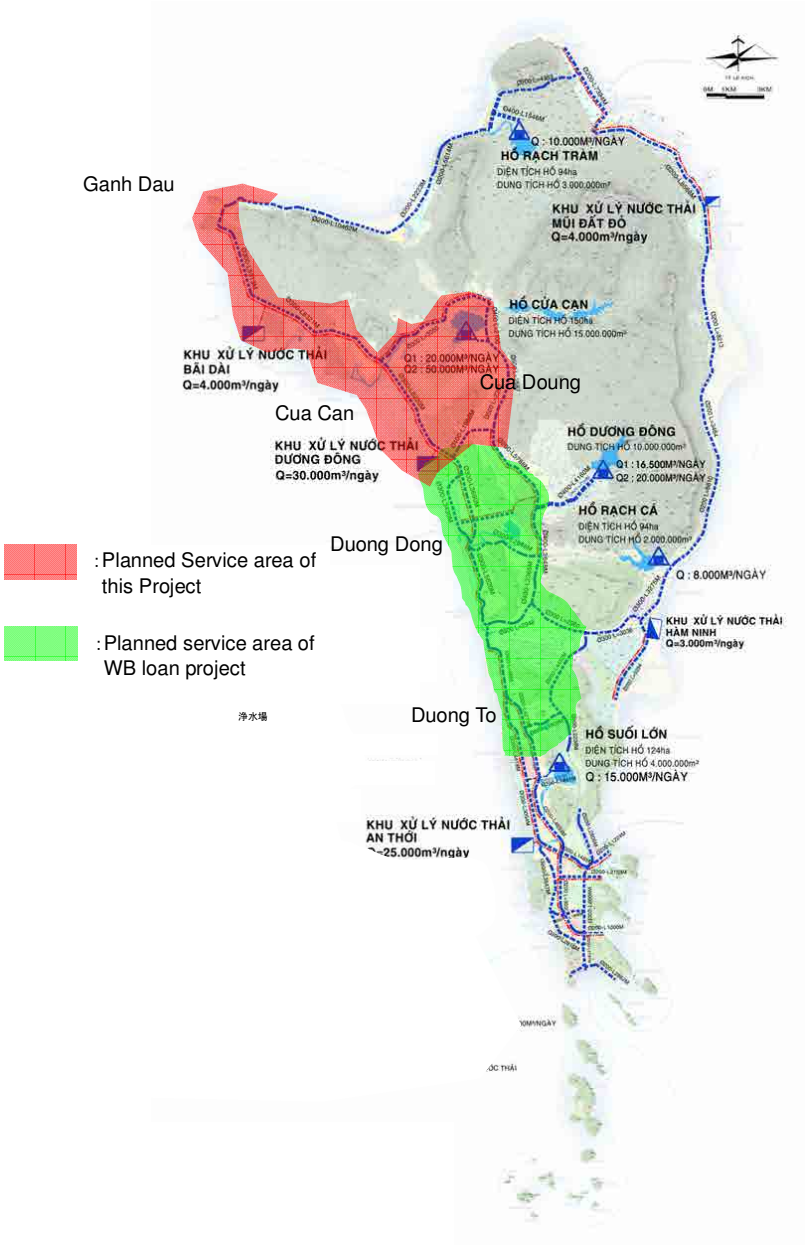


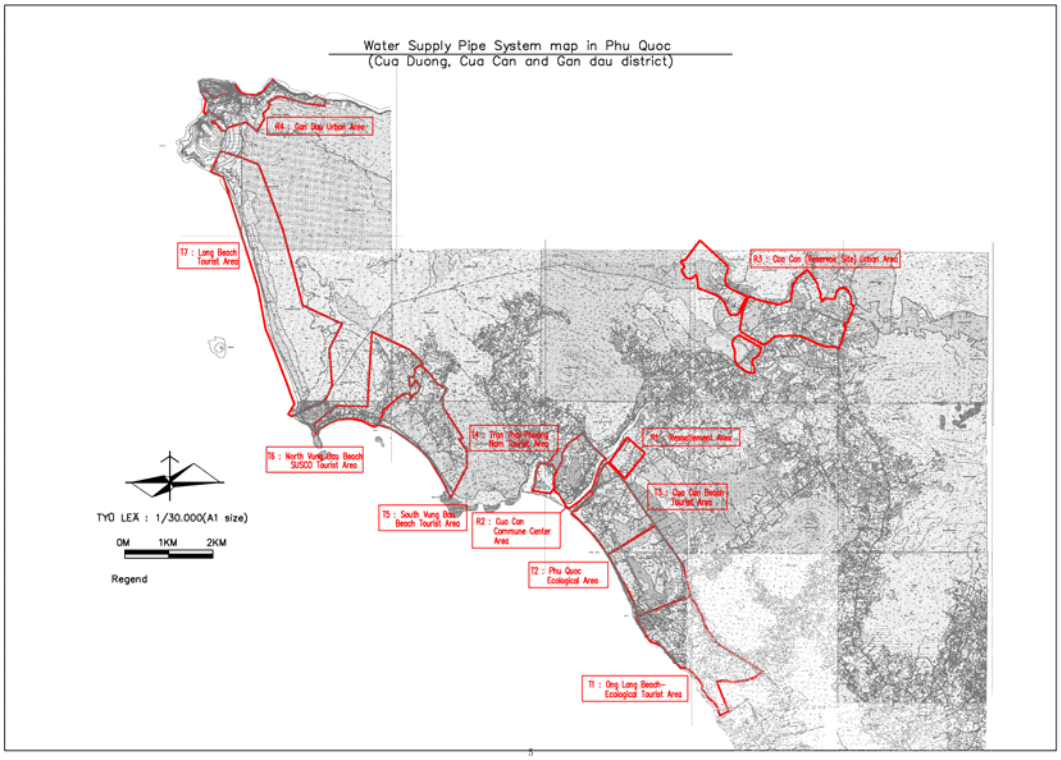
Figure 2 Planned Service Area

3.2 Water Demand

The population of the Cua Can, Cua Doung, and Ganh Dau areas was 15,903 persons in 2008 and the annual growth rate is around 3% in recent years. A lot of resort development projects are proposed for these areas. Therefore, water demand is estimated by considering the water demand trend in terms of urban development, as well as the additional demand from the resort

development projects. The projected water demand was submitted by developers and approved by Kien Giang Province.

Figure 3 shows the locations of resort development and urban development areas. Water demand projections for Phase 1 and Phase 2 are shown in **Table 4** and **Table 5**, respectively.



Note） T1 - T7: Tourist resort development area
R1 - R4: Urban development and housing development area

Figure 3 Locations of Resort Development and Urban Development Areas

Table 4 Water Demand Projection in the year 2020

				Domestic				Resort								Urban Area & Resettlement Area					total	Distribute	Total
				Cua Can	Cua Duong	Ganh Dau	Total	T1	T2	T3	T4	T5	T6	T7	Total	R1	R2	R3	R4	Total		Other Area	
							< A >								< B >					< C >	<D>	< E >	<A>+<D>+<E
Person	Calculation	(1)	(person)	4,889	11,543		16,432												4,659				
	resettlement	(2)	(person)	※1 2,330	※1 2,329		4,659																
	Total	(3)=(1)-(2)	(person)	2,559	9,214	0	11,773																
per capita demand		(4)	(l/pcd)	120	120	120																	
Domestic Water Consumption		(5)=(3)x(4)/1000	(m3/day)	307	1,106	0	1,413	785 (1,570)	1,214 (1,214)	2,950 (2,950)	960 (960)	0 (2,200)	0 (3,960)	0 (7,000)	5,909 (19,854)	1,346 (1,819)	639 (1,278)	0 (3,975)	0 (1,782)	1,985 (8,854)	7,894 (28,708)	5,682	14,989
Commercial		(6)=(5)x0.03	(m3/day)	9	33	0	42																42
Institutions		(7)=(5)x0.05	(m3/day)	15	55	0	71																71
Total		(8)=(5)+(6)+(7)	(m3/day)	332	1,194	0	1,526	785	1,214	2,950	960	0	0	0		1,346	639	0	0		7,894	5,682	15,102
Leaking		(9)=(8)*0.10	(m3/day)	33	119	0	153	79	121	295	96	0	0	0		135	64	0	0		790	568	1,511
Total		(10)=(8)+(9)	(m3/day)	365	1,314	0	1,678	864	1,335	3,245	1,056	0	0	0		1,481	703	0	0		8,684	6,250	16,612
Peak factor		(11)		1.2	1.2	1.2		1.2	1.2	1.2	1.2	1.2	1.2	1.2		1.2	1.2	1.2	1.2			1.2	
Max daily demand		(12)=(10)*(11)	(m3/day)	438	1,576	0	2,014	1,037	1,602	3,894	1,267	0	0	0		1,777	844	0	0		10,421	7,500	19,935
Peak factor		(13)		1.5	1.5	1.5		1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.5	1.5	1.0	1.5			1.0	
Max hourly demand		(12)*(13)	(m3/day)	656.7	2,364.4	0.0	3,021	1,037.0	1,602.0	3,894.0	1,267.0	0.0	0.0	0.0	7,800	2,665.5	1,266.0	0.0	0.0	3,931.5	11,731.5	7,500	22,253
		(14)=(12)*(13)/24	(m3/hr)	27	99	0	126	43	67	162	53	0	0	0		111	53	0	0		489	313	928
		(12)*(13)/86400	(m3/s)	0.0076	0.0274	0.0000	0.0350	0.0119	0.0186	0.0450	0.0147	0.0000	0.0000	0.0000		0.0308	0.0147	0.0000	0.0000		0.1358	0.0869	0.2577

Table 5 Water Demand Projection in the year 2030

				Domestic				Resort								Urban Area & Resettlement Area					total	Distribute	Total
				Cua Can	Cua Duong	Ganh Dau	Total	T1	T2	T3	T4	T5	T6	T7	Total	R1	R2	R3	R4	Total		Other Area	
							< A >								< B >					< C >	<D>	< E >	<A>+<D>+<E
Person	Calculation	(1)	(person)	6,570	15,513	8,389	30,472																
	resettlement	(2)	(person)	3,130	3,131		6,261																
	Total	(3)=(1)-(2)	(person)	3,440	12,382	8,389	24,211																
per capita demand		(4)	(l/pcd)	150	150	150																	
Domestic Water Consumption		(5)=(3)x(4)/1000	(m3/day)	516	1,857	1,258	3,632	1,570	1,214	2,950	960	2,200	3,960	7,000	19,854	1,819	1,278	3,975	1,782	8,854	28,708	5,682	38,022
Commercial		(6)=(5)x0.03	(m3/day)	15	56	38	109																109
Institutions		(7)=(5)x0.05	(m3/day)	26	93	63	182																182
Total		(8)=(5)+(6)+(7)	(m3/day)	557	2,006	1,359	3,922	1,570	1,214	2,950	960	2,200	3,960	7,000	19,854	1,819	1,278	3,975	1,782	8,854	28,708	5,682	38,312
Leaking		(9)=(8)*0.10	(m3/day)	56	201	136	392	157	121	295	96	220	396	700	1,985	182	128	398	178	886	2,871	568	3,831
Total		(10)=(8)+(9)	(m3/day)	613	2,206	1,495	4,314	1,727	1,335	3,245	1,056	2,420	4,356	7,700	21,839	2,001	1,406	4,373	1,960	9,740	31,579	6,250	42,144
Peak factor		(11)		1.2	1.2	1.2		1.2	1.2	1.2	1.2	1.2	1.2	1.2		1.2	1.2	1.2	1.2			1.2	
Max daily demand		(12)=(10)*(11)	(m3/day)	736	2,648	1,794	5,177	2,072	1,602	3,894	1,267	2,904	5,227	9,240	26,206	2,401	1,687	5,248	2,352	11,688	37,894	5,000	48,072
Peak factor		(13)		1.5	1.5	1.5		1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.5	1.5	1.0	1.5	6	6	1.0	
Max hourly demand		(12)*(13)	(m3/day)	1,103	3,972	2,691	7,766	2,072	1,602	3,894	1,267	2,904	5,227	9,240	26,206	3,602	2,531	5,248	3,528	14,908	41,114	5,000	53,880
		(14)=(12)*(13)/24	(m3/hr)	46	165	112	324	86	67	162	53	121	218	385	1,092	150	105	219	147	621	1,713	208	2,245
		(12)*(13)/86400	(m3/s)	0.0128	0.0460	0.0311	0.0899	0.0239	0.0186	0.0450	0.0147	0.0336	0.0606	0.1069	0.3033	0.0417	0.0292	0.0608	0.0408	0.1725	0.4758	0.0578	0.6235

3.3 Water Supply Facilities

3.3.1 Phased Development Plan

The water supply facility will be developed in two phases. The phased development plan takes into consideration the time required for licensing process for the developers, for road construction, what is happening with other infrastructure developments, as well as meeting the increasing water demand and the need to expand service areas. The first phase to be completed by 2020 will deal with higher priority areas where the developments are more advanced.

Figure 4 shows the water supply service area of Phase 1 and Phase 2, respectively.

- Phase 1
  - Target Year: 2020

- Service Area: Cua Can, Cua Duong, Duong Dong (Bulk Supply)
- Supply Capacity (Day Max): 20,000 m^3/d

➢ Phase 2

- Target Year: 2030
- Service Area: Phase 1 Area plus Ganh Dau
- Supply Capacity (Day Max): 50,000 m^3/d

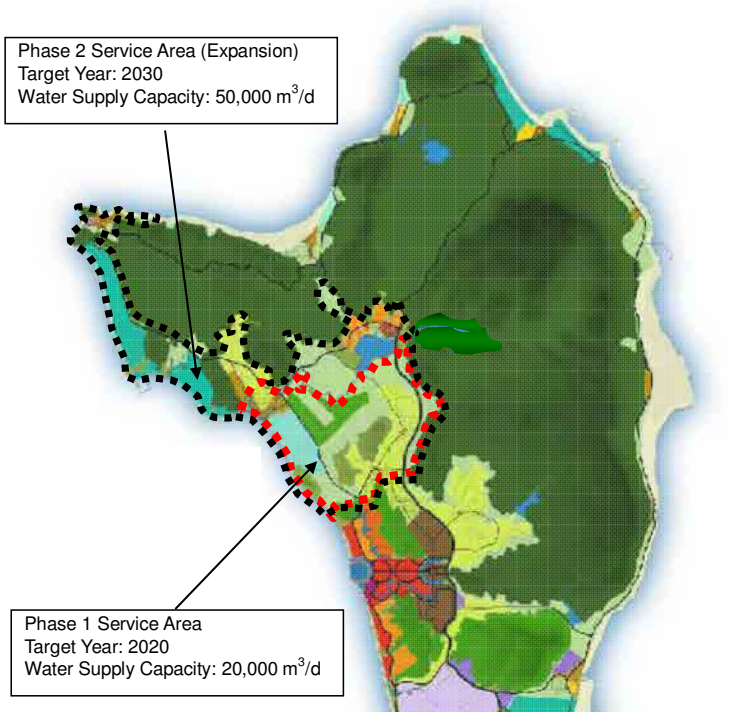


Figure 4 Service Areas for Phase 1 and Phase 2

3.3.2 Cua Can Impounding Reservoir

The Cua Can impounding reservoir would be the raw water source for this Project. The reservoir about 200 ha would be constructed along the mid section of the Cua Can River with the National Park located upstream. The site of the reservoir at 10 m elevation is low and flat. **Table 6** summarizes the proposed reservoir storage and capacity.

Table 6 Planned Reservoir Capacities

No	Parameters	Unit	Phase 1	Phase 2
1	Reservoir bottom elevation	m	7.0	7.0
2	Deposit Level	m	7.07	7.36
3	Minimum Water Level	m	7.6	7.9
4	Maximum Water Level	m	9.2	12.5
5	Dead Volume	10^6 m^3	1.13	1.69
6	Effective Capacity	10^6 m^3	3.02	8.77
7	Total Capacity	10^6 m^3	4.15	10.47

Water will be pumped from the river to the reservoir which is dug into the ground as a holding pond.

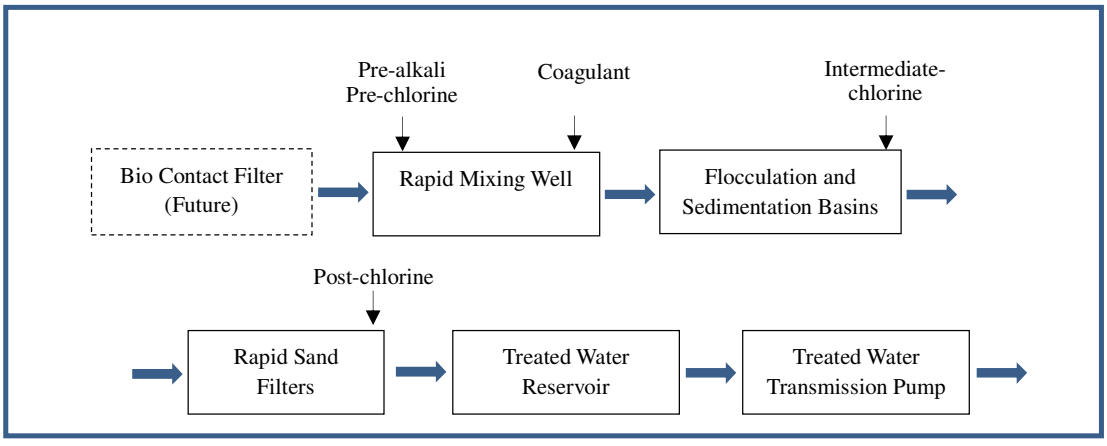
The reservoir bottom should be lower than the river bottom in order to draw water from the river by gravity. The finished elevation of the reservoir bottom should also be lower than the flood level. Unfortunately at the desired level for the reservoir bottom, the soil is sandy-clay and is thus too permeable. In addition, the cost of disposing the excavated soil to achieve this reservoir depth is also prohibitive. A more practical solution would be setting a higher elevation for the reservoir bottom where there is a clay layer, which would require that water be pumped from the river to the reservoir.

The top of the dam surrounding the reservoir is at 14 m elevation. This is almost the same or a little higher than the ground level of the urban area of the Cua Can area to be developed north of the reservoir. Therefore, there is no significant impact in terms of visual aesthetics.

Figure 5 Cua Can Impounding Reservoir Layout and Location of WTP

3.3.3 Water Treatment Plant

At the water treatment plant to be constructed near the raw water reservoir, raw water would be treated by a rapid sand filtration system as shown below:



The WTP construction site is at 11.8 m elevation and would occupy 3.5 ha. Figure 6 shows the WTP layout. Figure 7 shows the Hydraulic Profile of the WTP.

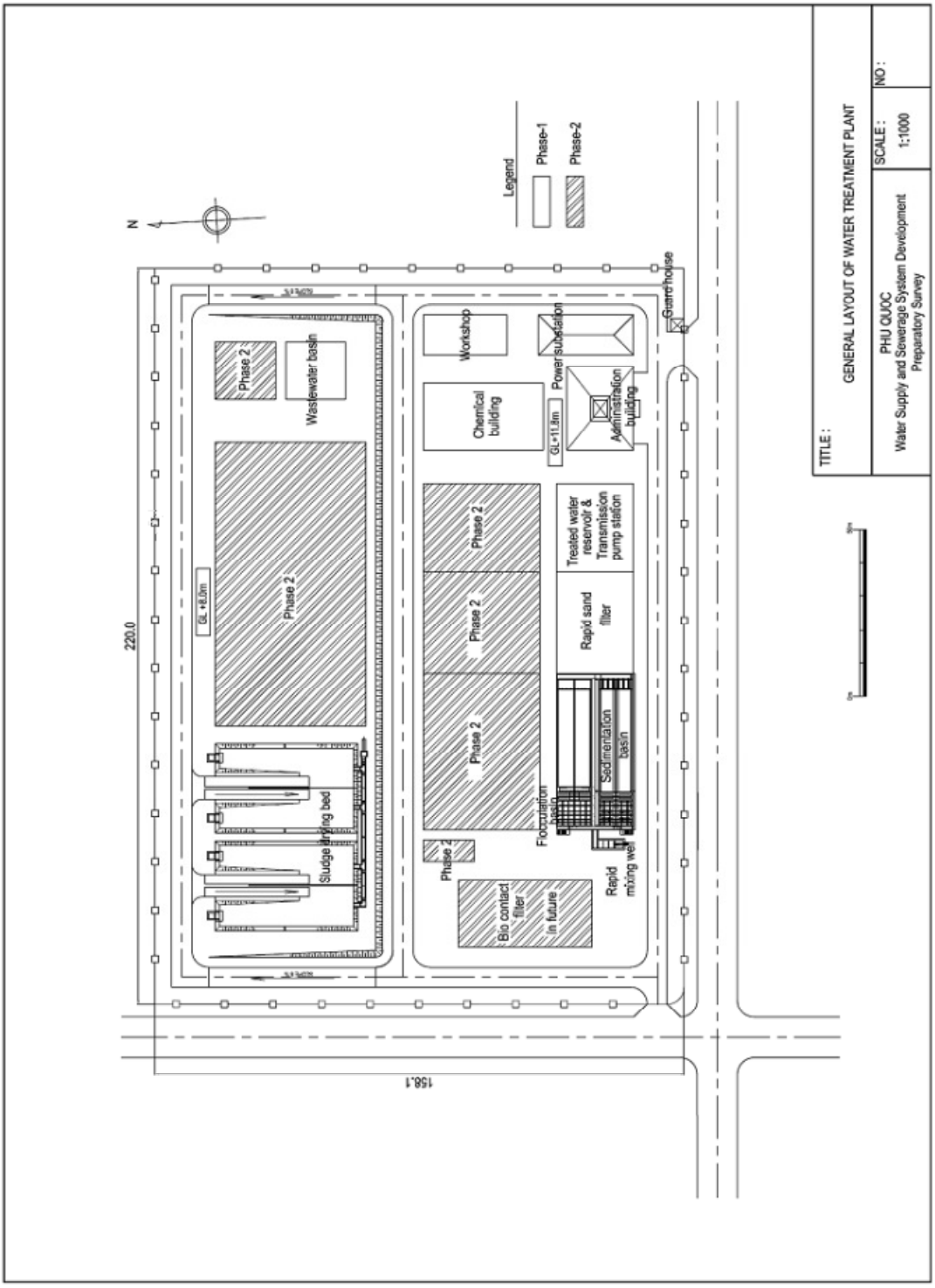


Figure 6 WTP Layout

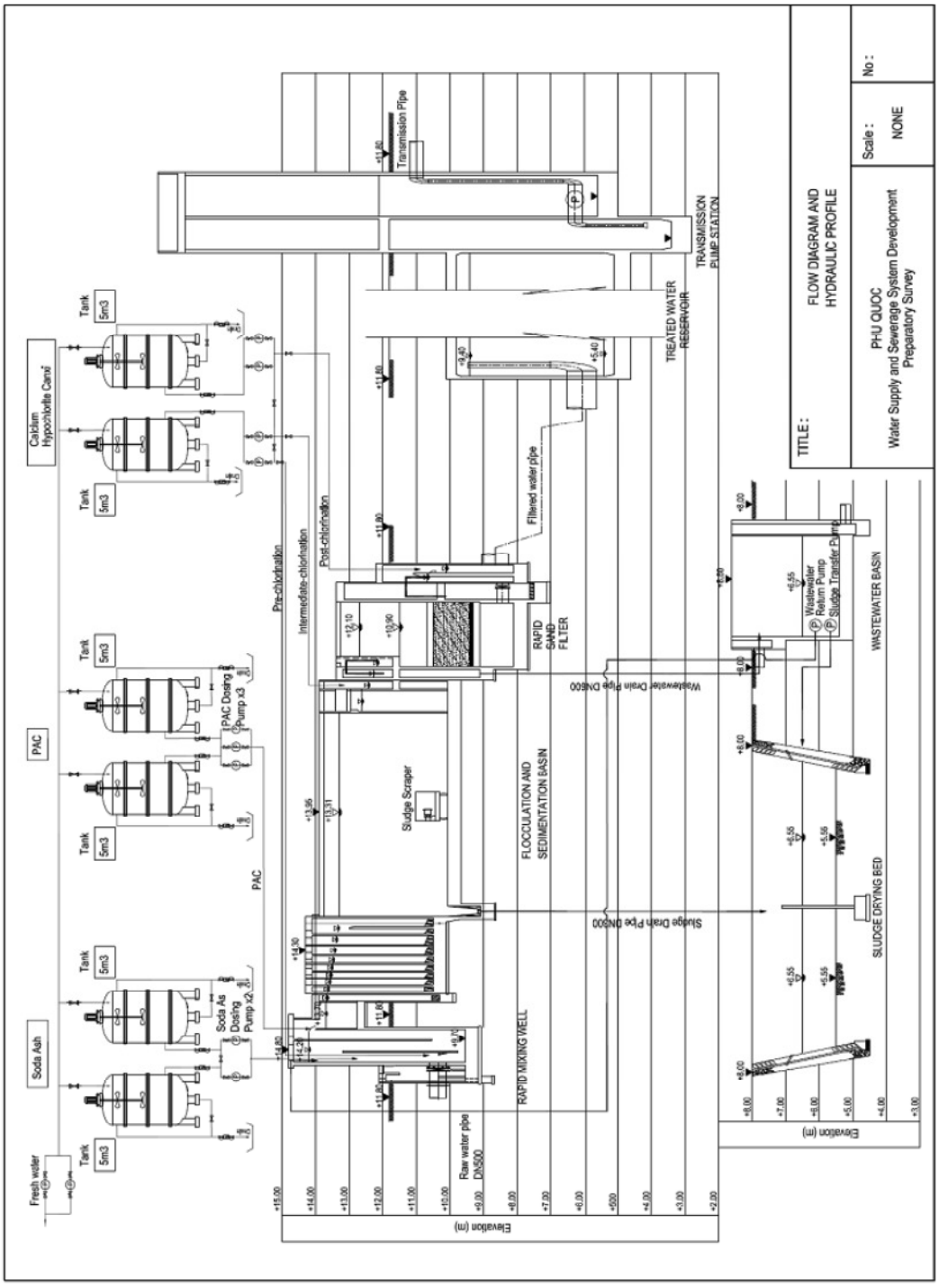


Figure 7 Hydraulic Profile of WTP

3.3.4 Water Transmission and Distribution

In Phase 1, treated water at the WTP would be pumped to the new distribution reservoir via a southern route and then distributed by gravity. In Phase 2, treated water would be distributed directly by pump via a northern route.

Figure 8 outlines the transmission and distribution system.

Bulk water would be supplied to the tourist resort area (T1 to T7 in Figure 8). Distribution pipelines in each development area would be installed by the developers at their own expense. HDPE pipe would be used for transmission and distribution.

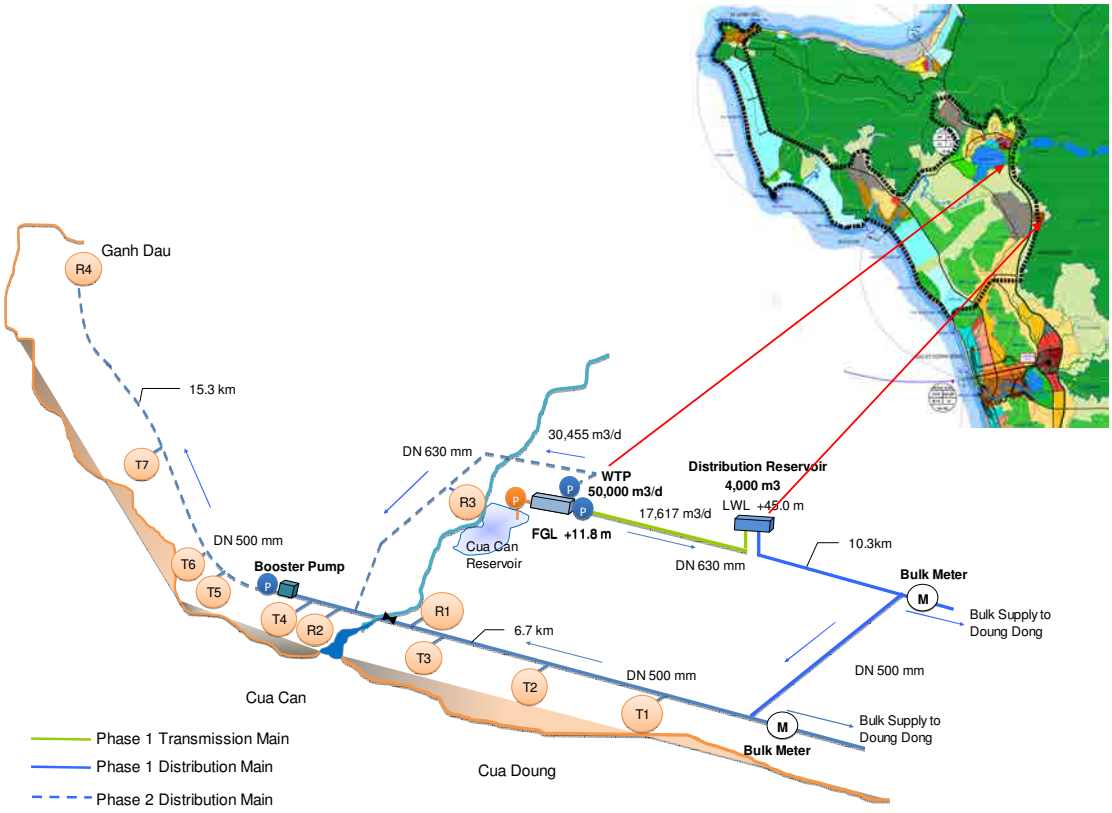


Figure 8 Transmission and Distribution System Layout

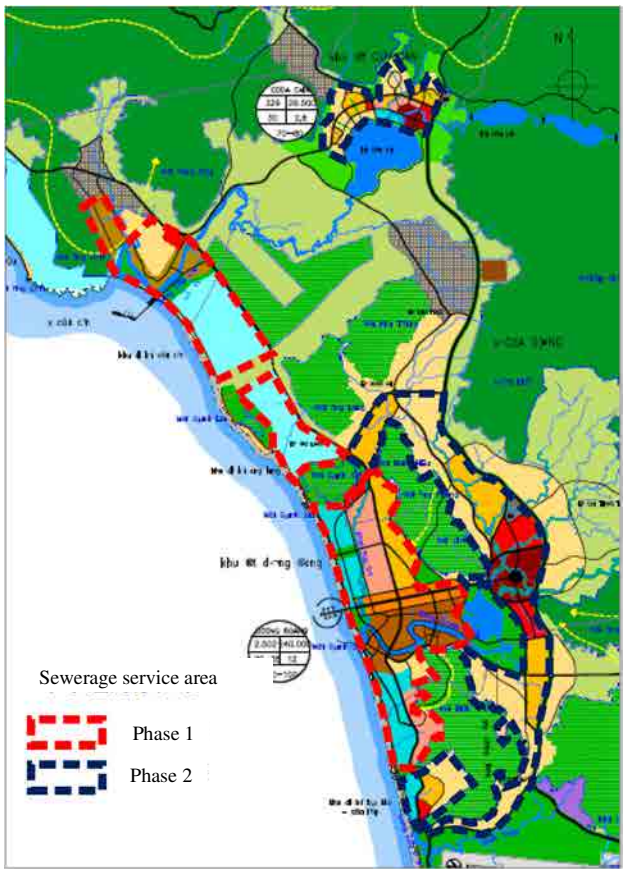
4. Sewerage System

4.1 Sewerage Service Area and Phased Development Plan

The sewerage system would be developed in the Duong Dong and Cua Can areas. Duong Dong is at the center of the town on Phu Quoc Island, and Cua Can is where the tourist resort is being developed as shown in **Figure 9**.

The river downstream of the Duong Dong urban area is polluted by the discharge of untreated domestic sewage. This together with the on-going resort development in Cua Can makes these areas priority candidates for the development of sewerage service in Phase 1.

In Phase 2, sewerage service would be expanded to the peri-urban areas of Duong Dong and the Cua Can, as shown in **Figure 9**.



Source: Master Plan, JICA Survey Team

Figure 9 Sewerage Service Area

Size of service areas of Phase 1 and Phase 2 are as follows:

Size of Sewerage Service Areas of Phase 1 and 2

Phase	Target Year	Area Size (ha)
・Phase 1	2020	1,632
・Phase 2	2030	1,280
Total		2,912

4.2 Sewage Collection System

A separate sewage collection system is recommended. The elevation of the service area is low and can be easily affected by backwater from the sea and river. With a combined system drainage pumping stations would be required and would add to the cost.

4.3 Estimation of Sewage Quantity and Influent Quality

(1) Sewage Quantity

Sewage quantity is determined based on the projected water demands. Water supply to the sewerage service area will be from the World Bank water supply project and the water supply system proposed by this Project. Projected water demands prepared by these projects are used to determine the planned sewage quantities as shown in **Table 7**.

Daily average and maximum sewerage influents are set at the same level, and determined to be 7,500 m^3/day for Phase 1 and 30,000 m^3/day for Phase 2.

Table 7 Planned Sewage Quantity

(Unit: m^3/d)

Sewage Quantity	Year 2020	Year 2030
Daily Average	7,500	30,000
Daily Maximum	7,500	30,000
Hourly Peak Flow	12,400	46,200

Source: JICA Survey Team

(2) Pollution Load and Influent Quality

Per capita daily pollution load and influent quality in the year 2030 are set as shown in **Table 8**.

Table 8 Pollution Load and Influent Quality

Parameter	Pollution Load (g/capita/day)	Influent Quality (mg/L)
BOD_5	36	230
SS	41	260
T-N	7	45
T-P	1.1	7

Source: JICA Survey Team

4.4 Sewage Treatment

(1) Site of the Sewage Treatment Plant

As discussed with the Vietnamese side, the 48 ha sewage treatment plant would be located in a farming area in the Ong Lang Beach Eco-Resort development as shown in **Figure 10**. It would be west of the existing road where the impact on the farming area would be minimal.

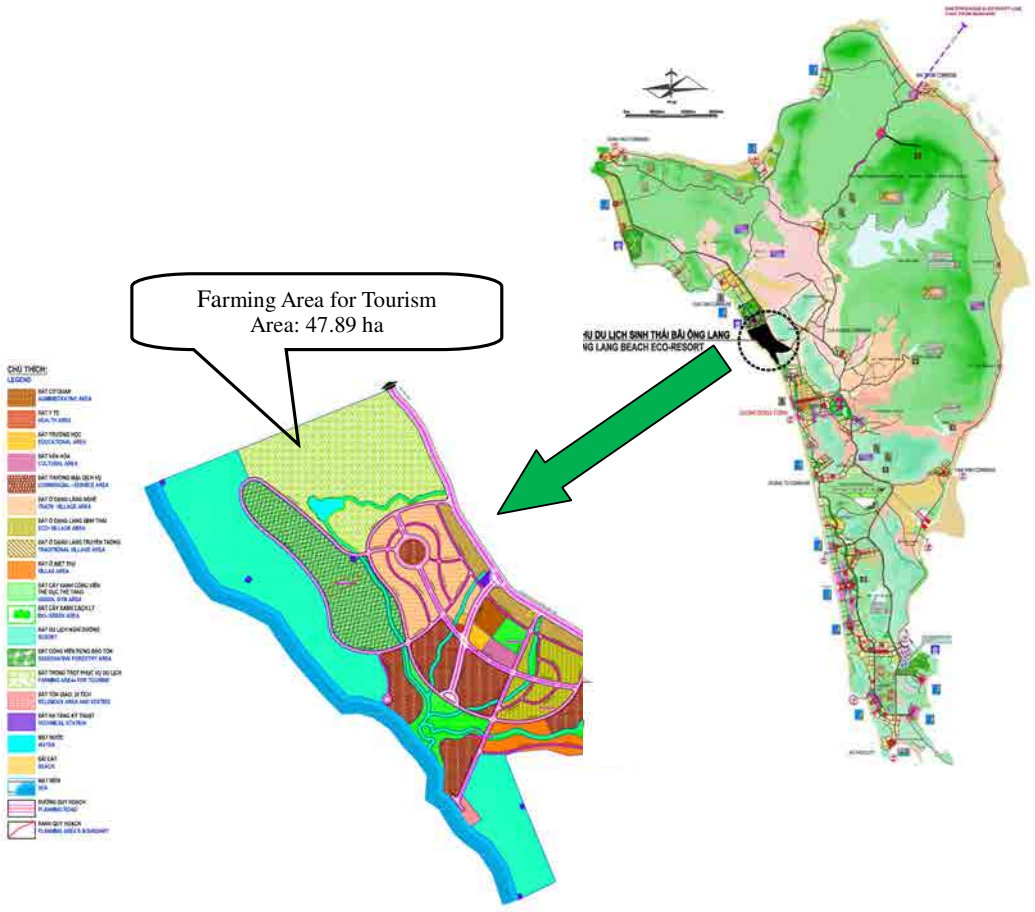


Figure 10 Expected Site of Sewage Treatment Plant

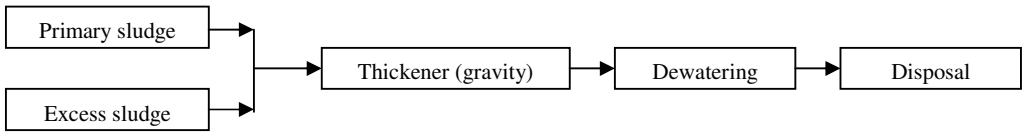
(2) Sewage Treatment Process

Conventional activated sludge process (a multi-stage nitrification denitrification process with step feed) is selected over the oxidation ditch, and sequencing batch reactor treatment processes because:

- the area requiring odor control is the smallest using screened methods;
- the cost is either the same or lower compared to the other two treatment methods;
- the effluent quality is almost the same or better than that of the other methods;
- nitrogen removal is better and
- the process is in use in many places in Vietnam, therefore, operating skills are well-established.

(3) Method of Sludge Treatment and Disposal

Sludge is treated without digestion because this method is cheaper and easier to operate. At this stage, no attempt is made to reuse or compost the treated sludge.



(4) The Impact of Future Garbage Disposal Units

In the future, it is expected that in-sink garbage disposal units shall be introduced in Viet Nam especially in the resort development area. It is estimated that influent quality would deteriorate in the following manner:

BOD：230 mg/L ⇒ 240 mg/L

S S：260 mg/L ⇒ 273 mg/L

T-N： 45 mg/L ⇒ 46 mg/L

T-P： 7 mg/L ⇒ 7 mg/L

The proposed treatment process is expected to be able to cope with the increased load.

(5) Energy Saving Measures

The planning for the STP would consider adopting energy saving measures and the use of biomass to reduce greenhouse gas emission and electricity consumption.

1) Measures for greenhouse gas reduction and its effects

If energy saving measures would be adopted for every unit process, the total energy savings would be about 2.2 million kWh with a cost saving of 53 million yen/year (based on current Vietnamese electricity charges).

2) Biomass utilization

The biomass produced by the sewage treatment processes could be digested to produce biogas used to generate electricity. However, the cost of the digestion facility and the biogas utilization equipment is more than the revenue from selling the electricity produced from the biogas. Therefore this approach would not be pursued at this time, but should be revisited when the cost of electricity goes up.

(6) Reuse of Reclaimed Water

The practical use of reclaimed water is for irrigation of the landscaped area surrounding the sewage treatment plant. Potential reclaimed water consumption volume is estimated at 1,650 m^3/day.

Double filtration, sand filtration or microfiltration produces adequate reclaimed water quality for landscape irrigation with unrestricted use. Sand filtration (deep-bed upflow continuous backwash) is recommended because it is cheaper.

4.5 Sewerage System

4.5.1 Sewer Network

(1) Layout of the Sewerage System

The layout of the proposed sewerage system is shown in **Figure 11**.

(2) Length of Sewer Pipes

Length of sewer pipes is described in **Table 9**.

Table 9 Length of Sewer Pipes

Phase	Main (m)	Secondary (m)	Tertiary (m)	Total (m)
1	18,246	9,801	31,365	59,412
2	24,037	3,200	10,240	37,477
Total	42,283	13,001	41,605	96,889

Source: JICA Survey Team

Source: JICA Survey Team

Figure 11 Layout Plan of Sewerage System

4.5.2 Sewerage Treatment Plant

The general layout and hydraulic profile of the STP are shown in **Figures 12** and **13**.

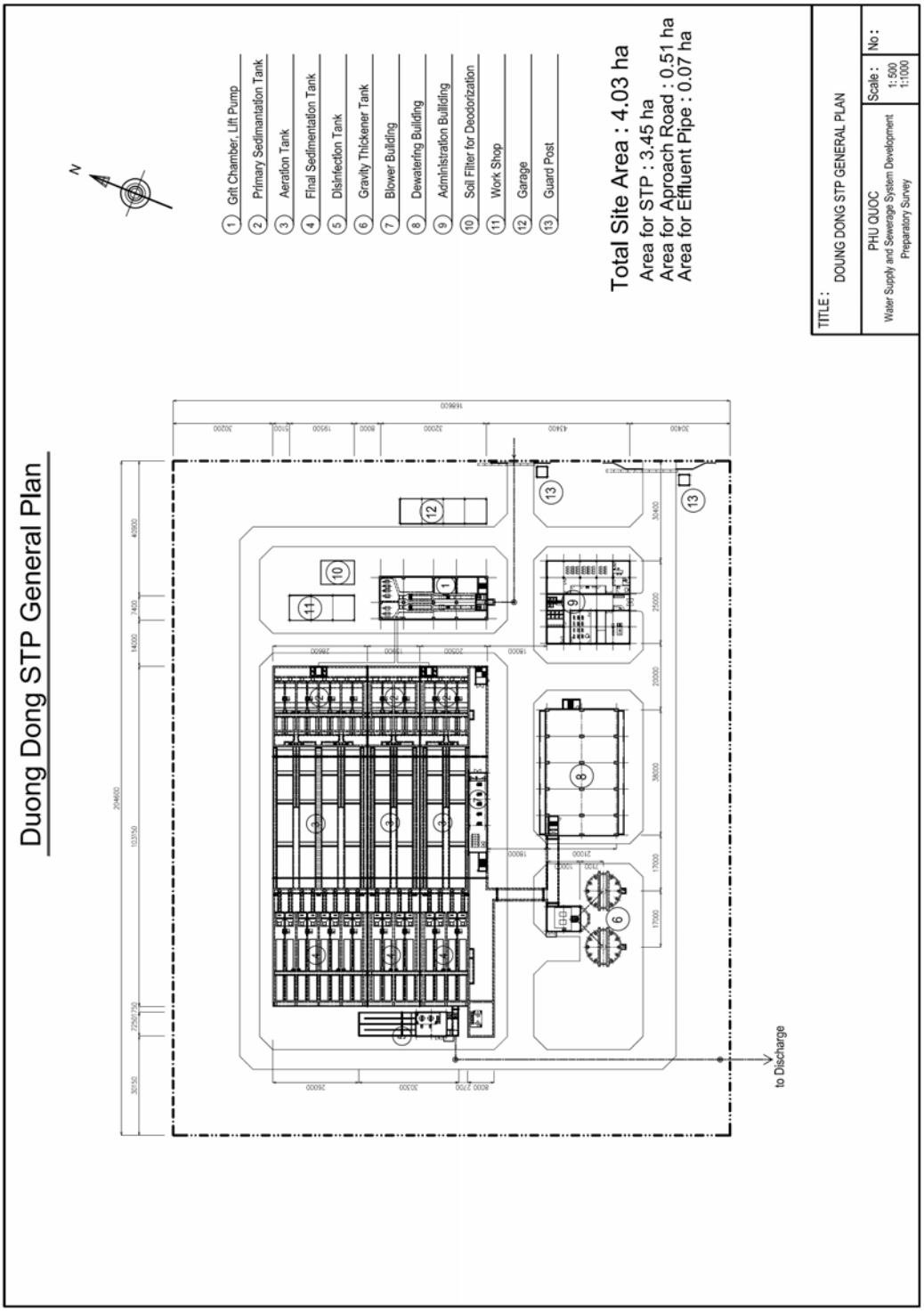


Figure 12 General Layout Plan of STP

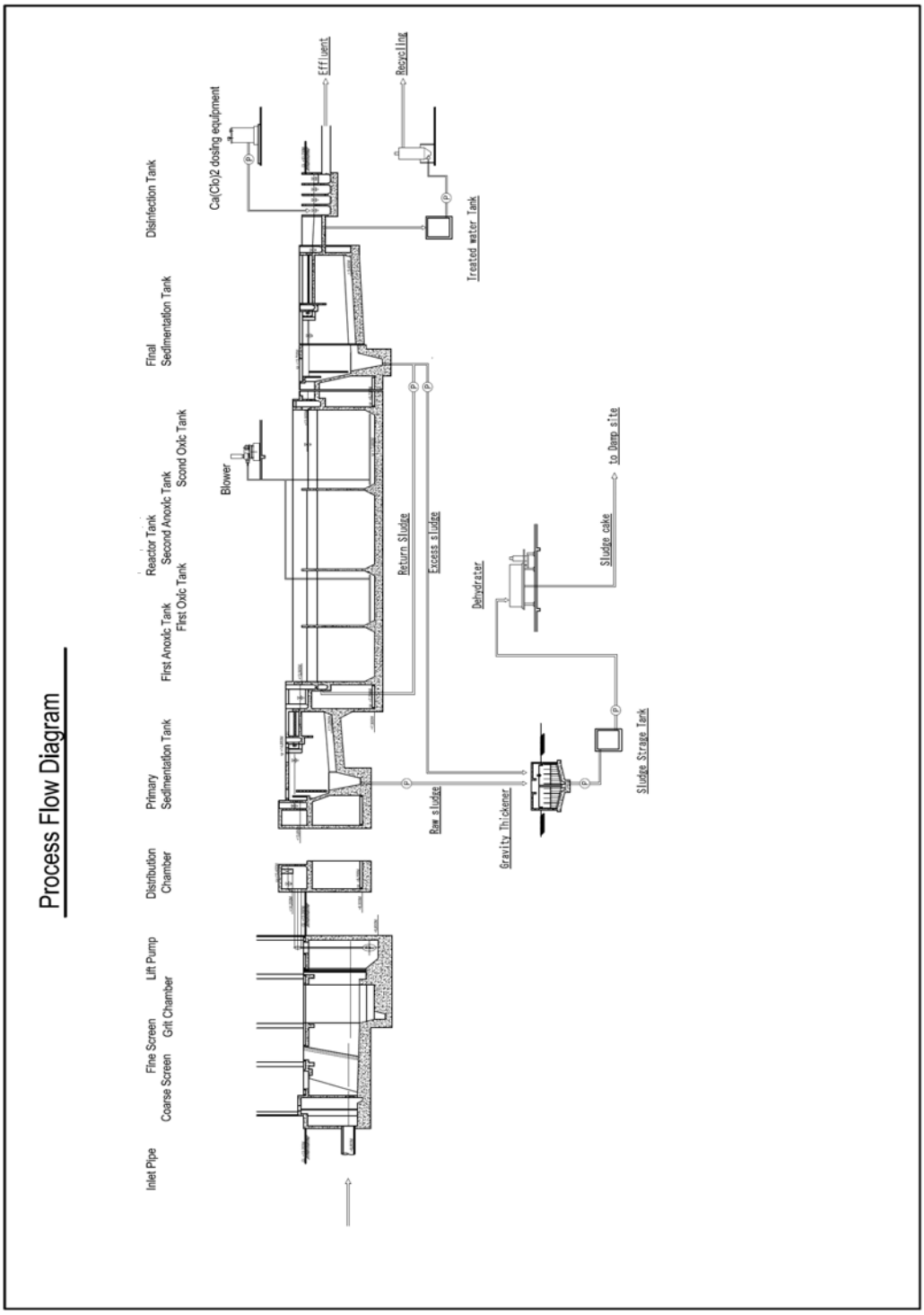


Figure 13 Hydraulic Profile of STP

5. Project Cost

5.1 Project Cost

The total project cost for the impounding reservoir, water supply system, and sewerage system is shown in **Table 10**.

Table 10 Project Cost

VND1=JPY 0.0037

No.	Item	Phase 1		Phase 2	
		JPY (x 1,000)	VND (x 1,000,000)	JPY (x 1,000)	VND (x 1,000,000)
1	**Impounding Reservoir**	**2,471,234**	**667,901**	**19,640**	**5,308**
	Construction	746,257	201,691	15,540	4,200
	Land acquisition & compensation	969,400	262,000	-	-
	Consultant services	93,728	25,332	-	-
	Price contingency	232,957	62,961	2,104	569
	Physical contingency	204,234	55,198	210	57
	VAT	224,658	60,718	1,785	483
2	**Water Supply System**	**2,632,036**	**711,361**	**3,147,505**	**850,677**
	Construction	1,475,220	398,708	1,497,349	404,688
	Land acquisition & compensation	20,258	5,475	2,161	584
	Consultant services	216,923	58,628	161,645	43,688
	Price contingency	462,836	125,091	940,085	254,077
	Physical contingency	217,524	58,790	260,124	70,304
	VAT	239,276	64,669	286,137	77,334
3	**Sewerage System**	**9,951,716**	**2,689,653**	**7,147,676**	**1,931,804**
	Construction	5,913,561	1,598,260	2,768,000	748,108
	Land acquisition & compensation	59,644	16,120	-	-
	Consultant services	473,017	127,842	195,004	52,704
	Price contingency	1,778,338	480,632	2,944,166	795,720
	Physical contingency	822,456	222,285	590,717	159,653
	VAT	904,701	244,514	649,789	175,619
	Total	**15,054,986**	**4,068,915**	**10,314,821**	**2,787,789**

1) As of February 2012

6. Public-Private Partnership

6.1 Sharing of Responsibilities

This project is proposed to be undertaken through a partnership of public sector authority (government) and a private party. The three business areas of this project are raw water supply (Cua Can impounding reservoir), water supply, and sewerage. At the meeting with KGPPC on 17 April, 2012, held at Rach Gia, it was agreed that the impounding reservoir would be constructed using government funds therefore raw water supply would remain public. Therefore, public private partnership (PPP) arrangements are only considered for the water supply and sewerage businesses.

6.1.1 Water Supply Business

The following 2 options will be discussed with KGPPC.

Water Supply Option 1 (BOO)

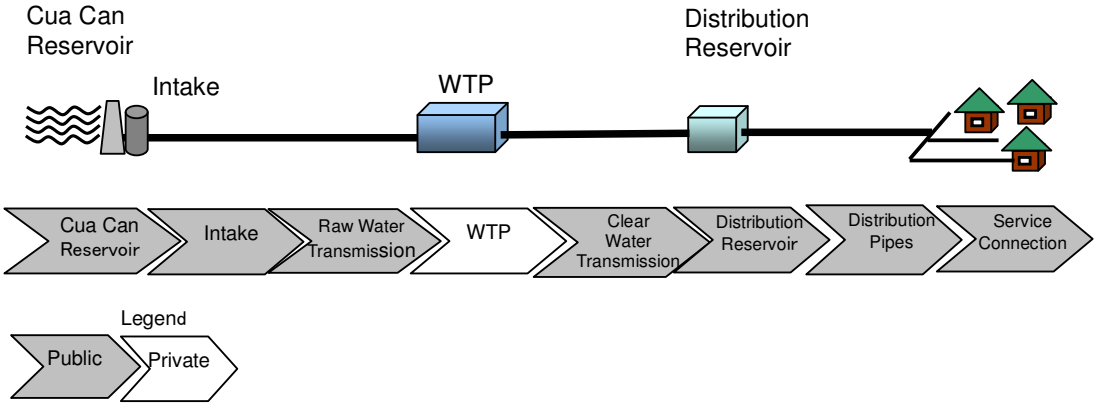


Figure 14 Water Supply Option 1 (Construction Responsibilities)

The Special Purpose Company (SPC), would construct the WTP, and operate and maintain the facilities from intake to WTP. The public sector authority would construct, operate, and maintain the other water supply facilities. This option is generally recognized as the build-own-operate (BOO) scheme.

The public sector authority would supply raw water to the SPC under a raw water bulk supply agreement. The SPC would supply the treated water to KIWACO from the WTP or from the distribution reservoir under a bulk water supply agreement. KIWACO would construct, operate and manage distribution facilities and service connections with its own financing and collect water tariff from customers.

Water Supply Option 2 (Concession)

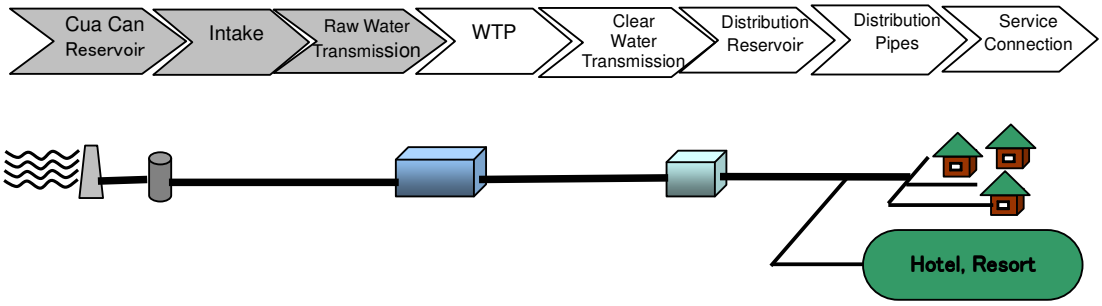


Figure 15 Water Supply Option 2 (Construction Responsibilities)

The SPC would receive a business license to construct the facilities from the WTP to service connections using its own funds. However, it would operate and maintain the facilities from the intake to the service connections. The SPC would sell water directly to the customers in the new water supply areas and collect the tariffs. KIWACO would continue to manage the existing service areas by receiving bulk water supply from the SPC.

In Option 2, the SPC would manage not only the WTP but also the distribution and service connections. The SPC would be required to establish the organizational structure of a water supply company, including pipe maintenance, meter reading, billing and collection, customer management and water quality control. KIWACO is already managing the water supply service in the Duong Dong District and surrounding areas. To avoid duplication, it is advisable that the responsibility of the SPC would end at the outlet of the WTP, or at distribution reservoirs, to supply bulk water to KIWACO.

6.1.2 Sewerage Business

The sewerage treatment plant (STP) and sewage collecting facilities could be constructed and managed by the private sector entity, or only the STP would be constructed and managed by the private sector entity utilizing the BOO scheme.

It is usually difficult for the private sector to construct and manage sewer pipes because the construction period is long and the construction cost is very high and the cost recovery period very long. This is particularly challenging when most of the sewerage network construction would take place in the already built up areas.

Therefore the 2 options being considered would exclude sewerage network construction in existing towns. Both options are categorized as BOO schemes.

Sewerage Option 1

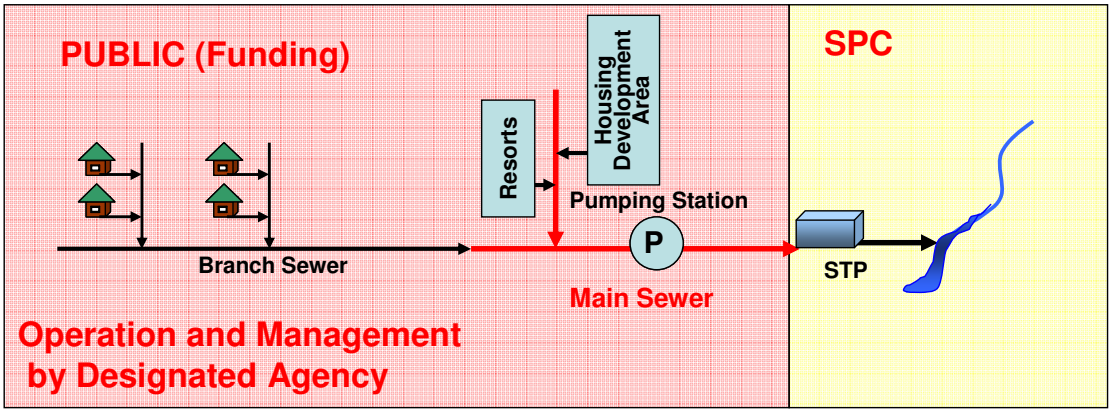


Figure 16 Sewerage Business Option 1 (Construction Responsibilities)

The SPC would be responsible for construction, operation and maintenance of the STP, while the public sector authority would be responsible for construction, operation and maintenance of all sewer and house connections.

Sewerage Option 2

The SPC would be responsible for construction, operation and maintenance of the STP and main trunk sewer. The public sector authority would be responsible for construction, operation and maintenance of branch and tertiary sewers, and house connections.

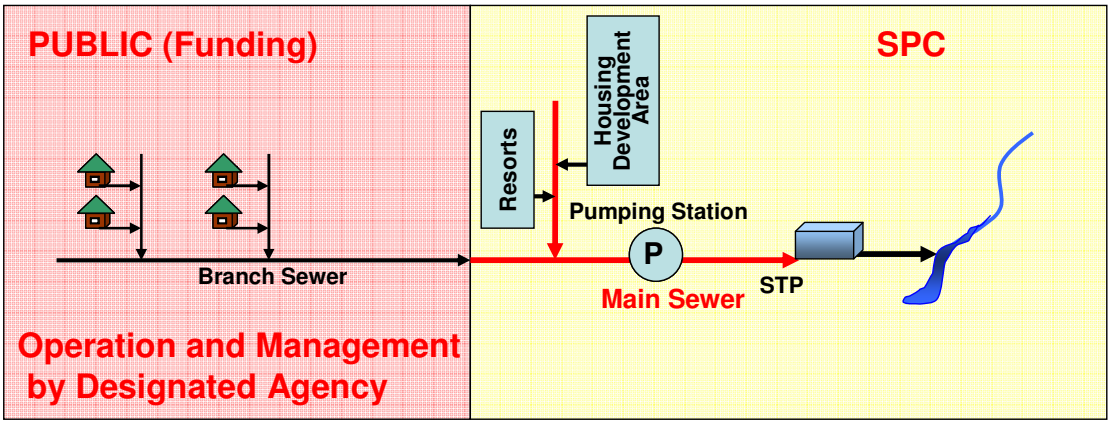


Figure 17 Sewerage Business Option 2 (Construction Responsibilities)

The proportion of public and private sector cost burdens for Phase 1 water supply and sewerage system development are shown in **Table 11** for each of the 2 Options.

Table 11 Public and Private Cost Burden of the Project (Phase 1)

Project		Burden	Facilities to be constructed	Construction Cost
Impounding Reservoir		Govt. of Viet Nam	Construction, Land acquisition & Compensation	2,471 million JPY
Water Supply System	Option 1	Govt. of Viet Nam	Intake, raw water transmission, clear water transmission, distribution reservoir, distribution pipe, service connection	1,192 million JPY
		SPC	WTP, land acquisition & compensation	1,439 million JPY
	Option 2	Govt. of Viet Nam	Intake, raw water transmission	137 million JPY
		SPC	WTP, clear water transmission, distribution reservoir, distribution pipe, service connections, land acquisition & compensation	2,494 million JPY
Sewerage System	Option 1	Govt. of Viet Nam	Main trunk sewer, pumping station, branch sewer, tertiary sewer	5,817 million JPY
		SPC	STP, Sewer maintenance vehicle, land acquisition & compensation	4,134 million JPY
	Option 2	Govt. of Viet Nam	Branch sewer, tertiary sewer	1,769 million JPY
		SPC	STP, main trunk sewer, pumping station, sewer maintenance vehicle, land acquisition & compensation	8,182 million JPY
Total Project Cost				15,053 million JPY

6.2 Financial Analysis

6.2.1 Water Supply System

(1) Analysis Methodology

The financial feasibility of the entire project is judged by whether or not the project's FIRR is higher than the WACC (Weighted Average Cost of Capital). For the SPC portion of the project, the Equity IRR must be higher than 15% (the minimum standard of capital cost) for this project to be financially feasible.

The financial analysis shows that the SPC project is not financially feasible under the current water tariff. The necessary tariff increases and the relevant bulk water tariff for achieving financial feasibility are also determined.

(2) Options and Preconditions

Financial analysis for Phase 1 of each of the 2 Options is explained in the following sub-sections.

1) Water Supply Option 1: BOO

In this option the public sector authority would construct the impounding reservoir, intake, and raw water transmission. The SPC would construct the WTP. The public sector authority would manage the impounding reservoir, and the SPC would manage the facilities from intake to the WTP. KIWACO would construct, operate and maintain the facilities from clear water transmission to service connections.

2) Water Supply Option 2: Concession

The public sector authority would construct the impounding reservoir, intake, and raw water transmission. The SPC would construct the facilities from the WTP to service connections. The public sector authority would manage the impounding reservoir, and the SPC would manage the facilities from intake to service connections. The SPC would also bill and collect water charges from its customers.

(3) Results of Analysis

The results of the financial analysis for Phase 1 of the water supply project are as follows:

Options	To make SPC project financially feasible (Equity IRR for 15 yrs ≧15.0%)	
	Bulk water tariff	Water tariff *1
Water Supply Option 1: BOO	**15,500 VND/m^3 (incl. VAT)**	**2.57 times of existing one, or** 14,135 VND/m^3: Domestic (incl. VAT) 25,700 VND/m^3: Commercial (incl. VAT) 19,275 VND/m^3: Industry (incl. VAT)
Water Supply Option 2: Concession	-	**3.28 times of existing one, or** 18,040 VND/m^3: Domestic (incl. VAT) 32,800 VND/m^3: Commercial (incl. VAT) 24,600 VND/m^3: Industry (incl. VAT)

Note: VAT 5%. The above tariff is calculated under the condition that tariff raise is conducted once in the year 2016. The above tariff does not include inflation adjustment. Therefore, it is necessary for the tariff to be adjusted to inflation. *1; Water tariff, which is enough to cover bulk water tariff, raw water cost, and construction, replacement, O&M costs of KIWACO's responsibility.

(4) Loan Repayment Capability

Loan repayment capability of the SPC is evaluated by calculating the Debt Service Coverage Ratio (DSCR) of the 2 options. In Japan if the DSCR is less than 1, repayment capability is generally considered as insufficient. If DSCR is greater than 1.5, repayment capability is generally considered as adequate. If the Equity IRR is higher than 15%, and the DSCR is greater than 1.5 the loan repayment capability of the SPC is healthy.

(5) Comparison of Financial Feasibility of Each Option

Table 12 shows that the financial feasibility of the entire Project (FIRR) (including public and private sector portions) is almost the same for both Option 1 and 2. However the financial feasibility of the SPC Project (Equity IRR) is quite different for the two options. The Equity IRR is 13.5% for Option 1 and only 1.2% for Option 2. Thus, Option 2 is not able to provide enough profitability for the private company to participate in the Project even with a 2.5 times tariff increase.

Table 12 IRR Values of Each Option at 2.5 Times Water Tariff Increase

Option	Project Cost (mil. JPY)	Water Tariff (including VAT)	FIRR	Equity IRR
Option 1: BOO	1,439	Bulk water tariff: 15,015 VND/m^3 Water tariff: 2.5 times, or Domestic: 13,750 VND/m^3 0.66 USD/m^3 Commercial: 25,000 VND/m^3 1.21 USD/m^3 Industrial: 18,750 VND/m^3 0.91 USD/m^3	12%	13.5%
Option 2: Concession	2,494	Water tariff: 2.5 times, or Household: 13,750 VND/m^3 0.66 USD/m^3 Commercial: 25,000 VND/m^3 1.21 USD/m^3	11%	1.2%

		Industrial: 18,750 VND/m^3 0.91 USD/m^3		

In Option 1 (BOO), the project cost for the facilities from intake to WTP would be funded by the private sector entity, but that for the facilities from transmission pipe to distribution pipes would be funded by the public sector authority. The Vietnamese side is encouraged to consider ODA loan to help cover part of the public sector portion of the project costs.

6.2.2 Sewerage System

(1) Analysis Methodology

Financial feasibility of the project of SPC (SPC project) is judged by Equity IRR of the project. In case that If the Equity IRR is greater than 15%, which is the general standard of capital cost, the SPC project is judged financially feasible.

Normally, in doing a financial analysis, revenue would be compared with the cost of the project. However it is not realistic to expect the sewerage tariff (assumed to be 10% of present water tariff) to be the sole source of revenue and to cover the full cost of the sewerage project (construction, O&M and replacement costs). Other sources of revenue such as developer's contribution and government subsidy must also be considered.

In Japan, capital cost contribution charges are levied on developers so the public sector authority is not carrying the full cost of the infrastructure investment. The developers would share this financial burden proportionally according to their estimated sewage flow. However, this approach would not work for this project because the financial burden would be higher than the cost for them to build their own sewerage treatment facilities. Therefore, in this project, the levy charged to developers is calculated using the estimated construction costs for the sewage treatment facilities that would be built by the developers divided by their estimated sewage flow, multiplied by the total estimated sewage flow of tourism resorts & hotels in this project.

The balance of the funding (subsidy) required to make the project financially feasible for the SPC would come from the government and a tourism surcharge.

(2) Options and Preconditions

Financial analysis of sewerage project conducted for Phase 1 of each of the 2 Options are as follows:

Sewerage Option 1: BOO of STP

The public sector authority would build the house connections, tertiary and branch sewers,

main trunk sewer and pumping stations. An entity designated by the public sector authority would operate and maintain these facilities. The SPC would construct, operate and maintain the facilities from the STP up to the discharge sewer.

Sewerage Option 2: BOO of Main Trunk Sewer, Pumping Station & STP

The public sector authority would construct the facilities from house connections to tertiary and branch sewers, excluding resort and development areas. These facilities would be operated and maintained by an entity designated by the public sector authority. The SPC would construct, operate and maintain the facilities from the main trunk sewer to pumping stations, STP and discharge sewer, in addition to house connections, tertiary and branch sewers in resort and development areas.

(3) Results of Analysis

The results of the financial analysis, for Phase 1 of the sewerage project are as follows:

Options	To make SPC project financially feasible (Equity IRR for 15 yrs≧15.0%) Required Subsidy from Govt., or Burden on tourist (to recover the Subsidy)
Sewerage Option 1: BOO of STP	**755 million JPY/year, 4.8 USD/ person**
Sewerage Option 2: BOO of trunk sewer, pumping station, STP	**1,068 million JPY/year, 6.8 USD/ person**

Note: In all of the above cases, sewerage tariff is 10% of water tariff, and total amount of developer's contribution is 53 billion VND (about 196 million JPY).

(4) Loan Repayment Capability

Loan repayment capability of the SPC is evaluated by calculating the Debt Service Coverage Ratio (DSCR) of the 2 Options. In Japan if the DSCR is less than 1, repayment capability is generally evaluated as insufficient. If DSCR is greater than 1.5, repayment capability is generally considered as adequate. If the Equity IRR is greater than 15%, and the average DSCR for the 2 options is greater than 1.5 the loan repayment capability of the SPC is healthy.

6.3 Project Implementation Schedule

After completion of this survey, fund procurement, project licensing procedure, and other related preparatory activities would follow. Construction would start in 2014 and the operation of the facilities would begin in 2017. The implementation schedule of the whole project is shown in **Figure 18**.

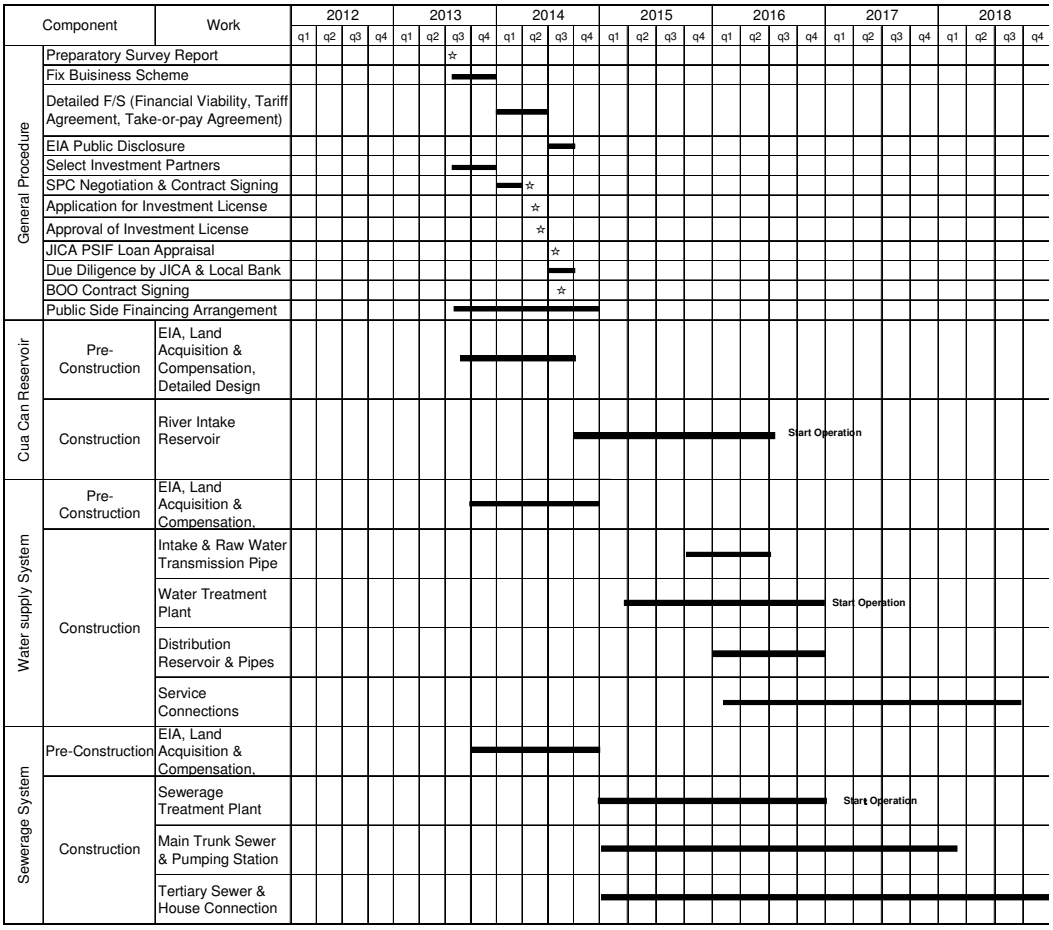


Figure 18 Implementation Schedule of the Whole Project

7. Preparation of Business Plan

7.1 Preferred Project Implementation Scheme

7.1.1 Water Supply Business

The preferred water supply project implementation scheme is BOO of the WTP and bulk water supply as described in "6.1.1 Water Supply Business".

The main reason for selecting BOO is that KIWACO is already managing the water distribution service in Duong Dong district and its surrounding areas and is organized to carry out all of the business and operating functions including pipe maintenance, meter reading, billing and collection, customer management and water quality control. It is reasonable for KIWACO to continue managing the distribution facilities and service connections in order to keep the service level uniform in the island and to avoid the inefficiencies of duplicating administrative and O&M management. For this project, it is advisable to simplify operational control and cost by giving SPC the responsibility for the WTP and bulk water supply to KIWACO. Furthermore, as was described in Financial Analysis, capital expenditure for SPC in Option 2 would be larger than Option 1. In order to raise provide enough profit to cover the risks and for the private companies to be interested in investing it, the tariff increase in Option 2 would be larger than Option 1 (BOO).

7.1.2 Sewerage Business

The preferred sewerage project implementation scheme is BOO of the STP as described in "6.1.2 Sewerage Business".

The main reason for selecting BOO is to minimize the capital expenditure for SPC and reduce the provincial government subsidy that would be required to make the operation of SPC financially viable. According to the estimation, the gap of the subsidy amounts between Option 1 and Option 2 becomes more than 300 million JPY per year.

7.2 Project Executing Agency

(1) Executing Agency (public sector authority) : Kien Giang Province, and KIWACO

It is necessary for the public sector authority to establish a special unit to facilitate and manage the implementation of this project.

(2) Private Contract Partner : SPC (Special Purpose Company)

The SPC would be directly engaged in the construction, operation and maintenance, and

replacement of equipment at the facilities. Some responsibilities may be subcontracted as required.

7.3 Responsibilities of the Public Sector Authority

7.3.1 Construction of Related Facilities

1) Water Supply Business

Kien Giang Province would use government funds to build the Cua Can impounding reservoir and cover the on-going O&M costs. KIWACO would be responsible for the procurement, construction and O&M of the treated water transmission system from the WTP as well as the distribution and service pipelines.

(2) Sewerage Business

Kien Giang Province would be responsible for the construction, O&M and replacement of equipment at sewage collection facilities up to the STP, including house connections, sewer pipes, and pumping stations.

7.3.2 Legal Requirements and Governmental Processes

(1) External Funding

It is recommended that the public sector authority secures necessary funding from the central government or from donor agencies through the central government by formulating a water sector program in combination with other local water supply and sewerage projects for the construction of treated water transmission pipes and sewage collection system.

(2) Island Entry Fee and Developer's Contribution

It would also be necessary to develop a legal framework via provincial decree to collect the 'Island Entry Fee' and 'Developer's Contribution'.

7.4 Project Financing Plan

7.4.1 Cost Sharing between Public and Private Sector Partners and Equity and Debt Ratio

The private sector partner would source its share of the project cost from investors (capital investment - equity) and financial institutions (loan - debt). The proportion of equity to loan should be 30 - 70 %.

Table 13 and **Table 14** show the Phase 1 cost sharing between the public - private sector

partners and the equity and debt amounts of the private sector partner for each proposed option of the water supply and sewerage system.

Table 13 Public and Private Cost Burden of the Water Supply Project (Phase 1)

Project		Burden	Facilities to be constructed	Construction Cost (million JPY)
Impounding Reservoir		Govt. of Viet Nam	Construction, Land acquisition & Compensation	2,471
Water Supply System	Option 1	Govt. of Viet Nam	Intake, raw water transmission, clear water transmission, distribution reservoir, distribution pipe, service connection	1,192
		SPC	WTP, land acquisition & compensation	1,439 (Equity 432) (Debt 1,007)
Total Project Cost				5,102

Note: Total Project Cost to calculate the actual Debt amount must add the Interest during Construction to SPC's Project Cost.

Table 14 Public and Private Cost Burden of the Sewerage Project (Phase 1)

Project		Burden	Facilities to be constructed	Construction Cost (million JPY)
Sewerage System	Option 1	Govt. of Viet Nam	Main trunk sewer, pumping station, branch sewer, tertiary sewer	5,817
		SPC	STP, Sewer maintenance vehicle, land acquisition & compensation	4,134 (Equity 1,240) (Debt 2,894)
Total Project Cost				9,951

Note: Total Project Cost to calculate the actual Debt amount must add the Interest during Construction to SPC's Project Cost.

7.4.2 Expected Capital Investors and Terms and Conditions of Loan for SPC

Japanese companies such as KOBELCO Eco-Solutions Co., Ltd. (KESV) and Vietnamese companies are expected to be the investors in the SPC. The loan is expected to come from JICA Private Sector Investment Finance as a two-step loan through a private bank in Viet Nam.

Table 15 Terms and Conditions of Two Step Loan (JICA Private Sector Investment through Private Bank in Viet Nam)

Items			Two Step Loan (JICA Private Sector Investment Fund through Private Bank in Viet Nam)
1)	Project		Private project
2)	Application procedure		Private bank, quick & easy
3)	Terms of Loan Condition	Interest	VND market rate minus preferential interest rate
		Repayment	Max. 25 years (including 5 years grace period)
		Currency	VND

7.5 Risk Allocation of the Project

Among the various solutions to tackling the risks, it is considered that the "Take-or-pay clause" is one of the most important factors for the success of this project. This is a solution for a future risk where water demand after facility construction completion becomes lower than that at the planning stage. In such a case, the public sector side guarantees to pay a certain minimum amount for Bulk Water Supply even though the amount of bulk water sold is lower than estimated amount. This clause is prevalent to avoid the risk that the SPC becomes financially unsustainable in the event of revenue shortage caused by unexpected low water demand.

The Government of Viet Nam is strongly committed to tourism development of Phu Quoc Island by improving transportation and municipal infrastructure. Visiting procedures for tourists would also be simplified, targeting to attract 2 million tourists per year by 2020 and 5 million by 2030. More hotels and resorts will be developed. The improvement of infrastructure, including water supply and sewerage systems, is very important in facilitating the smooth operation of these businesses.

In this survey, the projected water demand and sewage flow (as calculated from the water demand) include the estimated infrastructure needs of the tourism industry. The estimated needs must be kept on an appropriate level to avoid any perceived less than robust outlook which may discourage continued investment. If the tourism business falls short of expectations, the government must be able to help mitigate this kind of demand risk by having the "Take-or-pay clause", for the private companies to be interested in participating in the project.

8. Recommendations

1. The proposed water supply system development is composed of three sub-projects, namely, Cua Can reservoir construction (including intake and raw water transmission), water treatment plant construction and distribution network construction. Although it is common in Viet Nam that impounding reservoirs are planned and developed by DARD, it would be necessary to establish a special unit to manage and coordinate the implementation of the three sub-projects. This is because Cua Can reservoir is exclusively used for water supply and the three sub-projects are closely related components of the water supply system.

   In the proposed business scheme, the three sub-projects would be operated and managed separately by KGPPC, a private investor, and KIWACO. A steering committee would be required for the comprehensive coordination at each stage of the implementation, such as financing, design, tender/contract, construction and operation.

2. Sewerage system developments in Viet Nam are usually financed using the central government grants and O&M expenditure covered by the environment protection fee collected as 10% of water supply charge. Since Phu Quoc will be developed into a world class eco-tourism center, extra fee on hotel accommodation could be collected to help finance the sewerage development so that the project would be less reliant on government subsidies. In Hawaii, a 12.5% transient accommodation tax (TAT) is collected to support schools, police, infrastructure and parks. Further discussions would be required to introduce a similar financing mechanism for this project.

3. The public sector partner would be responsible for securing funding for the construction of the Cua Can reservoir and distribution system in the proposed water supply system development and the sewer network in the proposed sewerage system development. KGPPC's own source of financing may not be sufficient. It would be necessary to seek support from the central government and/or funding from donor agencies through the central government. In competing with other candidate projects for donor funding, KGPPC would have to show strong leadership, such as establishing a sector program for the joint development and management of water supply and sewerage projects. KGPPC may also wish to make special effort to discuss with relevant agencies to seek their support and assistance in this process.