SOCIALIST REPUBLIC OF VIET NAM
QUANG NINH PROVINCIAL PEOPLE'S COMMITTEE
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CONSTRUCTION INVESTMENT PROJECT

WATER SUPPLY SYSTEM UPGRADING, REHABILITATING AND EXPANDING PROJECT FOR 03 COMMUNES OF PHONG COC, CAM LA, LIEN HOA IN QUANG YEN TOWN, QUANG NINH PROVINCE FUNDED BY IATALIA ODA FOR WATER INDUSTRY IN PHASE II

05-2014

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CLIENT

HONG QUANG CO.,LTD

M.S.D.N: 5700507926 - C.T.T.N.H.H
CÔNG TY TRÁCH NHIỆM HỮU HẠN HỒNG QUẢNG YÊN HƯNG
TX.QUẢNG YÊN - T.QUẢNG NINH

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Nguyễn Hữu Quảng

CONSULTANT

DONG DUONG INVESTMENT AND CONSTRUCTION JOINT STOCK COMPANY

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GIÁM ĐỐC
Nguyễn Văn Minh

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1. DESCRIPTION OF PROJECT, PROPOSAL AGENCY, PROJECT IMPLEMENTATION AGENCY AND OPERATION AGENCY.

1.1 Project description

1.1.1 Project objectives

- ✓ Completing the construction of water supply system to meet water needs of the entire island of Ha Nam, Quang Yen town, Quang Ninh province
- ✓ Improving quality of life of people in the project area
- ✓ Reducing water-born diseases
- ✓ Improving the role and position of the project area, Ha Nam island in Quang Yen town, Quang Ninh province.
- ✓ Promoting economic development, attracting investment.

1.1.2 Summary of technical proposals for the project

Table 1: Summary of technical proposals for water supply system in **Phong Coc Ward**

Items	Technical solutions
Location	Phong Coc Ward, Quang Yen town, Quang Ninh province
Water supply diagram	Rehabilitate and expand the water supply system in Phong Coc Ward from Q = 600 m3/day to Q = 1,100m3/day. Water source is from Yen Lap lake → raw water chanel→ Water reversoir → Pumping station 1 →water treatment work → water tank -> Clean water pumping station -> distribution and service pipeline network.
Water supply capacity	Water supply capacity until year 2020: Q = 1,100m3/day.
Intake structure – PS1	Install 02 centrifugal horizontal-axis pumps (01 operation, 01 standby) with Q=46m3/h, H=29m.
Treatment works	Rehabilitate and expand Phong Coc water treatment plant with capacity from Q = 350m3/day to 1,100m3/day - Build new pump stations and chemical house. - Construct a new treatment work DHK-V4.1000. - Construct a new water tank by steel Vefficiency = 312m3. - Install 03 clean pumps: Q=39m3/h, H=34m.
Transmission, distribution/service pipeline network	Using HDPE-PN8 pipe for transmission and distribution pipe with diameter of: - DN200-L=1,143m - DN160-L=1,295m - DN110-L=1,334m Using HDPE-PN8 pipe for service pipe: HDPE D75 Pipe m 5,061 HDPE D 63 Pipe m 2,823 HDPE D 50 Pipe m 2,120 HDPE D 40 Pipe m 2,689 HDPE D 32 Pipe m 640

Items	Technical solutions		
	HDPE D75	m	5.061
	HDPE D63	m	2.823
	HDPE D50	m	2.120
	HDPE D40	m	2.689
	HDPE D50	m	2.120

Table 2: Summary of technical proposal for water supply system in Cam La commune

Items	Technical solutions		
Location	Cam La commune Quang Yen town, Quang Ninh province		
Water supply diagram	Rehabilitate and upgrade of Cam La water supply systems from Q=120 m3/day to Q=700m3/day. From Yen Lap lake's water source → raw water chanel → Water reversoir → pumping station 1 → treatment work -> water tank -> pumping station 2 -> distribution and service pipeline network.		
Water supply capacity	Water supply capacity until year 2020: Q = 1.000 m3/day.		
Intake structure – PS1	Install 02 horizontal pump with Q=29m3/h, H=29m		
Treatment plant	Rehabilitate and expand Cam La water treatment plant from Q = Q=120m3/day to Q=700m3/day - Improve the pump station and chemical house - Construct a new treatment work DHK-V4.1000. - Construct a new water tank by steel $V_{efficiency}$ = 176 m3. - Install 02 clean pumping station: Q=45m3/h, H=34m		
Transmission, distribution/service pipeline network	Using HDPE-PN8 pipe for transmission and distribution pipeline with diameter of:		
	HDPE pipe D160	m	992
	HDPE pipe D11	m	2.30
	Using HDPE-PN8 pipe for service pipe:		
	HDPE pipe D63		3.260
	HDPE pipe D50	m	1.344
	HDPE pipe D40	m	1.647
	HDPE pipe D32	m	1.616

Table 3: Summary of technical proposals for water supply system in Lien Hoa commune

Items	Technical solutions
Location	Lien Hoa commune, Quang Yen town, Quang Ninh province
Water supply diagram	Rehabilitate and upgrade the water supply system in Lien Hoa commune from Q=360 m3/day to Q=1.300m3/day. Yen Lap lake's water source → raw water chanel → Clean water reversoir → pumping station 1 -> water treatment unit → reservoir -> pumping station 2 -> distribution and service pipeline network.
Water supply capacity	Water supply capacity until year 2020: Q= 1.300 m3/day
Intake structure – PS1	Install 3 horizontal pumps Q= 30 m3/h, H= 29m

Items	Technical solutions		
Treatment plant	Rehabilitate and expand Lien Hoa treatment plant from Q = 360 m^3 /day to Q = 1300 m^3/day. - Construct a new water tank by steel $V_{efficiency}$ = 312 m3. - Construct a new treatment work DHK-V 4.1500. - Install 3 clean water pumps: Q=46m3/h, H=34m, and a backwash pump: Q=30m3/h, H=29m		
Transmission, distribution/service pipeline network	Using HDPE-PN8 pipe for transmission and distribution pipe with diameter of:		
	HDPE D200	m	338
	HDPE D60	m	1.115
	HDPE D110	m	3.278
	Using HDPE-PN8 pipe for service pipe:		
	HDPE D63	m	755
	HDPE D50	m	3.371
	HDPE D40	m	2.770
	DPEP D32	m	1.343

1.2 Project responsible agencies.

1- Project name: water supply system upgrading, rehabilitating and expanding project for 03 communes of Phong Coc, Cam La, Lien Hoa in Quang Yen town, Quang Ninh province financed by ODA borrowed fund from Iatalia Government for water industry in phase II:

2- Executing agency: Quang Ninh Provincial People's Committee, Viet Nam

a) Contact Address: Hong Ha ward - Ha Long - Quang Ninh.

b) Phone number: 033.3836032 Fax: 033.3835353

c) Email: *vpubnd@quangninh.gov.vn*

3- Project proposing agency

a) Quang Ninh Department of Agriculture and Rural Development

b) Address : Hong Ha ward - Ha Long - Quang Ninh

c) Phone : 033.835661 Fax: 033.839597

4- Project Owner: Hong Quang Co., Ltd

a) Contact Address : 4 area – Phong Hai ward– Quang Yen town – Quang Ninh

b) Phone number : 033.3680610 Fax: 033.3680610

2. PROJECT IMPLEMENTATION PROGRESS

- Preparing Feasibility Study Report: May 2014
- Designing detailed design drawings, cost estimation and bidding documents: January, 2015
- Bidding, approving and selecting construction contractor: April, 2015

- Construction of works : from June, 20 5 to December, 2016.

3. LOCATION OF PROJECT

The project is implemented in 03 communes in Ha Nam island of Quang Yen town, Quang Ninh province

4. FINANCING SOURCE OF THE PROJECT

4.1 Total investment cost:

Total investment cost of the project is: **29.274,000,000** VND.

4.2 Funding source of the project:

The project is implemented with commodity assistance capital from the Government of Italy and counterpart fund (the Ministry of Finance and People committees of Quang Ninh province). In which:

- Commodity assistance from the Government of Italy : **11,644,000,000 VND**
  Rate : 40%

- Counterpart fund: **17,630,000,000 VND**
  Rate : 60%

4.3 Financial mechanism

Commodity assistance from the Government of Italy: the Project Owner is allocated with capital as capital budget.

Counterpart fund of the Ministry of Finance and the People's Committee of Quang Ninh Province: The Project Owner is financed under the Budget Law

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5. PROJECT EFFICIENCY

5.1 Financial Efficiency

- ✓ Water tariff for domestic use: 4.000 VND/1 m3
- ✓ Water tariff for administrative, public: 5.700 VND/1 m3
- ✓ Water tariff for small production, small industry: 6.800 VND/1 m3
- ✓ Water tariff for business, services, restaurants: 9.800 VND/1 m3
- ✓ Average water tariff: 4.945 VND/1m3.
- ✓ The analysis is as follows:

NPV value	46.020	(million VND)
FIRR coefficient:	12.96%	

5.2 Economic Efficiency

ENPV value	11,100
Benefit/Cost ratio (EBCR)	1.15

EIRR coefficient: 14,95%

5.3 Social efficiency

The implemented project will bring about a great social-economic efficiency and contribute to improve living standards and conditions of people in the project area and also attract investors to build infrastructure, trade and service centre and attract tourists to the island of Ha Nam.

II. CONTEXT AND RATIONALE OF THE PROJECT

1. GENERAL INTRODUCTION

1.1 Overview

Water and rural sanitation has been one of the top national goals in Viet Nam. Since 1998, Vietnam national objective program on water and sanitation in rural areas has been implemented since 1998. The program has so far brought about significant effect. The number of people access to clean water and safe sanitation increased significantly.

Quang Yen district is located in the southern of Quang Ninh, this is the land of rich culture and long history with the heroic historical evidence of the nation. Along with the development of the nation, Quang Yen has changed it appearance day by day and the rural areas are gradually improving. In recent years with the attention of the Government, ministries and central branches and along with the endeavor of the locality, the economy - society of the district has made significant progress; people's lives are improved and infrastructure has been gradually built. Local Party ha pay attention to investment task to develop infrastructure such as electricity, schools, clinics, roads, irrigation,.... However, with limited budget, while there are many problems to be solved, so in some areas did not meet the essential needs of the people. Especially the problem of water supply and drainage and environmental sanitation construction which has not been uniform and completed.

Quang Ninh Provincial People's Committee has assigned the Center for water and rural sanitation, Quang Ninh province to take water to the people on Ha Nam island. However, until now water supply is only processed at modest level for some urban ; and for some suburban areas, there is no water supply system or some water plants have been built and invested but does not operate at its full capacity due to lack of funds to invest in expanding network of distribution pipeline Many projects have been calling for investment to provide access to clean water including the upgrading, improving and expanding regional water supply system in Ha Nam island, Quang Yen town, Quang Ninh province

1.2 Project introduction

Project name: Project name: water supply system upgrading, rehabilitating and expanding project in Ha Nam island, Quang Yen town, Quang Ninh province;

Project Owner: Hong Quang Company Limited;

Consultant: Dong Duong Construction and Investment Joint Stock Company (DDC)

Project location: Phong Coc Ward, Cam La, Lien Hoa, Quang Yen town, Quang Ninh province.

Commencement and completion date: Commencement time on December, 2013 and Completion time on December, 2016.

2. INVESTMENT NECESSITY

2.1 Current status of the project area

2.1.1 General

Surveying, collecting data and assessing the current state of technical infrastructure systems in general, the current status of water supply systems in particular is to understand the actual situation as well as the inadequacies, the burning issues on water demand in the project area as a whole huyện Quang Yen town. Effectiveness and feasibility of the project is guaranteed by the status of the project area.

2.1.2 Current status of water supply

2.1.2.1.1 Comment and assessment

In general, water resource faint of Quang Yen Town is very limited. Light surface water and groundwater is very limited and scale pale vay.Vi also planning to utilize both water supply rainwater, surface water extraction or if ground water exploitation regime must be appropriate to prevent salt water from side (river water salinity) and go up from deep (water in limestone CP). With water resources in Henan island area than the district is more limited, can only exploit rainwater and surface water to process water supply.

2.1.2.2 Current status of domestic water supply .

2.1.2.2.1 The status of people's water using

Ha Nam Island area as well as localities in the coastal mountains, the water used for drinking activities in an organized way is still inadequate. Rural people ever took advantage of all the water, depending on natural conditions and socio-economic of the family. Rainwater on the island has become the leading source of water supply for local people; most households have some equipment such as jars, ... inspired to collect and store rainwater. Howerver, the number of household can collect and store rainwater for cooking and daily life activities is limited, each village has only a few family afford of building new storage tanks with a capacity large. The majority of water used by surface water (rivers, ponds, lakes).

2.1.2.2.2 Water treatment works in Ha Nam island

Until now, the water supply for domestic use in Ha Nam island, Quang Yen town remains some concerns. In recent years, the water supply has been implemented in some localities with better condition. The existing water supply plant were built in 80 or 90 decade. These are plants with out of date and simple technology and are not qualified to process fresh water as defined by the Misnistry of Health. In some communes, there have been implementation of UNICEF well but the quantity is not much

Below are some of the current water processing construction in Ha Nam island.

Current status of water supply station		
Station name	**Item**	**Status**
Cam La station Capacity Q = 120 m3/day. Area S = 170 m2	*1. Reservoir*	Water from Yen Lap lake
		Using a reservoir for 550 households/ 970 house holds
		Volume: V max = 3000 m3; V tb = 2500 m3
		Shortage of reserves

Current status of water supply station		
Station name	**Item**	**Status**
	2. Pumping station	Supply pump (1 pump): Q_1 = 50 m3/h, H = 42m (directly pumping from primary settling reservoir to network)
	3. Filter	Not operating because of small capacity and partly failure
		Degraded, not in use now
	4. Network	Length: L = 9,5 km
		Diameter reduced from D = 90 to D = 27
Phong Coc station Capacity Q = 600 m3/day	*1. Reservoir*	Get water from Yen Lap lake
		Using 2 basin water supplying for 680 house hold/ 2000 household
		Volume V = 4000 m3; S = 5000 m2, in good operation
		Shortage of reserves
	2. Pumping station	Raw water pump (1 pump): Q_1 = 78 m3/h (Pump from reservoir to the filter tank)
		Clean water pump (1 pump): Q_2 = 33 m3/h (Pump from reservoir to network)
	3. Filter	It has just been built with small capacity (15m3/h), thus it is not used now
	4. Reservoir	Capacity: 90m3
	5. Net work	Length: L = 10,5 km
		Diameter reduce from D = 90 to D = 27
Lien Hoa station Supply water to 2 communes: Lien Hoa 2 and Lien Hoa 3 Q=360m^3/day	*1. Reservoir*	Get water from Yen Lap lake
		Use a reservoir to reserve water and supplying for 720 house holds/ 2065 house holds
		In good operation, with indicator: V = 3000 m3
		Shortage of reserves
	2. Pumping station	Raw water pump (1 pump): Q_1 = 78 m3/h (Pump from reservoir to filter tank)
		Clean water pump 2 (1 pump): Q_2 = 33 m3/h (Pump from reservoir to network)
		Backwash pump: Q =80m3/h
	3. Filter	In bad operation Insufficient volume
	4. Basin	Shortage of volume Lack of chemical equipment
	5. Network	Network of (uPVC) pipe is damaged at many parts. L= 7,71 m

2.1.2.2.3 Comment and evaluation:

In general, the use of water of the people on Ha Nam island is still very limited, water treatment technologies is backward and not qualified for standard food hygiene and activities of people. Treatment works were built long ago, are now seriously degraded.

many items in the works no longer used, lack of reserves. Thus construction, renovation and upgrading of water supply system in Ha Nam island is urgently needed.

2.1.3 Drainage system and environmental sanitation

The drainage system in the communes in the project area, is unavailable or incomplete. The water is poured out naturally improperly and unplanned or defined in a certain direction. Rainwater and wastewater flow out into the grooves in the road edges or in the alley and then flow into the pond, lake or canal leading to serious environmental pollution due to uncollected.

2.1.4 Traffic status

Network of rural and town's traffic including town road and inter-communal roads are relatively convenient and easy. The road network and motorways were built reaching 100% level. Network of inter-village road is gradually upgraded. Hundreds of miles have been concreted and asphalted to meet the demand for travelling and commodity exchanging and making a better present of the rural. Currently, communes are continuously implemented concretion of rural roads.

Network of waterway with large and small canals spread evenly across communes with a convenient system of dikes for irrigation in agricultural production.

2.1.5 Irrigation status

In many different funds from central to local levels, there are many investment projects in irrigation infrastructure throughout the district. The irrigation construction in and out the system basically meet the requirements of irrigation water. In order to serve agricultural production at the highest level, cooperatives focus on irrigation and annually mobilize contributions of thousands of labor to dredg canals and ditches. Pumping stations are active in adding new field-pump irrigation for production and also repairring or building more irrigation works.

2.2 The needs for investment

As stated in the previous section, communes on Ha Nam island, Quang Yen town now have the only source of safe water surface water from Yen Lap Lake which is relatively abundant and can be utilized for living, besides people still make use of water wells (wells), public wells and rainwater. Used water is not yet sanitary; and cannel water due to the end of the source , was heavily contaminated by the fertilizer and organic matter.

So many germs arise in recent years such as: skin diseases, intestinal diseases , gynaecological diseases and respiratory diseases ... Water quality is not qualified and affecting to people's health.

Currently the rural economy is on the rise. Party and State always pay attention to develope the infrastructure of society. Focus on taking care to protect people's health and

clean water is essential needs of man which is also one of criteria to evaluate the civilized life of society in general and the people on the island region in particular.

The project of upgrading, improving and expanding water supply system in Ha Nam island is very urgent. This is also a major policy of developing the infrastructure in the area of island district of the Party and Government, in accordance with the desires of the people.

III. DESIGN, RESOURCES, RESULTS

1. WATER SOURCE

1.1. Overview

The project of upgrading, improving and expanding water supply system in Ha Nam island, Quang Yen town, Quang Ninh province will build a centralized water supply system to ensure hygiene standards following regulations . Therefore, research of water resource is one of requirements and has significant meaning in project.

The different water sources are studied and compared by the consultant

1.2. Rain water source

Average annual rainfall in Quang Yen town is at 1657mm.

The rainy season occurs from May to October which are months with a rainfall of over 100 mm, the month with highest rainfall is August with over 300mm. From November to April there is less rain, often no more than 50mm. Thus, in a year there are up to 6 months shortage of rain.

The quality of rainwater ensuring hygiene standards but the average rainfall is irregular, flow of water supply for people not guaranteed. Therefore, rain water is only able to partially meet the needs of people in the area because rain depends on season within a year.

1.3. Underground water

According to collecting documents, Ha Nam island with the characteristics of nearing the sea, sharly changing terrain and the geological structure in the project area is relatively complex and potentially contains hazardous metal source such as Sb, As, Cu, ... especially radioactive elements. In many places, many reasons including unsanitary water cause the hair loss disease, intestinal diseases. Underground water reserves in the project area is low; groundwater extraction from wells of households contains more iron and other impurities.

The above problem shows that in order to use groundwater as a source of raw water for the project it is nessary to conduct research and evaluation on quality of underground water reserves.

1.4. Sources of surface water

Main water supply source of Quang Yen town is Yen Lap lake. Yen Lap lake is constructed on Mip river , a large river of Quang Ninh province. Mip river completely flows out of Quang Yen area, only the end of river flowing into the sea under the Quang Yen land area. This river has the length of 34 km, the area of catchment is 182 km^2 the flow capacity of about 153x106m3/year. Maximum flow at 623m3/s, minimum 0.08 m3/s. Minimal traffic *(annual Mini 2 0.46 m3/s), the largest Mini Mean (Mini 9 6.7 m3/s, 2.67 on september, annual average in m3/s)*

Yen Lap lake is constructed and put into operation from 1980s with designed volume of $118x10^6m^3$, altitude of water level + 23,5m, average depth 29,5m ; length of

20km and the width of smallest section about 100m (and the largest section of 500m) with main purpose of agricultural activities, and then using on the living activities of Quang Yen town, Hoanh Bo town, and Ha Long city under Quang Ninh province. Currently, dute to climate change and other causes, water reserve of the reservoir also reduces to 64 x$10^6 m^3$, water level also reduces 5,5m comparing the design. Yen Lap lake always plays an important and unique role for the Quang Yen town.

For Ha Nam island area, the water source of Yen Lap lake is the unique source for irrigation in the living activities of communes in the island. Open ditche system has length of 20 km (main chanel) put water in all communes in the district. A pipeline D 1000 mm is set up accross Chanh river to take water from the north area of the district to open ditche system of the communes in the island.

Water of Yen Lap lake to supply for the communes in Quang Yen district has the high quality, meeting the requirements of living and drinking water. However, it shall treat bacteria in Yen Lap lake prior to put water in use. In recent years, Yen Lap Lake is reinforced and protected well.

Currently, the Yen Lap Lake is the source of raw water to water plants in the project area.Below is the table shows analysis results of water samples taken from the Yen Lap.

Table 1: Water quality of Yen Lap lake

No	Target	Unit	Result	QCVN 08: 2008/BTNMT (Collum A2)
1.	pH		7,75	6,5÷8,5
2.	Turbid	NTU	7,0	2
3.	Total Dissolved Solids (TDS)	mg/l	81	1000
4.	Absolute alum	mg/lCaCO$_3$	80	-
5.	Rate of oxidationKMnO$_4$	mg/l O2	0,08	-
6.	Total hardness	mg/lCaCO3	80	300
7.	NO_2^-	mg/l	0,001	3
8.	NO_3^-	mg/l	5,48	50
9.	NH_4^+	mg/l	0,03	3
10.	Salinity	o/oo	0,022	-
11.	Total Fe	mg/l	1,68	0,3
12.	Total Mn	mg/l	0,2	0,3
13.	E. Coli	MPN/100ml	6	0
14.	Odorant	-	None	None
15.	Suspended Solidd material (SS)	mg/l	77	-
16.	fluoride (F)	mg/l	0,01	1,5
17.	Cloride (Cl)	mg/l	15	250-300

Water sample with analysing criteria: turbidity, salinity, total Fe and E. Coli is not meeted drinking water and sanitation and living activitiy standard in Decision No. 09/2005/QD-BYT of the Ministry of Health.

Comparing the norms of the Yen Lap Lake's water samples with the National technical regulation on the quality of surface water QCVN 08:2008 / BTNMT we see that it is possible to use the lake as a source of raw water for the project .

Assess the water reserve at the reservoirs in the project area:

There is primary settling reservoir at 03 communes under the project area taking water from the small chanel system of Yen Lap lake. The reservoirs are wayer supply source for the existing water supply plants of 03 communes. The existing status parameters are the following:

Phong Coc reservoir:

Water reserve Q = 4000 m3. The quality ensures the supply of WTP for living and drinking demand. According to water supply design standard – pipeline network and works TCVN 33:2006, water reserve of primary settling tank can meet the water supply source for WTP with capacity of Qday<2000 (m3/day), equivalent to detention time about t=2 days, depth H=1,5m-3,5m.

Thus, the water reserve and quality in Phong Coc reservoir ensures the requirements of water supply source for the Plant.

Cam La reservoir:

Water reserve Q = 3000 m3. The quality ensures the supply of WTP for living and drinking demand. According to water supply design standard – pipeline network and works TCVN 33:2006, water reserve of primary settling tank can meet the water supply source for WTP with capacity of Qday<1500 (m3/day), equivalent to detention time about t=2 days, depth H=1,5m-3,5m

Thus, the water reserve and quality in Cam La reservoir ensures the requirements of water supply source for the Plant.

Lien Hoa reservoir:

Water reserve Q = 3000 m3. The quality ensures the supply of WTP for living and drinking demand. According to water supply design standard – pipeline network and works TCVN 33:2006, water reserve of primary settling tank can meet the water supply source for WTP with capacity of Qday<1500 (m3/day), equivalent to detention time about t=2 days, depth H=1,5m-3,5m

Thus, the water reserve and quality in Lien Hoa reservoir ensures the requirements of water supply source for the Plant.

1.5. Comparing and selecting water sources.

Through the information on the above water sources it can be confirmed that the raw water source for the project can only be harvested from two sources: surface water and groundwater from Yen Lap Lake. The water sources such as rainwater, water wells, ponds can not be a source of raw water for the project. The below table shows the comparison and selection between the two water sources: surface water and groundwater of Yen Lap Lake.

Table _':Comparing and selectiong water sources

Content	Yen Lap lake water	Ground water

Content	Yen Lap lake water	Ground water
Advantages	- Large reserves (average flow rate Q = 120 million m3) - In accordance with the scale of water supply in rural areas	- Be convenient for exploitation and operation management. - Investment cost, operating costs and maintainance cost are resonable - Especially suitable for the rural water supply projects with small scale
Disadvantages	- Need to build a system of irrigation ditches to bring water to the reservoir of the commune	- Water quality is not stable so it requires a complex Treatment technology. - It is required to conduct research to determine the volume and quality of water to ensure the exploitation in long-term and with stability. - There are risks to impact on the strata which can cause subsidence during extracting groundwater
Conclusion	*By analyzing the advantages and disadvantages mentioned above, the major difficulty is that the quality is not stable and ensured. Besides, for the region which can exploit surface water, it should be put higher priority. Therefore, the feasible and optimal option is using surface water in Yen Lap lake .* **Consultant recommends to choose surface water of Yen Lap river as raw water source.**	

2. CAPACITY SCALE.

2.1. Research scope

The scope of the study for design phase to 2020 (phase 1: 2010-2020, Phase 2: 2020-2030) bases on field surveys, the natural boundaries, boundaries of planning, development plan, characteristics of population and the consultation from concerned agencies and sectors. According to the research, boundaries of the project are:

➢ **Phong Coc Ward with the boundary as follows:**

- Border Yen Hai commune in the north
- Border Lien Vi commune in the East
- Being surrounded by Bach Dang river in the South and West(border on An Hai and Thuy Nguyen district).

➢ **Lien Hoa commune with the boundary as follow:**

- Border Phong Hai commune in the north
- Border Ha An commune in the East
- Border Yen Hai commune in the West
- Border Lien Vi commune in the South

➢ **Cam La commune with the boundary as follow:**

- Border Ha An commune in the north
- Border Phong Hai commune in the East
- Border Nam Ha commune in the West
- Border Yen Hai commune in the South

2.2. Water supply service region

In principle, the water supply service region will be determined on (i) scope of research projects, (ii) service level of the project, (iii) population distribution characteristics of the project area (iv) the status of regional water supply project (v) the financial status of the project.

Accordingly, the water supply services in Phase 1 will exclude a residential area far from downtown and households which are scattered away from the center of project. Accordingly the rate of the water supply in 2020 is determined to be 80%. By Phase 2 (2030) when the system go into stable operation, it will continue to expand the water supply for the entire population of the project area, this ratio is 90% water.

2.3. Population forecast

2.3.1. The rate of population growth

Various sources of information about the rate of population growth like: the Statistical Yearbook of Quang Ninh province in 2009, data on the local People's

Committee of communes in the project area and planning data have been studied and compared.

The base for calculating the population in the future is determined by the current population data and the annual population growth rate.

According to the data from the Statistical Yearbook of Quang Ninh, the population of communes in recent years volatile and different among regions. But in the long term, it is expected that the population growth rate will be equal to the average of the district, as follows:

- The period from 2010 to 2020:
  - The population growth rate of Phong Coc Ward is 2,0%
  - The population growth rate of Lien Hoa commune is 2,0%.
  - The population growth rate of Cam La commune is 1,5%.
- The period from 2020 to 2030:
  - The population growth rate of Phong Coc Ward is 2,3%
  - The population growth rate of Lien Hoa commune is 2,0%.
  - The population growth rate of Cam La commune is 1,3%.

2.3.2. Population forecast.

Population forecast is described as below table:

Table 3: *Population forecast in project area*

No	Area	Population 2013 (people)	Population growth rate (%)	Estimate population in 2020 (people)	Population growth rate (%)	Estimate population in 2030 (people)
1	Phong Coc Ward	7040	2,0%	8087	2,3%	10152
2	Lien Hoa Commune	7607	2,0%	8738	2,1%	10651
3	Cam La Commune	4106	1,5%	5158	1,6%	5869

Population forecast who will be supplied with water is described as below table:

Table 4: Population forecast supplied with water

No	Area	2010		2020		2030	
		Rate of population supplied with water (%)	Number of population supplied with water (Man)	Rate of population supplied with water (%)	Number of population supplied with water (Man)	Rate of population supplied with water (%)	Number of population supplied with water (Man)
1	Phong Coc Ward	60%	4224	80%	6470	90%	9137
2	Lien Hoa Commune	60%	4564	80%	6990	90%	9586

DDC Consultant – 2010

3	Cam La Commune	60%	3251	80%	4126	90%	5282

2.4. Forecast of water demand.

2.4.1. Water for domestic use (Qsh)

Water supply standards for the project area shall comply with standards TCXDVN 33-2006: Water supply - external network and works and Vietnam Construction Standards Volume 01- Water supply Planning. Accordingly, the domestic water using standard is determined through 02 following basis:

(i) According to TCXDVN 33-2006, the standard of urban water supply for urban of type V and IV and the rural area is 60-100 l / day per capita. Experience shows that, in the early installation of new water supply systems, water demand is low, so the standard will be obtained at different periods.

(ii) According to Vietnam construction standard water-supply planning, for water demand for the rural population, the minimum standard of water supply for daily consumption is 80 l / ng.day.

From the above 2 bases, Consultant proposed to select standard used for drinking water projects in each region at different stages as follows:

+ Phase 1:

In the period from 2010 to 2020: 60-100 l/day per capita

+ Phase 2:

In the period from 2020 to 2030: 100-150 l/day per capita

2.4.2. Water for other services

According to TCXDVN 33-2206, for water supply system for urban Type V, type IV and rural population water demand for services other than domestic demand is taken in proportion % of domestic demand at a rate of 10% -15%.

From the above two factors, to fit the specialized rules and regulations as well as the nature of a rural water supply projects and in accordance with the conditions and practical needs of water for the other daily needs in the project area, consultants give out the water demand for other services as follows: (percentage of these other services in comparison with daily life need, meet the criteria of TCXDVN 33-2006, has been determined by experience of similar projects).

2.4.2.1. Water for service, commerce,

Water flow demand for services, commerce is the amount of water allocated to commercial service business units in the project area and is determined by % Qsh:

According to TCXDVN 33-2006, water supply for this demand

+ Phase 1:

In the years: 2010 - 2020: 5%Qsh

+ Phase 2:

In the year: 2020 - 2030: 10%Qsh

2.4.2.2. Water for public

The amount of water to the public demand is calculated by: 5-10% Qsh

2.4.2.3. Water for production and handicraft

The volume of water for small production and handicraft demand is counted as 10-15%Qsh.

2.4.3. Water loss and leakage

According to TCXDVN 33-2006, water loss and leakage is determined by the rate of percentage of average daily capacity of the system (power on average daily water supply capacity and water supply capacity to the demand other services).

Accordingly, the rate of leakage of water supply system proposed is 25% Qtb

2.4.4. Water used for the plant

Water flow for its own treatment plant is the water filtered and other demands in the plant which are determined by % average capacity of day: 5%Qtb.

2.4.5. The total water demand

Based on the standard water, water demand of 03 communes in the project area is calculated using the following table:

Table 5::Water demand of Phong Coc Ward

NO	Content	Unit	2013	2020	2030
I	**The served population**				
1	Total population supplied with water in Phong Coc ward	person	4.224	6.470	9.137
II	**Water supply standard**				
1	Water supply standard for domestic demand	l/per.day	70	80	100
2	Water supply standard for public demand (%Qsh)	%	5%	5%	10%
3	Water supply standard for service-trading demand (% Qsh)	%	5%	5%	10%
4	Water supply standard for production demand	%	10%	10%	15%
5	Rate of water loss and leakage - % Qtt	%	25%	25%	20%
6	Rate used for station % Qtt	%	5%	5%	5%
7	Daily use coefficient max - Kngày max =		1,35	1,35	1,35
III	**Volume**				
	Domestic demand (Qsh)				
1	Phong Coc Ward	m3/ day	296	518	914
	Total domestic water demand	m3/ day	296	518	914
2	Volume of water supplied for public demand	m3/ day	15	26	91
3	Volume of water supplied for service-trading demand	m3/ day	15	26	91

4	Volume of water supplied for production demand	m3/ day	30	52	137
5	Total average water usage (Qtt)	m3/ day	356	621	1.233
6	Volume of lost and leakage water (%Qtt)	m3/ day	81	155	247
7	Volume of water for station (%Qtt)	m3/ day	16	31	62
8	Total average water volume per day(Qtb)	m3/ day	453	807	1.542
9	Daily use coefficientmax - Kday max	m3/ day	1,35	1,35	1,35
10	Daily capacitymax - Qmax	m3/ day	612	1.090	2.080
11	**Daily capacitymax - Qmax - be rounded**	m3/ day	600	1.100	2.000

Table 6: Water demand for Lien Hoa commune

NO	Content	Unit	2013	2020	2030
I	**Population supplied with water**				
1	Total population supplied with water in Lien Hoa Commune	person	4.564	6.787	8.688
II	**Water supply standard**				
1	Water supply standard for domestic demand	l/per.day	70	90	120
2	Water supply standard for public demand (%Qsh)	%	5%	5%	10%
3	Water supply standard for service-trading demand (% Qsh)	%	5%	5%	10%
4	Water supply standard for production demand	%	10%	10%	15%
5	Rate of water loss and leakage - % Qtt	%	25%	25%	20%
6	Rate used for station % Qtt	%	5%	5%	5%
7	Daily use coefficient max - Kngày max =		1.35	1.35	1.35
III	**Volume**				
	Domestic demand (Qsh)				
1	Lien Hoa Commune	m3/ day	319	611	1.043
	Total domestic water demand	m3/ day	319	611	1.043
2	Volume of water supplied for public demand	m3/ day	16	31	104
3	Volume of water supplied for service-trading demand	m3/ day	16	31	104
4	Volume of water supplied for production demand	m3/ day	32	61	156
5	Total average water usage (Qtt)	m3/ day	383	733	1.408

6	Volume of loss and leakage water (%Qtt)	m3/ day	88	183	282
7	Volume of water for station (%Qtt)	m3/ day	18	37	70
8	Total average water volume per day(Qtb)	m3/ day	489	953	1,759
9	Daily use coefficientmax - Kday max	m3/ day	1,35	1.35	1.35
10	Daily capacitymax - Qmax	m3/ day	660.1	1,290	2,380
11	**Daily capacity max - Qmax - be rounded**	m3/ day	**700**	**1,300**	**2,400**

Table 7: Water demand of Cam La commune

NO	Content	Unit	2013	2020	2030
I	**Population supplied with water**				
1	Total population supplied with water in Cam La Commune	person	3251	4,126	5,282
II	**Water supply standard**				
1	Water supply standard for domestic demand	l/per.day	70	80	100
2	Water supply standard for public demand (%Qsh)	%	5%	5%	10%
3	Water supply standard for service-trading demand (% Qsh)	%	5%	5%	10%
4	Water supply standard for production demand	%	10%	10%	15%
5	Rate of water loss and leakage - % Qtt	%	25%	25%	20%
6	Rate used for station % Qtt	%	5%	5%	5%
7	Daily use coefficient max - Kday max ==		1.35	1.35	1.35
III	**Volume**				
1	Domestic demand (Qsh)				
	Cam La Commune	m3/ day	228	330	528
	Total domestic water demand	m3/ day	228	330	528
2	Volume of water supplied for public demand	m3/ day	11	17	53
3	Volume of water supplied for service-trading demand	m3/ day	11	17	53
4	Volume of water supplied for production demand	m3/ day	22	33	79
5	Total average water usage (Qtt)	m3/ day	272	396	713
6	Volume of lost and leakage water (%Qtt)	m3/ day	63	99	143
7	Volume of water for station (%Qtt)	m3/ day	13	20	36
8	Total average water volume per day(Qtb)	m3/ day	348	515	891

9	Daily use coefficientmax - Kday max	m3/ day	1,35	1,35	1,35
10	Daily capacitymax - Qmax	m3/ day	469,8	700	1,200
11	**Daily capacitymax - Qmax - be rounded**	m3/ day	**500**	**700**	**1,200**

2.5. The design horizon

Phasing of investment in water supply systems will be effective and avoid wasteful investment. The project is divided into two investment phases as follows.

- Phase 1 from 2013 to 2020: construction and improvement of the whole 03 water supply plant and aparrt of water supply pipeline system in wards of Phong Coc, Cam La and Lien Hoa commune
- It is expected that should select a prefabricated modules, therefore it shall be consistent with the manufacturer's equipment and DHK V4 prefabricated treatment modules.

  - Contents of proposed option: water from primary settling tank → Pumping station 1→ prefabricated treatment modules (Reactor associated with Lamella settling tank for sludge circulation + automatic valveless gravity filter) → clean water reservoir → clean water reservoir → Pumping station 2 → Water supply network.
  - Reactor associated with Lamella settling tank for sludge circulation operated by combination mechanism, adding more chemical to increase the combination ability of sludge/grit in water. Water flows through nozzles at high speed into the central pipeline. A low pressure area formed around the center tube. Sludge adsorption and formation are relatively large on settling tank. And circulating moving of particles separated in the water and mud particles being sucked into the collision occurred repeatedly exposed. The adhesive again to increase the ability to combine the sediment particles in the water. Forming larger scale cotton create gravity for rapid sedimentation and changing dynamics of moving water create great potential for sediment particles to the deposition process easy. Do take advantage of reflux and chemical sludge in the tank should also significantly reduce the amount of necessary chemical to flocculation. Sludge concentration after settling tank < 5NTU
  - Finishing the above processes, water is cleaned by physical and chemical surface before flowing into reservoir with Javel injection to disinfect and then pumped into clean water reservoir. Secondary pumping station: using vertical pump to suck water from reservoir into water supply network.

- Capacity of Phong Coc station: with demand of 1.100 m^3/day. It is selected a DHK V4 treatment module with capacity of 1000 m^3/day (this module can treat with capacity over 1000 m^3/day, thus it meets the water supply demand).

- Capacity of Cam La station: with demand of 700 m^3/day, it is proposed to select DHK V4 treatment module with capacity of 1000 m^3/day to meet the using demand more anh more increasing in the future. The period after 2020 and the current period can operate from 16 – 18 h/day.

- Capacity of Lien Hoa station: with demand of 1300m^3/day, it is proposed to select DHK V4 treatment module with capacity of 1500 m^3/day to meet the using demand more anh more increasing in the future. The period after 2020 and the current period can operate from 16 – 18h/day

- Phase 2 from 2020 to 2030. Construct and complete water supply pipeline network for 03 communes.

3. TECHNICAL OPTIONS

3.1. Studied contents

The study include options on treatment technology, water supply network, pipe material and the operating mode of water supply systems, ...rawwater source is selected from Yen Lap Lake. Water treatment technology remains for each station, water supply network is carried out with hydraulic calculations to ensure water supply to the point of consumption to the excess pressure at the end of not less than 10m.

Technology solutions, appropriate structures to ensure treated water standards and has the lowest cost..

3.2. Parameters and design standards

3.2.1. Design parameters

➢ ***Cam La station***

Table 15: Technical parameters of Cam La station

NO	Item	Design a suitable construction for the period			Technical requirments
		2015	To 2020	To 2030	
1	Reservoir		x		Rehabilitate and increase containing volume
2	Pump station		x		Rehabilitate the station and replace with new pump
3	Treatment block		x		Construct and rehabilitate pressure filter tank
4	Clean water reservoir		x		Build a new reservoir and use chemicals to purify the water
5	Tranmission and distribution pipeline		x		HDPE pipe(D110-D90-D63)
6	Network of service pipe	x			Buid a network of HDPE pipe with diameter decrease from D=40 toD=25
7	Connection to household, including meter and small type pipe	x			Service pipe and small type pipe before the meter Meter with the accuracy of level B and the limits of error by flow

➢ ***Phong Coc station***

Table 3: *Design coefficient of Phong Coc station*

NO	Item	Design a suitable construction for period			Technical requirments
		2015	To 2020	To2030	
1	Reservoir		x		Reconstruct and increase containing volume
2	Pump station		x		Build a new housing for station and replace with new pump
3	Treatment block		x		Build a new batch processing
4	Clean water reservoir		x		Build a new tank and use chemical to purify the water
5	Tranmission and distribution pipe		x		HDPE pipe(D110-D90-D63)
6	Network of service pipe	x			Buid a network of HDPE pipe with diameter decrease from:D=40 ToD=25)
7	Connectors to household, including meter and small type pipe	x			Service pipe and small pipe in ahead of meter Meter with the accuracy of level B and the limits of error by flow

➢ **Lien Hoa Station**

Table 17: Design parameters of Lien Hoa station

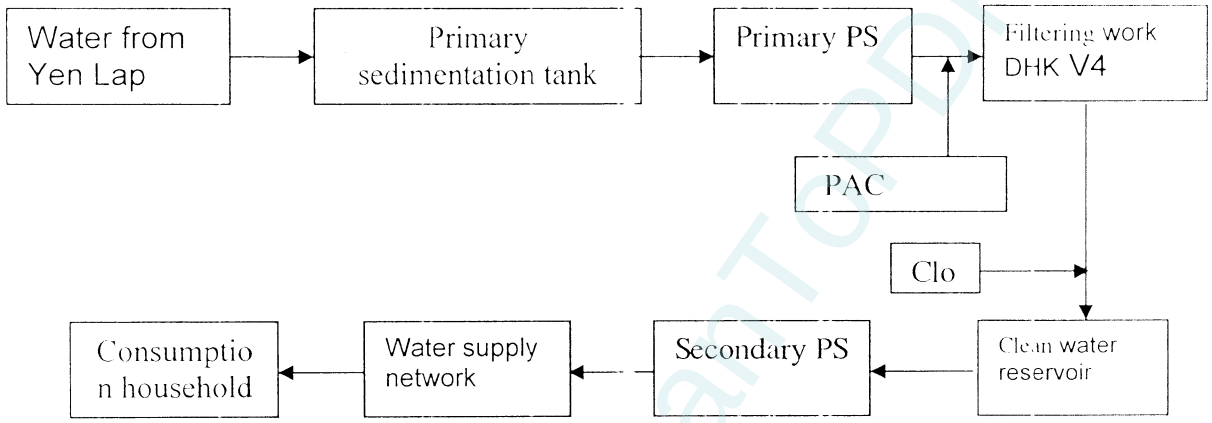
NO	Item	Design a suitable construction for period			Technical requirments
		2015	To 2020	To 2030	
1	Reservoir		x		Rehabilitate and increase containing volume
2	Pump station		x		Rehabilitate and replace with new pump
3	Treatment block		x		Construct and rehabilitate pressure filter
4	Clean water reservoir		x		Rehabilitate the existing reservoir and build a new tank and use chemical to purify the water
5	Tranmission and distribution pipeline.		x		HDPE pipe(D110-D90-D63)
6	Network of service pipeline	x			Buid a pipeline network HDPE with diameter decrease from:D=40 ToD=25
7	Connection to household, including meter and small type pipe	x			Service pipeline and small pipe before the meter. Meter with the accuracy of level B and the limits of error by flow.

3.3. Technical options

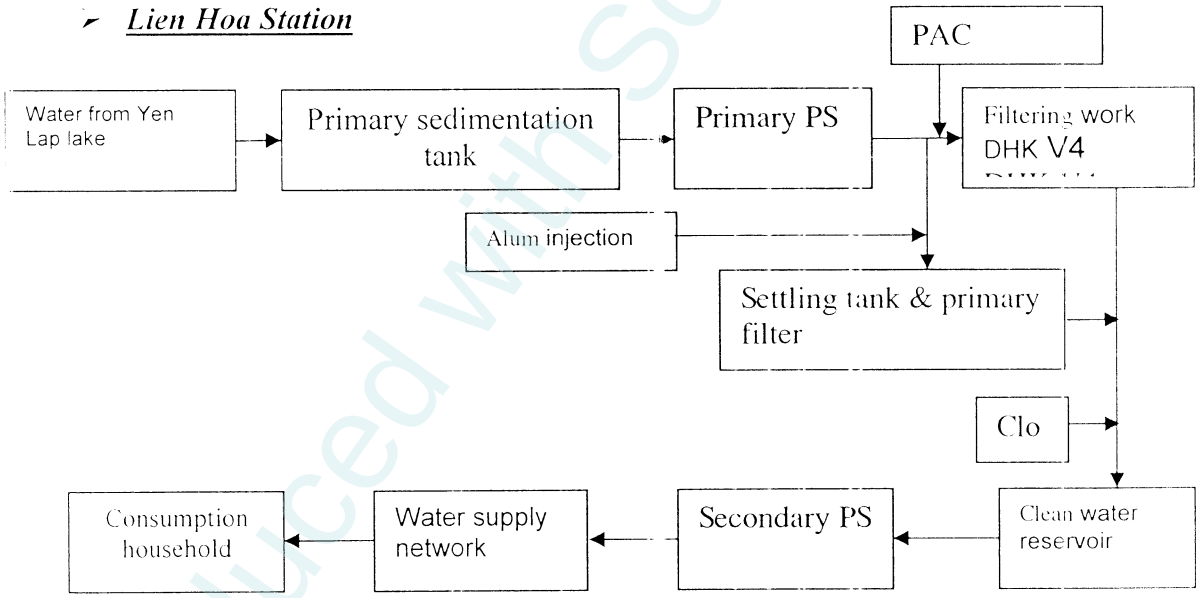
3.3.1. *Options on treatment process*

The wastewater treatment process diagram of treatment plants is as follows:

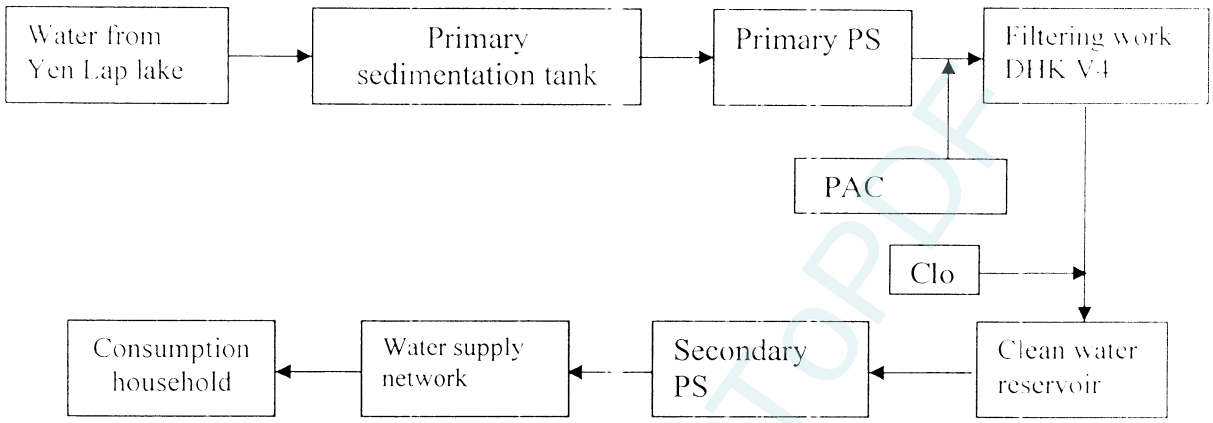
- ***Phong Coc station***



- ***Lien Hoa Station***



- ***Cam La station***



3.3.2. *Options on water supply pipe material*

Selection of water supply pipe for distribution and service network in the project area is reviewed based on technical features of each pipe and economic costs on installation and in similar works in Quang Ninh province.

Currently the material used for water supply is very diverse with many types, such as uPVC pipe, plastic pipe PE / HDPE, steel, cast iron pipe (ductile cast iron and gray cast iron), glass fiber reinforced plastic pipe, ... The selection of the appropriate type of pipe for the project to ensure the highest efficiency, the safest and most economical.

UPVC Pipes: are durable, long life-service, low pressure loss, easy for construction and lower construction costs. However the management difficulties due to the vulnerable digging pipelines.

HDPE Pipes: There are many advantages like uPVC plastic pipe. It is also capable of bending plastic, suitable for any terrain, especially durable, long service life. However, construction costs are often more expensive than uPVC, thus it should be applied to the water supply pipes of small diameter.

Ductile Iron Pipe: There are durable, long-service life, safe in all terrain and weather conditions. In particular can reduce the Demolition pipe. But, high construction costs, high technical requirements in the construction, installation

Steel Pipe: There are all advantages like cast iron pipes, besides, it is capable to lead water better than cast iron pipe. Suitable for building in the complex terrain areas. However, construction costs are expensive, must take measures to paint anti-corrosion, anti-erosion.

By comparing and study of the mentioned-above materials as well as the water supply works which have been being constructed showing that: The combination of many kinds of pipe which belongs to levels and qualities, effects as well as cost of each needed to calculate to find option to use material. Therefore, the Consultant proposes to select the following material:

- HDPE pipe will be used for the installation of distribution, services, water supply pipeline networks to each point of consumption in the project area.

3.3.3. Technical solution for certain selected option

➢ **Technical solution**

✓ ***Phong Coc Station***

We propose to expand Phong Coc water supply plant to supply water to residents in the commune. The current capacity of Phong Coc water supply plant is of Q=600m3/day to meet the local demand basing on the above calculation is about 1100m3/day, it is neccessary to a new construction to replace the existing degrading one. It can be summarized the main constructions to be built in the water supply plant as follows:

Distribution pipeline network:

Distribution pipeline network is calculated according to the highest flow by hour. Volume of water is calculated basing on distribution table of water volume by hour of period until year 2020.

Hydraulic calculation is implemented by Epanet program using HAZEN-WILLIAM hydraulic formula, roughness coefficient for HDPE pipe is C = 140.

On the main distribution pipelines with a diameter larger than DN100, valves are arranged at the lowest points. Building the bearings, the support at places of Tee, reduceers, bends, ...

The average depth of buried pipes to the pipe crown is 0.7m. The average width of the trench is 0.8 m.

Using HDPE pipe-PN10 for transmission and distribution pipes.

Network of service pipeline

Network of service pipes use material HDPE-PN 8

The service pipe is calculated following the flow distribution diagram and depending on the number of households supplied with water. Service pipes will mainly lie on the sidewalk, 0.5 to 1.5 m away from household. The average bried depth of pipe is 0.5 m

No	Main material	Unit	Quantity
1	HDPE D200 pipe	m	1143
2	HDPE D160 pipe	m	1295
3	HDPE D110 pipe	m	1334
4	D200 Two-way valve	piece	1
5	D150 Two-way valve	Piece	1
6	D100 Two-way valve	Piece	1
7	Tee HDPE D200	Piece	1
8	Tee HDPE D200x110x200	Piece	2
9	Tee HDPE D160	Piece	2
10	Tee HDPE D110	Piece	1
11	Tee HDPE D200x160	Piece	2
12	Tee HDPE D160x110	Piece	2

13	D200 Flexible joint	Piece	1
14	D150 Flexible joint	Piece	1
15	D100 Flexible joint	Piece	1
16	Bolt BU D200	Piece	1
17	Bolt BU D160	Piece	1
18	Bolt BU D110	Piece	1
19	D200 L = 0,7m short pipe	Piece	2
20	D160 L = 0,7m short pipe	Piece	2
21	D160 L = 0,7m short pipe	Piece	2
22	D110 Seal	Piece	5
23	Bend HDPE D200x90	Piece	4
24	Bend HDPE D200x45	Piece	1
25	Bend HDPE D200x22	Piece	3
26	Bend HDPE D200x11	Piece	3
27	Bend HDPE D160x22	Piece	2
28	Bend HDPE D160x11	Piece	6
29	Bend HDPE D110x11	Piece	3

House connection

The number of house connection points is temporarily calculated as 212 households. The project will cover the connection points with the points of a material including HDPE pipe with diameters from PN10-D25-D32, flow meters, valves, junction, etc.

✓ ***Lien Hoa Station***

We propose to expand and renovate Lien Hoa water plant to supply water to people in the commune. The current capacity of water plant is Q=360m3/day, to meet the water demand of people in the village as calculated above need to build and improve treatment plants to achieve capacity of 1500 m3/day.

It can be summarized the main construction works at the water plant as follows:

Distribution pipeline network:

The network of distribution pipes is calculated basing on the highest amount of using hours in a day. The amount is calculated basing on the table of water distribution by hour in the period toward 2020.

The hydraulic calculation of the network uses Epanet program with the formulation of hydraulic calculation of HAZEN WILLIAM with the roughness coefficient for HDPE pipe is C= 140.

On the main tranmission pipe with the diameter over DN100, it is neccessary to install discharge valve at the lowest positions. It is neccessary to build a supports at the position of Tee, reducers, bend, etc…

The average deepth of pipe laying from the pipe crown is 0.7 meter. The trench to install pipe has width of 0.8 meter

Using HDPE-PN10 pipe for tranmission and distribution network.

Service pipeline network

The network of pipe using HDPE-PN8 material

Service pipeline is calculated according to the Flow diagram and depending on the number of consumption house holds. Service pipe will be installed mainly on sidewalks and about 0,5 to 1,5 meters from the house hold. The average deepth of pipe laying is 0,5 meter

House connection

The number of house connections is temporarily calculated as 413. The Project will pay for these connection points with the material for one point including HDPE-PN10 pipe with diameter of D25-D32, corresponding meter, valve, jack ...

➢ **Construction solution**

Basing on the results of drilling for geological survey, it is necessary to make a reasonable solution for the structural work. This section only define the preliminary measures on construction projects, construction solutions in detail will be presented in the basic design of the project.

The works in the processing station will be constructed with reinforced concrete, poured in place. On the distribution pipeline, the position of elbows and connectors ... must have bearing concrete. The valve pit, pit of brick building meter, knit cap with reinforced concrete.

No	Material	Unit	Quantity
1	HDPE D200 pipe	m	338
2	HDPE D160 pipe	m	1115
3	HDPE D110 pipe	m	3278
4	D200 two-way valve	piece	1
5	D150 two-way valve	Piece	1
6	D100 two-way valve	Piece	6
7	Tee HDPE D200x200x110	Piece	4
8	Tee HDPE D160x160x110	piece	2
9	Reducer HDPE D200x160	Piece	1
10	Reducer HDPE D160x110	Piece	1
11	Flexible joint D200	Piece	1
12	Flexible joint D150	Piece	1
13	Flexible joint D100	Piece	6
14	Bolt BU D200	Piece	1
15	Bolt BU D160	Piece	1
16	Bolt BU D110	Piece	6
17	D200 L = 0,7m short pipe	Piece	2
18	D160 L = 0,7m short pipe	Piece	2

19	D160 L = 0,7m short pipe	piece	12
20	D110 seal	piece	7
21	Bend HDPE D200x90	piece	1
22	Bend HDPE D200x11	piece	1
23	Bend HDPE D160x22	piece	2
24	Bend HDPE D160x11	piece	2
25	Bend HDPE D110x90	Piece	1
26	Bend HDPE D110x45	Piece	6
27	Bend HDPE D110x22	Piece	9
28	Bend HDPE D110x11	Piece	7

✓ ***Cam La station***

We propose to expand Cam La water supply plant to supply water to citizens in the commune. The current capacity of Cam La water supply plant is of Q=120m3/day to meet the citizen's demand basing on the above calculation is about 700m3/day, it is neccessary to a new construction to replace the existing degrading one. It can be summarized the main construction will be build in the water supply plant as follow:

Distribution pipeline network:

The network of distribution pipes is calculated basing on the highes amount of using hours in a day. The amount is calculated basing on the table of water distribution by hour in the period toward 2020.

As for hydraulic power, the network use Epanet program with the formulation of hydraulic HAZE- WILLIAM with the rough coefficient for HDPE pipe, C= 140.

On the main tranmission pipe with the diameter over DN100, it is neccessary to install exposing valve at the lowest position. It is neccessary to build a supportor at the position of T-shape connectors…

The average deep of pipe fixing from the top of the pipe is 0.7 meter. The ditch to install pipe has width of 0.8 meter

Using HDPE-PN10 pipe for transmission and distribution pipeline

Service pipeline network

The network of pipe use HDPE-PN8 material

Service pipeline is calculated according to the flow distribution diagram and depending on the number of consumption house holds. Service pipe will be installed mainly in sidewalks and about 0,5 to 1,5 meter from the house hold. The average deepth of laying pipe is 0,5 meter

Connection to household:

The number of connection to household is temporarily calculated as 192. The Project will pay for these connection points with the material for one connection point

including HDPE-PN10 pipe with diameter of D25-D32, a flow meter, valve, junction, etc.:

No	Name of material	Unit	Quantity
2	HDPE D160 pipe	m	937
3	HDPE D110 pipe	m	2300
4	D200 two-way valve	Piece	2
5	D150 two-way valve	Piece	3
6	D100 two-way valve	Piece	9
7	Tee HDPE D200	Piece	1
8	Tee HDPE D200x160x200	Piece	1
9	Tee HDPE D160	Piece	1
10	Tee HDPE D110	Piece	4
11	Reducer HDPE D200x110	Piece	1
12	Reducer HDPE D160x110	Piece	3
13	Flexible joint D200	Piece	2
14	Flexible joint D150	Piece	3
15	Flexible joint D100	Piece	9
16	Bolt BU D200	Piece	2
17	Bolt BU D160	Piece	3
18	Bolt BU D110	Piece	9
19	D200 L = 0,7m short pipe	Piece	4
20	D160 L = 0,7m short pipe	Piece	6
21	D160 L = 0,7m short pipe	Piece	18
22	D110 seal	Piece	8
23	Bend HDPE D200x22	Piece	3
24	Bend HDPE D200x11	Piece	6
25	Bend HDPE D160x45	Piece	3
26	Bend HDPE D160x22	Piece	6
27	Bend HDPE D160x11	Piece	9
28	Bend HDPE D110x90	Piece	8
29	Bend HDPE D110x45	Piece	5
30	Bend HDPE D110x22	Piece	8
31	Bend HDPE D110x11	Piece	13

➢ Construction solution

Basing on the results of drilling for geological survey, it is necessary to make a reasonable solution for the structural work. This section only define the preliminary measures on construction projects, construction solutions in detail will be presented in the basic design of the project.

The works in the processing station will be constructed with cast-in-place reinforced concrete. On the distribution pipeline, the positions of Tee and reducer, bend, etc ... must have concrete supports. The valve chamber, meter chamber, cover slabs in reinforced concrete.

Details of calculation of construction solution will be presented in basic design.

➢ **Power supply solution.**

The transformer of each water supply plant is considered to ensure the plant's capacity in phase two.

3.3.4. Standard for materials, equipment and technical requirements

- ***Distribution Pipe***: HDPE ISO 4427 1996 (E), test pressure 12kg/cm2. Other accessories such as reducer, Tee, Bend ....
- ***Service pipe***: Using HDPE pipe in accordance with ISO 4427-1996 (E), the trial pressure of 8kg/cm2. Other accessories such as reducer, Tee, bend, ...
- ***Accessories***:
  - ***Valves :***

Valves are provided to separate a system or device for purposes of maintenance and repair. They must be suitable for the continous working pressure at 70^0 C and for at least 1.25 times maximum working pressure of the current system.

Valves are used as flange gate valve manufacturing under standard BS 5163, length (distance of two flanges) standard BS 5163 (ISO 5752 series 3). PN 10/16 Flange and drilling to ISO 7005-2. Valve body and valve cover are made of gray cast iron (BS 1452 grade 220/250) or ductile cast iron (BS 2789 grade 500-7).

Valve on the transmission network and distribution are used as manually operated gate valve.

  - ***Flexible joints***

Soft connections must be manufactured according to ISO 9001 standards. All details of fittings including bolts and nuts shall be coated to avoid corrosion at the highest level.

All types of coupling must be mounted fixtures available help for the installation are quick and effective without lubrication and does not need any special tools.

  - ***Air release valve:***

Must be a single valve with a hole wide and semi-automatic operation by the flange according to ISO 7005-2 (EN 1092-2:1997, DIN 2501). Body and lid valve must be made of gray cast iron GG-25 according to DIN 1691 and is coated with blue epoxy.

They must be suitable for drinking water or untreated water (not sewage) and to ensure good working conditions at minimum pressure is 0.2 bar maximum of 16 bar and temperatures can reach to 90^0C.

All valves must be tested in the hydraulic test pressure equal to 1.5 times nominal pressure.

IV. TOTAL INVESTMENT, CAPITAL STRUCTURE, FINANCIAL MECHANISM

1. TOTAL INVESTMENT CAPITAL.

1.1 Overview.

Determination of total investment and financial mechanism of the project is one of the important stages. It is based on the volume of works proposed in the technical section to calculate the total investment. Besides, the determination of the financial mechanism for the project is one of the crucial issues for the effectiveness of the project under the financial-economic viewpoint.

1.2 Basis for total investment.

Currency and exchange rate: The total investment will be calculated with Vietnam dong then converted into EURO with the exchange rate issued by State Bank of Vietnam at the time of the first quarter of 2010 is: 1EURO = 26,000 VND.

Price changing rate: the total investment estimate is based on the price rate at the begining of 2010 when the project is completed and put into operation with the annual price slide rate of 5% in comparision with VND currency.

Construction investment period: The time limit for construction investment is from from October, 2014 to the end of 2015. The payables are determined on the basis of the progress of construction and use of capital respectively.

Tax and financial duties: The project is invested with commondity aid from Italia goverment (ODA) and the local counterpart fund, thus it must obey current regulation and tax policy and duty applying for ODA projects.

Contingencies: Including contingencies for works arised in the project implementation period, and calculation errors and price slippage. The contingency is calculated at the rate of 10% for all expenditure items.

The other provisions of law:

- Basing on Decree No. 112/2009/ND-CP on December 14th, 2009 of the Government on the management of construction investment cost.
- Decision No. 957/QD-BXD on 29/09/2009 by Ministry of Construction on publication of Norms on costs for project management and work construction consultancy;
- Basing on Circular No. 05/2009/TT-BXD on April, 15th 2008 of the Ministry of Construction on guideline of creating and adjusting construction estimate.

1.3 Total investment capital.

Total investment for the project will be presented in annex of the report.

2. FUNDING SOURCES.

Capital structure of the project is determined based on the current provisions of the Government of Vietnam, financial regulations of the project and donor are below :

- The commodity assistance from Italia government for material and equipment such as: raw water pump, clean water pump, supply pipe and other accessories..
- The counterpart fund of the Financial ministry and the people's committee of Quang Ninh for the rest activities (including investment preparation, site clearance and taxes).

Table 9: Funding mechanism of the project

Exchange rate : 1EURO=29.900VND

No	Contents	Value (VND)	Value (EURO)	Rate %
1	Aid fund from Italia government	11,644,000,000	389,431	40%
2	Counterpart fund	17,630,000,000	589,632	60%
	Total	**29,274,000,000**	**979,063**	**100%**

3. FINANCIAL MECHANISM

The project is implemented with the two following funding sources:

- Commodity aid from Italia government : The project owner can use this fund as the state budget.
- The counterpart fund of the Financial ministry and the People's committee of Quang Ninh province : this type of fund will be applied the law of National budget.

Thus, it is considered the financial mechanism of this project as the supply from National budget supply.

Table 10: Project Implementation Progress

No	Content	Completion
1	Preparation of the construction investment project (FS)	10/2013
2	Detailed Design Drawings and total cost estimate	01/2014
3	Bid evaluation, approval of bid results and negotiation for contract signing	04/2014
4	Construction of works	12/2015
5	Training, operating guideline, commissioning and handover of works	12/2016

1.1 Procurement plan/bidding

Basing on the method of bidding, bid packaging and the value of each package, we propose he procurement plan as follows:

Table 11: Procurement schedule

Contract number	Package name	Contract type	Milestones		Completion
			Bid invitation	Contract award	

QT/01	Material and equipment supply for Italia fund	NCB	04/2014	06/2014	12/2015
QT/02	Material and equipment supply for counterpart fund	NCB	04/2014	06/2014	12/2015
QT/03	Construction of items in water plant	NCB	04/2014	06/2014	12/2015
QT/04	Implementing and installing technological pipeline in water plant and water supply network	NCB	04/2014	06/2014	12/2015

*:Without contingency cost and VAT

a) Cost for management, operation and maintenance.

The determination of cost for management, operation and maintenance is very important because it relates to the determination of water prices.

Table 12: Management and operation cost

No	Work items	Unit	Rate	Quantity	Unit price	Amount
1	Cost of electricity in a year					2.698.080.000
2	Cost of electricity of pumping station	Kw	0.06	963.600	2800	2.698.080.000
	Cost of chemicals					
	Chlorine disinfection, rate of 1.6 g/m3	0	0.0016	144.540	400	57.816.000
	Cost of alum (dosage of 50g/1m3 with content of pure commercial alum of 50%)	kg	0.05	10.950	15500	169.725.000
3	Cost for minor repair in a year (5% of basis depreciation value)	Item		1	5% khấu hao	93.233.192
4	Labor cost in a year	Manmonth	12	144	2.500.000	360.000.000
	Total (1+2+3+4):					**3.378.854.192**
	Overhead in a year	Item		1	5%*(1+2+3+4)	168.942.710
	Total cost (rounded)					**3.547.797.000**
	Operation and management cost for 1m3 clean water (VND)					**2.430**

Thus, the cost to produce 1 m3 of clean water (calculated for daily needs) needs 2.587 VND, this is the important basis for determining the cost of clean water.

b) Calculation of the clean water price

Components of the water price includes:

- Operating cost
- Amortization payment cost

General principles of determining the water price

- Calculating correctly, sufficiently to ensure repayment of loans and costs for operation and maintenance, including norm interest.
- Basing on ability to pay of consumers. Ability to pay is often evaluated basing on income percentage of households. Cost for using water accounting for 3-5% of income is reasonable and this ratio is often applied by international lending organizations.
- The water price will be adjusted to ensure the effect in aspect of finance, ensure that the Project Owner can balance between revenues and expenditures and ensure the project is feasible. In theory, each year the cost of production and operation will be different (usually increase), inflation may be different. Therefore in this project, the water price is proposed by Consultant to increase 3 years a time. Of course, in fact the water price must be determined by the Provincial People's Committee, Provincial People's Council, but to ensure the project having benefit and feasibility in aspect of finance, we anticipate the route to increase the water price of 3 years a time.
- Being approved by PPC and consistent with the price range of water issued by Ministry of Finance.
- Components of the water price is detemined as follow:

Table 13: Components of the water tariff

Water price	(1) Direct cost	*1.1. Cost electricity* *1.2 Cost of chemical* *1.3 Cost of labor* *1.4 Cost for minor repairment* *1.5 Cost for general management*
	(2) Depreciation	*Depreciation of fixed assets*
	(3) Taxes and charges	*3.1 VAT* *3.2 Business Income Tax*
	(4) Norm interest	*Norm interest on 1m3 of selling water*

Through bases above, the water price is calculated as the table below (calculated separately for daily needs):

Table 14: Calculated water selling price

No	Cost items	Unit	Price
I	**Direct cost**		
1	Cost of electricity	VND/m^3	1,848.00
2	Cost of chemical	VND/m^3	155.85
3	Cost of labor	VND/m3	246.58
4	Costs for maintenance and minor repair	VND/m^3	63.86
5	Cost for general management	VND/m^3	115.71
II	**Depreciation of fixed asset**		
1	Depreciation	VND/m^3	1,277.17
III	**Total cost**		**3,707,16**
IV	**Rate interest and Business income tax**		
1	Interest rate 3% (III)	VND/m3	111
2	Business income tax (25% of Interest rate)	VND/m3	28
V	**Water tariff before VAT (III+IV)**	**VND/m3**	**3,846**
	VAT tax (10%)	VND/m3	192
	Average water tariff	VND/m3	**4,000**

Thus, the cost of clean water is 3700 VND/1m3 (at the time of 2016-the year when the project are put into operation).

This water price is calculated for adequate management operation, sufficient to pay interest costs and principal repayment and ensure that project owners have interest and enterprises pay taxes to the State. At the same time, water price should match the affordability of consumers, consumer acceptance. But in reality the price of clean water and raising the water price is determined by PPC and consistent with the water tariff frame issued by the Ministry of Finance.

To ensure that the project activities are effective in financial term during the project life cycle, we propose the water price and water tariff road map as follows:

- Domestic water price is 3.700 VND/1m3 (at the time of 2016-the year when the project are put into operation).
- Water tariff road map of 3 years/time.
- The increase in water price is 2.000 VND/time.

In fact, there are many different water objects and water cost for these objects are also different. Therefore, based on objects as well as the proportion of water used for water% of current water supply system in Quang Yen town, we refer to the table and give the sale price determined for each subject using. This wide variety of countries as follows.

Table 15: Water selling price for different consumers:

No.	Consumers	Rate %	Water tariff
1	Domestic	75.0%	
2	Administration and profession, public, school, hospital, ...	5.0%	
3	Production, civil construction, business, ...	10.0%	
4	Business in services, restaurants and other services	10.0%	
	Average water tariff		

The route of increasing the water price is one time three years and as described above, to provide clean water cost as well as the route of increasing the water price must be decided by the Provincial People's Committee.

Figure H-4:: Water tariff road map

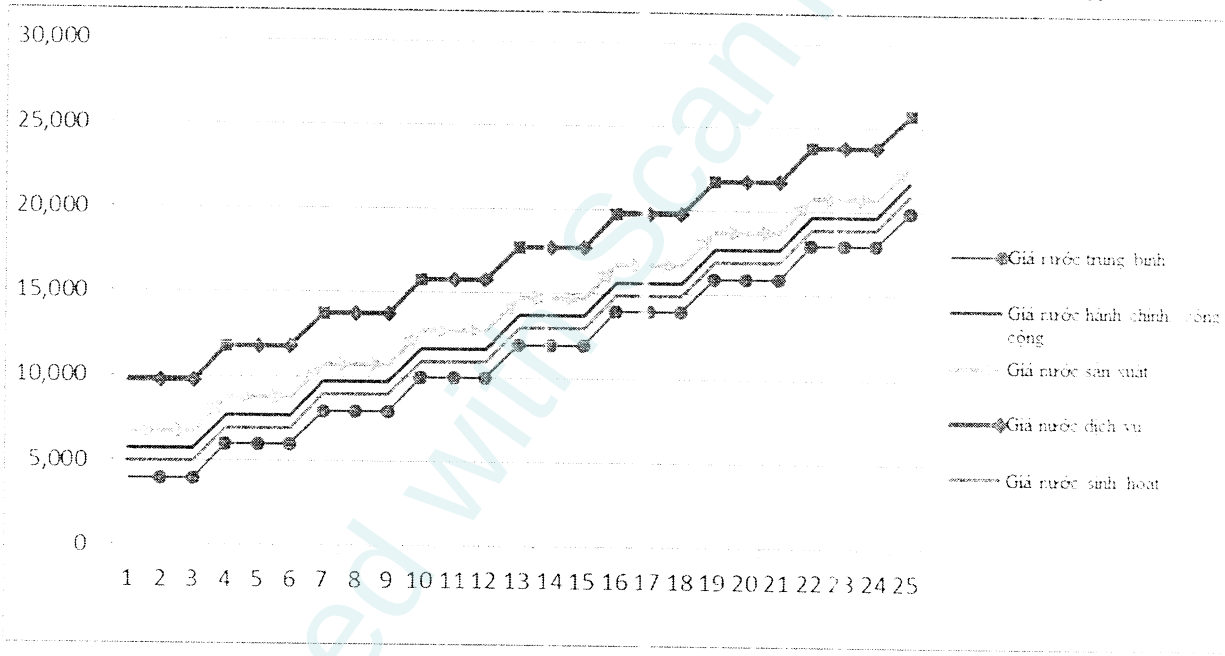
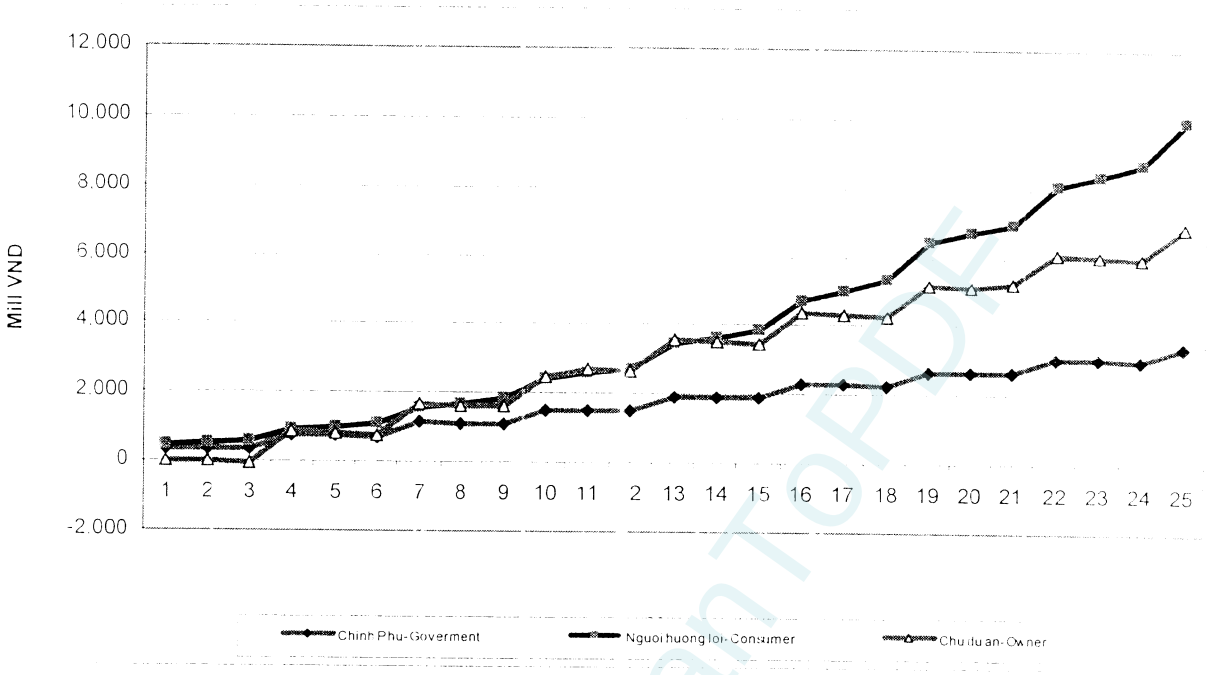


Figure H-5: Benefit line of the parties involved in the project



Through the diagram above, we see that the project will bring benefits to the Government, Project Owner and Consumers after 25 years of operation.

1.1.1 Sensitivity analysis

The sensitivity analysis was conducted with 03 options as follows:

- Option 1: The average water consumption is lower than the calculated level of 10%
- Option 2: Invested capital increases up to 10%.
- Option 3: Combining 02 options.

Calculation results for evaluation criterion of sensitivity analysis options are summarized in the table below:

Table 16: Sensitivity analysis

Cases	ENPV	EIRR	EBCR
Unadjusted option	11,100	14.95%	1.15
Option 1: Decreasing consumption down to 10%	12,963	15.63%	1.18
Option 2: Increasing invested capital up to 10%	12,963	15.63%	1.18
Option 3: Combining two options above	22,567	18.72%	0.93
Criteria		>12.0%	>1.0

Compared with unadjusted plan, the criterion of socio-economic analysis of all 03 options analyzing sensitivity decreases low. Option 3 has the worst analyzed criterion, but the value of the criterion is achieved.

Calculation results of sensitivity analysis shows that the main criterion of socio-economic efficiency of the project has small fluctuations while the input parameters fluctuate significantly.

In terms of socio-economic, the project of water supply system for Hà Nam is feasible. In addition, the project brings benefits not be quantified, including:

- The impact of the development
- The environmental impact

- The social impact
- Job creation
- Benefits from values of land and real estate

V. CONCLUSION AND RECOMMENDATIONS

1. CONCLUSION

Water demand is now very essential for all people over the country. Using unhygienic domestic water leads to considerable consequences for the life, health, economic and even economy for people.

Due to economic difficulties, people and local government hope for a system of clean water supply to improve the quality of life, improve the health of the family...

People in the region can take the benefit from the project. Their life will be easier when having clean water. The health will be improved due to disease risks caused by environmental pollution is minimized. Landscape and environment will be cleaner thanks to water supply works of the projects.

The other economic benefits are also considered, including the increase in property values, the improvement in health and the reduction in sickness and disease, affecting to poverty reduction. The socio-economic problems are improved; the situation of communes is increasingly changed, partly thanks to the water supply project

2. RECOMMENDATIONS

Water supply project in Ha Nam island play important role in terms of social-economy not only for 03 communes in particular, but also beneficial for the whole Quang Yen town and Quang Ninh province in general.

As the demand for large capital, it is recommended that the People's committee to support and facilitate the project investor to conduct the necessary procedures to use aid funds given by the Government of Italy. For the reciprocal fund of Vietnam, it is proposed that the People's committee will balance and allocate the annual budget for the project.

To meet timely the rate of the project, it is recommended Quang Ninh Provincial People's Committee to direct the departments concerned to coordinate closely with the Project Owners in the preparation process for project implementation and consider early for approval of the project so the Project Owner can carry out the next steps. /.

VI. APPENDIX

- Appendix A: Total investment capital
- Appendix B: Financial analysis and calculation tables
- Appendix C: Calculation table of economic analysis
- Appendix D: Attached equipment quotation

➢ Appendix A: Total investment capital

SUMMARY OF COST ESTIMATE

UPGRADING, REHABILITATION AND EXPANSION OF WATER SUPPLY SYSTEM FOR HAI NAM ISLAND

LOCATION: QUANG YEN TOWN, QUANG NINH PROVINCE

No.	items	Symbol	Value before tax	VAT	Value after tax	Source of fund	
						Italia	Vietnam
1	Construction cost	G_{XD}	12,754,545,455	1,275,454,545	14,030,000,000		14,030,000,000
2	Equipment cost	G_{TB}	10,585,454,546	1,058,545,455	11,644,000,000	10,585,454,546	1,058,545,455
3	Management cost	G_{QLDA}	378,181,818	37,818,182	416,000,000		416,000,000
4	Consulting cost for investment and cor	G_{TV}	1,302,727,273	130,272,727	1,433,000,000		1,433,000,000
5	Other cost	G_{K}	329,408,636	27,591,364	357,000,000		357,000,000
	TOTAL A = 1+2+3+4+5		**25,350,317,728**	**2,529,682,273**	**27,880,000,000**	**10,585,454,546**	**17,294,545,455**
6	Contingency	G_{DP}			1,394,000,000	96,909,091	1,297,090,909
	TOTAL :	G_{XDCT}			**29,274,000,000**	**10,682,363,636**	**18,591,636,364**
	INVESTMENT COST (ROUND)				**29,274,000,000**	**10,682,364,000**	**18,591,636,000**

COST SUMMARY

UPGRADING, REHABILITATION AND EXPANSION OF WATER SUPPLY SYSTEM FOR HAI NAM ISLAN

LOCATION: QUANG YEN TOWN, QUANG NINH PROVINCE

No.	Name of items	Value before tax	VAT 10%	value after tax	Source of fund	
					Italia	Vietnam
I	PHONG COC WATER SUPPLY STATION					
1	Primary and secondary pumping station					
	- Technology	*58.531.700*	*5.853.170*	*64.384.870*		*64.384.870*
	- Construction	*358.060.300*	*35.806.030*	*393.866.330*		*393.866.330*
2	Distribution pipeline network					
	- Technology	*1.209.770.958*	*120.977.096*	*1.330.748.054*		*1.330.748.054*
	- Construction	*857.343.960*	*85.734.396*	*943.078.356*		*943.078.356*
3	Support of treatment works	40.000.000	4.000.000	44.000.000		*44.000.000*
4	Service pipeline network					
	- Technology	*1.223.880.110*	*122.388.011*	*1.346.268.121*		*1.346.268.121*
	- Construction	*347.281.270*	*34.728.127*	*382.009.397*		*382.009.397*
5	Lighting power system in station	66.515.471	6.651.547	73.167.018		73.167.018
6	Clean water reservoir					
	- Technology	*36.291.980*	*3.629.198*	*39.921.178*		*39.921.178*
	- Construction	*162.626.000*	*16.262.600*	*178.888.600*		*178.888.600*
II	CAM LA WATER SUPPLY STATION					
1	Primary and secondary pumping station					
	- Technology	*68.175.050*	*6.817.505*	*74.992.555*		*74.992.555*
	- Construction	*357.998.500*	*35.799.850*	*393.798.350*		*393.798.350*
	- Power	*91.663.484*	*9.166.348*	*100.829.832*		*100.829.832*
2	Clean water reservoir					
	- Technology	*29.585.730*	*2.958.573*	*32.544.303*		*32.544.303*
	- Construction	*106.604.000*	*10.660.400*	*117.264.400*		*117.264.400*
3	Building enbankment + leveling of WTP	50.000.000	5.000.000	55.000.000		55.000.000

No.	Name of items	Value before tax	VAT 10%	value after tax	Source of fund	
					Italia	Vietnam
4	Gate + Fencing	50.000.000	5.000.000	55.000.000		55.000.000
5	Support of treatment works	40.000.000	4.000.000	44.000.000		44.000.000
6	technical pipeline in WTP	50.000.000	5.000.000	55.000.000		55.000.000
7	Distribution pipeline network					
	- Technology	*927.563.612*	*92.756.361*	*1.020.319.973*		*1.020.319.973*
	- Construction	*1.092.497.696*	*109.249.770*	*1.201.747.466*		*1.201.747.466*
8	Service pipeline network					
	- Technology	*955.144.110*	*95.514.411*	*1.050.658.521*		*1.050.658.521*
	- Construction	*445.057.999*	*44.505.800*	*489.563.799*		*489.563.799*
9	Lighting power system in station	65.000.000	6.500.000	71.500.000		71.500.000
III	LIEN HOA WATER SUPPLY STATION					
1	Primary and secondary pumping station					
	- Technology	*122.843.570*	*12.284.357*	*135.127.927*		*135.127.927*
	- Construction	*361.066.890*	*36.106.689*	*397.173.579*		*397.173.579*
2	Clean water reservoir					
	- Technology	*36.291.980*	*3.629.198*	*39.921.178*		*39.921.178*
	- Construction	*162.626.000*	*16.262.600*	*178.888.600*		*178.888.600*
3	Building embankment + leveling	75.000.000	7.500.000	82.500.000		82.500.000
4	Gate + Fencing	50.000.000	5.000.000	55.000.000		55.000.000
5	Support of treatment works	40.000.000	4.000.000	44.000.000		44.000.000
6	technical pipeline in WTP	50.000.000	5.000.000	55.000.000		55.000.000
7	Distribution pipeline network					
	- Technology	*638.262.543*	*63.826.254*	*702.088.797*		*702.088.797*
	- Construction	*723.308.277*	*72.330.828*	*795.639.105*		*795.639.105*
8	Service pipeline network					
	- Technology	*1.377.242.365*	*137.724.236*	*1.514.966.601*		*1.514.966.601*
	- Construction	*363.311.900*	*36.331.190*	*399.643.090*		*399.643.090*
9	Lighting power system in station	65.000.000	6.500.000	71.500.000		71.500.000
	TOTAL :	**12.754.545.455**	**1.275.454.545**	**14.030.000.000**		**14.030.000.000**

SUMMARY OF EQUIPMENT COST

UPGRADING, REHABILITATION AND EXPANSION OF WATER SUPPLY SYSTEM FOR HAI NAM ISLAND

LOCATION: QUANG YEN TOWN, QUANG NINH PROVINCE

NO	Equipment	Unit	Quantity	Unit price (VND)	Price before tax (VND)	VAT (VND)	Total (VND)	Fund (Counterpart)	Fund (Italia)
I	**Phong Coc water treatment plant**								
1	**Primary -Secondary Pumping Station**								
1.1	Pump Q=70m3/h, H=17m	set	1	95.000.000	95.000.000	9.500.000	104.500.000	9.500.000	95.000.000
1.2	Pump Q=46m3/h, H=8m	set	1	70.000.000	70.000.000	7.000.000	77.000.000	7.000.000	70.000.000
1.3	Stainless steel tank 1m3	set	1	5.000.000	5.000.000	500.000	5.500.000	500.000	5.000.000
2	**Tank**								
2.1	CST Storage Glass-fused-to-steel bolted tank, imported from US, Mode 3414, diameter D=10238mm, H=4266mm, Net capacity 312m3	tank	1	987.067.636	987.067.636	98.706.764	1.085.774.400	98.706.764	987.067.636
3	**Treatment unit DHK -V4.1000**								
3.1	Reactor with Lamella settling tank 1000m3/day	set	1	860.000.000	860.000.000	86.000.000	946.000.000	86.000.000	860.000.000
3.2	Automatic gravity filter, capacity 1000m3/day	set	1	700.000.000	700.000.000	70.000.000	770.000.000	70.000.000	700.000.000
4	**Chemical system**								
4.1	Polymer mixing and metering pump system	set	1	70.000.000	70.000.000	7.000.000	77.000.000	7.000.000	70.000.000
4.2	PAC mixing and metering pump system	set	1	70.000.000	70.000.000	7.000.000	77.000.000	7.000.000	70.000.000
4.3	Disinfection system	set	1	270.000.000	270.000.000	27.000.000	297.000.000	27.000.000	270.000.000
5	**Mixing equipment with retaining ring**	set	2	2.500.000	5.000.000	500.000	5.500.000	500.000	5.000.000
6	**Control power**	ht	1	200.000.000	200.000.000	20.000.000	220.000.000	20.000.000	200.000.000
II	**Cam La water treatment plant**								
1	**Primary -Secondary Pumping Station**								
1.1	Pump Q=37m3/h. H=60m	set	1	95.000.000	95.000.000	9.500.000	104.500.000	9.500.000	95.000.000
1.2	Pump Q=50m3/h, H=12m	set	1	80.000.000	80.000.000	8.000.000	88.000.000	8.000.000	80.000.000
1.3	Stainless steel tank 1m3	set	1	5.000.000	5.000.000	500.000	5.500.000	500.000	5.000.000
2	**Tank**								
2.1	CST Storage Glass-fused-to-steel bolted tank, imported from US, Model 2514, diameter D=7679mm, H=4266mm, Net capacity 176m3	tank	1	651.322.000	651.322.000	65.132.200	716.454.200	65.132.200	651.322.000
3	**Treatment unit DHK -V4.1000**								
3.1	Reactor with Lamella settling tank 1000m3/day	set	1	860.000.000	860.000.000	86.000.000	946.000.000	86.000.000	860.000.000
3.2	Automatic gravity filter, capacity 1000m3/day	set	1	700.000.000	700.000.000	70.000.000	770.000.000	70.000.000	700.000.000
4	**Chemical system**								
4.1	Polymer mixing and metering pump system	set	1	70.000.000	70.000.000	7.000.000	77.000.000	7.000.000	70.000.000
4.2	PAC mixing and metering pump system	set	1	70.000.000	70.000.000	7.000.000	77.000.000	7.000.000	70.000.000

NO	Equipment	Unit	Quantity	Unit price (VND)	Price before tax (VND)	VAT (VND)	Total (VND)	Fund (Counterpart)	Fund (Italia)
4.3	Disinfection system	set	1	270.000.000	270.000.000	27.000.000	297.000.000	27.000.000	270.000.000
5	Mixing equipment with retaining ring	set	2	2.500.000	5.000.000	500.000	5.500.000	500.000	5.000.000
6	Control power	system	1	200.000.000	200.000.000	20.000.000	220.000.000	20.000.000	200.000.000
III	Lien Hoa water treatment plant								
1	Primary -Secondary Pumping Station								
1.1	Pump Q=40m3/h, H=25m	set	2	75.000.000	150.000.000	15.000.000	165.000.000	15.000.000	150.000.000
1.2	Pump Q=30m3/h, H=11m	set	2	70.000.000	140.000.000	14.000.000	154.000.000	14.000.000	140.000.000
1.3	Stainless steel tank 1m3	set	1	5.000.000	5.000.000	500.000	5.500.000	500.000	5.000.000
2	Tank								
2.1	CST Storage Glass-fused-to-steel bolted tank, imported from US; Model 3414, diameter D=10238mm, H=4266mm, Net capacity 312m3	tank	1	987.067.636	987.067.636	98.706.764	1.085.774.400	98.706.764	987.067.636
3	Treatment unit DHK -V4.1500								
3.1	Reactor with Lamella settling tank 1500m3/day	set	1	1.300.000.000	1.300.000.000	130.000.000	1.430.000.000	130.000.000	1.300.000.000
3.2	Automatic gravity filter, capacity 1500m3/day	set	1	1.050.000.000	1.050.000.000	105.000.000	1.155.000.000	105.000.000	1.050.000.000
4	Chemical system								
4.1	Polymer mixing and metering pump system	set	1	70.000.000	70.000.000	7.000.000	77.000.000	7.000.000	70.000.000
4.2	PAC mixing and metering pump system	set	1	70.000.000	70.000.000	7.000.000	77.000.000	7.000.000	70.000.000
4.3	Disinfection system	set	1	270.000.000	270.000.000	27.000.000	297.000.000	27.000.000	270.000.000
5	Mixing equipment with retaining ring	set	2	2.500.000	5.000.000	500.000	5.500.000	500.000	5.000.000
6	Control power	system	1	200.000.000	200.000.000	20.000.000	220.000.000	20.000.000	200.000.000
	TOTAL				10.585.454.546	1.058.545.455	11.644.000.001	1.058.545.455	10.585.454.546

Bieu 4 CPK

SUMMARY OF PROJECT MANAGEMENT COST, CONSTRUCTION INVESTMENT CONSULTANCY COST AND OTHER COSTS

UPGRADING, REHABILITATION AND EXPANSION OF WATER SUPPLY SYSTEM FOR HAI NAM ISLAND

LOCATION: QUANG YEN TOWN, QUANG NINH PROVINCE

NO	COST	CALCULATING METHOD	UNIT	VALUE BEFORE TAX (D)	TAX (D)	VALUE AFTER TAX (Đ)	FUND	
							ITALIA	VIETNAM
I	CONSTRUCTION VALUE		dong	12.754.545.455	1.275.454.545	14.030.000.000		
II	EQUIPMENT VALUE		dong	10.585.454.546	1.058.545.455	11.644.000.001		
	CONSTRUCTION + EQUIPMENT COST		dong	23.340.000.001	2.334.000.000	25.674.000.001		
III	PROJECT MANAGEMENT COST	(Gxl + Gtb) x1,7815%	dong	378.181.818	37.818.182	416.000.000		416.000.000
IV	CONSTRUCTION CONSULTANCY COST		dong	1.302.727.273	130.272.727	1.433.000.000		1.433.000.000
1	Tophographical, geological survey for detailed design drawing	Provisional	dong	634.216.057	63.421.606	697.637.663		697.637.663
8	Design of Detailed Drawing	Gxl x1,6044%x1,3	dong	266.024.105	26.602.411	292.626.516		292.626.516
3	Appraisal of Detailed Design Drawing	Gxd x 0,1457%	dong	18.587.006	1.858.701	20.445.706		20.445.706
4	Appraisal of Cost estimates	Gxd x 0,1402%	dong	17.887.670	1.788.767	19.676.437		19.676.437
5	Preparation of Bidding Document and evaluation of Construction Bids	Gxd x 0,2827%	dong	36.062.240	3.606.224	39.668.465		39.668.465
6	Preparation of Bidding Document and evaluation of Euipment procurement Bids	Gtb x 0,236%	dong	24.981.673	2.498.167	27.479.840		27.479.840
7	Construction supervison cost	Gxd x 1,8574%	dong	236.904.048	23.690.405	260.594.453		260.594.453
8	Equipment installation monitoring cost	Gtb x 0,643%	dong	68.064.473	6.806.447	74.870.920		74.870.920
V	OTHER COSTS		dong	329.408.636	27.591.364	357.000.000		357.000.000
1	Work insurance	Gxd x 0,7000%	dong	89.281.818	8.928.182	98.210.000		98.210.000
2	Audit cost	TMĐT x 0,1717%	dong	186.631.818	18.663.182	205.295.000		205.295.000
3	Appraisal of settlement approval	TMĐT 0,2635% x 0,5	dong	53.495.000		53.495.000		53.495.000

Appendix B: Financial analysis and calculation tables

FINANCIAL ANALYSIS

Year	Initial cost	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Depreciated value of mechanical - electrical part		0																								
Depreciated value of electrical equipment		12.226																								
DEPRECIATION (MILLION VND)																										
Depreciation period of construction part		25	năm																							
Depreciation period of mechanical - electrical part		20	năm																							
Depreciation period of equipment part		10	năm																							
Rate of calculating depreciation (%)		100%																								
Construction part (million VND)		589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589
Mechanical - electrical part (million VND)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Equipment part (million VND)		1.223	1.223	1.223	1.223	1.223	1.223	1.223	1.223	1.223	1.223	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total depreciation (million VND)		*1.812*	*1.812*	*1.812*	*1.812*	*1.812*	*1.812*	*1.812*	*1.812*	*1.812*	*1.812*	*589*	*589*	*589*	*589*	*589*	*589*	*589*	*589*	*589*	*589*	*589*	*589*	*589*	*589*	*589*
BUSINESS REPORT																										
Revenue (million VND)																										
Revenue from bill		5.415	5.415	5.415	7.605	7.605	7.605	9.795	9.795	9.795	11.985	11.985	11.985	14.175	14.175	14.175	16.365	16.365	16.365	18.555	18.555	18.555	20.745	20.745	20.745	22.935
VAT 5%		271	271	271	380	380	380	490	490	490	599	599	599	709	709	709	818	818	818	928	928	928	1.037	1.037	1.037	1.147
Net revenue		5.144	5.144	5.144	7.225	7.225	7.225	9.305	9.305	9.305	11.386	11.386	11.386	13.466	13.466	13.466	15.547	15.547	15.547	17.627	17.627	17.627	19.708	19.708	19.708	21.788
Other cost (million VND)																										
Operation and management cost		3.545	3.616	3.688	3.762	3.837	3.914	3.992	4.072	4.154	4.237	4.321	4.408	4.496	4.586	4.678	4.771	4.867	4.964	5.063	5.164	5.266	5.373	5.481	5.590	5.702
Depreciation		1.812	1.812	1.812	1.812	1.812	1.812	1.812	1.812	1.812	1.812	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589
Total cost		5.357	5.428	5.500	5.574	5.649	5.726	5.804	5.884	5.965	6.049	4.911	4.997	5.085	5.175	5.267	5.360	5.456	5.553	5.652	5.754	5.857	5.962	6.070	6.179	6.291
Profit (million VND)																										
Profit before tax		-213	-284	-356	1.651	1.575	1.499	3.501	3.421	3.340	5.337	6.475	6.388	8.381	8.291	8.199	10.186	10.091	9.995	11.975	11.873	11.770	13.745	13.638	13.529	15.497
Income taxes (25%)		0	0	0	413	394	375	875	855	835	1.334	1.619	1.597	2.095	2.073	2.050	2.547	2.523	2.498	2.994	2.968	2.943	3.436	3.409	3.382	3.874
Profit after tax		-213	-284	-356	1.238	1.182	1.124	2.626	2.566	2.505	4.003	4.856	4.791	6.286	6.218	6.149	7.640	7.568	7.496	8.981	8.905	8.828	10.309	10.228	10.146	11.622
FINANCIAL CONDITION CALCULATION:																										
Cash inflow (million VND)																										
Profit	0	-213	-284	-356	1.238	1.182	1.124	2.626	2.566	2.505	4.003	4.856	4.791	6.286	6.218	6.149	7.640	7.568	7.496	8.981	8.905	8.828	10.309	10.228	10.146	11.622
Depreciation		1.812	1.812	1.812	1.812	1.812	1.812	1.812	1.812	1.812	1.812	589	589	589	589	589	589	589	589	589	589	589	589	589	589	589
Total cash inflow	0	1.599	1.528	1.456	3.050	2.993	2.936	4.438	4.378	4.317	5.815	5.445	5.381	6.875	6.807	6.739	8.229	8.157	8.084	9.570	9.494	9.417	10.898	10.818	10.735	12.212
Cash outflow (million VND)																										
Initial investment cost	29.274																									
Total cash outflow	29.274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Financial balance (million VND)	-29.274	1.599	1.528	1.456	3.050	2.993	2.936	4.438	4.378	4.317	5.815	5.445	5.381	6.875	6.807	6.739	8.229	8.157	8.084	9.570	9.494	9.417	10.898	10.818	10.735	12.212
Cumulative number (VND)	-29.274	-27.675	-26.147	-24.691	-21.641	-18.648	-15.712	-11.274	-6.897	-2.580	3.235	8.680	14.061	20.935	27.743	34.482	42.710	50.868	58.952	68.521	78.016	87.433	98.331	109.149	119.884	132.096
Discount rate %																										
Year																										
NPV (million VND)	-29.274	1.599	1.528	1.456	3.050	2.993	2.936	4.438	4.378	4.317	5.815	5.445	5.381	6.875	6.807	6.739	8.229	8.157	8.084	9.570	9.494	9.417	10.898	10.818	10.735	12.212
IRR		46,04%																								
Cumulative NPV (million VND)	-29.274	-27.675	-26.147	-24.691	-21.641	-18.648	-15.712	-11.274	-6.897	-2.580	3.235	8.680	14.061	20.935	27.743	34.482	42.710	50.868	58.952	68.521	78.016	87.433	98.331	109.149	119.884	132.096
MIRR		19,84%																								

OPERATION AND MANAGEMENT COST

Capacity of WTP **4.000** **(m3/day)**

Unit:VND

No.	Items	Unit	Norm	Quantity	Unit price	Amount
1	Annual power cost					2.698.080.000
	Power cost of WTP	Kw	0,66	963.600	2800	2.698.080 000
2	Chemical cost					
	Chroline disinfection, rate 1.6 g/m3	0	0,0016	144.540	400	57.816 000
	Alum cost (dosage 50 g/1m3 comparing with pure alum dosage 50%)	kg	0,05	10.950	15500	169.725 000
3	Minor repairing cost per year (5% of basic depreciation cost)	item			5% of depreciation	90.594 000
4	Salary for worker per year	Manmonth	12	144	2.500.000	360.000 000
	Total (1+2+3+4):					**3.376.215.000**
	Overhead per year	item		1	5%*(1+2+3+4)	168.810.750
	Total cost (round):					**3.545.026.000**
	Operation and management cost for 1m3 clean water (VND)					**2.- 28**

CLEAN WATER PRICE CALCULATION FOR LIVING REQUIREMENT

Capacity of WTP 4.000 (m3/day)

Capacity per year: 1.460.000 m3/year

1. Legal basis to calculate clean water price

- The price is calculated to ensure and meet the produc ion cost and profit and pay taxes to the Government.

- Prope ly and sufficiently calculating to ensure operation and mana -

2. Table of clean water price calculation for living requirement

No.	Items	Unit	Amount
I	**Direct cost**		
1	Electric cost	VND/m^3	1.848,00
2	Chemical cost	VND/m^3	155,85
3	Labour cost	VND/m3	246,58
4	Minor maintenance and repair cost	VND/m^3	62,05
5	General management cost	VND/m^3	115,62
II	**Depreciation of fixed assets**		
1	Depreciation	VND/m^3	1.241,01
III	**Total cost**		**3.669,11**
IV	**Norm of interest rate and business income tax**		
1	Norm of interest rate 3% (III)	VND/m3	110
2	Business income tax (25% of)	VND/m3	28
V	**Price before tax VAT (III+IV)**	**VND/m3**	**3.807**
	VAT (10%)	VND/m3	190
	Clean water clean for living requirement	VND/m3	**4.000**

PRICE CALCULATION BY EACH OBJECT

- The determination of clean water price for each object to reach the correct and sufficient calculation according to the government's regulation on applying other price units for other objects
- Price is calculated at the time of the work starting to put into operation in 2014

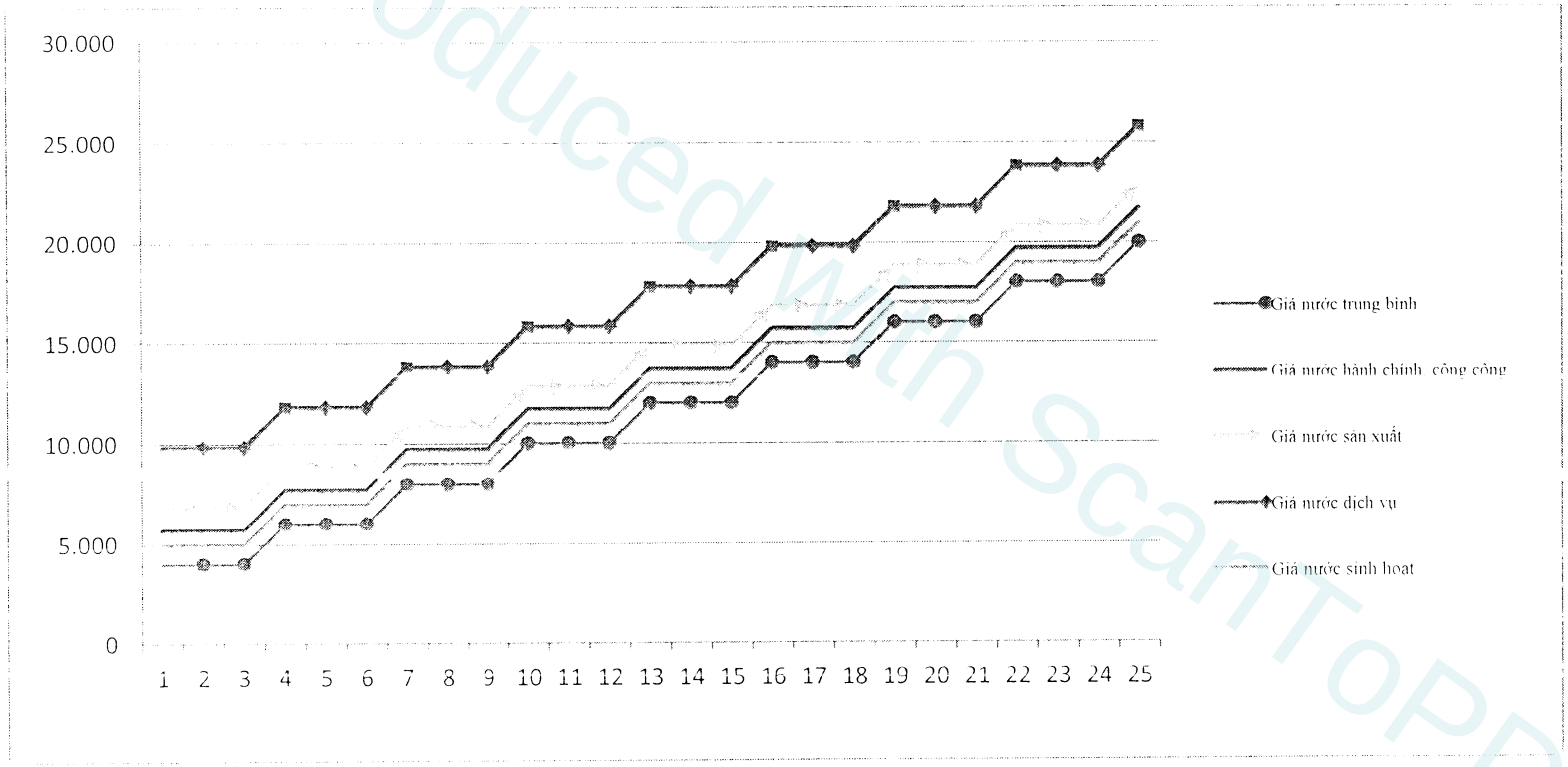
Unit: VNĐ/1 m3

No.	Activities	Proportion %	Price
1	Living requirements	75,0%	4.000
2	Administration, public, school, hospital,...	5,0%	5.700
3	Service for production, construction, business,...	10,0%	6.800
4	Business, services, restaurant and other services	10,0%	9.800
	Average price		**4.945**

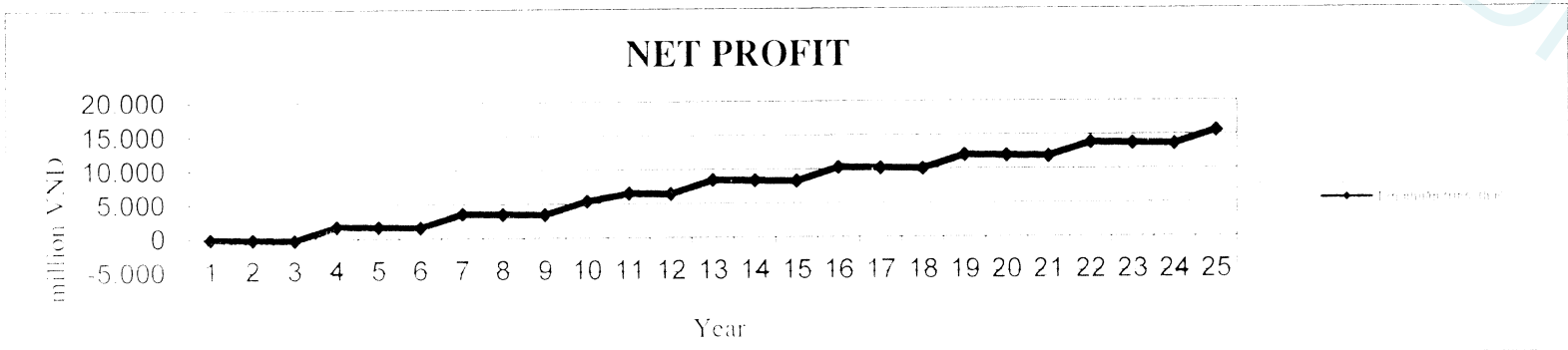
SENSITIVENESS ANALYSIS TABLE

Variable method	Value	Original	Variable	
Total investment capital	Rate (%)	0%	-10%	10%
	NPV (Million VND)	46.528	40.679	18.357
	IRR (%)	13,14%	20,33%	11,77%
Loss rate	Rate (%)	25%	15%	35%
	NPV (Million VND)	46.528	40.679	18.357
	IRR (%)	13,14%	20,33%	11,77%
Depreciation rate (%)	Depreciation rate	100%	50%	0%
	NPV (Million VND)	46.528	40.679	18.357
	IRR (%)	13,14%	20,33%	11,77%
	Domestic waste price (VNĐ)	4.000	4.000	4.000

TARIFF INCREASE ROADMAP



NET PROFIT



➢ **Appendix C: Calculation table of economic analysis**

TOTAL INVESTMENT COST

Unit: 1000 VND

NO	Items	Financial investment capital		Economic investment capital
		Cost before tax	VAT 10%	
A	Direct investment cost	25.674.000	1.283.700	25.674.000
B	Contingency	1.324.300	69.700	1.394.000
C	Indirect investment cost	2.206.000	110.300	2.206.000
	Total	**29.204.300**	**1.463.700**	**29.274.000**

DETERMINATION OF DEPRECIATION

Unit: Million VND

NO	Items	Financial investment capital	VAT 10%	Factor	Economic investment capital
1	Construction	7.015	702	1,00	7.015
1	Technology	7.015	702	1,00	7.015
2	Equipment	11.644	1.164	1,00	11.644
3	Indirect cost (including contingency)	3.600	268	1,00	3.600
	Total	**29.274**	**2.836**		**29.274**

CALCULATION OF DEPRECIATION

Unit Million VND

NO	Item	Depreciation period	Investment cost	Operation period											
				2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
				1	2	3	4	5	6	7	8	9	10	11	12
1	Construction	25	7.015,00	280,6	280,6	280,6	280,6	280,6	280,6	280,6	280,6	280,6	280,6	280,6	280,6
2	Equipment	10	7.015,00	701,5	701,5	701,5	701,5	701,5	701,5	701,5	701,5	701,5	701,5	0,0	0,0
3	Technology	20	11.644,00	582,20	582,20	582,20	582,20	582,20	582,20	582,20	582,20	582,20	582,20	582,20	582,20
5	Indirect cost	10	3.600,00	360,00	360,00	360,00	360,00	360,00	360,00	360,00	360,00	360,00	360,00	0	0
	Total		29.274,0	1.924,3	1.924,3	1.924,3	1.924,3	1.924,3	1.924,3	1.924,3	1.924,3	1.924,3	1.924,3	862,8	862,8

NO	Item	Depreciation period	Operation period												
			2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
			13	14	15	16	17	18	19	20	21	22	23	24	25
1	Construction	25	280,6	280,6	280,6	280,6	280,6	280,6	280,6	280,6	280,6	280,6	280,6	280,6	280,6
2	Equipment	10	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
3	Technology	20	582,20	582,20	582,20	582,20	582,20	582,20	582,20	582,20	0,00	0,00	0,00	0,00	0,00
5	Indirect cost	10	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
	Total		862,80	862,80	862,80	862,80	862,80	862,80	862,80	862,80	280,60	280,60	280,60	280,60	280,60

PRODUCTION COST

Unit: Million VND

NO	Items	Operation period											
		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
A	Material cost												
1	Electricity	2,698.08	2,752.04	2,807.08	2,863.22	2,920.49	2,978.90	3,038.48	3,099.25	3,161.23	3,224.46	3,288.94	3,354.72
2	Chemical	227.54	232.09	236.73	241.47	246.30	251.22	256.25	261.37	266.60	271.93	277.37	282.92
3	Small repairing	90.59	92.41	94.25	96.14	98.06	100.02	102.02	104.06	106.15	108.27	110.43	112.64
	Total	**3,016.21**	**3,076.54**	**3,138.07**	**3,200.83**	**3,264.85**	**3,330.15**	**3,396.75**	**3,464.68**	**3,533.98**	**3,604.66**	**3,676.75**	**3,750.28**
B	Tax												
	VAT (10%)	301.62	307.65	313.81	320.08	326.48	333.01	339.67	346.47	353.40	360.47	367.67	375.03
	Total taxes	**301,62**	**307,65**	**313,81**	**320,08**	**326,48**	**333,01**	**339,67**	**346,47**	**353,40**	**360,47**	**367,67**	**375,03**
C	**Total material cost**	2,714.59	2,768.89	2,824.26	2,880.75	2,938.36	2,997.13	3,057.07	3,118.21	3,180.58	3,244.19	3,309.07	3,375.26
D	Labor cost												
1	Labor wage	360.00	367.20	374.54	382.03	389.68	397.47	405.42	413.53	421.80	430.23	438.84	447.61
2	Overhead	168.81	172.19	175.63	179.14	182.73	186.38	190.11	193.91	197.79	201.74	205.78	209.89
	Total labor cost	**528.81**	**539.39**	**550.17**	**561.18**	**572.40**	**583.85**	**595.53**	**607.44**	**619.59**	**631.98**	**644.62**	**657.51**
E	Total economic production cost	**3,243.40**	**3,308.27**	**3,374.44**	**3,441.93**	**3,510.77**	**3,580.98**	**3,652.60**	**3,725.65**	**3,800.17**	**3,876.17**	**3,953.69**	**4,032.77**

STT	Items	Operation period												
		2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
A	**Material cost**													
1	Electricity	3,421.82	3,490.25	3,560.06	3,631.26	3,703.89	3,777.96	3,853.52	3,930.59	4,009.20	4,089.39	4,171.18	4,254.60	4,339.69
2	Chemical	288.58	294.35	300.24	306.24	312.37	318.61	324.98	331.48	338.11	344.88	351.77	358.81	365.99
3	Small repairing	114.90	117.19	119.54	121.93	124.37	126.85	129.39	131.98	134.62	137.31	140.06	142.86	145.71
	Total	**3,825.29**	**3,901.80**	**3,979.83**	**4,059.43**	**4,140.62**	**4,223.43**	**4,307.90**	**4,394.06**	**4,481.94**	**4,571.58**	**4,663.01**	**4,756.27**	**4,851.39**
B	Tax													
	VAT (10%)	382.53	390.18	397.98	405.94	414.06	422.34	430.79	439.41	448.19	457.16	466.30	475.63	485.14
	Total taxes	**382,53**	**390,18**	**397,98**	**405,94**	**414,06**	**422,34**	**430,79**	**439,41**	**448,19**	**457,16**	**466,30**	**475,63**	**485,14**
C	**Total material cost**	3,442.76	3,511.62	3,581.85	3,653.49	3,726.56	3,801.09	3,877.11	3,954.65	4,033.74	4,114.42	4,196.71	4,280.64	4,366.25
D	Labor cost													
1	Labor wage	456.57	465.70	475.01	484.51	494.20	504.09	514.17	524.45	534.94	545.64	556.55	567.68	579.04
2	Overhead	214.09	218.37	222.74	227.20	231.74	236.38	241.10	245.93	250.84	255.86	260.98	266.20	271.52
	Total labor cost	670.66	684.07	697.75	711.71	725.94	740.46	755.27	770.38	785.78	801.50	817.53	833.88	850.56
E	**Total economic production cost**	**4,113.42**	**4,195.69**	**4,279.60**	**4,365.20**	**4,452.50**	**4,541.55**	**4,632.38**	**4,725.03**	**4,819.53**	**4,915.92**	**5,014.24**	**5,114.52**	**5,216.81**

CONSUMPRTION SURPLUS

Unit: 1.000 VND

NO	Item	Unit	Production year										
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
A	**POPULATION**													
1	Served population	Person	8.911	9.633	10.413	11.256	12.179	13.166	14.232	15.385	16.630	17.461	18.334	19.251
B	**WITHOUT PROJECT**													
B1	**Water expenses**													
1	Water consumption standard	l/day.person	30,0	30,5	30,9	31,4	31,8	32,3	32,8	33,3	33,8	34,2	34,6	35,0
2	Total amount of water per year	m3/year	97.575	107.060	117.468	128.888	141.549	155.309	170.408	186.974	205.131	217.973	231.618	246.117
3	Average tariff (according to monthly expense for water in project area, based on average household expense)	VND/m3	200	210	221	232	243	255	268	281	295	310	326	342
4	Totl expenses for water	1000 VND	19.514,9	22.482,7	25.901,7	29.840,8	34.410,6	39.643,6	45.672,5	52.618,2	60.614,5	67.629,4	75.456,2	84.188,7
B2	**Medical expenses**													
1	Average medical expense for medical care and treatment in hospital due to effect of unsanitary water	VND/1 household/1 year	20.000	20.200	20.402	20.606	20.812	21.020	21.230	21.443	21.657	21.874	22.092	22.313
2	Total medical expense for medical care and treatment	1000 VND	44.554,6	48.645,18	53.111,29	57.987,44	63.369,84	69.187,82	75.539,95	82.475,28	90.039,00	95.486,36	101.263,29	107.389,72
C	**WITH PROJECT**													
C1	**Water expenses**													
1	Water consumption standard	l/day.person	80	80	80	80	80	80	80	80	90	90	90	90
2	Total amount of water per year	m3/year	260.199	281.275	304.058	328.687	355.639	384.446	415.586	449.249	546.292	573.607	602.287	632.402
3	Average tariff	VND/m3	4.756	4.756	4.756	6.756	6.756	6.756	8.756	8.756	8.756	10.756	10.756	10.756
4	Total revenue of clean water sale	1000 VND	1.237.506	1.337.744	1.446.102	2.220.610	2.402.700	2.597.319	3.638.874	3.933.623	4.783.335	6.169.716	6.478.201	6.802.111
C2	**Medical expenses**													
1	Average medical expense for medical care and treatment in hospital due to effect of unsanitary water (provisional)	VND/1 household/1 year	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
2	Total medical expense for medical care and treatment	1000 VND	33.416	36.123	39.049	42.212	45.633	49.332	53.332	57.655	62.362	65.489	68.754	72.192

D	**CONSUMPTION SURPLUS**													
1	Saving A (which is created through sale when project is implemented)	233.992.464	1.217.991	1.315.262	1.420.200	2.190.769	2.368.290	2.557.675	3.593.202	3.881.005	4.722.721	6.102.086	6.402.745	6.717.923
2	Consumption surplus B (surplus benefit of consumer due to difference between expenses relating to water use and effect of water use)	-135.254.210	-729.778	-779.458	-832.217	-1.287.809	-1.376.656	-1.469.746	-2.058.905	-2.197.891	-2.858.718	-3.684.855	-3.833.656	-3.987.544
	Total consumption	98.738.254	**488.213**	**535.804**	**587.983**	**902.960**	**991.634**	**1.087.929**	**1.534.297**	**1.683.114**	**1.864.003**	**2.417.231**	**2.569.089**	**2.730.379**

STT	Items	Unit	Thời kỳ hoạt động											
			2.026	2.027	2.028	2.029	2.030	2.031	2.032	2.033	2.034	2.035	2.036	2.037	2.038
A	**POPULATION**														
1	Served population	Person	20.214	21.224	22.286	23.400	24.570	25.798	27.002	27.542	28.093	28.655	29.228	29.812	30.409
B	**WITHOUT PROJECT**														
B1	**Water expenses**														
1	Water consumption standard	l/day person	35,4	35,7	36,1	36,4	36,8	37,2	37,6	38,3	39,1	39,9	40,6	41,5	42,3
2	Total amount of water per year	m3/year	261.007	276.798	293.544	311.304	330.138	350.111	370.108	385.060	400.617	416.802	433.640	451.160	469.386
3	Average tariff (according to monthly expense for water in project area, based on average household expense)	VND/m3	**684**	**718**	**754**	**792**	**832**	**873**	**917**	**963**	**1.011**	**1.061**	**1.114**	**1.170**	**1.229**
4	Totl expenses for water	1000 VND	**178.564**	**198.836**	**221.409**	**246.544**	**274.533**	**305.699**	**339.318**	**370.677**	**404.935**	**442.360**	**483.242**	**527.904**	**576.693**
B2	**Medical expenses**														
1	Average medical expense for medical care and treatment in hospital due to effect of unsanitary water	VND/1 household/1 year	**22.537**	**22.762**	**22.989**	**23.219**	**23.452**	**23.686**	**23.923**	**24.162**	**24.404**	**24.648**	**24.894**	**25.143**	**25.395**
2	Total medical expense for medical care and treatment	1000 VND	**91.109**	**96.622**	**102.467**	**108.666**	**115.241**	**122.213**	**129.193**	**133.095**	**137.114**	**141.255**	**145.521**	**149.916**	**154.443**
C	**WITH PROJECT**														
C1	**Water expenses**														
1	Water consumption standard	l/day person	90	90	90	90	90	90	100	100	100	100	100	100	100
2	Total amount of water per year	m3/year	664.022	**697.223**	**732.084**	**768.688**	**807.122**	**847.479**	**985.571**	**1.005.282**	**1.025.388**	**1.045.895**	**1.066.813**	**1.088.150**	**1.109.913**
3	Average tariff	VND/m3	12.756	12.756	12.756	14.756	14.756	14.756	16.756	16.756	16.756	18.756	18.756	18.756	20.756
4	Total revenue of clean water sale	1000 VND	8.470.260	8.893.773	9.338.462	11.342.761	11.909.899	12.505.394	16.514.220	16.844.504	17.181.395	19.616.813	20.009.149	20.409.332	23.037.311
C 2	**Medical expenses**														

1	Average medical expense for medical care and treatment in hospital due to effect of unsanitary water (provisional)	VND/1 household/1year	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
2	Total medical expense for medical care and treatment	1000 VND	75.802	79.592	83.571	87.750	92.137	96.744	101.257	103.282	105.348	107.455	109.604	111.796	114.032
D	**CONSUMPTION SURPLUS**														
1	Saving A (which is created through sale when project is implemented)		8.291.696	8.694.938	9.117.053	11.096.217	11.635.367	12.199.695	16.174.902	16.473.827	16.776.459	19.174.453	19.525.907	19.881.429	22.460.651
2	Consumption surplus B (surplus benefit of consumer due to difference between expenses relating to water use and effect of water use)		-4.849.830	-5.043.899	-5.244.343	-6.366.012	-6.618.639	-6.879.413	-9.720.494	-9.765.566	-9.805.387	-11.097.811	-11.134.273	-11.163.919	-12.467.392
	Total consumption		**3.441.866**	**3.651.038**	**3.872.711**	**4.730.206**	**5.016.727**	**5.320.282**	**6.454.408**	**6.708.261**	**6.971.072**	**8.076.642**	**8.391.634**	**8.717.509**	**9.993.260**

CALCULATION OF INCOME

Unit: Million VND

NO	Items	Operation period											
		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
A	REVENUE												
1	Annual amount of water recorded on bill (m3/year)	684	684	684	684	684	684	684	684	684	684	684	684
2	Average water tariff (VND)	4.756,0	4.756,0	4.756,0	6.756,0	6.756,0	6.756,0	8.756,0	8.756,0	8.756,0	10.756,0	10.756,0	10.756,0
3	Revenue (million VND)	3.254,9	3.254,9	3.254,9	4.623,6	4.623,6	4.623,6	5.992,4	5.992,4	5.992,4	7.361,1	7.361,1	7.361,1
4	VAT (5%)	162,7	162,7	162,7	231,2	231,2	231,2	299,6	299,6	299,6	368,1	368,1	368,1
5	Indirect cost depreciation	360,0	360,0	360,0	360,0	360,0	360,0	360,0	360,0	360,0	360,0	0,0	0,0
6	**Net revenue**	**3.452,1**	**3.452,1**	**3.452,1**	**4.752,5**	**4.752,5**	**4.752,5**	**6.052,8**	**6.052,8**	**6.052,8**	**7.353,1**	**6.993,1**	**6.993,1**
B	PRODUCTION COST												
	Production cost	**3.243,4**	**3.308,3**	**3.374,4**	**3.441,9**	**3.510,8**	**3.581,0**	**3.652,6**	**3.725,7**	**3.800,2**	**3.876,2**	**3.953,7**	**4.032,8**
C	PROFIT												
1	Income before tax	208,7	143,9	77,7	1.310,5	1.241,7	1.171,5	2.400,2	2.327,1	2.252,6	3.476,9	3.039,4	2.960,3
2	Enterprise tax	58,4	40,3	21,8	366,9	347,7	328,0	672,0	651,6	630,7	973,5	851,0	828,9
3	Net profit	**150,3**	**103,6**	**55,9**	**943,6**	**894,0**	**843,5**	**1.728,1**	**1.675,5**	**1.621,9**	**2.503,4**	**2.188,4**	**2.131,4**
D	OPERATING COST												
	Production cost and enterprise income tax	3.301,9	3.348,6	3.396,2	3.808,9	3.858,4	3.909,0	4.324,6	4.377,2	4.430,9	4.849,7	4.804,7	4.861,7
	Direct cost depreciation	1.564,3	1.564,3	1.564,3	1.564,3	1.564,3	1.564,3	1.564,3	1.564,3	1.564,3	1.564,3	862,8	862,8
	Total economic operation cost	**4.866,2**	**4.912,9**	**4.960,5**	**5.373,2**	**5.422,7**	**5.473,3**	**5.888,9**	**5.941,5**	**5.995,2**	**6.414,0**	**5.667,5**	**5.724,5**

NO	Items	Operation period												
		2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
A	REVENUE													
1	Annual amount of water recorded on bill (m3/year)	684	684	684	684	684	684	684	684	684	684	684	684	684
2	Average water tariff (VND)	12.756,0	12.756,0	12.756,0	14.756,0	14.756,0	14.756,0	16.756,0	16.756,0	16.756,0	18.756,0	18.756,0	18.756,0	20.756,0
3	Revenue (million VND)	8.729,9	8.729,9	8.729,9	10.098,6	10.098,6	10.098,6	11.467,4	11.467,4	11.467,4	12.836,1	12.836,1	12.836,1	14.204,9
4	VAT (5%)	436,5	436,5	436,5	504,9	504,9	504,9	573,4	573,4	573,4	641,8	641,8	641,8	710,2
5	Indirect cost depreciation	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
6	**Net revenue**	**8.293,4**	**8.293,4**	**8.293,4**	**9.593,7**	**9.593,7**	**9.593,7**	**10.894,0**	**10.894,0**	**10.894,0**	**12.194,3**	**12.194,3**	**12.194,3**	**13.494,6**
B	PRODUCTION COST													
	Production cost	**4.113,4**	**4.195,7**	**4.279,6**	**4.365,2**	**4.452,5**	**4.541,5**	**4.632,4**	**4.725,0**	**4.819,5**	**4.915,9**	**5.014,2**	**5.114,5**	**5.216,8**
C	PROFIT													
1	Income before tax	4.180,0	4.097,7	4.013,8	5.228,5	5.141,2	5.052,2	6.261,6	6.169,0	6.074,5	7.278,4	7.180,1	7.079,8	8.277,8
2	Enterprise tax	1.170,4	1.147,4	1.123,9	1.464,0	1.439,5	1.414,6	1.753,3	1.727,3	1.700,9	2.038,0	2.010,4	1.982,3	2.317,8
3	Net profit	3.009,6	2.950,3	2.889,9	3.764,5	3.701,7	3.637,6	4.508,4	4.441,7	4.373,6	5.240,5	5.169,7	5.097,5	5.960,0
D	OPERATING COST													
	Production cost and enterprise income tax	5.283,8	5.343,0	5.403,5	5.829,2	5.892,0	5.956,2	6.385,6	6.452,3	6.520,4	6.953,9	7.024,7	7.096,9	7.534,6
	Direct cost depreciation	862,8	862,8	862,8	862,8	862,8	862,8	862,8	862,8	280,6	280,6	280,6	280,6	280,6
	Total economic operation cost	**6.146,6**	**6.205,8**	**6.266,3**	**6.692,0**	**6.754,8**	**6.819,0**	**7.248,4**	**7.315,1**	**6.801,0**	**7.234,5**	**7.305,3**	**7.377,5**	**7.815,2**

ECONOMIC INDICATOR

Unit: Million VND

NO	Items	Total	2014-2015	Operation period											
				2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
A	Cost and benefit														
I	**Annual profit**														
1	Net revenue	200.532,33		3.452,14	3.452,14	3.452,14	4.752,46	4.752,46	4.752,46	6.052,77	6.052,77	6.052,77	7.353,08	6.993,08	6.993,08
2	Labor wage			528,81	539,39	550,17	561,18	572,40	583,85	595,53	607,44	619,59	631,98	644,62	657,51
3	Tax			221,19	203,03	184,50	598,13	578,86	559,19	971,67	951,21	930,35	1.341,59	1.219,00	1.196,95
	Depreciation			1.564,30	1.564,30	1.564,30	1.564,30	1.564,30	1.564,30	1.564,30	1.564,30	1.564,30	1.564,30	862,80	862,80
4	Consumption surplus	98.738,25		488,21	535,80	587,98	902,96	991,63	1.087,93	1.534,30	1.683,11	1.864,00	2.417,23	2.569,09	2.730,38
5	Total annual benefits	299.270,58		**6.254,66**	**6.294,66**	**6.339,10**	**8.379,02**	**8.459,65**	**8.547,73**	**10.718,56**	**10.858,83**	**11.031,01**	**13.308,18**	**12.288,67**	**12.440,71**
II	**Annual cost**														
1	Operation cost			4.866,15	4.912,86	4.960,50	5.373,17	5.422,74	5.473,29	5.888,95	5.941,54	5.995,19	6.414,00	5.667,52	5.724,45
2	Investment cost		29.274,00												
3	Total cost			**4.866,15**	**4.912,86**	**4.960,50**	**5.373,17**	**5.422,74**	**5.473,29**	**5.888,95**	**5.941,54**	**5.995,19**	**6.414,00**	**5.667,52**	**5.724,45**
III	Net value (NV)		**-29.274,00**	**1.388,51**	**1.381,81**	**1.378,61**	**3.005,85**	**3.036,91**	**3.074,44**	**4.829,61**	**4.917,29**	**5.035,81**	**6.894,18**	**6.621,15**	**6.716,26**
B	Economic indicators														
1	Discount factor		12,0%	0,89	0,80	0,71	0,64	0,57	0,51	0,45	0,40	0,40	0,32	0,29	0,26
2	Original capital cost	29.274,00	29.274,00												
3	Annual present benefit	85.212	0	5.584,52	5.018,07	4.512,05	5.325,02	4.800,23	4.330,55	4.848,53	4.385,70	4.455,24	4.284,88	3.532,70	3.193,22
4	Annual present cost	74.077	29.274,00	4.344,78	3.916,50	3.530,78	3.414,75	3.077,01	2.772,94	2.663,86	2.399,69	2.421,36	2.065,14	1.620,28	1.469,32
5	**NPV**	**11.135**	**-29.274,00**	1.239,74	1.101,57	981,27	1.910,27	1.723,22	1.557,61	2.184,67	1.986,01	2.033,88	2.219,74	1.903,42	1.723,90
6	**Benefit Cost Rate (BCR)**	**1,15**													
7	**EIRR**	**14,98%**													

STT	Items	Total	2014-2015	Operation period											
				2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
A	Cost and benefit															
i	**Annual profit**															
1	Net revenue			8.293,39	8.293,39	8.293,39	9.593,71	9.593,71	9.593,71	10.894,02	10.894,02	10.894,02	12.194,33	12.194,33	12.194,33	13.494,64
	Labor wage			670,66	684,07	697,75	711,71	725,94	740,46	755,27	770,38	785,78	801,50	817,53	833,88	850,56
	Tax			1.606,89	1.583,85	1.560,36	1.968,91	1.941,17	1.919,54	2.326,63	2.300,69	2.274,23	2.679,76	2.652,23	2.624,15	3.028,04
	Depreciation			862,80	862,80	862,80	862,80	862,80	862,80	862,80	862,80	280,60	280,60	280,60	280,60	280,60
2	Consumption surplus			3.441,87	3.651,04	3.872,71	4.730,21	5.016,73	5.320,28	6.454,41	6.705,29	6.971,67	8.076,64	8.391,63	8.717,51	9.093,26
3	Total annual benefits			**14.875,61**	**15.075,16**	**15.287,01**	**17.867,34**	**18.143,65**	**18.436,79**	**21.293,13**	**21.536,14**	**21.205,70**	**24.032,84**	**24.336,33**	**24.650,47**	**27.647,10**
II	**Annual cost**															
1	Operation cost			6.146,61	6.205,85	6.266,26	6.691,98	6.754,84	6.818,95	7.248,44	7.315,14	6.800,99	7.234,47	7.305,26	7.377,47	7.815,20
2	Investment cost															
3	Total cost			**6.146,61**	**6.205,85**	**6.266,26**	**6.691,98**	**6.754,84**	**6.818,95**	**7.248,44**	**7.315,14**	**6.800,99**	**7.234,47**	**7.305,26**	**7.377,47**	**7.815,20**
III	Net value (NV)			**8.728,99**	**8.869,31**	**9.020,75**	**11.175,36**	**11.388,81**	**11.617,83**	**14.044,69**	**14.221,00**	**14.404,72**	**16.798,36**	**17.031,07**	**17.273,01**	**19.831,89**
B	Economic indicators															
1	Discount factor			0,23	0,20	0,18	0,16	0,15	0,13	0,12	0,10	0,09	0,08	0,07	0,07	0,06
2	Initial capacity cost															
3	Annual present benefit			3.403,10	3.084,68	2.792,88	2.914,55	2.642,52	2.397,51	2.472,28	2.232,58	1.962,73	1.986,13	1.795,53	1.624,03	1.626,23
4	Annual present cost			1.998,65	1.269,84	1.141,82	1.091,61	983,80	886,73	841,50	758,34	629,56	597,88	539,63	486,94	459,72
5	**NPV**			2.000,46	1.814,84	1.648,06	1.822,94	1.658,72	1.510,78	1.630,98	1.474,24	1.333,23	1.388,26	1.256,00	1.137,08	1.166,58
6	**Benefit Cost Rate (BCR)**															
7	**EIRR**															

BENEFITS OF STAKEHOLDERS

Unit: 1000 VND

NO	Items	Government	Project Owner	Beneficiaries	Total
I	**Benefits**				
	Revenue		200.532		200.532
	Surplus consumption tax			98.738	98.738
	Import tax				-
	VAT	10.365			10.365
	Income tax	27.061			27.061
	Land tax				-
	Total	***37.425***	***200.532***	***98.738***	***336.696***
II	**Cost**				
	Investment cost	-	29.274		29.274
	Production cost		156.622		156.622
	Total	***-***	***185.896***	***-***	***185.896***
III	**Net profit**	**37.425**	**14.636**	**98.738**	**150.800**
	Rate (%)	**24,8%**	**9,7%**	**65%**	**100,0%**

Appendix D: Attached equipment quotation.