

## 17.2 Economic Study

This section shows a evaluation of the anticipated economic benefits to be derived from the project and economic cost.

Evaluation is concentrated mainly on such benefits, among others, as public health, improvement of living environment and economic contribution to the community. Regarding the economic evaluation of the project, a most preferable approach may be quantification of the economic benefits and costs. But in many cases, there are many unquantifiable factors in the infrastructure development project, such as this water supply project; however, in this study, quantifiable benefits and cost is counted for analysis as much as possible. And intangible factors are also considered.

The first step in the economic analysis is to adjust financial prices to economic values by eliminating direct transfer payments. Direct transfer payments are payments that represent not the use of real sources but only the transfer of claims to real resources from one party in the same economic society to another. In this projects, the most large transfer payments are direct government subsidies and credit transactions that include loans, receipts, repayments of principal and interest payments. All these entries should be taken out before the financial accounts are adjusted to reflect economic values.

### 17.2.1 Economic Benefits of the Project

The main economic benefit which will be brought about by the implementation of the project as proposed in this study are summarized as follows.

#### Direct Benefits :

- Increase in the area and population to be served
- Continuous supply of safe water

#### Indirect Benefits :

- Increase of employment opportunity
- Improvement of health condition
- Increase in consumer satisfaction
- Increase in land values
- Increase in income in some productive sectors

### 1) Beneficial Value of Water

It is assumed that all residents in the served area would be willing to obtain water in sufficient quantities at a given price. In general, public charges such as water tariff are established lower than real its value by political reason. Taking the benefits for "consumer's satisfaction" into consideration, it is assumed that the economic value of water is 20 percent

higher than the average rate per volume of water used in the financial analysis.

According to the result of questionnaire survey in Patum Thani area, 24.4 percent of residents are willing to pay for water charge in the up-to-50 Baht bracket, 32.6 percent in the 51-100 Baht bracket and 12.8 percent in the 101-200 Baht bracket. The remaining 30.2 percent didn't give clear answer. In Prachatipat, 60.2 percent of residents are willing to pay in the up-to-200 Baht bracket and 13.7 percent in the 201-500 Baht bracket. Respondents, who didn't use the water supply system of PWA or municipal, wanted the water charge less than 200 Baht.

In the meantime, it clears from water sales forecasting that average monthly water charge per connection for domestic is 143.34 Baht at 2011. This figure shows that water charge is about two percent of average monthly income of respondent, in 1988. If this water charge increase by 20 percent, monthly water charge of 172 Baht is considered within the willingness-to-pay of consumers.

Table 17-2-1 shows economic water value of the project.

Table 17-2-1 Economic Water Value

Unit: Baht x 1000

Year	Domestic	Governmental	Commercial	Industrial	Others	Total
1990	10,656	5,717	3,931	0	1,181	21,485
1991	11,794	6,293	4,363	0	1,296	23,746
1992	13,723	7,546	5,184	0	1,498	27,950
1993	16,157	8,827	6,019	0	1,757	32,760
1994	19,152	10,094	6,854	0	2,059	38,160
1995	23,256	36,936	9,259	107,971	2,592	180,014
1996	28,166	39,442	10,166	128,232	3,067	209,074
1997	32,674	41,875	11,160	141,782	3,470	230,962
1998	37,829	44,280	12,168	156,096	3,917	254,290
1999	43,646	46,728	13,162	181,901	4,421	289,858
2000	50,371	49,234	14,155	200,002	4,997	318,758
2001	57,946	51,768	15,163	214,934	5,659	345,470
2002	64,094	53,539	15,595	231,394	6,134	370,757
2003	70,661	55,296	16,042	247,853	6,653	396,504
2004	77,616	57,053	16,042	264,298	7,186	422,194
2005	85,003	58,838	16,920	279,000	7,762	447,523
2006	92,779	60,581	17,352	282,686	8,366	461,765
2007	103,622	62,366	17,798	286,358	9,158	479,304
2008	115,229	64,109	18,230	290,059	10,022	497,650
2009	127,152	65,880	18,662	293,746	10,944	516,384
2010	141,091	67,651	19,109	297,432	11,923	537,206
2011	155,333	69,408	19,555	301,118	12,960	558,374
2012	155,333	69,408	19,555	301,118	12,960	558,374
2013	155,333	69,408	19,555	301,118	12,960	558,374
2014	155,333	69,408	19,555	301,118	12,960	558,374
2015	155,333	69,408	19,555	301,118	12,960	558,374
2016	155,333	69,408	19,555	301,118	12,960	558,374
2017	155,333	69,408	19,555	301,118	12,960	558,374
2018	155,333	69,408	19,555	301,118	12,960	558,374
2019	155,333	69,408	19,555	301,118	12,960	558,374
2020	155,333	69,408	19,555	301,118	12,960	558,374

## 2) Benefit Pertinent to Health

Benefit pertaining to health which is the one of the purposes of installing a water supply system, involves both the community concerned and the individuals in the area. The anticipated benefits concerning health, viewed from public and individual standpoints, are detailed in the following.

### (1) Benefits from Public Health Standpoint

Health benefit to accrue to the community from the water supply system has two aspects, namely, 1) the preventive effect brought forth by the water supply system reduces the burden on the local and central governments for the disease preventive activities and patient treatment facilities, and 2) the elimination of opportunities of contact with infected matters reduces epidemic cases on the part of the individuals.

Regarding the first item above, Budgetary and physical provisions of the governments will be lightened with respect to chemical disinfection for prevention of epidemics, hospitals together with necessary personnel and equipment and materials. Regarding the second items, details will be presented in the next subsection.

### (2) Individual Health Benefits

The provision of the proposed water supply system results in health benefits to the individual people in the service area, such as reduction in the risk and incidence of water borne diseases, consequent elongation of life span, reduced expenditure on medical care, reduction in income loss through absence from work, and others.

Table 17-2-2 shows age-cause-specific distribution of patients and Medical Cost per capita in 1981.

Table 17-2-2 Age-Cause-Specific Distribution & Medical Cost Per Capita

Age	Type of Disease					Total
	Infective	Digestive	Respiratory	Delivery and Obstetric	Others	
0	0.114	0.017	0.135	0.276	0.458	1.0
1-4	0.045	0.016	0.181	0.0	0.758	1.0
5-14	0.010	0.061	0.066	0.001	0.862	1.0
15-24	0.001	0.010	0.002	0.044	0.933	1.0
25-44	0.001	0.020	0.004	0.034	0.941	1.0
45-64	0.005	0.040	0.027	0.0002	0.928	1.0
65+	0.001	0.034	0.044	0.0	0.011	1.0
Outpatient cost/patient	74.33	101.83	66.88	66.23	78.04	
Inpatient cost/patient	1,424.90	1,464.66	684.27	552.02	1,417.46	

Source: HOMES RESEARCH REPORT by Faculty of Economics, Thammasat University, National Economic and Social Development Board, and Asian Development Bank.

According to historical consumer price increase, it is estimated that outpatient cost per patient is 100 Baht and inpatient cost per patient is 2,000 Baht regarding Infective in 1989.

The following assumptions are made to calculate the saving of medical care cost by the installation of the water supply system .

- a. The average number of water-borne disease occurred per 1,000 persons is to be 1.13 in the Study Area on the basis of the recorded incidences rate in the year 1986, which described in SECTION 1.2.4.
- b. About 50 percent of the above cases is attributable to the in-provision of the adequate water supply system.
- c. Hospitalization for treating these cases is on the average for two weeks, and amounts spent for medical care is about 300 Baht per day per patient.
- d. About 30 percent of the population is actually economically active. The final figure for the cost of time lost due to illness was derived by taking the economically active portion of those afflicted by water-borne diseases by minimum daily salary of 73 Baht and 15 days based on the assumption that workers earning 73 Baht per day (73 Baht is the minimum salary rate of a laborer in Patum Thani Province) are unable to work for an average of 15 day described in the above clause.

The cost of the medical expenses was derived by multiplying the morbidity rate by the served population and the average expenditure for medical expenses of 300 Baht.

The sum of the two economic costs related to health benefits was adjusted by 50 percent to account for the fact that not all water-borne diseases are caused by a poor water supply system but may also be due to poor personal hygiene or lack of sewerage facilities.

The economic values derived from health benefits is shown in Table 17-2-3.

These benefits are more quantifiable in due assumptions which are based on various available data. Hence, an estimate of such benefit in the monetary terms was exhausted possible means.

### 3) Contribution to Local Economy

The construction of the water supply system contributes substantially to the local economy in several ways.

In the first place, land value in the area will be appreciated, and in accordance with such an increase in land value, related properties will also rise in value. On the other hand, the construction of the system furnishes employment opportunities to the local people and purchases local products of materials and equipment. Some of the above benefits are quantifiable while others are not.

#### (1) Value Added to Land

Investment in water supply facilities, and also in other public utilities such as sewerage, electricity and road improvement, have the effect of raising the intrinsic value of the parcels of land served by those facilities. The value added per unit of land tends to equal or exceed pro rate share of the investment involved.

In the present project area, this benefit is considered especially significant. The value of the benefit will be measured by the additional prices buyers are willing to pay for properties on which physical improvements have been made. It is because the buyers appreciate the possible intensive use of land, not to mention the improved quality of amenity in the area.

The projected land values over the entire Study Area are shown in Table 17-2-4. The projected land values are estimated by assuming a conservative increase rate of 50 percent up to the year 2011 which is seven years after completion of the project construction. On the basis of proportionate shares of estimated infrastructure investments in public utilities about five percent of total increase in land values have been attributed to the availability of water supply system.

Table 17-2-3 Health Benefits

Unit: Baht x 1000

Year	Served Population	Cost of Time Loss (A)	Medical Expenses (B)	Total Economic Loss	Reduction Due to Project
1990	40,415	15.0	205.5	220.5	110
1991	43,659	16.2	222.0	238.2	119
1992	49,648	18.4	252.5	270.9	135
1993	57,685	21.4	293.3	314.7	157
1994	67,772	25.2	344.6	369.8	185
1995	82,527	30.6	419.6	450.3	225
1996	99,556	37.0	506.2	543.2	272
1997	112,454	41.7	571.8	613.6	307
1998	126,913	47.1	645.4	692.5	346
1999	142,933	53.1	726.8	779.9	390
2000	161,263	59.9	820.0	879.9	440
2001	181,529	67.4	923.1	990.5	495
2002	197,205	73.2	1,002.8	1,076.0	538
2003	213,460	79.2	1,085.4	1,164.7	582
2004	230,293	85.5	1,171.0	1,256.5	628
2005	247,704	91.9	1,259.6	1,351.5	676
2006	265,693	98.6	1,351.0	1,449.7	725
2007	286,452	106.3	1,456.6	1,562.9	781
2008	307,889	114.3	1,565.6	1,679.9	840
2009	330,005	122.5	1,678.1	1,800.6	900
2010	352,798	131.0	1,794.0	1,924.9	962
2011	376,270	139.7	1,913.3	2,053.0	1,027
2012	376,270	139.7	1,913.3	2,053.0	1,027
2013	376,270	139.7	1,913.3	2,053.0	1,027
2014	376,270	139.7	1,913.3	2,053.0	1,027
2015	376,270	139.7	1,913.3	2,053.0	1,027
2016	376,270	139.7	1,913.3	2,053.0	1,027
2017	376,270	139.7	1,913.3	2,053.0	1,027
2018	376,270	139.7	1,913.3	2,053.0	1,027
2019	376,270	139.7	1,913.3	2,053.0	1,027
2020	376,270	139.7	1,913.3	2,053.0	1,027

NOTE : (A)  $30 \% \times 1.13/1000 \times \text{S.P.} \times 73 \text{ Baht} \times 15 \text{ Days}$   
 (B)  $1.13/1000 \times \text{S.P.} \times 300 \text{ Baht} \times 15 \text{ Days}$

Table 17-2-4 Estimated Land Value in the Study Area

Year 2004			
Zone	Area (sq. km)	Value per m <sup>3</sup> (Baht)	Total Value (Million Baht)
1.	22.8	6,250	142,500
2.	68.1	6,250	425,625
3.	53.5	6,250	334,375
4.	56.9	6,250	355,625
5.	23.3	6,250	145,625
6.	46.8	6,250	292,500
7.	45.0	6,250	281,250
8.	28.3	6,250	176,875
<b>Total</b>	<b>344.7</b>		<b>2,154,375</b>

Year 2001			
Zone	Area (sq. km)	Value per m <sup>3</sup> (Baht)	Total Value (Million Baht)
1.	22.8	9,500	126,600
2.	68.1	9,500	646,950
3.	53.5	9,500	508,250
4.	56.9	9,500	540,550
5.	23.3	9,500	221,350
6.	46.8	9,500	444,600
7.	45.0	9,500	427,500
8.	28.3	9,500	268,850
<b>Total</b>	<b>344.7</b>		<b>3,274,650</b>

(2) Intensified Land Use

When water supply systems become available, coupled with other public utilities in general, the land in the area can be more intensively used, as the present project is implemented. More people can be supported and more activities in industry, commerce and others can be conducted in the project area. This project will, therefore contribute to this area which is expected to develop the important economic area of Thailand, but can't be immediately quantifiable its economic benefits.

(3) Public Revenue

Public tax revenue to the local and central government will be increased in two ways.

First, the appreciated land value will produce an increase in land tax revenue. On the other hand, buildings, such as for commerce, dwelling and others, will be graded up in quality and quantity, thus making possible an increase in property tax. This benefit cannot necessarily



be quantified, but it can stitutes an important reliable tax source for the governments concerned.

(4) Employment and Local Products

During the construction period, the local economy will benefit through the employment of individuals for construction work and through the purchase of locally made materials and supplies. The amount of investment for the project is sizable. The project after completion will also provide permanent employment opportunities for the operation and maintenance of water supply systems.

These economic benefit of production for employment opportunity should be counted in economic cost analysis by using the shadow pricing factor.

Some of the economic benefits, presently regarded as unquantifiable, may become quantifiable in the future when scientific tools useful for such evaluation are devised. Even at this stage where those benefits cannot be measured in the monetary terms, the benefits justify, it is judged, the proposed investment in the present water supply project. And further, the evaluation justifies that the investment is to be made from the fund sources of public and private beneficiaries, namely, the central, local province governments and PWA and the people in the area involved.

Summary of Economic Benefit is shown in Table 17-2-5.

Table 17-2-5 Summary of Economic Benefits

( Unit: Baht x 1000)

Year	Economic Water Value	Health Benefits Cost of Time Loss	Medical Expenses	Total Economic Loss	Total Economic Benefit
1990	21,485	15	206	110	21,595
1991	23,746	16	222	119	23,865
1992	27,950	18	253	135	28,085
1993	32,760	21	293	157	32,917
1994	38,160	25	345	185	38,345
1995	180,014	31	420	225	180,239
1996	209,074	37	506	272	209,346
1997	230,962	42	572	307	231,269
1998	254,290	47	645	346	254,636
1999	289,858	53	727	390	290,248
2000	318,758	60	820	440	319,198
2001	345,470	67	923	495	345,965
2002	370,757	73	1,003	538	371,295
2003	396,504	79	1,085	582	397,086
2004	422,194	86	1,171	628	422,822
2005	447,523	92	1,260	676	448,199
2006	461,765	99	1,351	725	462,490
2007	479,304	106	1,457	781	480,085
2008	497,650	114	1,566	840	498,490
2009	516,384	123	1,678	900	517,284
2010	537,206	131	1,794	963	538,169
2011	558,374	140	1,913	1,027	559,401
2012	558,374	140	1,913	1,027	559,401
2013	558,374	140	1,913	1,027	559,401
2014	558,374	140	1,913	1,027	559,401
2015	558,374	140	1,913	1,027	559,401
2016	558,374	140	1,913	1,027	559,401
2017	558,374	140	1,913	1,027	559,401
2018	558,374	140	1,913	1,027	559,401
2019	558,374	140	1,913	1,027	559,401
2020	558,374	140	1,913	1,027	559,401

### 17.2.2 Economic Costs of the Project

The direct costs of the project should be transformed into economic costs. For this purpose, the project cost and operating and maintenance costs are considered in the study. These costs will be covered into the economic cost using factors of shadow pricing.

The financial project costs explained in Sub-section 12.1 was converted into economic costs by the following modification.

- 1) Import duties and domestic taxes are assumed to be 10 percent for foreign portion and five percent for the local portion of the project cost.
- 2) Shadow exchange rate factor of 1.00 was applied to the foreign currency component. A shadow pricing factor of 0.95 was applied to the local currency component. A premium factor of 0.5 was applied to unskilled labor portion, which is estimated about 10 percent of local currency portion of project cost. On the other 1.0 premium factor was applied to skilled labor portion.

Table 17-2-6 Shows Economic Project Cost.

Table 17-2-6 Economic Project Cost

(Unit : Baht x 1000)

Year	Financial Project Cost			Tax			Economic Project Cost		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
Total	1,385,231	906,402	2,291,633	138,524	45,321	183,845	1,246,707	786,845	2,033,552
1990	0	177,000	177,000	0	8,850	8,850	0	159,743	159,743
1991	0	0	0	0	0	0	0	0	0
1992	27,987	15,638	43,625	2,799	782	3,581	25,188	13,445	38,633
1993	113,223	46,296	159,519	11,322	2,315	13,637	101,901	39,803	141,704
1994	518,257	256,114	774,371	51,826	12,806	64,632	466,431	220,194	686,625
1995	440,446	232,435	672,881	44,045	11,622	55,667	396,401	199,836	596,237
1996	0	0	0	0	0	0	0	0	0
1997	5,597	3,128	8,725	560	156	716	5,037	2,690	7,727
1998	124,631	81,354	205,985	12,463	4,068	16,531	112,168	69,944	182,112
1999	155,090	94,437	249,527	15,509	4,722	20,231	139,581	81,192	220,773
2000	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0

### 17.2.3 Economic Internal Rate of Return (EIRR)

EIRR is determined based on economic costs and benefits of the project. Table 17-2-7 shows the computation of the EIRR. The EIRR is calculated to be 9.5 percent. Since this rate exceeds the opportunity cost of capital of nine percent, and a number of unquantifiable benefits will also be conceived from the implementation of the project, the project is considered economically feasible and an undertaking of the project is suggested itself to be proceeded positively.

Benefits of the proposed project have so far been considered from the two viewpoints of health and contribution to the local economy. Some of the benefits were quantified, but most of them were treated as unquantifiable. Therefore, the benefits of the latter category have been elaborated in works. The calculations of the quantifiable benefits show that the monetary values to be gained in the period of 16 years after the completion of the project area equal to 4,780 million Baht, converted to present worth, 75,484 thousand Baht discounted at 9% of capital opportunity cost.

Table 17-2-7 Economic Internal Rate of Return

(Unit : Baht x 1000)

year	Water Value	Total Income	Capital Investment	Operating Expenses	Total Expenses	NET INCOME	Present Value Discounted at	
							(5 %)	(10 %)
1990	0	0	159,743	0	159,743	-159,743	-159,743	-159,743
1991	0	0	0	0	0	0	0	0
1992	0	0	38,633	0	38,633	-38,633	-35,041	-31,928
1993	0	0	141,704	0	141,704	-141,704	-122,409	-106,464
1994	0	0	686,625	0	686,625	-686,625	-564,888	-468,974
1995	141,854	141,854	596,237	51,083	647,320	-505,466	-396,046	-313,855
1996	170,914	170,914	0	61,090	61,090	109,824	81,953	61,993
1997	192,802	192,802	7,727	69,892	77,619	115,183	81,858	59,107
1998	216,130	216,130	182,112	78,301	260,413	-44,283	-29,972	-20,658
1999	251,698	251,698	220,773	91,500	312,273	-60,575	-39,047	-25,690
2000	280,598	280,598	0	102,512	102,512	178,086	109,330	68,660
2001	307,310	307,310	0	113,633	113,633	193,677	113,239	67,883
2002	332,597	332,597	0	121,766	121,766	210,831	117,398	67,177
2003	358,344	358,344	0	133,347	133,347	224,997	119,321	65,174
2004	384,034	384,034	0	144,339	144,339	239,695	121,062	63,119
2005	409,363	409,363	0	156,211	156,211	253,152	121,770	60,602
2006	423,605	423,605	0	165,031	165,031	258,574	118,456	56,273
2007	441,144	441,144	0	175,603	175,603	265,541	115,855	52,536
2008	459,490	459,490	0	185,844	185,844	273,646	113,706	49,218
2009	478,224	478,224	0	196,629	196,629	281,595	111,437	46,043
2010	499,046	499,046	0	208,278	208,278	290,768	109,587	43,221
2011	520,214	520,214	0	220,534	220,534	299,680	107,568	40,496
2012	520,214	520,214	0	220,534	220,534	299,680	102,446	36,814
2013	520,214	520,214	0	220,534	220,534	299,680	97,567	33,468
2014	520,214	520,214	0	220,534	220,534	299,680	92,921	30,425
2015	520,214	520,214	0	220,534	220,534	299,680	88,496	27,659
2016	520,214	520,214	0	220,534	220,534	299,680	84,282	25,145
2017	520,214	520,214	0	220,534	220,534	299,680	80,269	22,859
2018	520,214	520,214	0	220,534	220,534	299,680	76,446	20,781
2019	520,214	520,214	0	220,534	220,534	299,680	72,806	18,892
2020	520,214	520,214	0	220,534	220,534	824,519	190,775	47,252
Salvage					-524,839			
Total Present Value							1,081,400	-62,516

EIRR is 9.5%







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