



USAID
FROM THE AMERICAN PEOPLE



PDAM KABUPATEN SUBANG FEASIBILITY ANALYSIS FOR THE PROPOSED SUBANG WATER RESOURCE AND WATER TRANSMISSION MAIN PROJECT

JULY 2006

This publication was produced by Development Alternatives, Inc. for the United States Agency for International Development under Contract No. 497-M-00-05-00005-00

PDAM KABUPATEN SUBANG FEASIBILITY ANALYSIS FOR THE PROPOSED SUBANG WATER RESOURCE AND WATER TRANSMISSION MAIN PROJECT

Title:	PDAM Kabupaten Subang Feasibility Analysis for the Proposed Subang Water Resource and Water Transmission Main Project
Program, activity, or project number:	Environmental Services Program, DAI Project Number: 5300201.
Strategic objective number:	SO No. 2, Higher Quality Basic Human Services Utilized (BHS).
Sponsoring USAID office and contract number:	USAID/Indonesia, 497-M-00-05-00005-00.
Contractor name:	DAI.
Date of publication:	July 2006

TABLE OF CONTENTS

LIST OF FIGURES	II
LIST OF TABLES.....	III
1. INTRODUCTION	I
2. POPULATION AND WATER DEMAND FORECASTS	I
3. PRELIMINARY ENGINEERING.....	4
4. CAPITAL COST ESTIMATES	5
5. OPERATION AND MAINTENANCE EXPENSES	7
6. ECONOMIC ANALYSES.....	8
7. CONCLUSIONS AND RECOMMENDATIONS	10
APPENDICES	II
APPENDIX A - PHASE I PREFEASIBILITY ANALYSIS FOR THE PROPOSED SUBANG WATER SOURCE AND WATER TRANSMISSION MAIN PROJECT	12
APPENDIX B - POPULATION AND FLOWS	15
APPENDIX C - CONSTRUCTION COSTS.....	17
APPENDIX D - FINANCIAL ANALYSIS	19

LIST OF FIGURES

FIGURE 1 POPULATION FORECAST	3
FIGURE 2 PROJECTED WATER DEMAND	3
FIGURE 3 EPANET COMPUTER SIMULATION	5
FIGURE 4: ANNUAL CASH FLOW	9

LIST OF TABLES

TABLE 1: POPULATION AND WATER DEMAND FORECASTS	2
TABLE 2: ESTIMATED CONSTRUCTION COST (Rp '000)	6
TABLE 3: OPERATION AND MAINTENANCE EXPENSES (Rp '000).....	7
TABLE 4: CASH FLOW SUMMARY (Rp '000).....	8

I. INTRODUCTION

Lembang is a peri-urban area located in the mountains of West Java north of Kota Bandung along the road to Subang. Lembang is developed with primarily residential, commercial, and resort type land usage.

Lembang is within the Perusahaan Daerah Air Minum (PDAM) Tirta Raharja water service area. The PDAM Tirta Raharja is the water utility service provider for Kabupaten Bandung. The Lembang area has a population of roughly 75,000 persons of which fewer than about 15,000 have water service through approximately 2,400 existing connections. The majority of the district relies on sources other than public water supply, such as on-site wells and springs.

The PDAM water sources are capacity limited. There are reportedly an additional 11,500 customers willing to connect if an adequate supply could be developed.

Kabupaten Subang, located approximately 20 km north of Lembang, has undeveloped mountain spring and river water sources. PDAM Tirta Rangga, Kabupaten Subang, is proposing to develop a project to collect spring water and transport it by transmission pipeline and pumping stations to a new distribution storage reservoir serving Lembang.

A Phase I prefeasibility analysis was performed to determine preliminarily if a raw water transmission main from Subang to Lembang appeared to be financially feasible. This prefeasibility analysis (included as Appendix A) indicated that the project was not “fatally flawed” and that a more in-depth analysis was warranted.

2. POPULATION AND WATER DEMAND FORECASTS

PDAM Tirta Raharja has advised that there are presently 2,400 existing connections in the Lembang area. They also advise that there are currently approximately 11,500 more customers waiting to connect.

The Badan Pusat Statistic (BPS) has recommended using an average population growth figure of 1.4% throughout Indonesia. This value has been rounded to 1½% per annum for the purposes of this forecast.

Existing water demand is reported by PDAM Tirta Raharja to be approximately 20 cu m³/month/connection. This translates to individual consumption rate of slightly over 110 liters per capita per day (lcd).

Table I summarizes the population and water demand forecasts for a planning period of 20 years following construction of the project.

Table I Population and Water Demand Forecasts

Year	Connections	Population	Demand (m³/d)	Demand (lps)
2006	2,400	14,400	1,584	18.3
2007	2,436	14,616	1,608	18.6
2008	4,773	28,635	3,150	36.5
2009	7,144	42,865	4,715	54.6
2010	9,551	57,308	6,304	73.0
2011	11,995	71,967	7,918	91.6
2012	14,474	86,847	9,553	111
2013	14,692	88,150	9,696	112
2014	14,912	89,472	9,842	114
2015	15,136	90,814	9,990	116
2016	15,363	92,176	10,139	117
2017	15,593	93,559	10,291	119
2018	15,827	94,962	10,446	121
2019	16,064	96,387	10,603	123
2020	16,305	97,832	10,762	125
2021	16,550	99,300	10,923	126
2022	16,798	100,789	11,087	128
2023	17,050	102,301	11,253	130
2024	17,306	103,836	11,422	132
2025	17,556	105,393	11,593	134
2026	17,829	106,974	11,767	136
2027	18,096	108,579	11,994	138

PDAM KABUPATEN SUBANG : FEASIBILITY ANALYSIS FOR THE PROPOSED SUBANG WATER RESOURCE AND WATER TRANSMISSION MAIN PROJECT

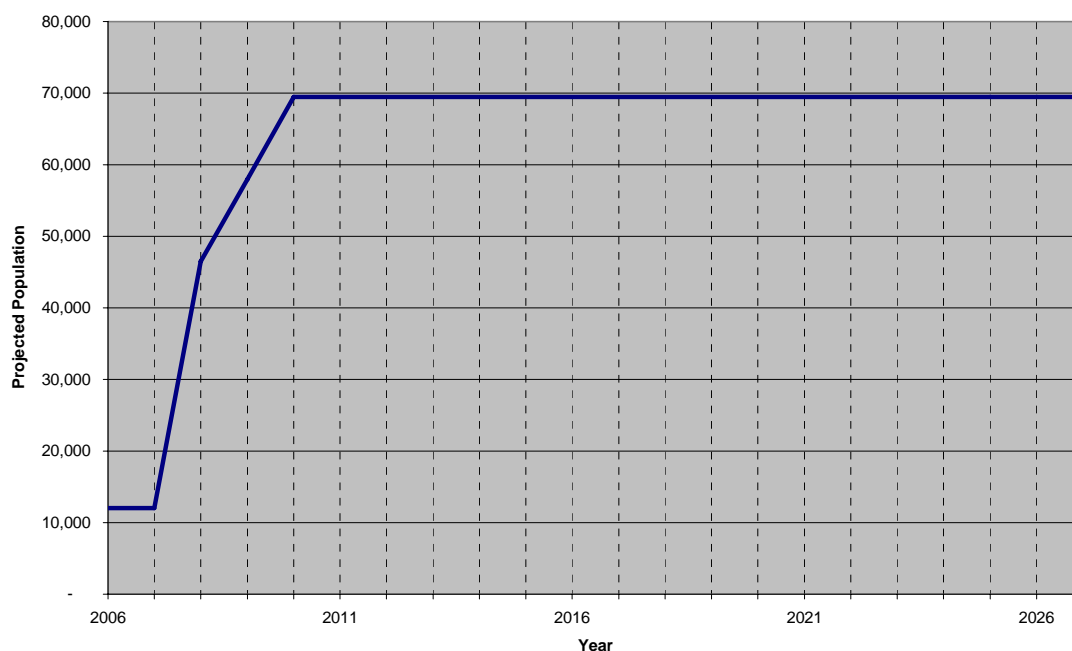


Figure 1 Population Forecast

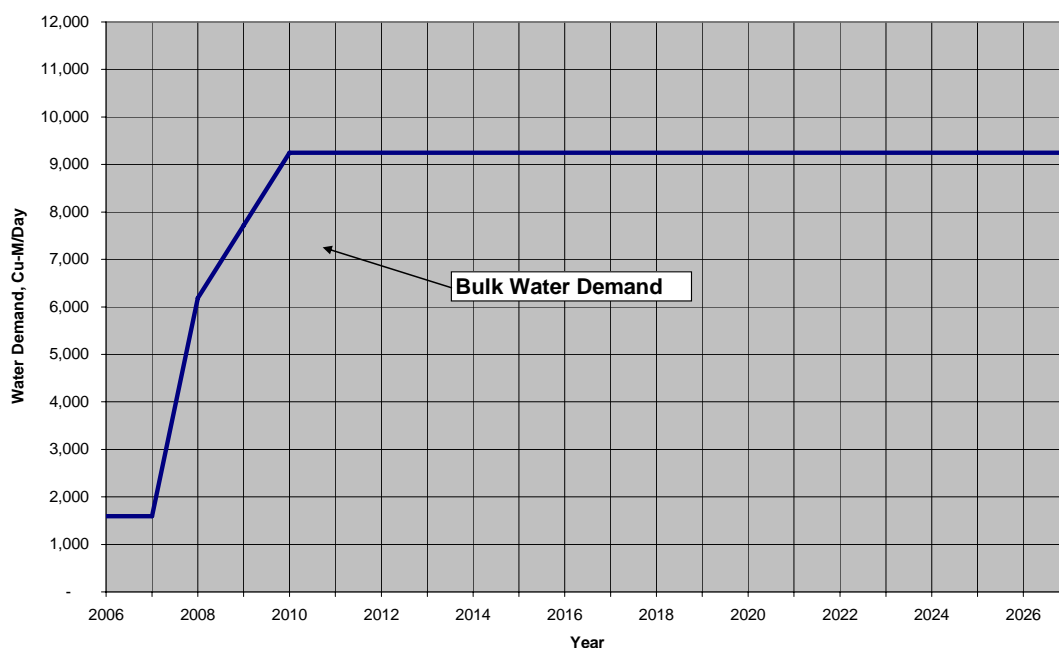


Figure 2 Projected Water Demand

The Subang water supply and raw water transmission main design is based on a demand of 3150 m³/d (36.5 lps) in the first year of operation. This demand is projected to increase nonlinearly to 12,000 m³/d (138 lps) in the twentieth year of operation (2027).

The pipeline, however, will have a useful substantially greater than the planning period. Pipelines can be typically expected to last 40-50 years with only routine maintenance. Demand projections that far into the future, however, are much less certain than the physical asset life. Selection of the ultimate capacity must, therefore, be tempered with large doses of judgment and guesswork.

3. PRELIMINARY ENGINEERING

There are three possible water sources located on a large private tea plantation in Subang. These are:

1. Mukanegara Spring with a capacity up to 300 lps
2. Cipunegara River with a capacity up to 300 lps, and
3. Rentang Dam with a capacity up to 1,000 lps.

The proposed intake system includes spring boxes and river intake structures, interconnecting pipelines and isolation valves, and source water metering systems. The conceptual transmission main system comprises 9 km of high density polyethylene (HDPE) from the source elevation of approximately 1230 meters above sea level (ASL) to a water booster pumping station at elevation 1180 meter ASL.

The water booster station would pump 2 km through a HDPE force main up to a hydraulic balancing structure at approximately 1330 meters ASL. The raw water would then flow by gravity approximately 11 km to a 1500 cubic meter distribution reservoir at elevation 1220 meter ASL.

The hydraulics of the transmission pipeline and appurtenances such as the booster pumping station, balancing tank, etc. were simulated using the water network computer program EPANET 2 developed by the United States Environmental Protection Agency (EPA). Multiple system capacity configurations were modeled as indicated below:

1. 100 lps capacity with 400 mm pipeline on either side of the booster pumping station at the low point and 300 mm pipeline from the balancing tank at the high point to the storage reservoir at Lembang.
2. 200 lps capacity with 400 mm pipeline on either side of the booster pumping station at the low point and 300 mm pipeline from the balancing tank at the high point to the storage reservoir at Lembang.
3. 200 lps capacity with 500 mm pipeline on either side of the booster pumping station at the low point and 400 mm pipeline from the balancing tank at the high point to the storage reservoir at Lembang.
4. 120 lps capacity with 500 mm pipeline on either side of the booster pumping station at the low point and 400 mm pipeline from the balancing tank at the high point to the storage reservoir at Lembang.
5. 180 lps capacity with 500 mm pipeline on either side of the booster pumping station at the low point and 400 mm pipeline from the balancing tank at the high point to the storage reservoir at Lembang.

After reviewing the various scenarios, it was decided to base the preliminary engineering design and construction cost estimates on a 500 mm & 400 mm pipeline with an initial capacity of 120 lps and an ultimate capacity of 180 lps. The 120 lps capacity corresponds to approximately one-half of the planning period and the 180 lps capacity is 30% more than the projected 20 year demand.

Figure 3 is the network diagram for this computer simulation. A four pump water booster pumping station was chosen with three pumps installed initially to provide 120 lps capacity with one pump out of service. This station could be upgraded in the future through the addition of a fourth pump (three duty and one standby) bringing the firm capacity to 180 lps.

The transmission main is 500 mm on the suction and discharge side of the booster pumping station in order to limit the required pumping energy to manageable levels. A 400 mm pipeline from the balancing tank to the storage reservoir is adequate because of the available head.

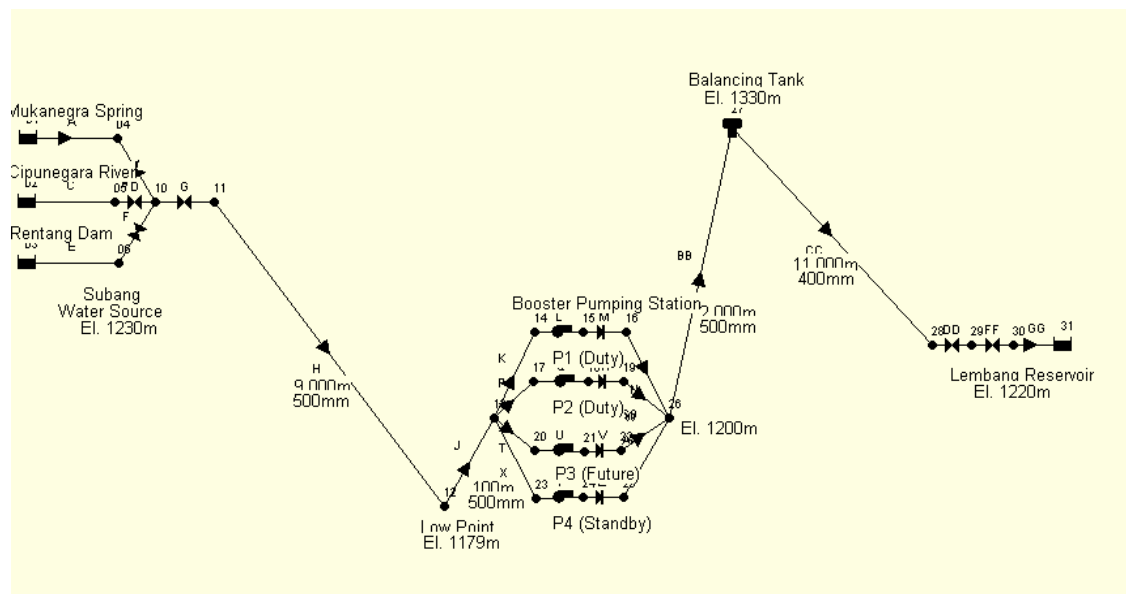


Figure 3 EPANET Computer Simulation

4. CAPITAL COST ESTIMATES

Construction costs and other capital costs for development of the project were estimated based on the preliminary engineering design in the previous section. The most significant cost components are the transmission pipelines, which were estimated based on quotes from manufacturers and installation allowances based on a percentage of suppliers quotes.

Table 2 summarizes the construction cost estimating exercise.

PDAM KABUPATEN SUBANG : FEASIBILITY ANALYSIS FOR THE PROPOSED SUBANG WATER RESOURCE AND WATER TRANSMISSION MAIN PROJECT

Table 2: Estimated Construction Cost (Rp '000)

Item Description	Dimensions	Capacity	Units	Quantity	Unit Price	Estimated Cost
Intake structures	400 mm	100-300 lps	LS	3	300,000	900,000
Transmission Main (Subang to Booster PS)	500mm	120 lps & 180 lps	LM	9,000	795,000	7,155,000
Water Booster Pumping Station	6m x 13m	120 lps	LS	1	2,000,000	2,000,000
Standby Generator	3m x 6m	500 kW	LS	1	1,000,000	1,000,000
Sitework and Access Road	1 ha		LS	1	500,000	500,000
Transmission Main (Booster PS to Balancing Tank)	500mm	120 lps & 180 lps	LM	2,000	795,000	1,590,000
Balancing Standpipe	3m x 10m	200 cu m	LS	1	400,000	400,000
Transmission Main (Balancing Tank to Lembang)	400mm	120 lps & 180 lps	LM	11,000	636,000	6,996,000
Lembang Storage Reservoir		1500 cu m				
Electrical Power Extensions			LS	1	1,000,000	1,000,000
Surge Relief Devices			LS	3	30,000	90,000
Construction Cost Subtotal						21,731,000
Estimating Contingencies (15%)						3,260,000
Construction Cost Total						24,991,000
Engineering & Surveying (5%)						1,250,000
Administrative & Legal (1%)						250,000
Overhead & Profit (15%)						3,749,000
Total Capital Cost						30,239,000

5. OPERATION AND MAINTENANCE EXPENSES

The principal operation and maintenance expenses associated with the raw water transmission main are the energy (electricity and fuel oil), staff wages, and annual costs for replacement and repair of pipeline and equipment. Electricity costs over a twenty year BOT planning period were estimated based on preliminary design of a water booster pumping station with two 60 lps duty pumps operating against a total dynamic head of approximately 110 meters. Each of these pumps would be fitted with a 100 kW electric meter. Electrical energy costs start at the current rate of 587 Rupiah per kilowatt-hour (kWh) and are assumed to increase at a rate of 3% per year greater than the average inflation rate.

Fuel oil is consumed for the operation and periodic exercising of the emergency generator. Staff wages are based on a full time operation and maintenance staff of 1 foreman and three skilled laborers. Maintenance and repair expenses for the pipeline, pumping station, and other appurtenances are assumed at the annual rate of 1% of the initial construction cost. Supplies were assumed to be 50,000,000 Rupiah per year. Table 3 summarizes the estimated operation and maintenance expenses.

Table 3: Operation and Maintenance Expenses (Rp '000)

Year	Electricity	Fuel Oil	Labor	Maintenance & Repair	Supplies	Total ('Rp 000)
2006	0	0	0	0		0
2007	0	0	0	0		0
2008	345,416	50,000	144,000	302,387	50,000	891,803
2009	532,573	50,000	144,000	302,387	50,000	1,078,960
2010	733,380	50,000	144,000	302,387	50,000	1,279,767
2011	948,612	50,000	144,000	302,387	50,000	1,494,999
2012	1,179,084	50,000	144,000	302,387	50,000	1,725,471
2013	1,232,673	50,000	144,000	302,387	50,000	1,779,060
2014	1,288,698	50,000	144,000	302,387	50,000	1,835,085
2015	1,347,269	50,000	144,000	302,387	50,000	1,893,656
2016	1,408,503	50,000	144,000	302,387	50,000	1,954,890
2017	1,472,519	50,000	144,000	302,387	50,000	2,018,906
2018	1,539,445	50,000	144,000	302,387	50,000	2,085,832
2019	1,609,413	50,000	144,000	302,387	50,000	2,155,800
2020	1,682,561	50,000	144,000	302,387	50,000	2,228,948
2021	1,759,033	50,000	144,000	302,387	50,000	2,305,420
2022	1,838,981	50,000	144,000	302,387	50,000	2,385,368
2023	1,922,563	50,000	144,000	302,387	50,000	2,468,950
2024	2,009,943	50,000	144,000	302,387	50,000	2,556,330
2025	2,101,295	50,000	144,000	302,387	50,000	2,647,682
2026	2,196,799	50,000	144,000	302,387	50,000	2,743,186
2027	2,296,644	50,000	144,000	302,387	50,000	2,843,031

These operation and maintenance expenses and the construction costs estimated earlier are used as inputs to an economic model which predicts the cash flow requirements and investment return for analysis of a build-operate-transfer (BOT) privatization development project.

6. ECONOMIC ANALYSES

Following are investment analysis assumptions used for economic modeling of this project:

1. Investment period = 22 years (two years construction and 20 years operation)
2. Commercial loan period = 10 years
3. Commercial interest rate = 15% per annum (construction interest and long term debt)
4. Debt:Equity Ratio = 70% debt to 30% equity
5. Investor equity post tax return on investment = 20% per annum (minimum)

The resulting economic model is presented in Appendix D. Table 4 summarizes some of the more significant cash flow components.

Table 4: Cash Flow Summary (Rp '000)

Year	Capital Cost	O&M Expense	Principal & Interest	Depreciation	After Tax Profit	Cash Flow
2006	15,119,000	0	2,268,000		0	-5,216,000
2007	15,119,000	0	4,876,000		0	-5,999,000
2008		891,803	5,214,000	1,166,000	-2,810,000	-1,644,000
2009		1,078,960	5,214,000	1,166,000	-1,277,000	-61,000
2010		1,279,767	5,214,000	1,166,000	277,000	1,443,000
2011		1,494,999	5,214,000	1,166,000	1,442,000	2,608,000
2012		1,725,471	5,214,000	1,166,000	2,641,000	3,807,000
2013		1,779,060	5,214,000	1,166,000	2,941,000	4,107,000
2014		1,835,085	5,214,000	1,166,000	3,277,000	4,442,000
2015		1,893,656	5,214,000	1,166,000	3,653,000	4,819,000
2016		1,954,890	5,214,000	1,166,000	4,076,000	5,241,000
2017		2,018,906	5,214,000	1,166,000	4,552,000	5,718,000
2018		2,085,832		1,166,000	5,090,000	6,256,000
2019		2,155,800		1,166,000	5,152,000	6,317,000
2020		2,228,948		1,166,000	5,212,000	6,378,000
2021		2,305,420		1,666,000	5,273,000	6,439,000
2022		2,385,368		1,666,000	5,332,000	6,498,000
2023		2,468,950		1,666,000	5,391,000	6,557,000
2024		2,556,330		1,071,000	5,515,000	6,586,000
2025		2,647,682		1,071,000	5,572,000	6,643,000
2026		2,743,186		1,071,000	5,628,000	6,699,000
2027		2,843,031		1,071,000	5,683,000	6,754,000

The annual cash flow from the BOT project is graphed in Figure 4.

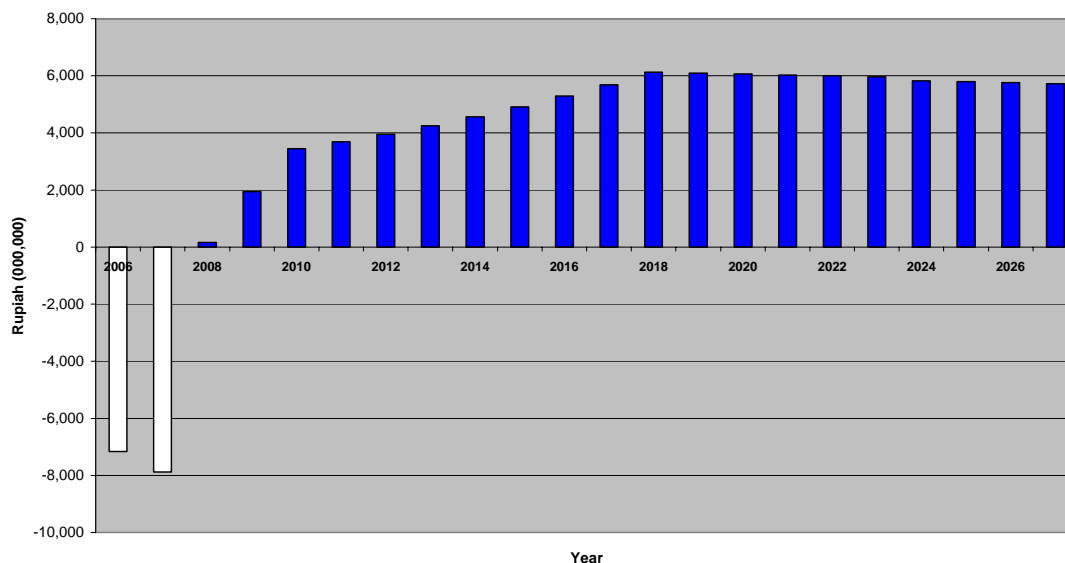


Figure 4 Annual Cash Flow

The entire purpose of this economic analysis is to determine bulk water tariff necessary to support a BOT project based on the above assumptions. The BOT tariff necessary to provide a return on investment of 20% per annum is 2780 Rupiah per cubic meter (Appendix D)

The BOT tariff, however, is not the tariff payable by PDAM Tirta Raharja in Bandung. PDAM Tirta Rangga in Subang is the project developer. PDAM Tirta Rangga will have some staff expenses associated with administrating the project. As the project developer, they are entitled to a small royalty.

It is estimated that a minimum bulk tariff of approximately 2900 Rupiah per cubic meter will be necessary to support this project. This is the **minimum** tariff because most of the assumptions regarding capital costs and operating expenses were very optimistic in order to give the analysis the greatest chance of concluding a positive feasibility. Most of the actual costs will probably be higher than this preliminary estimate, requiring and even higher bulk water tariff.

7. CONCLUSIONS AND RECOMMENDATIONS

The conclusion of this Phase II feasibility analysis is that a minimum bulk water tariff of over 2900 Rupiah per cubic meter would be necessary to support a BOT project. The actual figure is probably significantly more.

The average retail tariff in PDAM Tirta Raharja is approximately 1500 Rupiah per cubic meter. The local DPRD has approved an increase over the next two years to an average of about 2000 Rupiah per cubic meter. Future increases exceeding the inflation rate are highly unlikely.

In the simplest terms, the wholesale cost of water exceeds the retail revenue. The PDAM has no other funding sources to subsidize this project, therefore, development of a raw water transmission main from the Subang source is not feasible.

APPENDICES

APPENDIX A
PHASE I PREFEASIBILITY ANALYSIS FOR THE PROPOSED SUBANG
WATER SOURCE AND WATER TRANSMISSION MAIN PROJECT

APPENDIX B
POPULATION AND FLOWS

APPENDIX C
CONSTRUCTION COSTS

APPENDIX D
FINANCIAL ANALYSIS

APPENDIX A - PHASE I PREFEASIBILITY ANALYSIS FOR THE PROPOSED SUBANG WATER SOURCE AND WATER TRANSMISSION MAIN PROJECT

BACKGROUND

Lembang is a peri-urban area located in the mountains of West Java north of Kota Bandung along the road to Subang with primarily residential, commercial, and resort type development.

Lembang is within the Perusahaan Daerah Air Minum (PDAM) Tirta Raharja water service area. PDAM Tirta Raharja is the water utility service provider for Kabupaten Bandung. The Lembang area has a population of roughly 75,000 persons of which fewer than about 15,000 have water service through approximately 2,400 existing connections. The majority of the district relies on sources other than public water supply. The PDAM water sources are capacity limited. There are reportedly an additional 11,500 customers willing to connect if an adequate supply could be developed.

Kabupaten Subang, located approximately 20 km north of Lembang, has undeveloped mountain spring and river water sources. PDAM Tirta Rangga, Kabupaten Subang, is proposing to develop a project to collect spring water and transport it by transmission pipeline and pumping stations to a new distribution storage reservoir serving Lembang.

PROJECT PROPOSAL

The principal elements of the project proposal are the source intakes, transmission pipeline, booster pumping station(s), hydraulic balancing structures, and the distribution storage reservoir.

There are three intakes on the property of a very large private tea plantation in Subang. These are the Mukanegara Spring (up to 300 l/s), Cipunegara River (up to 300 l/s) and Rentang Dam (up to 1,000 l/s). The proposed intake system includes spring boxes and river intake structures, interconnecting pipelines and isolation valves, and source water metering systems.

The conceptual transmission main system comprises 9 km of 400mm diameter high density polyethylene (HDPE) from the source elevation of approximately 1230 meters above sea level (ASL) to a water booster pumping station at elevation 1180 meter ASL.

The water booster station would pump 2 km through a 400 mm HDPE force main up to a hydraulic balancing structure at approximately 1330 meters ASL. The raw water would then flow by gravity approximately 11 km through a 400mm diameter pipeline to a 1500 cubic meter distribution reservoir at elevation 1220 meter ASL.

PDAM Tirta Rangga in Kabupaten Subang proposes to develop this project as a public-private partnership (PPP) in the form of a Build-Operate-Transfer (BOT) project. Under the BOT PPP model, a private investment company designs and constructs the project using a mix of equity and debt financing. The investment company operates for a predetermined time period after which ownership is transferred to the public partner.

The public partner pays a fee to compensate the private investor for the development costs and the operation and maintenance expenses plus provide a return on equity. The fee can be structured as either fixed recurring charge or, in the case of a water supply project, is usually based on the quantity of water delivered with a “take-or-pay” guaranteed minimum payment.

PPP BOT EVALUATION

Local Environmental Services Program (ESP) engineering and financial analysis staff performed a **prefeasibility** analysis of the proposed project to determine if further investigation was warranted.

Engineering staff developed a very preliminary opinion of probable construction cost of approximately 20 billion Rupiah.

Cash operating expenses were estimated to begin at 824 million Rupiah per year and increase to 1.18 billion Rupiah per year over a 16 year operation period.

Depreciation expenses were estimated to be a level 1.2 billion Rupiah during the operation period.

Interest expenses were estimated to 1.5 billion Rupiah at the beginning decreasing to 150,000 million Rupiah in the last year of the assumed eight year loan term.

A debt equity ratio of 60:40 was assumed and the BOT investor was assumed to realize a 20 percent return on equity, which is designed to be sufficient to attract suitable investors.

The result of these preliminary analyses is a preliminary estimate that PDAM Tirta Raharja (Kab. Subang) would pay a bulk water tariff of 1250 Rupiah per cubic meter.

The final step of this Phase I analyses is to determine if the estimated bulk water tariff represents an affordable source of supply.

RETAIL TARIFF IMPACT

The customer in this project, PDAM Tirta Raharja, serving Kabupaten Bandung, has approximately 47,000 existing connections. The average retail water tariff is approximately 1,500 Rupiah per cubic meter. The tariff approval agency, DPRD, has reportedly approved increases to bring the average tariff up to 2,000 Rupiah per cubic meter over the next two years.

The estimated bulk water tariff to support the BOT is significantly less than the present average tariff and is substantially less than the approved increased tariff. Therefore, the project is not “fatally flawed”. A more detailed Phase II feasibility analysis should be performed in order to advance the project.

APPENDIX B - POPULATION AND FLOWS

PDAM KABUPATEN SUBANG : FEASIBILITY ANALYSIS FOR THE PROPOSED SUBANG WATER RESOURCE AND WATER TRANSMISSION MAIN PROJECT

POPULATION AND FLOW

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Population	12,000	12,000	46,500	58,000	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500	69,500
Water Demand, Cu M/Day	1,596	1,596	6,185	7,714	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244
Number of Customers @ 5	2,400	2,400	9,300	11,600	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900
Usage per Population, l/cap /day	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
Usage Per Household, Cu M/Day	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Usage Per Household, Cu M/Year	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7	242.7

OPERATING COST

Personnel																						
No. of Staff	0	0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Average Annual Salary, Rp '000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Annual O&M Staff Cost, Rp '000	0	0	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
Electricity																						
Unit Rate, Rp/kWh (esc. @ 3%/yr)	600	618	637	656	675	696	716	738	760	783	806	831	855	881	908	935	963	992	1,021	1,052	1,084	1,116
Total Dynamic Head, m (EPANet)	0	0	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124	124
Demand, m3/s	0.0185	0.0185	0.0716	0.0893	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070	0.1070
Water Power, kW	-	-	87.07	108.61	130.14	130.14	130.14	130.14	130.14	130.14	130.14	130.14	130.14	130.14	130.14	130.14	130.14	130.14	130.14	130.14	130.14	130.14
Wire Power, kW @ 70%E	-	-	124.39	155.15	185.92	185.92	185.92	185.92	185.92	185.92	185.92	185.92	185.92	185.92	185.92	185.92	185.92	185.92	185.92	185.92	185.92	185.92
Annual Energy Usage	0	0	1,089,651	1,359,135	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619	1,628,619
Annual Energy Cost, Rp '000	0	0	693,607	891,098	1,099,815	1,132,809	1,166,794	1,201,797	1,237,851	1,274,987	1,313,237	1,352,634	1,393,213	1,435,009	1,478,059	1,522,401	1,568,073	1,615,115	1,663,569	1,713,476	1,764,880	1,817,827
Check kW (US English)	0	0	173	215	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258
kWh/year	0	0	1,512,436	1,886,479	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522	2,260,522
Cost, Rp. '000 (@ \$.07/kWh)	0	0	1,058,705	1,320,535	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365	1,582,365

APPENDIX C - CONSTRUCTION COSTS

SUBANG TO LEBANG RAW WATER TRANSMISSION MAIN CONSTRUCTION COST ESTIMATE

Item	Item Description	Dimensions	Capacity	Units	Quantity	Unit Price (Rp '000)	Extended Cost (Rp '000,000)	Subtotals (Rp '000,000)	Inc/Contingencies Etc
1	Spring/River/Dam Intake Structures	400mm	100-300 lps	LS	3	1,500,000	4,500	4,500	6,262
2	Transmission Main - Subang to PS	500mm	120-180 lps	LM	9,000	1,250	11,250	11,250	15,654
3	Water Booster Pumping Station								
3.01	Pumping Station Structure (CMU)	6m x 13m	120 lps	LS	1	5,000,000	5,000		
3.02	Standby Generator w/Integral Fuel Tank	3m x 6m	500 kW	LS	1	1,000,000	1,000		
3.03	Sitework & Access Road	1 ha		LS	1	500,000	500		
								6,500	9,045
4	Transmission Main - PS to Standpipe	500mm	120-180 lps	LM	2,000	1,250	2,500	2,500	3,479
5	Balancing Standpipe	5m x 10m	200 cu-m	I	3	1,500,000	4,500	4,500	6,262
4	Transmission Main - Standpipe to Lembang	400mm	120-180 lps	LM	11,000	1,000	11,000	11,000	15,307
5	Lembang Storage Reservoir		1500 cu-m	LS	1	2,500,000	2,500	2,500	3,479
6	Electrical Power Extensions			LS	1	1,000,000	1,000	1,000	1,392
7	Instrumentation & Control (SCADA System)								
7.01	System Engineering			LS	1	250,000	250		
7.02	Fiber Optic Cable & PVC Conduit			LM	22,000	100	2,200		
7.03	Remote Terminal Units (RTU)			CT	4	150,000	600		
7.04	Miscellaneous SCADA			LS	1	10,000	10		
								3,060	4,258

Construction Cost Subtotal	46,810
Estimating Contingency (15%)	7,022
Construction Costs Total	53,832
Engineering & Surveying (5%)	2,692
Administrative & Legal (1%)	538
Profit & Overhead (15%)	8,075
Total Capital Cost	65,136
	65,136

APPENDIX D - FINANCIAL ANALYSIS

SUBANG TO LEMBANG RAW WATER TRANSMISSION MAIN CASH FLOW AND INTERNAL RATE OF RETURN ANALYSIS

Description		Year										
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Capital Cost--Raw Water Transmission Main	65,136	32,568	32,568									
Construction Loans Interest Rate, %	10.0%											
Capitalized Interest During Construction	10,096	3,257	6,839									
Total Capital Cost	75,232	35,825	39,407									
Debt:Equity Ratio, % Debt	80%											
Debt Principal	60,186											
Debt Interest Rate, %/annum	8.0%											
Debt Period, yrs	10											
Debt Service, Rp (000,000)				8,969	8,969	8,969	8,969	8,969	8,969	8,969	8,969	8,969
Principal Payment, Rp (000,000)	60,186			4,155	4,487	4,846	5,234	5,652	6,104	6,593	7,120	7,690
Outstanding Balance, Rp (000,000)				60,186	56,031	51,544	46,698	41,465	35,812	29,708	23,115	15,995
Interest Payment, Rp (000,000)				4,815	4,482	4,124	3,736	3,317	2,865	2,377	1,849	1,280
Debt:Equity Ratio, % Equity	20%											
Equity Investment, Rp (000,000)	15,046	-7,165	-7,881									
\$												
Operation & Maintenance Costs, Rp (000)												
Labor		0	0	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
Electricity		0	0	693,607	891,098	1,099,815	1,132,809	1,166,794	1,201,797	1,237,851	1,274,987	1,313,237
Fuel				50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Chemicals				0	0	0	0	0	0	0	0	0
Annual Maintenance and Repair, % of ConstructionCost	1%			651,361	651,361	651,361	651,361	651,361	651,361	651,361	651,361	651,361
Supplies				50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Total O & M Costs, Rp (000)				1,684,968	1,882,459	2,091,176	2,124,171	2,158,155	2,193,159	2,229,213	2,266,348	2,304,598
Total Annual Cost, Rp (000,000)				10,654	10,852	11,061	11,094	11,128	11,163	11,199	11,236	11,274
Flow, Cu M/Day				6,185	7,714	9,244	9,244	9,244	9,244	9,244	9,244	9,244
Flow, 1000 Cu M/Year				2,257	2,816	3,374	3,374	3,374	3,374	3,374	3,374	3,374
BOT Tariff, Rp/Cu M	3,000			3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000

SUBANG TO LEMBANG RAW WATER TR/

Description	Year											
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	
Capital Cost--Raw Water Transmission Main												
Construction Loans Interest Rate, %												
Capitalized Interest During Construction												
Total Capital Cost												
Debt:Equity Ratio, % Debt												
Debt Principal												
Debt Interest Rate, %/annum												
Debt Period, yrs												
Debt Service, Rp (000,000)	8,969											
Principial Payment, Rp (000,000)	8,305											
Outstanding Balance, Rp (000,000)	8,305											
Interest Payment, Rp (000,000)	664											
Debt:Equity Ratio, % Equity												
Equity Investment, Rp (000,000)												
\$												
Operation & Maintenance Costs, Rp (000)												
Labor	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
Electricity	1,352,634	1,393,213	1,435,009	1,478,059	1,522,401	1,568,073	1,615,115	1,663,569	1,713,476	1,764,880	1,817,827	
Fuel	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Chemicals	0	0	0	0	0	0	0	0	0	0	0	0
Annual Maintenance and Repair, % of ConstructionCost	651,361	651,361	651,361	651,361	651,361	651,361	651,361	651,361	651,361	651,361	651,361	651,361
Supplies	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Total O & M Costs, Rp (000)	2,343,995	2,384,574	2,426,370	2,469,420	2,513,762	2,559,434	2,606,476	2,654,930	2,704,837	2,756,241	2,809,188	
Total Annual Cost, Rp (000,000)	11,313	2,385	2,426	2,469	2,514	2,559	2,606	2,655	2,705	2,756	2,809	
Flow, Cu M/Day	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244	9,244
Flow, 1000 Cu M/Year	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374
BOT Tariff, Rp/Cu M	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000

PDAM KABUPATEN SUBANG : FEASIBILITY ANALYSIS FOR THE PROPOSED SUBANG WATER RESOURCE AND WATER TRANSMISSION MAIN PROJECT

Description	Year											
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Annual Revenue, Rp (000,000)			6,772	8,447	10,122	10,122	10,122	10,122	10,122	10,122	10,122	10,122
Less: Offtake Fee, Rp (000,000) @ 50Rp/Cu-M			113	141	169	169	169	169	169	169	169	169
Less: O&M Expenses, Rp (000,000)			1,685	1,882	2,091	2,124	2,158	2,193	2,229	2,266	2,305	
Operating Profit			4,974	6,424	7,862	7,829	7,795	7,760	7,724	7,687	7,648	
Less: Depreciation Expense			2,753	2,753	2,753	2,753	2,753	2,753	2,753	2,753	2,753	2,753
Less: Interest Expense			4,815	4,482	4,124	3,736	3,317	2,865	2,377	1,849	1,280	
Net Profit Before Taxes			-2,594	-812	985	1,339	1,724	2,141	2,594	3,084	3,615	
Less: GOI Corporate Income Tax	30%		0	0	295	402	517	642	778	925	1,085	
Net Profit After Taxes			-2,594	-812	689	938	1,207	1,499	1,816	2,159	2,531	
Add Back Depreciation (non-cash expense)			2,753	2,753	2,753	2,753	2,753	2,753	2,753	2,753	2,753	2,753
Net Cash Flow		-7,165	-7,881	159	1,941	3,443	3,691	3,960	4,252	4,569	4,912	5,284
After Tax Internal Rate of Return (IRR), %	20.2%											
Bulk Water Tariff to BOT Operator, Rp/Cu M	3,000											
PDAM Tirta Rangga (Subang) Admin Fee & Profit, %	7.5%											
PDAM Subang Bulk Water Tariff Revenue, Rp (000000)	225	0	0	508	634	759	759	759	759	759	759	759
Lembang Bulk Water Tariff, Rp/Cu M				3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225
Lembang Annual Bulk Water Cost, Rp (000,000)				7,280	9,080	10,881	10,881	10,881	10,881	10,881	10,881	10,881

PDAM KABUPATEN SUBANG : FEASIBILITY ANALYSIS FOR THE PROPOSED SUBANG WATER RESOURCE AND WATER TRANSMISSION MAIN PROJECT

Description	Year										
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Annual Revenue, Rp (000,000)	10,122	10,122	10,122	10,122	10,122	10,122	10,122	10,122	10,122	10,122	10,122
Less: Offtake Fee, Rp (000,000) @ 50Rp/Cu-M	169	169	169	169	169	169	169	169	169	169	169
Less: O&M Expenses, Rp (000,000)	2,344	2,385	2,426	2,469	2,514	2,559	2,606	2,655	2,705	2,756	2,809
Operating Profit	7,609	7,568	7,527	7,484	7,439	7,394	7,346	7,298	7,248	7,197	7,144
Less: Depreciation Expense	2,753	2,753	2,753	2,753	2,753	2,753	2,753	2,400	2,400	2,400	2,400
Less: Interest Expense	664	0	0	0	0	0	0	0	0	0	0
Net Profit Before Taxes	4,191	4,815	4,773	4,730	4,686	4,640	4,593	4,898	4,848	4,796	4,743
Less: GOI Corporate Income Tax	1,257	1,444	1,432	1,419	1,406	1,392	1,378	1,469	1,454	1,439	1,423
Net Profit After Taxes	2,934	3,370	3,341	3,311	3,280	3,248	3,215	3,428	3,393	3,357	3,320
Add Back Depreciation (non-cash expense)	2,753	2,753	2,753	2,753	2,753	2,753	2,753	2,400	2,400	2,400	2,400
Net Cash Flow	5,687	6,124	6,095	6,064	6,033	6,001	5,969	5,829	5,794	5,758	5,721
After Tax Internal Rate of Return (IRR), %											
Bulk Water Tariff to BOT Operator, Rp/Cu M											
PDAM Tirta Rangga (Subang) Admin Fee & Profit, %											
PDAM Subang Bulk Water Tariff Revenue, Rp (000000)	759	759	759	759	759	759	759	759	759	759	759
Lembang Bulk Water Tariff, Rp/Cu M	3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225
Lembang Annual Bulk Water Cost, Rp (000,000)	10,881	10,881	10,881	10,881	10,881	10,881	10,881	10,881	10,881	10,881	10,881

ENVIRONMENTAL SERVICES PROGRAM

Ratu Plaza Building, 17th. Fl.

Jl. Jend. Sudirman No. 9

Jakarta 10270

Indonesia

Tel. +62-21-720-9594

Fax. +62-21-720-4546

www.esp.or.id