

ASIAN DEVELOPMENT BANK

PPA:LAO 24104

PROJECT PERFORMANCE AUDIT REPORT

ON THE

**SOUTHERN PROVINCIAL TOWNS WATER SUPPLY PROJECT
(Loan 1122-LAO[SF])**

IN THE

LAO PEOPLE'S DEMOCRATIC REPUBLIC

December 2000

CURRENCY EQUIVALENTS

Currency Unit – Kip (KN)

		At Appraisal (October 1991)	At Project Completion (May 1997)	At Operations Evaluation (August 2000)
KN1.00	=	\$0.0014	\$0.0004	\$0.0001
\$1.00	=	KN700	KN2,400	KN8,000

ABBREVIATIONS

ADB	–	Asian Development Bank
ADTA	–	advisory technical assistance
BME	–	benefit monitoring and evaluation
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
ICB	–	international competitive bidding
IS	–	international shopping
Lao PDR	–	Lao People's Democratic Republic
Lpd	–	liters per day
MCTPC	–	Ministry of Communication, Transport, Post and Construction
mg/L	–	milligrams per liter
ML/d	–	megaliters per day
NORAD	–	Norwegian Agency for Development Cooperation
NPL	–	Nam Papa Lao (Lao Water Supply Authority)
NPV	–	net present value
OEO	–	Operations Evaluation Office
PCR	–	project completion report
PIO	–	project implementation office
PMU	–	project management unit
PPAR	–	project performance audit report
PPTA	–	project preparatory technical assistance
SDR	–	special drawing rights
TA	–	technical assistance

NOTES

- (i) The fiscal year of the Lao PDR ends on 31 December.
- (ii) In this report, "\$" refers to US dollars.

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BASIC DATA
Southern Provincial Towns Water Supply Project
(Loan 1122-LAO[SF])

A. Project Preparation/Institution Building

TA No.	TA Name	Type	Consultant Person-Months	Amount (\$)	Approval Date
759-LAO	Southern Area Development Master Plan Study	ADTA	—	150,000 ^a	13 Mar 1986
1143-LAO	Southern Area Development Multiproject	PPTA	—	95,000	4 Apr 1989
1339-LAO	Southern Provincial Water Supply	PPTA	8.2	362,000	24 Jul 1990
1606-LAO ^b	Institutional Strengthening of the Water Supply Sector	ADTA	—	630,000	19 Nov 1991
1607-LAO ^b	Northern Provincial Towns Water Supply Development Project	PPTA	14.4	420,000	19 Nov 1991

ADTA = advisory technical assistance; — = not available; PPTA = project preparatory technical assistance; TA = technical assistance.

^a TA was cofinanced by the United Nations Development Programme for \$600,000.

^b Accompanying TA.

B. Key Project Data

Item	Currency	As per ADB Loan Documents	Actual
Total Project Cost	\$ million	12.00	11.04
Foreign Exchange Cost	\$ million	8.90	8.64
Local Currency Cost	\$ million	3.10	2.40
ADB Loan Amount/Utilization	\$ million	9.60	9.11
	SDR million	7.05	6.25
Foreign Exchange Cost	\$ million	8.90	8.64
Local Currency Cost	\$ million	0.70	0.47
ADB Loan Amount /Cancellation	\$ million	0.00	1.22
	SDR million	0.00	0.80

ADB = Asian Development Bank; SDR = special drawing rights.

C. Key Dates

Item	Expected	Actual
Fact-Finding		31 May-21 Jun 1991
Appraisal		20 Aug-5 Sep 1991
Loan Negotiations		22-23 Oct 1991
Board Approval		19 Nov 1991
Loan Agreement		13 Dec 1991
Loan Effectiveness	12 Mar 1992	2 Jul 1992
First Disbursement		2 Jul 1992
Project Completion	31 Dec 1995	30 Jun 1997 ^a
Loan Closing	30 Jun 1996	12 Nov 1997
Months (effectiveness to completion)	45	60

^a First revised closing date. The original closing date was 30 June 1996.

D. Key Performance Indicators (%)

Item	Appraisal	PCR	PPAR
Financial Internal Rate of Return	—	4.3	< 0
Part A: Pakse	6.6	4.7	< 0
Part B: Attapeu	5.3	3.7	< 0
Part C: Saravane	5.7	0.2	< 0
Part D: Sekong	6.2	8.7	< 0
Economic Internal Rate of Return	—	12.1	20.0
Part A: Pakse	—	11.8	25.1
Part B: Attapeu	—	—	< 0
Part C: Saravane	—	11.3	24.6
Part D: Sekong	—	16.4	< 0

— = not calculated; PCR = project completion report; PPAR = project performance audit report.

E. Borrower Government of the Lao People's Democratic Republic

F. Executing Agency Ministry of Communication, Transport, Post and Construction

G. Mission Data

Type of Mission	No. of Missions	Person-Days
Fact-Finding	1	—
Appraisal	1	68
Project Administration:		
Inception	1	6
Review	11	166
Project Completion	1	25
Subtotal Project Administration	13	197
Operations Evaluation	1	33
Total	16	298

— = not available.

EXECUTIVE SUMMARY

In 1991, only about 33 percent of the urban population and 15 percent of the rural population in the Lao People's Democratic Republic (Lao PDR) had access to treated water supplies. Reliable supplies of water were available in only 7 out of 17 provincial capitals. Water supply in Vientiane and Savannakhet was acceptable but, in other towns, it was poor and did not meet the recommended World Health Organization standards. Water supply systems were generally old, in poor condition, and unable to provide for existing and future demand because investment was insufficient and there was a lack of planning and skilled personnel to manage them. No significant investment in urban water supply had been made since 1981.

The main objective of the Southern Provincial Towns Water Supply Project (Loan 1122-LAO[SF]) was to rehabilitate and upgrade the water supply systems in Pakse, Attapeu, and Saravane and to construct a new water supply system for Sekong, with a view to assisting the Government in meeting its water supply targets and thus improve the health of the population and support economic growth. Upon completion, the Project was to benefit 82,000 people in the four towns. ADB provided SDR7.05 million (\$9.6 million equivalent) from the Asian Development Fund to finance the entire foreign exchange cost of the Project and \$0.7 million of the local currency cost. The Government of the Lao PDR provided budgetary funds for the balance of the local currency cost. The actual project cost at completion amounted to \$11.0 million, with a foreign exchange cost of \$8.6 million (78 percent of the actual total cost) and a local currency cost of \$2.4 million. The lower actual cost of the Project was primarily because gravity-operated infiltration galleries were used for the water treatment plants. The Project was expected to have been implemented over four years, from 1992 to 1995, with loan closing in 1996. However, some project delays were incurred and loan closing was postponed to 1997, about a year later.

The Project was generally consistent with ADB's country operational strategy. Moreover, it had a poverty-reducing dimension, even though this was not an explicit intention of the strategy. In terms of current ADB strategic priorities, the Project is relevant. The Project was also implemented satisfactorily in the main part, with only a small delay. However, there were several shortcomings. In two of the project towns, Attapeu and Sekong, the proposed conventional water treatment plant was replaced with a gravity-operated infiltration gallery without an adequate investigation of the hydrology at the water intake location. As a result, the infiltration galleries are either ineffective or not in use. In Pakse, the water treatment plant is underutilized because too few consumers are connected to the distribution system. The Project was also inadequately designed from an institutional perspective. The finance and accounting systems of Nam Papa Lao (Lao Water Supply Authority) were not upgraded to international standards and the accounting skills of the staff were not strengthened. The amount of consulting services provided under the Project was insufficient and contributed to the poor performance of the Project in Attapeu and Sekong.

The main objective of the Project of providing potable water supply to four provincial towns was only partly achieved. Only about half of the 82,000 intended beneficiaries benefited from the Project. In two of the four project towns (Attapeu and Sekong), the Project did not bring potable water to residents and there has been no improvement in water supply. In Pakse, more consumers could be served by the Project if additional households were connected. Only in Saravane did the Project successfully meet its objectives. However, the Project did have a substantial impact on the populations of Pakse and Saravane. The overall economic internal rate of return (EIRR) was estimated at 20 percent in real terms. The high EIRR is attributable to the large size of Pakse relative to the other three towns and the substantial economic benefits from the Project in Pakse.

The financial position of the water utilities in the four project towns is precarious. Revenue is insufficient to cover operating expenses, depreciation, and interest payments; the water utilities reported losses in 1998 and 1999 on the income statement. The lack of financial viability is already affecting the operation of the water supply systems through neglect of necessary maintenance. The water tariff in the four project towns is low and recovers only minimal costs. Consequently, water is provided virtually free, and as a result, the financial net present value of the Project is negative.

The sustainability of the Project at Pakse and Saravane is doubtful. The lack of resources to finance maintenance has already caused operational difficulties in Pakse and will likely shorten the life of the Project. Sustainability is also affected by shortcomings in the technical abilities of water utility staff that need upgrading to ensure proper operation and maintenance of the plants. Even though the EIRR is high, based on a shorter than expected economic life of the Project, the Project was rated as less than successful.

The evaluation identified several lessons. Although designs of water supply systems are relatively standard, they need to take into account local conditions, particularly in developing countries where geological and environmental conditions vary greatly. Siltation of rivers is a well-known phenomenon in Asia and water supply designs need to incorporate data on water characteristics, such as turbidity, during project preparation or implementation when major design changes are being considered. The design should also include a thorough needs analysis of engineering design and supervision for project implementation.

In addition, the successful operation of a water utility depends on skilled and experienced staff. Therefore, project design needs to make adequate provision for staff training based on a thorough needs analysis. In certain developing countries, such as those in transition from central planning to a market orientation, relatively more institutional strengthening may be needed. In such cases, a relatively greater amount of technical assistance may be necessary in the initial projects in the sector to create a critical mass of skilled staff to ensure both the proper operation and maintenance, and the financial operations, of the project facilities. Institutional strengthening also needs to address the financial information issues of a water utility.

A key issue facing the Government is the nonperformance of project facilities in Attapeu and Sekong. The engineering firm that designed and constructed these facilities is likely to have a legal responsibility for rectifying the problems or providing some compensation.



I. BACKGROUND

A. Rationale

1. In 1991, only about 33 percent of the urban population and 15 percent of the rural population in the Lao People's Democratic Republic (Lao PDR) had access to treated water supplies. Reliable supplies of water were available in only 7 out of 17 provincial capitals. Water supply in Vientiane and Savannakhet was acceptable but, in other towns, it was poor and did not meet the recommended World Health Organization standards. Water supply systems were generally old, in poor condition, and unable to provide for existing and future demand because investment was insufficient and there was a lack of planning and skilled personnel to manage them. No significant investment in urban water supply had been made since 1981.

B. Formulation

2. The Government of the Lao PDR recognized the deficiencies in the water supply systems in the country and undertook a study of urban and rural water supply financed by three agencies: United Nations Development Programme, United Nations Children's Fund and the World Bank. The study identified a number of towns that required urgent rehabilitation and development of water supply systems, among them Pakse, Attapeu, Saravane, and Sekong. To address the water supply needs of these towns, the Government requested the Asian Development Bank (ADB) to provide a project preparatory technical assistance¹ (PPTA) to carry out a feasibility study of these towns' water supply needs. The PPTA was completed in August 1991.

3. The PPTA study made a thorough investigation of the options and resulted in a generally high-quality report that made reasonable recommendations. However, the study had three shortcomings. First, the planning horizon of the PPTA was too short—only five years. A 20-year planning horizon would have been more appropriate to take into account population and economic growth. Second, the study underestimated the degree of difficulty in operating rapid sand filters in a water treatment plant compared to slow sand filters. The operation of the former needs considerably more technical expertise and funds for maintenance. The study did not consider these aspects. Third, the study overlooked the possibility of rehabilitating the existing water treatment plant at Pakse.

4. The ADB's Board of Directors approved a loan on 19 November 1991 for the Southern Provincial Towns Water Supply Project by summary procedure. The Project included two technical assistance (TA) grants, one advisory² and one project preparatory.³

C. Purpose and Outputs

5. The main objective of the Southern Provincial Towns Water Supply Project was to rehabilitate and upgrade the water supply systems in Pakse, Attapeu, and Saravane, and to construct a new water supply system for Sekong, to help the Government meet its water supply

¹ TA 1339-LAO: *Southern Provincial Water Supply*, approved on 24 July 1990, for \$362,000.

² TA 1606-LAO: *Institutional Strengthening of the Water Supply Sector*, approved on 19 November 1991, for \$630,000.

³ TA 1607-LAO: *Northern Provincial Towns Water Supply Development Project*, approved on 19 November 1991, for \$420,000.

targets and thus improve the health of the population and support economic growth.⁴ Upon completion, the Project was to benefit 82,000 people in the four towns. The Project had six components: (i) at Pakse, construction of a new 15 megaliters per day (ML/d) water treatment plant, temporary rehabilitation and then decommissioning of the existing water treatment plant, and rehabilitation of the existing distribution network; (ii) at Saravane, construction of a new 2 ML/d water treatment plant, extension of distribution water mains and rehabilitation of existing mains, installation of service connections, and provision of water meters; (iii) at Sekong, construction of a new gravity-fed 2 ML/d water treatment plant and a new distribution network, installation of service connections, and provision of water meters; (iv) at Attapeu, construction of a new 2 ML/d water treatment plant, extension of distribution water mains and rehabilitation of existing mains, installation of service connections, and provision of water meters; (v) provision of institutional support through establishing a project management unit (PMU) and four project implementation offices to support the Executing Agency in project implementation, and through financing the supply of equipment for maintenance, repair, and leak detection of existing water supply networks; and (vi) provision of consulting services for engineering design and construction supervision.

D. Cost, Financing, and Executing Arrangements

6. ADB approved Loan 1122-LAO(SF) for the Southern Provincial Towns Water Supply Project for SDR7.05 million (\$9.6 million equivalent) from the Asian Development Fund to finance the entire foreign exchange cost of the Project and \$0.7 million of the local currency cost (Basic Data Sheet and Appendix 1). The Government provided budgetary funds for the balance of the local currency cost incurred by the Project. The loan had a term of 40 years, including a grace period of 10 years, with a service charge of 1 percent per annum. ADB financing covered 80 percent of the total project cost of \$12 million as estimated at appraisal. The Borrower was the Government of the Lao People's Democratic Republic. The Government relented the loan funds to Nam Papa Lao (NPL), the Lao Water Supply Authority, at 6.6 percent per annum for 25 years with a five-year grace period. The Government bears the foreign exchange risk.

7. The Executing Agency for the Project was the Ministry of Communication, Transport, Post and Construction (MCTPC) and the Implementing Agency was NPL. A PMU, headed by a project manager, was to be established in NPL in Vientiane to coordinate all project activities. A project implementation office (PIO) was also to be established in the NPL office in each town, headed by a project implementation officer. The overall project management structure was to have a staff of 20. Overall coordination was to be carried out by a project implementation coordination committee that met at least quarterly in each of the four towns on a rotation basis and, as needed, in Vientiane.

E. Completion and Self-Evaluation

8. A project completion report (PCR) for the Southern Provincial Towns Water Supply Project was prepared in June 1998 and discussed the design, scope, implementation, and operational aspects of the Project, and provided detailed project information. The PCR identified the main issues, including the apparent presence of iron and manganese in the raw water at Attapeu, which was deposited on the infiltration gallery screens and blocked water meters. However, the PCR did not provide evidence of the presence of these impurities; a chemical analysis would have been appropriate. An economic reevaluation was prepared, but the details of the analysis were not

⁴ Pakse town is about three times the size of the other three towns together.

provided. A summary discussion of the assumptions of the economic analysis was provided in the appendix, but these assumptions were not quantified. The PCR did not assess the financial health of NPL. There was no analysis of its income statement, balance sheet, or source/application of funds statement. Furthermore, the PCR did not assess the benefit monitoring and evaluation system that was covenanted under the Loan. The PCR rated the Project as generally successful, although there was insufficient evidence to support this rating.

F. OEO Evaluation

9. This project performance audit report (PPAR) focuses on the pertinent aspects of the Southern Provincial Towns Water Supply Project and presents the findings of the Operations Evaluation Mission to the Lao PDR during 31 July–11 August 2000. The PPAR presents an assessment both of the Project's effectiveness in terms of achieving its objectives and generating benefits, and of the sustainability of the Project's operations.

10. The PPAR is based on a review of the PCR, the appraisal report, material in ADB files, a report by a consultant engaged by the Operations Evaluation Mission, and discussions with the Government and MCTPC. Copies of the draft PPAR were provided to the Government, MCTPC, and ADB staff concerned for review and comments. Comments received were taken into consideration in finalizing the PPAR.

II. PLANNING AND IMPLEMENTATION PERFORMANCE

A. Formulation and Design

11. The primary thrust of ADB's country operational strategy in the Lao PDR was to assist the Government in its transition to a market economy through policy reform to develop competitive markets and encourage private sector development and direct capital investments in support of private sector activity. This strategic objective was to be achieved by, among others, "addressing basic needs and human resource development." The Project is to a certain extent in line with this concept, but the Project had no measures to develop competitive markets in water supply or encourage private sector participation in the provision of potable water. However, it was unlikely that private sector participation could have been successfully promoted in the provinces at the time. The Project has a poverty-reducing dimension, even though this was not an explicit intention of the country operational strategy. In terms of current ADB strategic priorities, the Project is relevant.

12. The Project was adequately prepared for the most part from a technical perspective. However, the size of the water treatment plant at Pakse was inappropriate with respect to the number of current and future consumers. The Project component for Pakse should have ensured that the distribution system was appropriately expanded to connect consumers and utilize the water treatment plant's design capacity. There also seems to have been insufficient attention to the institutional aspects of the Project. The finance and accounting systems of NPL were rudimentary and remain so. Accounting at NPL does not comply with international standards and staff skills in accounting are weak. The TA associated with the Project did not address these shortcomings.

13. At implementation, the Project underwent a number of design changes. At Pakse, the project implementation consultant reported as suitable for rehabilitation the existing raw water intake of 17.5 ML/d and the existing water treatment plant of 7.5 ML/d. This led to the decision to construct a new water treatment plant of a smaller capacity of 7.5 ML/d. It was also decided to include a presedimentation tank to reduce the very high silt levels from wet season flows in the Mekong River. The project implementation consultant's proposed and eventually accepted design changes were appropriate and resulted in a lower overall project cost.

14. At Attapeu, the design for a conventional water treatment plant was replaced with a gravity-operated infiltration gallery because the cost of diesel electricity to run the water treatment plant was considered too high. Although the motive for the design change may have been correct, the choice of an infiltration gallery does not seem to have been appropriate. First, Attapeu was connected to an electricity grid supplied by hydropower on a 24-hour basis in April 2000. Construction of the Houay Ho hydropower plant, the source of this power, began in 1994, about the time when the design change was being considered. Electricité du Laos should have been consulted about plans for 24-hour power in Attapeu. Use of diesel power for a water treatment plant until hydropower was available would have likely been a better solution. Second, silt in the raw water during the wet season has rendered the infiltration gallery ineffective and silt-laden water is being pumped through the distribution system to consumers. In the dry season, water levels are so low that there is insufficient hydraulic head to drive the water through the filter pack. Water inflow falls from 26 liters per second to 0.6 liters per second. The project implementation consultant seems to have failed to investigate the hydrology at the water intake location.

15. At Saravane, the Project added a presedimentation tank to the design of the water treatment plant. This was appropriate because of the high levels of silt in the river. However, the location of the water intake may not have been appropriate. The site is only several meters downstream from a creek that empties into the river and that has a high silt content because of deforestation upstream. The creek's water is polluted with insecticides/pesticides and chemical fertilizers from runoff of farms in the area. A small roofing factory and car repair shop also contribute to the pollution, according to Nam Papa Saravane staff. Although the extent of the pollution cannot be ascertained without more study, the intake site should have been located upstream of the creek. The additional cost would have been minimal. In the dry season, water levels are also so low that the volume of water at the intake is insufficient for the capacity of the water treatment plant. The low water level was caused by the installation of 6,000 irrigation pumps in the region, many upriver, to provide water to farms. Nam Papa Saravane remedied this situation by building a sandbag weir downstream to raise the water level at the intake.

16. At Sekong, the conventional water treatment plant was also replaced with a gravity-operated infiltration gallery because there was no electricity supply. The design was changed even though local staff had conducted some experiments with infiltration and concluded that an infiltration gallery was inappropriate because of the high levels of silt in the river.⁵ As a result, the constructed infiltration gallery is not in use. Consumers in Sekong rely on bottled water for drinking and traditional sources (rain, trucked-in water) for other uses.

B. Achievement of Outputs

⁵ An expert from the Asian Institute of Technology in Bangkok visited the project sites and confirmed that infiltration galleries should not be used when raw water has turbidities in excess of 40 turbidity units. Raw water sources during the wet season in Attapeu and Sekong can exceed 200 turbidity units and reach as high as 2,000 turbidity units.

17. The main objective of the Project of providing potable water supply to four provincial towns was partly achieved. Only about half of the 82,000 intended beneficiaries benefited from the Project. In Pakse, Project facilities are underutilized because of the water utility's inability to connect more households to the water supply system. In two of the four Project towns (Attapeu and Sekong), the Project did not bring potable water to its residents and there has been no improvement in water supply. Only in Saravane did the Project successfully meet its objectives.

C. Cost and Scheduling

18. At appraisal, the Project was estimated at \$12.0 million, a foreign exchange cost of \$8.9 million and a local currency cost of \$3.1 million. ADB provided a loan of \$9.6 million representing 80 percent of the total cost, while the Government provided the balance to finance the remaining 20 percent of the total cost. The actual project cost at completion amounted to \$11.0 million, with a foreign exchange cost of \$8.6 million (78 percent of the actual total cost) and a local currency cost of \$2.4 million. The lower actual cost of the Project was primarily because of the substitution of the gravity-operated infiltration galleries at the water treatment plants. Some of these savings were offset by higher costs in other parts of the Project.

19. The Project was expected to have been implemented over four years, from 1992 to 1995 (Appendix 2), with loan closing in 1996. This seems to have been a reasonable implementation schedule. However, some project delays—although not of a serious nature—were incurred and loan closing was postponed to 1997, about a year later.

D. Consultant Performance, Procurement, and Construction

20. Consulting services were procured in accordance with ADB's *Guidelines on the Use of Consultants* and contracted to an international engineering firm in association with a domestic firm. Consulting services were provided for engineering design and construction supervision. The consulting services contract was to provide 59 person-months of international and 86 person-months of domestic consulting services. This was to be based on three years of full-time presence in the field until substantial completion of the civil works, followed by one year of part-time presence for institutional support and administration. Because of delays in the project schedule, the consulting services contract was extended by 8.5 person-months of international and 21.2 person-months of domestic consulting services. Following the completion of the consulting services contract, the firm was retained on an intermittent basis to assist with final completion and some minor remedial civil works. These services were paid for from the liquidated damages under the civil works contract.

21. The amount of consulting services provided was inadequate. Much of the design and supervision work depended on one project implementation consultant who found it difficult to provide a complete range of services. The infiltration galleries proposed for Attapeu and Sekong were inappropriate and based on incomplete information. Wet season water quality data had not been collected and the advice of local NPL staff was not heeded. More engineering design and supervision resources were needed to adequately implement the Project.

22. Procurement was carried out according to ADB's *Guidelines for Procurement*. A total of 19 international competitive bidding (ICB) and international shopping (IS) contracts were executed for the procurement of goods and services with a value of \$6.5 million. ICB procedures were followed for the major civil works contracts, and IS procedures for the material and equipment purchase and

office construction. Force account was used by NPL for minor civil works and pipelaying. Direct purchase was adopted for one pipe procurement package.

23. None of the civil works contractors had previous experience in the Lao PDR. As a result, all experienced some difficulty in executing their contracts and none was able to complete its contract on time. Cumbersome government procedures and the unfamiliarity of contractors with commercial contracts caused the delays. One civil works contractor was terminated because of slow progress, failure to allocate sufficient resources to the contract, and poor quality work. No significant difficulties were experienced in the material supply contracts.

E. Organization and Management

24. As stated above, the Executing Agency was MCTPC and the Implementing Agency was NPL. The Project provided for institutional support. A PMU, headed by a project manager, was established in NPL in Vientiane to coordinate all project activities. A PIO was established in the NPL office in each town and was headed by a project implementation officer. Support for the PMU and PIOs was needed because of the relative inexperience of NPL personnel. Although the overall project management structure was to have a staff of 20, it did not exceed 14 during implementation because of a lack of qualified staff. The important position of PIO project engineer was unfilled in the last two years of implementation. This put added pressure on the project implementation consultant (para. 21). Overall coordination was carried out by the Project Implementation Coordination Committee that met at least quarterly in each of the four towns on a rotation basis and as needed in Vientiane. The committee was generally effective.

25. There is little evidence that the institutional support component made much contribution to the institutional strengthening of NPL. PIOs had minimal input into the decision-making process and the PMU lacked experience to make informed decisions. Moreover, the PMU had four different heads—on three occasions the Government moved the head to work elsewhere. As a result, the project implementation consultant had a free hand in deciding project design and other issues. Although NPL's experience with the Project may have somewhat improved NPL's capacity to administer externally funded projects, there are still serious shortcomings and more capacity building is needed. Externally funded water supply projects still need substantial institutional support to ensure appropriate design and to assure that substantial technological know-how is transferred.

26. The project implementation consultant established an office in NPL in Vientiane and used the civil works contractor's offices in Pakse and Saravane for the supervision of construction, including that in Attapeu and Sekong. Project implementation arrangements were generally satisfactory despite the communication and logistical difficulties with these remote towns.

27. The Loan Agreement for the Project contained a number of covenants (Appendix 3). In addition to standard covenants related to reporting requirements and the use of loan proceeds, the Loan Agreement contained several Project-specific covenants related to financial performance, three of which were not complied with. Water tariffs have not been increased in a timely manner or to sufficient levels to ensure the financial health of the water utilities in the four towns (Appendix 4). Since the water utilities came under provincial jurisdiction in 1998, the water utilities for Pakse, Attapeu, Saravane, and Sekong have been incurring financial losses. Also, the debt service covenant for Pakse has not been complied with. Although the collection efficiency of these water utilities has improved with respect to private consumers, public sector consumers have, in most cases, outstanding accounts in excess of 90 days of sales. A benefit monitoring and evaluation system was initially established, but it has not been maintained since the reorganization of the water

supply sector in 1998. The Water Supply Authority plans to reestablish and centralize the benefit monitoring and evaluation system in Vientiane, and operate it on behalf of the water utilities in the provinces. The debt-service covenant of Nam Papa Vientiane was complied with.

III. ACHIEVEMENT OF PROJECT PURPOSE

A. Operational Performance

28. At Pakse, the water supply system is producing potable water on a 24-hour basis, but is operating at only about 70 percent capacity. Demand is insufficient to require full capacity output because only about half of the population is connected to the supply system. Nam Papa Pakse does not have the financial resources to expand the water distribution system and meet demand. The water treatment plant is in good condition, but there is a need to improve operation and maintenance through the training of staff. For example, during discussions with the Operations Evaluation Mission, staff demonstrated a lack of understanding of centrifugal pump operation. The poor financial position of Nam Papa Pakse has also resulted in inadequate maintenance of some equipment, particularly the four pumps at the intake site on the Mekong River. These four pumps (three duty and one standby) are operated simultaneously, working at only about 50 percent capacity because of the lack of maintenance.⁶ During the dry season, the pumping capacity will be reduced even more because of low water levels. In 1999, households consumed about 82 percent of the incremental water supply produced by the Project, while the commercial and industrial sector consumed the balance. Losses accounted for about 30 percent of production. The Project has benefited an incremental 10,000 people with new water supply and another 30,000 with improved water quality.⁷

29. At Attapeu, the water supply system operates only in the wet season, but the water delivered is not potable because of the high silt content. The quality of the raw water and the water after passing through the infiltration gallery is virtually the same. During the dry season, the Project does not supply any water to the distribution system; water is supplied to Attapeu, in part, by a 10-centimeter pipe from a mountain spring. Operation and maintenance of the Project facilities are inadequate. The facilities are not orderly, and simple tasks such as exercising the valves are not part of general maintenance. Nam Papa Attapeu staff cannot open or close some valves that control water flow. In 1999, households consumed about 80 percent of the incremental water supply produced by the Project, while the commercial and industrial sector consumed the balance. Water losses were about 21 percent of production. The Project has provided an incremental 2,000 persons with piped, but not potable, water. Since the households that lacked piped water use rainwater collected in cisterns, households that were connected to the water supply system under the Project are not likely to have realized any incremental benefit.⁸

30. The Operations Evaluation Mission tested the raw water used for Attapeu water supply because the issue of the presence of iron and manganese was raised in the PCR (para. 8). Two water samples were tested: one from the river and the other from the pump well. These tests concluded that it is unlikely that iron and manganese are present in sufficient concentration to block the infiltration gallery screens.

⁶ The poor maintenance of the worn wearing rings is caused by the high silt content of the water. The Norwegian Agency for Development Cooperation (NORAD) is committed to rehabilitate the four pumps at the intake.

⁷ Pakse's population was 73,184 in mid-2000, of which 40,122 (55 percent) were connected to the water supply system.

⁸ Attapeu's population was 9,443 in mid-2000, of which 7,708 (82 percent) were connected to the water supply system.

31. At Saravane, the water supply system is operating well and producing potable water. The water treatment plant is in good condition and is well maintained by appropriately trained staff. In 1999, households consumed about 92 percent of the incremental water supply produced by the Project, while the commercial and industrial sector consumed the balance. Losses accounted for about 23 percent of production. The Project benefited an incremental 1,600 people with new water supply and another 4,000 with improved water quality.⁹

32. At Sekong, the infiltration gallery installed under the Project has not been used since 1995. The Norwegian Agency for Development Cooperation (NORAD) is financing the construction of a water treatment plant at the site of the infiltration gallery. The water treatment plant is expected to be in operation by the end of 2001. No benefit has accrued to Sekong from the Project.

33. The Project provided for the supply of equipment for maintenance, repair, and leakage detection because of the lack of suitable equipment for the maintenance of the new project facilities. This equipment is kept at Nam Papa Vientiane in Vientiane and not at any of the four project sites. Use of the equipment is limited because only one Nam Papa Vientiane staff that had been trained remains to operate it.

B. Performance of the Operating Entity

34. The water utilities in each of the four towns, Pakse, Attapeu, Saravane, and Sekong, have been producing financial statements since their formation in 1998. These are produced manually (only the income statement and the balance sheet are prepared) and in the Lao language. However, the financial statements do not comply with international reporting standards (para. 12) and seem to be used primarily as a reporting tool rather than as a management instrument. The Operations Evaluation Mission reviewed the financial performance of these water utilities with the assistance of water utility personnel and made some conclusions.

35. All of the water utilities reported losses in 1998 and 1999 on the income statement. Revenue is insufficient to cover operating expenses, depreciation, and interest payments. Water tariffs have not been increased since 1998 in three of the water utilities. In the case of the fourth, tariffs were adjusted in 1999 but are still inadequate. The lack of financial viability of the water utilities is already affecting the operation of the water supply systems through neglect of necessary maintenance. The water utilities' debt service obligations have to date been met. However, debt service obligations to 1999 did not include repayment of the loan principal associated with the Project because of the grace period in the subsidiary loan agreement that specifies the terms of the relending. In mid-2000, repayment of the principal will begin and the water utilities will not be able to meet their obligations without a substantial tariff increase.

36. Accounts receivable from private consumers are generally less than three months of water sales. This is a result of a strict disconnection policy of the water utilities when nonpayment of the water bill exceeds three months. However, public sector consumers, which include schools and hospitals, perform poorly with respect to paying their water bills. In the aggregate, the accounts receivable for public sector consumers exceeds the covenanted three months of water sales.

37. The financial benefits of the Project are based on revenues collected from water sales. Appendix 5 provides details of the financial analysis. The financial internal rates of return (FIRRs) of the Pakse and Saravane project components could not be calculated because of low revenues and

⁹ Saravane's population was 8,150 in mid-2000, of which 5,670 (70 percent) were connected to the water supply system.

the resultant negative net cash flows. However, the net present values (NPVs) of these cash flows were calculated on the basis of no real increase in the water tariff and a discount rate of 12 percent. The NPVs are a negative KN30,378 million (about \$3.8 million) for Pakse and a negative KN8,335 million (about \$1 million) for Saravane. Without any financial benefit of the Project in Attapeu and Sekong, the NPVs for these project components are also negative.

38. The negative NPVs are caused primarily by the low water tariff. The average water tariff in Pakse in 2000 is KN288 (or about \$0.04) per cubic meter. The price of water in the other project towns is of the same order of magnitude. Water is provided virtually free to the residents and wasteful use of this resource is evident in the project towns. This may be acceptable in Attapeu and Sekong where the Project failed to deliver the intended potable water supply but, in Pakse and Saravane, full or at least initially partial cost recovery needs to be implemented.

C. Economic Reevaluation

39. The Southern Provincial Towns Water Supply Project was designed to upgrade and rehabilitate water supply systems in Pakse, Attapeu, and Saravane and to construct a new water supply system at Sekong to assist the Government in meeting its water supply targets, improving the health of the beneficiary population, and supporting economic growth. This objective was to be achieved through the economic benefits of the incremental water supplied by the Project measured in terms of the resource cost savings in the existing water market and people's willingness to pay for additional water supplied by the Project. Appendix 5 discusses the valuation of these economic benefits and the project costs, along with details of the economic analysis, which assumes that the expected project benefits will not be realized in the future because of a lack of resources for maintenance. Based on current practices, the Project should continue to operate to no later than 2008 in Pakse and Saravane. The economic internal rates of return (EIRRs) for Pakse and Saravane are 25.1 percent and 24.6 percent, respectively. Because of the failure of the infiltration galleries at Attapeu and Sekong, there is little incremental benefit from the Project in these two towns and their EIRRs are negative. The EIRR of the Project as a whole is 20.0 percent.¹⁰

D. Sustainability

40. The Project at Attapeu and Sekong is clearly unsustainable because the infiltration galleries are either ineffective or not in use. The sustainability of the Project at Pakse and Saravane is questionable. The water utilities in the four towns are financially weak and do not have the resources to finance maintenance. The lack of maintenance has already caused operational difficulties in Pakse (para. 28) and will undoubtedly shorten the life of the Project. Sustainability is also affected by shortcomings in the technical abilities of water utility staff that need upgrading to ensure proper operation and maintenance of the plants.

IV. ACHIEVEMENT OF OTHER DEVELOPMENT IMPACTS

¹⁰ As the town of Pakse is about three times the size of the other three towns together, the overall EIRR is influenced heavily by the Pakse project component.

A. Socioeconomic and Sociocultural Impacts

41. The socioeconomic impact of the Project varies from town to town. In Attapeu and Sekong, the impact of the Project has been minimal because the quality of water consumed by the people in these towns has not improved. Even though new consumers have been connected to the water supply system, water is available only during the wet season in Attapeu, and is not available through the distribution system in Sekong. In Pakse and Saravane, the Project has made an impact. Before the Project, water from the distribution system in Pakse was available only sporadically, the pressure in the distribution system was low, and the water was not potable. These deficiencies in the water treatment and distribution system have now been remedied. In Saravane, the distribution system has been expanded and the water treatment plant produces potable water. Before the Project, water was trucked in from nearby rivers or rainwater was collected.

42. The health impact of a potable water supply is substantial. According to the Ministry of Health in Vientiane, the two main illnesses from poor water supply are dysentery and cholera. In 1999, Savannakhet District, for example, had 422 reported cases of dysentery caused by poor water quality, of whom 16 (mostly children) died. In Kaelum in Sekong Province, from February to June 2000, 215 cases of dysentery were reported, of whom 22 died. This is representative for most parts of the country. This very high rate of mortality is easily preventable with good water supply and public awareness campaigns on hygiene and disease control.

B. Environmental Impact

43. Sediment and sludge from the treatment plants at Pakse and Saravane are discharged into the river downstream of the raw water intake. This has two effects. First, it increases the concentration of sediment and other wastes in the river. This may not be a serious problem for big rivers such as the Mekong, but may become an issue as the size of the water treatment plant increases with population growth. For smaller rivers such as the Sedone in Saravane, the effect may be significant. Second, the waste byproducts of the water treatment plants now include alum (aluminum sulphate) and chlorides that are also disposed of in the river. The environmental impact of these two chemicals is not clear at this time and needs further study. Water treatment plants should incorporate in their design measures that mitigate the environmental impact of discharges.

C. Impact on Institutions and Policy

44. The major effort of the Southern Provincial Towns Water Supply Project at institutional strengthening was provided through a TA.¹¹ The TA had three separate components: human resource development (part A); strengthening of the institutional framework (part B); and a national water tariff study (part C). The objective of part A was to establish training capability in NPL including the development of curricula for training of trainers and in-house training of NPL staff. Part B's objective was to develop an appropriate institutional framework for the operation of the urban water supply sector. And, under part C, water tariff policy was to be reviewed and a cost-recovery framework was to be proposed. The TA was implemented from 1992 to 1996.

¹¹ TA 1606-LAO: *Institutional Strengthening of the Water Supply Sector*, approved on 19 November 1991, for \$630,000.

45. Under part A, a training center was established in NPL in 1992 and a training coordinator appointed. The training center is now used only sporadically because of a lack of trainers. Eleven staff, ranging from plant operators to the general manager, underwent training in Thailand, but only one of the trainees is still available for conducting in-house training in Nam Papa Vientiane where the training center is located. There are no trainers in Attapeu, Saravane, or Sekong. The training was useful although too short and in insufficient numbers, according to MCTPC. The objective of establishing training capability in NPL was achieved but was not sustainable because of the reorganization of NPL in 1998 and staff movements.

46. Part B proposed a new organizational structure for the water supply sector under which NPL was restructured, a board of directors established in NPL, and greater operational and financial autonomy introduced. The TA consultant sought primarily the views of NPL staff when preparing the recommendations and did not sufficiently consult with Government officials. Although the Government took cognizance of the study, reorganization took place in 1998 along other lines. It transferred responsibility for water supply in provincial towns to provincial governments, while responsibility for planning and construction of facilities was left with the newly established Water Supply Authority of the central Government.

47. Under part C, water tariffs were reviewed and recommendations for cost recovery were made. Several recommendations were implemented including introducing separate tariffs for Vientiane and the rest of the country. In 1998, responsibility for tariffs was transferred to the provincial governments along with responsibility for water supply. As a result, tariffs now differ by region, reflecting the different costs of supply. The study's recommendation that Vientiane consumers subsidize consumers in other regions was not implemented.

48. Overall, the TA is rated less than successful. There is still a need for technical training, particularly in the provinces, but the training center in Vientiane cannot meet this need. The proposed reorganization of the water supply sector did not adequately meet the needs of the Government. As a result, the Government implemented its own reorganization. The tariff review was adequate, but was overtaken by events, namely the Government's reorganization of the sector and the transfer of responsibility for tariffs to the provincial governments.

V. OVERALL ASSESSMENT

A. Relevance

49. The Project was generally consistent with ADB's country operational strategy. Moreover, the Project had a poverty-reducing dimension, even though this was not an explicit intention of the country operational strategy. In terms of current ADB strategic priorities, the Project is relevant. However, the Project was inadequately prepared, particularly with respect to the institutional aspects. NPL's finance and accounting systems were not upgraded to international standards and accounting skills of the staff were not strengthened.

B. Efficacy

50. The major objective of the Project of providing potable water supply to four provincial towns was partly achieved. Only about half of the 82,000 intended beneficiaries benefited from the Project.

In Pakse, Project facilities are underutilized because of the water utility's inability to connect more households to the water supply system. In two of the four Project towns (Attapeu and Sekong), the Project did not bring potable water to its residents and there has been no improvement in water supply. Only in Saravane did the Project successfully meet its objectives.

C. Efficiency

51. The high EIRR for the Project as a whole masks some serious shortcomings. There was no economic benefit from the Project in Attapeu and Sekong, and the facilities in Pakse are underutilized.

D. Sustainability

52. The Project is unsustainable. All of the water utilities reported losses in 1998 and 1999 on the income statement. Revenues on the basis of current tariffs are insufficient to cover operating expenses, depreciation, and interest payments. The lack of any financial viability of the water utilities is already affecting the operation of the water supply systems through neglect of necessary maintenance. Water utility staff are also insufficiently trained to provide the necessary maintenance of facilities. There is serious doubt whether the facilities will be able to operate over the full term of the Project's expected economic life.

E. Institutional Development and Other Impacts

53. The Project resulted in some institutional development. The training component of the TA was only partly successful. The TA's proposed reorganization of the water supply sector did not adequately meet the needs of the Government. The tariff review was adequate, but was overtaken by the Government's reorganization of the sector.

F. Overall Project Rating

54. Table 2 summarizes the overall assessment of the Project. The Project is rated as less than successful.¹²

Table 2: Assessment Of Overall Project Performance

Criterion	Assessment	Rating (0-3)	Weight (%)	Weighted Rating
1. Relevance	Relevant	2	20	0.40
2. Efficacy	Less Efficacious	1	25	0.25
3. Efficiency	Less Efficient	1	20	0.20
4. Sustainability	Unlikely	0	20	0.00
5. Institutional Development	Negligible	0	15	0.00
Overall Rating	LS		100	0.85

Assessment Ratings:

Relevance: 3 = highly relevant; 2 = relevant; 1 = partly relevant; 0 = irrelevant.

Efficacy: 3 = highly efficacious; 2 = efficacious; 1 = less efficacious; 0 = inefficacious.

Efficiency: 3 = highly efficient; 2 = efficient; 1 = less efficient; 0 = inefficient.

Sustainability: 3 = most likely; 2 = likely; 1 = less likely; 0 = unlikely.

Institutional Development and Other Impacts: 3 = substantial; 2 = moderate; 1 = little; 0 = negligible.

¹² Agriculture Department West disagrees with this assessment because it feels that the Project should be rated as highly relevant; sustainability as less likely; and institutional development as successful. The PPAR rates the Project as only relevant because of the inadequacy of the Project's design with respect to institutional aspects. Given the weak financial position of the water utilities and the lack of sufficient technical skills of staff, the Project is clearly not sustainable. While there was some positive socioeconomic impact from the Project in Pakse and Saravane, the environmental and institutional impacts were negligible. If any, the environmental impact was negative and the institutional strengthening that was undertaken was not sustainable.

Overall Rating:

HS = highly successful	$2.5 < HS \leq 3.0$
S = successful	$1.6 \leq S \leq 2.5$
LS = less than successful	$0.6 \leq LS < 1.6$
U = unsuccessful	< 0.6

G. Assessment of ADB and Borrower Performance

55. ADB undertook two review missions annually and provided guidance and support to project staff and NPL management. Structured training programs were arranged for two NPL staff in Manila. When difficulties with siltation became apparent, ADB project administration staff engaged an expert in the field from the Asian Institute of Technology in Bangkok to investigate the matter. ADB project administration staff monitored the Project closely and effectively resolved issues that arose. This was greatly appreciated by MCTPC. ADB performance was satisfactory.

56. The Government, MCTPC, and NPL originally lacked the experience and skilled resources to efficiently implement the Project. Although this initially hampered implementation, over time, some capability was developed, and completion of the Project was not seriously affected. Overall, the implementation performance of the Government was satisfactory given the available resources.

VI. ISSUES, LESSONS, AND FOLLOW-UP ACTIONS

A. Key Issues for the Future

57. Where projects fail to deliver the expected output because of faulty design at the project implementation stage, the responsible firm should be held accountable. Such was the case with the Project in Attapeu and Sekong. The engineering consulting firm in charge of project implementation proposed a design that was inappropriate and consequently the constructed facilities are ineffective or not in use. From a contractual (legal) point of view, the engineering firm failed to fulfill the conditions of its contract with the Government. The normal procedure is for the engineering firm to remedy the situation. However, the Government did not contact the engineering firm and begin discussions on possible remedies because it did not know its legal rights. In such situations, ADB should assist governments in explaining their legal rights and obligations, and in advising on a course of action.

B. Lessons Identified

58. The technology of water supply is well developed and established in developed countries. Although designs of water supply systems are relatively standard, they need to take into account local conditions, particularly in developing countries where geological and environmental conditions vary greatly. Siltation of rivers is a well-known phenomenon in Asia and water supply designs need to incorporate data on water characteristics, such as turbidity, during project preparation or implementation when major design changes are being considered. Therefore, the collection of hydrological data for at least one and preferably two or more years should be mandatory before any design is proposed. The design of water treatment plants should also incorporate features that mitigate the environmental impact of the plants' discharges.

59. The amount of consulting services provided under a project is directly related to the project's rate of success. An inadequate amount of engineering consulting services for design and supervision usually leads to project failure as was experienced in Attapeu and Sekong where much of the design and supervision work depended on one project implementation consultant. A thorough

needs analysis of engineering design and supervision for a project's implementation should always be undertaken. The assessment should include capabilities of the local staff who are to participate in the project's implementation.

60. The successful operation of a water utility depends on skilled and experienced staff. Therefore, project design needs to make adequate provision for staff training based on a thorough needs analysis. Some developing countries, such as those in transition from central planning to a market orientation, may need more institutional strengthening than the average. In such cases, a relatively greater amount of technical assistance may be necessary in the initial projects in the sector to create a critical mass of skilled staff to ensure the proper operation and maintenance of the project facilities.

61. Institutional strengthening also needs to address the financial information issues of a water utility. Timely financial information is crucial for decision making and ensuring that sufficient resources are available for day-to-day operations, as well as resources for capital investment; it is also required to justify increases in tariffs. Management information systems need to be put in place when they are lacking, and staff trained in accounting and finance and the use of these systems. Initially, a relatively greater amount of technical assistance may also be required to develop the skilled staff necessary to ensure proper financial operation.

C. Follow-Up Actions

62. Project administration staff in ADB's Agriculture and Social Sectors West Department and Office of the General Counsel should assist as soon as possible the Water Supply Authority in finding a remedy for the nonperformance of the water supply facilities constructed under the Project in Attapeu and Sekong. The engineering firm that designed and supervised construction of these facilities is likely to have legal responsibility for rectifying the problems or for providing some compensation. These issues should be looked into by the Office of the General Counsel, and the Government advised accordingly. If no remedies are proposed by the engineering firm, consideration should be given to financing a water treatment plant in Attapeu¹³ out of funds under the ongoing Water Supply and Sanitation sector loan.¹⁴

63. Given the precarious financial position of the water utilities in Pakse, Attapeu, Saravane, and Sekong, project administration staff in Agriculture and Social Sectors West Department should closely monitor compliance with the Project's loan covenants dealing with debt-service ratios in these four towns. The debt-service covenant for Pakse is not complied with. In Attapeu, Saravane, and Sekong, this covenant comes into effect in 2000 and, based on preliminary 2000 financial data for these water utilities, will not be complied with. Project administration staff should encourage the Government to raise water tariffs in 2001 in Pakse and Saravane to levels that comply with the Project's loan covenants, and to raise water tariffs in Attapeu and Sekong when project facilities become operational.

64. The benefit monitoring and evaluation system established during project implementation is not operational. Project administration staff in Agriculture and Social Sectors West Department should assist as soon as possible the Water Supply Authority to ensure that the benefit monitoring and evaluation system functions properly.

¹³ NORAD is financing a water treatment plant in Sekong (para. 32).

¹⁴ Loan 1710-LAO(SF): *Water Supply and Sanitation*, approved on 16 November 1999, for \$20 million.

APPENDIXES

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COMPARISON OF PROJECT COSTS AT APPRAISAL WITH ACTUAL COSTS
(\$ million)

Project Components	At Appraisal			Actual Financing			
				ADB		Government	
	Foreign	Local	Total	Foreign	Local	Local	Total
1. Part A: Pakse Water Supply	3.850	0.770	4.620	4.002	0.180	1.113	5.295
Land	0.000	0.030		0.000	0.000	0.354	0.354
Civil Works	1.610	0.540		2.767	0.180	0.759	3.706
Equipment & Materials	2.240	0.200		1.235	0.000	0.000	1.235
2. Part B: Attapeu Water Supply	0.560	0.120	0.680	0.862	0.056	0.178	1.096
Land	0.000	0.020		0.000	0.000	0.009	0.009
Civil Works	0.260	0.070		0.831	0.056	0.169	1.056
Equipment & Materials	0.300	0.050		0.031	0.000	0.000	0.031
3. Part C: Saravane Water Supply	0.540	0.140	0.680	0.818	0.054	0.272	1.144
Land	0.000	0.020		0.000	0.000	0.027	0.027
Civil Works	0.250	0.070		0.818	0.054	0.245	1.117
Equipment & Materials	0.290	0.050		0.000	0.000	0.000	0.000
4. Part D: Sekong Water Supply	0.800	0.180	0.980	0.498	0.014	0.124	0.636
Land	0.000	0.020		0.000	0.000	0.017	0.017
Civil Works	0.330	0.080		0.229	0.014	0.107	0.350
Equipment & Materials	0.470	0.080		0.269	0.000	0.000	0.269
5. Part E: Institutional Support- Establish PMU & PIOs and Support to NPL	0.720	0.160	0.880	0.596	0.162	0.245	1.003
a. Equipment, materials and vehicles	0.500	0.010		0.596	0.040	0.231	0.867
b. Staff salaries and office supplies	0.220	0.150		0.000	0.122	0.014	0.136
6. Part F: Consulting Services	1.030	0.480	1.510	1.665	0.000	0.000	1.665
7. Service Charge During Construction	0.120	0.700	0.820	0.131	0.000	0.000	0.131
8. Prior Technical Assistance Cost	0.100	0.000	0.100	0.072	0.000	0.000	0.072
9. Unallocated	1.180	0.550	1.730	0.000	0.000	0.000	0.000
Total	8.900	3.100	12.000	8.644	0.466	1.932	11.042

NPL = Nam Papa Lao; PIO = project implementation office; PMU = project management unit.

Source: Asian Development Bank.

IMPLEMENTATION SCHEDULE

Item	1992				1993				1994				1995				1996				1997			
	I	II	III	IV																				
Part A: Pakse Water Supply Development																								
Investigation and Survey	■	■																						
Design and Drawing		■	■		■	■	■	■																
Rehabilitation of Existing Water Treatment Plant		■	■										■	■	■	■	■	■	■	■				
Procurement of Equipment for Force Account Work						■	■		■	■	■	■	■	■	■	■								
Tender Process			■	■	■	■	■																	
Supply Contracts					■	■	■	■	■	■	■	■												
Civil Works Contracts					■	■	■	■	■	■	■	■												
Construction									■	■	■	■	■	■	■	■								
Commissioning															■	■								
																					■	■	■	■
Parts B, C & D: Attapeu, Saravane, and Sekong																								
Investigation and Survey		■	■		■	■	■																	
Design and Drawing		■	■		■	■	■																	
Procurement of Equipment for Force Account Work						■	■		■	■	■	■	■	■	■	■								
Tender Process					■	■	■																	
Supply Contract									■	■	■	■												
Civil Works Contracts					■	■	■	■	■	■	■	■												
Construction									■	■	■	■	■	■	■	■								
Commissioning															■	■								
																					■	■	■	■
Part E: Institutional Support																								
Support to Nam Papa Lao		■	■		■	■	■		■	■	■	■	■	■	■	■								
		■	■		■	■	■		■	■	■	■	■	■	■	■								
Part F: Consulting Services																								
Engineering Design and Supervision	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■								
	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■								

■ - Planned
 ■ - Actual

^a Contract includes rehabilitation of the existing and construction of a new treatment plant.
 Source: Asian Development Bank.

STATUS OF COMPLIANCE WITH MAJOR LOAN COVENANTS

Covenant	Status
A. Loan Agreement (LA)	
1. The Borrower will make available to the Ministry of Communication, Transport, Post and Construction (MCTPC) and the Nam Papa Lao (NPL) promptly, as needed the funds, facilities, services, land, and other resources required for the carrying out of the Project. (LA, Section 4.02)	Complied with. The Government's contribution to NPL for Pakse was financed by short-term commercial loans. In the case of the three other towns, the contribution was funded through provincial budgets.
2. The Borrower will cause to be established, within one month of the effective date, an imprest account to facilitate timely disbursements of the proceeds of the loan to meet expenditures under the Project. (LA, Schedule 3, para. 9)	Complied with.
3. Within 90 days of the effective date, NPL will establish a project management unit (PMU) and a project implementation office (PIO) in each of the four project towns and appoint a works supervisor as head of each PIO. NPL shall appoint in a timely manner to each PIO full-time staff with appropriate qualifications and experience. (LA, Schedule 6, paras. 2 [a] and [c])	Complied with.
4. Within 90 days of the effective date, a Project manager with qualifications and experience satisfactory to the Asian Development Bank (ADB) will be appointed to work full time. (LA, Schedule 6, para. 2 [b])	Complied with.
5. Within 90 days of the effective date, the Borrower will establish a Project Implementation Coordination Committee, which will meet at least quarterly. (LA, Schedule 6, para. 3)	Complied with.
6. The Borrower and NPL will take all necessary measures including appropriate and timely approval of tariffs for NPL to ensure that the water supply systems in the four project towns produce sufficient revenues to meet the prescribed financial obligations. (LA, Schedule 6, para. 6 [a])	Not complied with.
7. The Borrower, ADB, and NPL will review tariff increases within three months of receipt of the report and recommendations of the National Water Tariff Study under TA 1606-LAO. If necessary after such review, the Borrower may adjust the above tariff increases to an appropriate level in consultation with the ADB. (LA, Schedule 6, para. 6[b])	Complied with. The review was undertaken, and increases became effective in 1995 and in 1998.

Covenant	Status
8. The Borrower will contribute equity to NPL in the equivalent of at least the following amounts in the following years: (i) 1992: \$26,000; (ii) 1993: \$16,000; (iii) 1994: \$15,000; (iv) 1995: \$260,000; (v) 1996: \$169,000; (vi) 1997: \$135,000; and (vii) 1998: \$42,000. (LA, Schedule 6, para. 7)	Complied with. In 1997, NPL's commitment to the Government amounting to \$0.625 million equivalent was reduced to approximately \$0.208 million equivalent as compensation. Equity contribution was made by the Government in 1997.
9. The Borrower and NPL will improve NPL's collection efficiency in each of the four project towns to less than 90 days of annual sales within one year after the commissioning of project facilities in each of the respective project towns. (LA, Schedule 6, para. 8)	Partly complied with. This was achieved with NPL's private consumers. However, there are still problems in collecting revenue from public sector institutions.
10. Within three months of receipt of the report and recommendations of the National Water Tariff Study, the Borrower and NPL will review NPL's policy on charges for connection fees and the adequacy of the structure of such connection fees and implement in a timely manner appropriate changes in such fees taking into account ADB's comments thereon. (LA, Schedule 6, para. 9)	Complied with. Connections costs are recovered in full from consumers.
11. Within three years of the effective date, MCTPC and NPL will complete, with the assistance of Project consultants, a comprehensive report analyzing water losses and unaccounted-for-water in the water supply systems of the four project towns, and containing a strategy and a phased action plan to reduce within one year of date of the commissioning of the project facilities in the four project towns the amount of losses and nonrevenue water (NRW) to less than 25 percent of water production in Pakse and 20 percent in Attapeu, Saravane, and Sekong. (LA, Schedule 6, para. 10)	Not complied with. Final NRW report was produced in March 1997. NPL conducted training of its staff in NRW reduction. A NRW reduction plan was approved by its board of directors. However, water losses and NRW exceed the covenanted limits in the four towns.
12. The Borrower will exempt MCTPC and NPL from, or bear the cost of, any taxes, duties, fees, or other impositions in respect of: (i) any equipment, vehicles, materials, and supplies brought into the territories of the Borrower for the purpose of carrying out the Project; (ii) any payments made to the project consultants who are not citizens or nationals of the Borrower in connection with the carrying out of the Project; and	Complied with.

Covenant	Status
(iii) any personal effects including automobiles, if required, of the project consultants and their families brought into the territories of the Borrower. (LA, Schedule 6, para. 11[a])	Complied with.
13. Within 90 days of the effective date, the Borrower will grant NPL necessary two-way radio licenses to enable NPL to communicate with each of the four project towns. (LA, Schedule 6, para. 12)	Complied with.
14. NPL will undertake a public information campaign prior to the commissioning of the project facilities with a view to educating the general public on the proper use of water, the health aspects of water use, water conservation, and the importance of prompt payment of water bills in contributing to a higher level of customer service. (LA, Schedule 6, para. 13)	Complied with.
15. Within two years of the effective date, the Borrower and NPL will, in consultation with ADB, conduct a mid-term review of the implementation of the project to assess the overall progress made and to make appropriate adjustments in the project design or implementation arrangements, as necessary. (LA, Schedule 6, para. 14)	Complied with.
16. The Borrower will cause NPL to carry out the benefit monitoring and evaluation (BME) program and submit to ADB annually a BME report within three months of the end of each financial year concerned. NPL will implement the BME in a manner consistent with ADB's <i>BME Guidelines</i> . (LA, Schedule 6, para. 15)	Not complied with. The BME system is not operational.
17. In the design, construction, operation and maintenance of the project facilities, the Borrower and NPL will take necessary steps to avoid adverse consequences to agricultural land, important cultural and historic sites, and the natural environment. Whenever possible, alternative locations will be considered to avoid such adverse consequences. In the design of project facilities, NPL will adhere to the ADB's latest <i>Environmental Guidelines for Infrastructure Projects</i> . (LA, Schedule 6, para. 16)	Complied with.
B. Project Agreement (PA)	
18. (a) NPL will take out insurance on the project facilities to such extent and against such risks	Complied with.

Covenant	Status
and in such amounts as shall be consistent with sound practice.	
(b) NPL will take out insurance for imported goods for the Project against hazards incident to the acquisition, transportation, and delivery thereof to the place of use or installation. (PA, Section 2.05)	Complied with.
19. NPL will furnish to ADB quarterly and annual reports, in the prescribed format, on the execution of the Project and on the operation and management of the project facilities. The fourth quarterly report of each year will be combined with the annual report. (PA, Section 2.08[b])	Complied with.
20. NPL will prepare and furnish to ADB not later than three months after physical completion of the Project, a report on the execution and initial operation of the Project, including its cost, and performance by NPL of its obligations under this Project Agreement, and the accomplishment of the purposes of the loan. (PA, Section 2.08[c])	Complied with.
21. NPL will: <ul style="list-style-type: none"> <li data-bbox="264 1115 894 1173">(i) maintain separate accounts for the Project and for its overall operations; <li data-bbox="264 1207 894 1266">(ii) have such accounts and related financial statements audited annually; and <li data-bbox="264 1299 894 1539">(iii) furnish to ADB, within six months after the close of the related fiscal year, unaudited copies of such (1) accounts and (2) financial statements, and within 12 months, certified copies of such audited accounts and financial statements and the report of the auditors relating thereto, all in the English language. (PA, Section 2.09[a]) 	Complied with.
22. NPL shall conduct an annual review of water rates and maintain: <ul style="list-style-type: none"> <li data-bbox="264 1661 894 1810">(i) for the water supply system in Attapeu, Saravane and Sekong respectively, a debt-service coverage ratio commencing in FY2000 and thereafter of at least 1:1 for each fiscal year during the term of this Agreement; 	Not yet due. Preliminary financial data for 2000 shows that this covenant will not be complied with.

Covenant	Status
(ii) for the water supply system in Pakse a debt-service coverage ratio in FY1995, FY1996 and FY1997 of at least 1:1 and commencing in FY1998 and thereafter of at least 1.5:1 for each fiscal year during the term of this Agreement; and	Not complied with.
(iii) for the water supply system in Vientiane a debt-service coverage ratio commencing in FY1992 and thereafter of at least 1.2:1 for each year during the term of this Agreement. (PA, Section 2.14)	Complied with in each year except 1999.

NAM PAPA VIENTIANE FINANCIAL STATEMENTS

Table A4.1: Income Statement
(year ending 31 December, KN million)

Item	1995	1996	1997	1998	1999
Operating Revenue					
Water Sales	2,116.2	2,721.8	3,164.6	4,429.8	5,486.6
New Connections	162.7	197.5	538.1	673.6	1,208.1
Other Income	154.0	203.6	495.9	920.2	3,498.3
Total Operating Revenue	2,432.9	3,122.9	4,198.6	6,023.6	10,193.0
Operating Costs					
Personnel	251.4	300.4	389.3	529.3	728.7
Electricity	179.5	210.4	269.4	571.1	1,272.8
Chemicals	202.8	224.3	196.0	479.8	1,578.9
Other Materials	326.9	403.0	634.5	1,321.6	3,465.7
Depreciation	237.7	528.0	1,181.4	1,309.8	1,550.5
Miscellaneous and Administration	184.6	260.5	380.9	568.5	1,687.4
Total Operating Costs	1,382.9	1,926.6	3,051.5	4,780.1	10,284.0
Net Operating Income	1,050.0	1,196.3	1,147.1	1,243.5	(91.0)
Less: Non Operating Expenses					
Interest Charges	762.7	887.1	1,100.3	1,140.5	1,024.2
Net Income Before Tax	323.3	309.2	46.8	103.0	(1,115.2)
Income Tax	145.4	108.2	16.3	36.0	0.0
Net Income	177.8	200.9	30.4	66.9	(1,115.2)
Debt Service Ratio	1.71	1.89	2.01	2.05	1.08

Source: Nam Papa Vientiane.

Table A4.2: Balance Sheet
(year ending 31 December, KN million)

Item	1995	1996	1997	1998	1999
Assets					
Fixed Assets	2,643.5	17,443.4	18,474.8	19,053.7	29,091.0
Gross Fixed Assets					
Less: Accumulated Depreciation					
Depreciation	1,187.5	1,622.3	2,522.3	3,584.0	5,032.6
Net Fixed Assets	1,456.0	15,821.1	15,952.5	15,469.7	24,058.4
Current Assets					
Cash	248.4	188.1	945.0	557.3	1,328.9
Accounts Receivable	669.6	991.3	1,555.4	1,664.2	3,084.9
Inventory	634.0	1,268.8	2,145.4	1,959.9	3,239.8
Prepayment and Other Receivables	118.3	113.1	105.7	2,513.5	2,089.7
Total Current Assets	1,670.3	2,561.3	4,751.5	6,694.9	9,743.3
Total Assets	3,126.3	18,382.4	20,704.0	22,164.6	33,801.7
Liabilities and Equity					
Liabilities					
Loan ADB and JICA	0.0	7,208.0	7,062.5	6,906.4	17,676.6
Interest Payable	652.7	1,273.2	2,042.3	2,744.2	3,634.3
Commercial Loan-Setha Thirad Bank	0.0	50.7	1,761.4	1,753.5	782.6
Creditors	112.5	228.0	54.4	14.5	206.6
Accounts Payable	390.9	485.9	188.5	444.5	2,234.2
Other Liabilities	152.4	47.9	78.8	86.3	39.8
Total Liabilities	1,308.5	9,293.7	11,187.9	11,949.4	24,574.1
Equity					
Government Equity	528.7	7,637.4	7,639.9	7,641.0	7,645.3
Capital and Other Reserves	1,111.3	1,250.2	1,829.4	2,471.6	2,697.5
Profit for the Year	177.8	201.1	46.8	102.6	(1,115.2)
Total Equity	1,817.8	9,088.7	9,516.1	10,215.2	9,227.6
Total Liabilities and Equity	3,126.3	18,382.4	20,704.0	22,164.6	33,801.7
Debt/Equity Ratio	0.72	1.02	1.18	1.17	2.66

Source: Nam Papa Vientiane.

ECONOMIC AND FINANCIAL REEVALUATION

A. Measuring the Household's Willingness to Pay for Water

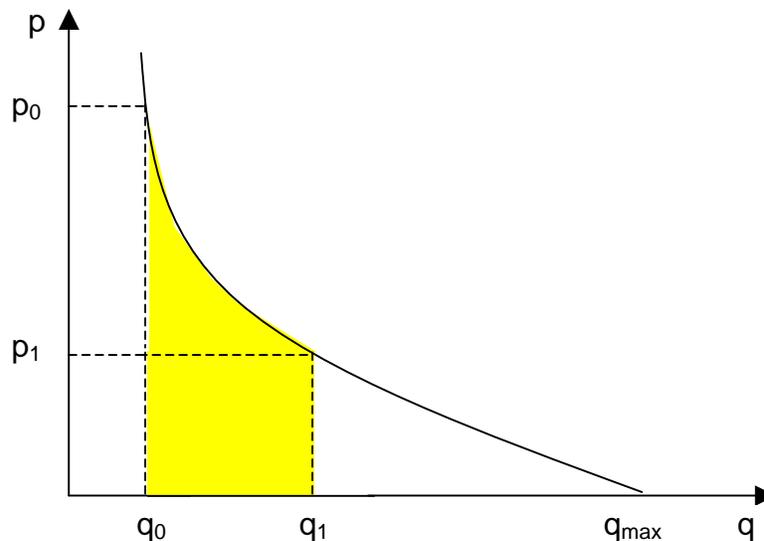
1. The measurement of a household's willingness to pay for goods or services for which there is a saturation point or finite demand even at zero price, such as water, relies on a reliable estimate of a demand function. However, standard microeconomic theory falls short in providing a plausible framework within which such estimation could be made. Empirical work to date has generally tended toward assuming that the demand for goods has no saturation point. Many demand models assume a constant price elasticity which implies infinite demand at prices approaching zero. Moreover, some single equation and demand system models do not allow for the possibility of goods at zero price because the price variable is in logarithmic form for which zero is undefined. It is intuitive that, even at zero price, the demand for some goods and services would be finite.

2. A functional form for the demand for water by a household should incorporate three characteristics. First, it should be negatively sloped with respect to price, as economic theory suggests for a normal good. Second, it should be a smooth and continuous function. And third, it should intercept the abscissa to allow for the finiteness of the demand for water. The class of functions that meets these conditions is

$$q = e^{(\alpha + \beta p)}$$

where q is the quantity of water demanded, p is the price in real terms, and $\alpha > 0$, $\beta < 0$. Figure 1 illustrates this graphically. The economic benefit of the incremental quantity ($q_0 - q_1$) is the area beneath the demand curve between q_0 and q_1 .

Figure A5.1: Household Demand for Water



3. The upper bound of water demand (when the price is zero) is given by e^α and β is the price semi-elasticity of demand. The price elasticity is given by

$$\eta_p = (dq/dp)(p/q) = \beta p$$

which varies with the price level, as may be expected. This functional form also has the desirable property that, as demand falls, willingness to pay rises rapidly, as suggested by economic theory.

4. This functional form readily lends itself to calculating the economic benefit (EB) of water, which is simply the area beneath the demand curve (1), that is,

$$EB = \int_{q_0}^{q_1} p \, dq$$

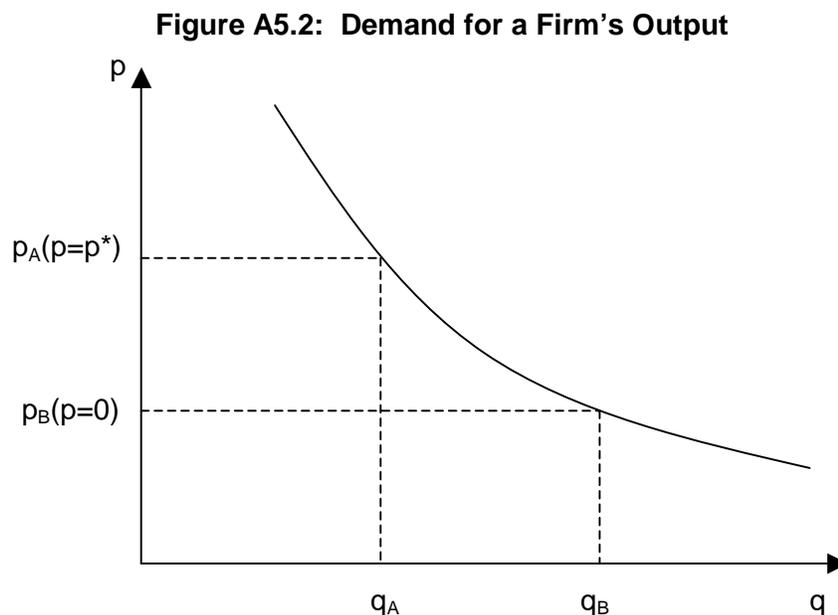
Integrating with respect to q results in an economic benefit of

$$EB = q_1(p_1 - 1/\beta) - q_0(p_0 - 1/\beta)$$

The parameter β is not dimensionless as in the constant elasticity case and is valued in terms of quantity units per currency unit.

B. Measuring the Firm's Willingness to Pay for Water

5. For a firm, water is a factor input in the production process and thus the amount of water demanded by a firm depends on the level of the firm's output. The relationship between water demand and the firm's output is determined by technological factors. The demand for a firm's output is a function of its price, that is, the cost of production in market equilibrium. This is represented by p_A in Figure 2. The price of the firm's output subsumes the price of water, p^* .



6. If the price of water is allowed to fall to zero (*ceteris paribus*), the cost of producing the firm's output will also fall and, assuming a competitive environment, the price that could be charged would fall to p_B . Thus, with a fall in the price to p_B , the demand for the firm's output will increase, as economic theory suggests, and the demand for water will also increase by some proportion of $q_B - q_A$. As long as no other components of the production cost change, the demand for water will not increase beyond the amount needed to produce q_B and thus an upper bound on water demand is reached. This implies that the demand for water function should have the same characteristics as the household function, namely, it should be negatively sloped with respect to price; it should be smooth and continuous; and it should intercept the abscissa. Therefore, it should fall into the same class of demand functions as (1).

C. Estimating Demand for Water Functions

1. Pakse

7. Data collected in August 2000 on domestic water demand in Pakse shows that consumers not connected to the water supply system are willing to pay KN1,000 for a 20-liter bottle of drinking water, or KN50 per liter, and consume about one liter of water per day or 30 liters per month. Based on Pakse water utility data for 2000, consumers are also willing to pay KN0.288 per liter for average monthly consumption of 5,195 liters. From this data, the estimated parameters of (1) for Pakse are $\alpha = 8.585$ and $\beta = -0.104$.

2. Saravane

8. Data collected in Saravane in August 2000 shows that domestic consumers not connected to the water supply system are also willing to pay KN1,000 for a 20-liter bottle of drinking water, or KN50 per liter and that individuals consume about 30 liters of drinking water per month based on a one liter per day consumption rate. From Saravane water utility data for 2000, consumers' willingness to pay for average monthly consumption of 4,454 liters is KN0.634 per liter. From this data, the estimated parameters of (1) for Saravane are $\alpha = 8.466$ and $\beta = -0.101$.

D. Valuation of Economic Benefits

9. The Project's economic benefits accrue to domestic and nondomestic consumers from two sources: resource cost savings and incremental benefits of additional water supply. Resource cost savings are economic benefits of switching from higher-cost bottled drinking water to lower-cost water produced by the Project. In the case of Pakse and Saravane, the annual resource cost savings in 2000 prices for each individual are valued at KN18,250 (KN50 per liter times 365 liters per year). This valuation is also used for the years prior to 2000 because of the lack of data on the cost of bottled drinking water, and for later years, on the basis that the cost of bottled drinking water will not increase in real terms.

10. Incremental economic benefits of additional water supply are determined by comparing *with* and *without* Project cases. Incremental water supply (net of losses) is apportioned to the displacement of bottled drinking water, to the additional demand of existing consumers, and to the demand of new consumers. The valuation of the economic benefits of additional demand of existing consumers and new consumers is estimated using equation (4). Nondomestic consumers' demand is assumed to be inelastic. Therefore, economic benefits are in terms of revenue alone. All economic benefits are adjusted by a standard conversion factor of 0.9.

E. Estimation of the Economic Internal Rate of Return

11. The economic internal rate of return (EIRR) calculation values the capital costs in 2000 prices and adjusts the nontradable goods component of the capital cost by a standard conversion factor of 0.9. Data on operation and maintenance for the project components were not available, so estimates based on the appraisal report were used. Even if data were available, the Pakse and Saravane water utilities spend an insufficient amount on operation and maintenance because of shortfalls in revenues from their operations. Therefore, estimates reflecting full operation and maintenance costs are appropriate for the analysis. Since the Project is likely unsustainable, the economic life of the Project at Pakse and Saravane is reduced to 12 years. The EIRR for the Pakse component of the Project is estimated at 25.1 percent in real terms. Details of the calculation are found in Table A5.1. The EIRR for the Saravane component of the Project is estimated at 24.6 percent, and 20.0 percent for the Project as a whole. Details for the EIRR calculation for Saravane and the Project as a whole are found in Tables A5.2 and A5.3, respectively.

Table A5.1: Calculation of the Economic Internal Rate of Return for Pakse
(KN million in constant 2000 prices)

Year	Capital Cost	O&M Cost	Total Cost	Domestic Benefits			Non-domestic Revenue	Total Economic Benefits	Net Economic Benefits
				Resource Cost Savings	Incremental Benefits				
					Existing Consumers	New Consumers			
1992	140		140					(140)	
1993	1,467		1,467					(1,467)	
1994	5,859		5,859					(5,859)	
1995	15,733		15,733					(15,733)	
1996	14,929		14,929					(14,929)	
1997	2,883	1,440	4,323	499	2,463	1,085	401	4,448	124
1998		1,440	1,440	549	9,074	2,804	247	12,674	11,234
1999		1,440	1,440	611	9,138	4,839	89	14,678	13,238
2000		1,440	1,440	673	9,661	6,874	52	17,260	15,820
2001		1,440	1,440	706	9,661	7,945	52	18,364	16,924
2002		1,440	1,440	739	9,661	9,016	52	19,468	18,028
2003		1,440	1,440	772	9,661	10,100	52	20,584	19,144
2004		1,440	1,440	808	9,661	11,277	54	21,801	20,361
2005		1,440	1,440	854	9,661	12,769	57	23,341	21,901
2006		1,440	1,440	900	9,661	14,278	58	24,898	23,458
2007		1,440	1,440	900	9,661	14,278	58	24,898	23,458
2008		1,440	1,440	900	9,661	14,278	58	24,898	23,458
EIRR =								25.1%	

O&M = operation and maintenance.

Source: Asian Development Bank estimates.

Table A5.2: Calculation of the Economic Internal Rate of Return For Saravane
(KN million in constant 2000 prices)

Year	Capital Cost	O&M Cost	Total Cost	Domestic Benefits			Non-domestic Revenue	Total Economic Benefits	Net Economic Benefits
				Resource Cost Savings	Incremental Benefits				
					Existing Consumers	New Consumers			
1992									
1993									
1994									
1995	1,624		1,624					(1,624)	
1996	3,509		3,509					(3,509)	
1997	4,247	279	4,526	73	1,491	160	37	1,760	(2,766)
1998		279	279	78	1,862	304	34	2,277	1,998
1999		279	279	84	1,673	481	7	2,245	1,966
2000		279	279	94	1,714	717	9	2,533	2,254
2001		279	279	100	1,714	945	12	2,771	2,492
2002		279	279	108	1,714	1,172	13	3,007	2,728
2003		279	279	118	1,714	1,491	16	3,339	3,060
2004		279	279	130	1,714	1,844	18	3,706	3,427
2005		279	279	140	1,714	2,142	21	4,016	3,737
2006		279	279	151	1,714	2,485	23	4,373	4,094
2007		279	279	164	1,714	2,875	26	4,779	4,500
2008		279	279	177	1,714	3,241	28	5,160	4,881
								EIRR =	24.6%

O&M= operation and maintenance.

Source: Asian Development Bank estimates.

F. Estimation of the Financial Internal Rate of Return

12. The estimation of the financial internal rate of return (FIRR) uses accounting data for the project costs and actual revenues from 1997 to 1999. From 2000 onwards, revenues are based on the 2000 water tariff and are assumed not to increase in real terms thereafter. As net cash flows over the estimation period are generally negative, a calculation of the FIRR is not possible. However, the net present values (NPVs) of the Project in Pakse, Saravane and the Project as a whole are estimated. In each case, the NPV is negative. Tables A5.4-6 provide details. Since the Project resulted in no incremental revenue to the water utilities in Attapeu and Sekong, the NPVs of these project components are also negative.

Table A5.3: Calculation of the Economic Internal Rate of Return for the Project
(KN million in constant 2000 prices)

Year	Capital Cost	O&M Cost	Total Cost	Domestic Benefits			Non-domestic Revenue	Total Economic Benefits	Net Economic Benefits
				Resource Cost Savings	Incremental Benefits				
					Existing Consumers	New Consumers			
1992	140		140					(140)	
1993	1,852		1,852					(1,852)	
1994	9,579		9,579					(9,579)	
1995	20,799		20,799					(20,799)	
1996	22,665		22,665					(22,665)	
1997	9,832	1,719	11,551	572	3,954	1,245	437	6,208	(5,343)
1998		1,719	1,719	627	10,936	3,107	281	14,951	13,232
1999		1,719	1,719	695	10,811	5,320	96	16,922	15,203
2000		1,719	1,719	767	11,375	7,591	60	19,793	18,074
2001		1,719	1,719	806	11,375	8,890	64	21,136	19,417
2002		1,719	1,719	847	11,375	10,188	65	22,475	20,756
2003		1,719	1,719	890	11,375	11,591	67	23,923	22,204
2004		1,719	1,719	938	11,375	13,120	74	25,507	23,788
2005		1,719	1,719	994	11,375	14,911	78	27,357	25,638
2006		1,719	1,719	1,051	11,375	16,763	82	29,271	27,552
2007		1,719	1,719	1,064	11,375	17,053	84	29,677	27,958
2008		1,719	1,719	1,077	11,375	17,520	87	30,058	28,339
EIRR =								20.0%	

O&M = operation and maintenance.

Source: Asian Development Bank estimates.

Table A5.4: Calculation of the Net Present Value of the Project in Pakse
(KN million in constant 2000 prices)

Year	Capital Cost	O&M Cost	Total Cost	Revenues		Total Revenues	Net Revenues
				Domestic	Other		
1992	140		140				(140)
1993	1,467		1,467				(1,467)
1994	5,859		5,859				(5,859)
1995	16,043		16,043				(16,043)
1996	15,243		15,243				(15,243)
1997	2,883	1,600	4,483	125	447	572	(3,911)
1998		1,600	1,600	461	274	736	(864)
1999		1,600	1,600	378	99	477	(1,123)
2000		1,600	1,600	380	54	435	(1,165)
2001		1,600	1,600	414	58	472	(1,128)
2002		1,600	1,600	452	58	509	(1,091)
2003		1,600	1,600	492	58	550	(1,050)
2004		1,600	1,600	537	58	594	(1,006)
2005		1,600	1,600	585	58	643	(957)
2006		1,600	1,600	636	58	694	(906)
2007		1,600	1,600	636	58	694	(906)
2008		1,600	1,600	636	58	694	(906)
						FIRR =	—
						NPV =	(30,377.71)

— = not calculated; O&M = operation and maintenance.

Source: Asian Development Bank estimates.

Table A5.6: Calculation of the Net Present Value of the Project
(KN million in constant 2000 prices)

Year	Capital Cost	O&M Cost	Total Cost	Revenues		Total Revenues	Net Revenues
				Domestic	Other		
1992	140		140				(140)
1993	1,852		1,852				(1,852)
1994	9,642		9,642				(9,642)
1995	21,241		21,241				(21,241)
1996	23,112		23,112				(23,112)
1997	9,946	1,910	11,856	162	487	649	(11,207)
1998		1,910	1,910	504	312	817	(1,093)
1999		1,910	1,910	470	107	577	(1,333)
2000		1,910	1,910	493	64	557	(1,353)
2001		1,910	1,910	547	71	618	(1,292)
2002		1,910	1,910	602	73	674	(1,236)
2003		1,910	1,910	665	75	740	(1,170)
2004		1,910	1,910	738	78	816	(1,094)
2005		1,910	1,910	815	81	896	(1,014)
2006		1,910	1,910	895	84	979	(931)
2007		1,910	1,910	924	86	1,011	(899)
2008		1,910	1,910	951	89	1,041	(869)
						FIRR =	—
						NPV =	(44,249.93)

— = not calculated; O&M = operation and maintenance.
Source: Asian Development Bank estimates.