

**REPORT AND RECOMMENDATION OF THE
PRESIDENT TO THE
BOARD OF DIRECTORS ON A
PROPOSED LOAN TO
PAPUA NEW GUINEA FOR THE
PROVINCIAL TOWNS WATER SUPPLY AND SANITATION PROJECT
AND A PROPOSAL FOR
ADMINISTERING A GRANT FROM THE
JAPAN FUND FOR POVERTY REDUCTION TO
PAPUA NEW GUINEA FOR
LOW-COST SANITATION, COMMUNITY AWARENESS AND
HEALTH EDUCATION**

November 2000

CURRENCY EQUIVALENTS

(as of 14 October 2000)

| | | |
|---------------|---|----------|
| Currency Unit | – | Kina (K) |
| K1.00 | – | \$0.35 |
| \$1.00 | – | K2.89 |

For the purpose of calculations in this report, an exchange rate of K2.50 to \$1.00 (K1.00-\$0.40), the rate prevailing during appraisal, has been used.

ABBREVIATIONS

| | | |
|--------|---|---|
| ADB | - | Asian Development Bank |
| AusAID | - | Australian Agency for International Development |
| CAHE | - | community awareness and health education |
| CBD | - | central business district |
| CU | - | coordination unit |
| DOH | - | Department of Health |
| DOW | - | Department of Works |
| DPM | - | Department of Planning and Monitoring |
| EA | - | executing agency |
| EIRR | - | economic internal rate of return |
| FIRR | - | financial internal rate of return |
| IEE | - | initial environmental examination |
| IU | - | implementation unit |
| JFPR | - | Japan Fund for Poverty Reduction |
| K | - | Kina |
| KL | - | kiloliters |
| LCS | - | low-cost sanitation |
| MTDS | - | medium term development strategy |
| NGO | - | non government organization |
| NWSS | - | National Water Supply and Sewerage Act |
| O & M | - | operation and maintenance |
| PDMC | - | Pacific Developing Member Countries |
| PMU | - | project management unit |
| PNG | - | Papua New Guinea |
| PPMS | - | project performance management system |
| PPTA | - | Project Preparatory Technical Assistance |
| PSC | - | project steering committee |
| PTCC | - | provincial town coordination committee |
| PTIU | - | provincial town implementing unit |
| SOE | - | state owned enterprise |
| TA | - | technical assistance |
| VIPL | - | ventilated improved pit latrine |

NOTES

- (i) The fiscal year (FY) of the Government and its agencies ends on 31 December.
- (ii) In this report, "\$" refers to US dollars.

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LOAN AND PROJECT SUMMARY

| | |
|---------------------------------|--|
| Borrower | Papua New Guinea (PNG) |
| Project Description | <p>The Project comprises two highly complementary parts made possible as a result of Japan Fund for Poverty Reduction (JFPR) grant financing. It will provide piped water supplies, sewerage and sewage treatment (new or upgrading of existing systems and expanding coverage) to six selected provincial towns, capacity building for the PNG Waterboard, and support for selected sector policy measures. In addition, a low-cost sanitation, community awareness and health education (LCS-CAHE) program will be implemented to provide (i) affordable options (e.g. ventilated improved pit latrines) for on-site sanitation to low-income households, and (ii) community awareness and health education.</p> |
| Classification | Primary : Human development Secondary : Environment |
| Environmental Assessment | Category B An initial environmental examination (IEE) was undertaken, and the summary IEE is a core appendix. |
| Rationale | <p>The prevailing environmental conditions in provincial towns have significant adverse impacts on people's health and quality of life and negative impacts on their human and economic development. Improving basic urban services, particularly water supply and sanitation, is directly linked to the goal of improving public health and overall social indicators. Large sections of urban society suffer from service inadequacies and unsanitary conditions, with the poor suffering disproportionately more. Water supply and sewerage systems cover about 43 percent and 20 percent of the total urban population of PNG, respectively. Communities in the project towns acknowledge water as their number one priority, with lack of water during the dry season as a very serious and universal problem. Sanitation is generally inadequate. Where sewerage systems exist, they serve mostly the developed sections of towns. For many communities on the urban fringes, defecating in open air is the only option.</p> |
| Objectives and Scope | <p>The overall goal is to promote human and economic development in selected provincial towns by improving public health and quality of life. The Project has two primary goals: (i) improvement of social indicators for the overall population, particularly in the poor communities of selected provincial towns; and (ii) improved governance in the water supply and sanitation sector. The objectives of the proposed Project are to (i) increase coverage and improve quality in the delivery of basic water supply and sanitation (sewerage) services; and (ii) improve management and coordination of the water supply and sanitation sector by building the capacity of the Waterboard. The objective of the LCS-CAHE program (financed by JFPR) is to improve health and reduce poverty for poor households and other urban residents through low-cost sanitation (LCS), community awareness and health education (CAHE) activities.</p> |

The Project scope consists of the following components:

(i) Provision of water supply and sewerage to six provincial towns: (a) new or extension of safe water supply services in Kerema, Mendi, and Wabag; and (b) rehabilitation of sewerage services and sewage treatment to improve environmental conditions in the towns of Alotau, Madang, and Mt. Hagen.

(ii) Sector policy support and capacity building for the Waterboard: (a) support policy reform to establish clearer sector planning and regulatory responsibilities as well as funding provisions; and (b) build the capacity of the Waterboard to improve management capacities for higher efficiency, better operation and maintenance, and adequate environmental management of its own operations.

(iii) Project management support: provision of consulting services to assist with project management activities including procurement, detailed design, and construction supervision.

In addition, as a highly complementary part, a LCS-CAHE program will be financed by the JFPR with contributions from the local governments and the beneficiaries. The program will cover five provincial towns with two major components: (a) low-cost and on-site sanitation solutions to the problem of inadequate sanitation for the urban poor and other residents; and (b) awareness and education programs to improve communities' knowledge on water, health, and sanitation issues.

Cost Estimates

The Project is estimated to cost \$23.3 million equivalent of which \$13.2 million is the foreign currency cost and \$10.1 million equivalent is the local currency cost.

Financing Plan

The Project will have the following overall financing plan.

| (\$ million) | | | | |
|--------------|---------------------|-------------------|---------------|------------|
| Source | Foreign Exchange | Local Currency | Total Cost | Percent |
| ADB | 11.8 | 3.5 | 15.3 | 66 |
| Central Govt | - | 6.1 | 6.1 | 26 |
| AusAID | 1.4 | 0.4 | 1.8 | 8 |
| Total | 13.2 | 10.1 | 23.3 | 100 |

Loan Amount and Terms

The Asian Development Bank (ADB) loan will amount to Special Drawing Rights 11,985,000 (\$15,300,000 equivalent) from the Asian Development Fund (ADF) with a term of 32 years, including an 8-year grace period, with an interest charge of 1 percent per annum during the grace period and 1.5 percent per annum thereafter.

Japan Fund for Poverty Reduction Grant

The low-cost sanitation, community awareness and health education (LCS-CAHE) program was approved by the Government of Japan for financing in the amount of \$1.74 million equivalent, under the JFPR.

Period of Utilization

Until 30 September 2005

Executing Agency

PNG Waterboard

Implementation Arrangements

The PNG Waterboard will establish a central project management unit that will be responsible for coordinating and managing all project activities. A project steering committee will provide overall direction and guidance. Provincial towns implementation units (PTIUs) will be established in the project towns for day-to-day management and

supervision. Provincial towns coordinating committees will also be established to complete coordination arrangements and to facilitate consultation and participatory processes between the PTIUs and the communities.

The LCS-CAHE program has specific implementation arrangements with a coordination unit and implementation unit to be established at the provincial level in each LCS-CAHE subproject town.

Procurement

Goods and services financed by ADB will be procured in accordance with ADB's *Guidelines for Procurement*. Major civil works contracts in excess of \$1,000,000 will be awarded under international competitive bidding (ICB) procedures. International shopping (IS) may be employed where the estimated amount of the civil works contracts is less than \$1,000,000. All contracts for procurement of goods exceeding \$500,000 in value will be procured under ICB, and IS may be employed where the estimated amount is less than \$500,000.

Local competitive bidding (LCB) for all civil works and materials supply contracts for the LCS-CAHE program not exceeding \$200,000 may be allowed in accordance with standard government procedures acceptable to ADB. Some civil works under the LCS-CAHE program may be procured with community participation in accordance with procedures acceptable to ADB.

Consulting Services

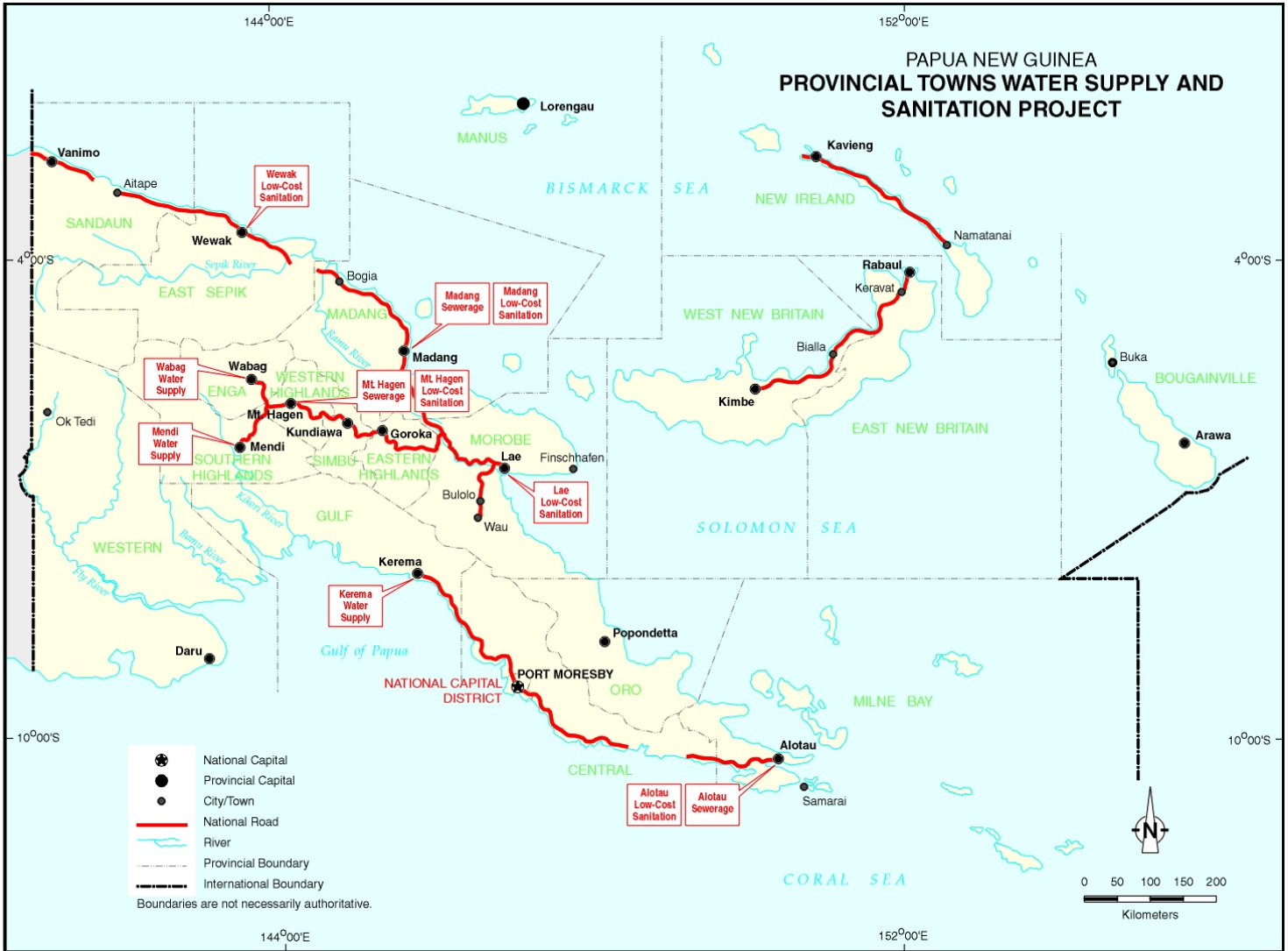
Consultants will be selected in accordance with ADB's *Guidelines on the Use of Consultants* and other arrangements satisfactory to ADB for engaging domestic consultants. A total of 675 person-months of consulting services (106 international, 569 domestic) is required. There will be four discrete consultancy packages (person-months in parenthesis): (i) project management and the water supply and sanitation engineering design and supervision (71 international, 178 domestic); (ii) capacity building for the Waterboard's operations and maintenance management (9 international, 16 domestic); (iii) capacity building and strengthening of the Waterboard and its environmental management capabilities (21 international, 12 domestic); and (iv) LCS-CAHE program (5 international, 363 domestic).

Estimated Project Completion Date

31 March 2005

Project Benefits and Beneficiaries

The Project and the LCS-CAHE program will directly benefit about 78,000 people as well as business concerns in the selected towns. In addition, the Project will indirectly benefit an estimated 200,000 customers through improved service delivery. As a result, all beneficiaries will enjoy better health and improved quality of life. The water supply components will improve the quality of drinking water and increase its availability. The sanitation components will improve public health conditions through improved hygiene and lower on-site and off-site pollution levels. The Project will improve overall sector governance, permit better project implementation and maintenance as well as increased coverage and improved service delivery. It will also strengthen the Waterboard's management capacities and overall performance. In addition, the LCS-CAHE program will give all beneficiaries, particularly the poorest, access to affordable on-site sanitation and improved health education.



I. THE PROPOSAL

1. I submit for your approval the following Report and Recommendation on (i) a proposed loan to the Independent State of Papua New Guinea (PNG) for the Provincial Towns Water Supply and Sanitation Project, and (ii) proposed administration of assistance for low-cost sanitation, community awareness and health education.

II. INTRODUCTION

2. In recognition of the adverse impacts of inadequate water supply and poor sanitation on human and economic development in provincial towns, in 1998 the Government requested Asian Development Bank (ADB) assistance in preparing the Provincial Towns Water Supply and Sanitation Project. Project preparatory technical assistance (TA) for this purpose was included in the 1999 Country Assistance Program and approved on 23 March 1999. The TA consultants presented the final report to ADB and the PNG Waterboard in May 2000. A Fact-Finding Mission was fielded from 15 May to 4 June 2000. An Appraisal Mission followed on 18-29 July 2000.¹ The Mission held discussions with national and local government officials as well as with project stakeholders including representatives of the private sector, non-government organizations (NGOs), and local communities to confirm the project objectives and components, and the willingness to actively participate in the project, especially in the low-cost sanitation program. This report is based on the findings of the ADB missions; reports prepared by the TA consultants; participatory workshops; and discussions with Government agencies, NGOs, international organizations, bilateral aid agencies, and potential project beneficiaries. The project framework is in Appendix 1.

III. BACKGROUND

A. Sector Description

1. Poverty

3. After 25 years of political independence and some economic and social progress, a large number of the people of PNG remain poor. The Human Poverty Index for PNG is at the level of the Central African Republic and Mali, which are among the most poverty-afflicted nations in the world. Evidence from a 1996 household survey and 1996 prices indicate that 37 percent of the population are below the poverty level of \$350 (K461) per year.² Poverty is high compared with that in countries with similar income levels. Approximately 17 percent of the population cannot meet the basic requirement of 2,200 calories per day per adult equivalent, even if they spend all their income on food.

4. Poverty coexists with wealth. The richest 10 percent of the population account for 36 percent of consumption, whereas the poorest 50 percent account for just 20 percent. The Gini coefficient of 0.461 is high compared with that for countries of similar income levels. This reflects the dualistic pattern of growth during the postindependence period. Growth has been led by a capital-intensive minerals sector generating State revenues that were used in part to support a relatively large public service. The semisubsistence sector on which the vast majority of the population depends has shown little intensive growth. Per capita real gross domestic

¹ The Mission comprised D. Ponzi, Economist (Environment) and Mission Leader; O. Tiwana, Counsel (20-25 July); M. Sultana, Social Development Specialist; Vo Van Cuong, Economist; N. Galang, Assistant Project Analyst; and F. Waters, Financial and Economic Analyst (Consultant) (16 July - 2 August). S. Van der Tak, Senior Program Officer; and H. Marko, Head, PNG Extended Mission, also assisted the Mission.

² The World Bank 1999. *Papua New Guinea: Poverty and Access to Public Services* Report No. 19584-PNG, 29 October.

product (GDP) in the nonmining economy grew at the average rate of just 0.2 percent per annum during 1978-1998.

5. Poverty in PNG has an important regional dimension, with 93.3 percent of the poor living in rural areas. The incidence and extent of poverty vary significantly across the five major regions (Table 1). The Momase/North Coast region exhibits the highest incidence of poverty, with 45.8 percent of the population living below the poverty line. Poverty rates in the regions of Papua/South Coast, Highlands, New Guinea Islands are clustered slightly below the national average, ranging from 33.2 percent to 35.8 percent. The urbanized National Capital District (NCD) accounts for only 3.8 percent of the poor and only a quarter of its population fall below the poverty line. The depth of poverty, measured by the poverty severity index³ is twice as high in the poorest Momase/North Coast region as in NCD.

Table 1: Poverty Measures by Region

| Region | Head Count Index | | Poverty Severity | | % of Total Population |
|---------------------------|------------------|---------------------------|------------------|---------------------------|-----------------------|
| | Index | Contribution to total (%) | Index | Contribution to total (%) | |
| National Capital District | 25.8 | 3.8 | 3.3 | 3.3 | 5.5 |
| Papua/South Coast | 33.2 | 13.2 | 5.5 | 14.7 | 14.9 |
| Highlands | 35.8 | 38.3 | 5.3 | 38.0 | 40.1 |
| Momase/North Coast | 45.8 | 35.5 | 6.6 | 34.2 | 29.2 |
| New Guinea Islands | 33.6 | 9.2 | 5.3 | 9.8 | 10.3 |
| PNG Total | 37.5 | 100 | 5.6 | 100 | 100 |
| Urban | 16.1 | 6.5 | 1.6 | 4.2 | 15.1 |
| Rural | 41.3 | 93.5 | 6.3 | 95.8 | 84.9 |

Source: PNG Household Survey 1996.

6. The incidence of poverty is linked to the ability to earn cash income to pay for nonfood items, to vary and improve diets, and to permit savings for times of economic difficulty (e.g., drought). Almost 17 percent of the poor population live in households whose heads earn no cash income, relying entirely on subsistence production (and perhaps gifts of cash). The poverty rate for these households is 47 percent. For almost 8 percent of the poor in households whose main source of cash income is hunting, gathering, and fishing, the poverty rate is 57 percent. Poverty rates are also above the national average for households that earn cash income from tree crops (44 percent) and commercial agriculture (42.7 percent). These households account for 42.5 percent and 19.0 percent of the poor population, respectively. Where household heads earn cash income from running a business or wage employment, poverty rates are much lower (25 percent and 17 percent, respectively). Although the latter households collectively account for 29 percent of PNG's total population, they account for only 14 percent of the poor population. In general, increased opportunities for earning secure cash incomes are needed to reduce the incidence and severity of poverty.

7. Both the extent of income-earning opportunities and the ability to respond to such opportunities are determined significantly by access to the basic public services of transport, utilities, health, education, and financial services. The population as a whole expressed considerable dissatisfaction with access to services in 1996, and it is highly likely that the

³ The poverty severity index is a distributionally sensitive poverty measure that takes into account the distribution of consumption for those falling below the poverty line. The index shows that poverty is significantly deeper in rural than in urban areas of PNG.

degree of dissatisfaction increased during the late 1990s as a result of a widely acknowledged deterioration in service provision. Poverty reduction requires improved service delivery to rural areas. This was the intention of provincial and local government reforms introduced under the Organic Law of 1995, but capacity and funding constraints have limited the effective implementation of devolution.

8. The fundamental and long-recognized development challenge for PNG is to achieve sustained economic growth with equity. The poorest 40 percent of the population must participate in and benefit from the growth process if poverty is to be reduced. There are severe development constraints, including the rugged terrain of PNG's 462,000 square kilometers, complexity of land tenure systems, dispersal of 4.5 million people collectively speaking well over 800 languages, limited and deteriorating physical infrastructure, a major law and order problem, and low level of human resource development. Nonetheless, some key development constraints can be eased over time through appropriate government action, notably in regard to investment in human capital, better service delivery including access to finance in the rural areas, and infrastructure improvement. The Government is committed to address these issues to reduce poverty and socioeconomic inequalities through private sector-led growth and employment creation.

2. Water Supply and Sanitation Sector

9. Papua New Guinea's population has a very high linguistic and cultural diversity. Total population in 1996 was estimated at 4.5 million, most of whom live in a subsistence lifestyle in the rural areas without access to basic services such as potable water, adequate sanitation, and electricity. A semi-subsistence sector provides livelihood for 85 percent of the population, which has a current per capita gross domestic product of just under \$900. Low life expectancy, high infant mortality rate, poor adult literacy, and low enrollment ratio combine with low per capita income to make PNG's human development level the lowest in ADB's Pacific developing member countries (PDMCs). Health indicators show a high incidence of waterborne intestinal diseases, particularly diarrhea and typhoid, which are directly attributable to unsafe drinking water supplies and poor sanitation conditions.

10. About 16 percent of PNG's urban population is categorized as poor.⁴ They are squatters in informal settlements, the unemployed and underemployed, and low-income groups burdened by very large households. The urban poor are most vulnerable because they have fewer resources with which to change their circumstances. The time consumed in searching for water diverts the poor from other productive tasks. Searching for alternative sources of water during the dry season has a high negative impact on their already low productivity.

11. PNG towns are typically small, consisting of 500 to 1,000 households, with the urban population as a whole not growing rapidly. Port Moresby and Lae are exceptions, with populations in excess of 100,000. Some urban centers have water supplies and only a few have adequate sanitation services. The small size of the towns and low urban population density combined with the low average per capita income of the urban residents limit the scope for providing and sustaining reticulated water supply and sanitation services on a cost recovery basis.

12. The Waterboard, Eda Ranu, Goroka Town Council, the Provincial Works Department in Kiunga operate reticulated water supply systems. The Waterboard operates in 11 towns (Alotau, Daru, Kavieng, Kimbe, Kokopo, Kundiawa, Lae, Madang, Mt. Hagen, Wabag, and Wewak) with

⁴ The World Bank 1999 *Papua New Guinea Poverty and Access to Public Services*.

about 20,800 connections. Eda Ranu, a private company operating in Port Moresby, has approximately the same number of connections as the Waterboard, and Goroka has about 2,000. Small community or village water supply systems were provided in the past by aid agencies, government funding, and NGOs. In rural areas and urban fringes, most households still obtain water from traditional sources such as rainwater catchment, dug wells, and rivers. Water supply coverage in PNG in 1996 was 43 percent of the total urban population and 29 percent of the total rural population.

13. Sanitation, a culturally sensitive issue in the country, is generally less developed than water supply. The Waterboard operates sewerage systems in Alotau, Kimbe, Kundiawa, Lae, Mt. Hagen, Popondetta, and Rabaul, collecting sewage through a reticulation system. Levels of treatment vary, and operation and maintenance (O&M) problems are frequently encountered with the treatment plants. Eda Ranu provides the only other reticulated sewerage system. The town councils in Madang and Wewak operate a pan collection system, where household toilet waste is collected twice weekly and discarded in waterways, some with basic treatment. Pan systems pose significant health hazards and are not well regarded by the town councils and household members. Urban households not connected to a sewerage system especially in small towns commonly use septic tanks and pit latrines, and waterways, and the surrounding bush continue to be used in many cases. Rural households defecate in open air. Sanitation coverage in 1996 was estimated at 20 percent of the total urban population. There were no estimates of rural coverage.

14. Although the National Water Supply and Sewerage (NWSS) Act established the Waterboard in 1986 with broad powers to regulate all water supply and sanitation systems, the sector remains highly fragmented. The Office of Conservation and Environment (OCE) is responsible for administering the Environmental and Contaminants Act. The Department of Planning and Monitoring (DPM) is responsible for planning development, formulating the national budget, and sector policy issues including water and sanitation. The Department of Works (DOW) has a Local Government Engineering Unit (LGE) that constructs small water supply systems funded from the Rural Development Fund of members of Parliament. Prior to the enactment of the Organic Law⁵ in 1996, the Department of Health (DOH) through its provincial offices carried out programs promoting health and sanitation in the rural areas, including providing water supplies at the village level. Since 1996, the direct responsibilities of DOH have been devolved to the provincial governments (Figure 1, Supplementary Appendix B).

15. The Waterboard is a commercial statutory authority with a board of directors directly appointed by professional bodies and the government agencies as stipulated in the NWSS Act. As a result of this status, the Waterboard has to generate sufficient revenue to sustain its activities.⁶ Its primary role is the development and O&M of urban water supplies and sanitation. Under the terms of its enabling legislation,⁷ the Waterboard also has the broader mandate of (i) promoting water supplies and sanitation in rural areas and urban fringe areas, (ii) setting standards for materials and equipment, and carrying out adequate compliance functions and exercising control over other organizations providing water supply and sanitation services, and (iii) advising the Government on sector policy development and investment planning. However, as directed in the NWSS Act, these “nonrevenue-generating” activities are to be undertaken with separate Government funding. Since the Waterboard receives no subsidy for this purpose, it has never been in a position to actually implement this broader role.

⁵ The Organic Law of Provincial Governments and Local Governments, 1996.

⁶ The Waterboard is required to cover its operating costs from its revenues. However, no firm cost recovery targets have been defined.

⁷ The National Water Supply and Sewerage Act of 1986.

16. A number of constraints contribute to the low water supply and sanitation coverage in both urban and rural areas in PNG. The underlying major sector issues can be put into the following categories: (i) sector planning and coordination, and (ii) service delivery and Waterboard performance.

a. Sector Planning, Regulation, and Funding

17. The absence of a central agency responsible for sector planning and coordination has led to ad hoc implementation of water supply and sanitation projects as Government agencies and communities react to offers of assistance from various aid agencies and NGOs. Consequently, there is no long-term national plan for developing the water supply and sanitation sector covering both the urban and rural areas. Shortage of financing is also a major constraint to sector development. A well-prepared national plan for developing water supply and sanitation that includes financial requirements can be a powerful tool for advocating more fund allotments to the sector, whether from the central Government or from external sources. Similarly, provincial sector plans prepared as components of the national plan can be used for a similar purpose with the provincial and local-level administrations (an initial analysis of the sector is in Figure 2, Supplementary Appendix B).

18. There is a major gap in the organization of the sector, leaving rural water supply and sanitation highly underdeveloped. The NWSS Act gave the Waterboard the mandate to promote water supply and sanitation in the rural areas, but did not provide it with funds to perform this role. Hence, this function was not actively pursued but by default was delegated to DOH, which planned and implemented rural water supply and sanitation projects through its provincial offices as part of its health promotion program. The devolution of these functions to the provincial governments under the Organic Law resulted in virtually no development of the rural water supply and sanitation sector. At present, the provincial and local governments lack the skills and management capability to ensure the sustainability of water supply and sanitation projects.

19. Further development of the sector will also require the Waterboard to perform its standard setting, licensing, compliance, and regulatory functions. These responsibilities cover the entire sector and are important to ensure that adequate water and sanitation services are delivered by service providers. The issue of funding for these activities will have to be resolved for the Waterboard to perform its mandated tasks. If the sector is reorganized in the future, the Government should consider placing the regulatory and compliance functions under an independent regulatory body. This would allow the Waterboard to concentrate on providing water supply and sanitation services to urban areas, including about 60 small secondary towns that are still not served.

b. Service Delivery and Waterboard Performance

20. The 11 water districts under the Waterboard supply water to about 59 percent of the population in 11 provincial towns. The water districts are relatively small with water connections ranging from about 608 in Kundiawa to 6,560 in Lae. Currently, total production of treated water is about 1,675,000 kiloliters (kl)/month. The financial and operational performance of the Waterboard has improved in recent years. Current average nonrevenue water for all 11 water districts is 25.1 percent, which is better than the average (40 percent) for the Asian and Pacific region and this is an improvement from the 30-40 percent average level in the last four years.

Staff per 1,000 connections is 10.7, down from 14.7 in 1995 and better than the regional average of 11.8. Sales per employee have increased from K29,000 in 1996 to K49,600 in 1999.

21. In the last two years, the Waterboard has made an overall profit, mainly the result of nonoperational activities. Essential core activities, the supply of water and sewerage services, can best be described as only marginally profitable and have relied on substantial cross-subsidization between towns. Net assets of the Waterboard are currently valued at K66.6 million. (The last major revision of these values was undertaken in 1988.) Current liabilities in 1999 were K4.0 million and long-term liabilities were K13.3 million. Total shareholders funds currently stand at K66.6 million with the PNG Government as the lone shareholder. The ratio of net profit to total assets has risen from negative 0.8 percent in 1996 to 5.9 percent in 1999. The return to owners' (Government) equity has risen from negative 0.7 percent to 5.7 percent in the same period. To further improve its financial position, the Waterboard approved an increase in tariffs effective April 2000. Rates for higher volume blocks for all types of consumers were increased. However, the new tariff structure also adopted a reduced charge lifeline rate for the first 12 kl, targeting low-income households. Similar reduced rates were also adopted for small commercial and industrial consumers.

22. Despite the improvements, delivery of water supply and sanitation services has been affected by deterioration in the facilities. Sewerage systems are presently discharging only partly treated effluent into receiving waters. Equipment needs repair, approaching complete obsolescence and breakdown. Water supply systems also suffer from problems of inadequate maintenance. The Waterboard will have to improve O&M and environmental management of its water supply and sanitation facilities particularly the sewerage systems (an initial analysis of the Waterboard management performance is in Figure 3, Supplementary Appendix B).

23. In addition to addressing the issue of O&M and environmental management, the Waterboard is trying to maintain and, to the extent possible, increase its customer base. Some of its smaller water districts are losing customers who disconnect from the water systems and construct and install their own systems. This problem is being addressed by adopting a more customer-oriented strategy and management policy, as well as enforcement of its compliance, regulatory, and monitoring functions.

24. Similarly, rural water supply facilities often break down only a few months after installation and continue to be in a state of disrepair due to the absence of repair and maintenance programs involving the beneficiary communities and relevant Government agencies. This was one of the lessons learned from the European Union-funded rural water supply programs. The ADB-funded Water Supply and Sanitation Sector Study⁸ in 1996 recommended a community-based approach that could lead to sustainable water supply and sanitation projects. The approach enhances participation through community awareness and health/hygiene education. Unfortunately, subsequent sector projects have not followed the recommendation.

25. The low sanitation coverage for both urban and rural areas in PNG is a major sector issue that needs to be resolved. For lack of promotion there are not many sanitation programs especially in the rural areas. Promoting sanitation and hygiene education is difficult due to limited staff and financial resources of most rural local governments, the long distances to the villages, and the highly varied conditions in PNG. In the urban areas, the high cost of reticulated systems due to low population densities and rugged terrain makes it difficult to expand coverage

⁸ TA 2196-PNG: *Water Supply and Sanitation Sector Study*, for \$380,000, approved on 2 November 1994.

for these systems. Services also suffer from inadequate maintenance. On-site sanitation using low-cost technologies may be the only viable and affordable solution for many urban areas, especially for the low-income households in the urban fringe areas and settlements.

B. Government Policies and Plans

26. The Medium-Term Development Strategy 1997-2002 (MTDS) of the Government is the main strategic plan for the country's economic and social development. Its central objective is to create an environment that encourages people to use land, labor, and natural resources for their own welfare and the national benefit. To this end, the Government assigns a crucial role to the provision of health and education services, maintenance of infrastructure, creation of opportunities for income generation, and addressing the problems of law and order. Accordingly, six priority sectors receive a significant proportion of the total central budget appropriation and most of the external assistance: (i) agriculture and rural development, (ii) health, (iii) education, (iv) infrastructure, (v) law and order, and (vi) institutional strengthening and capacity building for good governance.

27. The health sector, in particular, is a major focus of the MTDS and was recently recognized as the main avenue, combined with education and agriculture, for achieving poverty reduction objectives. The Government recently reiterated its commitment to reduce poverty along the lines of the ADB poverty reduction strategy.⁹ The Government recognizes that poverty is a major development issue that continues to undermine the government's efforts. In this context, the provision of basic services such as water supply and sanitation as part of a primary health care program is definitely a priority area for additional investments. Significantly, the new tariff structure recently implemented by the Waterboard is directed to the urban poor, with the adoption of a low and affordable lifeline rate of K3.50 for 12 kl water consumption per month and abolition of the connection fees. Another development with good potential impact on poverty is the Waterboard's commitment to include low-cost sanitation as an option for those in peri-urban areas of provincial towns.

28. A major decentralization process was initiated with the passage of the Organic Law in 1995 and the associated Provincial Governments Act and the Local-Level Governments Act which were both approved in 1997. The Organic Law provides for the devolution of powers, functions, and financial resources from the central to provincial, district, and local governments. Its thrust is to improve services delivery by relocating civil servants to provincial, district, and local levels; shifting responsibilities for implementation and funding to local governments; strengthening community participation in government decision making; and fostering involvement of NGOs and community groups in service delivery. However, the objectives have not been realized in the water supply and sanitation sector. Provincial and local governments do not have the human and financial resources to plan and implement water supply and sanitation programs and therefore will need assistance in developing their capacities.

29. The MTDS further stresses that provincial and local Governments must be responsible for basic services, and be innovative in identifying efficient and effective means for ensuring that the grass roots have reasonable access to these services. In November 1999, the national Government and the provincial governments signed the National Charter on Reconstruction and Development signifying their commitment to work together to improve basic services and create opportunities for income and employment activities as enunciated in the MTDS. They also

⁹ Statement made by the National Planning and Monitoring Minister representing the Prime Minister, endorsing ADB's strategy against poverty during the 33rd Annual Board of Governors Meeting held in Chiang Mai in May 2000.

pledged to allocate appropriate resources, including funds and personnel, to the priority programs through national, provincial, district, and local budget appropriations.

30. The government policy machinery was recently realigned to better implement the government program for rapid divestment and privatization of government-operated businesses. The policy objectives and strategies of the Government now increasingly focus on (i) encouraging competition and fostering efficiency and productivity by reforming the present institutional structure and supporting private sector development; (ii) stabilizing the economy through an integrated package of financial, monetary, and budget adjustment and stabilization measures; and (iii) adopting a corporatization and privatization program to divest State ownership, management and control of public enterprises as well as create an enabling environment for developing private sector initiatives. In this connection, the Government is considering privatizing the Waterboard.

C. External Assistance to the Sector

31. ADB support to the sector commenced with the TA¹⁰ and loan¹¹ for the first Water Supply Project in 1975 and 1976, respectively. In total, three ADB-funded urban water supply projects have progressively improved water supply and sanitation services in five provincial towns (Kokopo, Lae, Madang, Mt. Hagen, and Wewak). The most recent of them, the Third Urban Water Supply Project,¹² is scheduled for completion in October 2001. Three TA projects since 1994¹³ have aimed at strengthening the Waterboard and reviewing the water supply and sanitation sector. ADB also assisted the development of rural water supply as a component of its Third Rural Health Project loan.¹⁴

32. Other bilateral and multilateral agencies active in the water supply and sanitation sector include the European Union, World Bank, the governments of Australia, Japan, and New Zealand. All have been particularly active in rural water supply. The European Union has funded a number of rural water supply projects. The World Health Organization and Australian Agency for International Development (AusAID) are providing technical expertise for planning and designing rural water supplies. Similarly, the World Bank has supported mainly the rural subsector. However, while ADB remains the main aid agency in the field of urban water supply, significant and recently increasing funding for urban projects has also come from AusAID and Japan International Cooperating Agency. A table showing external assistance to the sector is in Appendix 2.

D. Lessons Learned

33. ADB is the leading funding agency in the water supply and sanitation sector with various investment and TA projects implemented in the last 15 years. As a result, some important lessons have been learned with respect to both sustainable sector development in general, and timely project implementation in particular. Lessons relating to sectorwide development point to the following constraints: (i) inadequate sector coordination, funding, and medium- and long-term planning; (ii) inadequate capacities of main sector agencies, especially the Waterboard; (iii)

¹⁰ TA 0179-PNG: *Water Supply Project*, for \$185,000, approved on 11 November 1975.

¹¹ Loan 0278-PNG: *Water Supply Project*, for \$13.5 million, approved on 11 November 1976.

¹² Loan 1211-PNG: *Third Urban Water Supply Project*, for \$11.3 million, approved on 15 December 1992.

¹³ TA 1803-PNG: *Institutional Strengthening Project*, for \$400,000, approved on 15 December 1992, TA 2196-PNG, *Water Supply and Sanitation Sector Study*, for \$250,000, approved on 2 November 1994; and TA 3173 - PNG: *Provincial Towns Water Supply and Sanitation*, for \$500,000, approved on 23 March 1999.

¹⁴ Loan 1097-PNG: *Third Rural Health Project*, for \$22.3 million, approved on 5 September 1991, of which \$1.1 million was for water supply and sanitation.

insufficient funding for O&M of water supply and sanitation systems; (iv) insufficient attention to low-cost options for both water supply and sanitation for the poor; (v) ineffective implementation of the overall sector regulatory functions of the Waterboard; and (vi) limited implementation of community-based programs, and awareness and health education activities.

34. Most water supply and sewerage systems have suffered from O&M deficiencies, lack of planned upgrading, and failure to replace obsolete equipment. Provisions for addressing O&M capacities and overall asset management have to be effectively built into any new project. Another major issue often causing project implementation delays and cost overruns relates to land ownership, land-lease disputes, and compensation. Based on ADB and Waterboard experience, land acquired and leased - particularly from customary landowners - may become a compensation issue with each new generation every 15 to 20 years. One solution is to minimize customary land involvement whenever possible. Where this is not possible, land can be used through joint ventures or other convenient arrangements with the traditional landowners.

35. In recent years and as a result of the Organic Law and the new role of the provincial administrations, some project implementation problems have arisen because of lack of coordination among the central agencies and between the Waterboard and the provincial administrations. Underdevelopment of water supply and sanitation for rural and urban fringe areas will continue unless a Government agency actively promotes sector development for those areas. DOH is no longer involved in promoting rural water supply and sanitation after responsibility for that was devolved to provincial administrations. In many developing countries, low-cost technologies for both water supply and sanitation have been successfully introduced to make services affordable to poor households in both rural and urban areas. In light of this experience, the Project will include a low-cost sanitation component. Finally, another major need is to design projects with the active participation of beneficiaries and local-level government institutions at all phases of project planning, implementation, and O&M.

E. ADB's Sector Strategy

36. ADB's policy on water supply and sanitation¹⁵ is centered on the following main objectives: (i) strengthening the policy and regulatory functions of the main planning/regulatory body for the sector; (ii) fostering overall institutional framework and institutional arrangements for efficient management of the sector; (iii) increasing community participation and management of water supply and sanitation at the lowest practicable level to ensure interaction with the beneficiaries; (iv) targeting the poor and addressing their needs through appropriate specific low-cost schemes, tariff adjustments (lifeline block tariffs), low or zero connection fees, and other appropriate solutions; (v) promoting private sector participation, public-private partnerships, and contracting-out arrangements; (vi) improving water utilities management performance; and (vii) increasing investments in the sanitation subsector as a percentage of the total water supply and sanitation sector investments.

37. The ADB country operational strategy (COS) for PNG is generally consistent with the overall water supply and sanitation sector policy outlined in para. 36 and with the ADB overarching goal of poverty reduction. In particular, the COS has a major focus on the goal of improved social indicators (together with improved governance and private sector development), which is among the main goals of the proposed Project. This goal is to be achieved mainly by pursuing the objectives of ADB's sector policy, which aims at increasing overall coverage of adequate water supply and sanitation in an equitable way. This is to be

¹⁵ Final draft under review.

attained by ensuring that existing and future services are affordable, particularly to the poor, and financially viable and economically sustainable in the medium to long term. Other cross-cutting issues such as gender, community awareness and education on health and hygiene, and environmental protection also remain central concerns of the sector strategy and positively help in achieving improved social indicators for the country. The Project is in line with these sector strategy objectives, is consistent with the COS for PNG, and meets ADB's poverty reduction strategy in relation to social sector and urban development.

F. Policy Dialogue

38. Policy dialogue with the Government started with the first Water Supply Project (footnote 11), which was approved in 1976. The ADB study identified a number of priority areas for legislation and policy reform including strategic development planning, policy development, and coordination. These are sectorwide functions that have been largely ignored by major sector institutions such as the Waterboard and currently remain crucial issues of the policy agenda. Hence, while progress in certain areas is encouraging, various key policy issues remain to be addressed and constitute the focus of the current policy dialogue.

39. In recent years, strengthening the Waterboard has been the focus of various TAs.¹⁶ Institutional strengthening is the area where policy dialogue efforts have been most successful, with significant improvements achieved in the last few years. They relate notably to (i) staff retrenchment and increase of overall personnel productivity, (ii) tariff increases and tariff structure adjustment, (iii) management information system, (iv) financial management, and (v) corporate strategic planning. An initial analysis of the Waterboard management performance is in Figure 3, Supplementary Appendix B.

1. Sector Policy Support and Capacity Building for the Waterboard

40. Institutional and policy reform are needed to address policy issues relating to sector planning and coordination, such as (i) overall rationalization and coordination of the sector and leadership role of the Waterboard; (ii) sector planning responsibilities and the advisory role of the Waterboard; (iii) promoting water supply and sanitation in rural areas; (iv) improving the decentralization process and developing partnerships with provincial and local governments; (v) funding the Waterboard nonrevenue-generating activities (compliance, licensing/monitoring, other planning and regulatory functions, rural water supply and sanitation, etc.); and (vi) future of the Waterboard vis-à-vis recent government privatization policies.

41. The issues have to be resolved to allow the Waterboard to fulfill its mandate under the NWSS Act. As a national organization with a sector focus and with central and provincial presence, the Waterboard is well placed and has authority under the Act to bring coordination and cohesive planning to the sector. Under the Project, and in particular the Waterboard Capacity Building Action Plan (Table 1, Supplementary Appendix B), the Waterboard will submit to the National Executive Council (NEC) a policy reform statement on a program to strengthen the water and sanitation sector. The submission will seek NEC approval to have the NWSS Act amended so that the sector can become self-funding by being allowed to use part of the Waterboard's previous years' revenue to promote rural water supply and sanitation and to effectively fulfill its planning and regulatory functions. The policy reform statement will also seek NEC approval for the Waterboard to become the main sector-planning agency to assist the Department of Planning and Monitoring by preparing a comprehensive sector development

¹⁶ TA 1803-PNG (footnote 13) which was associated with the Third Urban Water Supply Project; and TA 3173-PNG (footnote 13) (advisory elements)

plan. Approval will allow the Waterboard to take the lead in sector planning and coordination, including the preparation of a long-term national plan for developing the water supply and sanitation sector. It can then take the necessary steps to actively promote rural water supply and sanitation and perform its other noncommercial functions with the use of part of its revenues.

42. Under the project preparation TA, the Waterboard started developing partnerships with provincial and local governments through dialogue and workshops on the Waterboard's new corporate strategy in delivering water and sanitation services in urban areas. This will be continued during project implementation in eight provincial towns.

43. The Government recently proposed the privatization of various state owned enterprises (SOEs). The Waterboard is included tentatively on the list of SOEs to be privatized; however, it is definitely not a high priority. The Government needs to maintain a continuing dialogue and consultation with ADB on the status of any plan to privatize the Waterboard. The prevailing economic, social, and market conditions in the water supply and sanitation sector in PNG may not be suitable for full privatization and complete divestiture of the Waterboard. Its overall size (20,800 total connections) and the size of its water districts (608-6,560 connections) are very small. This characteristic combined with rugged topography, low urban density, and low average household income, creates an environment not likely to attract private investors.

44. In addition, at the current development stage, the sector still needs financing on concessional terms and overall public support despite recent progress in overall efficient service delivery and cost recovery. ADB's general support to the sector and capacity building for the Waterboard should therefore continue, especially toward increased efficiency and financial autonomy. This could include some form of private sector involvement through contracts for specific services or management. Besides, the Waterboard has sector management responsibilities including regulatory, licensing, and compliance functions that should remain under Government control, notwithstanding any possible privatization of the office.

45. The Waterboard as a water utility needs to improve the performance of its water districts in supplying water and sanitation services to the urban population. Under the Project, the policy dialogue on capacity building for the Waterboard relates to the following issues: (i) introducing an integrated management information system (MIS); (ii) strengthening compliance enforcement, standard setting, licensing, and other regulatory capacities; (iii) implementing a more client-oriented strategy and management policy; (iv) improving financial management; (v) strengthening the environmental management and monitoring capacities; (vi) improving O&M performance; and (vii) building the capacity to provide technical support for and promote low-cost sanitation programs. Accordingly, through the Project, the Waterboard will address various issues: establishing an integrated MIS; developing capacities for O&M; environmental management and monitoring; and setting up a compliance and monitoring unit. This capacity-building program is well coupled with the recently developed Waterboard Corporate Plan and Strategic Plan oriented to further improvement of its internal operations and customer focus, including creating institutional awareness among consumers and local governments of the Waterboard's new strategies and service development policies.

2. Low-Cost Sanitation

46. The high capital costs of conventional reticulated sewerage systems have proved to be unsustainable, particularly for low-income households in the urban settlements. Current sanitation practices such as unsafe disposal at the household and local authority level present

major health risks in many towns. Alternative affordable low-cost and easily maintained forms of sanitation must be used to improve living conditions for these households. The Waterboard recently developed a pro-low-cost sanitation (LCS) position, according to which, the implementation of both water and sanitation projects needs to be a progressive process, the first step being low-cost and affordable solutions. To address these concerns, under the LCS part of the proposed Project, the Waterboard will pilot-test in selected provincial towns a community-based approach in providing on-site, low-cost technology solutions to sanitation where reticulated sewerage is unaffordable to urban residents. The program will involve participatory approaches with the communities/beneficiaries, NGOs, and the local governments.

47. Drawing from past sector experience, particularly that of the European Union, the proposed Project will complement the use of appropriate on-site sanitation technology with community awareness and hygiene education to improve sustainability by strengthening commitment and participation of the partners in the Project. The use of a community-based approach was also recommended in the ADB study. The active participation of communities/beneficiaries in planning and implementing this component will reduce the cost of sanitation facilities at the community level, provide a sense of community ownership, and help maintain improved community sanitation conditions.

3. Tariff Reform, Cost Recovery and Affordability

48. Following a review under the TA, the Waterboard took steps to address the objectives of (i) improved financial performance and sustainability, and (ii) poverty reduction and affordability. As a result of the work undertaken during project preparation and during the policy dialogue between the Waterboard and ADB, new tariffs applicable to all districts became effective in April 2000. The new tariff structure includes a lifeline tariff for the first 12 kl for both domestic and nondomestic users, and abolishes connection charges. These measures address the needs of low-income groups - households and small commercial and industrial users - by making water services affordable to them. To improve financial performance, rates for higher volume blocks were increased (average tariff increases of about 20 percent) to improve revenue and encourage rationale use and water conservation through demand management.

49. While the April 2000 tariffs uniformly apply across all the Waterboard towns, the board of the Waterboard in principle accepted the need for differential tariffs across towns and is working toward the goal of financial viability for each district cost center and gradual elimination of cross-town subsidies. In pursuit of this financial objective and to improve the overall financial position of the Waterboard, the board recommended that any investment undertaken as part of the Project should be financially viable for each individual subproject. This requires tariffs to cover O&M including administration costs at the district level, full depreciation on assets, interest payable, and incremental head office costs. While a subsidy may be acceptable in the short term, the board requires each subproject to break even in the medium term and provide in the longer term a return on investment of around 5 percent, in accordance with the recently adopted Waterboard corporate plan.

50. The application of full cost recovery tariffs needs to be carefully structured to ensure that poverty reduction and affordability objectives are not compromised. Required increases in tariffs should take place gradually, and their effects monitored, particularly in small districts, to balance the need for financial viability on one side and affordability on the other. Tariffs also need to be structured in such a way as to encourage demand management, and also participation and customers' loyalty to ensure adequate revenues. To this end tariff adjustments will need to be backed by strong compliance, licensing, and regulatory procedures to ensure that higher tariffs

do not lead to disconnections and an overall loss in Waterboard revenue. Compliance, licensing, regulation, and enforcement are critical to the financial performance of the Waterboard at the subproject and at the general institutional level. These needs are addressed as a key part of the Waterboard capacity building component that will help the Waterboard achieve its financial objectives.

IV. THE PROPOSED PROJECT

A. Rationale

51. Prevailing environmental conditions in provincial towns have significant adverse impacts on people's health and quality of life, with negative impacts on their human and economic development. Improving basic urban services, particularly water supply and sanitation, is directly linked to the goal of improving public health and overall social indicators. Currently, large sections of urban society suffer from service inadequacies and unsanitary conditions, with the poor suffering disproportionately more. Urban water supply and sewerage coverage is about 43 percent and 20 percent, respectively.¹⁷ Communities in these towns consider water as their number one priority, with lack of water during the dry season being a very serious and universal problem. Households often resort to polluted supplies, thus exposing themselves to risks of waterborne intestinal diseases. The incidence of diarrhea and typhoid, among others, is high. Sanitation is generally inadequate, and where sewerage systems exist, they mostly serve the developed sections of towns. For many communities on the urban fringes and most of the poorer settlements, defecating in open air is the only option. The fact that many sewerage schemes carry out only partial treatment of wastewater and often are malfunctioning adds to the overall environmental degradation process. At the same time, residents have little appreciation of good sanitation and hygiene practices and their linkage to health conditions. In many towns, therefore, inadequate sanitation is a source of major health hazards: human waste continues to pollute water sources used for all purposes while raw or poorly treated sewage flows into watercourses, tidal beaches, and onto coastal and harbor foreshores.

52. The contribution of women to the PNG household welfare is affected by high levels of diarrhea, which has impacts on their role in the family and the local economy, particularly the informal sector - subsistence gardening and selling of produce. Due to intestinal illnesses, children repeatedly miss out on education opportunities, and those who continue to attend school while sick exhibit reduced attention and low knowledge retention levels. Improvements to water supply and sanitation will reduce household outlays on medicines and hospital visits. Health improvements resulting from better sanitation and greater availability of clean water are particularly important to the poor who frequently do not have cash for health services and medicines. The need for intervention in the project target towns is very strong.

53. Past external support to the sector has significantly improved the level of water supply and sanitation (mainly sewerage) services in towns around the country and strengthened the management capabilities of the Waterboard. However, the situation in the sector remains critical in a number of crucial areas and there is a strong need to (i) increase overall coverage in an equitable, participatory, and sustainable way in various provincial towns for both water supply and sanitation as current coverage remains relatively low; (ii) extend low-cost and sustainable solutions to the urban fringes and informal settlements where most of the poor reside (small urban populations in most provincial centers combined with their average low income translate, in most cases, into low levels of affordability of conventional reticulated sewerage schemes);

¹⁷As percentage of total urban formal population Source: TA 219 –PNG: *Water Supply & Sanitation Sector Study*, final report, March 1996 (the ADB study).

and (iii) further improve management capacities and operational efficiency of the Waterboard as well as promote improved sector planning, policy development, and institutional coordination.

B. Objectives and Scope

54. While the overall goal is to promote human and economic development in selected provincial towns by improving public health and quality of life, the Project has two primary goals: (i) improved social indicators for the overall population, particularly the poor communities of selected provincial towns including improved health and poverty reduction through the provision of affordable water supply, sewerage, and sanitation services; and (ii) improved governance in the water supply and sanitation sector. The Project objectives are as follows:

- (i) increased coverage and improved delivery of basic water and sanitation services by developing affordable and sustainable water supply, sewerage, and sanitation schemes in selected priority towns;
- (ii) improved management and coordination of the water supply and sanitation sector through sector policy reform, institutional strengthening, and capacity building for the Waterboard;

55. The project consists of the following three components:

- (i) provision of water supply and sewerage to selected provincial towns. These subprojects will provide for: (a) new or expanded safe water supply services in the provincial towns of Kerema, Mendi, and Wabag; and (b) new or rehabilitated sewerage services in the provincial towns of Alotau, Madang, and Mt. Hagen. Detailed technical design of subprojects and construction supervision will also be provided through specific consulting services packages. A summary description of the water supply and sanitation subprojects is in Appendix 3.
- (ii) Sector policy support and capacity building for the Waterboard. The first subcomponent is policy reform support to establish clear sector planning and regulatory responsibilities and initiate other required policy changes relating to the planning and advisory role of the Waterboard, promotion and funding of water supply and sanitation in rural areas, funding of the Waterboard's nonrevenue-generating activities (regulatory functions), overall rationalization and coordination of the sector, and the potential overall leadership role of the Waterboard in the context of the organic law for decentralization (Appendix 2). A policy/institutional specialist will provide consulting services for this component. The second subcomponent is capacity building. Consulting services will help improve the Waterboard's overall performance by (a) strengthening to improve its management capacities and increase efficiency; (b) building its capacity for O&M through appropriate training, systems establishment, and awareness programs; and (c) strengthening its capacity to effectively assess and mitigate negative environmental impacts resulting from its operations. A summary description of this component is in Supplementary Appendix A.
- (iii) Project management support. An engineering consulting services package will train the project management unit to carry out all project management activities including procurement, detailed design, and construction supervision.

C. Technical Justification

56. To select the subproject towns, prefeasibility studies and engineering designs were made during project preparation for water supply and sanitation for 12 provincial towns currently without adequate facilities. Where technical options were available, an economic least-cost analysis was undertaken. The selected options were then subjected to financial and economic analyses, with the economic internal rate of return (EIRR) decision cutoff rate of 10 percent as the main criterion to select the subprojects. As a result the following schemes were recommended: (i) water supply subprojects for Kerema, Mendi, and Wabag; and (ii) sewerage subprojects for Alotau, Madang, and Mt. Hagen. In addition a LCS program for the urban fringe areas of Alotau, Lae, Madang, Mt. Hagen, and Wewak was recommended to target poor households that could not be covered by sewerage systems.

57. Project identification and preliminary designs for the water supply reticulated schemes were based on predicted demand as determined by projections of population levels for the year 2020 and per capita water consumption. In towns where no potable water supply exists, alternative water sources were identified and options for their use considered in detail. Preferred options were chosen on the basis of availability, cost, quality of the water source, and consequent ease of treatment. In towns where a potable water supply exists, augmenting the existing system, using the same source and treatment methods, was found feasible, allowing for simpler installation and O&M of the new or improved plant.

58. The scope for installing reticulated systems and a sewage treatment plant and the demand for a sewerage system were assessed before identifying and designing the sanitation systems. The technical feasibility for a reticulated system was constrained in some towns by very low housing density that requires a very high investment per household in pumping facilities. This situation is exacerbated in several cases by low gradients and high water tables. The simplicity of O&M of the treatment systems was also considered. There is scope for low-cost alternatives, particularly in areas of low-density housing. The LCS program covers options for managing human waste and substantially reducing exposure to the pathogens it contains, based on a single household on site. The need to improve the living conditions of poor urban dwellers is further addressed through the CAHE program.

59. Limited land availability affected the scope for both water supply and sanitation subprojects. All proposed systems were designed to be sited within the present town boundaries on public-owned land or roads because nearly all remaining candidate sites for treatment plants and other facilities were on customary land, which is rarely made available for public use in PNG on an indisputable, long-term basis. In the unlikely event that land issues cause problems, a 20 percent physical contingency for the water supply and sewerage subprojects was included in the cost estimates to ensure that insufficient funding does not become a constraint in resolving such issues.

D. Cost Estimates

60. The total cost of the Project, including allowance for physical and price contingencies, and duties and taxes, is estimated at \$23.3 million equivalent. The foreign currency cost is \$13.2 million equivalent, or 57 percent of the total cost. The local currency cost is \$10.1 million equivalent, or 43 percent of the total cost. The cost estimates are summarized in Table 2. Detailed cost estimates are in Appendix 5 and Supplementary Appendix C.

**Table 2: Cost Estimates
(\$ millions)**

| Component | Foreign Exchange | Local Currency | Total Cost | Percent |
|---|------------------|----------------|-------------|------------|
| Water Supply | | | | |
| Kerema | 1.0 | 1.1 | 2.1 | 9 |
| Mendi | 3.7 | 3.2 | 6.9 | 29 |
| Wabag | 1.5 | 1.3 | 2.8 | 12 |
| Sub-Total | 6.2 | 5.6 | 11.8 | 51 |
| Sewerage | | | | |
| Alotau | 0.2 | 0.1 | 0.3 | 1 |
| Mt. Hagen | 0.3 | 0.2 | 0.5 | 2 |
| Madang | 0.3 | 0.3 | 0.6 | 3 |
| Sub-Total | 0.8 | 0.6 | 1.4 | 6 |
| Capacity Building | 1.2 | 0.4 | 1.6 | 7 |
| Project Management ^a | 1.5 | 0.8 | 2.3 | 10 |
| Total Base Cost | 9.6 | 7.4 | 17.0 | 73 |
| Physical contingencies ^b | 1.6 | 1.6 | 3.2 | 14 |
| Price contingencies ^c | 0.5 | 1.1 | 1.6 | 7 |
| Project Cost | 11.7 | 10.1 | 21.8 | 93 |
| Interest Charge (for grace period + TA funding) | 1.5 | | 1.5 | 7 |
| Total Costs to be Financed | 13.2 | 10.1 | 23.3 | 100 |
| Percent | 57 | 43 | 100 | |

^aIncludes an allowance for external auditing.

^bPhysical contingency is 20% for water supply and sewerage subprojects and 10% for other subprojects. Because of the preliminary nature of the engineering designs, lack of detailed topographical maps, and the need to ensure sufficient funding to assist in resolving any potential land issues, a physical contingency of 20% has been applied to base costs.

^cThe international escalation factor used is 2.4% and the domestic is 5%.

E. Financing Plan

61. Under ADB's Graduation Policy, the normal cost-sharing limit for PNG during 2000 is 50 percent. However, the policy allows ADB financing for a project to exceed the cost-sharing limit under exceptional circumstances, when justified by country and project considerations. The Government has recently faced severe financial constraints due to the economic crisis and the attendant scarcity of domestic counterpart funds. As a consequence, in August 1999, the Government initiated a macroeconomic stabilization and structural reforms program with wide external support: the International Monetary fund (IMF) approved a \$115 million line of standby credit in March 2000, and the World Bank approved a \$90 million Governance Promotion Adjustment Loan in June 2000. Technical assistance and budgetary support from Australia, and general balance of payments support from Japan are also providing additional assistance to the Government's program. These measures have brought about improvements in the country's fiscal and balance of payments positions with inflation and interest rates also declining since the beginning of the program. Nevertheless, the very tight fiscal situation is expected to continue over the next few years. Accordingly, the Government has requested ADB to consider a general change in its treatment of PNG and, in the interim, consider an increase in the cost-sharing percentage for this project. Therefore, it is proposed that ADB's share of the project cost be increased from 50 percent to 66 percent of the total project cost.

62. It is proposed that ADB finance \$15.3 million equivalent (66 percent) of the total project cost (\$23.3 million). About \$6.1 million equivalent (26 percent) will be financed by the central Government. Detailed financing plans for the ADB-funded components are in Appendix 5 and Supplementary Appendix C.

63. AusAID has agreed, in principle, to provide parallel grant co-financing in the amount of \$1.8 million equivalent (8 percent) for the capacity building component of the Project, subject to completing its own appraisal and obtaining required internal approvals.

64. The ADB loan will be from ADB's Asian Development Fund (ADF) with a term of 32 years, a grace period of 8 years and an interest charge of 1 percent per annum during the grace period and 1.5 percent thereafter. The Borrower will be Papua New Guinea. In consideration of (i) the social nature of the project, which will bring significant benefits in terms of public health, better environmental conditions and improved access to basic services for all town residents including the poor; and (ii) the need to further support the financial position of the Waterboard, (paras. 44 and 45), it is proposed that the Government bear the foreign exchange rate risk and relend to the Waterboard on the same terms and conditions through a subsidiary loan agreement in form and substance acceptable to ADB. The Waterboard, as the Executing Agency, will enter into a project agreement with ADB.

**Table 3: Financing Plan
(\$ million)**

| Source | Foreign Exchange | Local Currency | Total Cost | Percent |
|--------------------|-------------------------|-----------------------|-------------------|----------------|
| ADB | 11.8 | 3.5 | 15.3 | 66 |
| Central Government | | 6.1 | 6.1 | 26 |
| AusAID | 1.4 | 0.4 | 1.8 | 8 |
| TOTAL | 13.2 | 10.1 | 23.3 | 100 |

ADB =Asian Development Bank, AusAID =Australian Agency for International Development.

F. Implementation Arrangements

1. Overall Project Implementation and Coordination Arrangements

65. The Project will be implemented over four years starting from 2001 (Appendix 6). The Waterboard has established a project management unit (PMU) with qualified staff acceptable to ADB. Staff will also be seconded from the Waterboard provincial offices to the PMU to develop their capacity for supporting the construction and operation of the project facilities. For water supply and sewerage construction implementation, project towns implementation units (PTIUs) will be established in the provincial town offices of the Waterboard for day-to-day project management and supervision. Detailed project implementation arrangements are in Supplementary Appendix D.

66. A project steering committee (PSC) at the central level is envisaged to ensure adequate support from and liaison with other Government agencies. The PSC will comprise the Waterboard's managing director and officials from various government departments, including DPM as chair, DOH, DOW, Department of Finance, and Department of Provincial and Local Government Affairs. The PSC will also have representatives of the private sector and NGOs nationally recognized for their involvement in the water supply and sanitation sector and community development work. The Waterboard will provide the PSC secretariat. The committee's responsibilities will include overall supervision of the Project and approval of the reports and financial statements to be submitted to the Government and ADB. The PSC membership and preliminary terms of reference (TORs) are outlined in Supplementary Appendix F.

67. To complete the coordination arrangements and to facilitate consultation and participatory processes with the provincial, town, and local authorities and the community, provincial towns coordination committees (PTCC) will be established for the water supply and sewerage subprojects. The PTCC will comprise the provincial administrator as the chair, the

town manager, a representative of women's interests, representatives of the NGOs active in the district, the Waterboard district manager, and community representatives chosen for their standing in the community and their ability to bring community participation inputs to the project. The PTCC will meet regularly, make its operations public, advise on and facilitate public debate and involvement in matters of community interest in water supply and sanitation. Membership and preliminary TORs for the PTCC are outlined in Supplementary Appendix F. The Waterboard's provincial offices will provide the PTCC secretariats.

2. Procurement

68. All ADB-financed procurement under the Project will follow ADB's *Guidelines for Procurement*. All civil works contracts for water supply, sewerage, and other major civil works in excess of \$1,000,000 will be awarded under international competitive bidding (ICB) procedures. International shopping (IS) may be employed where the estimated cost is less than \$1,000,000. All contracts for procurement of goods exceeding \$500,000 in value will be procured under ICB, and IS may be employed where the estimated amount is less than \$500,000.

69. At the Government's request, and given the lack of interest of foreign contractors and suppliers, all civil works and materials supply contracts for the LCS-CAHE program not in excess of \$200,000 may use local competitive bidding (LCB) in accordance with standard government procedures acceptable to ADB. Under the LCS-CAHE program, civil works estimated to cost the equivalent of \$50,000 or less may be procured through community participation in accordance with procedures acceptable to ADB. The proposed packaging and draft bidding documents for the LCS-CAHE program should be submitted for prior review and concurrence of ADB.

70. Minor and off-the-shelf items such as office equipment and consumables, with cost not exceeding \$100,000, will be procured by direct purchase. ADB's approval prior to the awarding of contracts will be required for all ICB contracts. Copies of all contracts not requiring prior ADB approval will be furnished to ADB for its review and consideration after contract award. If ADB does not concur with any decision taken by the Waterboard, ADB will not be committed to financing those contracts. The list of contract packages is in Appendix 8.

71. The ADB anticorruption provisions (as provided in ADB's *Guidelines for Procurement* and *Guidelines on the Use of Consultants*) will apply to all expenditures financed under the loan. This means that (i) ADB will reject a proposal for award if it finds that the proposed bidder has engaged in corrupt or fraudulent practices in competing for the contract in question; (ii) any expenditures incurred with or through corrupt or fraudulent practices will not be reimbursable; (iii) any firm or individual found to have engaged in such practices will be declared ineligible, either indefinitely or for a stated period, for ADB-financed contracts; and (iv) where the Borrower has not taken timely and appropriate remedial action when such practices have been committed, the relevant portions of the loan may be cancelled.

3. Consulting Services

72. All ADB-financed consultants will be engaged in accordance with ADB's *Guidelines on the Use of Consultants* and other arrangements satisfactory to ADB for engaging domestic consultants. As the Government has requested that internationally recruited consultants collaborate with domestic consultants, there will be one consulting service package for overall project management and the water supply and sanitation engineering design and supervision (71 person-months of international and 178 of domestic consultants). Capacity building in the

O&M component will require 9 persons-months of international and 16 of domestic consultants. Additional separate consulting packages will combine capacity building for the Waterboard and capacity building for environmental management (21 person-months international, and 12 domestic), and the LCS-CAHE program (5 person-months international, and 363 domestic). Total consulting services will be 106 international person-months and 569 domestic. The consultant inputs and summary TOR are in Appendix 7 and Supplementary Appendix F. ADB approved advance action for selecting the project management consultants, but approval does not commit ADB to finance the Project.

4. Disbursement Procedures

73. The Government will allocate annual counterpart funds for expenditures for four consecutive years. All disbursements for eligible expenditures will be made in accordance with ADB's disbursement guidelines following ADB's *Loan Disbursement Handbook* (1996). All applications for withdrawal of loan proceeds may use one of the following procedures: (i) direct payment, (ii) reimbursement procedures, and (iii) imprest fund procedure.

- (i) Direct payment. Under direct payment procedures, the Government, using ADB's standard withdrawal application, requests ADB to pay the supplier of goods and services directly from the loan funds. The Government will indicate in the withdrawal application the date on which payment becomes due to the supplier. A separate application will be filled out for each currency in which the payment is requested. The application should be submitted with supporting documents such as contract invoice receipts and vouchers. This procedure will be used to pay for (a) consultant's fees, (b) civil works, and (c) procurement of goods. Copies of signed contracts will be forwarded to ADB promptly to facilitate timely payments.
- (ii) Reimbursement procedures. Reimbursement procedures are used when eligible expenditures are paid from the Waterboard's budget and reimbursement claimed from ADB. The Waterboard will prepare withdrawal applications with supporting documents and summary sheets of expenditures, and ADB will make payments directly to the Waterboard's account. The reimbursement procedure will be used to pay (a) local currency costs, (b) small purchases, and (c) small works contracts.
- (iii) Imprest fund. Under the imprest fund procedure, ADB provides the relevant borrower with funds in advance to meet expenditures to prefinance payments to contractors and suppliers. The imprest account will be used for small civil works expenditures, payment of indirect foreign exchange costs in local currency, and small purchases under all cost categories eligible for ADB financing. The ADB statement of expenditure (SOE) procedure may be used for reimbursing eligible expenditures and liquidating the imprest account for payments with value equal to or below \$10,000 each. The imprest account will be in US dollars and the maximum initial advance will be \$300,000. The imprest account will be opened by the Government at a bank acceptable to ADB. Government contributions to the Project will be maintained in a separate counterpart trust account. Further disbursement details will be finalized during project inception.

5. Midterm Review

74. In addition to regular loan reviews, a comprehensive midterm review will be carried out when all the detailed designs are completed and contracts are awarded, which will be about 24 months after loan effectiveness. The review will evaluate the actual progress of each project component; coordination, implementation procedures; monitoring and evaluation functions of the PMU, PSC, PTIUs, PTCCs, LCS/CUs, and LCS/IUs; and performance of the consultants. The financial performance of the provincial water supply and sanitation activities and the agreed-upon cost recovery mechanisms for the subprojects will be reevaluated. Remedial action will address identified problems, if any. The review will also determine the need for changes in the original project design, implementation arrangements, and loan allocations, or more generally identify cost overruns and other factors that may constrain satisfactory implementation of the Project.

6. Reports and Accounts

75. The Waterboard will submit to ADB quarterly project progress reports. The PMU, with assistance from the consultants, will collect and consolidate project information in a format acceptable to ADB. The format will be set in ADB's Project Administration Memorandum (PAM). The Government and the Waterboard will maintain separate accounts for project expenditures and will furnish ADB with the Project's accounts and financial statements of the Waterboard. Such project accounts and financial statements will be audited annually by independent auditors acceptable to ADB and submitted to ADB within nine months of the close of the relevant fiscal year. The loan includes amounts for engaging independent auditors. The imprest account and SOE procedures will be audited as part of the regular audit of the project accounts and financial statements, and audit opinion on the imprest account and SOE should be set out separately. A project completion report will be submitted by the project director to the Government and ADB within three months of physical completion of the Project. The report will highlight the development impacts of the Project.

76. The PMU, with assistance from the consultants for project management support, will set up the project accounts in accordance with ADB and Government guidelines. The consultants will also provide training and operating support to the PMU accounting staff in the use of these accounts in the initial stage of project implementation. The PMU, assisted by the consultants, will prepare the required information for audit in accordance with ADB's project auditing requirements.

7. Project Performance Monitoring and Evaluation

77. To ensure that the Project is managed efficiently and that the intended benefits are maximized, a system for project performance management and evaluation (PPME) will be developed in accordance with ADB's Guidelines (Supplementary Appendix F). Project benefit monitoring and evaluation (BME) during the implementation period will be conducted by the PMU with the assistance of the provincial health department agencies as well as other relevant provincial governments. For 24 months after the project is completed, the Waterboard will continue BME as part of its routine operations. For the duration of implementation (four years) and the following two years, the BME surveys will be carried out by the PMU at six-month intervals starting from project inception. Participatory, community, and beneficiary surveys will be the basis for these evaluations. The officers responsible for BME will be well-experienced staff with wide community consultation experience. The Waterboard will maintain all records for

this and make such records available to ADB when required. BME will cover all the components of the Project.

78. In addition, particular attention will be paid to the LCS program as its implementation during the first 18 months is seen as a pilot to gauge community acceptance and preferences. The project achievements will be periodically monitored against performance indicators by the PSC, PTCCs, and LCS/CUs. Benchmark information collected during project preparation will be updated at the beginning of the Project. A special report will be prepared for the midterm review of the Project. Detailed arrangements for the LCS-CAHE program are in Appendix 4 and Supplementary Appendix F.

8. Land Acquisition

79. At present, no water supply and sanitation subprojects will require land outside town boundaries or alienated state land for their implementation. Detailed design of the subprojects will also be geared to minimizing land acquisition. However, it is recognized that some subprojects may require the construction of infrastructure outside the town boundaries. Should this occur, work will be planned to be alongside the existing facilities. In the unlikely event that some land acquisition may be required, negotiations will be held with landowners, the provincial government and town administrations. The cost estimates have used a high physical contingency of 20 percent to ensure that insufficient funds do not become a constraint in resolving such issues. While the Project does not involve population relocation, land will be acquired by the Government, as necessary, in accordance with the consultative and legal process under its Land Act and applicable ADB policies. In particular, the Government will acquire the required land or rights thereto on a timely basis in accordance with ADB's Policy on Involuntary Resettlement and provide compensation including crop compensation, as required, in accordance with ADB's relevant guidelines. The Waterboard, with support from the project management consultants, will identify a program for resolving outstanding land disputes and claims.

G. The Executing Agency

80. The Executing and Implementing Agency is the PNG Waterboard. The Waterboard's executive manager for technical services will be the project director. The Waterboard will appoint a suitably qualified project manager to head the PMU in charge of implementing the Project. The Waterboard overall has a good record as Executing Agency for both TAs and loans. It has shown consistent experience, competence, and sufficient resources in implementing ADB-funded projects. It has also demonstrated a good absorptive capacity for institutional strengthening and project implementation and a firm commitment to adopt organizational and policy changes required to increase its financial sustainability and enable it to fully carry out its mandate as the main water supply and sanitation agency in PNG.

81. During project implementation, the Waterboard will be supported by domestic and international consultants, through the project management and the Waterboard capacity building components. The latter is described in Supplementary Appendix A. In particular, Waterboard staff will receive support and training in (i) pursuing policy and institutional reform, (ii) improving its management information systems, (iii) strengthening its compliance functions, (iii) building public (institutional) awareness of Waterboard's plans and operations, (iv) improving O&M, (v) strengthening overall inspection and monitoring, and (vi) improving environmental monitoring and management.

H. Environmental and Social Measures

1. Environment

82. The Project is classified as environmental category B and an initial environmental examination (IEE) was conducted for each subproject under the project preparatory TA study. No significant adverse effects are anticipated, and the IEE concludes that a detailed environmental impact assessment is not required. The potential environmental impacts and mitigation measures are summarized in Appendix 9. The IEE indicates that the Project will improve the environmental conditions in the project towns by (i) providing new and upgraded water supplies to the towns of Kerema, Mendi, and Wabag; (ii) providing new and upgraded sewerage and treatment facilities to Alotau, Madang, and Mt. Hagen; and (iii) introducing a LCS program in Alotau, Lae, Madang, Mt. Hagen, and Wewak.

83. For water supplies with surface sources (Wabag and Mendi surface water option), the possibility of abstraction interfering with the downstream river regime is assessed as minimal for the sites chosen. For towns with groundwater sources (Kerema and Mendi groundwater option), the possibility of abstraction interfering with and drying up the shallow wells in the area has been examined. The average borehole depth to reach the aquifer is 50 to 100 meters. Abstraction of water for the town supplies from an aquifer this deep is not expected to affect the shallow (phreatic) groundwater, which sustains shallow wells. The disposal of effluent and sludge has been examined for the towns concerned. At the detailed design stage, the consultants will be required to provide design, monitoring, and mitigation safeguards to ensure compliance with the national environmental standards of PNG. For the LCS program, there is the possibility of direct contamination of the shallow groundwater if the toilet tanks for any of the latrines are not constructed with due care. This risk will be mitigated by requiring that the design and construction of the tanks follow appropriate technologies and, as necessary, watertightness requirements.

2. Social Analysis

84. The household survey indicates that water is a number one priority. The poor segments of the society suffer more from services inadequacies and unsanitary conditions than do the wider urban population. During the dry season, urban communities with no town water supply turn to alternative, often polluted, sources and risk exposure to waterborne diseases. Human waste is polluting water sources used for drinking, washing clothes, and bathing. Statistics for urban towns indicate a high prevalence of typhoid, diarrhea, and skin diseases. The water and sanitation components are designed to improve basic services and the unacceptable health and environmental conditions.

85. Active community involvement is essential to identify and address the felt need of the people. Community and beneficiary participation was encouraged during project preparation. Discussions were held with key stakeholders including central Government agencies, provincial and town governments as well as local communities, representatives of women's interests, NGOs, and the private sector. Socioeconomic surveys were conducted in all project provincial towns. Socioeconomic and technical surveys, key interviews, meetings, and workshops (particularly on the parallel LCS-CAHE program) with provincial and town agencies and representatives were organized and conducted during project preparation. As a result, the Project has comprehensive knowledge of the communities' background, needs, willingness to pay, expectations, and social desires. The Project was designed to respond to those conditions

and to ensure outcomes that will have positive social impacts. A summary initial social analysis is presented in Appendix 10.

86. Social measures were incorporated into the Project. For instance, the new water and sanitation pricing and tariff structure developed during project preparation in consultation with the Waterboard sets rates affordable particularly to the poorer sections of the community. The abolition of direct costs for service connections for low-volume consumers and the inclusion of a minimum quantity “lifeline” supply (12 kl) monthly at K3.5 are examples of the Waterboard’s proactive recognition of the broad social needs.

V. PROJECT JUSTIFICATION

A. Financial and Economic Analyses

1. Financial Viability and Cost Recovery

87. In accordance with the financial viability requirements of the Waterboard and cost recovery objectives of ADB, proposed subproject tariffs were set to achieve cost recovery. No long-term subsidies are required. The proposed tariffs are set to recover full O&M costs of the facilities, including administration costs at the district level, full depreciation on assets, interest payable on the ADB loan, and incremental head office costs. In the medium to long term, the subprojects will also yield a small return of around 2 percent.

2. Financial Appraisal

88. Each subproject was financially appraised in real terms using constant June 2000 prices. For all subprojects, the financial internal rate of return (FIRR) compared favorably with the weighted average cost of capital of negative 0.6 percent for water supply subprojects and negative 0.8 percent for sewerage subprojects. Average incremental financial revenues (AIFR) exceeded average incremental financial costs (AIFC) for all. Sensitivity tests showed that each subproject can withstand adverse cost and revenue scenarios. The financial analysis and the Waterboard financial projections are presented in Appendix 11.

3. Affordability

89. The Waterboard recently introduced a lifeline tariff of K3.50 for the first 12 kl of water and K4.86 for sewerage for the poor. While connection is voluntary, connection charges were also abolished to give the poor access to the basic services of water supply and sewerage.

90. The affordability analysis incorporates the current block tariff system, which charges different rates for domestic and nondomestic customers and for different volumes consumed. For subprojects to be affordable to domestic customers, while maintaining individual financial viability, some degree of cross-subsidization is needed from nondomestic to domestic customers and from higher volume customers (those in higher income brackets) to lower volume customers (including the poor).

91. The affordability analysis demonstrates that, with careful structuring of tariffs within the current block system, subprojects can be made more affordable without compromising financial objectives. The analysis calculates a possible tariff structure that, given current consumption patterns across comparable towns, will achieve the required average tariffs while keeping household bills at affordable levels.

92. In all cases, the nondomestic high-volume user was the main target to absorb most of the impact resulting from adoption of the proposed structure where costs to the lower volume and domestic users are kept at affordable levels. In addition, any tariff increase must be carefully structured to take account of price and income elasticity of users, and the need for compliance, regulation, and enforcement, which will be critical where nondomestic, large-volume charges are high.

4. Economic Analysis

93. Least-cost analysis at the prefeasibility stage compared viable technical alternatives, where available. In all cases the least-cost alternative was the chosen subproject option. Where on-site sanitation proved to be the least-cost option, the subproject was included under the LCS component.

94. The economic analysis was for 25 years inclusive of the project construction period, in accordance with ADB's *Guidelines for the Economic Analysis of Projects*. Economic benefits and costs were denominated in the domestic price numeraire and expressed in constant June 2000 prices. Project benefits and costs were estimated on a without- or with-project basis appropriately apportioned on the basis of the components being tradable or nontradable. Tradable components were adjusted to economic prices using a shadow exchange rate factor of 1.1, and nontraded components were valued at domestic market prices. No other conversion factors were applied.

95. For the water supply subprojects, nonincremental benefits were valued based on the existing supply price and incremental benefits were valued based on incremental revenues. Non-technical losses and a small allowance for resource savings in O&M were included. For sewerage subprojects, benefits were valued based on incremental revenues and on the estimated reduction in the use of medicines resulting from a lower incidence of waterborne disease, the benefits amounting to about K3.5 per person, which represents about 20 percent of provincial spending on public health.

96. For both water supply and sewerage subprojects, the base case economic internal rate of return (EIRR) exceeds the assumed 10 percent economic opportunity cost of capital (EOCC) with the lowest EIRR being for Alotau sewerage where the base case EIRR is 11.4 percent. While some of the calculated EIRRs are relatively low compared with the assumed EOCC of 10 percent, under the project significant economic benefits will be generated, particularly public health benefits, amenity values, and indirect economic benefits. However, these benefits are not fully valued and reflected in the EIRR analysis. All subprojects are believed to be economically viable. The economic analysis including base case EIRR, net present value (NPV) and switching values (SV) is presented in Appendix 12.

B. Environment

97. The Project will significantly improve the urban environment and quality of life for the communities in the project towns. The people living in the project towns (Alotau, Kerema, Lae, Madang, Mendi, Mt. Hagen, Wabag, and Wewak) currently do not have adequate safe, secure, water supplies or sanitation. Lack of these basic facilities and the consequent environmental degradation result in very high levels of preventable waterborne intestinal diseases (diarrhea, dysentery). These are reflected in the very poor public health indicators.

98. In addition, the Project addresses the present lack of environmental management capacity within the Waterboard through the environmental management capacity building component. The broad aim is to enable the Waterboard to become a responsible “corporate citizen,” fully aware of all the possible impacts of its operations and their effects on the environment while carrying out its mandated functions. This component will provide technical and institutional advice and training to strengthen the Waterboard’s environmental management capacities for higher levels of pollution prevention, better monitoring and compliance with standards and wastewater minimization. Selected officials of the Waterboard will be trained. It is expected that nominees from DOH, Office of Environment and Conservation, and related Institutions will also participate and thus ensure that the training program will have a broader impact for better management of the environment.

C. Social Dimensions and Impact on Poverty

99. In PNG towns, as is typical in many developing countries, it is most often the poor who do not have easy access to safe water supply and safe excreta disposal. Low incomes go together with general absence of basic services. Poverty engenders more poverty unless conscious efforts are made to break the vicious cycle. This points to the need for including more social indicators in appraising the viability of projects. About 16 percent of PNG’s urban population are categorized as poor. These people and the broader community stand to benefit from the project. Among PNG’s urban poor are squatters, unemployed and underemployed, low-income families that are often very large. As populations have increased, particularly in squatter settlements and urban areas, environmental conditions have suffered and public health has deteriorated.

100. Lack of water during the dry season is a difficulty experienced all over PNG. A reliable year-round supply of clean water is essential to ensure good health. The shift by the Waterboard to a strong and proactive stance in customer services coupled with the decision to provide better services to existing and potential customers is a step in the right direction.

101. Improvements to general sanitation through both the sewerage and the parallel LCS-CAHE program will ensure that better health and improved quality of life are spread to a wider section of the population, than through a sewerage system alone. Sewerage systems in towns and cities throughout the developing world usually serve only a small proportion of the population, typically the richer residential, commercial, or government areas. The low population densities and rugged terrain of most provincial towns make it difficult to justify the cost of sewerage schemes for every town for most of the settlements. The LCS-CAHE program will allow a greater number of low-income urban dwellers and the urban poor to benefit from the project. The primary beneficiaries of LCS-CAHE will have lower levels of pollution and incidence of less preventable illnesses, more time for productive use, and the resulting better opportunities for economic improvement. The need for low-cost on-site schemes was emphasized by ADB in its Urban Sector Profile in 1992.

102. Workshops participated in by all stakeholders were held in selected provincial towns in the second phase of project preparation to identify and discuss the main findings and recommendations of the TA final report, and to seek feedback and commitment to the Project, particularly with regard to the proposed LCS-CAHE program. The Appraisal Mission visited the selected urban settlements for the pilot phase of the program. The level of support for both water supply and sewerage subprojects and for the LCS VIPL program was clearly positive. The LCS-CAHE program will involve community mobilization, participatory planning with the

communities, NGOs, and the provincial town administrations. Active involvement of the community will be maximized and the social impacts of the proposed Project enhanced.

103. The Project will also assist in improving the hygiene education of poorer households by raising awareness of health and sanitation issues through the parallel LCS-CAHE program. It will benefit households financially by providing information and ideas on water conservation and various methods to reduce expenditure, including simple water tap maintenance. The Project will improve the availability of safe water in the project towns and eliminate the substantial time spent daily by the family, especially the women, in fetching water and enable them to attend to more productive tasks.

D. Benefits and Risks

1. Benefits

104. The Project will assist the PNG Waterboard in pursuing its mandate of enhancing the delivery of water supply and sanitation services to the communities in PNG. The Project will address basic needs and poverty reduction by improving overall health status, living conditions and lifestyle, and specifically ensuring that poorer beneficiaries are not unduly economically burdened. Through its components, the Project aims in particular to (i) improve the coverage of water supply to give a greater number of people access to safe water; and (ii) increase the quantity of water available through improved and more cost-effective delivery of the services. This includes new supplies, upgrading existing ones, 24-hour service, and loss reduction.

105. Providing appropriate and adequate systems for the safe disposal of human waste is the other key component of the Project. This will be achieved by rehabilitating sewerage systems and treating sewage, where possible, through the sewerage component of the main project. In addition, the parallel LCS-CAHE program will address the problems generated by indiscriminate defecation and the need for health education in the selected towns. This will result in substantial improvement in public health and environmental conditions for the community in the long term. The LCS-CAHE program will therefore enhance the positive health impacts and overall poverty reduction benefits of the main project. The Project and the parallel LCS-CAHE program meet the objectives of ADB's poverty reduction strategy.

2. Health Impacts

106. Health statistics in the provincial towns show that inadequate water supply and sanitation, poor living conditions, and bad health and hygiene practices contribute to the prevalence of preventable intestinal diseases. Typhoid, diarrhea, dysentery, skin diseases, and intestinal worms are common and are easily transmitted. The elderly, very young, and infirm are at considerable risk of death from some of these illnesses. Diarrhea is one of the leading causes of infant mortality in PNG. The LCS-CAHE program will cover all aspects of community health-related issues.

107. The sewerage component of the project and the LCS-CAHE program activities will improve hygiene and living conditions for residents in Alotau, Madang, and Mt. Hagen. These towns have problems with overflowing septic toilets, unsanitary bucket toilets, and unhygienic pit latrines. Adequate sanitation, through the isolation and safe containment of feces, is the first step in improving public health. Improved sanitation will also address environmental conditions such as bad smell, sewage overflows or effluent seepage, and other concerns raised by householders in the survey. Sewerage system improvements will reduce the potential for contamination of shallow wells and open water.

108. Provision of piped treated water to Kerema, where 96 percent of households rely on rainwater and 4 percent use bores or wells, will reduce the incidence of illness during the dry season and periods of extended drought. At present, when rainwater supplies are exhausted in a few months, households depend on alternative water supplies, which are often of poor quality and contaminated bacteriologically or otherwise. Similarly, improvements to water supply quantity and quality in Wabag will greatly reduce waterborne illness there. The incidence of diarrhea, which ranks seventh as cause of death, is very high in Wabag district. The project preparation household survey reported more cases of typhoid for Wabag than for any other town. Typhoid ranked fourth as cause of death in Wabag district, with 19.2 deaths per 100,000 people between 1995 and 1997 (DOH). A continuously treated water supply will significantly improve health conditions for Wabag residents.

3. Gender Impact

109. In PNG, as in many other developing member countries, the responsibility for water collection, which often takes considerable effort, labor and time, falls on women. It is also the women who provide most of the work in maintaining the household and caring for small children, the elderly, and the sick in the family. Through adequate sanitation, the incidence of the now common preventable intestinal diseases will be considerably reduced. This will mean not only improving health generally, but also considerably reducing the time that women have to spend caring for the sick, and freeing them to use that time more profitably. The Project will benefit women in two specific ways. First, through the LCS-CAHE program, women will be targeted for sanitation awareness training and they will benefit significantly from education building on water use and hygiene. This information will give them control and choice in the way they care for families, and manage water resources and household finances. Second, the provision of safe and easily accessible water means that the time women spend in fetching water will be obviated. Active involvement of women during planning and implementing the LCS-CAHE program will provide them with opportunities to decide on issues that affect their daily lives and the well-being of their families.

4. Risks

110. The main risks to the Project and the parallel LCS-CAHE program are (i) the potential unwillingness of the provincial governments and local councils to work with the Waterboard and commit funds to support project implementation with respect, in particular, to the LCS-CAHE program; (ii) inadequate available resources for counterpart assistance and resourcing of the PMU, PTIUs, LCS/CUs and LCS/IUs; (iii) slow project implementation and ineffective project management due to insufficient number of trained staff with experience in externally funded projects; (iv) unresolvable land acquisition issues; (v) slow implementation of the LCS-CAHE program due to limited community participation and lack of trained local government staff; (vi) improper selection of settlements in a way that does not meet community priorities, e.g., settlements with very limited water availability and (vii) vandalism and destruction of piped networks and VIPLs due to low security in the project areas and LCS selected settlements.

111. The attitude, level of support, and commitment of the provincial and local governments have been assessed as positive as a result of the workshops carried out during project preparation. The assessment was confirmed in subsequent field visits during project fact-finding and appraisal. The required provincial counterpart contributions for the LCS-CAHE program were confirmed during appraisal. During project preparation, civic society groups, NGOs, and local communities expressed their firm willingness to be involved in project implementation, particularly in the LCS-CAHE program. With this level of enthusiasm and able support from the

Waterboard, the project is well positioned to achieve its goals. As indicated earlier, the PNG Waterboard has considerable experience and evident competence in managing aid-funded loan projects. It has the capabilities required, but the demand for the secondment of resources could stretch the organization should the need come on top of other demands. Strong international consultant assistance is proposed to bolster the resources for project management and to assist the Waterboard in this regard. With respect to the land acquisition risks, (para. 83), during project preparation all efforts were made to minimize land requirements. As a result, no water supply and sewerage subprojects are envisaged to require land outside town boundaries or alienated State land. In any case, the Waterboard with support from the project management consultants will develop a program to address and resolve outstanding and potential land disputes and claims. With regard to vandalism and possible lack of community demand for LCS, these risks will be minimized through the highly participatory and community-based approaches that will be used in planning, designing, and implementing the LCS-CAHE program. Through this process the poor and low-income households will have the opportunity to confirm their willingness to contribute and demonstrate their interest and motivation to participate.

VI. THE JFPR FUNDED PROGRAM (LCS-CAHE)

A. Rationale

112. Although some reticulated water supplies and sewerage systems are proposed in the main project, for reasons of nonviable population groupings, physical and topographic hindrances and high unit cost per head, developing additional reticulated sewerage in most of the other provincial towns is not economically and financially viable and is thus not included. For these populations, the proposed community- and individual household-based LCS activities provide the best option. The LCS program is planned for three years, with the first 18 months to be implemented as a pilot trial covering only the towns of Lae and Madang. During the pilot trial, low-cost ventilated improved pit latrine (VIPL) systems will be introduced in selected settlements at the urban boundary and in the settlements on the periphery of the urban boundary.

113. The LCS program aims to provide appropriate and affordable sanitation for the poor in the target towns. The urban poor often resort to informal and ad hoc methods to dispose of human waste, directly causing the high incidence of preventable intestinal diseases - diarrhea and dysentery - which are endemic in most towns. The causes of such behavior are not only the inability to afford sanitation but also lack of general public health and hygiene knowledge and awareness. It is evident that the communities do not understand the cause-effect relationship between sanitation or hygiene and waterborne diseases. To rectify this and ensure that the sanitation interventions of the Project have a long-lasting effect on the target population, the LCS program is combined with the CAHE program. The CAHE program will specifically disseminate basic knowledge to the target populations in a simple format that can be understood and accepted by ordinary citizens, for eventual change of behavior regarding household and personal hygiene. The LCS-CAHE program is expected to have significant positive results in the long-lasting improvement of general public health for all the program towns' residents, particularly the poor.

B. Objectives and Scope

114. As a highly complementary part of the main project, the LCS-CAHE program will offer a solution to inadequate sanitation by (i) providing options to improve sanitation standards, and (ii) enhance overall health and environmental conditions in the project provincial towns. The primary objective of the program is public health improvement and poverty reduction in the

selected provincial towns. In addition, the program will involve a participatory approach that includes individual households and the community in developing affordable on-site sanitation solutions. The scope will include two major activities: (i) providing LCS schemes to urban residents particularly in the poorer urban settlements in Alotau, Lae, Madang, Mt. Hagen, and Wewak; and (ii) undertaking of CAHE program activities to improve communities' knowledge of the linkages between water, sanitation, and health, as well as to develop community networks and institutional arrangements between the Waterboard, the local governments, and other stakeholders to support the low-cost sanitation projects and related training. A summary description of the LCS-CAHE program, as well as its cost estimates, financing plan, implementation arrangements, poverty reduction impact, and benefits and risks are all in Appendix 4.

VII. ASSURANCES

A. Specific Assurances

115. The Government and the Waterboard have given the following assurances, in addition to the standard assurances which have been incorporated in the legal documents:

- (i) Counterpart funds. The Government will ensure during each year of project implementation, timely and regular (a) submission of necessary requests for annual budgetary appropriations and disbursements of required counterpart funds; and (b) release of such funds by the relevant authorities to facilitate project implementation.
- (ii) Cofinancing. If the Government is unable to obtain the AusAID grant within six months of loan effectiveness, it will (a) enter into other arrangements, satisfactory to ADB, to obtain the required additional funding necessary for timely and effective implementation of the sector policy reform and Waterboard capacity building component; or (b) provide additional counterpart funds to finance any shortfall resulting from the Government's inability to obtain the AusAID grant or the alternative funding.
- (iii) Project performance monitoring and evaluation (PPME). The Waterboard, through the PMU, will develop and implement a PPME system, in accordance with benchmark and performance indicators and other procedures acceptable to ADB within 12 months of the Effective Date.
- (iv) Gender. The Government will ensure that at least 50 percent of the community representatives who are members of each PTCC will be women.
- (v) Waterboard operations. The Waterboard will implement its first five-year corporate plan (1999-2003) including: (a) maintaining a collection rate of not less than 90 percent; (b) ensuring that its average nonrevenue water from all Waterboard districts will not be more than 20 percent by 31 March 2005; and (c) ensuring that the percentage of current receivables due from Waterboard customers outstanding for more than 90 days will not exceed 15 percent of the total value of all current receivables payable to the Waterboard.
- (vi) Cost recovery. The Waterboard will increase water supply and sewerage tariffs during project implementation from current levels to ensure operational cost recovery. To this end, the Waterboard will prepare and submit the necessary applications for tariff increases to government authorities concerned to ensure that, on or before 30 September 2005, the applicable average tariff rates charged

to consumers will not be less than approximately K1.3/kl for water and K0.5/kl for sewerage (in constant March 2000 prices).

- (vii) Operations and maintenance (O&M). The Waterboard will ensure that necessary expenditures are incurred to maintain and operate its assets, so that (a) continuous water supply and sanitation services are provided in districts in which it operates so that the average number of hours of water supply in any town does not fall below 20 hours per day, and (b) the quality of water supplied to districts in which it operates conforms to current World Health Organization standards. For monitoring (a) and (b), the Waterboard will maintain records of daily hours of water supplied and results of periodic water testing.

The Waterboard further undertakes (a) to increase O&M expenditure from the current rate of 0.5 percent to not less than 1 percent on the average asset value of the Waterboard in any year; (b) to prepare and implement an O&M action plan, on terms and with time-bound milestones acceptable to ADB, to improve its O&M of water supply and sewerage systems, including improvements in related environmental management; and (c) ensure that annual budgeted amounts for O&M expenditures are used exclusively for O&M purposes.

- (viii) Environment. The Waterboard will ensure, that the environmental mitigation and monitoring measures recommended in the IEE for the Project will be followed in design and implementation of the Project, including: (a) for the water supply subprojects, that regular monitoring will be undertaken of (i) abstraction of water from aquifers and its impact on the level of available surrounding shallow groundwater; and (ii) the downstream flow of Mangani River and Pagwa Creek below the relevant abstraction points and related impacts, if any, on downstream users and fish and wildlife, and timely measures to mitigate any adverse environmental impacts monitored under (i) and (ii) will also be undertaken; and (b) for the sewerage subprojects, that sewerage works and treatment, including construction of facilities, disposal of sludge, and discharge of effluent, will comply with applicable national standards of the Borrower and relevant ADB guidelines. Further, the Waterboard shall ensure that training will be provided for senior and operational staff in environmental awareness, with particular reference to Waterboard activities including Project implementation, in form and substance acceptable to ADB.
- (ix) Land. The Government will ensure that all (a) title to land (and related easements or rights-of-way) required for each water supply and sewerage (WSS) subproject will have been obtained in a timely manner to ensure proper commencement and completion of the related WSS subproject activities, and to such end the Government will provide satisfactory evidence to ADB in the proposal submitted to ADB for financing of such WSS Project, that the land (or any related easements or rights-of-way therein) has been obtained; and (b) land acquisition under the Project will be carried out in accordance with ADB's Policy on Involuntary Resettlement.
- (x) Privatization. The Government will ensure that any proposal for privatization of the Waterboard through sale of more than 20 percent of the Government's equity and/or transfer of management of any part of the operations of the Waterboard to the private sector by way of lease, concession, or otherwise will be submitted to ADB for prior review and comment.

- (xi) Audit. The Government shall cause the Waterboard to ensure that any independent auditors financed under the loan will be selected and engaged in accordance with competitive selection procedures acceptable to ADB.
- (xii) Mid-term review. The Government will carry out a comprehensive mid-term review no later than the expiry of 24 months from the loan effectiveness.

B. Conditions for Loan Effectiveness

116. The Government has agreed to complete the following, prior to loan effectiveness, in form and substance satisfactory to ADB:

- (i) A PTCC will have been established for each of the provincial towns participating under the WSS subprojects component of the Project.
- (ii) The Government and the Waterboard will have executed a subsidiary loan agreement, on terms and conditions satisfactory to ADB, for the Government to relend the loan proceeds to the Waterboard for the purposes of the Project.

VIII. RECOMMENDATION

117. I am satisfied that the proposed loan would comply with the Articles of Agreement of ADB and recommend that the Board approve:

(i) the loan in various currencies equivalent to Special Drawing Rights 11,985,000 to the Independent State of Papua New Guinea for the Provincial Towns Water Supply and Sanitation Project, with a term of 32 years, including a grace period of 8 years, and with an interest charge at the rate of 1 percent per annum during the grace period and 1.5 percent per annum thereafter, and such other terms and conditions as are substantially in accordance with those set forth in the draft Loan and Project Agreements presented to the Board; and

(ii) the administration by ADB of assistance to the Government of Papua New Guinea in an amount not exceeding the equivalent of \$1,740,000, to be financed by the Japan Fund for Poverty Reduction on a grant basis, for the purpose of low-cost sanitation, community awareness and health education.

TADAO CHINO
President

22 November 2000

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PROJECT FRAMEWORK

| Design Summary | Project Targets | Monitoring Mechanisms | Assumptions/ Risks |
|--|---|--|--|
| <p>I Overall Goals Promote human and economic development in the project provincial towns</p> <p>Improve social indicators, physical environment, and quality of life for the poor and other residents in the project towns</p> <p>Improve governance of the water supply and sanitation sector</p> | <p>Improved social and economic conditions and overall quality of life</p> <p>Improved access to safe water and sanitation facilities in a sustainable and affordable way</p> <p>Improved sector management and institutional setup and coordination; improved overall Waterboard performance and sector service delivery</p> | <p>Living standards, life expectancy, literacy and employment levels by project completion; various reports and economic studies</p> <p>Various statistics surveys, other studies and reports by bilateral and multilateral agencies and local organizations, non-government organizations (NGOs)</p> <p>Household satisfaction survey at evaluation phase; benefit monitoring and evaluation (BME) monitoring targets achieved; implementation of the agreed-upon Waterboard action plan</p> | <p>Government commitment to public sector reform, good governance and privatization policies</p> <p>Policy framework stability Political commitment to invest in the sector and support its development Waterboard senior management remains in place Commitment to strengthen sector management and institutional coordination Support for the leadership role of the Waterboard</p> |
| <p>II Project Objectives Increase coverage and improve quality of basic water and sanitation services</p> <p>Improve public health and reduce poverty in selected provincial towns</p> <p>Improve management and coordination of water supply and sanitation sector</p> | <p>By 2004 urban town populations of about 41,500 people will directly benefit from the project</p> <p>Better community health, higher income, more productive activities, easier access to school and other social services for the poor. 36,000 poor will benefit from low-cost sanitation and community awareness and health education (LCS-CAHE) JFPR funded program</p> <p>Reformed policy framework for the sector; strengthened institutional capacity & overall management; improved sector coordination</p> | <p>Project progress reports, implementation targets reached per component and subprojects</p> <p>Number of persons using these services by year and per town Other socioeconomic statistics at the town level</p> <p>Institutional and organizational sector studies, review reports Operating and financial efficiency of Waterboard, management information system reports</p> | <p>Central and local government contributions are fulfilled as committed</p> <p>Large participation and involvement at all institutional levels including local communities and individual households</p> <p>Timely policy and institutional changes promoted by Waterboard and endorsed by Government</p> |
| <p>III. Components/Outputs Improve provincial towns' water supplies</p> <p>Provide the provincial sanitation (sewerage) schemes</p> <p>Sector policy and coordination support</p> <p>Building the capacity of the Waterboard</p> | <p>Upgraded/constructed surface and groundwater intakes, treatment plants, and reticulation networks; provided operations and maintenance (O&M) training for Waterboard staff. By 2004 urban populations of about 20,700 people will have directly benefited from the project</p> <p>Installed sewerage network Upgraded treatment and effluent disposal systems 20,800 direct beneficiaries in project towns</p> <p>Implemented the recommended policy and institutional changes</p> <p>Achieved better sector performance and service delivery</p> <p>Waterboard efficiently performs its mandate on a national front. Implemented improved Operation and Management Systems.</p> | <p>All planned improvements in water quality and quantity achieved by town and year Progress reports and project implementation targets met</p> <p>Project implementation schedule and targets achieved by town and year</p> <p>Major policy and institutional changes including funding, planning, tariff structure adjustment, cost recovery and agreed-upon poverty-oriented measures</p> <p>The strategy and policies adopted by the Waterboard Organizational changes to implement the new system</p> | <p>Government counterpart funds are not delayed. Waterboard management capacities as Executing Agency are maintained and constantly upgraded</p> <p>Appropriate and rigorous O&M regime adopted and implemented by the Waterboard</p> <p>Coordination between the related government agencies. Government commitment to improve sector organization .</p> <p>Management commitment remains Waterboard and senior management remain</p> |

| Design Summary | Project Targets | Monitoring Mechanisms | Assumptions/ Risks |
|--|---|---|--|
| <p>Building the capacity of the Waterboard's financial performance</p> <p>Institutional and technical strengthening in environmental management and monitoring</p> <p>Improved customer and business focus of the Waterboard</p> <p>Institutional strengthening and technical advice in environmental monitoring for control and mitigation capacities</p> <p>Provide project implementation assistance for water supply and sanitation improvements</p> | <p>Installed Integrated Management Information System. Established a compliance and licensing unit.</p> <p>Preparation and adoption by Waterboard of revenue generation and income plan, including a reviewed water supply and sanitation price and tariff structure</p> <p>Fulfillment of statutory requirements for environmental assessment and monitoring of its projects and activities</p> <p>Organizational structure and operating focus are aligned to the Waterboard's primary business requirements with adequate and competent personnel</p> <p>Water quality testing and other monitoring activities are undertaken regularly Quick responses are made to any detected deterioration in water quality and other environmental indicators</p> <p>Engineering, project management, design construction supervision</p> | <p>Suitability and use of management, financial, and other reports produced by the project management unit</p> <p>Periodic reporting against targets set; attainment of indicators for revenue generation and income; tariffs and price changes schedule achieved by year and town</p> <p>Number of initial environmental examination and environmental impact assessments produced by the Waterboard; Waterboard's staff number and capacities for environmental management</p> <p>Public notification of new structure Interviews with staff, provincial government, and customers Monitoring and evaluation indicators</p> <p>Project progress reports, fact-finding and loan missions. Review of responses and mitigation measures undertaken.</p> <p>Project progress reports, fact-finding and loan missions, and project completion report</p> | <p>enthusiastic and committed to effect change</p> <p>Timely recruitment of consultants by the Waterboard</p> <p>Commitment remains for the Waterboard to improve environmental management</p> <p>Competent and effective staff in executing and implementing agencies</p> <p>Waterboard's mandate for environmental monitoring remains</p> <p>Consultants are recruited early in accordance with project schedule</p> |
| <p>IV JFPR Funded Program (LCS-CAHE) Implement low-cost sanitation program</p> | <p>Conducted pilot programs for installing low-cost toilets for urban peripheral and non-serviced areas</p> <p>Completed pilot schemes and implemented the extended LCS-CAHE program to directly benefit a total of 36,000 people in the 5 LCS towns</p> | <p>Project progress reports, monitoring and evaluation of community enthusiasm and involvement</p> <p>Fact-finding and loan review missions and project completion report; provincial hospital/clinic records showing patient numbers by ailment, treatment record, on a time base</p> <p>Responses by residents to BME surveys; questionnaire survey</p> | <p>Waterboard commitment Cooperation of provincial, town governments, local communities, NGOs, and individual households</p> <p>Surveys conducted in a valid and participatory manner</p> <p>Monitoring and analysis capacity is developed.</p> |
| <p>Implement community awareness and health education (CAHE) program</p> | <p>Develop and deliver program for public health and sanitation education; increase awareness of water supply and sanitation and related health and lifestyle practices to improve public health</p> <p>Improved awareness of benefits of LCS options</p> <p>Reduced incidence of waterborne diseases attributable to poor sanitation conditions and ignorance</p> | <p>Available statistics and comparison with project socio-economic data</p> <p>BME conducted during the project and public/ customer feedback</p> <p>Repeat household survey at evaluation phase</p> | <p>Surveys are conducted in a valid and community participatory manner. Monitoring and analysis capacity is developed</p> |

| Design Summary | Project Targets | Monitoring Mechanisms | Assumptions/ Risks |
|--|--|--|--|
| | Improved urban environment and resident lifestyle | | |
| V. INPUTS Civil works and physical development | On-schedule implementation of the Project's components Target disbursement of \$13.2 million on time | Disbursement quarterly report PMU periodical and annual auditing reports | Land issues of target project sites Unexpected devaluation of the kina |
| Implementation assistance and capacity building through consultants support | Consulting services for PMU valued at \$1.5 million; for PIUs/PTIUs at \$0.7 million Capacity building package valued at \$1.6 million. JFPR program: LCS and CAHE consultants package valued at \$0.7 million | Consultants engagement PMU and inception mission reports Review mission assessment | Consultants recruitment delays |
| PMU and other Project implementing agencies | On time appointment of right personnel to project steering committee, project management unit, provincial town implementing unit, LCS-CAHE/coordination unit & implementation unit | Inception mission checkup | Key personnel are not available |
| JFPR funded program Low cost sanitation & community awareness and health education participatory activities | LCS-CAHE CUs and IUs are operational. Consultation at pilot provinces is made and interested NGOs engaged. 4200 ventilated improved pit latrines installed with purchasing package valued at \$1.1 million | Periodical reports from PMU NGOs reports Consultants recruited and disbursement report | Pilot provincial towns are becoming involved in other aid agencies' programs |

EXTERNAL ASSISTANCE TO THE WATER SUPPLY AND SANITATION SECTOR

| No. | Project Title | Year | Source | Terms | Amount (\$ million) |
|-----|---|------|--------|-------|------------------------|
| 1 | Water Supply: TA 179 | 1975 | ADB | TA | 0.185 |
| 2 | Water Supply: Loan 278 | 1976 | ADB | Loan | 7.700 |
| 3 | Second Water Supply: Loan 346 | 1978 | ADB | Loan | 5.400 |
| 4 | Goroka Sewerage | 1978 | OECF | Loan | 1.000 |
| 5 | Wabag Water Supply | 1978 | OECF | Loan | 0.600 |
| 6 | Porebada Water Supply | 1982 | AIDAB | Grant | 1.000 |
| 7 | Kimbe/Kundiawa Water Supply and Sewerage | 1983 | KfW | Loan | 5.600 |
| 8 | Water Supply and Sewerage Review: TA 736 | 1985 | ADB | TA | 0.200 |
| 9 | Water & Sanitation Assets Register | 1985 | AIDAB | Grant | 0.120 |
| 10 | Rural Water Supply | 1989 | EU | Grant | 1.750 |
| 11 | Third Urban Water Supply: TA 1437 | 1990 | ADB | TA | 0.587 |
| 12 | Special Interventions Project: Loan 1054 | 1990 | ADB | Loan | 4.200 |
| 13 | Third Rural Health: Loan 1097 (amount for water supply and sanitation component only) | 1991 | ADB | Loan | 1.100 |
| 14 | Port Moresby Water Supply | 1992 | JICA | Grant | 1.600 |
| 15 | Rural Water Supply Programs | 1993 | EU | Grant | * 6.000 |
| 16 | Third Urban Water Supply: Loan 1211 | 1994 | ADB | Loan | 11.300 |
| 17 | Institutional Strengthening: TA 1803 | 1994 | ADB | TA | 0.400 |
| 18 | Water Supply and Sanitation Sector Study: TA 2196 | 1996 | ADB | TA | 0.350 |
| 19 | El Nino Drought Response | 1997 | IBRD | Loan | 0.500 |
| 20 | Peri-Urban Areas Water Supply Development | 1998 | AusAID | Grant | 0.310 |
| 21 | Bougainville Community Water Supply Improvement | 1999 | NZODA | Grant | 0.150 |
| 22 | Provincial Towns Water Supply and Sanitation: TA 3173 | 1999 | ADB | PPTA | 0.800 |
| 23 | Lae Watermains, 700 mm Pipeline Alternative Route | 2000 | AusAID | Grant | 10.100 |
| 24 | Lorengau Water Supply Upgrading | 2000 | JICA | Grant | 2.670 |

ADB = Asian Development Bank, AIDAB = Australian International Development Assistance Board (now AusAID), AusAID = Australian Agency for International Development, EU = European Union, IBRD - World Bank, JICA = Japan International Cooperation Agency, KfW - Kreditanstalt für Wiederaufbau (German Aid Agency), NZODA = New Zealand Overseas Development Assistance, OECF = Overseas Economic Cooperation Fund* ECU (European currency unit).

SUMMARY OF WATER SUPPLY AND SANITATION SUBPROJECTS

Kerema Water Supply

| | | |
|---------------|---|--|
| Description | : | <ul style="list-style-type: none"> • New water supplies • Groundwater • Gravity distribution from elevated reservoir • Subproject includes boreholes, pumps, rising mains, reticulation network, chlorination system, building and storage reservoir, metered connections. |
| Justification | : | <ul style="list-style-type: none"> • Absence of reliable water supply is inhibiting economic development and posing a major public health risk. • Severe, water shortages occur in dry periods. • Rainfall is estimated to satisfy only 30 percent of residential demand. |
| Beneficiaries | : | <ul style="list-style-type: none"> • Estimated 4,200 population served • Commercial and institutional establishments • Up to an additional 700 persons during the design period |

Mendi Water Supply

| | | |
|---------------|---|--|
| Description | : | <ul style="list-style-type: none"> • New water supplies • Surface water • Gravity distribution from elevated reservoir • Subproject includes raw water intakes, storage reservoir, pump house, package water treatment plant, chlorination system and building, reticulation network, metered connections. |
| Justification | : | <ul style="list-style-type: none"> • Absence of reliable water supply is inhibiting economic development and posing health risk. • Water shortages occur in dry periods. |
| Beneficiaries | : | <ul style="list-style-type: none"> • 8,100 population • Commercial and institutional establishments • Up to an additional 4,000 persons during the design period |

Wabag Water Supply

| | | |
|---------------|---|--|
| Description | : | <ul style="list-style-type: none"> • Rehabilitation and upgrading of existing supplies • Surface water • Subproject includes intake upgrading, rehabilitation and expansion of existing water treatment plant, chlorination system, storage reservoir, expansion of reticulation system, metered connections. |
| Justification | : | <ul style="list-style-type: none"> • Inadequate existing water supply system is partly due to lack of maintenance. • Existing service coverage is less than 100 percent. • Low pressure, lack of metering, unsafe, untreated water |
| Beneficiaries | : | <ul style="list-style-type: none"> • 2,700 population • Small number of commercial and institutional establishments • Up to an additional 1,000 persons during the design period |

Alotau Sewerage

| | | |
|---------------|---|--|
| Description | : | <ul style="list-style-type: none"> • New collection system and treatment facility • Reticulated collection system for central business district (CBD) area only • Subproject includes reticulation system, sewerage treatment plant and sea outfall, property connections. |
| Justification | : | <ul style="list-style-type: none"> • Inadequate sanitation facilities in the CBD lead to public health, amenity, and environmental problems. • Lack of treatment facilities for existing systems |
| Beneficiaries | : | <ul style="list-style-type: none"> • Establishments connected to the existing sewerage systems, which lack treatment facilities, mainly the hospital and the school • New connections, approximately 30 commercial and business establishments • Indirect public health amenity and environmental benefits to an estimated 9,400 population |

Mt. Hagen Sewerage

| | | |
|---------------|---|--|
| Description | : | <ul style="list-style-type: none"> • Rehabilitation of existing treatment and disposal system • Subproject includes conversion of the existing treatment pond to an aerated lagoon, additional effluent treatment and disinfecting unit, outfall pipeline, building and equipment. |
| Justification | : | <ul style="list-style-type: none"> • Malfunctioning of existing treatment facilities is an environmental and public health hazard • Inadequate treatment and disposal of wastewater |
| Beneficiaries | : | <ul style="list-style-type: none"> • Approximately 4,000 people, commercial and institutional establishments currently connected to the reticulation system • Indirect public health amenity and environmental benefits to an estimated 25,000 population |

Madang Sewerage

| | | |
|---------------|---|--|
| Description | : | <ul style="list-style-type: none"> • Rehabilitation of existing collection, treatment, and disposal system • Subproject includes connections to existing reticulation systems, new collection sewers, pumping station, rising mains, and upgrade of the existing treatment pond. |
| Justification | : | <ul style="list-style-type: none"> • Inadequate existing system for sewage collection, treatment, and disposal is a public health and environmental hazard. |
| Beneficiaries | : | <ul style="list-style-type: none"> • Approximately 120 connections to the existing reticulation system • Indirect public health amenity and environmental benefits to an estimated 35,000 population |

LOW-COST SANITATION, COMMUNITY AWARENESS, AND HEALTH EDUCATION (LCS-CAHE) PROGRAM (JFPR GRANT FUNDED)

A. Background and Rationale

1. Papua New Guinea (PNG) is the poorest country among the Pacific developing member countries (PDMCs). An estimated 17 percent of the population are hard core poor falling below the food poverty line, while 37 percent live below a poverty line of \$350 per year.¹ Prevailing environmental conditions in provincial towns have significant adverse impacts on people's health and quality of life with negative impacts on their human and economic development. Improving basic urban services, particularly water supply and sanitation, is directly linked to the goal of improving public health and overall social indicators. Large sections of urban society suffer from service inadequacies and unsanitary conditions, with the poor suffering disproportionately more. Urban water supply and sewerage coverage is about 43 percent and 20 percent respectively. Communities in selected towns put water and sanitation as their number one priority, with lack of water during the dry season being a very serious and universal problem. Sanitation is also generally inadequate and where sewerage systems exist, most of them serve the developed sections of towns. Thus for many communities on the urban fringes, defecating in open air is common practice.

2. The poorest households in the component towns of Alotau, Lae, Madang, Mt. Hagen, and Wewak live in unsanitary conditions and the present practices in human waste disposal harm their health and pollute the environment. The high incidence of diarrhea and other waterborne, preventable intestinal diseases among the urban poor in the provincial towns is high. Lack of awareness of the relationship between basic cleanliness, hygiene, and the pathogens of waterborne intestinal diseases is seen as a major issue in public health.

3. It is against this backdrop that the low-cost sanitation, community awareness and health education program is proposed. The logical framework for this program is in Table A4.1 (page 13).

4. The LCS-CAHE program is a highly complementary and additional part to the overall Project. Grant financing from the Japan Fund for Poverty Reduction (JFPR) is required because the PNG Waterboard, a commercial statutory authority, is unwilling to borrow for an innovative and highly participatory program where short-term financial viability is not yet proven. In addition, funding from JFPR is appropriate as it will allow the Waterboard to fulfill its wider social function and help prove the viability of a new sanitation technology in PNG.

B. Objectives

5. The long-term goal of the LCS-CAHE program is health improvement for the population, particularly the poor in provincial towns, to enhance their standard of living through lower health expenditures, higher labor productivity, and increased income-earning opportunities. The main objective is to provide poor urban dwellers affordable, environment-friendly, and appropriate sanitation facilities and to bring about positive behavioral changes in sanitation practices.

C. Scope

6. The LCS-CAHE program will include two major activities: (i) low-cost sanitation (LCS) to provide low-income groups and the urban poor with easy access to low-cost basic sanitation facilities, and (ii) community awareness and health education (CAHE) to build awareness and

¹ World Bank 1999 Papua New Guinea: *Poverty and Access to Public Services*, Report No. 19884-PNG, October 1999.

improve health education for the communities. The targeted beneficiary communities have been identified. The CAHE program activities will be implemented in selected urban and peri-urban settlements where unhealthy waste disposal systems (e.g., bucket system and simple pit latrines) exist and where a reticulated sewerage system would be too expensive. Implementation of the LCS program activities will start in selected settlements in Lae and Madang where 2,400 ventilated improved pit latrines (VIPLs) will be installed. During the second phase of implementation, an additional 1,800 VIPLs will be installed in selected urban and peri-urban settlements in Alotau, Mt. Hagen, and Wewak.

7. **Low-Cost Sanitation.** The LCS program activities provide for the construction and maintenance of low-cost sanitation facilities such as VIPLs will involve participatory planning with the targeted beneficiary households. During project preparation, needs were assessed in the field. It was found that about 8,620 poor households in the urban settlements of the provincial project towns need improved sanitation. The program will construct low-cost sanitation facilities for the most needy 4,200 households (36,000 people), about half of the total potential demand. It will provide funds for construction costs, and the beneficiary households will share through in-kind contributions such as materials and labor. The required funding will give the initial impetus to the provision of much-needed sanitation services. The LCS will be implemented over three years with an initial 18 months pilot-testing period in poor urban communities in Lae and Madang². During this learn-as-you-go phase, workable, socially sensitive, and cost-effective approaches to LCS-CAHE interventions will be developed, providing a model for building a community sense of ownership and involvement. The situation will be replicated more extensively in all provincial towns during the remaining 18 months of the implementation period. The total duration of the project will be 36 months, with start-up expected in April 2001 and completion in April 2004 (Table A4.2).

Table A4.2: Implementation Schedule

| Program Activities | III-2001 | 2002 | 2003 | II-2004 |
|---|----------|------|------|---------|
| • Recruit Consultants | ■ | | | |
| • Planning & Development of LCS Program | ■ | | | |
| • Pilot Test in Madang and Lae | ■ | | | |
| • Continue Implementation in Madang and Lae | | ■ | ■ | ■ |
| • Implementation in Alotau, Mt. Hagen and Wewak | | | ■ | ■ |
| • Monitoring | | ■ | ■ | ■ |
| • Evaluation | | ■ | ■ | ■ |

8. **Community Awareness and Health Education.** The LCS subprogram will build on interventions that are part of the CAHE subprogram. Household surveys in the targeted project communities and field investigations have confirmed a very low level of understanding of water and sanitation-related issues, particularly the linkages between water, sanitation, personal hygiene, and good health. The health awareness campaigns under the CAHE subprogram will

² During appraisal, participatory consultations were held with the beneficiaries as well as provincial and town authorities for the initial selection of target settlements. For Lae, the following settlements were identified: Bundi, Nawae and settlements 2,3 and 4. For Madang, the settlement of Sisiak was selected for the pilot phase.

educate people in appropriate toilet use and maintenance, and provide information on the health sanitation linkages. The CAHE activities will be instrumental in mobilizing the targeted communities to introduce low-cost sanitation practices. As women are primarily responsible for maintaining household sanitation conditions, a special project focus will be on existing women's groups and the formation of new ones to help achieve positive behavioral changes in sanitation practices.

9. The CAHE program will be implemented in all program towns. Awareness building is key to ensuring the long-lasting effects of public health knowledge within the communities. As the most common source of bacteriological pollution to water sources is the indiscriminate disposal of fecal matter by the general public, the CAHE program is designed to address the problem directly to effect major changes in personal behavior. The aim is to impart knowledge of general personal hygiene, the cause effect relationship between pathogens and illnesses (particularly diarrhea, dysentery, typhoid, etc), effectively so that it is readily understood and accepted by the communities. Simple cartoon style handouts, together with mass media programs will be utilized to effectively disseminate this knowledge.

D. Costs and Financing Plan

10. The total cost is estimated at \$2.2 million equivalent, including contingencies. The foreign exchange part is estimated at \$0.5 million, or 21 percent of total cost. Local currency costs are estimated at \$1.7 million equivalent or 79 percent of total cost. Of the total cost of \$2.2 million equivalent, \$0.1 million equivalent will be financed by the beneficiaries, \$0.3 million equivalent by the provincial and local governments, and the remainder (\$1.74 million equivalent) is proposed to be financed by JFPR. The cost estimates and financing plan are in Table A4.3.

11. Since the LCS-CAHE program will be for the low-income and poor people, households' contributions will be mainly in the form of labor and partial cost of the VIPL materials. The cash contribution will be determined with the community during the planning stage. The experiences of NGOs working in Lae in VIPL programs suggests that cash contributions for materials will be about 10 percent. During project appraisal, field visits to the urban settlements indicated that the households were willing to pay cash as partial contribution for the VIPL materials.

**Table A4.3: Cost Estimates and Financing Plan
(\$ '000)**

| Item | Foreign Exchange | Local Currency | Total Cost | Percent |
|---|------------------|----------------|--------------|------------|
| A. JFPR | | | | |
| 1. Consultants | 126 | 434 | 560 | 26 |
| 2. Equipment | 195 | 451 | 646 | 30 |
| 3. Capacity Building | 75 | 33 | 108 | 5 |
| 4. Others | 0 | 161 | 161 | 7 |
| Price Contingency | 16 | 60 | 76 | 4 |
| Physical Contingency | 39 | 149 | 189 | 9 |
| Subtotal | 451 | 1,289 | 1,740 | 80 |
| B. Beneficiaries | 0 | 100 | 100 | 5 |
| C. Provincial and Local Government | 0 | 330 | 330 | 15 |
| Total Cost | 451 | 1,719 | 2,170 | 100 |
| Percent | 21 | 79 | | |

JFPR = Japan Fund for Poverty Reduction

E. Implementation Arrangements

1. Executing and Implementing Agencies

12. The Waterboard will be the Executing Agency for the program. However, the urban authorities of the respective provincial towns will be the Implementing Agencies and will play a key role. For each selected provincial town, a LCS-CAHE Coordination Unit (LCS/CU) and a LCS-CAHE Implementation Unit (LCS/IU) will be established in the relevant urban council (Figure A1, page 6). The LCS/CU will coordinate and oversee project operations and will deal with project-related policy matters. The LCS/IU will be responsible for implementing the program. The national coordinator (domestic consultant) and the international consultant will advise the LCS/CU and will assist the LCS/IU in implementing the program.

2. Detailed Implementation and Coordination Arrangements

13. The LCS-CAHE program will be implemented over three years. The Waterboard will be the Executing Agency and will provide suitable counterpart staff as required. The costs for the international consultants (LCS environmental engineer, LCS project accountant/financial analyst) and domestic consultants (LCS manager-headquarters-national coordinator, CAHE national coordinator, computer aided design draftsman, LCS provincial team coordinators, and LCS facilitators) will be covered by the budget of this component.

14. Given the complex nature of this program, separate coordination and implementation units will be established at the provincial level. An LCS-CAHE coordination unit (LCS/CU) and an LCS-CAHE implementation unit (LCS/IU) will be established in the provincial town offices of the relevant urban council within three months of loan effectiveness. The LCS/CU will oversee, guide, and monitor program operations and will deal with program-related policy and coordination matters. The LCS/IU will be responsible for implementing the component.

15. The LCS/CU will comprise the provincial administrator as the chair, town manager, Waterboard district manager, director of health and community service-urban local-level government council (ULLGC), provincial advisor for health, president of the urban local-level government women's council, an NGO representative of women's interests, a representative of the NGOs, and representatives of selected communities.

16. The LCS/IU will consist of the LCS provincial team coordinator as the manager, LCS facilitators, representatives of provincial health staff, ULLGC health staff, Waterboard staff, community development officer of the relevant ward, a representative of the relevant women's council, representatives of NGOs, and representatives of selected communities. The national coordinator of the LCS-CAHE program (domestic consultant) and the international consultants will advise the LCS/CU and will assist the LCS/IU in implementing the program. The participation of the communities and NGOs in the LCS/CU and LCS/IU will ensure active community involvement at higher levels of management, planning, and implementation of the LCS-CAHE program. The female representatives from the communities and the women's council will provide the required inputs in addressing gender dimensions in planning and implementing the sanitation facilities, and increase overall women's participation in health and hygiene awareness activities.

17. The LCS-CAHE program will be implemented over the first three years of the project. The first 18 months of implementation will take the form of a pilot trial. In selected urban and peri-urban settlements of Lae and Madang with water supply connections from the Waterboard, one VIPL per household will be constructed. Lessons learned from the pilot phase will be used to expand the area in the second phase to include the towns of Alotau, Mt. Hagen, and Wewak. During the second phase, settlements depending on rainwater, shallow water wells, spring, and other water sources will also be selected.

18. The LCS-CAHE program envisages wide dissemination of basic hygiene principles and sanitation awareness training in the beneficiary communities. The training will include production of acceptable printed material, popular theater and media presentations, and holding focus group meetings on sanitation, etc. In addition, training for staff from the institutions concerned (Waterboard, DOH, Urban Council, DOW, etc.) will also be implemented. The field surveys show that the general public has little understanding of the relationship between hygiene, sanitation, and their own health.

19. Through the CAHE program, communities will be mobilized to develop links with existing community groups - church networks, women's groups, and other existing networks - for planning and implementing the LCS-CAHE program. The LCS facilitators together with the community development officer of the ward will plan and implement the program activities. CAHE will be introduced in individual households and the community before installing the toilets. Household and community contributions will mainly be in the form of labor and part of the cost of the materials. Through CAHE, awareness on health, sanitation, and O&M of the VIPLs will be undertaken. Eighty percent of the beneficiaries of the CAHE training and O&M program will be women.

20. NGOs will support the LCS-CAHE program by facilitating the selection of the LCS facilitators working in the LCS/IUs. Several NGOs such as Adventist Development and Relief Agency International, Red Cross, Young Women's Christian Association, and Habitat for Humanity, PNG can provide the required cooperation and support.³ Any NGO participating in implementing the LCS-CAHE program will be engaged in accordance with competitive selection procedures acceptable to ADB. The involvement of various NGOs will facilitate active community participation in planning and implementing the program. The program will be linked with other existing development programs in the settlements.

2. Linkages to the Project

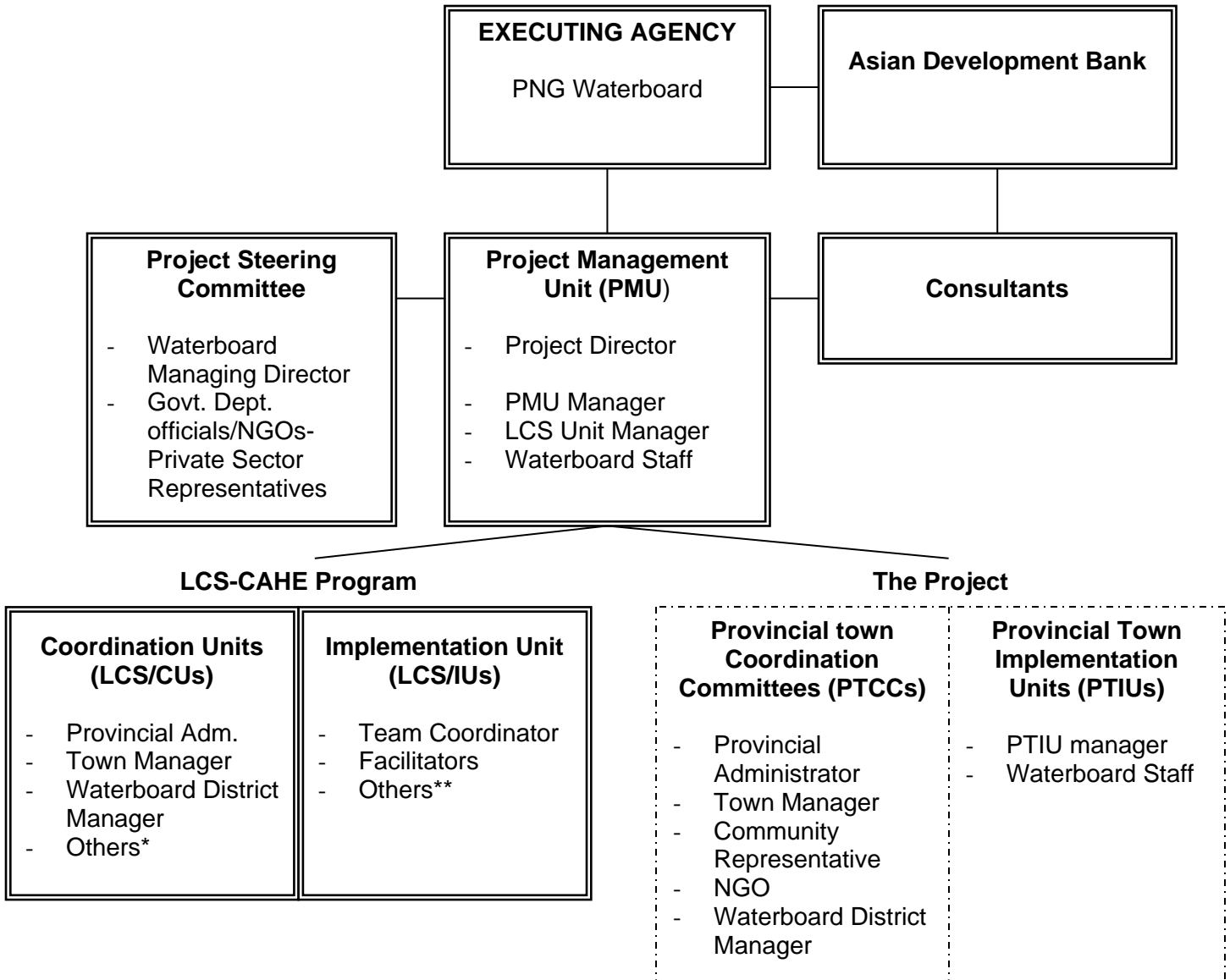
21. The ADB-financed components of the Project will provide water supply and sewerage services to selected provincial towns. Provision of new or rehabilitation of the sewerage services under the Project will be limited to downtown areas in Alotau, Madang, and Mt. Hagen. Therefore, by providing cost-effective low-cost sanitation facilities in urban settlements not served by sewerage systems, the LCS-CAHE program will add substantive value to the Project and make it more poverty oriented. The program has specific objectives different from but highly complementary to those of the Project. Through the program, an integrated water supply and sanitation approach can be followed in the selected provincial towns.

3. Involvement of the Community and Non-Government Organizations

22. The program will mobilize the communities and develop links with the existing community groups (particularly women's groups) by involving them in planning, design, and implementation of LCS-CAHE activities. The facilitators (domestic consultants) under the program, together with the community development officer of the urban settlement, will plan and implement the program activities. Non-government organizations (NGOs) will be involved in implementing the LCS-CAHE activities in several ways, e.g., identifying and possibly providing the facilitators in each provincial project implementation unit (LCS/IU). Several NGOs could be contracted to provide facilitators to work in the communities. The NGOs will help conduct the CAHE activities and train the volunteers and relevant staff of the local governments. Involvement of NGOs will facilitate active community participation in planning and implementing LCS-CAHE activities.

³ At present, ADRA in Lae is involved in a VIPL sanitation program in the rural communities of Morobe Province and to this end is working with provincial health authority for water projects.

Figure A1: Implementation Structure



* Director of Health & Community Service, Provincial Program Advisor (Health), President Urban Women Council, NGO Representative

** Provincial Health staff, Representative Women Council, Urban Local level Government Health Staff, Water Board staff, NGOs Representative, Community Representatives (Male/Female)

23. Women in particular have a primary role in collecting water, controlling its use and looking after sanitation facilities. Women's preference for siting of the household VIPLs will be given priority. Knowledge about basic water and sanitation interlinks with health is poor in PNG. Under the LCS-CAHE program, sanitation awareness training will be given to women. The program will benefit the community in terms of health and improved overall understanding of the healthy livelihood.

4. Procurement, Consulting Services and Flow of Funds

24. The Waterboard project management unit (PMU) will procure goods and services in accordance with ADB's *Guidelines for Procurement*. The urban councils of the provincial administrations will be responsible for design, site selection, and construction supervision jointly with the appropriate local government departments and the Waterboard. The relevant town administration may wish to undertake the construction of the VIPLs as a contractor to the Waterboard, through normal commercial contractual arrangements. Beneficiary households will give their contributions (mostly labor) during the construction works. Civil works and materials may be procured under local competitive bidding or through community participation in accordance with procedures acceptable to ADB.

25. Except as provided below for civil works contracts under \$50,000 equivalent, civil works and materials supply contracts for the program in each case estimated to cost the equivalent of \$200,000 or less may be awarded on the basis of local competitive bidding among prequalified contractors in accordance with the standard procurement procedures of the Government and acceptable to ADB. Prequalification selection and engagement of contractors shall be subject to the approval of ADB. As soon as the bids received have been evaluated, the proposal for award of contract shall be submitted to ADB for approval. For this purpose, ADB shall be furnished with three copies of (i) an account of the public opening of bids, (ii) a summary and evaluation of the bids, (iii) the proposal for award, and (iv) a draft contract or a draft letter of acceptance. Promptly after each contract is awarded, ADB shall be furnished with three copies of the contract executed. Civil works contracts estimated to cost the equivalent of \$50,000 or less may involve the participation of local communities and may be awarded in accordance with procedures agreed between the Waterboard and the community concerned and acceptable to ADB.

26. The PMU will select and engage the consultants in accordance with ADB's *Guidelines on the Use of Consultants* and other arrangements satisfactory to ADB for engaging domestic consultants (a summary of consultant's inputs is in Table A4.4). Implementation will be supported by a consulting team that includes one international consultant (environmental engineer), a national coordinator (environmental engineer), a CAHE coordinator, five provincial team coordinators, and the facilitators. The international consultant, the national coordinator and the CAHE coordinator will be hired intermittently to provide required inputs. The consultants should have experience in the following fields: international consultant, environmental engineering and community health in developing countries; national coordinator, environmental engineering as well as management of community health projects; LCS-CAHE program coordinator, design and planning of health and sanitation awareness campaigns at the community level; provincial team coordinator, environmental engineering and community health; facilitators, community organizing; NGOs selected for component implementation, work on community health and community organizing. The terms of reference are in paras. 43-44.

27. To facilitate payments under the program, a JFPR special account will be opened with a commercial bank in the name of the EA (the Waterboard). An annual Work Plan and funds requirement are to be established that would ascertain the amount for advance, which is limited to the estimated 6 months' expenditure by the EA. The Special Account will be replenished after the EA liquidates at least 50% of the initial advance on the basis of a statement of expenditures

(SOE). This procedure is applicable to all expenditures of \$10,000 or less for individual payments, otherwise, the EA is required to attach supporting documents such as invoice and receipts for liquidation and replenishment purposes.

Table A4.4: Summary of Consultants Inputs

| International Consultants | | Domestic Consultants | |
|--|-------------|---|--------------|
| • Environmental (low-cost sanitation) engineer | 4.0 | <i>Pilot low-cost sanitation activities (1.5 years)</i> | |
| • Accountant/Financial analyst | 0.75 | • National coordinator-CAHE | 4.0 |
| | | • Computer aided Design draftsman | 2.0 |
| | | • LCS manager-nat.coord (HQ) | 7.0 |
| | | • Team coordinator (2 towns) | 36.0 |
| | | • LCS facilitators (2 towns) | 54.0 |
| | | <i>Comprehensive LCS-CAHE Response (1.5 years)</i> | 5.0 |
| | | • LCS manager-nat.coord (HQ) | 3.0 |
| | | • National coordinator-CAHE | 90.0 |
| | | • Team coordinator (5 towns) | 162.0 |
| | | • LCS facilitators (5 towns) | |
| Subtotal | 4.75 | | 363.0 |

5. Performance Monitoring Indicators

28. A simplified and cost-effective LCS-CAHE program performance management system (PPMS) will be set up in the LCS/CU, and linked to the Project's PPMS through the PMU. The indicators will monitor both process and impacts. The process indicators will give information on the progress and implementation of CAHE activities (number of participating households, number of households that have adopted sanitation practices and show behavioral changes) and LCS activities (number of households that have installed VIPLs, household contributions, participation in training for operation and maintenance (O&M)). The impact indicators will comprise data on changes in incidence of diseases, public health expenditures, and improvements in standard of living. Benchmark surveys will collect detailed information specific to the targeted beneficiary communities at the earliest possible stage during program implementation. Data on the process and impact indicators will be collected and analyzed every six months. At the end of the initial phase (18 months), an assessment report will describe lessons to be incorporated in the LCS-CAHE activities, which will cover more comprehensively the selected urban settlements in five provincial towns during the second phase. An independent NGO will carry out the assessments at the end of phase I and phase II.

6. Reporting and Auditing

29. The LCS-CAHE coordinator in each provincial town will submit a biannual report on LCS-CAHE performance monitoring and assessment to the national coordinator at the project PMU. The report's contents will be included in the progress reports to be submitted quarterly to ADB. At the end of this component implementation, performance assessment reports prepared by the LCS/CUs will be consolidated by the PMU and then submitted to ADB.

30. All expenditures under the program including funds held in the JFPR special account, SOE transactions are subject to periodic audit by an independent auditor acceptable to ADB.

F. Impact Assessment

1. Impact on Poverty

31. Poor urban residents in the project provincial towns will benefit from access to clean and reliable water, and safe disposal of excreta through the upgraded existing services or the newly constructed services under both the LCS-CAHE program and the Project components.

32. About 16 percent of PNG's urban population are categorized as poor (World Bank, 1999) and these people and the broader community residing in the five project component towns stand to benefit from the Project. PNG's urban poor include squatters, the unemployed and underemployed, and low-income families that are often very large. The poor are most vulnerable because they have fewer resources they can use to change their circumstances. Unaffordable costs drive poor people to compromise on living standards, by resorting to such common practices as drinking unsafe water from rivers. Other options, such as purchasing drinking water through vendors which is common in Asia, do not exist in PNG, largely due to the prohibitive transport costs to supply and distribute water. The poor cannot afford the inflated prices of tanker-supplied water during the dry season.

33. The five program towns, diarrhea due to unsafe water and inadequate sanitation is endemic. This disease and others reduce the capacity of adults to work productively and to care for other family members. Intestinal diseases are more prevalent among poorer people and the resulting loss of productivity has more pronounced negative economic effects on them.

34. The LCS subprogram will remedy the situation by offering significant benefits to the community without economically burdening the beneficiaries at the lower end of the socioeconomic scale. The LCS-CAHE program is consistent with ADB's poverty reduction strategy as it will provide essential sanitation services to poor urban dwellers. The CAHE subprogram will assist in improving the hygiene education of poorer households by raising awareness of health and sanitation issues. Health education will also benefit households financially by providing information and ideas on water conservation and use.

35. Community education in water supply and sanitation has been largely ignored in PNG. The program will assist to address this gap by developing and implementing a package of activities to improve the knowledge of householders in basic hygiene, safe collecting and storage of water, environmental health, and O&M of various toilet systems. The CAHE subprogram will also emphasize safe water supplies and the desirability of sanitation systems. The program will adopt a holistic approach to community health and hygiene.

36. Finally, health improvements will greatly benefit women by reducing the time they need to look after the sick, particularly small children. Women stand to benefit significantly in the education on water use, hygiene practices, and other CAHE activities. The information will give them control and choice in the way they care for their families and manage resources of water and money. It will give women opportunities to make decisions about issues that affect their daily lives and enable them to actively contribute to the economic development of the family.

2. Sustainable Poverty Reduction Impact

37. At the macro level of the component will have a structural impact on poverty. First, compared with other nonaffordable options (sewerage, septic tanks), the proposed low-cost sanitation facilities (VIPLs) are the most cost-effective solution to the existing public health problem and are a viable alternative from an economic viewpoint as scarce project resources will be used efficiently for the benefit of the poor. Second, and more importantly, the LCS-CAHE program will directly contribute to better public health. The benefits, in terms of savings of

private and public health expenditures and direct opportunity costs, will disproportionately benefit the urban poor through higher labor productivity and increased real income at the household level. Annual public health expenditures in the provinces are estimated at K15 per person⁴ and a major share is for treating waterborne diseases. Although undocumented to date, average health expenditures may be significantly higher in the targeted urban settlements in the five program provincial towns. As targeted LCS-CAHE program beneficiaries are about 36,000 people, a reduction in public health expenditures by 20 percent would result in around K100,000 resource cost savings annually.

38. Beneficiary ownership is critical to a sustainable outcome of the proposed component. Direct community involvement, participation, and sense of ownership have been secured through agreed-upon cost sharing with the beneficiary households. The field visits during project preparation have confirmed that the targeted beneficiary households are willing to share about 5-10 percent in the construction costs through labor and in-kind contribution.

39. Sustainable provision of low-cost sanitation services also requires regular maintenance of the VIPLs. Training for the beneficiaries will be part of the CAHE subprogram. The beneficiary communities, particularly the women, will be responsible for maintaining the LCS facilities.

40. From a gender perspective it is expected that the targeting of women and their close involvement will contribute considerably to sustainable project outcomes.

3. Participatory Development Issues

41. Because of higher population density and as a result of poor sanitary practices, the urban and peri-urban poor in the proposed Project's provincial towns are more directly exposed to health risks than are the rural communities. Public resources to address the sanitation problems of the urban poor are not available and public interventions alone will not be sustainable. Durable solutions to public health issues due to poor sanitary conditions require an innovative approach and a new strategy through a participatory process. Therefore, building a Government-community partnership and close involvement of the beneficiary communities in all LCS-CAHE activities is critical.

42. During the project preparatory fieldwork, civil society groups (church networks, women's groups, local NGOs, neighborhood associations) that were consulted expressed willingness to be involved in the implementation process. The proposed program will be a model of partnership building involving the provincial government, urban authorities, and a variety of community based organizations.

G. Risks and Assurances

43. Two major risks have been identified. First, the provincial governments and the urban authorities of the respective provincial towns may lack the capabilities to implement the program. This risk will be minimized by establishing LCS/CU and LCS/IU in each selected provincial town. Both units will be assisted and guided by consultants. Second, there may be no community demand for low-cost sanitation facilities. This risk is minimized in the project design through the implementation of the associated CAHE subprogram. Field investigation at the project design stage has confirmed that poor and low-income households are willing to contribute, demonstrating their interest and motivation to participate. The Government and the Waterboard have given the following assurances:

⁴ UNDP. 1998. PNG Human Development Report.

44. Implementation Arrangements. Within three months of commencement of the program, the Government shall ensure the establishment of a LCS-CAHE Coordination Unit (LCS/CU) and a LCS-CAHE Implementation Unit (LCS/IU) in the provincial town office of the urban council concerned in each participating township. Each LCS/CU shall oversee, guide, and monitor the carrying out of the program in its respective area and will handle policy and coordination matters. Each LCS/CU shall include as members throughout program implementation: the relevant provincial administrator (Chair), the town manager concerned, the Waterboard District Manager concerned, the Director of Health and Community Service of the relevant Urban Local-Level Government Council (ULLGC), the Provincial Advisor for Health concerned, the President of the Urban Local Level Government Women's Council, a NGO representative of an NGO concerned with women's interests, a representative of NGOs and designated community representatives. Each LCS/IU shall be responsible for program implementation in its respective area. Each LCS/IU shall include as members: the relevant LCS provincial team coordinator (manager), selected LCS facilitators, a representative from the relevant women's council, the community development officer concerned and representatives from the relevant (i) provincial health staff concerned, (ii) from ULLGC health staff, (iii) from Waterboard staff, (iv) from NGOs, and (v) from selected communities.

45. Counterpart Funds. In the event the participating provinces, or any one or more of them, are unable to allocate the required provincial counterpart contributions for the LCS-CAHE program, the Provincial Executive Councils of East Sepik, Madan, Milne Bay, Morobe and Western Highlands, or any one or more of them, as applicable, shall submit timely requests to the Government for additional funds to ensure the availability in of the respective amounts of not less than in aggregate over the Project period, \$100,000, \$80,000, \$50,000, \$50,000 and \$50,000 equivalent for their required provincial counterpart contributions.

46. Operations and Maintenance (O&M). The Government will ensure that a memorandum of understanding will be executed between the Waterboard and each participating province and local government, in form and substance satisfactory to ADB, which will describe in detail the required contributions to capital cost and O&M, as well as contributions in-kind or in cash, from the beneficiaries of the LCS facilities, including arrangement for inspection of such LCS facilities at least once every six months after completion.

47. Environment. The Government and the Waterboard will ensure that adequate environmental mitigation and monitoring measures will be followed in the design and implementation of the proposed low-cost sanitation program and that (i) design and construction of each toilet will adhere to specific environmental guidelines; and (ii) samples from shallow groundwater sources surrounding particular toilets will be tested in accordance with the environmental monitoring and mitigation program.

48. Gender. The Government will ensure that women will comprise (i) at least 50 percent of the community representatives who are members of each LCS/CU; and (ii) at least 80 percent of the participants for training and at least 50 percent of the facilitators engaged under the LCS-CAHE program.

49. Performance Monitoring: Within 12 months of commencement of the program, a simplified LCS-CAHE programs performance management system with indicators to monitor program progress and inputs will be set up. Such data will be collected every six months and an assessment report will be provided at the end of 18 months after commencement of the LCS-CAHE program.

H. Conditions for Disbursement

50. No withdrawals shall be made from the relevant account of any JFPR grant proceeds for the LCS-CAHE program until: (i) a memorandum of understanding shall have been executed between the Waterboard and the participating provincial and local level government concerned on terms and conditions satisfactory to the Bank; and (ii) the LCS/CU and LCS/IU in the participating province concerned shall have been established in a manner satisfactory to the Bank.

I. Consultants' Terms of Reference

51. The consulting team comprises international and domestic consultants with specific duties and responsibilities. In addition, the national consultants in the PMU of the Waterboard in Port Moresby will assist the international consultants by giving advice relevant to the local systems and to the procedures and manuals to be developed.

1. International Consultant (Environmental Engineer) (4 person-months)

- (i) Develop the technical aspects of the low-cost sanitation program (VIPL) as well as overall LCS-CAHE activities including an appropriate environmental monitoring and mitigation program.⁵
- (ii) Together with the domestic consultants (LCS/IU), develop systems and procedures for planning, implementing, monitoring, and evaluating (PIME) LCS-CAHE activities.
- (iii) Prepare implementation manuals, training designs and materials for PIME of LCS program subprojects.
- (iv) Conduct training in PIME for LCS project staff at the LCS/IU in the pilot provincial towns.
- (v) Develop overall methodology for the preparation of the concrete operation plans for maintenance of VIPL including appropriate financing schemes

2. Domestic Consultants

a. National Coordinator (12 person-months)

- (i) Be responsible for overall coordination of the program.
- (ii) Together with the international consultant, prepare implementation manuals, training designs and materials for PIME of LCS-CAHE program subprojects.
- (iii) Conduct training in PIME for LCS subproject staff at the LCS/IUs and LCS-CAHE program subproject teams in other provincial towns.
- (iv) Provide advisory support to LCS-CAHE domestic consultants in the provincial towns.
- (v) Provide technical support to PMU
- (vi) Develop concrete operation plans for maintenance of VIPL including appropriate financing schemes

⁵ A comprehensive program of regular testing of shallow water sources (shallow wells, hand pumps, streams, etc.) within the project areas will be instituted to prevent bacteriological contamination from toilets constructed in the LCS-CAHE program. The testing program will be instituted and implemented as part of the routine operations of the Waterboard and participating local government departments.

b. LCS-CAHE Coordinator (7 person-months)

- (i) Review the existing materials on the CAHE program and develop new ones to promote and support LCS in the program subproject areas.
- (ii) Prepare a plan for community-level CAHE program training and campaign for five provinces.
- (iii) Conduct CAHE training (training the trainers) among LCS project staff in the provincial towns.
- (iv) Provide advisory support to LCS staff domestic consultants in the provincial towns.
- (v) Provide technical support to PMU.

3. LCS-CAHE Subproject Teams at the Provincial Level

52. The LCS-CAHE subproject teams composed of the LCS-CAHE provincial team coordinator and facilitators will actually promote and implement the LCS and CAHE subprojects in the communities. Their duties and responsibilities are as follows:

a. Provincial Team Coordinator (126 person-months)

- (i) Be responsible for overall coordination of the work of the provincial team and of NGOs responsible for CAHE program.
- (ii) Prepare a provincial implementation plan for LCS-CAHE program.
- (iii) Get community/household commitment and consent to sign contracts.
- (iv) Endorse subprojects for approval by the LCS/IU.
- (v) Assist the LCS/IU in procurement and delivery of materials.
- (vi) Supervise of construction and installation of LCS facilities.
- (vii) Inspect and accept completed LCS facilities.
- (viii) Do follow-up visits and monitoring.
- (ix) Prepare quarterly report on program and subproject activities.
- (x) Provide advisory and technical support to LCS/CU in the provincial town.

b. Facilitator (216 person-months)

- (i) Be responsible for identifying communities for LCS-CAHE program.
- (ii) Identify and work together with the existing community group and the women's group to implement the LCS-CAHE program.
- (iii) Conduct a training program for volunteers for the CAHE program.
- (iv) Help the engineering team to implement the LCS sub program at the household level.
- (v) Monitor and report on community level LCS-CAHE program.

Table A4.1: Logical Framework for the LCS-CAHE Program

| Design Summary | Program Targets | Monitoring Mechanisms | Assumptions/ Risks |
|--|---|--|---|
| <p>I. Overall Goals Promote human and economic development in the project provincial towns</p> <p>Improve social indicators, physical environment and quality of life for the poor in the project towns</p> | <p>Improved social and economic conditions and overall quality of life</p> <p>Improved access to safe water, and low-cost sanitation facilities in a sustainable and affordable way</p> | <p>Living standards, life expectancy, literacy, and employment levels by project completion</p> <p>Various reports and economic studies</p> <p>Various statistical surveys, other studies and reports by bilateral and multilateral agencies and local organizations, non-government organizations (NGOs)</p> | <p>Government commitment to public sector reform, good governance, and privatization policies</p> <p>Policy framework stability</p> <p>Political commitment to invest in the sector and support its development</p> <p>Waterboard senior management remains in place.</p> |
| <p>II Objectives Improve public health and reduce poverty in selected provincial towns</p> | <p>Better community health, higher income, more productive activities, easier access to school and other social services for the poor</p> <p>36,000 poor will benefit from low-cost sanitation, community awareness and health education (LCS-CAHE) program</p> | <p>Number of persons using these services by year and per town</p> <p>Provincial hospital/clinic records showing patient numbers by ailment, treatment record, on a time base</p> <p>Other socio economic statistics at the town level</p> | <p>Large participation and involvement at all institutional levels including local communities and individual households</p> |
| <p>III Components/Outputs Implement low-cost sanitation program</p> | <p>Conducted pilot programs for installing low-cost toilets for urban peripheral and non-serviced areas</p> <p>Completed pilot schemes and implemented the extended LCS-CAHE program to directly benefit a total of 36,000 people in the 5 LCS towns</p> | <p>Project progress reports, monitoring and evaluation of community enthusiasm and involvement.</p> <p>Number of households with newly installed ventilated improved pit latrines, changed hygiene practices and sanitation</p> <p>Fact-finding and loan review missions and project completion report</p> <p>Responses by residents to budget monitoring and evaluation surveys.</p> <p>Questionnaire survey.</p> | <p>Waterboard commitment. Cooperation of provincial, town level governments, local communities, NGOs and individual households.</p> <p>Surveys conducted in a valid and participatory manner.</p> <p>Monitoring and analysis capacity is developed.</p> |
| <p>Implement Community Awareness and Health Education (CAHE) Program</p> | <p>Develop and deliver program for public health and sanitation education</p> <p>Increase awareness of water supply and sanitation and related health and lifestyle practices to improve public health</p> <p>Improved awareness of benefits of LCS options</p> <p>Reduced incidence of waterborne diseases attributable to poor sanitation conditions and ignorance</p> <p>Improved urban environment and resident lifestyle</p> | <p>Available statistics and comparison with project socio-economic data.</p> <p>Benefit monitoring and evaluation conducted during the project and public/ customer feedback</p> <p>Repeat household survey at evaluation phase</p> <p>New sanitation practices and hygiene behavior changes</p> | <p>Surveys are conducted in a valid and community participatory manner.</p> <p>Monitoring and analysis capacity is developed.</p> |
| <p>IV Inputs Low cost sanitation & community awareness and participatory program</p> | <p>LCS-CAHE coordinating units and implementing units are operational. Consultation at pilot provinces made and interested NGOs engaged</p> <p>4200 ventilated improved pit latrines installed with purchasing package valued at \$1.1 million</p> | <p>Periodical reports from project management unit</p> <p>NGOs reports</p> <p>Consultants recruited and disbursement report</p> <p>Household contribution and involvement</p> <p>Participation in CAHE and operation and maintenance programs</p> | <p>Pilot provincial towns becoming involved in programs of other aid agencies</p> |

COST ESTIMATES AND FINANCING PLAN

**Table A5.1: Project Cost Estimates
(\$ '000)**

| | Foreign Exchange | Local Currency | Total Cost | % |
|---------------------------------------|---------------------|-------------------|---------------|-------------|
| A. Water Supply | | | | |
| Civil Works | 3,585 | 4,382 | 7,967 | 34% |
| Materials & Equipment | 1,569 | 277 | 1,845 | 8% |
| Consulting Services ^a | 1,012 | 961 | 1,973 | 8% |
| <u>Subtotal (A)</u> | <u>6,166</u> | <u>5,619</u> | <u>11,785</u> | <u>51%</u> |
| B. Sewerage | | | | |
| Civil Works | 355 | 434 | 788 | 3% |
| Materials & Equipment | 220 | 39 | 259 | 1% |
| Consulting Services ^a | 194 | 157 | 352 | 2% |
| <u>Subtotal (B)</u> | <u>769</u> | <u>630</u> | <u>1,399</u> | <u>6%</u> |
| C. Project Management | 1,462 | 788 | 2,250 | 10% |
| D. Capacity Building | 1,235 | 353 | 1,588 | 7% |
| Total Base Cost | 9,633 | 7,390 | 17,023 | 73% |
| E. Contingencies | | | | |
| Physical ^b | 1,601 | 1,573 | 3,174 | 14% |
| Price | 480 | 1,087 | 1,567 | 7% |
| <u>Subtotal</u> | <u>2,081</u> | <u>2,660</u> | <u>4,741</u> | <u>20%</u> |
| Subtotal Project | 11,714 | 10,050 | 21,764 | 93% |
| F. Interest Charge^c | 902 | | 902 | 4% |
| Prior TA Funding | 630 | | 630 | 3% |
| Total Project Cost | 13,245 | 10,050 | 23,295 | 100% |

^a Consulting services include mobilization, design, supervision, and investigation fees, but exclude project management.

^b Physical contingencies are 20 percent for water supply and sewerage, and 10 percent for other components.

^c Interest charge is approved at 1 percent per annum during the grace period.

**Table A5.2: Detailed Financing Plan by Components
(\$ '000)**

| | Foreign Exchange | Local Currency | Total Cost |
|---|-----------------------------|---------------------------|-------------------|
| ADB | 11,844 | 3,501 | 15,345 |
| Water Supply | 7,835 | 2,189 | 10,024 |
| Civil works | 4,555 | 1,438 | 5,993 |
| Equipment & Materials | 1,994 | 359 | 2,353 |
| Consulting Services | 1,286 | 392 | 1,678 |
| Sewerage | 978 | 252 | 1,230 |
| Civil works | 451 | 142 | 593 |
| Equipment & Materials | 280 | 47 | 327 |
| Consulting Services | 247 | 63 | 310 |
| Project Management | 1,499 | 1,060 | 2,559 |
| Equipment & Materials | 222 | 862 | 1,084 |
| Consulting Services | 1,277 | 198 | 1,475 |
| Interest during Implementation | 1,532 | | 1,532 |
| Central Government | | 6,148 | 6,148 |
| Water Supply | | 5,350 | 5,350 |
| Civil works | | 4,454 | 4,454 |
| Consulting Services | | 896 | 896 |
| Sewerage | | 591 | 591 |
| Civil works | | 440 | 440 |
| Equipment & Materials | | 4 | 4 |
| Consulting Services | | 147 | 147 |
| Project Management | | 207 | 207 |
| Consulting Services | | 207 | 207 |
| AusAID^a Grant Cofinancing | 1,401 | 401 | 1,802 |
| TOTAL PROJECT COST | 13,245 | 10,050 | 23,295 |

^a Australian Agency for International Development.

PROJECT IMPLEMENTATION ARRANGEMENTS, IMPLEMENTATION SCHEDULE, AND FLOW OF FUNDS

A. Project Organization for Implementation

1. The Project has a single sector focus involving one primary executing agency. This agency, the PNG Waterboard, has experience with managing previous Asian Development Bank investment programs, and other aid agency activities. Therefore, the roles of the project management unit (PMU), and the provincial town implementation units (PTIUs) in the provinces are well understood. Furthermore, observations during the project preparation TA indicated that the Waterboard has the procedures, operating discipline, and staff skills and resources to perform these roles.

2. To achieve these objectives, a proposed structure will delineate the financial management, coordination and planning roles from the project implementation/delivery function. The provincial activities will be channeled through the Waterboard's provincial administrations/operations. The proposed project implementation schedule and organization structure are presented in the Figures A and B.

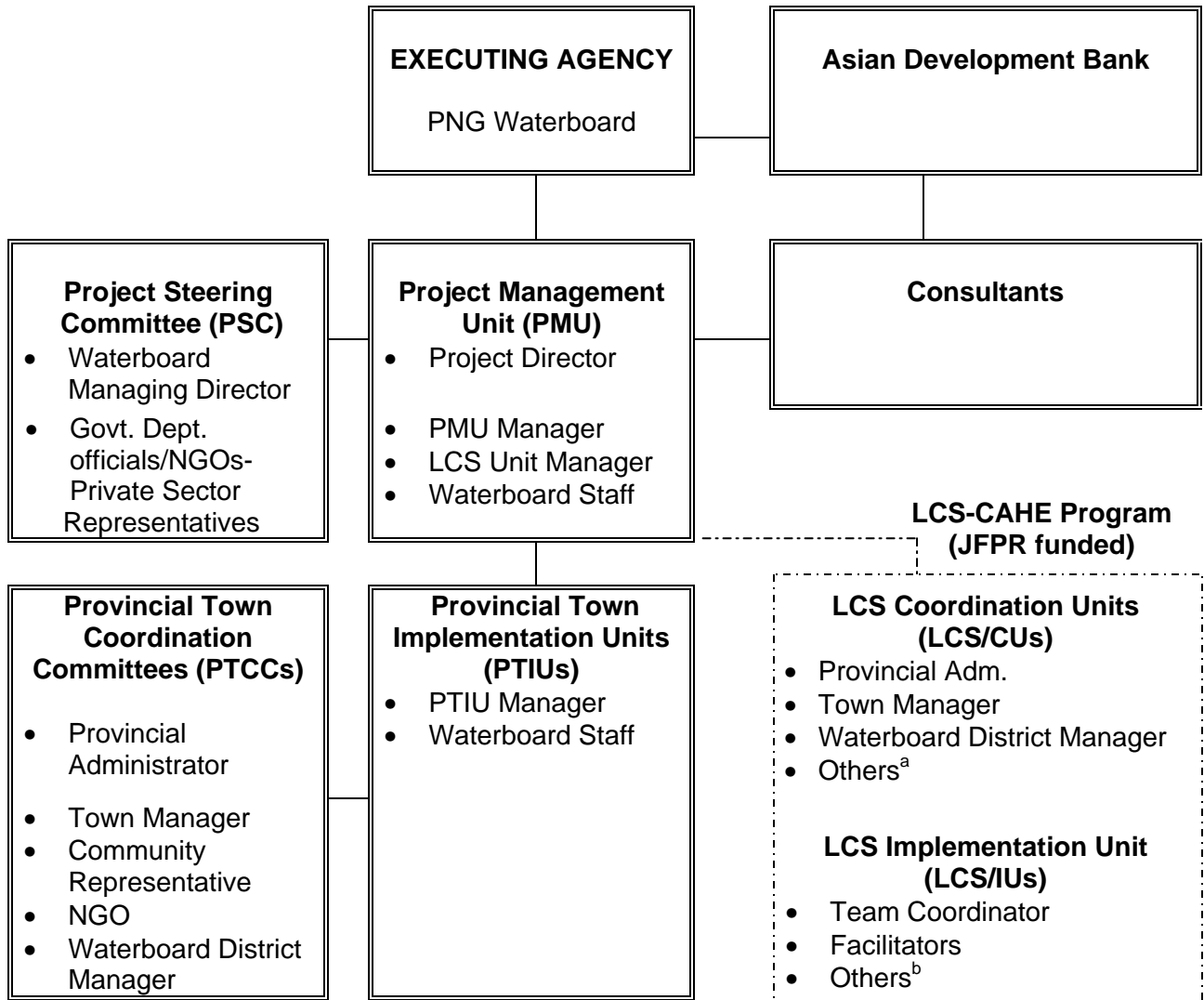
3. For the LCS-CAHE parallel program, a separate implementation structure has been envisaged. Implementation and coordination details of this program are presented in Appendix 4.

Figure A: Project Implementation Schedule

| Item | Component Activity | 2001 | 2002 | 2003 | 2004 | 2005 |
|----------|--|--|------|------|------|------|
| A | Project Management Unit | [Bar spanning from start of 2001 to end of 2005] | | | | |
| B | Provincial Water Supply (Kerema, Mendi, Wabag) Recruit Consultants Design and Contract Documents Prequalify Contractors Tender Procurement and Construction | [Gantt chart showing activities from 2001 to 2005] | | | | |
| C | Provincial Sewerage (Alotau, Madang, Mt Hagen) Recruit Consultants Design and Contract Documents Prequalify Contractors Tender Procurement and Construction | [Gantt chart showing activities from 2001 to 2005] | | | | |
| D | Operations and Maintenance Capacity Building Recruit Consultants Consulting Services | [Gantt chart showing activities from 2001 to 2005] | | | | |
| E | Institutional Capacity Building Recruit Consultants Consulting Services | [Gantt chart showing activities from 2001 to 2005] | | | | |
| F | Environmental Management Capacity Building Recruit Consultants Consulting Services | [Gantt chart showing activities from 2001 to 2005] | | | | |

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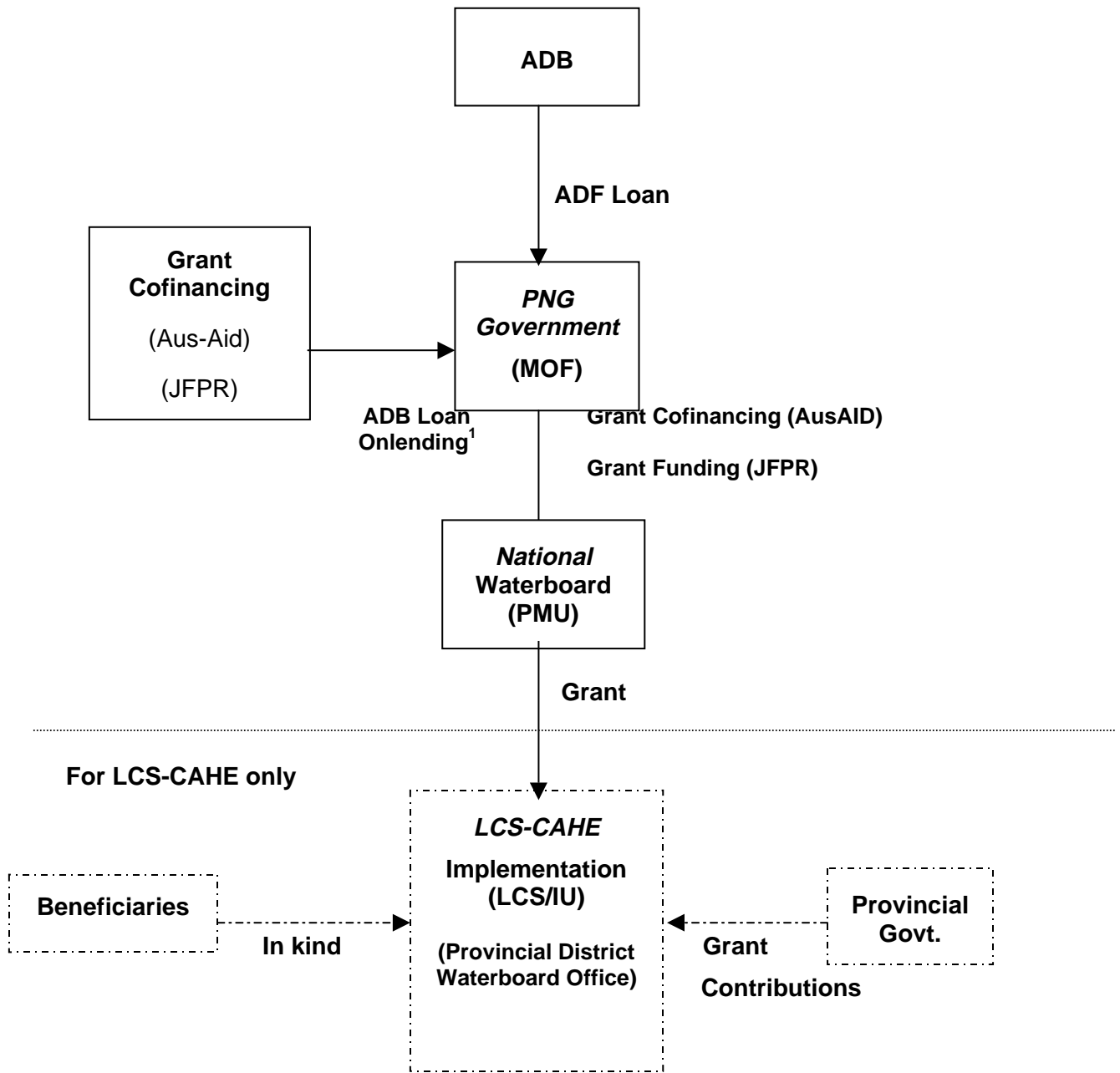
**Figure B: Project Implementation Organization
(with linkages to the LCS-CAHE program)**



^a Director of Health & Community Service, provincial program advisor (Health), president of Urban Women's Council, non-government organization representative.

^b Provincial Health staff, representative of Women's Council, Urban local level government health staff, Waterboard staff, non-government organization representative, community representatives (male/female).

Proposed Flow of Funds including the LCS-CAHE program (JFPR)



ADB = Asian Development Bank, ADF = Asian Development Fund, AusAID = Australian Agency for International Development, IU = implementing unit, JFPR = Japanese Fund for Poverty Reduction, LCS-CAHE = low-cost sanitation and community awareness and health education, MOF = Ministry of Finance

¹ Same terms and conditions as the main ADF loan from ADB to PNG Government

SUMMARY OF CONSULTANTS INPUT AND DESCRIPTION OF TASKS***A. Summary of Consultant Inputs**

| International | Person-months | Domestic Consultants/ Staff | Person-months |
|---|----------------------|---|----------------------|
| 1. Consultant Inputs for Project Management | | | |
| • Project Manager – Water Supply/Sanitation Specialist | 30.0 | • Water Supply Engineer | 20.0 |
| • Benefit Monitoring and Evaluation Specialist | 3.0 | • Environmental (Sanitation) Engineer | 10.0 |
| | | • Financial Controller | 30.0 |
| | | • Secretary/ Receptionist | 30.0 |
| Subtotal (Project Management) | 33.0 | | 90.0 |
| 2. Consultant Inputs for Water Supply and Sewerage Subprojects | | | |
| Kerema Water Supply Subproject | | | |
| • Design Manager – Water Supply Engineer | 3.8 | • Water Supply Engineer | 2.15 |
| • Mechanical and Electrical Engineer | 1.0 | • Technician/Computer Aided Design Draftsperson | 2.00 |
| • Construction Engineer | 1.0 | • Construction Supervisor | 5.50 |
| Subtotal Kerema | 5.8 | | 9.65 |
| Mendi Water Supply Subproject | | | |
| • Design Manager – Water Supply Engineer | 10.0 | • Water Supply Engineer | 6.0 |
| • Mechanical and Electrical Engineer | 2.0 | • Mechanical and Electrical Engineer | 3.0 |
| • Water Treatment Specialist | 4.0 | • Technician/CAD Draftsperson | 5.5 |
| • Construction Engineer | 4.0 | • Contract Supervisor | 22.0 |
| Subtotal Mendi | 20.0 | | 36.5 |
| Wabag Water Supply Subproject | | | |
| • Design Manager–Water Supply Engineer | 4.0 | • Water Supply Engineer | 4.5 |
| • Mechanical and Electrical Engineer | 1.0 | • Mechanical and Electrical Engineer | 2.0 |
| • Construction Engineer | 1.0 | • Technician/CAD Draftsperson | 3.2 |
| | | • Contract Supervisor | 5.5 |
| Subtotal Wabag | 6.0 | | 15.2 |
| Subtotal (Water Supply) | 31.8 | | 61.35 |
| Alotau Sewerage | | | |
| • Design Manager – Environmental (Sanitation) Engineer | 1.0 | • Environmental (Sanitation) Engineer | 1.0 |
| • Construction Engineer | 1.0 | • Technician/CAD Draftsperson | 1.0 |
| | | • Contract Supervisor | 7.0 |
| Subtotal Alotau | 2.0 | | 9.0 |

* Summary description of consultants inputs for the LCS-CAHE program (JFPR) is presented in Appendix 4.

| Consultant Inputs for Water Supply and Sewerage Sub-Projects (continued) | | | |
|---|--------------|---|---------------|
| Madang Sewerage | | | |
| • Design Manager – Environmental (Sanitation) Engineer | 1.0 | • Environmental (Sanitation) Engineer | 1.0 |
| • Construction Engineer | 1.0 | • Technician/CAD Draftsperson | 1.0 |
| Sub-Total Madang | 2.0 | • Contract Supervisor | 7.0 |
| | | | 9.0 |
| Mt Hagen Treatment Rehabilitation | | | |
| • Design Manager – Environmental (Sanitation) Engineer | 1.0 | • Environmental (Sanitation) Engineer | 1.0 |
| • Construction Engineer | 1.0 | • Technician/CAD Draftsperson | 1.0 |
| Subtotal Mt Hagen | 2.0 | • Contract Supervisor | 7.0 |
| | | | 9.0 |
| Subtotal (Sewerage) | 6.0 | | 27.0 |
| Total (Project Mgt & Water & Sewerage Design & Supervision) | 70.8 | | 178.35 |
| 3. Operations and Maintenance Capacity Building | | | |
| • Operations and Maintenance Specialist | 6.0 | • Trainers | 8.0 |
| • Training Specialist | 3.0 | • Production Staff (training courses/ material) | 8.0 |
| Subtotal (Operations and Maintenance Capacity) | 9.0 | | 16.0 |
| 4. Institutional Capacity Building | | | |
| • Institutional/Legal Specialist | 3.0 | | |
| • Institutional and Management Systems Specialist | 9.0 | | |
| Sub-Total (Institutional Strengthening) | 12.0 | | 0 |
| 5. Environmental Management Capacity Building | | | |
| • Institutional/ Legal Specialist | 3.0 | • Tutors/ Training Specialists | 12.0 |
| • Environmental Scientist/ Trainer | 6.0 | | |
| Sub-Total (Environmental Management Capacity Building) | 9.0 | | 12.0 |
| Subtotal (Capacity Building) | 30.0 | | 28.0 |
| Total | 100.8 | | 206.35 |

B. Summary of Inputs from PNG Waterboard

| Description | Person-months |
|--|---------------|
| PNG Waterboard Inputs to PMU | |
| • PMU Manager | 48 |
| • Site Engineers (4 persons) | 192 |
| • Construction Manager | 48 |
| • Administrative Assistant | 48 |
| • Project Accountant | 48 |
| • Secretary/ Clerical Assistant | 48 |
| Subtotal (PMU Staffing) | 432 |
| PNG Waterboard Inputs to PTIUs (Provincial Towns) | |
| • PTIU Coordinators (x 6 towns) | 288 |
| • Technical/ Clerical Assistants (x 6 towns) | 288 |
| Subtotal (PTIU Staffing) | 576 |
| Total | 1,008 |

C. Description of Tasks

1. Project Management

1. Engineering consulting services will help the PMU carry out investigations, review designs and contract documents, evaluate bids, and manage the loan works and construction activities. For project management, consultants will provide 123 person-months of support to the PMU, the project implementation section and PTIUs (33 person-months international and 90 person-months domestic).

2. Detailed Design and Construction Supervision: Water Supply and Sewerage Subprojects

2. Engineering consulting services are required for investigating, preparing detailed designs and contract documents, and supervising construction. For water supply subprojects, consultants will provide 93.15 person-months of services (31.8 international and 61.35 domestic). For sewerage subprojects, design and construction supervision will provide 33 person-months of services (6 international and 27 domestic). Outline terms of reference are presented in Supplementary Appendix F.

3. Operation and Maintenance Capacity Building

3. The proposed operation and maintenance capacity building program will enhance the operational efficiency and environmental sensitivity of the Waterboard's water and sanitation installations throughout the country, by setting up or reinforcing operation and maintenance systems, and raising staff awareness of operational concepts. International consultants will provide 9 person-months and domestic consultants 16 person-months of support. Primarily, consultants will develop training procedures and manuals and undertake a training program. The outline terms of reference are in Supplementary Appendix E.

4. Institutional Capacity Building

4. The institutional strengthening program will improve the sustainability of the Waterboard's operations, and thereby further develop the Waterboard to the stage where devolution can occur and town water boards can be established to operate their own water and sanitation systems under the umbrella of the PNG Waterboard. The international consultants will comprise an institutional/management/systems specialist (9 person-months) and an institutional legal specialist (3 person-months). The outline terms of reference are presented in Supplementary Appendix E.

5. Environmental Management Capacity Building

5. The environmental management capacity building program will support the Waterboard through technical and institutional advice and training to strengthen its capacity to address environmental issues in executing its mandated functions. The training activities will be extended to nominees from other agencies in the sector, notably the Department of Environment and Conservation and the Department of Health, to provide broad support to the sector as a whole. The program will require consulting services of some 9 person-months from an international specialist supported by 12 person-months of domestic consultant time. The outline terms of reference are presented in Supplementary Appendix E.

INDICATIVE CONTRACT PACKAGES

| | Civil Works (\$) | | Eqpt & Mat. (\$) | |
|---------------------|------------------------|-----|------------------------|-------|
| Sewerage | | | | |
| Madang | 419,440 | IS | 18,040 | DP |
| Alotau | 76,421 | DP | 92,642 | DP |
| Mt. Hagen | 189,517 | IS | 114,800 | IS |
| Water Supply | | | | |
| Mendi | 3,852,980 | ICB | 1,095,200 | ICB |
| Kerema | 1,423,996 | ICB | 124,640 | IS/DP |
| Wabag | 1,650,450 | ICB | 384,800 | IS/DP |

DP = direct purchase, ICB = international competitive bidding,
IS = international shopping

SUMMARY INITIAL ENVIRONMENTAL EXAMINATION (IEE)

A. Introduction

1. The proposed Project is classified as environment category B as per the Asian Development Bank's (ADB) guidelines for environmental assessment of project impacts. Consequently, consultants for each subproject carried out an initial environmental examination (IEE) as part of the project preparatory technical assistance for this Project. The IEE examined the likely environmental impacts and consequences of implementing the water supply, sewerage and sewage treatment activities as identified in each project town.

2. The Project aims at (i) increased coverage and improved delivery of basic water and sanitation services by developing affordable and sustainable water supply, sewerage, and sanitation schemes in selected priority towns; (ii) improved management and coordination of the water supply and sanitation sector through sector policy reform, institutional strengthening, and capacity building for the Waterboard; and (iii) improved health and poverty reduction for poor households and other urban residents through the provision of affordable water supply, sewerage, and sanitation services.

B. Description of the Project

3. The Project will provide water supplies (new or upgraded existing systems and expanded coverage) to selected provincial towns and piped sewerage and sewage treatment (new or upgraded existing systems) to selected towns.

C. Description of the Environment

4. Papua New Guinea (PNG) is a tropical country, generally hot and humid with varied climates in the different regions. There are three highland project towns (Mt. Hagen, Mendi, and Wabag) and five coastal towns (Alotau, Kerema, Lae, Madang, and Wewak). The coastal areas have equatorial climates and the northern towns (Alotau, etc) suffer from the same cyclone season as Northern Australia. Temperatures range from 23° to 32° C. Rainfall is of the order of 2,200 to 2,500 millimeters per year. In the highlands, Mendi is 1,700 meters above sea level (asl). Mt. Hagen is at 1,500-2,100 masl with peaks of 4,100 m and has a typical tropical highlands climate regime. Temperatures range from 12° to 24° C. Rainfall averages 2,500 to 3,000 mm per year.

5. PNG has a wealth of fauna and flora which are considered some of the most diverse and unique in the world. The project components are in urban areas surrounded by rural areas dominated by low-density population and subsistence livelihood activities. There are no known species of endangered fauna or flora or sites of archaeological significance in the immediate vicinity. The Project will not have any negative impact.

1. Human and Economic Development

6. The most recent population census was in 1990; the next census is due in 2001. The estimated population of PNG is 4.6 million, most of whom live a subsistence lifestyle. Most of the larger populations live in coastal towns, and population density in both the coastal towns and the highlands is low. Many towns are former government administration centers, and have become provincial administration centers after decentralization. Many towns have 500-1,000 households. A semi-subsistence lifestyle provides livelihood for over 85 percent of the

population. Urbanization is a recent phenomenon in PNG. The 1971 census, had only three towns with more than 20,000 people. In 1980, the urban population was 13 percent. Projections of the 1990 census estimate that the urban population will rise to 25 percent between 2010 and 2020. The population of PNG is very youthful; surveys show 47 percent of the population are below the age of 15.

7. The project towns are urban in a broad sense. People from many parts of the country and migrants from rural areas from the same province coverage in most urban centers, all expecting to find gainful employment. Strong provincialism at the urban and peri-urban levels results in the concentration of clans and the general intolerance for “outsiders.”

8. The per capita gross domestic product is \$1,266. A survey of 979 households’ income showed that in most of the project towns, the median income was K667 per month (equivalent to \$266.8). Significantly, the bottom 10 percent had an income of less than K292 per month (equivalent to \$116.8), and the top 10 percent had an income five times that of the lowest 10 percent.

9. Discrete central business areas occur in the larger towns and are evident even in the smaller towns. Water and sanitation services for these areas are, however, generally inadequate. Residential areas of towns vary with the socioeconomic status of residents. In most towns, “settlements” occupied by squatter communities are interspersed among the residential areas. Environmental services are generally very poor for those settlements. The peri-urban areas usually consist of markets, workshops, institutional establishments, and low-density, semirural subsistence communities. Basic services including water and sanitation in these areas are usually very poor.

2. Quality of Life Values

10. Housing surveys showed that more than 65 percent of households in the towns live in low-standard housing with 25 percent living in makeshift or bush material housing. The average household size is 8.2 persons; households of medium- or high-cost housing have fewer members per household. There is no official poverty line in PNG. A consumption-based poverty assessment by the World Bank in 1996 suggests that about 37 percent live below the poverty line. The United Nations Development Program in 1999 reported that the Human Poverty Index for PNG is one of the worst in the world. The project towns are small, with populations ranging from 4,200 in Kerema to 9,400 in Alotau, 24,400 in Mt.Hagen and 26,600 in Wewak. Lae is unusually large with 130,000.

11. Low life expectancy, high infant mortality rate, poor adult literacy rate, and low school enrollment all combine to make PNG’s human development level one of the lowest in ADB’s developing member countries. Health indicators are very poor and show a high incidence of waterborne diseases (Malaria, typhoid) and preventable intestinal diseases (diarrhea, dysentery). The latter are directly attributable to poor sanitation conditions, poor hygiene, and unsafe drinking water combined with the public’s lack of understanding of the general principles of hygiene and sanitation. In the “settlement” areas in the towns, environmental conditions are generally worse than in other parts, because of lack of safe water and sanitation, which lowers the quality of life.

12. Highland towns have many settlements in steep-sided gullies that often experience landslides and mudflows. Rainwater is often the preferred drinking water source when available

in most towns. However, supplies do not last all year, and most people resort to water vendors for supplies, that are often unsafe.

13. Most towns have, to a greater or lesser degree, problems with personal and property security. Vandalism is another common social problem in most towns.

D. Screening of Potential Environmental Impacts and Mitigation Measures

14. Table A9.1 and A9.2 give an overview of the proposed works and the physical interventions.

Table A9.1: The Water Supply Component

| Town | Source | Proposed Works | Physical Interventions |
|-------------|--------------------------------------|---|---|
| Kerema | Groundwater | New water supplies | Chlorinated water distributed by gravity from an elevated reservoir |
| Mendi | Two options- surface and groundwater | New supplies | Weir, water treatment plant (WTP), chlorinated water to reservoir, gravity supply to town |
| Wabag | Surface | Upgrade existing works, extend delivery network | Upgrade the existing intake, refurbish existing WTP, extend reticulation, new metering |

Table A9.2: The Sewerage Component

| Town | Proposed Works | Physical Interventions |
|-------------|---|--|
| Alotau | Sewerage for new part of town or a combination of old and new | Sewerage for the business area, or business and residential area; modular sewage treatment plant (STP); outfall to sea |
| Madang | New rising main to deliver to the existing sewage ponds | New pumping station plus connection of the two existing stations to a new rising main that will deliver the combined sewage to the existing sewage ponds |
| Mt. Hagen | Upgrade the existing treatment plant | Convert existing first sewage pond to aerated lagoon; add wetlands for further oxygenation, and a disinfection unit before effluent discharge point |

1. Construction of Water Supply and Sewerage Facilities

a. Project Location

15. Water supplies are proposed in Kerema, Mendi and Wabag. Work for the first two entail new supplies and distribution, works for Wabag entail upgrading the existing treatment plant and extending the delivery network. The output will be safe supplies of chlorinated water. Land requirements were carefully assessed, and the subprojects will be located on lands that are unlikely to be contested. Mendi will abstract 3,400 cubic metres (m³) of raw water per day from the Mangani River. This abstraction is not expected to cause significant negative changes to the river regime. Wabag will use the existing Pagwa creek intake after upgrading it. The intake is expected to provide 168 liters per second (l/s) and the abstraction is assessed to cause no significant change to the river regime. Kerema's water supply is aimed at providing 1.5 megaliters per day (MI/d) now and 1.7 MI/d in 2020, with a suitable number of boreholes. The typical borehole depths in Kerema are 50-100 m. It is claimed that abstracting these quantities

of water from aquifers this deep will have no significant effects on the shallow groundwater in open wells. A plan for minimal monitoring of the boreholes themselves and some open wells must be prepared to confirm that this is the case.

16. Sewerage services will be provided for Alotau, Madang, and Mt. Hagen to ultimately have 24-hour service. Alotau will have sewerage and a new, modular sewage treatment plant. Madang and Mt. Hagen will use the existing sewage ponds after these facilities are upgraded to ensure adequate treatment. Madang will have a package sewage treatment plant and the effluent will be discharged by sea outfall. The Department of Environment permit is mandatory and will ensure that standards are adequate for biochemical oxygen demand, and total suspended solids. Sludge will be discharged to sludge ponds for treatment. Alotau will have a package plant to treat up to 184 kiloliters per day (Kl/d), and the effluent will be disposed of by sea outfall to discharge no less than 200 m past low water, which is considered sufficient to ensure that no coral reefs or mangroves are affected. Mt. Hagen's design figures are a total of 2,475 Kl/d. Treatment is in concrete-lined sewage ponds and final polishing of the effluent is by wetlands. The effluent will be disposed of by outfall to the river, and chlorination prior to discharge is recommended. Sludge will be taken from the aeration ponds for treatment in the facultative ponds, where it will be rendered harmless. In Madang, the flow from the hospital is 31 l/s and the others combined is 72 l/s. Sewage from the hospital is only toilet waste and therefore does not contain any intractable waste material.

b. Design Aspects

17. The water supply component will provide clean and safe water for, ultimately, 24-hour supplies. Design considerations will ensure that abstraction (ground water or surface), treatment, and distribution through trunk mains and networks to the delivery points will be affordable to the target populations and water delivered at the point of consumption will be safe. Sewerage services will be provided to ensure adequate treatment of sewage so that the effluent will not cause environmental damage primarily to receiving waters. The new sewage treatment plant in Alotau will conform to effluent standards. The upgrading in Mt. Hagen and Madang will ensure that the resulting effluent conforms to appropriate standards. The final and safe disposal of sludge will be addressed during the design phase. Sewerage works are designed for a time horizon to year 2020. The law requires all sewerage interventions to obtain approval from the Office of Environment. Before a license is given, the treatment details must be presented and the quality of effluent and its disposal and disposal of sludge will have to comply with the PNG national standards. Effluent and sludge disposal was examined for the towns concerned. At the detailed design stage, the consultants will be required to provide design, monitoring and mitigation safeguards to ensure compliance with PNG's national environmental standards.

c. Construction Stage

18. No significant or unusual environmental problems are envisioned during the construction stage. Excavation for pipelines and backfilling of the trenches will involve some disruption to normal traffic flows (both vehicular and pedestrian), and may cause some soil to be washed off the sites. However, this problem is estimated to be minor and can be further minimized by scheduling construction during the dry season and adequate monitoring. However, as land ownership and access to it are vexing questions in PNG, adequate care will be taken during construction to ensure minimum levels of problems arising from land disputes.

d. Operations Stage

19. Adequate water testing at the treatment works, at points along the distribution system and at sample points of delivery, will be undertaken to ensure that standards for delivering safe water are maintained. As maintenance of project facilities is crucial to their longevity and sustainability, the operational and maintenance (O&M) capacity building program will train Waterboard staff. Adequate effluent testing will be undertaken at entry points to treatment works and the effluent discharge points to ensure that the sewage entering the works and the effluent being discharged into receiving waters comply with the design standards.

20. The Project aims to strengthen the environmental monitoring capacity of the PNG Waterboard, both institutionally and physically by providing adequate laboratory facilities and training technologists in routine monitoring functions. This will ensure that problems arising will be dealt with to safeguard the environment.

e. Critical Overall Environmental Review

21. In the short term, during the design, construction, and operation of the project facilities, it is anticipated that environmental impacts will be minor and can readily be managed with proper planning, and adequate mitigation measures together with regular monitoring.

22. For the much longer term, project facilities will significantly improve the personal, household, and community hygiene; and health and environmental sanitation. The enhanced quality of life can lead to poverty reduction in the target communities.

E. Environmental Monitoring and Institutional Requirement

23. The Project Management Unit (PMU) together with the consultants ensure that environmental monitoring programs are designed for the Waterboard generally and incorporated in the civil construction contracts with specific mitigation measures. The provincial town implementing unit will ensure that the contractors comply with the mitigation measures required. Regular monitoring of the actual environmental impacts and conditions during implementation will be carried out as part of the new responsibilities of the Waterboard, and ultimately delegated to the provincial/district offices. Tables A9.3 will serve as a guideline. To strengthen the presently weak environmental management capacity of the Waterboard, senior and operational staff will be trained in environmental awareness, especially of their own projects, and in environmental assessments and ways to mitigate adverse impacts. This will ensure that the Waterboard will play its role as an environmentally responsible corporate citizen. Additionally, senior staff from the Office and the Department of the Environment, Department of Health, etc. will be included in the training program.

F. Findings and Recommendations

24. The Project will bestow long-lasting and significant improvements in personal, household, and community health and well-being, thereby improving the quality of life for the target populations in the project towns. It will also reduce poverty. The Project as is conceived and prepared is recommended for implementation.

G. Conclusions

25. The Project will have no significant adverse environmental impact. On the contrary, it will result in significant, widespread, and long-lasting environmental improvements. A full environmental impact assessment is not necessary.

Table A9.3: Potential Environmental Impacts and Mitigation/Protection Measures

| Problems Arising | Impacts | Mitigation/Protection Measures | Post Mitigation Environmental Effect |
|--|--|--|---|
| A. Water Supply | | | |
| Vandalism | Loss, disruption of service | Adequate fencing and security | Minimum |
| Irresponsible sludge/ effluent disposal in river | Pollution of the river for all downstream users | Adherence to strict treatment specifications and safe disposal of sludge and effluent | Minimum |
| Water use conflicts | Social tensions | Total catchment management planning essential | Minimum |
| Site land acquisition and disputes | Social tensions | Proper planning to avoid land problems; allowances for adequate compensation where necessary | Minimum |
| Excessive pumping of ground water using the water supply boreholes | Possible drying up of shallow wells in the area of influence | Design must prescribe safe abstraction, and as the aquifer is deep, shallow water table is unlikely to be influenced. | Minimum |
| Delivery of unsafe water to consumers | Unacceptable adverse health impacts to many consumers | Enforce high quality control during pipe laying to ensure watertight network; operate supply system under positive pressure all the time; Monitor residual chlorine at points of delivery widely and regularly | Minimum so long as the full operation and maintenance (O&M) program is carried out rigorously by the Waterboard operational staff, who will be trained by the Project |
| Excessive algal growth in reservoirs | Delivered water quality decreases | Reservoirs must be covered and algae removed regularly. | Minimum |
| Management of chlorine use | Health/occupational safety hazards to workers and public especially when using gas | Well-designed facilities Comprehensive training of operational staff in all safety aspects for handling chlorine, compulsory use of safety gear | Minimum |
| Water and sewer pipes in same trench | Possible cross-contamination, especially with low pressures in water supply pipes | Avoid using same trench, wherever possible; avoid intermittent water supplies; ensure high quality workmanship in pipe network construction | Minimum when 24-hour water supplies are maintained where possible |
| Soil erosion, sediment runoff, noise, dust, disruption of normal public life during construction | Water quality downstream affected, nuisance value to residents and vehicular traffic and pedestrians | Planned precautionary measures to be taken to contain the minimum soil disturbance Safe disposal of excavated material; avoid construction during rainy season; avoid use of jackhammers at night; proper backfilling of trenches | Minimum |
| Unsustainable power failure | Water supply system failure resulting in hardship and denial of services to consumers | At planning stage, ensure that adequate standby generators are provided and ensure these are installed and fully maintained at all times. | Minimum |

Table A9.3 (cont.): Potential Environmental Impacts and Mitigation/Protection Measures

| B. Sanitation (Sewerage) | | | |
|--|--|--|---|
| Site land acquisition and disputes | Social tensions | Proper planning to avoid land problems; allowances for adequate compensation where necessary | Minimum |
| Contamination of receiving waters by partly treated or untreated sewage | Major hazards to the health of all downstream users of the same water source | Proper planning and design for the sewage treatment plant to provide adequate treatment. | Minimum |
| Treatment plant inadequately protected against inflow overload (storm flow incursion) | Major hazards to the health of all downstream users of the same water source | Proper planning, design, and construction of the sewer network and the treatment plant to ensure safeguards are there | Minimum |
| Future increase in sewage production demanding connection | Inability of treatment plant to cope with consequent overflows/inadequate treatment | Planning and design must allow spare capacity to be built in for sewer network as well as treatment plant | Minimum |
| Inadequate or ad hoc disposal of sludge / effluent | Major public health hazard and source of nuisance to residents in surrounding properties | Planning & design should clearly address this comprehensively with adequate provision for safe final disposal. | Minimum, depending on the correct maintenance of the disposal facilities |
| Discharge of unacceptable, high strength effluent into receiving waters | Major public health hazard, and extensive ecological damage through high biochemical oxygen demand loads | Planning & design for adequate treatment; more importantly the regular, routine checking of the effluent quality through a sampling and action program; training of Waterboard staff in such procedures | Minimum, depending on the acceptance of the sampling and analysis of effluent as routine for the operation of these facilities; More importantly, the O&M program must be carried out rigorously by the trained Waterboard staff to maintain vigilance. |
| Water supply and sewer pipes in the same trench leading to contaminated water supplies | Possible contamination especially with low pressures in water supply pipes | Avoid using same trench wherever possible; avoid intermittent water supplies; ensure high quality workmanship in pipe network construction | Minimum when 24-hour water supplies are maintained where possible |
| Soil erosion, sediment runoff, noise, dust, disruption of normal public life during construction | Water quality downstream affected, nuisance value to residents and vehicular traffic and pedestrians | Planned precautionary measures to be taken to contain the minimum soil disturbance; safe disposal of excavated material; avoid construction during rainy season; avoid use of jackhammers at night; proper backfilling of trenches | Minimum |
| Vandalism | Loss, disruption of service | Adequate fencing and security | Minimum |

SUMMARY INITIAL SOCIAL ANALYSIS

A. Introduction

1. Papua New Guinea (PNG) in the western Pacific comprises the eastern portion of the island of New Guinea and about 300 small islands to the north and east. It is dominated by mountain ranges subject to earthquakes and volcanic activity. PNG has a population of 4.4 million about 85 percent of whom reside in the rural areas. The people speak over 800 languages. The country is rich in mineral resources, including copper and gold. The main economic activity is mining and minerals account for most exports. The country's energy is from natural gas, oil and hydroelectric power. Agricultural activity tends to be either subsistence farming or intensive production of coffee, tea, cocoa, and copra for export. Important fisheries and forestry exports include prawns, tuna, palm oil, logs, and lumber. Because of the islands' mountainous and swampy terrain, transportation is mainly by air.

B. Stakeholder Features

2. The Project is expected to contribute to human development and economic growth, and thus help to reduce poverty in the project towns. The profile of the stakeholders is based on the socioeconomic surveys carried out during project preparation for the technical assistance, review of available data and statistics, and discussions with Waterboard personnel, and central and provincial government organizations. The table gives the population of the project towns, and the estimated number and percentage of people within the areas to be served by the water supply and sanitation subprojects.

Table A10: Populations and Estimated Service Coverage in Project Towns

| Town | Urban Population ^a | Service Area Population | |
|---------------------|-------------------------------|-------------------------|---------|
| | | no ^b | Percent |
| Water Supply | | | |
| Kerema | 4,900 | 4,900 | 100 |
| Mendi | 12,100 | 12,100 | 100 |
| Wabag | 3,700 | 3,700 | 100 |
| Sewerage | | | |
| Alotau | 17,100 | 6,300 ^c | na |
| Madang | 60,500 | 3,500 | 6 |
| Mt. Hagen | 44,100 | 11,000 | 25 |

^a Project preparatory technical assistance estimate of town populations in year 2020.

^b Project preparatory technical assistance estimate of population to be served by subproject.

^c Includes central business district.

na = not applicable

3. The household survey during project preparation indicates that 47 percent of the population are below the age of 16. Males outnumber females 112:100 in all age groups in the 1990 census of the urban population, and in the 15–24 years age group the ratio is 122:100. Urban centers typically have a much higher male-female ratio than the rural areas (126 compared with 109).

4. **Household Size.** The average household has around 8.2 persons.

5. **Poverty.** There is no poverty line in PNG. Using data collected from the 1996 demographic and health survey of 1,200 households, the World Bank (1999) calculated a

poverty line based on consumption of 2,200 calories per day together with nonfood essentials to reach an overall upper poverty line of K461 per adult equivalent per year. The report further suggested that some 16 percent of the urban population lived below this upper poverty line in 1996. The household surveys for the Asian Development Bank (ADB) study confirmed that the bottom 10 percent of the population has an income of less than K292.50 per month. The top 10 percent of households has an income more than five times that of the lowest percentile.

6. **Health.** Infant mortality rate is 73 per 1,000 live births while maternal mortality rate is 0.37 per 1,000 live births. Life expectancy is 54.6 years for men and 53.3 years for women. One health extension worker serves every 16,800 people and one nurse per 1,400 people. The five leading causes of national mortality for 1995-1999 were predominantly diseases exacerbated by poor living conditions: pneumonia, malaria, prenatal conditions, tuberculosis, and meningitis. Diarrhea and typhoid also ranked high as leading causes of death. The health indicators for PNG show a high incidence of waterborne diseases, particularly diarrhea and typhoid, a situation that was confirmed by the household survey and the review of data for each town.

7. **Education.** Education levels are low and so are the literacy rates. Literacy rate is 40 percent for women and 50 percent for men. Enrollment rate is 90.5 percent for elementary grades 1-2, 55.8 percent for primary (grades 3-9), 9.2 percent for secondary (grades 10-12), and only 0.4 percent for tertiary or higher education.

8. **Employment.** All towns show high levels of unemployment and/or under-employment.

9. **Housing and Tenure.** More than 26 percent of all households surveyed live in makeshift or bush materials housing, and more than 65 percent live in low-cost, low-standard housing. The majority (54.9 percent) of urban residents do not own the house they live in.

C. Infrastructure Needs

10. **Water.** Information from household surveys suggests that 21.6 percent of the households overall do not have enough water, and at least 31 percent do not have water available year-round. Households in the towns that rely predominantly on rainwater are very vulnerable to shortages during the dry season, and prolonged lack of water during droughts. For these households a regular and reliable reticulated water supply is most important. In towns where reticulated water supply is available, the level of access varies significantly between the richer and poorer households. In Mt. Hagen it appears that 75 percent of the households surveyed have access to a reticulated supply. However, the poor are less likely to be connected and are more likely to rely on unsafe water sources. While 86.7 percent of the wealthy households are connected, only 50.9 percent of the poorer households are. The results are similar for Lae, the other large town.

11. **Sewerage.** The main types of sanitation units in urban areas are flush toilets (waterborne sewerage and septic) and pit latrines, with bucket disposal systems still operating in some towns. The household survey shows that about 41 percent of households are using flush toilets and 41 percent are using pit latrines. Almost 8 percent of households have no toilet and members defecate in the sea, bush, or mangrove areas. Towns such as Kerema, Wabag, and parts of Madang rely on the unsatisfactory bucket collection system.

D. Service Demands

12. Household surveys show that a reliable reticulated water supply and sanitation improvements are top priorities of households in all towns. There is also a significant awareness among households of the benefits from improved urban environment and infrastructure. Willingness to pay, however, is quoted at less than the amount households are actually paying

at present. A more fair and less subjective test of the willingness to pay for urban services could be based on the amounts the households are actually paying at the time of the survey, e.g., K6-K10 per month for bucket collection, and K10–K15 per month for piped water supply. During the dry season, untreated water is purchased at prices far in excess of the town water tariffs.

E. Impact on the Communities

13. Improved quantity and quality of water supply will improve the health and well-being of the project beneficiaries. Beneficiaries who presently spend considerable time fetching water for household use, can more productively spend time on income-generating and/or subsistence activities.

14. The LCS-CAHE program (JFPR) will undertake a comprehensive community awareness and health education program to raise the communities' appreciation and knowledge of public health and hygiene and the linkages between water supply and improved sanitation. The LCS-CAHE program, in particular, will involve community mobilization, participatory planning with the communities, non-government organizations and the provincial town administrations. Community involvement will help maximize the social impacts of the proposed project. Since LCS will be provided to low-income and poor people, the households contribution will be in the form of labor and partial cost of the ventilated improved pit latrine (VIPL) materials.

F. Impact on the Poor

15. The Project will address the needs of the poorer members of the communities, especially those who currently have little access to safe water and therefore suffer higher than average incidences of waterborne diseases. The recent Waterboard decision to introduce a lifeline tariff of 12 kl at a fixed (discounted) rate of K3.50 and to remove the direct charge for water connections removed the substantial impediments of connection fees and high water charges for the poorer sections of the community.

16. Construction works under the Project will require labor and will generate direct income-earning opportunities for the poor. Moreover, by stimulating economic growth and attracting investments to the project towns, improved infrastructure will indirectly create employment opportunities.

17. In addition, the LCS-CAHE program (JFPR) will directly target the poorer sections of the community with information designed to assist them in making informed choices on sanitation options. In parallel the LCS program will offer affordable, technically appropriate on-site sanitation facilities for the poorer urban households. The improved hygiene and sanitation resulting from the Project will lead to improved health, greater productivity, and reduced expenses on medical treatment.

G. Gender Impact

18. Although the water supply and sanitation components are not specifically targeted at women, the Project will improve their living conditions by providing easier and more affordable access to potable water and improved sanitation. Women and children are particularly affected by poor living conditions arising from inadequate supplies of water and poor sanitation. Women exposed to unsanitary conditions in the domestic environment while managing the household, exhibit higher incidence of disease. Children exposed to standing and contaminated waters in their immediate environment are highly vulnerable to waterborne and vectorborne diseases.

19. Activities under the parallel LCS-CAHE program will make women and children less vulnerable to disease and will enhance their health, education, and productivity. The LCS activities will be designed to ensure that women play a key decision role, increase their awareness of environmental sanitation issues and maximize their commitment to the O&M of the household water supply and sanitation requirements. To this end, the implementation arrangements for the LCS-CAHE program have centered on women and their potential role. For instance, at least 50 percent of the provincial town facilitators will be women.

H. Potential Adverse Impact

20. The project design incorporates an appropriate degree of training and awareness building to allow early identification of adverse social impacts. This will ensure that such adverse impacts are properly dealt with do not hinder the goal of achieving a highly viable and sustainable project. Institutional impacts could occur where project demands cannot be met because of the influence of traditional attitudes and social norms toward the poorer and more vulnerable groups in the community. This would artificially reduce or constrain the absorptive capacities of the Waterboard and the local agencies to effectively implement the Project. The Project contains significant capacity-building which, while focusing on the more traditional areas, will also enhance the role of women in development. With a view to changing attitudes, the Project will encourage the Waterboard and its agencies to interact more with the poorer and more vulnerable groups in the community.

21. The tariff structure adopted will be important to the poorer and more vulnerable groups, if they are to gain access to the services. The tariffs required for the water supply sub-projects will range between 5.2 percent and 9.2 percent of the monthly household income. Under the PNG Waterboard's new tariffs, low-volume, poor customers will pay only K3.50 for the first 12 kl of water consumed. For the sewerage subprojects, the tariffs established for cost recovery are relatively high but can be reduced by contribution or subsidy from the provincial and local governments, if necessary.

I. Monitoring and Evaluation

22. An outline of the project's monitoring methodology by component is given in the project framework (Appendix 1) and the detailed methodology and approach are in Supplementary Appendix E. Similarly, monitoring and evaluation arrangements for the LCS-CAHE program are included in Appendix 4. A detailed benefit and monitoring manual will be prepared. It will contain project monitoring and evaluation frameworks for each component and details on the objectives, evaluation criteria and achievement indicators. The manual and its associated procedures will permit a quantifiable and logical assessment of outcomes in accordance with ADB's requirements. The procedures and indicators will measure the positive changes to the urban environment, such as improved health, and number and type of beneficiaries serviced by the new utilities and services.

FINANCIAL ANALYSIS AND WATERBOARD FINANCIAL PROJECTIONS

A. General

1. For the water supply and sewerage subproject components chosen and evaluated under the Asian Development Bank (ADB) -funded TA 3173-PNG¹ and subsequently reviewed and updated during appraisal, financial internal rates of returns (FIRRs) were calculated in accordance with ADB's *Guidelines for Preparation and Presentation of Financial Analysis of Projects*. A summary of the financial analysis, affordability of tariffs, together with a summary of the financial projections of the Waterboard for the next 15 years are presented. International inflation is assumed to be 2.4 percent per annum. The exchange rate is assumed to be K1 = \$0.4. Domestic inflation is assumed to be 15 percent for 2000 and 5.0 percent thereafter. The detailed calculation for each subproject is in Supplementary Appendix G.

B. Financial Analysis

2. In accordance with the recommended investment criteria of the Waterboard, proposed subproject tariffs were set to achieve cost recovery so that no long-term subsidies are required. Expenditures include full operation and maintenance of the facilities including administration costs in the districts, full depreciation on assets, interest payable on the ADB loan, and incremental head office costs. Tariffs are assumed to be introduced as soon as the facility operates and to remain constant in real terms. Revenues are based on the demand assessment undertaken as part of the project preparatory technical assistance and the proposed average tariff. The net revenue (profit/loss) is calculated for each year. Since the number of connections and volume consumed are assumed to rise over time while tariffs remain constant, the annual return on the total initial investment will rise. The proposed tariffs are calculated on the basis that, in the medium to long term, each subproject will also yield a small return on initial investment. All figures and calculations are in constant June 2000 prices. All components are assumed to have a life of 25 years. The analysis is undertaken for 20 years from the start of operations, and thus no residual value is included.

3. Current tariffs for water and sewerage are structured by user type - domestic/non-domestic - and by volume. Based on the volumes sold by category block for February and March 2000, the average tariff of water services for C category towns is K1.08, ranging from K0.81 for domestic users and K1.46 for nondomestic. For the first five months of 2000, the average sewerage tariff was K0.39, ranging from K0.20 for domestic and K0.44 for non-domestic.

4. The recommended tariff for financial viability was calculated on an average kiloleter basis. A tariff that remains constant in real terms (increases in line with inflation) is more practical and easier to implement. It is also more appropriate in terms of affordability (paras. 9-13). Summary results of required tariffs, and the proportionate increase on current tariffs, for system operation (3-5 years) for each subproject are shown in Table A11.1. A detailed breakdown of the calculation and the yearly profit/loss to 2010 is shown in Supplementary Appendix G. The average tariff required for financial viability varies across towns. This reflects the fact that the number of connections, water sales, and the capital cost of the subproject are not directly related to the volume of water produced. Generally the smaller the system, the higher the cost per kiloleter consumed. Capital cost estimates are based on preliminary design

¹ TA 3173-PNG: Provincial Towns Water Supply and Sanitation, for \$908,000, approved on 23 March 1999.

and incorporate the design of the system, number of pumps, storage, treatment, length of pipe required among topographic, geographic, and other technical considerations.

5. An investment appraisal for each subproject was undertaken using methods that consider the time value of a flow of expenditure and income. The net present value (NPV) is the present-day value of the income and expenditure stream discounted at the weighted average cost of capital (WACC). The FIRR is the discount rate at which the NPV equals zero. The average incremental financial revenue (AIFR) and average incremental financial cost (AIFC) is the NPV of the revenue (cost) stream discounted at the WACC divided by the NPV of the volume of water sold (or sewerage treated), giving the per unit revenue (cost). Where the NPV is greater than zero, the FIRR exceeds the WACC, or the AIFR exceeds the AIFC, the investment is financially viable.

Table A11.1: Required Tariffs for Financial Sustainability

| Subproject | Current Average Tariff (K/kl) | Required Average Tariff (K/kl) | Increase (percent) |
|---------------------------------|-------------------------------|--------------------------------|--------------------|
| Water Supply^a | | | |
| Kerema | 1.08 | 1.6 | 48 |
| Mendi | 1.08 | 2.5 | 130 |
| Wabag | 1.08 | 2.7 | 150 |
| Sewerage^b | | | |
| Alotau ^a | 0.44 | 2.5 | 468 |
| Mt Hagen ^b | 0.37 | 0.8 | 116 |
| Madang | 0.39 | 1.3 | 233 |

^a The required tariff for Alotau is very high due to the low number of connections (32). A flow volume of 100 kiloliters per connection/month is used, based on water volumes for the central business district area. Current average tariff is K0.44/kl, since all users are non-domestic.

^b For Mt. Hagen the average current tariff is K0.37/kl.

6. The WACC is calculated at negative 0.6 percent for water supply subprojects and negative 0.8 percent for sewerage subprojects. Table A11.2 shows the calculation of the WACC, which is negative given the low ADB borrowing rate and an average domestic inflation rate of 5 percent.

Table A11.2: Weighted Average Cost of Capital (%)

| Source | Amount | Interest Rate | Inflation Rate ¹ | WACC |
|-----------------------|--------|---------------|-----------------------------|-------------|
| Water Supply | | | | |
| ADB, ADF loan | 67 | 1.5 | 5.0 | -3.3 |
| PNG Government equity | 33 | 5.0 | 0.0 | 5.0 |
| WACC | | | | -0.6 |
| Sewerage | | | | |
| ADB, ADF loan | 70 | 1.5 | 5.0 | -3.3 |
| PNG Government equity | 30 | 5.0 | 0.0 | 5.0 |
| WACC | | | | -0.8 |

ADB = Asian Development Bank, ADF = Asian Development Fund

PNG = Papua New Guinea, WACC = weighted average capital cost

¹ The ADB loan is discounted at domestic inflation since the PNG Government, not the Waterboard, will assume the FX risk. The real return on equity is assumed to be 5 percent; grant-funded portion is discounted at domestic inflation. Tax does not apply since the Waterboard is tax exempt.

7. Table A11.3 summarizes the results of the analysis and sensitivity tests. The base case FIRR exceeds the WACC for all subprojects. Sensitivity tests show that the subprojects remain viable under assumptions of adverse cost, revenue and exchange rate.

8. For all subprojects the AIFR likewise exceeds the AIFC, demonstrating that at the chosen tariff level, the average revenue gained from producing each unit is greater than the average cost. The analysis indicates that each subproject will realize positive returns. Since NPVs are positive, the FIRR exceeds the WACC, and the AIFR exceeds the AIFC, each subproject appears financially viable. Detailed calculations are found in Supplementary Appendix I.

C. Affordability

9. Affordability is critical to (i) ensure that the poverty reduction policy objective of ADB is met, (ii) encourage domestic and other customers to connect to the system, (iii) ensure that bills are paid to provide revenue for the Waterboard so that service provision is sustained, and (iv) reduce misuse of facilities, and limit the number of disconnections.

Table A11.3: Summary of FIRR Analysis and Sensitivity Tests

| Subproject | Base Case | Costs Increase 10% | Revenues decrease 10% | Revenues delayed one year | Devaluation 30% |
|---------------------|-----------|--------------------|-----------------------|---------------------------|-----------------|
| Water Supply | | | | | |
| <i>WACC (-0.6%)</i> | | | | | |
| Kerema | 4.6 | 3.4 | 3.3 | 3.7 | 2.9 |
| Mendi | 5.1 | 3.8 | 3.7 | 4.1 | 3.3 |
| Wabag | 4.8 | 3.5 | 3.3 | 3.8 | 3.0 |
| Sewerage | | | | | |
| <i>WACC (-0.8%)</i> | | | | | |
| Alotau | 3.8 | 2.6 | 2.5 | 3.0 | 2.2 |
| Mt Hagen | 9.1 | 6.0 | 5.6 | 6.4 | 4.7 |
| Madang | 3.7 | 2.4 | 2.3 | 2.9 | 2.0 |

WACC = weighted average cost of capital

10. The analysis for affordability looked at the tariff structure and used information on the number and volumes of consumers across user types and for different volumes of consumption in line with the current block tariff system. For water, the information used is for C category towns, which are the smaller towns more relevant to the subprojects. For sewerage in Alotau and Madang, volumes were based on an average of all towns covered. Since Mt. Hagen already has an existing system, actual data provided by the Waterboard was used. For a subproject to be affordable to domestic customers while maintaining financial viability, a degree of cross-subsidization is needed from non-domestic to domestic customers and from higher volume customers (those in higher income brackets) to lower volume customers (including the poor).

11. With careful structuring of tariffs within the current block system, subprojects can be made more affordable without compromising financial objectives. The analysis calculates a possible tariff structure that, given current consumption patterns across comparable towns, will

achieve required average tariffs while keeping household bills to affordable levels. However, these rates are indicative and are for assessing whether a tariff structure could be designed to achieve both affordability and financial objectives.

12. In all cases, the nondomestic high volume user was the main target to absorb most of the impact of constraining the cost to the lower volume and domestic users. In the case of water, for the lowest volume domestic users, the lifeline tariff remained at K3.5, less than 2 percent of monthly income. For consumers in the middle volume block, average bills remain below 5 percent of household income at the 25th percentile. The resultant high volume, nondomestic tariffs were in the order of K2.4/kl, K3.7/kl, and K4.3/kl. Table A11.4 summarizes the tariffs. It is evident that for towns where the number of connections is very low, constraining domestic tariffs may lead to problems of affordability for nondomestic, high-volume consumers despite their better ability to pay.

13. In the case of sewerage, the lifeline domestic tariff remained at K4.86, and average bills for those in the lower and middle range incomes were less than 2 percent. The resultant high-volume, non-domestic tariffs were in the order of K0.8/kl to K2.5/kl. Table A11.5 and A11.6 compares household incomes and proposed charges for a range of water supply consumption and sewerage volumes. The potential impact of tariff structure and proposed charges will be assessed further during project implementation. In particular, once the results of the 2000 census are available, further analysis of incomes and nondomestic use in each subproject area will assess the potential for differential tariffs. The analysis will also consider price and income elasticity of users, and the need for compliance, regulation, and enforcement, which will be critical where nondomestic, large-volume charges are high. In conclusion, the affordability analysis shows that it is possible to design a tariff structure that balances the need for affordability and revenue generation. Detailed analysis and presentation of proposed charges for different consumption levels for both domestic and non-domestic customers are in the Supplementary Appendix G.

Table A11.4: Current and Proposed Tariffs, by User Type and Volume

| Volume | Proposed For Water Supply (K) | | | | Proposed for Sewerage (K) | | | |
|---------------------------------|-------------------------------|--------|-------|-------|---------------------------|--------|-----------|--------|
| | Current (K) | Kerema | Mendi | Wabag | Current (K) | Alotau | Mt. Hagen | Madang |
| Domestic^a | | | | | | | | |
| 0-12 kl | 3.50 | 3.5 | 3.5 | 3.5 | 4.86 | na | 4.86 | 4.86 |
| 12-30 kl | 0.64 | 1.3 | 2.1 | 2.0 | 0.14 | na | 0.5 | 0.5 |
| 30 kl+ | 1.05 | 1.3 | 2.1 | 2.0 | 0.14 | na | 0.5 | 0.5 |
| Non-Domestic^a | | | | | | | | |
| 0-12 kl | 3.50 | 10.0 | 10.0 | 20.0 | 4.86 | 10.0 | 10.0 | 10.0 |
| 12-30 kl | 0.64 | 2.4 | 3.7 | 4.3 | 0.44 | 2.5 | 0.8 | 1.5 |
| 30 kl+ | 1.50 | 2.4 | 3.7 | 4.3 | 0.44 | 2.5 | 0.8 | 1.5 |

na = not applicable

^a The indicative charges apply in the same way as the current tariff system

D. Financial Projections

14. The Papua New Guinea Waterboard was established in 1986 under the National Water Supply and Sewerage (NWSS) Act, with a broad mandate to provide and regulate water and

sanitation services. The Waterboard operates and maintains services in 11 towns in Papua New Guinea, including Lae, the second largest town. Financial projections are based on existing operations and facilities proposed under the Project. The proposed ADB-financed project will provide water services in three towns where the Waterboard does not currently operate (Kerema, Mendi, and Wabag) and sewerage services in three towns where the Waterboard currently provides water supply services (Alotau, Madang, and Mt. Hagen). The capacity building component and LCS-CAHE program will be financed by grants from the Australian Agency for International Development (AusAID) and Japan Fund for Poverty Reduction (JFPR) respectively. Both the capacity building component and the LCS-CAHE program are not targeted for cost recovery, and the LCS-CAHE program will be operated and maintained by the beneficiaries. These component/program activities are not incorporated in the forecast.

15. Current operating costs of the Waterboard are around K14 million including water production, water distribution, sewerage services, and administration (Table A11.7). Wages and salaries form the largest component although the workforce has been reduced by approximately a third since 1995. Operating costs are assumed to increase at 3 percent above inflation. Additional operating costs are estimated at K0.9 million in 2003 rising to K2.0 million in 2010 and thereafter (2000 prices), including fixed and variable costs of administration, labor, power, maintenance, chemicals, and incremental head office costs. Operating costs are assumed to increase in line with inflation.

16. Project capital expenditure is estimated at K50 million over four years. This includes physical contingencies of 20 percent for physical items and 10 percent for project management, and price contingencies in line with expected inflation. AusAID will finance Waterboard expenditure of A\$45 million as a grant over the next five years. Since, the expenditure is not determined, this grant financing is not included in the forecast. If capital items are created through grant financing, then depreciation charges will be higher.

17. Revenues will come from direct user charges and other nonoperating income. Existing revenues include the increase in tariffs of around 12 percent in April 2000. Revenues are assumed to increase by 2 percent per annum, reflecting a growth in consumption and number of connections. Additional revenues from project components are assumed to be realized during operation of the facility. Tariffs for project towns are set for cost recovery with a small return in the medium to long term.

18. The opening balance is based on an estimate of the Waterboard balance sheet for 1999. Project fixed assets are depreciated at 3.5 percent per annum on a declining balance. Existing assets are depreciated at 3.3 percent per annum for civil works and 3.5 percent for buildings, plant and equipment. Land is not depreciated. Accounts receivable represent 10 percent of current period debit. Accounts payable represent about 10 percent of operating expenses. Seventy percent of additions to accounts payable are paid in the following year. The allowance for doubtful debts represents 5 percent of current period debit. Long-term debt includes the ADB loan of \$15.3 million from ADB's Asian Development Fund. Other long-term debt includes the ADB and CTB loans, which are assumed to have an interest rate of 10 percent and a grace period of three years. Loan repayments begin in 2000, at K2.1 million. Nonoperational revenue in 1998 and 1999 provided windfall gains for the Waterboard from funds held as treasury bonds. It is assumed that the funds held as short-term interest-bearing deposits will be used to fund capital investment during 2000 and other expenditures. Other nonoperating revenue, mainly from engineering work, is assumed to continue. No changes to the existing tariff structure are assumed. However, the Waterboard, as expressed by the board and shown in its corporate plan, is moving toward full cost recovery, and further tariff increases are likely, even without the

Project. Loan conditions for real tariff increases of 20 percent by the year 2005 are incorporated in the forecast. It is likely that tariff would be increased much earlier.

19. Detailed financial projections go up to the year 2015. They cover the current operations of the Waterboard and the facilities proposed under the Project. The projected financial statements are presented in current prices that include inflation in each year. A summary balance sheet, sources and application of funds, and income statement is shown in Table A11.7. Total assets are seen to increase to K188 million by 2010, primarily due to the completion of capital works under the Third ADB Water Supply Project, the revaluation of assets that took place in 1999, and the proposed ADB Project.

20. On the basis of the existing tariffs, the proposed tariffs for the new project facilities and the 20 percent real tariff increase required under the Project, the Waterboard will run at a loss until 2004. In 2005, the increase in revenue in line with the ADB loan condition is assumed to occur. Profits (measured by return on capital employed) in the early years are low, rising to 4.0 percent by 2010.

21. The financial projections indicate that the Waterboard under the Project will be financially sustainable in the medium to long term. However, important factors will impact on the overall performance of the agency and should be monitored carefully. First, expenditure on regulation and compliance is set to increase under Waterboard plans for improved performance, which will enhance revenue collection and should improve performance. The Waterboard is currently investigating the potential impact of expenditure scenarios. Second, the impact of price increases on consumption is important, particularly for the proposed Project, and further work should be undertaken on the potential impact of tariffs.

Table A11.5: Household Income and Proposed Charges for a Range of Water Supply Consumption

| Kerema | | Charges (K) | | Monthly HH Income at nth Percentile | | | |
|----------------------------------|---------|-------------|-----|-------------------------------------|------|------|------|
| | | | | 10th | 25th | 75th | Mean |
| Volume (kl) | Current | Proposed | 433 | 541 | 1060 | 954 | |
| <i>Percent of Monthly Income</i> | | | | | | | |
| 10 | 3.5 | 3.5 | 1% | 1% | 0% | 0% | |
| 20 | 8.6 | 13.5 | 3% | 2% | 1% | 1% | |
| 30 | 15.0 | 26.0 | 6% | 5% | 2% | 3% | |
| 40 | 42.0 | 50.0 | 12% | 9% | 5% | 5% | |
| 50 | 52.5 | 62.5 | 14% | 12% | 6% | 7% | |
| 80 | 84.0 | 100.0 | 23% | 18% | 9% | 10% | |
| 100 | 105.0 | 125.0 | 29% | 23% | 12% | 13% | |

| Mendi | | Charges (K) | | Monthly HH Income at nth Percentile | | | |
|----------------------------------|---------|-------------|-----|-------------------------------------|------|------|------|
| | | | | 10th | 25th | 75th | Mean |
| Volume kl | Current | Proposed | 316 | 478 | 1291 | 939 | |
| <i>Percent of Monthly Income</i> | | | | | | | |
| 10 | 3.5 | 3.5 | 1% | 1% | 0% | 0% | |
| 20 | 8.6 | 19.5 | 5% | 4% | 2% | 2% | |
| 30 | 15.0 | 39.5 | 9% | 7% | 4% | 4% | |
| 40 | 42.0 | 80.0 | 18% | 15% | 8% | 8% | |
| 50 | 52.5 | 100.0 | 23% | 18% | 9% | 10% | |
| 80 | 84.0 | 160.0 | 37% | 30% | 15% | 17% | |
| 100 | 105.0 | 200.0 | 46% | 37% | 19% | 21% | |

| Wabag | | Charges (K) | | Monthly HH Income at nth Percentile | | | |
|----------------------------------|---------|-------------|-----|-------------------------------------|------|------|------|
| | | | | 10th | 25th | 75th | Mean |
| Volume kl | Current | Proposed | 308 | 498 | 1013 | 865 | |
| <i>Percent of Monthly Income</i> | | | | | | | |
| 10 | 3.5 | 3.5 | 1% | 1% | 0% | 0% | |
| 20 | 8.6 | 19.5 | 5% | 4% | 2% | 2% | |
| 30 | 15.0 | 36.0 | 8% | 7% | 3% | 4% | |
| 40 | 42.0 | 80.0 | 18% | 15% | 8% | 8% | |
| 50 | 52.5 | 100.0 | 23% | 18% | 9% | 10% | |
| 80 | 84.0 | 160.0 | 37% | 30% | 15% | 17% | |
| 100 | 105.0 | 200.0 | 46% | 37% | 19% | 21% | |

Table A11.6: Household Income and Proposed Charges for a Range of Sewerage Volumes^a

| Mt Hagen | | Charges (K) | | Monthly HH Income at nth Percentile | | | |
|----------------------------------|---------|-------------|-----|-------------------------------------|------|------|------|
| | | | | 10th | 25th | 75th | Mean |
| Volume (kl) | Current | Proposed | 216 | 352 | 1083 | 1086 | |
| <i>Percent of Monthly Income</i> | | | | | | | |
| 10 | 4.9 | 4.9 | 2% | 1% | 0% | 0% | |
| 20 | 6.0 | 8.9 | 6% | 4% | 1% | 1% | |
| 30 | 7.4 | 13.9 | 12% | 7% | 2% | 2% | |
| 40 | 5.7 | 20.0 | 23% | 14% | 5% | 5% | |
| 50 | 7.2 | 25.0 | 29% | 18% | 6% | 6% | |
| 80 | 11.4 | 40.0 | 46% | 28% | 9% | 9% | |
| 100 | 14.3 | 50.0 | 58% | 36% | 12% | 12% | |

| Madang | | Charges (K) | | Monthly HH Income at nth Percentile | | | |
|----------------------------------|---------|-------------|-----|-------------------------------------|------|------|------|
| | | | | 10th | 25th | 75th | Mean |
| Volume kl | Current | Proposed | 322 | 438 | 1002 | 954 | |
| <i>Percent of Monthly Income</i> | | | | | | | |
| 10 | 4.9 | 4.9 | 2% | 1% | 0% | 0% | |
| 20 | 6.0 | 8.9 | 9% | 6% | 2% | 2% | |
| 30 | 7.4 | 13.9 | 18% | 11% | 4% | 4% | |
| 40 | 5.7 | 20.0 | 37% | 23% | 7% | 7% | |
| 50 | 7.2 | 25.0 | 46% | 28% | 9% | 9% | |
| 80 | 11.4 | 40.0 | 74% | 45% | 15% | 15% | |
| 100 | 14.3 | 50.0 | 93% | 57% | 18% | 18% | |

^a Alotau is not included since customers are all non-domestic

**Table A11.7: PNG Waterboard
Financial Statements, 2000- 2015
(K million)**

| BALANCE SHEETS | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|--|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| ASSETS | | | | | | | | | | | | | | | | |
| Current Assets | 18 | 19 | 20 | 19 | 22 | 31 | 41 | 51 | 63 | 72 | 83 | 94 | 106 | 119 | 133 | 147 |
| Net Fixed Assets | 117 | 118 | 129 | 149 | 147 | 140 | 134 | 127 | 120 | 113 | 106 | 98 | 91 | 84 | 77 | 70 |
| Total Assets | 135 | 138 | 149 | 169 | 169 | 172 | 174 | 178 | 182 | 185 | 188 | 193 | 198 | 204 | 210 | 218 |
| LIABILITIES | | | | | | | | | | | | | | | | |
| Current Liabilities | 4 | 5 | 5 | 5 | 5 | 6 | 7 | 8 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Long-term Liabilities | 24 | 30 | 40 | 54 | 58 | 57 | 57 | 57 | 55 | 53 | 50 | 48 | 45 | 43 | 40 | 37 |
| Total Liabilities | 29 | 34 | 44 | 59 | 63 | 64 | 64 | 64 | 65 | 63 | 61 | 60 | 58 | 56 | 55 | 53 |
| Equity | 107 | 103 | 105 | 109 | 107 | 108 | 110 | 113 | 117 | 122 | 127 | 133 | 140 | 147 | 156 | 165 |
| Total Assets and Liabilities | 135 | 138 | 149 | 169 | 169 | 172 | 174 | 178 | 182 | 185 | 188 | 193 | 198 | 204 | 210 | 218 |
| INCOME STATEMENTS | | | | | | | | | | | | | | | | |
| Operating Revenues | 17 | 18 | 19 | 22 | 24 | 33 | 36 | 39 | 42 | 45 | 48 | 51 | 55 | 59 | 62 | 67 |
| Operating Expenses | 13 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 33 | 35 | 38 | 41 | 44 | 47 |
| Income Before Depreciation | 3 | 3 | 4 | 4 | 4 | 11 | 12 | 13 | 14 | 15 | 16 | 16 | 17 | 18 | 19 | 19 |
| Depreciation | 5 | 5 | 5 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Operating Income | -1 | -2 | -2 | -2 | -2 | 4 | 5 | 6 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 |
| Net Non-Operating Income | -1 | -2 | -2 | -2 | -2 | -2 | -1 | -1 | -1 | -1 | -1 | 0 | 0 | 1 | 1 | 2 |
| Income Tax Expense | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 |
| Net Income | -3 | -4 | -4 | -4 | -4 | 2 | 3 | 5 | 6 | 6 | 8 | 9 | 10 | 11 | 13 | 14 |
| CASH FLOW STATEMENTS | | | | | | | | | | | | | | | | |
| Sources of Funds | | | | | | | | | | | | | | | | |
| Internal Cash Generation | 4 | 4 | 4 | 4 | 5 | 11 | 12 | 13 | 13 | 15 | 16 | 16 | 17 | 18 | 19 | 19 |
| Government Investment | 0 | 0 | 5 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Borrowing | 3 | 6 | 10 | 15 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Sources | 8 | 10 | 20 | 28 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 16 | 17 | 18 | 19 | 19 |
| Application of Funds | | | | | | | | | | | | | | | | |
| Capital Investment | 11 | 6 | 16 | 26 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Debt Service | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Increase in Working Capital | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |
| Total Applications | 14 | 9 | 20 | 30 | 9 | 4 | 5 | 4 | 5 | 8 | 7 | 8 | 8 | 8 | 8 | 8 |
| Net Change in Cash | -7 | 1 | 0 | -2 | 1 | 7 | 7 | 9 | 9 | 7 | 8 | 9 | 9 | 10 | 10 | 11 |
| TARGETS AND RATIOS | | | | | | | | | | | | | | | | |
| Current Ratio | 4.27 | 4.17 | 4.21 | 3.86 | 4.17 | 4.94 | 5.80 | 6.58 | 6.37 | 7.02 | 7.42 | 7.86 | 8.26 | 8.62 | 8.96 | 9.27 |
| Long-Term Debt to Capital Employed | 0.19 | 0.23 | 0.28 | 0.34 | 0.35 | 0.35 | 0.34 | 0.34 | 0.33 | 0.31 | 0.30 | 0.28 | 0.26 | 0.24 | 0.22 | 0.20 |
| Operating Ratio (%) | 109 | 110 | 109 | 108 | 109 | 88 | 87 | 85 | 84 | 83 | 82 | 82 | 82 | 82 | 82 | 82 |
| Debt Service | 0.34 | 0.29 | 0.22 | 0.18 | 0.18 | 0.32 | 0.35 | 0.38 | 0.41 | 0.45 | 0.50 | 0.55 | 0.60 | 0.67 | 0.75 | 0.84 |
| Rate of Return on Average Capital Employed (| 0 | -3 | -3 | -2 | -3 | 1 | 2 | 3 | 4 | 4 | 4 | 5 | 6 | 6 | 7 | 7 |
| Rate of Return on Average Net Fixed Assets | -5 | -3 | -3 | -3 | -3 | 1 | 2 | 4 | 5 | 5 | 7 | 9 | 11 | 13 | 16 | 19 |

Average Rate of Return on Capital Employed (2001-2015) **0.70%**

ECONOMIC ANALYSIS

A. Economic Context

1. Many provincial towns in Papua New Guinea do not have a reticulated water supply and most do not have adequate facilities for collecting and safely disposing of wastewater. Where a reticulated water system is not available, rainwater tanks and streams are the main sources of water. Considerable problems are experienced during the dry periods when residents often turn to alternative, often polluted, sources of water, risking exposure to waterborne diseases. Current sanitation practices also pose a major health risk. Water sources are being polluted by open-air defecation, seepage from pit latrines, improper disposal of septic sludge and bucket waste and overflowing septic tanks. Living conditions are generally poor and the incidence of diseases associated with lack of clean water and inadequate sanitation facilities is high. The poorer segments of society who also have the least means to fund alternative water supplies from sources and medical treatment suffer most from the lack of these basic facilities.

2. The proposed Project provides a new reticulated water system, including storage and chlorination in Mendi and Kerema, and upgrading of the existing system in Wabag. It also provides for waste collection and treatment for the central business district (CBD) in Alotau, rehabilitation of the existing collection and treatment facility in Madang, and upgrading of the existing treatment facility in Mt. Hagen. In addition, a LCS-CAHE program (JFPR funded) will provide low-cost sanitation (LCS) facilities in six provincial towns, targeting peri-urban areas where the needs are highest and reticulation systems are not viable.

B. Methodology and Approach

3. The economic analysis is undertaken separately for each subproject or town. The analysis establishes the economic rationale, describes beneficiaries, sets out the without-Project situation, assesses the need and demand for each component, and examines alternatives where they are available. Since the benefits are nontradeable in nature, the domestic price numeraire is used and financial costs are converted into economic costs, including physical contingencies but excluding taxes and duties. The shadow exchange rate factor of 1.1 is applied to tradables, no other conversion factors are used. The analysis was constant June 2000 prices.

4. The calculated economic internal rate of return (EIRR) for each subproject is compared with the economic opportunity cost of capital (EOCC), which is assumed to be 10 percent for water supply subprojects and 10 percent for sewerage subprojects, given their environmental benefits. The analysis also assesses nonvalued factors, which are particularly important, given the difficulties of valuing benefits.

C. Water Supply

1. Subproject Selection and Alternatives

5. Three towns of the five considered under the project preparatory technical assistance (PPTA) were chosen for the introduction of Waterboard water supply services. Systems in the other towns were not considered viable.

6. For Kerema, groundwater and surface water sources were considered. The chosen alternative was the groundwater scheme as it has the least cost. There was no feasible alternative for Mendi. For Wabag, the proposed subproject is an upgrading of the existing system, which is not operated by the Waterboard. This option would be considerably cheaper than introducing of a new scheme and is therefore also the least-cost option.

2. Without-Project Situation

7. Without the Project, Kerema and Mendi will continue without a reticulated water supply system. In Wabag, the town is likely to continue experiencing problems with quality and pressure of the water supply, and the system will eventually fail completely. Residents will continue to suffer during dry periods, being forced to pay water vendors for water of suspect quality or search for alternative supplies, which are becoming increasingly contaminated.

3. Project Beneficiaries and Demand for Water

8. In all three subproject towns, the proposed reticulated system will cover 100 percent of the urban area, with 4,900 residents in Kerema, 12,100 in Mendi, and 3,700 in Wabag in 2000. Systems are designed to the Waterboard standard of 270 liters per capita per day (lpcd). This standard includes demand from nondomestic users. Domestic consumption is on average 90 lpd or 21kiloliters (kl) per connection per month. This is low by Pacific standards. Nondomestic use is conservatively estimated at 109 kl per connection per month. Demand projections are based on expected population growth and economic trends within the town.

4. Economic Rate of Return Analysis

a. Costs and Benefits

9. Capital and operation and maintenance costs are converted to economic costs and are phased over the life period of the Project. Capital costs are adjusted to exclude project management costs, which cover the subprojects other than water supply and sewerage.

10. The component will supply water to the urban areas of the three towns. In Kerema and Mendi, in addition to the increased volume of water supplied, incremental benefits include improvement in quality, pressure, and reliability of the existing water. Benefits include resource cost savings from reductions in (i) the need to install and maintain rain tanks, (ii) time and effort in collecting water in dry periods, (iii) amounts paid for water from water vendors during dry periods, (iv) risk of waterborne disease and other diseases associated with lack of water for washing, and (v) damage to the environment from the use of rivers and streams for washing.

11. As recorded in the PPTA social survey, households were willing to pay on average about K16 per month for water in Kerema, K13 per month in Mendi, and K8 per month in Wabag. The expressed willingness to pay is less than the actual amount paid for untreated water during the dry season, which is estimated at K30-K90 per month, based on minimum consumption levels and prices paid for tankers or containers.

12. The benefits from the subprojects were based on (i) the value of nonincremental water at its average supply price, (ii) incremental water at the proposed average tariff, (iii) 10 percent nontechnical losses valued at the proposed average tariffs, and (iv) savings in maintenance costs for water supplies. The average supply price of non-incremental water is the weighted average price of all existing water sources including rain tanks, streams, wells, and water vendors and is calculated to be K2.8 for Kerema, K4.6 for Mendi and K8.6 for Wabag.

13. Valued benefits attempt to cover direct benefits to households and businesses. However, the benefits are likely to be underestimated, since the proposed water charges are intentionally kept to a minimum. The social and environmental benefits of a reticulated, safe, and reliable water supply include public health benefits, which are not fully reflected in the supply price and which are the primary objective of the Project.

b. Results

14. Table A12.1 summarizes the results of the EIRR analysis and the sensitivity tests. The base case EIRRs for Kerema, Mendi, and Wabag are 12.7 percent, 13.3 percent, and 12.8

percent respectively. While these values are relatively low compared with the EOCC of 10 percent, significant economic benefits, particularly public health benefits, have not been fully valued and are not reflected in the EIRR analysis. Given the significant nonvalued environmental and health benefits, the calculated EIRRs understate the true value of the EIRR, and the subprojects are considered economically viable.

Table A12.1: Economic Internal Rate of Return and Sensitivity Tests

| Item | Kerema | Mendi | Wabag |
|--|-----------|-----------|-----------|
| Base case | | | |
| Economic Internal Rate of Return (%) | 13.33 | 11.98 | 12.81 |
| Net Present Value (K) | 1,251,853 | 2,265,417 | 1,281,127 |
| Sensitivity Analysis | | | |
| Costs Increase by 10% (%) | 11.70 | 10.44 | 11.21 |
| Sensitivity Indicator | 1.04 | 1.23 | 1.11 |
| Revenue Reduced by 10% (%) | 11.54 | 10.28 | 11.05 |
| Sensitivity Indicator | 1.17 | 1.38 | 1.25 |
| Costs Increase and Benefits Reduced by 10% (%) | 10.00 | 8.79 | 9.52 |
| Benefits Delayed by One Year (%) | 11.30 | 10.13 | 10.83 |
| Switching Value(%) | | | |
| Cost increase | 8.00 | - | 5.00 |
| Revenue reduce | 7.00 | - | 5.00 |

D. Sewerage

1. Subproject Selection and Alternatives

15. Three towns of the five considered under the PPTA were chosen for the sewerage services. Systems in the other towns were not considered viable.

16. In Alotau, two service coverage options were considered for the reticulated system. In the first, the system would cover only the CBD; in the second, the system would include nearby residential areas. For the CBD, topographic and space constraints make on-site sanitation inappropriate; while for the residential areas, on-site sanitation was found to be cheaper. The subproject design therefore restricts the service area to the CBD but allows capacity for expansion to accommodate residential flows if required.

17. In Mt. Hagen, the proposed subproject is to rehabilitate the existing treatment works, which do not function properly and are an environmental hazard. The service area was considered in assessing the appropriate size of the facility. The first option was to cover existing flows and the second to allow for an increased number of connections. As in Alotau, on-site sanitation was cheaper for those not already connected; thus the subproject involves only rehabilitation of the existing plant.

18. In Madang, three technical treatment options were considered. The least-cost alternative, which involves the proper use and rehabilitation of existing facilities, forms the proposed subproject.

2. The Without-Project Situation

19. Without the Project, the residents will be exposed to greater health risks, and lack of adequate facilities for collection and disposal of wastewater will affect amenity and

environmental quality within the town. In Mt. Hagen and Madang, the subprojects include the rehabilitation of existing facilities, which themselves pose a significant health and environmental hazard.

3. Project Beneficiaries and Demand for Sewerage Services

20. In all three towns, the proposed subproject provides facilities for a specific area within the town. In Mt Hagen and Madang, the need is for primarily rehabilitating and upgrading existing facilities to enable them to treat and dispose of existing flows effectively. In Alotau, the CBD is the area covered. The total number of connections is about 680. However, all residents will indirectly benefit from public health, and environmental and amenity improvements, giving a total of about 70,000 beneficiaries.

4. Economic Rate of Return Analysis

a. Costs and Benefits

21. Capital and operation and maintenance costs are converted to economic costs and are phased over the life period of the Project, which is assumed to be 25 years. Capital costs are adjusted to exclude project management costs, which cover the subprojects other than water supply and sewerage.

22. The component will permit safe and environmentally sound disposal of wastewater in the urban areas of the three towns. Benefits are valued considering the proposed subproject revenues and an amount for improvements to public health. Public health benefits are estimated at K3.5 per person per year, based on the incidence of waterborne and sanitation-related diseases in Madang, average length of illness, and cost of medicines. This represents around 20 percent of provincial expenditure on public health.¹

b. Results

23. Table A12.2 summarizes the results of the EIRR analysis and the sensitivity tests. The base case EIRRs for Alotau, Mt. Hagen, and Madang are 11.4 percent, 19.2 percent and 14.6 percent, respectively. The calculated EIRRs considerably underestimate the true EIRRs as not all environmental and public health benefits could be correctly valued.

Table A12.2: Economic Internal Rate of Return and Sensitivity Tests

| Item | Alotau | Mt. Hagen | Madang |
|--|--------|-----------|---------|
| Base Case | | | |
| Economic Internal Rate of Return (%) | 11.44 | 19.18 | 14.59 |
| Net Present Value (K) | 73,516 | 747,036 | 467,974 |
| Sensitivity Analysis | | | |
| Costs Increase by 10% (%) | 9.92 | 15.55 | 15.80 |
| Sensitivity Indicator | 1.33 | 1.22 | 0.96 |
| Revenue Reduced by 10% (%) | 9.77 | 15.18 | 12.62 |
| Sensitivity Indicator | 1.49 | 1.37 | 1.07 |
| Costs Increase and Benefits Reduced by 10% (%) | 8.34 | 11.71 | 10.94 |
| Benefits Delayed by One Year (%) | 9.74 | 13.95 | 12.24 |
| Switching Value(%) | | | |
| Cost increase | 10 | 21 | 15 |
| Revenue reduce | 9 | 17 | 13 |

¹ PNG Human Development Report 1998.

E. Poverty Impact

25. The human poverty index for Papua New Guinea ranks it as one of the most poverty-afflicted nations in the world. About 16 percent of the urban population are categorized as poor, and most do not have access to systems for reliable water supply and safe disposal of excreta. The subprojects and the LCS-CAHE program (JFPR funded) will benefit all town residents, including the poor, by improving public health and the environment. Since the poor are least able to purchase water during the dry season, or medicines for treating waterborne and sanitation-related diseases prevalent in the subproject towns, they will be significant beneficiaries of the subprojects. In addition, the Waterboard pricing structure is designed specifically to ensure that the poor are not excluded. Connection fees were abolished and a lifeline tariff provides domestic households with access to safe water at a very low rate. The poor will have significant savings, considering the cost of their existing, untreated, and often polluted water supply.

F. Summary

26. The six water supply and sewerage subprojects are all economically viable. In fact, the EIRRs probably understate the true economic value of the subprojects, since significant health and environmental benefits are not fully reflected in the calculations.