

ECONOMIC ANALYSIS

The proposed loan will finance a water supply subproject and a sewerage subproject. The water supply subproject will provide piped water to people living in both urban and rural areas of Jaffna Peninsula and Northern Kilinochchi. The sewerage subproject will provide a piped sewerage system for the Jaffna Municipal Council. Economic analyses¹ were carried out for each subproject, and results are summarized in the tables below.

Table 1: Water Supply Subproject

Assessment items	Results
Subprojects in Macroeconomic context	<ul style="list-style-type: none"> • Before the civil war, Jaffna Peninsula was a place of many small-scale industries for manufacturing household items and packaging and processing foods. • The conflict displaced many people, forced most industries to leave or shut down, and cut off connectivity with southern areas of the country. As a result, the economy of Jaffna Peninsula faced major constraints. • Provision of basic urban services in the immediate post-conflict period is the first step in encouraging displaced people to return and luring back industries to revive the economy.
Subprojects in sector context	<ul style="list-style-type: none"> • The National Policy on Water Supply and Sanitation, 2002 set the target of achieving total population coverage of water supply and sanitation services by 2025. • Despite this, little investment into water supply infrastructure was undertaken in Jaffna Peninsula. • A socioeconomic survey^a showed that in Jaffna Peninsula: <ul style="list-style-type: none"> (i) less than 1% of population are served by household connections, and about 15% are served by standpost^b connections; (ii) about 81% of households have access to latrines, but about 90% of those households share it with at least one other household; (iii) about two-thirds of latrines are connected to earth pits, which contaminate surrounding areas and groundwater sources because of high infiltration capacity of the earth pits; and (iv) no sewerage system exists on the Jaffna Peninsula.
Demand analysis	<ul style="list-style-type: none"> • As the earlier socioeconomic survey showed, access to water supply services is limited. In the “willingness-to-pay” question in the same survey, responses showed that: <ul style="list-style-type: none"> (i) 10% of households were willing to pay up to SLRs75; (ii) 51% were willing to pay SLRs125 per month; (iii) 26% were willing to pay SLRs200 per month; (iv) 13% were willing to pay SLRs300 or more per month. • A preliminary assessment based on the above results shows that revenue can be maximized at SLRs125 per month, even if 10% of households prove unwilling or unable to pay. • Currently, people who depend on bowsers^c generally pay SLRs264 per cubic meter (m³), which is 18 times more expensive than the NWSDB average tariff for domestic house connections in Jaffna (SLRs14 per m³). This suggests that people are likely to choose domestic house connections if the availability and quality of the water is equivalent or

¹ The scope of project loan economic analysis is defined in the Asian Development Bank’s *Operations Manual*, Section G1.

Assessment items	Results															
	<p>better.</p> <ul style="list-style-type: none"> The population in the project area is estimated at 820,000 in 2010 and is projected to increase by 1.5% per year during 2011–2015. After 2015, the population is projected to grow by about 0.5% annually. The project will cater to 317,000 people by 2030. 															
Subproject rationale	<ul style="list-style-type: none"> The National Water Supply and Drainage Board Law (1974) mandates that the National Water Supply and Drainage Board be the primary agency responsible for water supply and sanitation in the country. The National Water Supply and Drainage Board is unable to deliver public services efficiently and economically. 															
Least-cost comparison	<ul style="list-style-type: none"> Six alternative designs for water sources were assessed in the feasibility study: <ul style="list-style-type: none"> (i) groundwater, (ii) surface water from Iranamadu, (iii) rainwater harvesting, (iv) surface water from minor streams, (v) desalination, and (vi) conversion of an inland lagoon to a lake. The least-cost comparison showed a result that the surface water from Iranamadu alternative is the only technically, financially, and environmentally feasible option, and that the remaining five alternatives are unfavorable because of contamination or salinity of water sources, higher operational costs, potential impacts on lagoon ecology, and/or limited availability of water for large-scale extraction. The subproject design stipulates that (i) selected technologies meet geographical restrictions and can be operated and maintained by the municipalities, and (ii) materials and equipment are locally available, incur least-cost during construction and maintenance, and are internationally accepted as health-hazard-free. 															
Identification and valuation of economic cost and benefit	<ul style="list-style-type: none"> The economic benefit was estimated assuming the following cost savings: <ul style="list-style-type: none"> (i) Resource cost savings^d on water that will be replaced by the project water; and (ii) Time savings^e generated by relieving subproject beneficiaries of the need to travel long distances or join queues to fetch water; Economic costs include: <ul style="list-style-type: none"> (i) Investment costs adjusted for economic price using a shadow exchange rate factor^f of 1.1 and shadow wage factor of 0.8; and (ii) Annual operations and maintenance costs^g comprising chemical, energy, personnel, and maintenance costs. 															
Economic efficiency of the investment, and sensitivity analysis	<ul style="list-style-type: none"> The economic internal rate of return for the base-case scenario is 15.5%, which is higher than the economic opportunity cost of capital, estimated at 12.0%. Sensitivity analysis was also undertaken under various assumptions. Reducing the benefit was the most sensitive risk factor. Such adverse scenarios are unlikely to happen, as the population of Jaffna Peninsula is likely to increase even beyond the projected growth rate as displaced residents return. <table border="1" data-bbox="505 1709 1430 1896"> <thead> <tr> <th data-bbox="513 1709 1073 1745">Item</th> <th data-bbox="1073 1709 1235 1745">EIRR (%)</th> <th data-bbox="1235 1709 1430 1745">NPV (SLR million)</th> </tr> </thead> <tbody> <tr> <td data-bbox="513 1745 1073 1780">• Base case</td> <td data-bbox="1073 1745 1235 1780">15.5</td> <td data-bbox="1235 1745 1430 1780">1,195.2</td> </tr> <tr> <td data-bbox="513 1780 1073 1816">• Capital costs increased by 10%</td> <td data-bbox="1073 1780 1235 1816">14.0</td> <td data-bbox="1235 1780 1430 1816">737.6</td> </tr> <tr> <td data-bbox="513 1816 1073 1852">• O&M costs increased by 10%</td> <td data-bbox="1073 1816 1235 1852">15.4</td> <td data-bbox="1235 1816 1430 1852">1,143.6</td> </tr> <tr> <td data-bbox="513 1852 1073 1887">• Benefit reduced by 10%</td> <td data-bbox="1073 1852 1235 1887">13.7</td> <td data-bbox="1235 1852 1430 1887">566.5</td> </tr> </tbody> </table>	Item	EIRR (%)	NPV (SLR million)	• Base case	15.5	1,195.2	• Capital costs increased by 10%	14.0	737.6	• O&M costs increased by 10%	15.4	1,143.6	• Benefit reduced by 10%	13.7	566.5
Item	EIRR (%)	NPV (SLR million)														
• Base case	15.5	1,195.2														
• Capital costs increased by 10%	14.0	737.6														
• O&M costs increased by 10%	15.4	1,143.6														
• Benefit reduced by 10%	13.7	566.5														

Assessment items	Results	
• Combined effects of above	12.2	57.4
• Capital costs increased by 20%	12.7	280.1
• O&M costs increased by 20%	15.2	1,092.1
• Benefit reduced by 20%	11.8	(62.1)
• Combined effects of above	9.0	(1,080.4)
EIRR = economic internal rate of return, NPV = net present value, O&M = operation and maintenance.		
Source: Jaffna Peninsula Water Supply and Sanitation Feasibility Study (March 2006) prepared under Loans 2043/2044-SRI Conflict-affected Areas Rehabilitation Project, updated by the post-fact finding mission.		

^a The socioeconomic survey was carried out in 2005 when the project was originally developed in Jaffna District. The survey covered 3,637 people. When asked about their willingness to pay, respondents were informed that an improved water supply service would provide good quality water for 24 hours a day at adequate pressure.

^b A public distribution point for a water supply system.

^c A mobile water tank deployed to distribute fresh water in emergency situations where the normal system of piped distribution has broken down or is insufficient

^d Without the project, the average domestic consumption is assumed to be 80 liters per capita per day (lpcd), of which 10 lpcd comes from wells and 70 lpcd from bowsers (mobile water tanks deployed to distribute fresh water in emergency situations where the normal system of piped distribution has broken down or is insufficient); with the project, the average domestic consumption from the new water scheme is expected to increase gradually from 77 lpcd in 2015 to 92 lpcd in 2030. The average community supply consumption is assumed to be 11 lpcd without the project and 25 lpcd with the project. The cost of water from wells is SLRs111 per m³ based on the technical estimate, and the cost of bowser water is estimated at the market rate of SLRS230 per m³.

^e Each household is assumed to save 2 hours per day with the availability of the piped water, which is valued at an unskilled wage rate of SLRs6,750 per month.

^f Based on the methodology suggested in *ERD Technical Note No. 11 (2004)*, a proxy was estimated using the expert and import values and taxes, and was 0.95. The reverse of the standard conversion factor value is used for the shadow exchange rate factor.

^g Chemical costs were estimated at SLRs1.2 per m³ of water produced, energy costs at SLRs7.9 per m³ of water produced, personnel costs at SLRs7.5 million per year, maintenance costs at SLRs44.7 million per year, and administration costs at 7% of total operations and maintenance costs.

Source: Jaffna Peninsula Water Supply and Sanitation Feasibility Study (March 2006) prepared under Loans 2043/2044-SRI Conflict-affected Areas Rehabilitation Project, updated by the post-fact finding mission.

Table 2: Sewerage Subproject

Assessment Items	Assessment												
Demand analysis	<ul style="list-style-type: none"> • As the earlier socioeconomic survey showed, access to sewerage services is limited. In the “willingness-to-pay” question in the same survey, responses showed that <ul style="list-style-type: none"> (i) 36% of households were willing to pay SLRs50 per month; (ii) 34% were willing to pay SLRs100 per month; (iii) 8% were willing to pay SLRs150 per month; (iv) 22% were willing to pay SLRs200 or more per month.^a • A preliminary assessment based on the above results shows that revenue can be maximized at SLRs100 per month, even if 36% prove unwilling or unable to pay. • The population in Jaffna Municipality is estimated at 112,000 in 2010 and is projected to grow by about 13.7% per year during 2011–2015. After 2015, the population is projected to grow by about 3% annually. The sewerage subproject will cater to 86,000 people by 2030. 												
Subproject rationale	<ul style="list-style-type: none"> • The National Water Supply and Drainage Board Law (1974) mandates that the National Water Supply and Drainage Board be the primary agency responsible for water supply and sanitation in the country. • The National Water Supply and Drainage Board is unable to deliver public services efficiently and economically. 												
Least cost comparison	<ul style="list-style-type: none"> • Because of limited land availability, the activated sludge option was the only technically feasible choice. Alternative treatment processes were considered unfeasible. • The subproject design stipulates that (i) selected technologies meet geographical restrictions and can be operated and maintained by the municipalities, and (ii) materials and equipment are locally available, incur least-cost during construction and maintenance, and are internationally accepted as health-hazard-free. 												
Identification and valuation of economic cost and benefit	<ul style="list-style-type: none"> • The economic benefit was estimated assuming the following cost savings: <ul style="list-style-type: none"> (i) Resource savings^b generated by relieving subproject beneficiaries of the need to maintain on-site sewerage disposal systems, (ii) Avoided medical costs of treating sanitation-related diseases^c; and (iii) Value of water extracted from cleaner aquifer^d as a result of fewer soakage pits and septic tanks being used. • Economic costs includes: <ul style="list-style-type: none"> (i) Investment costs adjusted for economic price using a shadow exchange rate factor of 1.1 and a shadow wage factor of 0.7; and (ii) Annual operations and maintenance costs comprising electricity, personnel, and spare-part costs. 												
Economic efficiency of the investment, and sensitivity analysis	<ul style="list-style-type: none"> • The economic internal rate of return for the base-case scenario is 13.4%, which is higher than the economic opportunity cost of capital, estimated at 12.0%. • Sensitivity analysis was also undertaken under various assumptions. Reducing the benefit was the most sensitive risk factor. Such adverse scenarios are unlikely to happen, as the population of Jaffna Peninsula is likely to increase even beyond the projected growth rate as displaced residents return. <table border="1" data-bbox="505 1745 1421 1871"> <thead> <tr> <th data-bbox="505 1745 1089 1778">Item</th> <th data-bbox="1089 1745 1235 1778">EIRR</th> <th data-bbox="1235 1745 1421 1778">NPV</th> </tr> <tr> <td></td> <td data-bbox="1089 1778 1235 1812">(%)</td> <td data-bbox="1235 1778 1421 1812">(SLRs million)</td> </tr> </thead> <tbody> <tr> <td data-bbox="505 1812 1089 1845">• Base case</td> <td data-bbox="1089 1812 1235 1845">13.4</td> <td data-bbox="1235 1812 1421 1845">207.6</td> </tr> <tr> <td data-bbox="505 1845 1089 1871">• Capital costs increased by 10%</td> <td data-bbox="1089 1845 1235 1871">12.1</td> <td data-bbox="1235 1845 1421 1871">20.1</td> </tr> </tbody> </table>	Item	EIRR	NPV		(%)	(SLRs million)	• Base case	13.4	207.6	• Capital costs increased by 10%	12.1	20.1
Item	EIRR	NPV											
	(%)	(SLRs million)											
• Base case	13.4	207.6											
• Capital costs increased by 10%	12.1	20.1											

Assessment Items	Assessment	
	• O&M costs increased by 10%	13.2 189.4
	• Benefit reduced by 10%	11.8 18.9
	• Combined effects of above	8.4 (458.4)
	• Capital costs increased by 20%	11.0 (167.4)
	• O&M costs increased by 20%	13.1 171.1
	• Benefit reduced by 20%	10.3 (245.4)
	• Combined effects of above	5.4 (859.6)
	EIRR = economic internal rate of return, NPV = net present value, O&M = operation and maintenance.	
	Source: Jaffna Peninsula Water Supply and Sanitation Feasibility Study (March 2006) prepared under Loans 2043/2044-SRI Conflict-affected Areas Rehabilitation Project, updated by the post-fact finding mission.	

^a The socioeconomic survey was carried out in 2005 when the project was originally developed in Jaffna District. The survey covered 3,637 people. When asked about their willingness to pay, respondents were informed that an improved water supply service would provide good quality water for 24 hours a day at adequate pressure.

^b The cost of installing a new septic tank is estimated at SLRs31,600.

^c The prevalence of water-related diseases is estimated at 81%. Households incur medical costs of SLRs721 per month on average, according to the socioeconomic survey. The project is assumed to reduce disease prevalence by 30%.

^d Because of soil conditions, the aquifer is vulnerable to contamination. Despite the water supply project, Jaffna Peninsula will still rely to some extent on groundwater. Water extracted from cleaner aquifer will have a resale value of SLRs114 per m³.

Source: Jaffna Peninsula Water Supply and Sanitation Feasibility Study (March 2006) prepared under Loans 2043/2044-SRI Conflict-affected Areas Rehabilitation Project, updated by the post-fact finding mission.