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STAFF APPRAISAL REPORT

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

JUNE 12, 1995

Agriculture and Water Operations Division
Country Department II - Bhutan, India, Nepal
South Asia Regional Office

CURRENCY EQUIVALENTS
(January 31, 1995)

Currency Unit	=	Indian Rupee (Rs.)
US$1.00	=	Rs 31.00
Rs. 1.00	=	US$0.03125

MEASURES AND EQUIVALENTS

mm	=	millimeter (1 millimeter = 0.039 inches)
m	=	meter (1 meter = 3.28 feet)
km	=	kilometer (1 kilometer = 0.62 miles)
km^2	=	square kilometer (1 km^2 = 0.386 square miles)
ha	=	hectare (1 hectare = 10,000 square meters = 2.47 acres)
lit	=	liter (0.22 Imperial gallons or 0.264 US gallons)
lpcd	=	liters per capita per day
m^3	=	cubic meters (220 Imperial gallons or 264.2 US gallons)
Ml	=	million liters
Mld	=	million liters per day (0.220 mill Imperial gallons or 0.264 mill US gallons)
MIGD	=	million Imperial gallons per day (1 MIGD = 4,546 m^3/day)

ABBREVIATIONS AND ACRONYMS

BCWQS	=	Bombay Coastal Water Quality Studies
BMR	=	Bombay Metropolitan Region
BMRDA	=	Bombay Metropolitan Regional Development Authority
CPHEEO	=	Central Public Health and Environmental Engineering Organization
MoRDE	=	Ministry of Rural Development and Employment
DWF	=	Dry Weather Flow
EA	=	Environmental Assessment
FY	=	Fiscal Year
GNP	=	Gross National Product
GoI	=	Government of India
GoM	=	Government of Maharashtra
ICB	=	International Competitive Bidding
LCB	=	Local Competitive Bidding
MCGB	=	Municipal Corporation of Greater Bombay
MoUAE	=	Ministry of Urban Affairs and Employment
NEERI	=	National Environmental Engineering Research Institute
NDP	=	Net Domestic Product
NGO	=	Non-Governmental Organization
PCRs	=	Project Completion Reports
PPARs	=	Project Performance Audit Reports
R&R	=	Resettlement and Rehabilitation
SOE	=	Statement of Expenditure
WSSD	=	Water Supply and Sewerage Department

GOVERNMENT FISCAL YEAR
April 1 to March 31

BOMBAY

BOMBAY SEWAGE DISPOSAL PROJECT

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This report is based on the findings of an appraisal mission to Bombay in February 1995, comprising Messrs/Mmes W. Roach - Task Manager and Senior Financial Analyst, C. Couzens - Principal Sanitary Engineer, and S. Choudhry - Consultant (SA2IN); T. Walton, Environmental Planner (ASTEN); and P. Ware, Engineering Consultant.

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BOMBAY SEWAGE DISPOSAL PROJECT

CREDIT, LOAN AND PROJECT SUMMARY

Borrower: India, acting by its President.

Beneficiaries: Maharashtra and
Municipal Corporation of Greater Bombay (MCGB).

Poverty Category: Not applicable. While a slum sanitation component is specifically designed to benefit slum-dwellers, it represents less than 25% of the project costs.

Amount: IDA Credit of SDR 15.9 (US$25.0 million equivalent).
IBRD Loan of US$167.0 million equivalent.

Terms: Credit on standard terms with 35 years maturity.
Loan repayable in 20 years, including 5 years of grace, at standard variable interest rate.

Commitment Fee: Loan: 0.75% of undisbursed balance, beginning 60 days after signing, less any waiver.

Onlending Terms: India to Maharashtra - as part of the central assistance to States for development project on terms and conditions applicable at the time.

Maharashtra to MCGB - 25 year term, five years of grace at an interest rate of 13%.

India will bear the foreign exchange risk.

Project Objectives: These are:

(a) strengthening the capacity of MCGB's WSSD in all aspects of the management of the provision of sewerage services;

(b) sustaining the financial viability of the provision of water supply and sewerage services in Greater Bombay through direct charges to beneficiaries at appropriate levels; and

(c) improving the health and environmental conditions in Greater Bombay including slum dwellers.

Description: The project includes: (b) the construction of two 3km submarine tunnel outfall sewers of about 3.5m diameter at each of Worli and Bandra to convey partially treated sewage effluent to the Arabian Sea; (b) a pumping station at Bandra; (c) two aerated sewage treatment lagoons at Ghatkopar and Bhandup; (d) facilities to prevent siltation in the influent tunnel at Ghatkopar; (e) the rehabilitation of the existing Ghatkopar tunnel; (f) measures to improve the structural stability of five existing sewage pumping stations; (g) conveyance systems improvements; and (h) slum sanitation schemes. It also includes technical and social services to assist implementation of the physical works, to upgrade MCGB's operational and maintenance capabilities with respect to Bombay's sewerage system and to plan and design a "Second Stage" program to further improve health and environmental conditions.

Project Costs:

	US$ million		
	Foreign	Local	TOTAL
Worli and Bandra Outfalls	36.2	50.4	86.6
Bandra Pumping Station	2.8	29.6	31.4
Bhandup and Ghatkopar Lagoons	6.2	25.4	31.6
Remedial Works	8.1	27.7	35.8
Slum Sanitation	2.0	20.1	22.1
Technical Assistance	7.7	8.4	16.1
Planning-Design Stage 2	7.1	10.9	18.0
TOTAL BASE COSTS	70.1	171.5	241.6
Physical Contingencies	14.8	37.8	52.6
Price Contingencies	5.0	-3.6	1.4
TOTAL PROJECT COST	89.9	205.7	295.6

Financing:

IBRD			167.0
IDA			25.0
Subtotal	89.9	102.1	192.0
MCGB	0.0	103.6	103.6
TOTAL PROJECT COST	89.9	205.7	295.6

The above figures include taxes and duties estimated at US$21.3 million

Estimated Disbursements:

	US$ million							
Bank FY	1996	1997	1998	1999	2000	2001	2002	2003
IBRD Loan	2.2	36.1	54.8	47.6	16.9	4.6	3.5	1.3
IDA Credit	25.0	-	-	-	-	-	-	-
TOTAL Cumulative	27.2	63.3	118.1	165.7	182.6	187.2	190.7	192.0

Project Benefits:

The potential health and environmental benefits of improving the disposal of more than 60% of the sewage from the Greater Bombay area are considered substantial even though they are not readily quantifiable - particularly in economic terms. Under this "First Stage" of development, some partially treated sewage from two drainage areas will be discharged into the Arabian Sea at a distance of three kilometers from the shore line. Sewage from three other drainage areas will receive the equivalent of primary treatment before being discharged to tidal creeks.

This level of sewage treatment and the effluent disposal arrangements will be a significant improvement over the present situation, in which sewage is discharged to the shoreline and to surface water drains and channels within the heavily populated urban area. Furthermore, under the Project, detailed studies will be conducted and a time-based program established for the "Second Stage" Program of sewage treatment and disposal facilities to further improve the quality of receiving waters.

The provision of sewage treatment and disposal facilities under this Project will enable the very extensive collection and conveyance systems, which have been constructed under the Second and Third Bombay Water Supply and Sewerage Projects, to be effectively utilized.

The slum sanitation schemes will help alleviate the harsh living conditions of some one million slum dwellers, mainly those occupying municipally-owned lands, by providing improved sanitation facilities - principally for safe excreta disposal. The implementation of this component will involve beneficiary consultation as to the details of the facilities to be provided and participation in the physical implementation and subsequent operations. Agreed implementation "Policy Guidelines" will ensure that any resettlement requirements are voluntary.

The direct physical benefits of the Project will come from removing domestic sewage and industrial wastes from the inner city's natural water courses, surface water drains, shore line and beaches thus improving the living conditions of the urban population living in close proximity to the many "open sewers" which presently exist. This will reduce health risks as well as improve the city's visual and aesthetic environment.

Economic Rate of Return:

No attempt has been made to estimate an economic rate of return. The impacts on public health and the environment, which will result from the proposed investments, cannot readily be quantified in economic terms.

Project Risks:

MCGB's engineers have insufficient relevant experience to undertake large and specialized sewerage works of this nature; this increases the project risks. However, these risks will be mitigated by support from experienced consultants.

The aerated lagoons largely involve the placement and compaction of selected materials to form water retaining embankments and the construction of sand drains. These works require careful site supervision to attain the required level of construction quality, and sound on-site management to avoid delays.

The ocean outfalls present higher risks. Tunneling under the sea bed has fewer risks than constructing a pipeline on the surface of the sea bed, which is subject to weather and sea conditions. The inherent uncertainties with this kind of work, and the risk-sharing principles adopted in the contracts for this work (for reasons of cost containment and efficiency) do nonetheless bring a risk of cost overruns.

Measures have been taken to contain the construction risks by ensuring that, prior to appraisal: (a) suitable contractors are pre-qualified under stringent criteria; (b) engineering designs are compatible with proven construction practices; (c) qualified consultants prepare the designs and supervise construction, having been delegated acceptable levels of responsibility; and (d) designs have been reviewed by qualified and experienced independent panels of experts, and their suggestions reflected in the final designs.

To reduce the risk of cost over-runs, and any consequent delays in project implementation, physical contingencies of 25% have been allowed for all civil, mechanical and electrical works, based on the rationale that for the Worli and Bandra marine outfalls and the Ghatkopar influent tunnel there are inherent uncertainties associated with tunnel construction. In the case of the aerated lagoons at Ghatkopar and Bhandup, there is uncertainty in the location of borrow areas that would yield sufficient laterite for embankment construction. In the case of the Bandra pumping station, the magnitude and complexity of work warrants a higher than average level of contingency.

Similarly, because of the programmatic nature of the slum sanitation schemes, and the preliminary status of preparation of the pumping station structural improvements and the conveyance system improvements, higher than average physical contingencies are justified.

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

I THE WATER SUPPLY-SANITATION SECTOR

Introduction

1.01 Urban water supply and sewerage (wastewater collection, treatment and disposal) are only two elements of the fabric of urban infrastructure. Other elements include, for example, roads and street lighting, storm water drainage works, electric power, telecommunications and so forth. However, water supply and sewerage are often separated from the others by two particular features: (i) they are not typically part of a "system" covering a much wider area as is the case, for example, in electric power and telecommunications; thus, the water supply and sewerage works are essentially "local" in character; and (ii) unlike roads an storm water drainage, water supply and sewerage lend themselves readily to being organized and managed as "utility" services with the possibility of full direct cost-recovery from beneficiaries.

1.02 These characteristics of water supply and sewerage have deserved its being classified as "a sector" in the Bank and in India. In the Bank, water supply and sewerage lending commenced in the middle 1960's - a few years before urban development lending commenced in the early 1970s.

1.03 In the late 1970s - it became recognized that water-borne sanitary sewerage, however desirable from an overall sanitation and environmental viewpoint, was sufficiently costly that lower cost alternatives were essential for many developing countries to realize improved sanitation and urban environmental conditions. Accordingly, much research - in the Bank and elsewhere - developed a number of lower cost alternatives for safe excreta disposal. In India, the twin-pit pour-flush water-seal household latrine was the alternative widely adopted. While not providing all the benefits of sanitary sewerage (since such latrines deal only with the safe disposal of excreta and not with wastewater generally) such programs have been found to bring substantial environmental benefit at more affordable costs than sanitary sewerage.

1.04 Accordingly, the sector in recent years has been more commonly referred to as the "water supply and sanitation" sector, with the word "sanitation" often having the restricted meaning of safe excreta disposal.

The Sector Context in India

1.05 India is the world's second most populous nation (844 millions in 1991) and accounts for 16% of the world's population. India has a population nearly twice that of sub-Saharan Africa and of Latin America. However, it is only the world's seventh nation in area (3,287,000 km^2) and the gross population density of 257 people per km^2 is very high by world standards.

1.06 Urbanization, in India's 3,378 "urban communities", accounted for only 26% of the population in 1991. This is low by world standards and such low levels elsewhere are to be found mainly in other South Asian countries and in sub-Saharan Africa. However, this low level tends to mask its sheer size of some 217 million people. Moreover, according to the UN's "World Population Prospects" this population is projected to grow to 659 millions by the year 2015 - a growth of over

400 million people. This projected growth by itself exceeds the population of all countries of the world except China and India. In contrast, India's rural population is projected to decline marginally (from 596 million in 1990 to 570 million in the year 2025).

1.07 The urban contribution to India's economy has been estimated as 29% of NDP in 1951, rising to 55% in 1986 and is expected to exceed 60% by 2000. Thus, urban economic endeavor is making a disproportionately large contribution in relation to its population.

1.08 Under India's constitution, community water supply and sanitation, and local government generally, are matters for India's 25 States. This is confirmed by the recent constitutional amendment (the Central Nagar Palika Act - 1992) since ratified by the requisite number of States. This constitutional amendment has three particular features worthy of note here: (i) the requirement that if elected local governments are "suspended" by State government action, then elections for a replacement are to be held within six months; (ii) the States are to constitute a "Municipal Finance Commission" to report to the State legislature on the matter of State-local finances and revenue sharing; and (iii) the States will appoint "District-level" (a geographic and administrative area within a State) "Planning Committees". More broadly, the themes of this constitutional amendment are oriented towards decentralization and local-level democracy and accountability.

1.09 The Central-State constitutional division of responsibility is particularly reflected in the funding of urban (in some contrast to rural) water supply and sanitation investments as between the Central and State levels of government. The following figures are from the 1992-97 Eighth Plan in reporting actual expenditures under the 1986-91 Seventh Plan. It will be noted that the Central contribution to urban water supply-sanitation were a mere 0.4% of the total; in contrast the Center made a substantial (42%) contribution to such investments in rural areas. (Rs b is Rupees billion).

WATER SUPPLY-SANITATION (WSS) EXPENDITURES UNDER THE 1985-90 7TH PLAN

	TOTAL	TOTAL WSS			URBAN WSS		RURAL WSS	
	Plan	Rs b	% Plan	% TOTAL	Rs b	% TOTAL	Rs b	% TOTAL
Center	1275.2	19.2	1.5%	27.1%	0.1	0.4%	19.4	42.2%
States	915.1	51.7	5.6%	72.9%	25.5	99.6%	26.2	57.8%
TOTAL	2190.3	70.9	3.2%	100.0%	25.6	100.0%	45.3	100.0%

The Sector Context in Maharashtra and Bombay

1.10 Maharashtra is India's third largest State both by area (308,000 km^2 - 9.4% India) and by total 1991 population (78.8 million - 9.3% India). However, it ranks first in 1991 urban population (30.5 million - 14.0% India) and first in absolute 1981-91 urban population growth (8.5 million) and accounts for nearly 15% of India's urban population growth in this period. By 1991, 45% of Maharashtra's population was urban. In 1989-90, Maharashtra accounted for 14% of India's NDP.

1.11 Bombay is India's largest city with a 1991 population in the urban agglomeration of 12.57 million or nearly 6% of India's total urban population. It is one of India's four "megacities" with a population of more than five million which together accounted for 17% of India's urban population in 1991. It contains India's largest seaport and is India's pre-eminent center of trade, commerce and finance. It is also a major manufacturing center and accounts for 30% of the value of India'a industrial production and an estimated 10% of India's industrial employment.

1.12 Bombay was the first beneficiary of Bank water supply-sanitation lending in India and there have been two subsequent loans to Bombay in this sector as follows:

		US$ million		
		Credit/ Loan	Project	Closed
1st Bombay Water Supply and Sewerage Project	FY73	C$ 55.0	$158.2	30-Jun-81
2nd Bombay Water Supply and Sewerage Project	FY79	C$196.0	$411.6	31-Mar-88
3rd Bombay Water Supply and Sewerage Project	FY86	C$145.0 + L$ 40.0	$304.3	Ongoing

Sector Organization

1.13 Central-level. In recognition of the need for an urban policy focal point at the Center, the Government of India (GoI) organized a Ministry of Urban Affairs and Employment (MoUD) in 1985 (recently renamed the Ministry of Urban Affairs and Employment MoUAE). This replaced the erstwhile Central Ministry of Works and Housing. This Ministry has exercised influence through its role in the review of State development plans, publication of various design manuals, coordination of certain urban research and so forth. It has also influenced the polices and practices of India's Housing and Urban Development Corporation (HUDCO). This latter institution, formed in 1970, is a public-sector lending institution which was initially concerned with urban land development and public housing schemes but in recent years has financed some urban infrastructure.

1.14 Within MoUAE, a Central Public Health and Environmental Engineering Organization (CPHEEO) is a small group of public health/sanitary/environmental engineers which has organized some training for sector personnel, published planning and design manuals and advises GoI on technical matters in the sector.

1.15 State-level. In India's various States a typical pattern some 30 years ago was to form "Public Health Engineering Departments" (PHEDs) from specialized staff within their Public Works Departments (PWDs). These typically report through a State-level Department of Local Government or Urban Development. The PHEDs usually provide what is essentially a public-sector planning/ design/construction-management engineering service to local governments and turn over the completed water supply (or more rarely - sewerage) works to the local municipal governments for operation and maintenance. In some States, the PHEDs additionally depute staff to the local municipal governments to assist with and guide such operation and maintenance.

1.16. In some States, PHEDs have been superseded by "Water Supply and Sewerage Boards" constituted by special State-level legislation [1/]. Such legislation prescribes the appointment of the Board of Directors and senior officials of such "Boards" and which gives varying degrees of autonomy of such agencies. However, only in the case of Kerala does the "Board" (the Kerala Water Authority) function as a partially-autonomous utility organization with a full State-wide responsibility for planning, design, operation, maintenance, revenue billing and collection and so forth. In some other cases, the distinction between a "Board" and a PHED may be more apparent than real.

[1/] These presently exist in the eight Sates of Maharashtra, Tamil Nadu, Uttar Pradesh, Karnataka, Rajasthan, Bihar, Gujarat and Kerala.

1.17 Local-level. A responsibility for the provision of urban water supply and sanitation services is traditionally a responsibility of the local-level municipal government and this is so prescribed in the State-level "Municipal Act" or equivalent. Partly, no doubt, because of a typically weak technical and management capacity at this level, the States have frequently usurped a substantial part of this responsibility as described in paras 1.15 and 1.16. In the case of three large cities - Bangalore, Madras and Hyderabad - the States of Karnataka, Tamil Nadu and Andhra Pradesh respectively have constituted by State-level legislation "local-level" partially-autonomous "Water Supply and Sewerage Boards". These nominally have the mandate to function as "utility" organizations although their degree of autonomy in such matters as personnel appointments, salaries, and service tariffs may be quite limited. Thus, they may be much dependent on State-government support for the policies which they develop and the management actions which they propose.

1.18 Urban local government in Maharashtra is under the State's Department of Urban Development and governed by the Municipal and other Acts of the State's legislature. In the case of Bombay, the provision of water supply and sewerage/sanitation services is within the overall responsibility of the Municipal Corporation of Greater Bombay (MCGB). Here, there is an elected Council, and a "Standing Committee" of Council with executive authority. The most senior administrative official is the "Municipal Commissioner" a member of India's Administrative Service (IAS).

1.19 Within the MCGB organization is a Water Supply and Sewerage Department (WSSD). Unusually, in India, the WSSD has maintained separate commercial-type accounts and plans, designs, operates, maintains water supply and sewerage works and also conducts revenue billing and collection and advises on all policy and regulatory aspects of the provision of these services. Thus, WSSD has many of the features of a utility organization. This organizational arrangement evolved with relation to the First Bank-supported Water Supply and Sewerage Project (para 1.12).

1.20 The matter of water resources management, of obvious relevance to this water supply-sanitation sector, is assuming an increasing importance to both India and the Bank [2/]. In India, water resources are again a State matter under India's constitution. At this time in Maharashtra, and quite commonly in other States, water resources planning and management is undertaken by State's Irrigation Department and its Central Design Organization. In a few other States, "Water Management Councils" (or some other title) with a broader water user representation than irrigation and with a broader view of "resource management" than mere quantitative allocations, are being established recently with Bank support in the preparation of several State-level "Water Resource Consolidation Projects". To date, work on such projects is underway in the States of Haryana and Tamil Nadu and is starting in other States. Additional Bank support to improved water resource management is being prepared under a proposed National Hydrology Project.

Sector Development

1.21 The following table compares the state of sector development, in terms of "coverage", for the years 1981 and 1990 - the period of the UN-declared International Water Drinking Water Supply and Sanitation Decade. It indicates:

(a) a 1990 "coverage" for urban water supply of 86% of the urban population;
(b) about two-thirds of this "coverage" was by private connections; the rest by public standposts;
(c) the coverage for urban sanitation was much less - 44% only; and

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[2/] See "Water Resources Management - a World Bank Policy Paper" approved by the Board in May-93.

(d) of this, about 70% was by sewerage; the balance by "other" (see para 1.03).

Thus, only 31% of India's 1990 urban population was served by sanitary sewers in 1990.

INDIA: WATER SUPPLY AND SANITATION COVERAGE 1981 and 1990

POPULATION FIGURES IN MILLIONS

	TOTAL		URBAN		RURAL	
1981 Population	687.3	100%	158.1	23%	529.2	77%
Served Water Supply	285.8	42%	121.7	77%	164.1	31%
Not Served WSupply	401.5	58%	36.4	23%	365.1	69%
Served Sanitation	48.0	7%	42.7	27%	5.3	1%
Not served - Sanit'n	639.3	93%	115.4	73%	523.9	99%
1990 Population	904.2	100%	232.7	26%	671.5	74%
Served Water Supply Connec'n	130.3	56%				
Standpost	70.0	30%				
TOTAL Served Water Supply	663.3	73%	200.3	86%	463.0	69%
Not Served WSupply	240.9	27%	32.4	14%	208.5	31%
Served Sanitation Sewers	72.1	31%				
Other	30.2	13%	20.1	3%		
TOTAL Served Sanit'n	122.4	14%	102.3	44%	20.1	3%
Not served - Sanit'n	781.8	86%	130.4	56%	651.4	97%
Changes 1981-90						
Population	216.9		74.6		142.3	
TOTAL Served Water Supply	377.5		78.6		298.9	
Not Served - Water Supply	-160.6		-4.0		-156.6	
TOTAL Served Sanitation	74.4		59.6		14.8	
Not served - Sanitation	142.5		15.0		127.5	

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Government's Sectoral Policy

1.22 The Central Government continues to recognize the importance of safe drinking water supply and basic sanitation for human health and welfare. Its Eighth Five Year Plan (1992-97) continues the strong support of the 1987 National Water Policy, which gives the highest priority to drinking water supply among all water uses, and recognizes the deficiencies in water and sanitation services in both urban and rural areas. Sector constraints are identified as a lack of funds for the development of water and sanitation (or sewerage) services in urban areas and a weak response by rural dwellers to proposals for sanitation (excreta disposal) facilities.

1.23 In reviewing performance in the sector under the 1985-90 Seventh Plan the Government concluded, inter alia, that:

(a) in implementing water supply programs, the needs of backward and poorer segments of the population were often neglected;

(b) there is a wide gap between the level of urban water services and sewerage services;

(c) substantial improvements were needed in the pricing of water, billing and collection;

(d) water losses due to wastage and leakage are substantial and require corrective measures;

(e) there is a need for programs to be more cost effective;

(f) operation and maintenance of water supply systems are badly neglected;

(g) inadequate sewerage systems are contributing to the pollution of ground and surface water sources and to the increased incidence of water borne diseases; corrective measures need to be taken to prevent further pollution and to improve river water quality;

(h) more attention should be given to the water supply and sanitation needs of small towns (up to population 20,000) since such towns have an inadequate financial base from which to finance such facilities; and

(i) local funding requirements of externally financed projects should be more carefully examined to avoid implementation delays.

1.24 These issues are to be addressed under the Eighth Plan. In addition emphasis will be given to generally improving rural water supplies, to the reduction of water borne diseases and particularly to the eradication of guineaworm, and to improving water quality. A further objective is to increase the level of service of rural sanitation to 5% of the rural population by the end of the Plan period.

1.25 In urban areas, the Plan proposes the extension of drinking water services to 100% of the population by the year 2000, with a priority given to small towns. In addition, financially viable sewerage systems are to be provided to cities with low-cost sanitation to fringe areas. Solid waste collection and disposal systems would be developed for major metropolitan areas. Some of the strategies identified in the Eighth Plan are listed below. They are discussed further under "The Main Sector Issues, in the context of this proposed project and other Bank endeavor, commencing para 1.26.

(a) management of water as a commodity, as with any other resource;

(b) freedom for local authorities to charge appropriate tariffs to cover operation and maintenance cost and also development costs where appropriate;

(c) the encouragement of private sector efforts for both the construction and maintenance of water supply projects;

(d) reduction of pollution by provision of treatment facilities for industrial wastes and sewage; and

(e) separation of the budget for water supply and sanitation from the general municipal budget.

The Main Sector Issues

1.26 A weak policy and institutional framework for the allocation and management of water resources. Notwithstanding a National Water Policy (para 1.22), water resources are a State subject under India's constitution (para 1.20). Thus, addressing this issue is much dependent on action by the individual States or mutually agreed cooperative action between two or more States. The available water resources are subject to ever-increasing demand pressures, particularly for irrigation and for community water supply. Additionally, the quality of water available is being increasingly threatened by pollution of various kinds from both urban and rural sources. Such issues are being increasingly well-recognized in India (eg see para 1.25(a)) and some measures to address them have been initiated. Some Bank-supported endeavor in this area was noted in para 1.20. Additionally, the Bank is supporting two Industrial Pollution Control Projects (which include Maharashtra). However, as in many countries of the world, developed and developing, their full resolution is a long-term proposition.

1.27 The need for improved general, personnel and financial management in the water supply-sanitation sector institutions. In general, the sector institutions in India and their management have been much dominated by engineers and by a bureaucratic rather than an active management, commercial and consumer-service frame of mind which is essential for the effectiveness of the "utility" organizational model. Over the last few years, this issue has been increasingly recognized in India and the management and efficiency benefits of some of the institutional changes introduced in Bank-supported projects (including Bombay) are being seen as a path to follow more generally (see also para 1.33).

1.28 The need for improved cost-recovery from beneficiaries. The widespread failure to realize full cost-recovery for water supply-sanitation services has made sector investments dependent on State and local budgetary allocations and precluded the evolution of private debt financing of such investments. The net consequence has been that investments have been at inadequate levels; this in turn gives rise to valid complaints of poor service which in turn reduces the public willingness to pay. Breaking this unproductive cycle has been a key objective of Bank-supported investments in the sector in India and has been successfully implemented in Bombay. The need to address this issue is increasingly accepted in India (eg see para 1.25(b)); full cost-recovery was firmly endorsed at a National Conference on Water Supply and Sanitation Policy held in March, 1993. However, while implementing action is variable across the country, it has been achieved over many years in Bombay.

1.29 The intermittent delivery of water to consumers. With rare exception, urban water supply in India (including Bombay) is delivered to consumers intermittently, and sometimes for as little as two hours per day. This may be a "rationing" response to a sheer inadequacy of the amount of the water supply. However, it is often the result of: (i) excessive leakage from the water system; and (ii) of water wastage by consumers. The reasons for the excessive leakage are some combination of the use of poor quality or inappropriate pipe materials, of poor workmanship at the time of construction and of poor maintenance. The reasons for water wastage include the relative rarity of consumer metering and volumetric tariffs and under-pricing of water even where these exist. One obstacle to effective metering has been the frequently poor quality of such meters as manufactured in India. One consequence of intermittent water delivery is that it brings the risk of the ingress of contamination into the distribution system when it is not under pressure with obvious health risks. Another consequence is the encouragement of private investment in (uneconomic) household water storage by

those who can afford it. Yet a third consequence is that the water distribution system cannot perform as designed and that seriously low (or no) pressure reduces the level of consumer satisfaction with the water service. This issue is being vigorously addressed in more recent Bank-supported projects with the hope it will furnish some methodological models for wider application. Water supply continues to be intermittent in Bombay but this issue is outside the purview of this Bombay Sewage Disposal Project (BSDP).

1.30 The need for improved engineering planning and design and material/construction quality management. The soundness of sector investments is entirely dependent on the quality of these activities, which also embrace all aspects of procurement. This problem appears in both water supply and sewerage but tends to be greater in sewerage where there is much less indigenous experience. To address this issue, the Bank has been requiring or encouraging the use of the services of private sector independent consulting engineers. Frequently, in practice, such services have been obtained from foreign-local associations of firms which combines the benefits of experience elsewhere with local knowledge. To the extent that "good practice" is transferred to Indian firms and sector institutions by the foreign participation, this itself is a "development benefit". Private consulting engineering firms are necessarily much motivated by concern for their reputation since this plays a large part in their securing future assignments. They are also motivated by the risk of being found financially liable for the consequences of proven professional negligence. The use of private consulting engineering services, including those of foreign-local associations of firms, is gaining wider acceptance in India generally and in Bombay in particular. Such services have been used very extensively in the preparation of this BSDP and will be used extensively in its implementation.

1.31 Poor operation and maintenance. Even when well designed and constructed using appropriate materials of good quality, water and sewerage systems certainly need operation and periodic maintenance for the sake of realizing the full benefit potential of the investments. Specific measures are included in this BSDP to address this issue.

The Bank's Sector Objectives

1.32 The essence of the Bank's water supply and sanitation sector strategy in India has been and is to: (a) improve its mobilization of financial resources; and (b) to improve the efficiency of financial and human resource utilization.

1.33 In pursuit of these objectives, Bank projects have: (a) encouraged the efficient use of resources through appropriate technology choices and sound engineering design and construction; (b) supported institutional development and improved institutional capacity having a "consumer-service" orientation; (c) encouraged the financial viability and managerial efficiency of sector institutions through the adoption of commercial style accounting; (d) assisted in the formulation of pricing policies to encourage water conservation and to provide affordable water and sanitation services to the poor, consistent with adequate financing of current expenditures and the internal generation of funds for further investment; and (e) encouraging sector institutions to participate actively in improved institutional arrangements for water resources management (paras 1.20, 1.25(a) and 1.26). Such measures contribute to addressing the sector issues identified in paras 1.26 - 1.31.

1.34 The growing acceptance by the central and state governments of these basic objectives, as witnessed by the Central Government's strategies expressed in the Eighth Five Year Plan (paras 1.23 - 1.25), indicates a potential for considerable further sector performance improvement in the medium and long term. However, it is clear that in future, continued effort will be needed to address the issues outlined above (paras 1.26 - 1.31) and to improve, in particular:

(a) unaccounted-for-water management and water conservation (with the objective of continuous delivery to consumers) through consumer metering, leak detection and repair (or replacement of leaking pipes beyond repair), good water system surveillance to control illicit connections and good management and management of meter reading, revenue billing and collection; supplies for a few hours per day;

(b) the design of tariffs charged for water supply and sewerage services which serve at the same time the objectives of the avoidance of complexity, the affordability of services to the poor and the achievement of full financial viability;

(c) the management capacity in sector institutions through personnel training programs;

(d) operation and maintenance practices and performance, also through personnel training; and

(e) the quality of engineering planning-design and construction quality surveillance through the use of the services of private firms of consulting engineers and otherwise.

Performance in Previous Bank Operations

1.35 The Bank Group began supporting water supply and sewerage/sanitation projects in India in FY1974 (the first Bombay Water Supply and Sewerage Project) and by the end of FY 1992 had approved 13 such projects. These have accounted for US$994 million in IDA Credits and US$93 million in IBRD Loans. In addition, a further 11 urban projects have been approved, accounting for US$990 million in Credits and US$44 million in Loans. In these urban projects, on the average, more than half the investments have been for water supply and sewerage/sanitation investments forming part of a city-wide infrastructure.

1.36 Of the 13 water supply and sewerage projects, the following six projects have been completed and project completion reports (PCRs) or project performance audit reports (PPARs) have been prepared. These are the First and Second Bombay Water Supply and Sewerage Projects; Uttar Pradesh; Punjab; Maharashtra; and Rajasthan. A review of the project completion reports [3]/ indicates that in most cases the physical work has been brought to completion although in most projects there have been implementation delays. However, in some instances the quality of construction work is questioned. In the case of the Second Bombay Water Supply and Sewerage Project, both procurement management and construction quality were found to be very seriously inadequate. Thus, an Annex 13 to this SAR entitled "Lessons Learned and their Application" also contains the full text of the Evaluation Summary from the relevant OED PPAR Report No 9265 of December, 1990.

1.37 The reported poor quality of construction has been due largely to lack of experience and ability on the part of the engineers supervising construction, and a failure to require contractors to comply with the terms of the contract documents. Implementation delays appear to have resulted primarily from ineffective construction management on the part of the contractors and the government entity supervising the work, although there are a number of other factors to which delays may be attributed, such as: lack of counterpart funds; inability to prepare clear and concise procurement documents and to reach procurement decisions; poor procurement management, disputes between

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[3] The report numbers and dates are, respectively: PCR 5875 (Oct. 1985); PPAR 9265 (Dec 1990); PCR 6242 (June 1986); 6935 (Sep. 1987); 7202 (April 1988); PCR 8090 (Sep 1989).

contractors and the implementing agencies; poor planning and insufficiently detailed project preparation; and land acquisition difficulties.

1.38 The more successful aspects of the projects have included the economic selection of components through careful comparison of alternatives during the project preparation stages. The use of lower cost technical options has sometimes been possible and successful. In addition, programs to develop low-cost sanitation for the fringes of urban areas and for areas having lower population densities have achieved increasing acceptance from sector institutions and the public. One of the most serious and pervasive sector deficiencies is the lack of incentive and ability to operate and maintain completed facilities to acceptable standards.

1.39 The trend of objectives in earlier projects has been to improve: cost recovery; institutional efficiency through improved management; financial accounting and reporting systems. Associated objectives have attempted to reduce unaccounted-for water and improve user charging by metering and more efficient billing and collection. A report prepared in 1986 in collaboration between the Government of India and the Bank, titled "Water Supply and Sewerage Projects Financed By the World Bank in India - Financial and Institutional Performance" concluded that in general terms these objectives have not been achieved to an appreciable extent. Reasons for the apparent lack of achievement are widespread, but the major constraints are summarized as:

(a) popular opposition to tariff increases because, traditionally, water was regarded as a free good;

(b) the objectives were too ambitious and inadequate planning and preparation preceded the attempts to achieve them;

However, there is a growing recognition throughout the sector, and by the public, that adequate tariffs are justifiable as the only available mechanism for realizing the resources to improve services.

1.40 More recent Bank-supported projects have aimed to reflect the lessons of experience. Ongoing projects in Madras (FY87 Cr 1822-IN and Ln 2846-IN) and in Hyderabad (FY90 Cr 2115-IN and Ln 3181-IN) are performing rather better than earlier projects. Both include substantial unaccounted-for water management efforts. In Hyderabad, strong general management is building a capable senior management team which has instituted many personnel reforms (many aimed at inculcating a consumer-service orientation), a comprehensive personnel training program, improved and computerized financial accounting systems and good construction quality management practices and improved operations.

1.41 Thus, there is evidence that persistence and effort, on the part of the Bank and the sector agencies, supported by the State and Central governments, can yield substantial development benefits. At the same time, it is recognized that many objectives will only be achieved in the medium and longer term.

Rationale for Bank Involvement in the Proposed Project

1.42 The Country Assistance Strategy (CAS) of 19-May-95, to be reviewed by the Bank's Board on 20-Jun-95, has emphasized that, in urban areas, there is an urgent need to build the institutional and financial framework that will enable cities to provide critically-needed services to a rapidly growing population. Its paragraph 32 discusses the key urban issues and its Attachment 1 lists the

sectoral reform objectives. One key theme of this CAS is State-level finances (and, by implication, local-level finances).

1.43 Attachment 1 to this 1995 CAS reviews the status of sectoral objectives to be supported through the Bank's lending operations as outlined in the 1994 CAS. It notes, under urban infrastructure, the impending commencement of a comprehensive review of urban infrastructure financing.

1.44 In the design of the project and the related dialogue with MCGB during preparation and appraisal, particular attention has been paid to the lessons of experience (Annex 13). Due account has also been taken of the five areas of the Bank's special operational emphasis. These are reviewed in turn in the context of features and components of the Project.

1.45 Poverty Alleviation. The slum sanitation component is explicitly focussed on alleviating health risks, and improving the urban environmental conditions for some one million slum dwellers in Bombay.

1.46 Participation. Specific investments under the slum sanitation components will be planned following the conduct of social surveys and taking account of beneficiary preferences and attitudes. The public participation and review in the environmental assessment process during project preparation was an important force in stimulating MCGB's commitment to this component, which will be implemented with the assistance, inter alia, of NGOs.

1.47 Gender Issues. The Slum Sanitation Schemes will provide a particular benefit to women, who have stronger concerns for privacy and who bear the brunt of the problems arising from ill health in the family.

1.48 Environment. The entire project is to be perceived as an important part of a staged program to realize urban environmental improvements through improved wastewater conveyance, treatment and disposal and improved excreta disposal facilities for the poor.

1.49 Private Sector Development. The goods and works will be procured by open bidding and contracts are expected to awarded to private sector suppliers and contractors; this is normal Bank and Indian practice. However, in this project, a greater role than has been normal in Indian practice has been assigned to private consulting engineering firms for both engineering planning and design and for the supervision of construction, including quality management.

1.50 In addition to features of the Project which respond to the five areas of special emphasis, it is noted here that the project includes foreign-local consulting services to review MCGB's WSSD sewerage system operation and maintenance organization, management and practices and to make recommendations and furnish personnel training for improvements. Although a small part of the Project in financial terms this element of the Project should make an important contribution to institutional development and to the eventual efficiency of prior, proposed and future sewerage system investments.

II PROJECT AREA, SERVICES AND DEMAND

The Project Area

2.01 Bombay is the capital city of Maharashtra State. The Bombay urban agglomeration, and its total 1991 population of 12.57 million, was described in para 1.11. Urban planning for the whole agglomeration is the mandate of the Bombay Metropolitan Region Development Authority (BMRDA). Within this agglomeration the municipal boundaries of the MCGB - the Project Area - occupy an area of 440 km^2 and account for an estimated population of about 10 million - about 3 million on Bombay Island and 7 million in the "suburbs". These boundaries were established in the 1950s with their extension from the "Island" to include "the suburbs".

2.02 The annual average population growth in Bombay's urban agglomeration between 1981 and 1991 rate was 4.3%; this is significantly higher than the 3.1% average for India's urban areas as a whole. This rate of growth ranked seventh highest among India's 23 metropolitan cities having a population of more than one million, but it was the highest in absolute terms.

2.03 Unfortunately, the provision of infrastructure and housing has not nearly kept pace with such growth rate. Bombay's population was a mere 3 millions in 1951. Thus, Bombay economic strength and its role in India's economy has created abundant employment opportunities and attracted rural migrants but an estimated 5 million of the present population live in slum conditions and about one million of these have occupied municipally-owned lands.

Water Supply Services

2.04 Annex 1 gives a brief history of Bombay's water supply system which was initially constructed in the mid-19th century to serve commercial and residential areas in the southern portion of Bombay Island near the harbor and the Fort. Subsequent rapid expansion of commerce and development of industry required the addition of a new source of supply, setting a pattern which was to be repeated in 1879, 1883, 1944, 1957, 1965, 1979, 1984 and 1990. On completion of the ongoing Bank and IDA assisted Third Bombay Water Supply and Sewerage project in 1996, the total water supply to the Greater Bombay area will reach an average of 2,930 Mld (644 MIGD) or about 80% of an estimated gross water demand of about 3,570 Mld (785 MIGD).

2.05 The 1996 water supply of 2,930 Mld represents an average daily per capita domestic water supply of about 130 liters after deductions for transmission system, distribution system and treatment plant losses and for industrial, commercial and government use. Despite the considerable efforts over almost half a century to develop new water sources, Bombay has failed to meet the demand for water due to rapid population increases, geographic expansion of the area, insufficient sector investments and system leakage. This has resulted in an intermittent water delivery to consumers for periods ranging from 2 to 5 hours per day. This operational mode causes technical difficulties with regard to metering, leakage detection and system maintenance and may also jeopardize public health (para 1.29). Investment funding constraints and the higher priority accorded to water supply has led to a comparative neglect of sewage collection, treatment and disposal creating serious environmental problems and risks to public health.

2.06 The Central Design Organization of the GOM Irrigation Department, is responsible for master plan water resource studies to meet BMR's future water needs (para 1.20). This organization in conjunction with BMRDA, which is responsible under GOM's Department of Urban Development for planning and investment programming, has proposed four sources of water supply for future

development. For the sake of public health and of the economic provision of water supply services, the next water supply objective should be the provision of water delivery on a continuous (24 hour per day) basis (para 1.29). This will require, inter alia, the establishment of full consumer metering and a volumetric tariff, as a means of controlling consumption and waste and a vigorous "unaccounted-for water management program" including leak detection and repair to control system leakage within acceptable limits.

Sanitary Sewerage Development and Service Levels

2.07 Over the past fifty years, in the efforts to develop urban infrastructure and keep pace with rapid urban growth being experienced in Bombay, a higher priority was accorded to water supply as compared to sanitary sewerage. This factor, and financial resource constraints, led to a situation in which only a very small area of the city was served by a piped sewerage system and the remainder of the urban area discharged wastewater indiscriminately to surface water streams, gullies and to open stormwater drains. The history of evolution of the sewerage system is also given in Annex 1.

2.08 The beginning of a planned attempt to reverse this situation was under the FY73 Bank-assisted First Bombay Water Supply and Sewerage Project (Credit 390-IN). Various sewerage system studies were undertaken in the 1970's and a **Sewerage Master Plan [4]/ was completed in 1979 which provides the basis for collection, conveyance and disposal of sewage from the Greater Bombay area to the year 2005.** Under this First Bank-assisted project, implementation difficulties and cost overruns resulted in reduction in the scope of work and deferral of the sewerage system expansion to the FY79 Second Bombay water Supply and Sewerage Project (Cr 842-IN). Although this credit closed on 31-Mar-88, parts of some components of the project are still under construction.

2.09 The objective of the Second Project was to improve and extend the sewage collection system to serve between 80% and 90% of the properties throughout the whole of the Greater Bombay area and to provide treatment facilities and a safe means of sewage effluent disposal. The FY86 Bank-supported Third Bombay Water Supply and Sewerage Project (Cr. 1750-IN/Ln 2769-IN) primarily addressed expansion of the water supply system and included only relatively minor extensions of the sewage collection system in suburban areas. However, mechanical and electrical works (outstanding from the Second Project) for two major pumping stations (Bhandup and Ghatkopar) were added to this Third project after credit/loan effectiveness.

2.10 The **proposed project** represents most of the **first stage** of development of facilities to partially treat and dispose of sewage which is collected and conveyed to the proposed treatment and disposal sites by facilities constructed under the three earlier Bombay Water Supply and Sewage Projects. The major part of these collection and **conveyance facilities** is completed; **the remainder (including some remedial works, the Bandra pumping station, facilities to overcome siltation in the Ghatkopar influent and an influent tunnel to Ghatkopar pumping station) are included in the proposed project**.

2.11 The configuration of the Greater Bombay sewerage system is appropriately planned and constructed around seven natural drainage or service areas (Annex 1). The Table below provides an

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[4] "Methods for Treatment and Disposal of Wastewaters from Greater Bombay"; Metcalf and Eddy Inc., Consulting Engineers, in association with Environmental Engineering Consultants; May 1979. The main features of this plan are reviewed in Annex 2.

outline of the status of the sewage **treatment and disposal** methods which serve the seven drainage areas. In the table, the estimated quantity and percentage of dry weather flow (DWF) from each of the drainage areas indicates its relative size, and "PT" is preliminary treatment for the removal of grit and screenings.

SEVEN DRAINAGE AREAS - SEWAGE TREATMENT AND DISPOSAL FACILITIES
GREATER BOMBAY AREA (see also Map No 26628 attached)

Drainage Area	Dry Weather Flow DWF (Mld)	DWF % Total	Treatment/Disposal Methods	Status and **Action Proposed under the Project**
1 Colaba	30	1.2	PT/discharge to the ocean through a 1.1 km outfall	Complete
2 Worli	760	30.1	PT/discharge to the ocean through a 3.0 km long outfall	PT complete; outfall to be constructed under the project
3 Bandra	796	31.5	PT/discharge to the ocean through a 3.0 km long outfall	Construction of pumping station, PT and outfall under the project
4 Versova	140	5.5	PT/primary treatment in aerated lagoons	PT and lagoons under construction (BUDP)
5 Malad	240	9.5	Present discharge of untreated sewage to Malad creek to continue pending second stage works	The project includes studies and eng. design for 2nd stage treatment and disposal works
6 Ghatkopar	386	15.3	PT and primary treatment in aerated lagoons, discharge to Thane creek	PT to be completed by mid 1996; lagoons to be constructed under the project
7 Bhandup	280	6.9	PT and primary treatment in aerated lagoons, discharge to Thane creek	PT to be completed by mid-1996; lagoons to be constructed under the project

2.12 In the First Stage of development, sewage from three service areas (Versova, Bhandup and Ghatkopar) will be treated in facilities to remove screenings and grit, and will then pass to aerated lagoons which will provide biological treatment to the level of conventional primary treatment. The treated effluent will then be discharged to Malad and Thane tidal creeks. One of the three aerated lagoons (Versova) is under construction, partially financed under the Bombay Urban Development Project (Cr. 1544-IN) and BWSSP III (Cr 1750-IN/Ln 2769-IN) and is due to be completed in

December 1996. Bid invitations for the remaining **two aerated lagoons (Bhandup and Ghatkopar) were issued in April 1995 and these lagoons would be financed under the proposed project**. The original Master Plan Study (para 2.08) recommended that sewage from Malad service area also be treated in aerated lagoons prior to discharge to Malad creek. However, more recent studies showed this to be impracticable due to the limited assimilative capacity of the creek. These works have therefore been deferred to the Second Stage Program (Annex 5) to allow sufficient time for further study of treatment and disposal alternatives.

2.13 Sewage from two of the remaining three service areas (Worli and Bandra), which account for about 60% of Bombay's total flow, will receive partial treatment, comprising screening and grit removal, and will then be discharged into the ocean through two marine outfalls. These **outfalls, which are 3.5 meters in diameter and three kilometers long, and for which bids have been received, would be financed under the proposed project**.

2.14 Sewage from the remaining service area, which is the smallest of the seven service areas, receives preliminary treatment at a completed installation (at Colaba) and is discharged to the harbor through a 1.1 km long 1.2 meter diameter outfall.

2.15 The construction of the two outfalls at Worli and Bandra is a major engineering task. As previously designed, they were to consist of reinforced concrete pipes laid in a sea bed trench. A 1984 contract (financed under the Second Bombay Water Supply and Sewerage Project Cr 842-IN) to construct the two outfalls was terminated in 1987 as a result of technical difficulties, contractual disputes and disputed data concerning the seabed conditions. The contract is now under litigation.

2.16 In March 1988, Credit 842-IN was drawn down and closed. Because of implementation delays, cost overruns, technical problems, funding problems and litigation, MCGB was unable to proceed with completion of the two marine outfalls and the aerated lagoons at versova. MCGB retained foreign consultants (financed under the Third Bombay Water Supply and Sewerage Project) to reinvestigate the sea bed conditions, to further evaluate the costs, benefits and risks of alternative approaches to completing the outfalls, and to prepare detailed engineering designs. To curtail the debate on the least-cost construction method, it was decided to prepare designs and invite bids for two alternatives: (i) a dredged seabed trench and pipe alternative, similar in many respects to that described in para 2.15; and (ii) for submarine tunnel alternative; it was agreed that the decision on the choice would be made on the basis of bid price. However, it is noted here that the tunnel choice has the least adverse effect on the environment (see Annex 11). As noted (para 2.13), designs and bidding procedures (by ICB - from stringently pre-qualified bidders) for the outfalls have now been completed. The bid evaluation has been completed and furnished to the Bank, and award of a construction contract for their construction in submarine tunnel is being processed; the award is now scheduled for the second half of 1995. The lowest bid for the seabed trench/pipe alternative was more than double that for the submarine tunnel.

2.17 A number of design and construction deficiencies in pumping stations and other components financed under the Second Bombay Water Supply and Sewerage Project were reported by a Bank supervision mission in 1989. As a consequence, the Municipal Corporation of Greater Bombay (MCGB) was asked to appoint consultants, acceptable to the Bank, to review these works and to assist MCGB in the coordination and supervision of the remaining works forming part of the overall, integrated sewerage system. Such consultants were duly appointed in May 1991 and a "Remedial Works Program" was formulated and agreed upon and implementation of works to remedy some of these defects is now proceeding. MCGB has agreed to a dated action program for implementation of

the Remainder of the Remedial Works Program (Annex 1, paras 12-16). At negotiations, agreement was reached that MCGB will complete the implementation of the Remedial Works Program.

2.18 Upon completion of these remedial works and completion of other components that are now under construction under MCGB financing and under the Third Bombay Water Supply and Sewerage Project, about 80% to 90% of the properties and an estimated 45% of the population of the Greater Bombay area (total estimated population 10 million) will be connected to a water-borne sewerage system capable of conveying domestic and industrial wastes to facilities for partial treatment and disposal.

2.19 With the exception of the Malad drainage area, the works ongoing and proposed as described above will complete the "First Stage Works" conceived in the Master Plan. As part of the "Second Stage Program" either a further outfall or a sewage treatment facility (or a combination of both) will be required to serve the Malad and Versova service areas. These components will bring the entire sewerage system into full operation. However, further works are desirable for further environmental improvement and are proposed under "Stage 2" of the program - see Annexes 2 and 5.

2.20 The portion of the population not served by the system, estimated at 40% to 50%, represents the pavement and slum-dwellers with no permanent housing. The solution to this issue does not rely on the development of the sewerage system, which has been designed, and is being constructed, to serve the entire urban area including those parts of the city occupied by the slum dwellers and the homeless. The solution lies in the provision of sanitation facilities explicitly for these poorer segments of the population. **A part of these needs are also proposed to be met by the slum sanitation schemes included in the Project**.

III THE PROJECT

Objectives

3.01 The major policy objectives of the first three Bank-supported water supply-sanitation projects were: (a) to establish an appropriate and effective public institution in Bombay to manage the planning, design construction, operation and maintenance for the provision of water supply and sewerage services; and (b) to establish a revenue stream to finance maintenance and operation and a portion of capital investment.

3.02 With regard to the first of these earlier objectives MCGB's WSSD has shown marked improvement in the water supply subsector but achievements in the sewerage subsector fall far short of the level required for an entity of this magnitude and importance. Some on-the-job training and further experience has been given by deputing some WSSD staff to work with the consultants assisting project preparation and such arrangements are planned during project implementation. One of the objectives of the proposed project would, therefore, address the further improvement of WSSD's ability in planning and implementation of sewerage works, with particular emphasis on construction management and supervision.

3.03 The second of these earlier objectives, the establishment of a revenue stream to finance maintenance and operation of the water supply and sewerage facilities and a portion of capital investment, has been substantially achieved in recent years but will require further effort and action to sustain these gains to date.

3.04 A further institutional objective was the development of MCGB's capacity to fully understand and manage the conduct of good environmental impact assessments in conjunction with project formulation and design. This has been substantially achieved during the preparation phase of the project, albeit the use of assistance from consultants in such efforts in the future will, no doubt, be both desirable and cost-effective.

3.05 An additional institutional development aspect of this Project is concerned with organizational changes, the establishment of procedures and provision of additional facilities to **raise the standards of WSSD's operation and maintenance practices for the entire sewerage system to a level consistent with good and cost-effective practice (see Annex 3, paras 28 and 29)**.

3.06 The physical objectives of the Project are to complete the facilities (originally proposed and partially completed under the First, Second and Third Water Supply and Sewerage Projects) and provide for the improved safety of the disposal of sewage from Greater Bombay, to complete these in substantial accordance with realistic timetables, and with a good construction quality (see para 1.37). This will realize further benefits from achieving full utilization of facilities which have been constructed so far and set the stage for further such improvements under the "second stage" program (Annex 5). They are also to construct sanitation improvement facilities, mainly for safe excreta disposal, to benefit up to one million slum dwellers residing in some 164 slums on municipally-owned lands. This is proposed to be implemented following social and physical/technical surveys and a beneficiary consultation process. Thus, beneficiary preferences will be fully taken into account in the determination of the works selected for implementation - all in the context of technically-feasible and cost-effective options. These processes are designed, inter alia, to identify, on a slum by slum basis, where no involuntary resettlement is required for implementation (para 6.20 and Annex 14).

3.07 In summary, from the preceding, the **Project objectives are**:

(a) strengthening the capacity of MCGB's WSSD in all aspects of the management of the provision of sewerage services including planning, design, construction supervision including materials and construction quality management, operation and maintenance;

(b) sustaining the financial viability of the provision of water supply and sewerage services in Greater Bombay through direct charges to beneficiaries at appropriate levels;

(c) improving the health and environmental conditions in Greater Bombay through the construction of sewerage works improvements so designed and constructed as to conveniently and economically permit a further level of such improvements in the future; and

(d) improving the health and environmental conditions for a significant portion of the slum dwellers of Bombay through the construction of sustainable sanitation improvement facilities, mainly for safe excreta disposal, of a kind and nature determined in consultation with the prospective beneficiaries.

Description

3.08 The project components are described in more detail in Annex 3 and are summarized in the schedules and detailed cost estimates in Annex 4. The locations of the project physical works are shown on Map IBRD 26628. Physical components of the project are summarized below; design capacities, which are based on year 2005 flows, are shown in parentheses and represent average dry weather flows in million liters per day (Mld).

Physical Components

(a) Construction of a 3 km long and 3.5 meter diameter marine outfall in submarine tunnel at Worli (or Lovegrove) (760) and a similar outfall at Bandra (796);

(b) Construction of Bandra pumping station (796);

(c) Construction of aerated lagoons at Ghatkopar (386) and Bhandup (176);

(d) Construction of facilities to overcome siltation in an influent tunnel at Ghatkopar and rehabilitation of an existing tunnel (386);

(e) The implementation of Slum Sanitation Schemes, conducted using beneficiary participation methods, in those of 164 slums which occupy municipally-owned lands (which are inhabited by an estimated one million people). Stage 1 would be a "pilot stage" covering about 10-15% of the beneficiaries; following a review of the findings of implementation experience and of an independent monitoring and evaluation process, Stage 2 for the remaining work would be designed and would proceed to implementation; independent monitoring and evaluation would continue. Agreement was reached at negotiations that implementation will proceed in accordance with "Policy Guidelines for the Implementation" (see Annex 14) and further that certification of compliance with these Policy Guidelines will accompany each withdrawal request with respect to this aspect of the Project.

(f) Addition of structural features to improve the stability of five existing sewage pumping stations; and

(g) Conveyance system improvements.

3.09 **Project support and technical assistance** will be provided in the form of consultants' services for the tasks listed below in each of three categories. This technical assistance, its estimated gross costs (in US$ million in parentheses) and its classification per GP 8.40 are as follows:

(a)	Policy Support	NIL
(b)	Project Support	paras 3.10 (13.3), 3.13 (1.8), 3.14 (2.2) and 3.15 (23.0) TOTAL US$40.3 million
(c)	Institutional Development	para 3.11, 3.12 - US$2.5 million

Category 1: Project Support

3.10 **Supervision of Construction of the Worli and Bandra Outfalls, the Bandra Pumping Station, and the Ghatkopar Influent Tunnel.** An ongoing contract, which expires in 30-Jun-96, provides for construction supervision by international Consultants. **As a condition of effectiveness MCGB will either: (i) extend the duration of this contract; or (ii) before 31-Jul-95 furnish in a form satisfactory to the Bank, consultant recruitment documentation and a consultant recruitment program to ensure continuity of the provision of such services.** Under the ongoing contract, and its extension or substitute contract, the consultant will be designated as the "engineer", as reflected in the general conditions of contract, for the construction of the Worli and Bandra outfalls, and (ultimately) in the general conditions of contract for the construction of the Bandra pumping station, and works to overcome siltation is the Ghatkopar Influent Tunnel. Assurances were also obtained at negotiations that **consultants will also supervise the construction of the Ghatkopar and Bhandup lagoons, the slum sanitation schemes and the pumping station structural modifications** but may not be designated as the "engineer" for this work, unless such an arrangement is requested by MCGB.

3.11 **Upgrading WSSD Operation and Maintenance Practices**. The level of maintenance of the existing sewerage system has been consistently poor, lacking adequately trained and skilled staff, suitable facilities and appropriate plant and equipment. In addition, preventive maintenance procedures are inadequate and the organizational structure of that section of WSSD dealing with sewerage maintenance needs reform.

3.12 MCGB has agreed to address this issue with the assistance of suitably qualified consultants, acceptable to the Bank, to implement a comprehensive study and to introduce improved operation and maintenance practices and organizational reforms. The consultant recruitment documentation for this study are available in the project file (Annex 15) and the award of this consulting services contract was made a condition for negotiations.

3.13 **Topographic and Condition Surveys of the Conveyance System.** These surveys would be implemented in connection with the component for the Conveyance System Remedial Works [para 3.08(g) above]. The topographic survey would enable record plans of the conveyance system to be prepared and would be followed by a condition survey of the system to provide input for the preparation of a program for remedial works. Requests for proposal for these surveys are available in

the project file (Annex 15) and the award of this consulting services contract was also a condition for negotiations.

3.14 **The Slum Sanitation Technical Assistance relates to the physical component described in para 3.08(e); the program and some further details of this technical assistance are described in Annex 14. An understanding, in the form of agreed terms of reference, was obtained at negotiations for this TA which will comprise, in those slums selected:**

(1) publicity for the slum sanitation schemes;

(2) the work of multi-disciplinary teams (social surveys; physical surveys and the assessment of physically feasible and economical technical options; beneficiary consultations for the purposes of the determination of community preferences, of beneficiary contributions to investments and to subsequent operation and maintenance);

(3) independent monitoring and evaluation of both the procedures and the activities described in (1) and (2) above and reporting thereon;

Category 2: Studies, Site Investigations and Engineering for Second Stage Works

3.15 The Environmental Impact Assessment (Annex 11) that has been carried out for the first stage of development of sewage treatment and disposal facilities to serve the Greater Bombay area, confirms that higher levels of treatment and/or improved disposal methods will be required to meet future coastal water quality standards. Planning for these improvements in sewage treatment and disposal facilities has, therefore, been included in the proposed project in the form of: (i) the Bombay Coastal Water Quality Study (para 3.17) which is under implementation; and (ii) the **Second Stage Program**, which includes provision for feasibility studies, and engineering designs for sewage treatment and disposal facilities in six service areas. The agreed schedule for implementation of the Second Stage Program and a description of the scope of each of the studies in the Program are detailed in Annex 5.

Category 3: Complementary Studies

3.16 These studies have been, or are being implemented under separate financing in the preparation of components of the proposed project and of the program of Second Stage works.

3.17 **The Bombay Coastal Water Quality Study.** This study is financed under a Japanese grant and is being implemented by India's National Environmental Engineering Research Institute (NEERI) under the direction of MCGB. The study supplements the hydrographic work carried out as part of the 1979 Master Plan and extends the work under a recent study implemented by NEERI, as part of the Environmental Impact Assessment. The study will estimate receiving water quality that would result from various lengths of outfalls discharging to the Arabian Sea, and/or sewage treatment options, for Worli and Bandra service areas, in addition to the effects of various outfall locations for Malad and Versova service areas. The extended study will examine the quality of receiving waters along the coastline (to about 8 to 10 km from the shore line) from a point about 20 km north of Malad creek to a point about 7 km south of the Worli outfall. A further study will extend the water quality studies of Thane creek almost to a point at which the creek reaches the sea (adjacent to Bombay harbor).

3.18 The results of the study will enable MCGB to assess the improvement in coastal waters which would result from various methods of sewage treatment and disposal, and the effects of extending the outfalls to various distances from the shore line under the Second Stage Program, in order to satisfy future environmental standards. Results of the study would provide the "starting point" and primary input for engineering feasibility studies for sewage treatment and disposal facilities to be constructed in the Second Stage Program to serve the six drainage areas (Annex 5).

3.19 The remaining three complementary studies that have been implemented to resolve issues arising from deficiencies in some of the existing facilities as outlined above. These three studies address the following items: Bandra Pumping Station [para 3.08(b)]; Ghatkopar Influent Tunnel [para 3.08(g)]; and Pumping Station Structural Stability [paras 3.08(f)]. Reports on these studies are available in the Project File (Annex 15).

Status of Project Preparation

3.20 The status of preparation for each of the physical components is outlined in the following table.

OUTLINE of the STATUS of PREPARATION of EACH COMPONENT
DATES OF COMPLETION of EACH ACTIVITY (month/year)

Physical Components

No	Component	Feasibility (or other) Study	Eng Design-Procure-ment Documents	Bidding Procedures	Contract Award
(a)	Worli and Bandra Marine Outfalls	Completed	Completed	Completed	9/95
(b)	Bandra Pumping Station	Completed	Completed	6/95 & 8/96	2/96 & 3/97
(c)	Ghatkopar & Bhandup Lagoons	Completed	Completed	8/95	11/95
(d)	Ghatkopar Siltat'nnt Prevention	In Process - due 1/96	4/96	8/96	12/96
(e)	Slum Sanitation Schemes	9/95 Stage 1	3/96 Stage 1	7/96 Stage 1	11/96 Stage 1
(f)	Improve Structural Stability of Five Pumping Stations	Completed	7/95	11/95	3/96
(g)	Conveyance System Improvements	Part In Process	8/95	12/95	4/96

Project Cost

3.21 The project has a total estimated cost of US$295.6 million, or US$274.3 million excluding taxes and duties of US$21.3 million. The estimates take account of the bids received for the construction of the Worli and Bandra marine outfalls; for other components the bids are based on data gathered by WSSD and consultants from similar works implemented throughout the world, adjusted to reflect conditions in India and to a January 1995 base.

3.22 Physical contingencies of 25% have been allowed for all civil, mechanical and electrical works, based on the following rationale:

• Worli and Bandra marine outfalls and Ghatkopar influent tunnel	:	Inherent uncertainties associated with tunnel construction.
• Aerated lagoons at Ghatkopar and Bhandup	:	Uncertainty in the location of borrow areas yielding laterite for embankment construction.
• Bandra pumping station	:	Magnitude and complexity of work.
• Slum sanitation	:	The programmatic nature of the component and the resulting difficulties of cost estimation.
• Pumping station structural improvements and conveyance system improvements.	:	Preliminary status of preparation.

Physical contingencies of 10% have been included for all technical assistance, studies, site investigations and engineering required for the Second Stage Program.

3.23 To provide for inflation throughout the project implementation period (estimated at 7½ years - Annexes 4 and 5) the following price escalation rates have been used for local expenditures: 9.0% for 1995, 8.5% for 1996, 8.0% for 1997, 7.0% for 1998 and 6.0% thereafter. For foreign expenditures the escalation rates used are 1.5% for 1995, 1.8% for 1996, 2.6% for 1997 and 2.5% per year thereafter. The cost estimates are given in detail in Annex 4 and are summarized on the following page.

Financing Plan

3.24 The Bank would finance 70% of the total project cost, net of taxes and duties; this amounts in total to US$192.0 million. A Bank loan (US$167.0 million) and an IDA Credit (US$25.0 million) would be made to the Government of India, which would make the proceeds available to the Government of Maharashtra in accordance with GOI's standard arrangements for development assistance to the States of India. In summary:

	in US$ million			%
	Foreign Costs	Local Costs	TOTAL Costs	
IBRD Loan			167.0	57%
IDA Credit			25.0	8%
TOTAL ABOVE	89.9	102.1	192.0	65%
MCGB	0.0	103.6	103.6	35%
PROJECT COSTS	89.9	205.7	295.6	100%

Agreement was reached at negotiations that the GOM will lend funds to MCGB for 65% of annual capital expenditures under the project, for a 25-year term, including a five-year grace period on principal repayment, at an interest rate of 13%. MCGB's WSSD is to provide the remaining 35% of annual capital expenditures from internally-generated cash flows.

PROJECT COST ESTIMATES

COST ESTIMATES IN US$ MILLION		Jan95 Base Costs (@ Rs31 = $1.00)			%	%
		Foreign	Local	Total	BASE	TOTAL
COMPONENT 1 - PHYSICAL WORKS						
1.01 -	Worli and Bandra Outfalls	36.2	45.2	81.4	36%	28%
1.02 3AA	Bandra Pumping Station (Civil)	2.4	21.8	24.2	11%	8%
1.03 3BB/CC/EE	Bandra Pumping Station (Equipment)	0.4	3.8	4.2	2%	1%
1.04 10AA	Bhandup Lagoons (Civil)	0.5	10.1	10.6	5%	4%
1.05 10G/SD	Bhandup Lagoons (Equipment)	2.6	1.3	3.9	2%	1%
1.06 11AA	Ghatkopar Lagoons (Civil)	0.5	10.1	10.6	5%	4%
1.07 11G/SD	Ghatkopar Lagoons (Equipment)	2.6	1.3	3.9	2%	1%
1.08 29AA	Ghatkopar Influent Tunnel Repair	0.1	0.7	0.8	0%	0%
1.09 29AAA	Ghatkopar Influent Tunnel Additional	1.9	7.7	9.6	4%	3%
1.10 -	Slum Sanitation Implementation	2.0	18.0	20.0	9%	7%
1.11 -	Stability Restoration - 5 PStns	0.3	2.9	3.2	1%	1%
1.12 -	Conveyance System Remedial Works	5.8	13.5	19.3	9%	7%
	COMPONENT 1 TOTAL	55.3	136.4	191.7	86%	65%
COMPONENT 2 - TECHNICAL SERVICES FOR COMPONENT 1						
2.01 -	Engineering Services - Supervision (BSDP)	5.6	4.5	10.1	5%	3%
2.02 -	Studies-Upgrade O&M (25% in BWSSP III)	1.2	0.6	1.8	1%	1%
2.03 -	Condition Survey-Conveyance System (30% BWSSP III)	0.9	0.5	1.4	1%	0%
2.04 -	Slum Sanitation - Consultant and NGO Services	0.0	1.9	1.9	1%	1%
	COMPONENT 2 TOTAL	7.7	7.5	15.2	7%	5%
COMPONENT 3 - PREPARATION OF STAGE 2 INVESTMENTS						
3.01 -	St II Wks: Feasibility Malad and Versova Areas	1.2	5.6	6.8	3%	2%
3.02 -	St II Wks: Feasibility Bhandup and Ghatkopar Areas	0.8	1.0	1.8	1%	1%
3.03 -	ST II Wks: Feasibility Worli and Bandra Areas	0.6	2.2	2.8	1%	1%
3.04 -	ST II Wks: Detailed Design (6 Areas)	4.5	1.0	5.5	2%	2%
	COMPONENT 3 TOTAL	7.1	9.8	16.9	8%	6%
	SUBTOTAL	70.1	153.7	223.8	100%	76%
	(1)PHYSICAL CONTINGENCIES	14.8	33.9	48.7		16%
	(2)PRICE CONTINGENCIES	5.0	-3.2	1.8		1%
	(3)SUBTOTAL	89.9	184.4	274.3		93%
	(4)TAXES AND DUTIES	0	21.3	21.3		7%
	(5)TOTAL PROJECT COST	89.9	205.7	295.6		100%

Implementation

3.25 The project will be implemented by MCGB's WSSD with the assistance of foreign and local consultants. The international consultants would be designated as the "Engineer" for major components of the project, including construction of the Worli and Bandra outfalls, the Bandra pumping station and the facilities to control siltation in the Ghatkopar Influent Tunnel. At negotiations, MCGB confirmed the understanding that it will appoint international consultants acceptable to the Bank, according to terms of reference acceptable to the Bank, to supervise construction of the Worli and Bandra outfalls, Bandra pumping station, and Ghatkopar influent tunnel. MCGB also gave assurances that it will appoint local consultants, acceptable to the Bank, according to terms of reference acceptable to the Bank, to supervise construction of the Ghatkopar and Bhandup lagoons, the slum sanitation component, structural improvements in five pumping stations and conveyance system improvements (para 3.10).

3.26 The conditions for negotiations included:

(a) Worli and Bandra Outfalls	Bid Evaluation Report furnished/approved by the Bank
(b) Bandra Pumping Station	Furnish Bid Documents to Bank for Review
(c) Ghatkopar and Bhandup Lagoons	Invite bids from Prequalified Contractors

It is reasonable to assume, therefore, that contracts for these major works (for which the total base cost estimate of civil works is US$126.8 million or 57% of the total base cost) will have been awarded by loan effectiveness. In view of this unusually advanced level of project preparedness, the project implementation schedule has been reduced from the Bank-wide sector disbursement profile of 8½ years to 7½ years. Project costs and financing have, therefore, been calculated on a 7½ year implementation period.

Procurement

3.27 During preparation of the project, in response to a request from MCGB, the Bank indicated that it would not object to bids being invited for two alternative outfall designs:

(a) based on the use of concrete pipes laid in a dredged trench on the sea bed and protected with rock armor (similar to the construction previously attempted but with significant technical changes); and

(b) tunnels constructed some 30 meters below the sea bed with risers and diffuser ports for sewage dispersal.

Both designs: (i) incorporated tapered diffuser sections at the terminal end with risers and diffuser ports for sewage dispersal; (ii) incorporated features to facilitate their future extension.

3.28 In the earlier outfall construction endeavor (paras 2.15-2.16) tunnels were not considered as a possible form of outfall construction. However, comparatively recent developments in tunnel construction technology, and the advances in tunnel boring machinery, have made it an economical option. The cost of the dredged trench and concrete pipe alternative was estimated to be considerably more than that of the tunnel alternative. However, to eliminate doubt, it was agreed that the final selection of method would be based on the bid prices received for each alternative. The bids received in December 1994, from bid documents approved by the Bank, have now shown the cost of the tunnel alternative to be substantially less than that of dredged trench and concrete pipe. The tunnel

alternative has therefore been selected for construction. As a condition for Loan negotiations, MCGB completed the bid evaluation and review process for the Worli and Bandra outfalls, and submit to the Bank a recommendation for contract award. This bid evaluation had been received and reviewed by the Bank, and a "no objection" issued for the award of the contract. In addition, as a condition of Loan effectiveness, MCGB would award the contract, in accordance with a Bank-approved bid evaluation, for construction of the Worli and Bandra outfalls.

3.29 The five major civil works contracts (Annex 4) will be awarded to prequalified contractors on the basis on international competitive bidding (ICB) in accordance with Bank Guidelines on Procurement and using Bank standard bidding documents. These contracts, (and their estimated gross costs) are: (i) the Worli and Bandra outfalls (US$107.9 million), for which bids have been received (paras 2.13 and 2.16); (ii) the Bandra pumping station (US$31.5 million); the (iii) Bhandup and (iv) Ghatkopar lagoons (US$13.7 million each); and (v) facilities to control siltation in the Ghatkopar tunnel (US$12.9 million). A preferential margin of up to 7½% may be granted to local bidders in evaluating these civil works bids.

3.30 Civil works for: (i) the Slum Sanitation Program (US$23.9 million gross cost); and for (ii) the Conveyance System Remedial works (US$26.1 million gross cost) will be broken down into a number of small contracts under local competitive bidding procedures (LCB), acceptable to the Bank, since the work will be spread over a wide area and will be carried out over an extended period. The remaining two civil works contracts: (iii) pumping station structural stability restoration (US$4.4 million gross cost); and (iv) other Ghatkopar influent tunnel repair (US$1.0 million gross cost) will also be awarded under LCB procedures.

3.31 The three contracts for the supply and installation of mechanical and electrical equipment [(i) Bandra Pumping Station - US$5.7 million gross cost; (ii) Bhandup Aerated Lagoon - US$6.0 million gross cost; (iii) Ghatkopar Aerated Lagoon - US$6.0 million gross cost, totalling US$17.7 million gross cost will be awarded under ICB using the Bank's standard documents. In evaluating bids for equipment and materials, local manufacturers participating in international bidding may be granted a preferential margin of up to 15% of the cif costs of the competing imports, or the existing customs duty, whichever is lower.

3.32 Four contracts for consultants services (Annex 4) for: (i) for planning, design and construction supervision of the civil, mechanical and electrical works described above - estimated gross cost US$13.3 million; (ii) studies and training on sewerage system operation and maintenance - estimated gross cost US$2.5 million; (iii) condition surveys and remedial measures formulation on the conveyance system - estimated gross cost US$1.8 million; and (iv) technical and social services related to the slum sanitation schemes - estimated gross cost US$2.2 million - will be awarded in accordance with Bank Guidelines on the Use of Consultants and the Bank's standard consulting services contract. Similarly, consultants services for feasibility studies and engineering designs for the Second Stage Program - estimated gross cost US$23.0 million - will be awarded in accordance with Bank Guidelines as described.

3.33 Review by the Bank will be (and has been) required of prequalification documents prior to an invitation to prequalify, prequalification evaluation reports prior to prequalification, bid documents prior to bid invitation and bid evaluation reports prior to contract award for: (a) all ICB contracts (both goods and works); (b) all LCB works contracts having a value of more than US$1.0 million. Review by the Bank will also be required of all: (c) consultant recruitment documentation [including shortlists and terms of reference] prior to an invitation for proposals; (d) proposal evaluation reports prior to negotiations; and (e) draft "as-negotiated" consultant contracts prior to contract signature.

3.34 Procurement arrangements are summarized as follows; amounts are the gross estimated costs, including contingencies, taxes and duties in US$; the amounts in parentheses are the estimated amounts financed by the Bank.

PROCUREMENT TABLE

Project Element	Procurement Method ICB	LCB	Other	Not Financed by Bank	TOTAL COSTS
Civil Works	179.7	55.4	-	-	235.1
	(107.9)	(32.7)	-	-	(140.6)
Equipment	17.7	-	-	-	17.7
	(14.2)	-	-	-	(14.2)
Project TA	-	-	19.8	-	19.8
	-	-	(17.2)	-	(17.2)
Studies 2nd Stage	-	-	23.0	-	23.0
	-	-	(20.0)	-	(20.0)
TOTALS	197.4	55.4	42.8	-	295.6
	(122.1)	(32.7)	(37.2)	-	(192.0)

Disbursement

3.35 The Bank funds of US$192.0 million will be disbursed over 7½ years. No disbursements will be made against land or administrative costs, or against taxes and duties in India. Disbursements against civil works and goods-equipment contracts with a value of over US$1.0 million equivalent will be fully documented. Disbursements for consultants' services will also be fully documented for contracts with firms for US$100,000 or more and for contracts with individuals for US$50,000 or more. Disbursements against other expenditures will be made against statements of expenditure (SOEs). Supporting documentation for expenditures disbursed against SOEs will not be submitted to the Bank but will be retained by MCGB and will be made available to Bank staff for review upon request. Agreement was reached at negotiations that such SOE expenditures will be audited annually by auditors acceptable to the Bank (see also para 5.12). Assurances were obtained at negotiations that withdrawl applications with respect to slum sanitation schemes will be accompanied by a policy compliance certification [para 3.08(e)].

3.36 To facilitate disbursements under this project, a Special Account will be established in the Reserve Bank of India with an authorized allocation of up to US$8.0 million equivalent to cover four months of estimated average requirements for Bank-financed items. Replenishment will be made quarterly or whenever the Special Account is drawn down by about 50% of the initial deposit, which ever comes earlier. Agreement was reached at negotiations that the Special Account will also be audited annually by auditors acceptable to the Bank.

3.37 **Retroactive financing** has been proposed of up to SDR 7.6 million, (about 6% of the Credit and Loan) for advance payments to become due on the contracts for the construction of the submarine outfalls after June 15, 1995. This is linked to the Bank's receipt of a bid evaluation report

on bids for these outfalls having been a condition for negotiations and to the expectation of bid validity expiry prior to effectiveness. This retroactive financing is recommended.

3.38 The Loan closing date will be December 31, 2002.

3.39 An estimated schedule of disbursements is in Annex 7. The estimated disbursements by Disbursement Category are as follows:

DISBURSEMENT BY CATEGORY (US$ million)

Category		Loan Allocation	Percentage Disbursement
1.	Civil Works	140.6	59% of expenditures.
2.	Equipment and Materials	14.2	100% of foreign expenditures, 100% of local expenditures (ex-factory) and 80% of local expenditures otherwise procured.
3.	Consultant and NGO Services Materials	37.2	100% of expenditure.
	TOTAL	192.0	

Operation and Maintenance

3.40 When completed, project works which form an integral part of the entire sewerage system, will be operated and maintained by the Water Supply and Sewerage Department (WSSD) of MCGB. Historically, WSSD's level of maintenance of the water supply system has been acceptable, with the exception of the distribution system and consumer metering which are operated without adequate attention to reduction of unaccounted-for water. However, the level of maintenance of the existing sewerage system has been poor; the staff have been inadequately managed and trained and more skilled staff, additional facilities, plant and equipment may be required.

3.41 MCGB's WSSD wishes to address these issues and technical assistance from suitably-qualified consultants for this purpose is included in the Project (paras 3.11 and 3.12). MCGB issued a letter of acceptance of a proposal as a condition of loan negotiations and the signing of the contract is a condition of effectiveness.

Supervision

3.42 The orderly management and supervision of project activities by MCGB and WSSD (and their consultants) will require the systematic recording of information and the periodic preparation of reports which present and analyze such information and conclude with actions required (and by whom) to address specific problems which are identified. A guide to topics for such reporting is

given in Annex 8 and includes the Monitoring Indicators set out in Annex 12 and the Environmental Monitoring and Mitigation Plans set out at the end of Annex 11.

3.43 Project supervision by the Bank is for the purpose of reviewing compliance with the legal agreements and to furnish assistance in the resolution of problems which may arise. Its effectiveness and efficiency is much aided by the availability of good quality quarterly progress reports such as described in para 3.42. It is estimated that project supervision by the Bank will require about 128 staff-weeks over the life of the project, of which about 45 staff-weeks will be at headquarters for review of progress reports, procurement processing and correspondence, and 83 staff-weeks will be in the field. The supervision staff time inputs will be greater than average during the first three years of the project's life and correspondingly less than average thereafter. The average supervision staff-weeks per year are estimated at 17.1. A Bank supervision plan (timing and staffing) is also given in Annex 8.

Land Acquisition - Resettlement and Rehabilitation

3.44 Land Acquisition. MCGB reports that all of the land required for this project has been acquired during the Second and Third Water Supply and Sewerage Projects. No resettlement is required. The Slum Sanitation Schemes are, by definition, to be conducted on those slums which occupy municipally-owned lands (para 3.08(e)).

3.45 Resettlement. No resettlement is required for project implementation excepting possible for the implementation of slum sanitation schemes. Here, the beneficiary consultation process is designed to ensure, inter alia, that any resettlement is voluntary. **Assurances were obtained at negotiations that the slum sanitation implementation will follow the "Policy Guidelines for Implementing Slum Sanitation Schemes" (Annex 14) which reflect this requirement that any resettlement be voluntary. Additionally, assurances were obtained at negotiations all withdrawal requests with respect to slum sanitation schemes will be accompanied by a certification of compliance with the "Policy Guidelines" described.**

Environmental Aspects

3.46 The preparation of the Project included a comprehensive environmental assessment (EA) process embracing a variety of studies, public consultation and the development of environmental mitigation and monitoring plans. The methods and findings of the EA studies and the resulting environmental and monitoring plans are reported in some detail in Annex 11.

3.47 Additionally, there is an ongoing "Bombay Coastal Water Quality Study" financed by a Japanese grant and being conducted by the same organization (India's National Environmental Engineering Research Institute - NEERI) as conducted the EA.

Monitoring Indicators

3.48 The performance of WSSD and the project will be monitored by indicators as generally outlined in Annex 12. These will be valuable to WSSD in managing the Project and their operations. Additionally, there are the environmental mitigation and monitoring plans presented at the end of Annex 11. It is proposed that these be reported on by WSSD to the Bank at quarterly intervals as an element of the overall quarterly reporting (para 3.42).

Conditions for Negotiations and Effectiveness

3.49 **Conditions for Negotiations**. Prior to negotiations, the following documents were received by the Bank:

(a) Bid Evaluation Report on Bids received for the Worli and Bandra Outfalls; this document has been reviewed and found satisfactory by the Bank; a Bank "no objection" to a contract award was issued in a Bank FAX communication dated 12-May-95;

(b) MCGB FAX to the Bank dated 27-Apr-95 advising that tenders for the Bhandup and Ghatkopar lagoons had been invited, from pre-qualified bidders, on 10-Apr-95 and were due 10-Jun-95;

(c) Complete detailed engineering design and bid documents for civil works for the Bandra pumping station (received 22-May-95);

(d) MCGB FAXes of 02-May-95 and 17-May-95 which together advise that all of the Remedial Works Program is either completed (336 items) or under contract (ie contracts have been awarded and work orders issued - 28 items), excepting only the inlet hydraulics for the Lovegrove pumping station and ventilation systems for the Colaba, Lovegrove and Bhandup Pumping Stations;

(e) "As-negotiated" consulting services contract for "Status of Condition Survey of Sewage Conveyance System" for Bank approval (received 10-May-95);

(f) "As-negotiated" consulting services contract for "Studies and Training Services to Upgrade MCGB's Operation and Maintenance Practices for the Sewerage System in Bombay" for Bank approval (received 16-May-95);

(g) With MCGB's FAX to the Bank of 16-May-95, a copy of a GoM's 5-May-95 request to GoI's Ministry of Environment and Forests (MoEF) that receiving water quality standards, that are applicable to wastewater discharges to marine coastal waters, be reviewed with a view to establishing revised standards as a basis for planning the Stage II sewerage improvement works;

(h) GoI-MoEF's environmental clearances, with due reference to the Coastal Regulation Zone (CRZ) as follows:

(1) MoEF Environmental Clearance for Bandra and Worli Outfalls; 12-Jul-94
(2) MoEF memorandum re (1); 26-Jul-94
(3) MoEF modification to (1); 21-Sep-94
(4) MCGB FAX to Bank enclosing (1) (2) and (3); 29-Sep-94
(5) MoEF Environmental Clearance of Bandra Influent Pumping Station; 16-May-95
(6) MoEF Envir'l Clearance-Aerated Lagoons at Ghatkopar and Bhandup;16-May-95
(7) MCGB FAX to Bank encl. (5)&(6): no MCGB objection to conditions; 23-May-95

(i) Project **approval** by MCGB Corporation Resolution No 83 of 5-May-95 furnished to Bank with MCGB FAX of 9-May-95;

(j) Project **approval** by GoM dated 10-Aug-94 enclosed with MCGB FAXes of 02-May-95 (and 09-May-95) to the Bank which states that this approval followed a Cabinet decision; and

(k) Project **approval** by India's National Planning Commission enclosed as Annex C to MCGB's FAX to the Bank dated 18-May-95.

3.50 The conditions for negotiations were substantially fulfilled. However, with respect to the two consulting services contracts referred to in para 3.49(e) and 3.49(f) above, it was agreed that the signing of these contracts by MCGB would be made a **condition of effectiveness** (see para 3.51 below).

3.51 During negotiations, the following were agreed as conditions of **effectiveness**:

(a) signing of the contracts for the construction of the outfalls (paras 3.28);

(b) invite tenders for the works to improve the structural stability of five pumping stations (see para 3.08(f));

(c) the execution of a subsidiary loan agreement, satisfactory to the Bank, to reflect the contents of para 3.24.

(d) the signing of the two consultant contracts referred to in para 3.49(e) and (f) above; and

(e) the Bank's receipt of consultant recruitment documentation and program, satisfactory to the Bank, for consultants to undertake the supervision of construction (para 3.10).

IV THE IMPLEMENTING AGENCY

The Water Supply and Sewerage Department

4.01 MCGB, the beneficiary, established under the Bombay Municipal Corporation Act of 1888, is the largest Municipal Corporation in India. The council of elected representatives is responsible for the provision of all municipal services including water supply and sewerage. MCGB maintains considerable autonomy in relation to the provision of municipal services through amendments to the 1888 Act which have been effected by GoM legislation.

4.02 The implementing agency for the project, the Water Supply and Sewerage Department (WSSD) of MCGB, was established in 1973 by an official order of the Municipal Commissioner and is responsible to the MCGB Standing Committee for planning, development, operation and maintenance of the water supply and sewerage services. Prior to the establishment of WSSD, these services were administered by several committees and departments of MCGB.

Organization and Management

4.03 The Municipal Commissioner, appointed by GOM, is the principal officer of the Municipal Corporation of Greater Bombay (MCGB) and retains overall responsibility for WSSD. The Municipal Commissioner has traditionally been a senior civil servant from the Indian Administrative Service with wide experience in state and local administration. WSSD is organized into five separate sections (Annex 9) for management purposes, each headed by a Chief Engineer, each of whom is responsible to the Deputy Municipal Commissioner of Special Engineering or the Deputy Municipal Commissioner Engineering, as appropriate. The Finance and Administration section is headed by an Additional Municipal Chief Accountant (see Section V).

4.04 Project management of both the Second and Third Bombay Water Supply and Sewerage Projects was not satisfactory, particularly with regard to the sewerage components of the projects (see paras 2.15-2.17 and Annex 13). The establishment of a special project management unit (or "cell") under the Third Project, designed to improve planning and coordination in support of section heads of WSSD, did not prove to be highly successful. In 1991, following the Bank's request for the appointment of a more experienced and senior manager to take control of both the Third Bombay Water Supply Project and Sewerage Project, and works remaining unfinished from the Second Bombay Water Supply and Sewerage Project, the management responsibility was assigned to the Additional Municipal Commissioner, a senior civil servant and from the Indian Administrative Service. This arrangement continues and has resulted in a marked improvement in the overall management of WSSD.

Project Management and Organization

4.05 Despite this steady improvement in project implementation, a great deal of the back-log in construction and a large number of remedial works items from the Second Bombay Water Supply and Sewerage Project have been be completed. All of these items are now identified, quantified to the extent possible and form part of an agreed program, much of which has been implemented (Annex 1). However, a substantial and sustained effort will be necessary to achieve a completed and effective sewerage system to reliably serve the Greater Bombay area.

4.06 Given the level of consulting services support proposed and agreed (see paras 3.10 to 3.19) WSSD will be capable of implementing the project provided that an Additional Municipal Commissioner, or an officer with similar experience and seniority, remains in charge of project

management. Agreement was reached at negotiations that MCGB will maintain a Project Management Unit in WSSD for the management of the Project which is led, organized and staffed in a manner satisfactory to the Bank.
Additionally assurances were obtained that MCGB will: (i) designate a group of people having appropriate qualifications and experience individually in either technical matters or social science to manage the slum sanitation schemes; (ii) MCGB will designate at least one procurement officer in the PMU, of suitable qualifications and experience; and (iii) MCGB will designate at least one environmental officer, of suitable qualification, in the PMU to coordinate and supervise the actions described in para 4.07 below.

4.07 The management of the Project will include the implementation of the environmental mitigation and monitoring plan which is given at the end of Annex 11. As presented, much of the activity is variously assigned to the consulting engineers, to the consultant who conducted the EA (NEERI) or to the construction contractors by appropriate provisions in their contracts; however, some remaining activity is assigned directly to MCGB. Agreement was reached at negotiations that MCGB will implement the environmental mitigation and monitoring plans as presented in Annex 11. As indicated in these plans, MCGB will make appropriate provisions in contracts with consultants and contractors for the delegation of this responsibility subject to MCGB supervision and overall management.

Training

4.08 Training programs initiated under the Second and Third Water Supply and Sewerage Projects will continue during implementation of the proposed Project. The MCGB Training Establishment at Borivili under the direction of MCGB Civic Training Institute and Research Center, has annual training programs applicable to water supply and sewerage operations. Much of this work is based on reliable, state-of-the-art materials and manuals originating from British Water International.

4.09 An extensive training component is to be provided under the Project to upgrade the operation and maintenance levels of the entire sewerage system for Bombay (paras 3.11, 3.12 and Annex 2). This will include retraining operators and artisans in standard mechanical, electrical and electronic skills in addition to training in the use and operation of plant and equipment for the operation and maintenance of sewerage collection, conveyance and treatment systems.

4.10 The project will continue the support of overseas training of MCGB personnel to improve job skills and operation and management efficiency under the umbrella of the consulting services described in para 4.09. Training of MCGB officers at Indian training institutes will continue under the project. Such institutes include the Indian Institute of Technology, and the National Institute for Training in Industrial Engineering.

Insurance

4.11 At negotiations assurances were obtained that:

(a) materials and equipment for the project will be insured and that all other public utility risks will continue to be borne by internal insurance funds;

(b) existing separate fire/accident and third party insurance funds of WSSD in respect of other risks will be maintained by annual contributions by WSSD in accordance with principles

agreed for the Third Bombay Water Supply and Sewerage Project, which are acceptable to the Bank.

V FINANCIAL ASPECTS

Recent Financial Performance

5.01 MCGB's Water Supply and Sewerage Department (WSSD) became a separate accounting entity within MCGB in 1974. This was a condition of credit effectiveness of the First Bombay Water Supply and Sewerage Project (FY73). Separate funds and accounts were established for WSSD in 1975, and the Department began reporting its financial position and results of operations using commercial accounting principles in 1979. Throughout the Second (FY79) and Third (FY86) Bombay Water Supply and Sewerage Projects, WSSD's financial management and accounting and its compliance with financial performance and audit covenants has been very satisfactory. The financial performance covenant in all of these prior projects has been to require WSSD to contribute, as a minimum, a fixed proportion of the investments from surplus cash flows; this proportion in the First Project was 33% at the outset thence 40% which proportion has remained the covenanted requirement under the Second and Third Projects. During the last fifteen years, water and sewerage investments accounted for over 50% of MCGB's total investment program.

5.02 Annex 10 presents a summary of historic and projected future financial statements for WSSD. Included are statements of income and expenditure, sources and application of funds, and balance sheets and the current tariff structure for WSSD. Tables IV and V in Annex 10 provide detailed statements on revenues and expenditures.

5.03 Over the past 5 years WSSD financial position has been good. WSSD's earnings performance for the last four fiscal years is summarized in the following table. It can be noted that, overall, both the return on fixed assets and total assets have improved and are at a very satisfactory level.

	1991/92 (actual)	%	1992/93 (actual)	%	1993/94 (actual)	%	1994/95 (budgeted)	%
Operating Rev.(Accrual)	2533.4	100	2588.7	100	3931.4	100	4754.0	100
Operating Rev.(Cash)	1900.0	75	1941.5	75	2948.5	75	3565.5	75
Operating Expenses	1294.2	51	1653.9	64	2045.3	52	2078.1	44
Depreciation	225.0	9	235.1	9	258.5	7	349.8	9
Operating Surplus (Cash)	380.9	15	52.5	2	644.7	16	1137.6	49
Return-Net Fixed Assets*	6.11%		0.70%		7.66%		11.30%	

* Returns are calculated based on cash income after depreciation and before interest
% Percentage of Operating Revenue

5.04 Liquidity. The liquidity position of WSSD has been consistently good over the past five years. Its current ratio has been good ranging from 2.7 to 3.1 during the last four years. Increases in the cash position occurred mainly because WSSD's investment program proceeded more slowly than anticipated. A high level of receivables is mainly due to old, disputed billings. However, WSSD's collection rate and efficiency has improved over the last two fiscal years from 72.1%% in FY92 to 75.4% of billings in FY94.

5.05 Covenant under Third Bombay Water Supply Project. Under the Third Project WSSD has been able to maintain tariffs at levels sufficient to generate annual cash surpluses to cover at least 40% of its capital expenditures and debt service in any given year. This financial target has been achieved for the past five years with tariff increases on April 1, 1993 and on April 1, 1994. In addition, WSSD has been able to successfully establish and annually contribute to a specific cash account which was used for the replacement and rehabilitation of capital assets. Finally, WSSD annually reviewed and updated the Operational Action Plan in manner satisfactory to the Bank.

Tariff Analysis

5.06 The following table shows the tariff structure for FY88 through FY95 and the percentages of WSSD's revenues from water and sewerage charges, water and sewerage taxes and water and sewerage benefit taxes for FY94.

WATER AND SEWERAGE TARIFFS Rs per 10,000 liters	FY88-FY93 Water	FY88-FY93 Sewerage	FY94 Water	FY94 Sewerage	FY95 Water	FY95 Sewerage	FY94 Water	FY94 Sewerage
							(% of Revenue Yield) *	
Charges (metered)								
Domestic	3.00	50% of Water	5.00	50% of Water	6.00	50% of Water	6.23	2.29
Non-Domestic	30-60	50% of Water	45-230	50% of Water	45-230	50% of Water	32.71	14.91
Compound Charges*	8-40	50% of Water	10-80	50% of Water	100-150	50% of Water	2.53**	5.74**
Taxes (unmetered)								
Domestic	9% of RV	5% of RV	20% of RV	10% of RV	26% of RV	13% of RV	1.19	2.12
Non-Domestic	15% of RV	15% of RV	45% of RV	15% of RV	55% of RV	20% of RV	3.10	2.82
Benefit Tax								
Domestic	6% of RV	6% of RV	10% of RV	6% of RV	10% of RV	6% of RV	5.51	3.30
Non-Domestic	10% of RV	6% of RV	20% of RV	12% of RV	20% of RV	12% of RV	10.98	6.57
TOTAL							59.72	32.01

RV: Rateable value of property

* Lumpsum

** Includes other general revenues

5.07 WSSD has a graduated tariff structure. Charges are levied for metered supply and taxes on unmetered supply. The sewerage charges are 50% of water charges. In addition to water and sewerage charges/or taxes, a water benefit tax and sewerage benefit tax is charged based on the annual rental value (or rateable value-RV) of the property. For water bills, the domestic sector currently pays 10% of the RV whereas the industrial sector pays 20% of the RV. For sewerage tariffs/charges, the domestic sector currently pays 6% of the RV whereas the industrial sector pays 12% of the RV. The compound water charge is levied on those consumers whose consumption cannot be metered and is based on a lump sum basis and the type of industry. Unmetered supplies are paid through a water and sewerage tax based on the rateable/rental value of the property. A sewerage tax can also be levied on properties which are unsewered but have metered water supply. This tax was introduced in FY75 and was used to finance some of the capital expenditures of MCGB. In cases where supply is metered but meters are out of order, consumption is calculated based on the corresponding period of the previous year. For FY93, charges to both domestic and industrial consumers increased by 50% whereas in FY94, 20% tariff increases were mainly in the domestic sector. There are no charges for water supplied to the urban poor through public standposts. Due to the high commercial rates for water and sewerage which users have been willing to pay, overall water and sewerage revenues have been fully sufficient to support operations, maintenance and a significant portion of new investments.

5.08 Industrial and commercial consumers are currently paying approximately 8 to 40 times more to those charges to the domestic sector depending on the type of industry. Through cross-subsidy tariff rates, industrial sector generates approximately 75% of WSSD's total revenues. MCGB meets all of industrial water demand but only approximately 55% of domestic demand (Annex 10-Table VI). Some 60% of WSSD revenues are from metered supply. The tariff increase of approximately 30-35% for all categories in April 1, 1993 and the additional supply of water of 90 mld from the Third Bombay Water and Sewerage Project led to a 50% increase in WSSD's revenues during that FY94. The second tariff increase of only 20% for the domestic sector on April 1, 1994 led to another increase in WSSD's revenues of 20% during FY95. Despite these increases, the level of domestic tariff are quite low compared to other metropolitan cities in India. Even for a relatively affluent domestic consumer, the bill would not exceed about Rs. 35 per month. A Rs. 25-30 monthly bill would be approximately 2% of an average family income, suggesting that higher domestic tariffs would still be affordable. Also subsidizing the domestic sector excessively does not promote water conservation. Accordingly the Bank will continue to encourage MCGB to review and revise its domestic tariff levels.

Customer Receivables

5.09 Under the Project agreement for the Third Bombay Water Supply and Sewerage Project, the audit report notes that WSSD is obligated to reduce its customer accounts receivables to no more than 20% of billings. The aging classification of the receivables as of March 31, 1994 is as follows:

	Rupees million	(% of total)
Less than one year	Rs 872.0	37.8%
More than one year-less than two years	Rs 218.3	9.5%
More that two years-less than three years	Rs 222.0	9.6%
More than three years	Rs 995.9	43.1%
Total	Rs 2308.2	100.0%

5.10 A major accumulation of arrears has been a problem for a long time. Some 43% of customer receivables are more than three years overdue. These arrears are from Central and State Governments: Rs 177 million (some going back to 1950) and the Bombay Textile Mills: Rs 122 million (accumulated from 1965). WSSD is reluctant to write off any of the larger arrears as it does not want to prejudice long standing litigation. The 20% target has proven to be unrealistic given the timing of billing and collection on a quarterly basis. One underlying problem is the lack of established policies and procedures for writing-off doubtful old disputed accounts, rather than with poor collections of billing in the year that they are due. In fact, WSSD collection efficiency has improved for the first two categories. The objection to not writing off doubtful accounts is that it could overstate WSSD's net income in any given year, and as the doubtful accounts have accumulated, it is beginning to overstate the WSSD's liquidity position. The Bank will work with WSSD in developing and implementing a reasonable write-off policy for doubtful or disputed accounts without jeopardizing the litigation on individual overdue accounts.

5.11 Billing and Collection. WSSD billings are prepared by the data processing unit of MCGB; the system is well controlled and operated. Under the Third Bombay Water Supply and Sewerage Project, technical assistance was provided to develop computer programs to automatically produce monthly delinquency reports, and to automatically print reminder letters to customers whose bills are

over 30 days in arrears. This has proven to be effective as the collection rate of WSSD has improved considerably over the last two fiscal years from 72.1%% in FY92 to 75.4% of billings in FY94. While this compares favorably to other water utilities in India, there is clearly much room for further improvement.

Accounts and Audit

5.12 The accounts of WSSD are well designed and prepared and are audited annually by the Municipal Chief Auditor of MCGB. His report is prepared and submitted to the MCGB, and forwarded to the Bank normally within six months of the fiscal year end. Under the Third Bombay Water Supply and Sewerage Project, this covenant has been consistently met. In recent years the reports have been completed and have addressed important financial and operational issues and have appeared to be both independent and reliable. Agreement was reached at negotiations that the report of the Municipal Chief Auditor on WSSD accounts will continue to be furnished to the Bank within six months of the end of WSSD's fiscal year (see also para 3.35).

5.13 The Office of the Municipal Chief Auditor is a large operation within MCGB staffed with more than 500 people. The work and the reports of the office has been commendable as the audit programs and procedures have been formally reviewed and updated. MCGB has expanded it use of computers in maintaining financial records, and advances have been made in the auditing field as a result of a technical assistance component in the Third Bombay Water Supply and Sewerage Project. The TA component under the Third Project also included the design and documentation of policies and procedures for the preparation and review and maintenance of audit workpapers; this has been implemented well.

Future Financial Performance

5.14 Financial indicators for FY92 to FY95, set out in the table below and are based on Financial Statements given in Annex 10 which also gives the assumptions made in preparing the projections.

Financial Indicators	1991-92 Actual	1992-93 Actual	1993-94 Actual	1994-95 Budgeted
Operating Ratio	1.67	1.37	1.71	1.96
Return on Net Fixed Assets (%)	16.27	9.89	19.33	23.10
Return on Total Assets (%)	6.12	3.99	8.49	10.28
Curent Ratio	2.66	2.50	2.60	3.05
Quick Ratio	2.55	2.40	2.44	2.76
Average age of customer receivables (months)	7.99	9.84	7.05	5.78
Return on Sales(%)	39.25	26.38	40.65	48.29
Debt Equity Ratio	0.25	0.25	0.25	0.26
% Increase in Revenues from Previous Year	8.91	2.18	51.87	20.92
% Increase in Expenditure from Previous Year	26.05	27.79	23.67	1.61

Explanation:
Operating Ratio: Operating Revenues/(Operating Cost + Depreciation)
Return on Net Fixed Assets: Income after Depreciation *100/Net Fixed Assets
Return on Total Assets: Income after Depreciation *100/Total Assets
Current ratio: Current Assets/Current Liabilities
Quick ratio: (Current Assets less inventories)/current liabilities
Average age of customer receivables (months): Recievables/(Sales/12)
Return on Sales(%): After tax profit/Sales
Debt Equity Ratio: Debt/(Debt + Equity). Debt includes all long term Loans from IDA, GOM and others. Equity includes Capital and all Reserves.

5.15 In general, the past financial performance by WSSD has been good with high returns on net fixed assets increasing from 16.27% in FY92 to 23.10% in FY95 which is high compared to other public water utilities in India. WSSD has consistently generated an operating surplus over the past four fiscal years. During this time it has had an operating ratio between 1.5-2.0 leaving sufficient cash to finance capital works. Debt/equity, liquidity, and profitability ratios have also improved during this period. The same pattern is expected to continue during FY95-FY2000 with effective tariff increases of about 4.7% in FY98, 33.8% in FY99, and 12.2% in FY2000 to bring average incremental revenues in line with costs. With this, MCGB would be able to meet the targeted internal cash generation of 35% of its investments.

5.16. Internal Cash Generation. The projected financial performance of WSSD is predicated upon WSSD's continuing to satisfy the kind of cash generation covenant used in the First, Second, and Third Projects. Agreement was reached during negotiations that MCGB will revise tariffs as required to ensure that internally-generated funds are sufficient to cover at least 35% of its capital expenditures in any year. Also, to minimize the effects of any project implementation delays on the effectiveness of this covenant, agreement was also reached that cash generation percentages in any year would apply to either actual annual capital expenditures, or to a stipulated plan of annual expenditures, whichever is greater. The stipulated plan of annual expenditures corresponds to the seven and a half year implementation schedule for the project.

5.17 Management of Cash Surpluses. Increasingly, MCGB's WSSD is faced with the need to plan, finance and execute the replacement and/or rehabilitation of physical assets. WSSD will be generating a significant and necessary cash surplus during the implementation of this Project and thereafter. However, this surplus will be needed and should be used to implement a planned program of replacement and/or rehabilitation of physical assets. To aid a systematic allocation of funds for this purpose (as was done in the Third Bombay Water Supply and Sewerage Project) and their prudent use, agreement was reached at negotiations that WSSD will maintain a specific cash account to cover the planned annual costs of asset replacement and/or rehabilitation and that annual operating surpluses (after meeting 35% of the capital expenditure and allowing for sufficient unrestricted cash to maintain a quick ratio of not more than 2) will be deposited in this account.

VI PROJECT JUSTIFICATION

Project Benefits

6.01 The potential health and environmental benefits of improving the disposal of more than 60% of the sewage from the Greater Bombay area are considered substantial even though they are not readily quantifiable - particularly in economic terms. Under this "First Stage" of development some partially treated sewage from two drainage areas will be discharged into the Arabian Sea at a distance of three kilometers from the shore line. Sewage from two other drainage areas will receive the equivalent of primary treatment before being discharged to tidal creeks.

6.02 Although not ideal, this level of sewage treatment and disposal will be a significant improvement over the present situation in which sewage is discharged to the shoreline and to surface water drains and channels within the heavily populated urban area. Furthermore, under the project a time based program will be established leading to a Second Stage Program of sewage treatment and disposal facilities in order to upgrade the quality of receiving waters to higher standards.

6.03 The provision of sewage treatment and disposal facilities under this Project will enable the very extensive collection and conveyance systems, which have been constructed under the Second and Third Bombay Water Supply and Sewerage Projects, to be effectively utilized.

6.04 The slum sanitation component will alleviate the harsh living conditions of some one million slum dwellers, mainly those occupying municipally-owned lands, by providing improved sanitation facilities - mainly for safe excreta disposal. The implementation of this component will involve beneficiary consultation as to the details of the facilities to be provided and participation in the physical implementation and subsequent operations.

6.05 The direct physical benefits of the Project will come from removing domestic sewage and industrial wastes from the inner city's natural water courses, surface water drains, shore line and beaches thus improving the living conditions of the urban population living in close proximity to the many "open sewers' which at present exist. This will reduce health risks as well as improve the city's visual and aesthetic environment.

Rate of Return

6.06 No attempt has been made to estimate an economic rate of return for the Project. The impacts on public health and the environment, which will result from the proposed improvements, cannot readily be quantified in economic terms.

Least Cost Solution

6.07 In 1970, Messrs. Binnie and Partners Ltd., (UK), Consulting Engineers studied and reported on the development of the sewerage system for Bombay in conjunction with a water supply study which was implemented at the same time. The recommendations contained in this report were supplemented by a subsequent sewage disposal plan, prepared by the same engineers. Although this plan was not implemented as presented, it formed the basis for a further study and report by Messrs. Metcalf and Eddy Inc. (USA), in association with Engineering Consultants (India), which is the conceptual foundation for the proposed project. The works recommended in Metcalf & Eddy report, for the treatment and disposal of sewage, represent least cost solutions based on the comparison of alternatives by present worth. Although these recommendations were prepared some fifteen years

ago, they remain valid in terms of delineating catchment areas and selecting and locating the major components of the system. These original recommendations, their staged development and variations from the initial recommendations are described in Annex 2.

6.08 To ensure that the Second Stage Program (which will be prepared under the proposed project) represents optimal choices, the alternatives of extending the aerated lagoons at Ghatkopar, Bhandup and Versova, selecting sewage treatment and disposal alternatives for the Malad service area, increasing the length of the Worli and Bandra outfalls and/or providing higher levels of treatment will all be studied under the technical assistance component of this project (paras 3.15 and Annex 5).

Environmental Impact

6.09 The environmental assessment (EA) for the project was undertaken by National Environmental Engineering Research Institute (NEERI); it began in 1991 and was initially designed to meet the requirements of GOI Environment (Protection) Act of 1986 and World Bank OD 4.00 Annex A, Environmental Assessment. The EA procedures were modified during the course of the studies to conform to OD 4.01 when it superseded OD 4.00 Annex A, and OD 17.50 Disclosure of Operational Information.

6.10 The primary objectives of the EA were: (a) to ascertain if the facilities proposed for the First Stage Program would be adequate to provide the desired environmental benefits; (b) if inadequacies were identified, to examine alternatives that would achieve the desired benefits; and (c) to develop a Mitigation Plan to address potential adverse impacts of construction and operation. Because of the extensive field investigations and hydrologic and water quality modelling required, the EA work was undertaken in three segments -- marine outfalls, aerated lagoons at Malad and Versova, and aerated lagoons at Bhandup and Ghatkopar -- and the results were compiled in separate reports. EA findings and Mitigation and Monitoring Plans are summarized in Annex 11.

6.11 For the marine outfalls, the EA concludes that the most prominent environmental impact will be a considerable improvement in physicochemical quality of coastal waters, including elimination of the dissolved oxygen depletion that presently occurs during low tide near the coast at Mahim. This will improve the ecological health of near-shore waters in the region and contribute toward elimination of nuisance odors, amelioration of aesthetic conditions at recreational beaches, and enhancement of beneficial water uses. No significant impairment of marine water quality or marine biota is predicted in the vicinity of the outfall discharge, and positive impacts on fisheries are possible in the coastal region. While the pipeline option also considered for the outfalls would have caused some seabed disturbance and local water quality impacts during construction, the tunnel option will not. Those construction-related impacts that could be significant, including vibration from blasting, noise from equipment operation and materials hauling , and pollution from spoil disposal, can be effectively mitigated. In contrast, under the "no action" alternative further deterioration of conditions at beaches and of already poor coastal water quality is unavoidable. At negotiations, agreement was reached that MCGB will implement the mitigation and monitoring plans recommended in the environmental assessments for the Worli and Bandra outfalls and the lagoons.

6.12 The EA predicts that the 3-km outfalls will not result in consistent compliance with the bacterial standard (< 1,000 total coliform per 100 ml at 1 km from the shoreline at all times) set by Maharashtra Pollution Control Board. The EA pointed out the need for a more sophisticated and extensive mathematical model to complete an analysis of conditions with longer outfalls, and necessary data collection and model development has begun under the Bombay Coastal Water Quality

Study (see para 3.17 and Annex 2). Also stated in the EA, however, is the fact that the GoI bacterial standard is unnecessarily stringent when compared to EEC and US standards.

6.13 Application of the EEC standard, for example, could reduce the length of outfall ultimately required to maintain bathing water quality at internationally-accepted levels. In recognition of these circumstances, the MPCB "consent to discharge" and the GoI environmental clearance for the outfalls approve their construction to 3-km in this project. However, the need for revised standards which would apply to the Second Stage Program has been acknowledged. The designs for the 3-km outfalls conveniently permit their eventual extension. As a condition for Loan negotiations, GoM requested the Ministry of Environment and Forests, GoI, to review water quality standards that are applicable to the discharge of wastewater to marine coastal waters, with a view to establishing revised standards. In addition, in order that the revised standards are available as basis for the Second Stage Program, at negotiations, GoI agreement was reached at negotiations that, by June 1997, the revised water quality standards, applicable to the discharge of wastewater to marine coastal waters, will be established.

6.14 On the basis of a mathematical water quality model NEERI developed for Malad Creek, the EA concluded that while the planned aerated lagoon at Malad would reduce pollution loading and would comply with the effluent standards in the MPCB consent to discharge, it would not materially improve water quality in the upper reaches of the creek. A range of alternatives was therefore evaluated, including advanced secondary treatment, but the model showed that due to the limited freshwater flow and incomplete tidal flushing, none of them would change conditions in the creek to the extent that it could support even a limited fish population. On the other hand, Versova is nearer the mouth of Malad Creek, where tidal flushing is more thorough. The model shows that an aerated lagoon at Versova will provide more significant water quality improvement, but not for the full amount of wastewater projected for its service area.

6.15 MCGB therefore plans to complete the treatment works currently under construction at Versova, with the present funding from Bombay Urban Development Project and Third Bombay Water Supply and Sewerage Project. MCGB has eliminated the Malad lagoon altogether, since it is not significantly superior to the "no action" alternative. Instead, MCGB has expanded the Bombay Coastal Water Quality Study (para 3.17) to include consideration of alternatives for wastewater management up to the year 2015 in both the Malad and Versova service areas.

6.16 Mathematical model results included in the EA for the proposed aerated lagoons at Bhandup and Ghatkopar show a more favorable situation because Thane Creek, the receiving water body, is larger, more completely flushed during the tidal cycle, and not already as badly degraded as Malad Creek. The construction of single-cell lagoons at these locations as planned in this project will arrest the further deterioration in creek water quality projected under the "no action" alternative. An analysis of alternatives for the Second Stage Program showed that the one currently proposed, expansion to three-cell lagoons, will provide a level of pollution control sufficient to sustain viable aquatic plant and animal communities in the creek until wastewater flows exceed the levels projected for 2005. The EA recommends that flows beyond the 2005 volume be treated and discharged at another location, because the model shows that while Thane Creek as a whole can accommodate additional organic pollutant loading, there will be insufficient additional assimilative capacity at Bhandup and Ghatkopar. The results of these actions, in terms of water quality improvement, will not be fully realized, however, unless other communities that discharge wastewater to Thane Creek construct comparable treatment works. They are communities outside the jurisdiction of MCGB, and the EA therefore recommends that GOM develop and implement a comprehensive water quality management plan for Thane Creek.

6.17 The lagoon sites are in sparsely populated areas, so that impacts of operation on the surrounding communities -- noise and odor, for instance -- will not be significant. The normal construction-related impacts of the proposed lagoons, such as noise and dust, can be mitigated effectively. However, the construction of the two lagoons will entail the unavoidable loss of approximately 40 ha of mangrove, roughly 5% of the total mangrove cover of the inner Thane Creek. On the basis of EA recommendations, MoEF in its environmental clearance for the construction of these lagoons, requires MCGB to carry out "**compensatory mangrove planting for double the area of mangroves disturbed shall be taken up and implemented immediately. Planning activities should be initiated immediately for planting at least 200 ha of mangroves. All the remaining mangrove areas on both sides of Thane Creek and its inlets should be protected and declared as CRZ-I at least up to the limit of 50m on the landward side from the edge of the mangroves.**"

6.18 Public information and consultation began in the early stages of the outfall EA with surveys of the most directly affected groups -- beach users and fishing communities. After the EA findings became known, and in connection with the GOI environmental clearance process, MCGB and its design and EA consultants conducted meetings with the Corporators (the representatives of MCGB political subdivisions) and with a group of environmental and community-based NGOs. MCGB also prepared an information brochure on the outfalls in English and Marathi, advertised its availability in newspapers, and distributed it to interested persons through the ward offices. The brochure has elicited a large volume of written comments, nearly all favorable. A similar brochure is to be published on the Bhandup and Ghatkopar Lagoons. MCGB staff and consultants have begun a program of public meetings in affected communities, the first of which was held in Bandra. MCGB has also contracted with a local university to conduct more detailed consultation with fishing communities. The EAs for the outfalls and lagoons have been made locally available to the public.

6.19 MCGB's wish to include Slum Sanitation schemes in the project [para 3.08(e)], to be implemented with assistance from NGOs and specialized consultants, was a direct outcome of the consultation with the Corporators and local NGOs. At the meeting with NGOs, MCGB also agreed to form a watchdog committee of citizens to provide oversight and advice during project implementation.

Resettlement and Rehabilitation

6.20 The EA found that there are no resettlement or rehabilitation requirements for the sewerage works proposed under the Project. In the Slum Sanitation Schemes, implementation will proceed in those slums where it is determined that no involuntary resettlement is required for implementation (see Policy Guidelines for Implementation in Annex 14).

Project Risks

6.21 The limited capabilities of MCGB engineers to undertake large and specialized sewerage works of this nature increases the project risks. However, these risks would be mitigated by support from experienced consultants (paras 3.10 and 3.25). The aerated lagoons largely involve the placement and compaction of selected materials to form water retaining embankments and the construction of sand drains. These works require careful site supervision to attain the required levels of quality and a high level of on-site management to avoid delays.

6.22 The ocean outfalls present higher risks. Tunneling under the sea bed has fewer risks than constructing a pipeline on the surface of the sea bed, which is subject to weather and sea conditions. However, tunnel-boring carries the risk of unforeseen water inflows although boring techniques have

been developed to minimize the risk and effect of such water inflows. Moreover, the inherent uncertainties with this kind of work, and the risk-sharing principles adopted in the contracts (for cost-containment and efficiency reasons) for this work, do bring a risk of cost overruns.

6.23 Measures have been taken to contain the construction risks by ensuring that, prior to appraisal: (a) suitable contractors are pre-qualified under stringent criteria; (b) engineering designs are compatible with proven construction practices; (c) qualified consultants prepare the designs and supervise construction, having been delegated acceptable levels of responsibility; and (d) designs have been reviewed by qualified and experienced independent panels of experts, and their suggestions reflected in the final designs.

6.24 To reduce the risk of cost over-runs, and any consequent delays in project implementation, physical contingencies of 25% have been allowed for all civil, mechanical and electrical works, based on the rationale that for the Worli and Bandra marine outfalls and the facilities to control siltation in the Ghatkopar influent tunnel, there are inherent uncertainties associated with tunnel construction. In the case of the aerated lagoons at Ghatkopar and Bhandup there is uncertainty in the location of borrow areas that would yield sufficient laterite for embankment construction. In the case of Bandra pumping station, the magnitude and complexity of work and the preliminary status of preparation warrants a higher than average level of contingency.

6.25 Similarly, because of the programmatic nature of the slum sanitation component, and the preliminary status of preparation of the pumping station structural improvements and the conveyance system improvements, higher than average physical contingencies are justified. Physical contingencies of 10% have been included for all technical assistance, studies, site investigations and engineering required for the Second Stage Program.

VII AGREEMENTS REACHED AND RECOMMENDATIONS

7.01 The following agreements were reached during negotiations:

(a) MCGB will implement the whole of the remedial works in accordance with the agreed program (para 2.17 and Annex 1 paras 12 to 16);

(b) MCGB will carry out slum sanitation schemes in accordance with the "Policy Guidelines for Slum Sanitation Schemes" (para 3.08(e) and Annex 14).

(c) GoM will onlend the proceeds of the Loan and the Credit to MCGB for the capital expenditures under the Project, for a 25 year term, including a 5 year grace period, at an interest rate of 13% (para 3.24);

(d) accounts and audit reports thereon, audited by auditors acceptable to the Bank, will be furnished to the Bank within 6 months of the end of each fiscal year: (i) for the Special Account by GoI (para 3.36); (ii) for all SoE withdrawal claims by MCGB (para 3.35); and (iii) for WSSD's entity accounts (para 5.12);

(e) MCGB will maintain, in its WSSD, a Project Management Unit (PMU) organized an staffed in a manner satisfactory to the Bank (para 4.06);

(f) MCGB will implement the environmental monitoring and mitigation plan (paras 4.07, 6.11 and Annex 11);

(g) MCGB will adequately insure materials and equipment used in the Project and cause WSSD to maintain its existing separate Fire/Accident and Third Party Insurance (para. 4.11);

(h) MCGB will generate internally the funds to cover at least 35% of its capital expenditures in any year and that cash generation percentages in any year would apply to either actual annual capital expenditures, or to a stipulated plan of annual expenditures, whichever is greater (para 5.16);

(i) MCGB's WSSD will maintain a specific cash account to cover the planned annual costs of asset replacement and/or rehabilitation and maintain annual operating surpluses (after meeting 35% of the capital expenditure) for this purpose (para 5.17);

(j) by June 1997, GOI will establish revised water quality standards, applicable to the discharge of wastewater to marine coastal waters (para 6.13).

7.02 At negotiations, assurances were obtained that:

(a) within the PMU, MCGB will designate at least one environmental officer, of suitable qualification, to coordinate and supervise the implementation of the environmental mitigation and monitoring plans, including those aspect of such plans which are reflected in the provisions of Project contracts with consultants and contractors (para 4.07);

(b) MCGB will appoint by contracts acceptable to the Bank, international consultants acceptable to the Bank to supervise construction of the Worli and Bandra outfalls, Bandra pumping station, facilities to control siltation in the Ghatkopar influent tunnel and will appoint consultants acceptable to the Bank to supervise construction of the Ghatkopar and Bhandup lagoons, the low cost sanitation component, structural improvements in five pumping stations and conveyance system improvements (para 3.25);

(c) MCGB will furnish promptly to the Bank at the end of each quarter, a project progress report with a format and content decided in consultation with the Bank (para 3.42 and Annex 8 para 3);

7.03 The following will be conditions of effectiveness:

(a) issuing a letter of acceptance to the successful bidder on the contracts for the construction of the outfalls (see para 3.28 and 3.51);

(b) inviting tenders for the works to improve the structural stability of five pumping stations (see paras 3.08(f) and 3.51);

(c) the execution of a subsidiary loan agreement between GoM and MCGB, satisfactory to the Bank, to reflect the contents of paras 3.24 and 3.51);

(d) the signing of the two consultant contracts referred to in para 3.49(e) and (f) above; and

(e) the Bank's receipt of consultant recruitment documentation and program, satisfactory to the Bank, for consultants to undertake the supervision of construction (para 3.10). (d)

Recommendation

7.05 Subject to the above conditions and assurances, the proposed project would be suitable basis for an IBRD Loan to India of US$167.0 million equivalent for 20 years, including five years of grace, at the standard variable interest rate, and an IDA Credit of SDR 15.9 million (equivalent to US$25.0 million) on standard terms with 35 years maturity.

7.06 Retroactive financing of up to SDR 7.6 million, for the advance payments due on the submarine tunnel outfall contracts (made after June 15, 1995), has been requested and is recommended.

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

EXISTING WATER SUPPLY AND SEWERAGE FACILITIES

Water Supply

1. Bombay's first piped water system was constructed in the mid-19th century to serve commercial and residential areas in the southern portion of Bombay island near the harbor and the Fort. Subsequent rapid development of industry and commerce in a northerly direction was accompanied by development of land reclaimed from the sea to form the Greater Bombay area (440 sq km).

2. Vihar Lake was Bombay's first source of water and was brought into use in 1860 to provide a 24-hour supply for an 8-year period until water demands exceeded the yield of the source. The Tulsi reservoir was then developed in 1879 and the Tansa reservoir in 1883, the first of the more distant sources of water located on the mainland. In 1944, further shortages of water prompted the Vaitarna reservoir project which was completed in 1957. However, a further increase in water demand, which resulted partly from the extension of the Corporation's boundaries in that year, led to the development of the Upper Vaitarna project and to the Ulhas river intake which were completed in 1965 and 1967 respectively.

3. The construction of a dam across the Bhatsai River provided the next water increment for Bombay, amounting to 1,365 Mld developed in three stages of 455 Mld. These three stages of development provided water for the Bank-assisted First (FY73), Second (FY79) and Third (FY86) Bombay Water Supply and Sewerage Projects. The present total average yield of all of the water sources for Bombay is about 2,475 Mld (544 MIGD) On completion of the Third Bombay Water Supply and Sewerage Project (estimated to be in 1996) the yield will increase to about 2,930 Mld (644 MIGD). Feasibility studies on additional water sources of water for Bombay are now in progress.

4. Despite continued efforts to develop water supply systems to keep pace with rapid urban expansion in the Bombay urban area the supply still falls short of the current water demand. On completion of the Third Project, an estimated deficit of about 20% to 25% will mean that the undesirable practice of restricting the supply of water on an area by area basis, to a few hours a day, would continue. Almost all (about 95%) of the water supplied to the urban area (est. 2,930 Mld in the year 1996), in addition to infiltration water, is returned as wastewater (sewage) to the sewage conveyance system for treatment and disposal.

History of the Sewerage System

5. Sewerage facilities within the city of Bombay date back to the 1860's following the inauguration of the Vihar lake as the first piped water system to serve Bombay. An outfall at Worli, to discharge sewage to the Arabian sea (above low water level) was completed in 1880. Sewerage facilities in the City continued to expand, and by 1900 all wastewater was conveyed to Lovegrove where it was pumped to the sea through the Worli outfall. By 1905 the basis of the present sewage collection, treatment and disposal system within the City had been established. Subsequent demands were met by the duplication of sewers, provision of overflows to relieve surcharging in developing

areas, the construction of additional facilities at Lovegrove, and the construction of new treatment facilities.

6. By 1950, the rapid increase in population of the City rendered many of the sewerage facilities completely inadequate. The Municipal Corporation boundary was extended in 1950 and again in 1957 to its present location. Sewerage facilities within the suburbs and extended suburbs were very limited during this period and, although some minor improvements were carried out, the collection, treatment and disposal facilities continued to be completely inadequate to deal with the increasing quantities of sewage.

7. Various studies of the sewerage needs to serve Bombay were undertaken during the period to 1979 when a Master Plan Report was prepared by Metcalf and Eddy Inc. (USA), Consulting Engineers, in association with Environmental Engineering Consultants (India). This report provides the basis for the collection, treatment and disposal of sewage from the Greater Bombay Metropolitan area to the year 2005. The First Stage of this Development Plan has been the basis for the Second and Third Bombay Water Supply and Sewerage Projects and is the basis for this proposed Bombay Sewage Disposal Project (BSDP). This prior experience of the Bank has had some seriously unsatisfactory aspects. "Lessons Learned and their Application" is in Annex 13.

The Sewerage Development Plan

8. The objectives of the Development Plan were to: (a) provide sewage collection, treatment and disposal facilities through the year 2005 that would achieve and maintain satisfactory levels of public health and environmental quality at least cost; (b) provide for the maximum utilization of the self-treatment capacities of the receiving waters and hence require the minimum investment in treatment and disposal; (c) outline further environmental or related studies required for the development of a long-range environmental quality improvement program.

Treatment and Disposal Facilities Under the Plan

9. Under the Plan, the greater Bombay area is divided into seven drainage areas, each of which has its own sewage treatment and disposal facilities; those to be provided under the First Stage of the Plan, and the status of these works, are summarized on the next page.

10. Additional sewage treatment facilities that were originally planned for the Malad drainage area (No 5 on the next page) included preliminary treatment (for the removal of grit and screenings) aerated lagoons and a 2.3 km force main to convey sewage from the pumping station to the aerated lagoons. However, studies of the projected quality of the receiving waters in Malad creek, carried out as part of the environmental assessment for the proposed BSDP (Annex 10), indicated that the creek would have insufficient assimilative capacity to receive the Malad creek effluent. The provision of treatment and disposal facilities for the Malad service area has, therefore, been deferred to the Second Stage Program (Annex 4) and the replanning and design of these facilities is included in the proposed project.

The Conveyance System

11. Parts of the sewage conveyance system have yet to be completed. Mostly, these comprise short lengths of trunk sewers and interceptors which are scattered throughout the system. Their

completion has been delayed by conflicting developments of road, rail and other services. Completion of these links in the system is programmed for mid-1996.

DRAINAGE AREA - DESCRIPTION OF FACILITIES	STATUS AS AT DECEMBER 1994
1 Colaba. Influent pumping station, bar screens, aerated grit chambers and 1.2 km long outfall for disposal of effluent to Bombay harbor (30).	Completed and in operation since 1988.
2 Worli. Influent pumping station, bar screens aerated grit chambers and a 3 km long outfall for disposal of effluent to the Arabian Sea (760).	All facilities completed except the outfall, of which about 500 meters constructed and brought into use in 1990.
3 Bandra. Influent and effluent pumping stations, bar screens, aerated grit chambers and a 3 km long outfall for disposal of effluent to the Arabian Sea (796). A 9 km tunnel to collect sewage from the Mahim area and convey it to the Bandra influent pumping station.	The effluent pumping station has been completed. All other works are included in the proposed project. (The influent pumping station is now being redesigned; a small part of the outfall, about 200 meters, was constructed in 1990; remedial works are required for the tunnel).
4 Versova. Influent pumping station, bar screens, aerated grit chambers and aerated lagoons (140). A 3 km force main to convey sewage from the pumping station to the aerated lagoons.	The pumping station has been completed; the remaining works are under construction and scheduled for completion by mid-1996.
5 Malad. Influent pumping station (280), bar screens, aerated grit chambers (see para 10 above planning/design under this proposed BSDP).	These works completed but see para 10 above.
6 Ghatkopar. Influent pumping station, bar screens, aerated grit chambers and aerated lagoons (386). A 2.4 km long tunnel to convey sewage from the southern portion of Chembur zone to the Ghatkopar pumping station. A 1.0 km long force main to convey sewage from the pumping station to the aerated lagoons.	The pumping station is scheduled for completion by mid-1996; the aerated lagoons, remedial works on the existing tunnel and design and construction of an additional tunnel are included in this proposed project.
7 Bhandup. Influent pumping station, bar screens, aerated grit chambers and aerated lagoons (180). A 1.2 km long force main to convey sewage from the pumping station to the aerated lagoons.	The pumping station has been completed. The remaining works are included in the proposed project.

NOTE: Figures in parentheses in the table above are the design average dry weather flows in Mld, based on estimates for the year 2005.

The Remedial Works Program

12. Some deficiencies in the facilities constructed under the Second Bombay Water Supply and Sewerage Project became evident in 1988 and early 1989. In consequence, MCGB appointed consultants to review these works under a comprehensive status survey and to recommend a program of remedial measures; the requirements (but see para 16) were divided into four categories:

Category I: Small works items to be implemented by the WSSD Sewerage **Operations** Department.

Category II: Works to be carried out by MCGB's WSSD Sewerage **Projects** Department, with assistance of consultants where necessary, under ongoing contracts.

Category III : Works to be carried out by MCGB's WSSD Sewerage **Projects** Department, with assistance of consultants where necessary, by awarding new contracts.

Category IV : Works for which further study, investigation and design are needed.

13. Progress continues to be made in implementing this program. Of the total of 347 items in categories I, II and III, 325 had been completed by the end of April, 1995. In summary:

1	Items Completed	325
2	Items under Execution at 30-Apr-95	10
3	Items - Tender Invited and Contracts Awarded 15-May-95	2
	SUBTOTAL COMPLETED OR AWARDED	337
4	Items linked to the completion of the Bandra and Ghatkopar PStns	10
	TOTAL	347

It was a condition of negotiations that all of above Category I, II and III works, except those in Item 4 above, would be completed or under contract. It is planned that the work in Item 4 will be completed within one year of completion of the respective pumping stations.

14. The position on the Category IV work is as follows:

5	Items Completed	11	
6	Items under Execution at 30-Apr-95		2
7	Items - Tenders Invited and Contracts Awarded 15-May-95	2	
	SUBTOTAL COMPLETED OR AWARDED	15	
8	Items on Inlet Hydraulics and Ventilation for Various Pstns	12	
9	Items linked to the completion of the Bandra and Ghatkopar Pstns	2	
		29	

It was a condition of negotiations that all of above Category IV works, except those in Items 8 and 9 above, would be completed or under contract. It is planned that the work in Item 8 be under contract before 31-Dec-96 and the work in Item 9 within one year of the completion of these pumping stations.

15. **It was agreed that by December 1996, all remaining items of the remedial works program would be completed, or under contract for completion, with the exception of the items**

dependent on Bandra and Ghatkopar pumping stations, and that these items would be completed within one year of the completion of the pumping stations.

16. Some of the more major works that were identified in the original survey, are being implemented as individual items apart from the above program. These include:

(a) modification of the operating and control systems of the Bandra and Ghatkopar pumping stations and modification of the civil works design of the Bandra pumping station;

(b) repair and leakage control associated with the Bandra and Ghatkopar influent tunnels, and resolution of sediment transport difficulties in the Ghatkopar tunnel;

(c) restoration of the structural stability of five pumping station which are subject to unbalanced hydrostatic uplift pressures; and

Satisfactory progress is being made in the design and preparation for implementation of these works [sub. paras. (a) to (c)], all of which are included in the proposed project.

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

SEWAGE TREATMENT AND DISPOSAL - THE MASTER PLAN RECOMMENDATIONS

1. Sewage treatment and disposal facilities to be constructed under this BSDP will complete the system proposed in the original Master Plan (Methods for Treatment and Disposal of Wastewaters from Greater Bombay; Metcalf and Eddy Inc., Consulting Engineers in association with Environmental Engineering Consultants, May 1979). This Master plan developed a number of alternatives that were feasible from the engineering point of view and then examined their advantages, disadvantages and present value (discounted capital and annual costs) in order to select the most beneficial method of sewage treatment and disposal. The following description is by "drainage area" as given in Annex 1 page 3. The environmental aspects are reviewed in Annex 11. The "Lessons Learned and their Application" are given in Annex 13.

2. **The Colaba Drainage Area No 1** This area was originally referred to as Malabar, although the Malabar area formed only part of Colaba drainage area. The original proposal was to provide primary treatment and chlorination and then to discharge the effluent through an outfall to Bombay harbor. The first stage of this proposal has been constructed and is now in operation. This comprises the Colaba pumping station, preliminary treatment facilities for the removal of grit and screenings (which is normally the first process in a primary treatment plant) and a 1 km long outfall. No additional facilities for the Colaba drainage area are planned under the proposed project. There were no adverse environmental indications in the recent environmental assessment. The Colaba drainage area is now fully developed and additional flows in the future are not forecast.

3. The disinfection of sewage effluent by heavy chlorination, as originally proposed, is no longer considered to be appropriate for health and ecological reasons and because of the hazards associated with the transportation, storage and handling of chlorine (a highly toxic gas) in a densely developed urban area. For the quality of effluent is to be upgraded in the future to meet national or state standards, the means by which this may be best achieved will require further study. Such study would have to consider, inter alia, whether the original concept of providing primary treatment continues to be appropriate having regard to: (i) its estimated level of enhancement of the level of receiving water quality; (ii) the problem of disposal of primary sludge in an urban area (which may have an adverse environmental impact); (iii) the difficulties of securing land to accommodate a primary, or other, treatment facility; and (iv) the environmental impact of such a facility in a densely developed urban area.

4. **The Worli and Bandra Drainage Areas No 2 and 3.** These areas have sometimes been referred to as Lovegrove and Mahim. The original plan was, as in the case of Colaba, to provide primary treatment, chlorination and discharge to the Arabian Sea through one outfall at Worli and one at Bandra. Originally the outfalls were proposed to be 3 km long, on the basis of the oceanographic studies which formed part of the Master Plan Study. Later, it was decided to construct a first stage of 1 km long outfalls (extendable to 3 km) but this proved to be uneconomic as the cost of mobilization for construction was disproportionate to such a short length of outfall. (This reasoning did not apply to Colaba where the outfall diameter is much smaller thus allowing a simpler construction method.) The lengths of the proposed outfalls therefore reverted to 3 km as included in this BSDP.

5. Also, as in the case of Colaba, the preliminary treatment (grit and screenings removal) has been constructed at Worli (or Lovegrove) and such facilities are now proposed at Bandra. Chlorination and primary treatment have been deferred for the same reasons as those outlined for the Colaba area (para 3 above). However, unlike Colaba, provision has been made in the proposed project to study: (i) future sewage flow projections from both drainage areas; (ii) alternatives for treatment and disposal of these increased flows; and (iii) the relative benefits and costs and environmental effects of enhancing sewage treatment and/or extending the outfalls. Provision has also been made for engineering design of the recommended facilities for construction in the Second Stage Program which is described in Annex 5.

6. **Versova and Malad Drainage Areas No 4 and 5**. These areas may have previously been referred to as the Marve zone. The Master Plan's recommended least cost methods of treatment and disposal of sewage from these areas was preliminary treatment, biological treatment to secondary effluent standard, chlorination and disposal to Malad creek.

7. These facilities were subsequently divided into stages for the sake of reducing both the large initial investment and related operation and maintenance costs but also to provide an opportunity to gain experience in the operation of aerated lagoons, which were the selected least cost treatment system. Chlorination was to be omitted for reasons stated above (para 3). The first stage of the Versova aerated lagoons is now nearing completion at Versova, together with preliminary treatment facilities. This first stage is designed to provide an effluent of 50 mg/l biochemical oxygen demand (BOD) and 50 mg/l of suspended solids (SS). This can be compared with a probable 30/30 level of BOD/SS for effluent from a secondary treatment facility.

8. Notwithstanding the recommendations of the Master Plan Study, there was some apprehension regarding the capacity of Malad creek to receive the discharge from the relatively large quantities of effluent from the Versova and Malad drainage areas. This issue was, therefore, studied in detail during the environmental assessment (EA) for this BSDP.

9. In the study, which was conducted by the National Environmental Engineering Research Institute (NEERI), a mathematical model using the projected flow conditions for the years 2005 and 2015 showed that operating the lagoons to comply with the 100 mg/l BOD effluent limit, as given in the Maharashtra Pollution Control Board (MPCB) consent, would not result in sustained dissolved oxygen (DO) concentrations of more than 2.0 mg/l in the creek waters. Furthermore, the final results showed that even the best possible secondary treatment of the 2005 flows at Malad (effluent BOD of 15 mg/l) would not lead to a sustained DO of more than 2.0 mg/l. When 2015 projections are examined the situation is even worse. Since a DO of 2.0 mg/l is considered the minimum that would enable a stable marine biotic community to be restored. This finding means that sewage treatment by aerated lagoons, or at an even higher level by activated sludge treatment, would produce only chemical and aesthetic benefits. There would be little or no measurable improvement in the present biological impoverishment of Malad Creek. The lack of complete tidal flushing and the low natural flow combine to produce a condition in which Malad Creek simply does not have the capacity to assimilate the projected flows from the Malad drainage area after any realistic level of treatment.

10. However, if the flow from the Malad drainage area is diverted from Malad Creek altogether, the water quality model indicates that DO of 2.0 mg/l can be consistently achieved provided that the flows from the Versova drainage area are treated to produce an effluent of no more than 30 mg/l BOD. With the forecast increase in flows in the Versova drainage area there may be difficulties in the longer term (2015). At that time, with the greater volume of wastewater projected, a treated

effluent achievement of 20 mg/l BOD may be no longer adequate. The model indicated that even a treated effluent achievement of 15 mg/l BOD (which may be possible with secondary treatment by an activated sludge process) would not lead to sustained DO in the creek of 2.0 mg/l.

11. After due consideration of these findings and NEERI's recommendations, MCGB decided upon the following actions:

(a) to not proceed with the construction of treatment facilities at Malad, except for screening and grit removal;

(b) to refine and verify the new flow projections;

(c) to initiate studies to develop a new master plan for collection and treatment and, where possible, reuse of the flows projected for the Malad drainage area and adjacent areas where appropriate, including a cost-effective scheme for diverting, treating and disposing the portion of the flows that can be conveyed to the grit and screening facilities by the present collector system;

(d) to complete the construction of two trains of aerated lagoons at Versova, and place them in operation, to provide secondary treatment to flows up to their design capacity; and

(e) to undertake studies to identify a cost-effective method for diverting, treating and disposing of that portion of the flows (projected under the new flow studies for 2015) that will be conveyed to Versova via the existing collector system.

These actions are included in the proposals for the Second Stage Program (Annex 5).

12. **Ghatkopar and Bhandup Drainage Areas No 6 and 7.** These areas may previously have been referred to as Chembur. Under a similar program to that for the Versova and Malad areas, the Master Plan's recommended least cost methods of treatment and disposal of sewage from Ghatkopar and Bhandup drainage areas were preliminary treatment, biological treatment to secondary effluent standard, chlorination and disposal to Thane creek.

13. Implementation was subsequently planned in stages for the sake of reducing both the large initial investment costs and the related operation and maintenance costs. The first stage included the preliminary treatment, and biological treatment to primary effluent standard without chlorination for reasons described in para 3 above.

14. NEERI's studies of Thane Creek in connection with the environmental assessment for this project indicate that, when ultimately expanded to three-stages, the proposed aerated lagoons will be capable of treating the sewage flows projected for 2005 to a level consistent with maintaining a reasonable and acceptable concentration of dissolved oxygen in Thane Creek. Such effluent discharges, however, would fully utilize Thane Creek's assimilative capacity **near the locations at which the treated effluent would be discharged**, requiring new discharge locations and/or additional treatment when the flows exceed the projected 2005 flows. Additional water quality and assimilation capacity studies, extended along Thane Creek to its confluence with the sea, and feasibility studies will be necessary to examine appropriate means of treatment and disposal (proposed to be

implemented during the second stage of the project) of future wastewater flows from these drainage areas after 2005.

15. From the environmental assessment (see Annex 11), it is noted that the single cell lagoons, as proposed for the first stage under this BSDP) will arrest the deterioration of water quality in Thane Creek. The single cell lagoons could be augmented to the ultimate three-cells configuration within four to five years as part of the second stage implementation.

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

PROJECT DESCRIPTION

Project Design

1. The design of the Project has taken careful account of the lessons of previous experience, which has had some gravely unsatisfactory aspects. Annex 13 "Lessons Learned and their Application" gives the details and gives in full the Evaluation Summary of the Operation Evaluation Department's Project Performance Audit Report No 9265, dated December 31, 1990.

Summary of Physical Components

2. The major physical components of the project (in descending order of magnitude - see Map IBRD No 26628 attached) are listed below. Their environmental aspects are reviewed in Annex 11.

(a) the Worli and Bandra (two) ocean outfalls for the disposal of partially treated sewage to the Arabian Sea;

(b) the Bandra influent pumping station, to receive sewage flows from the Bandra tunnel, serving the entire Bandra service area, and to discharge these flows, after screening and grit removal, through an ocean outfall;

(c) the Ghatkopar and Bhandup (two) Aerated Lagoons, to provide biological treatment for sewage from these two service areas prior the discharge to Thane creek;

(d) Conveyance System Remedial Works, to correct deficiencies in the sewage conveyance system, identified by a status survey of the system to be implemented under the project;

(e) Slum Sanitation Schemes, to provide sanitation improvements (with a particular emphasis on safe excreta disposal) to up to 1.0 million slum dwellers living in up to 164 selected individual slums located on municipally-owned lands [1]; (technical assistance, under "Project Support" - para 28 below, will use a beneficiary consultation approach as well as technical assessments to identify the form of sanitation improvements to be provided); further details are in Annex 14;

(f) facilities to overcome siltation in the Ghatkopar Influent Tunnel; the final choice between: (i) an additional tunnel capable of satisfactorily conveying low sewage flows to the Ghatkopar pumping station; and (ii) the provision of preliminary treatment to all such flows, is the subject of ongoing study effort, but the costs of either alternative are similar; and

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[1] These selected slums number 164 individual settlement clusters in 15 different city wards. The largest has a population of 69,750, the smallest has a population of 416 and their average population is 5,596.

(g) pumping station structural modifications, to reduce the risk of structural damage to existing pumping stations from hydrostatic uplift forces.

The Ocean Outfalls [para 2(a) above]

3. As originally designed early in the 1980's, the Worli and Bandra outfalls were to be constructed of 3.5 m diameter reinforced concrete pipes laid in a dredged seabed trench and protected with rock armor. The outfalls were to be laid 3 km out to sea and were to discharge degritted and screened sewage in 10 to 12 meters depth of water. In this first stage of development, discharges did not meet widely-accepted environmental standards, and provision was made in the engineering planning for the future addition of primary treatment.

4. Construction of the outfalls began in 1984. A total length of 498m of outfall was laid in the sea at Worli and 209m at Bandra. The contractor stopped work in 1987 contending that the outfalls could not be constructed as designed. At this time, many outfall pipes had been cast but not laid and extensive trench excavation had been undertaken. The ensuing dispute concerned the suitability of the design for the alleged seabed conditions. In 1988 MCGB retained a consultant, Binnie and Partners (India) Ltd. in association with Tata Consulting Engineers, to reinvestigate the seabed conditions, and to investigate the costs, benefits and risks of alternative approaches to completing the outfalls and to prepare detailed engineering designs.

5. Site investigation work was completed in February 1990 and provided reliable and useful data on the geological conditions along the outfall routes. Five alternative methods for constructing the outfalls were considered, two of which were finally selected on the grounds of technical feasibility and estimated costs. The two methods selected were: (a) reinforced concrete pipes laid in trench on the seabed and protected by rock armor, similar in many respects to the outfalls originally proposed; and (b) the construction of tunnels bored in rock beneath the sea bed from vertical shafts at the shore line. Both alternatives incorporate tapered diffusors with risers to discharge sewage at the sea bed, and provision for extension of the outfalls if required in the future. Both alternatives provide for internal diameters of 3.5m and lengths of 3 km at both Worli and Bandra.

6. Engineering designs, geological data and geotechnical data were reviewed by independent experts comprising two individual specialists in geology and tunnel construction, and others from the Sydney Water Board, which recently completed construction of three ocean outfalls of similar dimensions in Sydney harbor. The experts' review recommendations were incorporated in the final engineering designs and specifications, as appropriate.

7. MCGB invited bids by international competitive bidding (ICB), for both alternatives, from international and local contractors who were prequalified under stringent criteria. It was prescribed that the selection of the construction method would be based on price. The lowest responsive bid was for the submarine tunnel alternative for which a contract is to be signed before loan effectiveness. Construction of the outfalls will be supervised by suitably-qualified and experienced independent consulting engineers, acceptable to the Bank, and designated as "the engineer" in the construction contracts [see related TA para 28(1) below].

Bandra Influent Pumping Station [para 2(b) above]

8. As originally designed, the pumping station was to receive sewage flows from the Bandra tunnel, which was to operate as an inverted syphon, and deliver the flows to the 3 km long ocean outfall at Bandra. The facility is one of the largest sewage pumping stations in the world, with a peak discharge capacity of 22 cubic meters per second. The wet well capacity was, however, relatively small with a detention time of only 9 seconds at the design peak flow. These, and other technical factors, caused some concern regarding the operation and reliability of the facility. In 1991, MCGB requested their consultants to examine the design and report on these issues. As a result, the pumping station was redesigned.

9. The main features of the new design are the lowering of the invert level of the wet well to allow open channel flow in the tunnel (in place of the inverted syphon) and an increase in the capacity of the wet well. The resulting hydraulic configuration enables the system to be operated within reasonable reaction times to flow variations and wet well levels. As in the original design, flow from the pumping station will pass through a 3m diameter steel main 1980m long to the fine screen and grit removal plant and will then discharge by gravity through the Bandra outfall. If the flow exceeds the capacity of this pumping station, due to a combination of the pumping rate and tide level, the excess flow will pass over a weir into the effluent pumping station which houses low head, axial flow pumps which also discharge through the outfall.

10. Bids will be invited from prequalified contractors and construction will be supervised by suitably-qualified and experienced independent consulting engineers, acceptable to the Bank, and designated as "the engineer" in the construction contracts [see related TA para 28(1) and (8) below].

The Aerated Lagoons [para 2(c) above]

11. The Ghatkopar and Bhandup aerated lagoons have been planned to provide biological treatment for sewage flows from these service areas to the year 2005. The effluent quality will be 100 mg/l for both BOD and suspended solids, which is acceptable. The effluent will be discharged to Thane creek. Model studies have shown that the proposed initial treatment will arrest the deterioration of the receiving water quality in Thane creek but that it will be necessary to augment the treatment level by building additional lagoon capacity by the year 2005.

12. The choice of aerated lagoons as a treatment method is particularly suitable for a developing country application in view of the low degree of maintenance and relative ease of operation. This system of biological treatment is relatively trouble free and will normally accommodate a wide range of waste types and characteristic variations, provided that chemical wastes, normally associated with industrial discharges, are maintained within acceptable limits. This system of treatment is cost-effective provided, as in the case of Bombay, large areas of land at relatively low value are available within reasonable distance of the urban area and provided that energy costs are within acceptable levels.

13. The construction of lagoons does not involve complex procedures and is well within the capability of Indian contractors. However, close quality control of the placement of water-retaining embankments is essential. A high standard of construction supervision is therefore necessary. With the use of earth moving plant, construction periods are relatively short, probably less than two years. However, a much longer construction period (four to five years) is common in India where manual methods are employed. Bids will be invited by ICB procedures from prequalified contractors and

construction will be supervised by suitably qualified and experienced independent consulting engineers [see related TA para 28(1) below].

Sewage Conveyance System Remedial Works [para 2(d) above]

14. The Greater Bombay sewage conveyance system is extensive. Although most of it was constructed in the last 20 years, the sewers in the older parts of the city date from the early part of this century (see "History of the Sewerage System in Annex 1). Some of the older parts of the system operate as a "combined system" (in which sanitary sewage and surface water flow in the same network) but most of the system is designed as a "separate system" for sanitary wastewater flows only. In summary:

Diameter (mm)		Length (km)
less than 375 mm		700
375 mm or greater		200
	TOTAL	900

15. Records and maintenance of the system have been neglected. From the level of flows reaching the pumping stations, and from surveys of the surface water drains and streams, it is clear that groundwater infiltration and inflow levels are high. This indicates that significant quantities of surface and ground water are reaching the sanitary sewers through damaged pipes, leaking joints, defective manholes (often missing covers), and illegal, or in some cases legal, connections of surface water drains to sewer manholes and/or directly to sewers.

16. Conversely, it is clear that many surface water drains and streams contain sewage from sources such as pavement dwellers and slum hutments, illegal and legal connections of properties to surface water drains and unrecorded connections.

17. Prior to the Project, a comprehensive list of 376 "remedial measures" items of work was prepared and implementation commenced. The status of and program for these actions is in Annex 1 paras 12-16.

18. Under the Project, surveys will be carried out to locate all sewers, manholes, overflow weirs and other appurtenances and also to determine the physical status of these facilities (para 15). From these surveys programs of conveyance system remedial works and preventative maintenance will be prepared for implementation under this Component of the Project [see related TA in para 28(3) below].

Slum Sanitation Schemes [para 2(e) above]

19. MCGB estimates that there are 5.5 million slum dwellers in Bombay. There have been previous efforts to improve sanitary conditions in Bombay's slums with the "Low-Cost Sanitation" components included in the Bank-supported Second (FY79) and Third (FY85) Bombay Water Supply and Sewerage Projects. However, these were largely unsuccessful, probably because of an inadequate institutional commitment by MCGB and a failure to invoke beneficiary participation in the decision-making.

20. However, during the public hearings which have been conducted in relation to the environmental assessment of this BSD Project (Annex 11), NGOs and slum-dwellers have vigorously represented to MCGB their concerns for the prevailing sanitary conditions in Bombay's slums. MCGB's response has been to give assurances as to the prompt initiation of a program to improve these conditions. Moreover, the Government of India's Ministry of Environment and Forests, in granting its environmental clearance for this BSD project, has directed MCGB to prepare an environmental sanitation program and implementation plan to benefit slum and pavement dwellers. MCGB has now indicated its strong commitment to such a program and has sought Bank support for the initiation of such a program under this BSDP. To move forward promptly, MCGB has already engaged, entirely on its own initiative, an association between a long-established well-known Bombay-based consulting engineering firm and a well-known NGO with relevant prior experience.

21. In concept, MCGB proposes to initiate such a program in those 164 slums which presently occupy municipally-owned lands, which contain an estimated one million people or nearly 20% of Bombay's total slum population (para 19). This approach permits the prompt initiation of such a program without awaiting resolution of the legal issues arising from public investments on privately-owned lands or, in the alternative, the costs and delays to be expected from efforts towards the municipal acquisition of such lands. However, it is also the intent that this initial effort would provide the experience base from which to refine the design of a program for the remaining slum dwellers.

22. At negotiations, the Bank obtained assurances on the details of the Program design including: (a) the details of institutional arrangements and the related organization and staffing within MCGB; (b) policy guidelines for implementation, with particular reference to any resettlement requirements; (c) outline terms of reference for: (i) related promotion and publicity (ii) related consulting/NGO services (including beneficiary consultation) endeavor [para 20 above and paras 28(4) and 33 below] on a slum by slum basis; and (iii) independent monitoring and evaluation. Bank supervision missions will undertake (with MCGB) annual reviews of the program, taking account - inter alia - of the findings and recommendations of the independent monitoring and evaluation. In the preceding, due account will be taken of relevant prior experience in Bombay, elsewhere in India and elsewhere in the world, and the adequacy and prospective sustainability of arrangements for operation and maintenance of investments under the Project. It is anticipated that investments will be concentrated in facilities for the safe disposal of excreta but that other low-cost, technically feasible environmental improvement measures which may relate, for example, to improved solid wastes collection and/or to improved surface water drainage would not be precluded. The implementation of this Program is planned in two Stages: (i) a First Stage covering about 10% to 15% of the beneficiaries; and (ii) a Second Stage, covering the remaining beneficiaries, which is designed taking full account of all the lessons of experience of the First Stage. However, the process of annual reviews [(d) above] would continue throughout. One aim of the social and physical surveys, the assessment of technical options and beneficiary consultation process would be ensure that, in the implementation of the program, implementation in a particular slum will proceed after it has been established that there are no resettlement requirements.

Facilities to overcome siltation is the Ghatkopar Influent Tunnel [para 2(f) above]

23. As a result of concerns regarding possible difficulties in the future operation of the Ghatkopar influent tunnel system, MCGB instructed its Consultants to review the original hydraulic design of the tunnel. Accordingly, early in 1994, the Consultants, Binnie and Partners (India) Ltd, reported on their study of the hydraulics of the tunnel. This report identified major sediment transport difficulties

resulting from the then recently-completed revised sewage flow estimates for the Ghatkopar drainage area.

24. Several alternative engineering solutions which would resolve the deficiencies of the system, were then studied. The alternative of the construction of an additional tunnel (operating under open channel flow conditions) was recommended as the least-cost feasible alternative, but the costs of the alternative provision of preliminary treatment of these flows is similar; a final decision is pending. This report also identified the defects in the existing tunnel and made recommendations for repairs. The existing tunnel will be modified for use as a standby facility and for conveying excess flows. Both the additional tunnel and the repairs to the existing tunnel are included in this BSDP [see related TA in para 28(9) below]. Construction will be supervised by suitably-qualified and experienced independent consulting engineers, acceptable to the Bank, and designated as "the engineer" in the construction contracts [see related TA para 28(1) and (9) below].

Pumping Station Structural Stability [see para 1(g) above]

25. The engineering design of structures located below ground normally incorporates measures to balance the hydrostatic uplift forces to which the structure is subjected. Two common methods used to balance these uplift forces are: (i) anchoring the structure to underlying rock by the use of steel "rock anchors"; and (ii) ensuring that the weight of the structure is sufficient to balance, or exceed, the uplift forces (by providing a thicker floor slab or increasing wall thicknesses etc).

26. The use of rock anchors is sometimes preferred on the basis of initial cost. However, the method requires very careful placement and bonding of the steel anchors and their adequate protection from corrosion to ensure that they will sustain the unbalanced uplift forces throughout the life of the structure.

27. Because of the apparent risk of early failure of several rock anchors in sewage pumping stations in Bombay MCGB, with the help of consultants, carried out a study of all of those stations in which rock anchors had been used, and also reviewed the methods used for their initial installation. These studies concluded that five pumping stations should be stabilized by the construction of additional structural members. These five are the Versova, Malad, Bhandup, and Lovegrove (Worli) influent and effluent pumping stations. These works will be designed and construction will be supervised by consultants acceptable to the Bank and will be financed under the proposed project [see related TA in para 28(1) and (10) below].

Technical Assistance

28. The technical assistance for BSDP falls into one of three categories as follows:

Category 1: Project Support

(1) supervision of construction of the Worli and Bandra submarine tunnel outfalls, the Bandra pumping station, the Ghatkopar influent tunnel, the Ghatkopar and Bhandup lagoons and the structural improvements to five pumping stations; (see paras 2-27 above and 29 below).

(2) upgrading WSSD's operation and maintenance practices in the whole of the Bombay sewerage system [see para 30-31 below];

(3) conducting topographic and condition surveys and mapping of the conveyance system and formulating a program of conveyance system improvements and preventive maintenance [see paras 2(d) and 14-18 above and para 32 below];

(4) slum sanitation consultant/NGO assistance [see paras 2(e) and 19-22 above and para 33 below];

Category 2: Studies, Site Investigations and Engineering for Second Stage Works

(5) conducting feasibility studies for Second Stage sewage treatment and disposal facilities in six drainage areas: Malad, Versova, Bhandup, Ghatkopar, Colaba, Worli, and Bandra [see para 34 below];

(6) completing detailed engineering designs for sewage treatment and disposal facilities in six drainage areas listed in (5) above [see para 34 below];

Category 3: Complementary Studies (under separate financing)

(7) a Bombay Coastal Water Quality Study (Japan grant - part in process)[see paras 36-37 below];

(8) Bandra Pumping Station Study [see paras 2(b) and 8-10 above and para 38 below - completed];

(9) Ghatkopar Influent Tunnel Study [see paras 2(f) and 23-24 above and para 38 below - completed];

(10) Pumping Station Structural Stability Study [see paras 2(g) and 25-27 above and 38 below - completed].

Each of these items is briefly described in the following paragraphs.

Category 1: Project Support

29. **Supervision of Construction of the Worli and Bandra Outfalls, the Bandra Pumping Station, and the Ghatkopar Influent Tunnel.** An ongoing contract with international consultants for part of the duration of construction of these facilities provides for construction supervision by Consultants; this contract expires 30-Jun-96. As a condition of effectiveness and before 31-Jul-95, MCGB has agreed to either extend this contract, in consultation with the Bank, to cover the remainder of the construction period OR furnish to the Bank, in a form satisfactory to the Bank, consultant recruitment documentation for the invitation of alternative competitive proposals and a program for such recruitment. Under the ongoing contract, its extension or the alternative proposals, the consultant will be designated as the "engineer", as reflected in the general conditions of contract, for the construction of the Worli and Bandra outfalls, and (ultimately) in the general conditions of contract for the construction of the Bandra pumping station, and for the Ghatkopar Influent Tunnel. **Consultants will also supervise the construction of the Ghatkopar and Bhandup lagoons, and the pumping station structural modifications** but may not be designated as the "engineer" for this work, unless such an arrangement is requested by MCGB.

30. **Upgrading WSSD Operation and Maintenance Practices**. The level of maintenance of the existing sewerage system has been consistently poor, lacking adequately trained and skilled staff, suitable facilities and appropriate plant and equipment. In addition, preventive maintenance procedures are inadequate and the organizational structure of that section of WSSD dealing with sewerage maintenance needs reform.

31. MCGB has agreed to address this issue with the assistance of suitably qualified consultants, acceptable to the Bank, to implement a comprehensive study and to introduce improved operation and maintenance practices and organizational reforms. The consultant recruitment documentation for this study are available in the project file (Annex 15) and the award of this consulting services contract was made a condition for negotiations.

32. **Topographic and Condition Surveys of the Conveyance System.** These surveys would be implemented in connection with the component for the Conveyance System Remedial Works described in paragraphs 14 to 18 above. The topographic survey would enable record plans of the conveyance system to be prepared and would be followed by a condition survey of the system to provide input for the preparation of a program for remedial works. Requests for proposal for these surveys are available in the project file (Annex 15) and the award of this consulting services contract was also a condition for negotiations.

33. **The Slum Sanitation Technical Assistance** relates to the physical component described in para 3.08(e); the program and some further details of this technical assistance are described in Annex 3 paras 19-22. An understanding, in the form of agreed outline terms of reference, was reached at negotiations for this TA which comprise:

(1) program publicity;

(2) on a slum by slum basis - social surveys; physical surveys and the assessment of physically feasible and economical technical options; beneficiary consultations for the purposes of the determination of community preferences, of beneficiary contributions to investments and to subsequent operation and maintenance, and the determination, for implementation, that no resettlement is required (see para 22) and reporting on all of the preceding; and

(3 independent monitoring and evaluation of both the procedures and the activities described in (2) above and reporting thereon.

Further details of the policy guidelines and the implementation modality for slum sanitation schemes, and outline terms of reference as described above are in Annex 14.

Category 2: Studies, Site Investigations and Engineering for Second Stage Works

34. The Environmental Impact Assessment (Annex 11) that has been carried out for the first stage of development of sewage treatment and disposal facilities to serve the Greater Bombay area, confirms that higher levels of treatment and/or improved disposal methods will be required to meet future coastal water quality standards. Planning for these improvements in sewage treatment and disposal facilities has, therefore, been included in the proposed project in the form of: (i) the Bombay Coastal Water Quality Study (para 36) which is under implementation; and (ii) the **Second Stage Program**, which includes provision for feasibility studies, and engineering designs for sewage treatment and disposal facilities in six service areas. The agreed schedule for implementation of the

Second Stage Program and a description of the scope of each of the studies in the Program are detailed in Annex 5.

Category 3: Complementary Studies

35. These studies have been, or are being implemented under separate financing in the preparation of components of the proposed project and of the program of Second Stage works.

36. **The Bombay Coastal Water Quality Study.** This study is financed under a Japanese grant and is being implemented by India's National Environmental Engineering Research Institute (NEERI) under the direction of MCGB. The study supplements the hydrographic work carried out as part of the 1979 Master Plan and extends the work under a recent study implemented by NEERI, as part of the Environmental Impact Assessment. The study will estimate receiving water quality that would result from various lengths of outfalls discharging to the Arabian Sea, and/or sewage treatment options, for Worli and Bandra service areas, in addition to the effects of various outfall locations for Malad and Versova service areas. The extended study will examine the quality of receiving waters along the coastline (to about 8 to 10 km from the shore line) from a point about 20 km north of Malad creek to a point about 7 km south of the Worli outfall. A further study will extend the water quality studies of Thane creek almost to a point at which the creek reaches the sea (adjacent to Bombay harbor).

37. The results of the study will enable MCGB to assess the improvement in coastal waters which would result from various methods of sewage treatment and disposal, and the effects of extending the outfalls to various distances from the shore line under the Second Stage Program, in order to satisfy future environmental standards. Results of the study would provide the "starting point" and primary input for engineering feasibility studies for sewage treatment and disposal facilities to be constructed in the Second Stage Program to serve the six drainage areas (Annex 4).

38. The remaining three complementary studies that have been implemented to resolve issues arising from deficiencies in some of the existing facilities as outlined above. These three studies address the following items: Bandra Pumping Station (paras 8-10); Ghatkopar Influent Tunnel (paras 23-24); and Pumping Station Structural Stability (paras 25-27). Reports on these studies are available in the Project File (Annex 15).

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

IMPLEMENTATION SCHEDULES - CONTRACTS - COSTS - PROCUREMENT MODE

This Annex is structured as follows:

1. ASSUMPTIONS FOR THE ESTIMATION OF PRICE CONTINGENCIES
2. IMPLEMENTATION SCHEDULES
3. ESTIMATED EXPENDITURE PROFILES - Rs million and US$ million

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INDIA: PROPOSED BOMBAY SEWAGE DISPOSAL PROJECT - SCHEDULES AND COST ESTIMATES

ASSUMPTIONS FOR ESTIMATION OF PRICE CONTINGENCIES

Local Escalation Rate		9.0%	8.5%	8.0%	7.0%	6.0%	6.0%	6.0%	6.0%
Local Escalation Factor		1.000	1.085	1.172	1.254	1.329	1.409	1.494	1.584
Foreign Escalation Rate		1.5%	1.8%	2.6%	2.5%	2.5%	2.5%	2.5%	2.5%
Foreign Escalation Factor	BASE	1.000	1.018	1.044	1.070	1.097	1.124	1.152	1.181
Exchange Rate Rs/US$	31.0	32.3	34.8	37.4	39.8	42.0	44.3	46.7	49.3

SCHEDULES

No	Contract No	Description	I L	G W C	Pre Post	1995	1996	1997	1998	1999	2000	2001	2002
						PERCENT COMPLETION							
1.01	-	Worli and Bandra Outfalls	I	W	Pre	20%	20%	25%	25%	10%	-	-	-
1.02	3AA	Bandra Pumping Station (Civil)	I	W	Pre	-	20%	30%	30%	20%	-	-	-
1.03	3BB/CC/EE	Bandra Pumping Station (Equipment)	I	G	Post	-	-	30%	40%	30%	-	-	-
1.04	10AA	Bhandup Lagoons (Civil)	I	W	Pre	-	20%	30%	30%	20%	-	-	-
1.05	10G/SD	Bhandup Lagoons (Equipment)	I	G	Post	-	-	30%	45%	25%	-	-	-
1.06	11AA	Ghatkopar Lagoons (Civil)	I	W	Pre	-	20%	30%	30%	20%	-	-	-
1.07	11G/SD	Ghatkopar Lagoons (Equipment)	I	G	Post	-	-	30%	45%	25%	-	-	-
1.08	29AA	Ghatkopar Influent Tunnel Repair	L	W	Post	-	100%	-	-	-	-	-	-
1.09	29AAA	Ghatkopar Influent Tunnel Additional (or Prel Tr)	I	W	Post	-	15%	20%	40%	25%	-	-	-
1.10	-	Slum Sanitation Implementation	L	W	Post	-	20%	30%	30%	20%	-	-	-
1.11	-	Stability Restoration - 5 PStns	L	W	Post	-	25%	40%	35%	-	-	-	-
1.12	-	Conveyance System Remedial Works	L	W	Post	-	15%	25%	35%	25%	-	-	-
			Manmonths										
			For	Loc	Tot								
2.01	-	Engineering Services (BSP)	252	770	1022	-	15%	30%	30%	25%	-	-	-
2.02	-	Studies-Upgrade O&M (25% in BMSSP III)	46	107	153	-	15%	20%	20%	20%	15%	5%	5%
2.03	-	Condition Survey-Conveyance System (30% BMSSP III)	56	280	336	-	65%	35%	-	-	-	-	-
2.04	-	Slum Sanitation - Consultant and NGO Services	-	1000	1000	10%	20%	20%	20%	10%	-	-	-
3.01	-	St II Wks: Feasibility Malad and Versova Areas	54	412	466	-	-	-	30%	35%	35%	-	-
3.02	-	St II Wks: Feasibility Bhandup and Ghatkpar Areas	36	88	124	-	-	-	30%	35%	35%	-	-
3.03	-	ST II Wks: Feasibility Worli and Bandra Areas	26	190	216	-	-	-	30%	35%	35%	-	-
3.04	-	ST II Wks: Detailed Design (6 Areas)	202	165	367	-	-	-	-	-	-	60%	40%

	TOTAL	1995	1996	1997	1998	1999	2000	2001	2002
EXPENDITURE PROFILE IN Rs MILLION (NET OF TAXES AND DUTIES)	10478	649	1612	2539	3129	1994	220	194	141
EXPENDITURE PROFILE IN Rs MILLION (INCLUDING TAXES AND DUTIES OF 834	11312	701	1740	2741	3378	2153	238	209	152
	100.0%	6.2%	15.4%	24.2%	29.9%	19.0%	2.1%	1.8%	1.4%
EXPENDITURE PROFILE IN US$ MILLION (NET OF TAXES AND DUTIES)	274.3	20.2	46.5	68.4	79.6	47.8	4.9	4.1	2.8
EXPENDITURE PROFILE IN US$ MILLION (INCLUDING TAXES AND DUTIES OF 21.3	295.6	21.8	50.1	73.8	85.8	51.5	5.3	4.4	2.9
	100.0%	7.4%	16.9%	25.0%	29.0%	17.4%	1.8%	1.5%	1.0%

1. COST ESTIMATES BY CONTRACT IN Rs million
2. FINANCING PLAN IN Rs million
3. ESTIMATED EXPENDITURES BY PROCUREMENT MODE IN Rs million
4. ESTIMATED DISBURSEMENTS BY PROCUREMENT MODE IN Rs million

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Local Bidding-L W-Works
C-Consultants

COST ESTIMATES BY CONTRACT IN Rs MILLION

INDIA: PROPOSED BOMBAY SEWAGE DISPOSAL PROJECT - SCHEDULES AND COST ESTIMATES

COST ESTIMATES (Rs MILLION

No.	Code	Item			Pre Post	Jan95 Base Costs (@ Rs31 = $1.00) FC	LC	TC	% BASE	% TOTAL	Physical Conting FC	LC	TC	Price Conting FC	LC	TC	Tax & Duty LC	TOTAL FC	LC	TC
		COMPONENT 1 - PHYSICAL WORKS																		
1.01	-	Worli and Bandra Outfalls	I	W	Pre	1121	1401	2522	36%	22%	280	350	630	341	274	615	226	1742	2251	3993
1.02	3AA	Bandra Pumping Station (Civil)	I	W	Pre	75	675	750	11%	7%	19	169	188	30	178	208	46	124	1068	1192
1.03	3BB/CC/EE	Bandra Pumping Station (Equipment)	I	G	Post	13	117	130	2%	1%	3	23	26	6	35	41	30	22	205	227
1.04	10AA	Bhandup Lagoons (Civil)	I	W	Pre	17	313	330	5%	3%	4	78	82	7	82	89	20	28	493	521
1.05	10G/SD	Bhandup Lagoons (Equipment)	I	G	Post	80	40	120	2%	1%	12	6	18	34	11	45	55	126	112	238
1.06	11AA	Ghatkopar Lagoons (Civil)	I	W	Pre	17	313	330	5%	3%	4	78	82	7	82	89	20	28	493	521
1.07	11G/SD	Ghatkopar Lagoons (Equipment)	I	G	Post	80	40	120	2%	1%	12	6	18	34	11	45	55	126	112	238
1.08	29AA	Ghatkopar Influent Tunnel Repair	L	W	Post	3	22	25	0%	0%	1	6	7	1	2	3	1	5	31	36
1.09	29AAA	Ghatkopar Influent Tunnel Additional (or Prelim Tr)	I	W	Post	60	240	300	4%	3%	15	60	75	26	69	95	28	101	397	498
1.10	-	Slum Sanitation Implementation	L	W	Post	62	558	620	9%	5%	9	84	93	22	136	158	35	93	813	906
1.11	-	Stability Restoration - 5 PStns	L	W	Post	10	90	100	1%	1%	3	23	26	4	21	25	8	17	142	159
1.12	-	Conveyance System Remedial Works	L	W	Post	180	420	600	9%	5%	45	105	150	77	118	195	76	302	719	1021
		COMPONENT 1 TOTAL				1718	4229	5947	86%	53%	407	988	1395	589	1019	1608	600	2714	6836	9550
		COMPONENT 2 - TECHNICAL SERVICES FOR COMPONENT 1 Manmonths	For	Loc	Tot															
2.01	-	Engineering Services (BSP)	252	770	1022	175	140	315	5%	3%	18	14	32	65	34	99	76	258	264	522
2.02	-	Studies-Upgrade O&M (25% in BMSSP III)	46	107	153	38	20	58	1%	1%	4	2	6	18	8	26	16	60	46	106
2.03	-	Condition Survey-Conveyance System (30% BMSSP III)	56	280	336	28	14	42	1%	0%	3	1	4	6	2	8	6	37	23	60
2.04	-	Slum Sanitation - Consultant and NGO Services	-	1000	1000	0	60	60	1%	1%	0	6	6	0	-4	-4	4	0	66	66
		COMPONENT 2 TOTAL	354	2157	2511	241	234	475	7%	4%	25	23	48	89	40	129	102	355	399	754
		COMPONENT 3 - PREPARATION OF STAGE 2 INVESTMENTS																		
3.01	-	St II Wks: Feasibility Malad and Versova Areas	54	412	466	38	175	213	3%	2%	6	26	32	22	67	89	20	66	288	354
3.02	-	St II Wks: Feasibility Bhandup and Ghatkpar Areas	36	88	124	25	31	56	1%	0%	4	5	9	14	13	27	13	43	62	105
3.03	-	ST II Wks: Feasibility Worli and Bandra Areas	26	190	216	18	67	85	1%	1%	2	7	9	9	24	33	18	29	116	145
3.04	-	ST II Wks: Detailed Design (6 Areas)	202	165	367	138	30	168	2%	1%	14	3	17	120	18	138	81	272	132	404
		COMPONENT 3 TOTAL	318	855	1173	219	303	522	8%	5%	26	41	67	165	122	287	132	410	598	1008
		SUBTOTAL	672	3012	3684	2178	4766	6944	100%	61%	458	1052	1510	843	1181	2024	834	3479	7833	11312

	FC	LC	TC	%
(1)PHYSICAL CONTINGENCIES	458	1052	1510	13%
(2)PRICE CONTINGENCIES	843	1181	2024	18%
(3)SUBTOTAL	3479	6999	10478	93%
(4)TAXES AND DUTIES	0	834	834	7%
(5)TOTAL PROJECT COST	3479	7833	11312	100%

FINANCING

FINANCING				FC	LC	TC
	BANK	70%	(3)	3479	3856	7335
	MCGB	30%	(3)	0	3143	3143
		100%	(4)	0	834	834
(5)TOTAL PROJECT COST				3479	7833	11312

EXPENDITURES BY PROCUREMENT MODE

			FC	LC	TC	%	Physical Conting FC	LC	TC	Price Conting FC	LC	TC	Tax & Duty LC	TOTAL FC	LC	TC
WORKS BY ICB	I	W	1290	2942	4232	61%	322	735	1057	411	685	1096	340	2023	4702	6725
WORKS BY LCB	L	W	255	1090	1345	19%	58	218	276	104	277	381	120	417	1705	2122
GOODS BY ICB	I	G	173	197	370	5%	27	35	62	74	57	131	140	274	429	703
CONSULTANT SERVICES			460	537	997	14%	51	64	115	254	162	416	234	765	997	1762
(5)TOTAL PROJECT COST			2178	4766	6944	100%	458	1052	1510	843	1181	2024	834	3479	7833	11312

ESTIMATED DISBURSEMENTS BY PROCUREMENT MODE

DISBURSEMENT AMOUNT	RATE		EXPENDITURE
3992	59%	WORKS BY ICB GROSS	6725
1252	59%	WORKS BY LCB GROSS	2122
563	100%	GOODS BY ICB NET	563
1528	100%	CONSULTANT SERVICES NET	1528
7335	7335		

1. COST ESTIMATES BY CONTRACT IN US$ million
2. FINANCING PLAN IN US$ million
3. ESTIMATED EXPENDITURES BY PROCUREMENT MODE IN US$ million
4. ESTIMATED DISBURSEMENTS BY PROCUREMENT MODE IN US$ million

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COST ESTIMATES IN US$ MILLION

INDIA: PROPOSED BOMBAY SEWAGE DISPOSAL PROJECT - SCHEDULES AND COST ESTIMATES

COST ESTIMATES IN US$ MILLION			I L	W C	Pre Post	Jan95 Base Costs (@ Rs31 = $1.00) FC	LC	TC	% BASE	% TOTAL	Physical Conting FC	LC	TC	Price Conting FC	LC	TC	Tax & Duty LC	TOTAL FC	LC	TC
COMPONENT 1 - PHYSICAL WORKS																				
1.01	-	Worli and Bandra Outfalls	I	W	Pre	36.2	45.2	81.4	36%	28%	9.0	11.3	20.3	1.9	-1.8	0.1	6.1	47.1	60.8	107.9
1.02	3AA	Bandra Pumping Station (Civil)	I	W	Pre	2.4	21.8	24.2	11%	8%	0.6	5.5	6.1	0.3	-0.3	0.0	1.2	3.3	28.2	31.5
1.03	3BB/CC/EE	Bandra Pumping Station (Equipment)	I	G	Post	0.4	3.8	4.2	2%	1%	0.1	0.7	0.8	0.1	-0.1	0.0	0.7	0.6	5.1	5.7
1.04	10AA	Bhandup Lagoons (Civil)	I	W	Pre	0.5	10.1	10.6	5%	4%	0.1	2.5	2.6	0.0	-0.0	0.0	0.5	0.6	13.1	13.7
1.05	10G/SD	Bhandup Lagoons (Equipment)	I	G	Post	2.6	1.3	3.9	2%	1%	0.4	0.2	0.6	0.1	0.0	0.1	1.4	3.1	2.9	6.0
1.06	11AA	Ghatkopar Lagoons (Civil)	I	W	Pre	0.5	10.1	10.6	5%	4%	0.1	2.5	2.6	0.0	-0.0	0.0	0.5	0.6	13.1	13.7
1.07	11G/SD	Ghatkopar Lagoons (Equipment)	I	G	Post	2.6	1.3	3.9	2%	1%	0.4	0.2	0.6	0.1	0.0	0.1	1.4	3.1	2.9	6.0
1.08	29AA	Ghatkopar Influent Tunnel Repair	L	W	Post	0.1	0.7	0.8	0%	0%	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.1	0.9	1.0
1.09	29AAA	Ghatkopar Influent Tunnel Additional (or Prelim Tr)	I	W	Post	1.9	7.7	9.6	4%	3%	0.5	1.9	2.4	0.2	-0.1	0.1	0.8	2.6	10.3	12.9
1.10	-	Slum Sanitation Implementation	L	W	Post	2.0	18.0	20.0	9%	7%	0.3	2.7	3.0	0.1	-0.1	0.0	0.9	2.4	21.5	23.9
1.11	-	Stability Restoration - 5 PStns	L	W	Post	0.3	2.9	3.2	1%	1%	0.1	0.7	0.8	0.1	0.0	0.1	0.3	0.5	3.9	4.4
1.12	-	Conveyance System Remedial Works	L	W	Post	5.8	13.5	19.3	9%	7%	1.5	3.4	4.9	0.4	-0.4	0.0	1.9	7.7	18.4	26.1
		COMPONENT 1 TOTAL				55.3	136.4	191.7	86%	65%	13.1	31.8	44.9	3.3	-2.8	0.5	15.7	71.7	181.1	252.8
COMPONENT 2 - TECHNICAL SERVICES FOR COMPONENT 1		Manmonths	For	Loc	Tot															
2.01	-	Engineering Services (BSP)	252	770	1022	5.6	4.5	10.1	5%	3%	0.6	0.5	1.1	0.4	-0.2	0.2	1.9	6.6	6.7	13.3
2.02	-	Studies-Upgrade O&M (25% in BMSSP III)	46	107	153	1.2	0.6	1.8	1%	1%	0.1	0.1	0.2	0.2	-0.1	0.1	0.4	1.5	1.0	2.5
2.03	-	Condition Survey-Conveyance System (30% BMSSP III)	56	280	336	0.9	0.5	1.4	1%	0%	0.1	0.0	0.1	0.1	0.0	0.1	0.2	1.1	0.7	1.8
2.04	-	Slum Sanitation - Consultant and NGO Services	-	1000	1000	0.0	1.9	1.9	1%	1%	0.0	0.2	0.2	0.0	0.0	0.0	0.1	0.0	2.2	2.2
		COMPONENT 2 TOTAL	354	2157	2511	7.7	7.5	15.2	7%	5%	0.8	0.8	1.6	0.7	-0.3	0.4	2.6	9.2	10.6	19.8
COMPONENT 3 - PREPARATION OF STAGE 2 INVESTMENTS																				
3.01	-	St II Wks: Feasibility Malad and Versova Areas	54	412	466	1.2	5.6	6.8	3%	2%	0.2	0.8	1.0	0.2	-0.1	0.1	0.5	1.6	6.8	8.4
3.02	-	St II Wks: Feasibility Bhandup and Ghatkpar Areas	36	88	124	0.8	1.0	1.8	1%	1%	0.1	0.2	0.3	0.2	0.0	0.2	0.4	1.1	1.6	2.7
3.03	-	ST II Wks: Feasibility Worli and Bandra Areas	26	190	216	0.6	2.2	2.8	1%	1%	0.1	0.2	0.3	-0.1	0.1	0.0	0.4	0.6	2.9	3.5
3.04	-	ST II Wks: Detailed Design (6 Areas)	202	165	367	4.5	1.0	5.5	2%	2%	0.5	0.1	0.6	0.7	-0.1	0.6	1.7	5.7	2.7	8.4
		COMPONENT 3 TOTAL	318	855	1173	7.1	9.8	16.9	8%	6%	0.9	1.3	2.2	1.0	-0.1	0.9	3.0	9.0	14.0	23.0
		SUBTOTAL	672	3012	3684	70.1	153.7	223.8	100%	76%	14.8	33.9	48.7	5.0	-3.2	1.8	21.3	89.9	205.7	295.6
		(1)PHYSICAL CONTINGENCIES				14.8	33.9	48.7		16%										
		(2)PRICE CONTINGENCIES				5.0	-3.2	1.8		1%										
		(3)SUBTOTAL				89.9	184.4	274.3		93%										
		(4)TAXES AND DUTIES				0	21.3	21.3		7%										
		(5)TOTAL PROJECT COST				89.9	205.7	295.6		100%										

FINANCING

FINANCING				FC	LC	TC
BANK	70%	(3)		89.9	102.1	192.0
MCGB	30%	(3)		0.0	82.3	82.3
	100%	(4)		0.0	21.3	21.3
(5)TOTAL PROJECT COST				89.9	205.7	295.6

EXPENDITURES BY PROCUREMENT MODE

	I L	W C	FC	LC	TC	%	Physical Conting FC	LC	TC	Price Conting FC	LC	TC	Tax & Duty LC	TOTAL FC	LC	TC
WORKS BY ICB	I	W	41.5	94.9	136.4	61%	10.3	23.7	34.0	2.4	-2.2	0.2	9.1	54.2	125.5	179.7
WORKS BY LCB	L	W	8.2	35.1	43.3	19%	1.9	7.0	8.9	0.6	-0.5	0.1	3.1	10.7	44.7	55.4
GOODS BY ICB	I	G	5.6	6.4	12.0	5%	0.9	1.1	2.0	0.3	-0.1	0.2	3.5	6.8	10.9	17.7
CONSULTANT SERVICES			14.8	17.3	32.1	14%	1.7	2.1	3.8	1.7	-0.4	1.3	5.6	18.2	24.6	42.8
(5)TOTAL PROJECT COST			70.1	153.7	223.8	100%	14.8	33.9	48.7	5.0	-3.2	1.8	21.3	89.9	205.7	295.6

ESTIMATED DISBURSEMENTS BY PROCUREMENT MODE

DISBURSEMENT AMOUNT	RATE		EXPENDITURE
107.9	59%	WORKS BY ICB GROSS	179.7
32.7	59%	WORKS BY LCB GROSS	55.4
14.2	100%	GOODS BY ICB NET	14.2
37.2	100%	CONSULTANT SERVICES NET	37.2
192.0	192.0		

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

THE SECOND STAGE PROGRAM

1. The First and Second Stage Programs for the development of the Bombay sewage treatment and disposal systems are closely integrated. An outline schedule for these two stages was agreed with MCGB in December 1994 and is as follows:

INDIA: BOMBAY SEWAGE DISPOSAL PROJECT
OUTLINE SCHEDULES OF FIRST AND SECOND STAGE SEWERAGE DEVELOPMENT PROGRAMS

Action No	Description	Proposed Financing	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09
	BANDRA AND WORLI - FIRST STAGE : BANDRA AND WORLI OUTFALLS																	
1	Tendering	-		-Dec														
2	Evaluate and Award Contract	-			-Jun													
3	Construction	BSDP			Oct-						-May							
4	Commission Worli	BSDP					-Jun											
5	Commission Bandra	BSDP						-Nov										
	BANDRA AND WORLI DRAINAGE AREA: SECOND STAGE PREPARATION																	
6	Prepare Flow Estimates 2015 & 2031	BBY III-BSDP			Jan-													
7	Implement Bombay Coastal Water Study	JapanGrant			Oct-			-Sep										
8	Review 7 : Decide basis for Decision and Action	-				Oct-Jun												
9	Geotechnical, Feasibility & Environmental Ass Studies	BSDP					Jul-			-Dec								
10	Detailed Engineering and Tender Documents	BSDP							Jan-		-Jun							
11	Invite Tenders - Evaluate - Award	-									Aug-Jun							
12	Construct Second Stage Works	TBD											Jan-			-Jan		
13	Commission Second Stage Works	TBD															-Jun	

NOTE: (1) As a Condition for Loan Negotiations GoM will request GoI's MoEF to review the water quality standards which would be applic to the discharge of wastewater to marine coastal water, with a view to establishing revised standards.
(2) In order that these revised standards are available as a basis for meaningful preparation of the Second Stage Program, GoI w be asked to establish such revised standards by Jun-97.

	VERSOVA AND MALAD DRAINAGE AREAS : FIRST STAGE WORKS																	
14	Construct prelim. treatment/aerated lagoons at Versova	BBY-III				-Jun												
15	Commission 14	BBY-III				-Dec												
16	Award Contracts-compl'n of prelim treatment for Malad	BBY-III				-Dec												
17	Commission 16	BBY-III					-Apr											
	VERSOVA AND MALAD DRAINAGE AREAS : SECOND STAGE WORKS																	
18	Prepare flow estimates for 2020	BSDP			Jul-													
19	Determine Flow capacity of existing systems	BSDP			Jan-													
20	Implement Bombay Coastal Water Study [see 7]	JapanGrant			Oct-			-Sep										
21	Review 7 : Decide basis for Decision and Action [see 8]	-				Oct-Jun												
22	Geotechnical, Feasibility & Environmental Ass Studies	BSDP					Oct-			-Oct								
23	Acquire Land per requirement indicated by 22	MCGB						Oct-			-May							
24	Detailed Engineering and Tender Documents	BSDP								Oct-		-Oct						
25	Invite Tenders - Evaluate - Award	-										Dec-Dec						
26	Construct Second Stage Works	TBD												Jan-				-Jan
27	Commission Second Stage Works	TBD																-Jun

	BHANDUP AND GHATKOPAR DRAINAGE AREAS: FIRST STAGE WORKS																	
28	Construct Ghatkopar Pumping Station (Civil Wks)	BBY-III				-Feb												
29	Complete Mech and Elect Works for Ghatkopar PStation	BBY-III				-Jun												
30	Commission 28-29	BBY-III				-Sep												
31	Complete Mech and Elect Wks for Preliminary Treatment	BBY-III			Jan-Sep													
32	Prepare Civil Works Bid Documents for Aerated Lagoons	BBY-III			-Mar													
33	Invite and Evaluate Tenders for 32 - Award Contracts	-			-Nov													
34	Construct Aerated Lagoon Civil works	BSDP				Jan-				-May								
35	Prepare Mech and Elect Tender Doc for Aerated Lagoons	BSDP			Aug-Dec													
36	Invite and Evaluate Tenders for 35 - Award Contracts	-				Jan-Jan												
37	Complete Mech and Elect Works and Commission Lagoons	BSDP					Oct-Dec											
	BHANDUP AND GHATKOPAR : SECOND STAGE WORKS																	
38	Prepare Flow Estimates for 2020	BSDP			Jul-													
39	Water Quality Stud-Thane Creek(to confluence with sea)	BSDP			Sep-			-Mar										
40	Geotechnical, Feasibility & Environmental Ass Studies	BSDP				Jun-			-Jun									
41	Detailed Engineering and Tender Documents	BSDP							Jan-		-Jan							
42	Invite Tenders - Evaluate - Award	-									JanJan							
43	Construct Second Stage Works	TBD											Jan-			-Jan		
44	Commission Second Stage Works	TBD														-Apr		

BSDP - Bombay Sewage Disposal Project
TBD - To be Determined
BBY-III - Third Bombay Water Supply and Sewerage Project
MCGB - Municipal Corporation of Greater Bombay

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The Need for the Second Stage Program

2. Environmental impact studies conducted during preparation of the proposed project reveal that, even after completion of the works presently planned (under the First Stage Program), the quality of coastal waters and the water quality in Malad and Thane creeks will require further measures for their protection in order to comply with national standards in effect elsewhere, which are indicative of the level of standards that India's State and Central Government may require in the future. It will, therefore, be necessary to raise the quality of sewage effluent, or to change the locations at which sewage effluent is discharged, or even to take both measures, in order to satisfy future environmental requirements. Planning for these Second Stage improvements in the sewage treatment and disposal facilities is included in the proposed project, as outlined in the above table, and further described in the following paragraphs by drainage area.

The Colaba Drainage Area

3. The existing facilities appear to have sufficient capacity to deal with flows from the Colaba drainage area up to the year 2015; the need for further works will be assessed in the Stage 2 studies. Program.

The Worli and Bandra Drainage Areas

Population Growth

4. The 1991 census shows that the populations in both drainage areas are significantly different from those predicted in the 1979 Master Plan Report (para. 2.10). In Worli there has been a migration out of the area due partly to a shift in industry and flows to the Worli outfall are, therefore, less than had been forecast. In the Bandra drainage area, the population has grown more rapidly than forecast, due partly to migration from the rural areas, and a trend to make land, that was formerly used for industry, available for housing development. In accordance with a recently formulated MCGB policy, part of this land is designated for re-housing squatters. These factors, and the increase in flows due to rising living standards justify continuing a program to measure sewage flows in most of the drainage areas. By this means, up to date information would be available for planning the Second Stage and particularly for the feasibility studies.

Details of the Second Stage Program

5. Flow studies carried out in 1992 will be updated in the light of MCGB plans to improve water supplies to these areas. Other factors to be considered are the planned developmental and demographic changes within the limitations imposed by the general infrastructure of the areas. The flow studies will be implemented by a dedicated team, to be established in MCGB, and will begin in 1995. The initial study results will be available in 1997 for incorporation into the proposed engineering feasibility studies.

6. Bombay Coastal Water Quality Studies (BCWQS). Studies that were implemented as part of the Environmental Assessment in relation to the Worli and Bandra outfalls, focussed on an area contiguous to the outfalls and was limited to a distance of 3 or 4 km from the shoreline. The area to be studied under BCWQS as part of the Second Stage Program will refine the available hydrodynamic

data and will cover a much larger area (extending to about 8 to 10 km from the shore line and from a point about 20 km north of Malad creek to an point about 7 km south of Worli outfall).

7. A mathematical model, to be constructed as part of the study, will provide data on the quality of coastal waters that could be achieved by the provision of varying methods of sewage treatment and effluent disposal through outfalls of varying lengths. The study, which is grant funded and is being conducted by the National Environmental Engineering Research Institute under the direction of MCGB, began in November 1994 and is scheduled to provide information to MCGB in the form of a draft report by September 1996.

8. The Feasibility Study. Under the agreed schedule, proposals for the study will be invited from consultants in June 1996 and consultants will be appointed in April 1997. The feasibility study can only begin when flow studies have been completed and information is available from BCWQS. The feasibility study is scheduled for completion in December 1999.

9. The scope of work for the feasibility study will include:

(a) review of flow forecasts to the year 2020;
(b) review of the BCWQS information;
(c) procurement of contracts for site investigation;
(d) examination of alternative methods for extending the (then existing) Worli and Bandra outfalls;
(e) examination of sewage treatment options;
(f) assessment of the required lengths of outfalls;
(g) assessment of land requirements and availability;
(h) estimates of costs and environmental benefits of different options;
(i) estimates of capital costs and operation and maintenance costs;
(j) supervision of site investigations;
(k) recommendations for the Second Stage of sewage treatment and disposal development;
(l) preparation of an implementation program and a schedule of financing requirements; and
(m) recommendations for staffing and training.

10. Detailed Engineering Designs. On completion of the feasibility studies, proposals will be invited from consultants for the preparation of detailed engineering designs and procurement documents for works recommended in the feasibility studies. The schedule would follow the outline above (items 10, 11 and 12). Construction contracts for the Second Stage Program for the Worli and Bandra drainage areas would be awarded in June 2003, and works would be completed in the year 2007.

The Versova and Malad Drainage Areas

Factors Influencing the Second Stage Program

11. Recently completed environmental impact studies indicate that discharges of sewage effluent to Malad creek from the combined Versova and Malad drainage areas would seriously deplete dissolved oxygen levels of the receiving waters. In addition, preliminary population and flow studies conducted in 1994 show residential development in these areas to be more rapid than was forecast in the original Master Plan. Thus, the original plan in which treated sewage effluent from these two drainage areas

would be discharged to Malad creek is no longer appropriate if the ecosystem of the creek is to be restored.

12. The discharge of sewage effluent to Malad creek from one drainage area, Versova, is, however, sustainable in the medium term (possibly for about 15 years). The Versova aerated lagoons will be put into operation on completion in 1996 and may be incorporated into an enhanced treatment and disposal system that will ultimately begin to serve the Malad and Versova areas in the year 2009.

Details of the Second Stage Program

13. Capacity of the Existing System. Surveys of the entire Bombay sewage conveyance system will be carried out under the First Stage of the proposed project. These surveys will provide information (e.g.,pipe sizes, topography, type of construction, and condition) from which the capacities of components of the existing conveyance system may be estimated. The surveys will begin in these two drainage areas in January 1995 and will be completed in June 1996.

14. Bombay Coastal Water Quality Study. This study is described in paragraph 3 ii, above. The study will assess the effects on coastal waters of discharging effluent through outfalls from the Worli, Bandra, Malad and Versova drainage areas at various locations in the coastal area described.

15. Flow Studies. Flow studies similar to those described for the Worli and Bandra drainage areas will be implemented by MCGB for the Versova and Malad drainage areas. In executing these studies the following additional factors will be recognized: increased water supplies from Municipal and other sources; population growth; the capacity of the existing conveyance system; constraints imposed by the existing infrastructure; the effects of possible improvements of that infrastructure; and the potential for reuse of treated sewage effluent. The study will begin in 1995 and will be an ongoing exercise as forecast flows are compared with actual flows.

16. The Feasibility Study. The feasibility will be similar to that described in paragraph 3 iii above, but with some variations in the scope of work to suit conditions on the particular drainage areas. Under the agreed schedule, proposals for the study will be invited from consultants in June 1996, consultants would be appointed and the study would begin in October 1997. The study is scheduled for completion in October 1999.

17. The scope of work for the feasibility study will include:

(a) review of flow forecasts to the year 2020;
(b) review of the BCWQS information;
(c) procurement of contracts for site investigation;
(d) examination of alternative methods for upgrading the existing sewerage system to meet development needs to the year 2020;
(e) examination of sewage treatment options;
(f) assessment of the required locations and lengths of outfall(s);
(g) assessment of land requirements and availability;
(h) estimates of costs and environmental benefits of different options;
(i) estimates of capital costs and operation and maintenance costs;
(j) supervision of site investigations;
(k) recommendations for the Second Stage of sewage treatment and disposal development;
(l) preparation of an implementation program and a schedule of financing requirements; and

(m) recommendations for staffing and training.

18. Land Acquisition. With the acceptance of the feasibility study report, land acquisition is scheduled to begin in October 1999 and to be completed in the year 2001.

19. Detailed Engineering Designs. On completion of the feasibility studies, proposals will be invited from consultants for the preparation of detailed engineering designs and procurement documents for works recommended in the feasibility studies. The schedule would follow the outline above (items 24 and 25), construction contracts for the Second Stage Program for the Versova and Malad drainage areas would be awarded in January 2004, and works would be completed in 2009.

The Bhandup and Ghatkopar Drainage Areas

Factors Influencing the Second Stage Program

20. Aerated lagoons would be constructed to treat sewage from these two drainage areas under the First Stage Program. Effluent from these lagoons would be discharged to Thane creek. Recently completed receiving water quality studies of Thane creek indicate that beyond the year 2015 other forms of sewage treatment and/or disposal would be necessary if the quality of the creek water is to be maintained at an acceptable level.

21. In addition, increased sewage flows are forecast for these drainage areas as a result of in-migration of the rural population and a sharp increase in residential development. Plans to rehouse that section of the population at present occupying temporary housing and plans to improve the water supply situation may also generate additional sewage flows. Against this forecast trend, the Ghatkopar drainage area is heavily industrialized and there is growing demand for sewage to be treated for reuse by industry, which may reduce the flows to Thane creek, depending on the method adopted by industry for the disposal of the wastewater after its reuse. It is evident that to maintain the quality of Thane creek at an acceptable level, planning of the Second Stage Program for these two drainage areas would need to be implemented in line with that for other drainage areas.

Details of the Second Stage Program

22. Flow Studies. Studies implemented in 1993 indicate that sewage flows in the Ghatkopar drainage area are lower than those forecast in the Master Plan Study. However there is a much higher growth potential than was previously forecast. In the Bhandup drainage area, a recent rapid assessment of sewage flows suggests that they are significantly larger than was originally forecast. Further study of the growth potential in these two drainage area are, therefore, a prerequisite for planning future sewage treatment and disposal facilities. Such a study is to be implemented by MCGB using a team of their own engineers, beginning in mid-1995. The findings of the study will be regularly reviewed and updated to reflect the changing flow pattern and to compare forecast and actual flows.

23. Thane Creek Water Quality Study. Recent studies of Thane creek to assess the effects on the creek of the First Stage facilities indicated that the assimilative capacity of the creek was limited, primarily by the lack of tidal flushing and the limited natural inflow to the creek. MCGB is now considering authorizing further studies of a greater portion of the creek to more accurately assess its assimilative capacity and the effects of discharging effluent from the aerated lagoons at different locations. This study is scheduled to begin in September 1995 and to be completed early in 1997.

24. The Feasibility Study. The feasibility will be similar to those described (above) for other drainage areas but with some variations in the scope of work to suit conditions in the Bhandup and Ghatkopar drainage areas. Under the agreed schedule, proposals for the study will be invited from consultants in June 1996, consultants would be appointed and the study would begin in June 1997. The study is scheduled for completion in June 1999.

25. The scope of work for the feasibility study will include:

(a) review of flow forecasts to the year 2020;
(b) review of information from the Thane creek Water Quality Study;
(c) procurement of site investigation contracts;
(d) examination of alternative methods of sewage treatment;
(e) review of various locations for sewage treatment facilities;
(f) assessment of the possible locations and lengths of outfall(s);
(g) assessment of land requirements and availability;
(h) estimates of costs and environmental benefits of different options;
(i) estimates of capital costs and operation and maintenance costs;
(j) supervision of site investigations;
(k) recommendations, for the Second Stage Program, for sewage treatment and disposal development;
(l) preparation of an implementation program and a schedule of financing requirements; and
(m) recommendations for staffing and training.

26. Land Acquisition. Land acquisition (and resettlement procedures if required) would begin on completion of the feasibility study report. This could prove to be a difficult issue in the case of these two drainage areas.

27. Detailed Engineering Designs. As for other drainage areas discussed above, on completion of the feasibility studies, proposals will be invited from consultants for the preparation of detailed engineering designs and procurement documents for works recommended in the feasibility studies. The schedule would follow the outline above (items 41 and 42), construction of facilities for the Second Stage Program for the Bhandup and Ghatkopar drainage areas would begin in the year 2003 and would be completed in 2006.

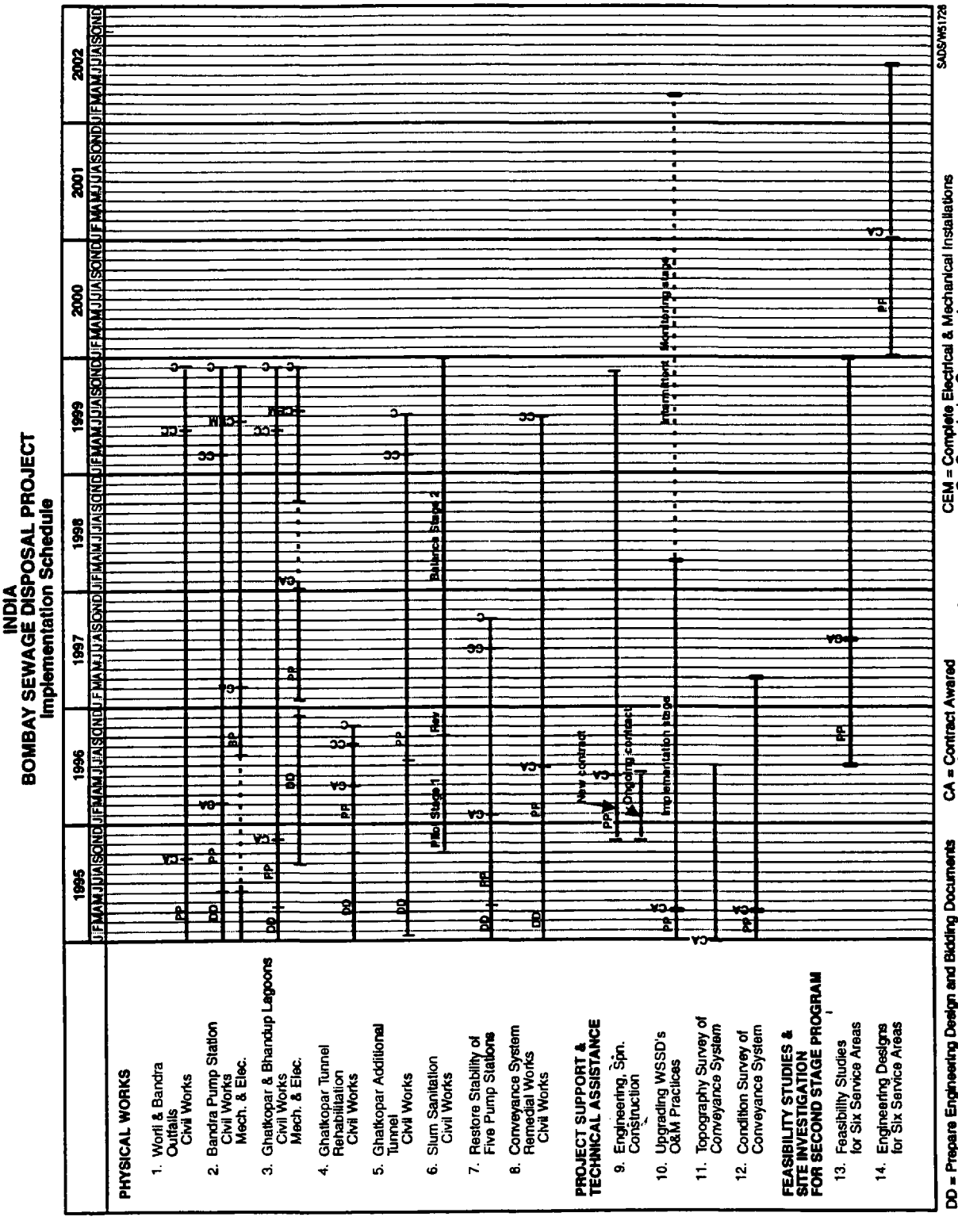
Note on Staffing and Training for All Feasibility Studies

28. The terms of reference for all feasibility studies would require the consultants appointed to address the requirements for operation and maintenance staff and the training of that staff prior to the completion of the work. All MCGB electrical and mechanical staff who would be assigned to operate the completed plants would be required to work with the installation teams during erection and commissioning of the plants to ensure their familiarity with the facility that they are to operate.

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

IMPLEMENTATION SCHEDULE



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BOMBAY SEWAGE DISPOSAL PROJECT

ESTIMATED SCHEDULE OF DISBURSEMENTS

Bank Fiscal Year	Quarter Ending	IDA Credit		IBRD Loan		TOTAL		Percent TOTAL Credit and Loan
		Quart	Cumul	Quart	Cumul	Quart	Cumul	
FY96	30-Sep-95	6.0	6.0	-	-	6.0	6.0	3.1%
	31-Dec-95	6.8	12.8	-	-	6.8	12.8	6.7%
	31-Mar-96	7.0	19.8	-	-	7.0	19.8	10.3%
	30-Jun-96	5.2	25.0	2.2	2.2	7.4	27.2	14.2%
FY97	30-Sep-96	-	25.0	7.8	10.0	7.8	35.0	18.2%
	31-Dec-96	-	25.0	8.3	18.3	8.3	43.3	22.6%
	31-Mar-97	-	25.0	9.3	27.6	9.3	52.6	27.4%
	30-Jun-97	-	25.0	10.7	38.3	10.7	63.3	33.0%
FY98	30-Sep-97	-	25.0	12.5	50.8	12.5	75.8	39.5%
	31-Dec-97	-	25.0	13.9	64.7	13.9	89.7	46.7%
	31-Mar-98	-	25.0	14.2	78.9	14.2	103.9	54.1%
	30-Jun-98	-	25.0	14.2	93.1	14.2	118.1	61.5%
FY99	30-Sep-98	-	25.0	14.0	107.1	14.0	132.1	68.8%
	31-Dec-98	-	25.0	13.2	120.3	13.2	145.3	75.7%
	31-Mar-99	-	25.0	11.0	131.3	11.0	156.3	81.4%
	30-Jun-99	-	25.0	9.4	140.7	9.4	165.7	86.3%
FY00	30-Sep-99	-	25.0	7.8	148.5	7.8	173.5	90.4%
	31-Dec-99	-	25.0	6.4	154.9	6.4	179.9	93.7%
	31-Mar-00	-	25.0	1.4	156.3	1.4	181.3	94.4%
	30-Jun-00	-	25.0	1.3	157.6	1.3	182.6	95.1%
FY01	30-Sep-00	-	25.0	1.3	158.9	1.3	183.9	95.8%
	31-Dec-00	-	25.0	1.0	159.9	1.0	184.9	96.3%
	31-Mar-01	-	25.0	1.2	161.1	1.2	186.1	96.9%
	30-Jun-01	-	25.0	1.1	162.2	1.1	187.2	97.5%
FY02	30-Sep-01	-	25.0	1.0	163.2	1.0	188.2	98.0%
	31-Dec-01	-	25.0	0.9	164.1	0.9	189.1	98.5%
	31-Mar-02	-	25.0	0.9	165.0	0.9	190.0	99.0%
	30-Jun-02	-	25.0	0.7	165.7	0.7	190.7	99.3%
FY03	30-Sep-02	-	25.0	0.7	166.4	0.7	191.4	99.7%
	31-Dec-02	-	25.0	0.6	167.0	0.6	192.0	100.0%

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BOMBAY SEWAGE DISPOSAL PROJECT

PROGRESS REPORTING AND PROJECT SUPERVISION

1. Page 2 of this Annex gives a tabulation of the topics that will come within the purview of supervision by the Bank either by correspondence from headquarters, through supervision missions or both.

2. In principle, the responsibility for supervising and managing the Project lies with MCGB. The essential aim of Bank supervision is supervision of the loan agreements but an additional aim will be to assist MCGB with advice in addressing issues which arise.

3. Accordingly, assurances will be sought at negotiations that MCGB will furnish promptly within thirty days after the end of each quarter, a Project Progress Report which covers the topics listed on page 2 of this Annex, and which is in a form decided in consultation with the Bank.

4. Although the Bank needs to be kept informed by the kind of Project Progress Report described in para 3, the preparation of such a report, and the maintenance of the systems and records which permit its preparation, is also aimed at aiding MCGB's effective management of the Project and its staff reporting, as may be required, to such bodies as the Standing Committee of the Bombay Corporation. Additionally, the availability to both MCGB and Bank supervision staff, of the kind of information to be contained in such reports, greatly assists the development effectiveness of the mission's time, which can thus be concentrated on addressing issues in consultation with MCGB and not taken up with routine data-gathering, assembly and analysis.

5. A "Provisional Bank Supervision Plan" is given on page 3 of this Annex. Its features include:

(a) generally two mission per year of implementation (usually one comprehensive and the other more selective);

(b) a heavier than average Bank staff time input near the beginning of the Project. This is partly because of the higher than average Bank staff time required to deal with procurement matters which are concentrated near the beginning of the Project. It is also to aid start-up and a full MCGB understanding of Bank requirements - particularly in the areas of (i) progress reporting; (ii) procurement of goods/works and of consultants; (iii) withdrawal requests (disbursements); and (iv) accounts and audit;

(c) declining Bank staff time inputs over the life of the Project for an average of 17.1 staff-weeks per year;

(d) a Mid-Term Review in September 1999; and

(e) an ICR mission in the Fall of 2002.

A PURVIEW OF SUPERVISION BY THE BANK
(and a Guide to Topics for MCGB's Quarterly Project Progress Reporting to the Bank)

A GENERAL
- 1 Review of Compliance with Covenants
- 2 Review of Monitoring Indicators (Annex 12)

B INSTITUTIONAL MATTERS
- 1 Review of MCGB's Organization-Management-Staff for Project Management and Supervision
- 2 Design and Use of Systems to Aid Project Management and Periodic Reporting
- 3 Review of Consultant's Recommendations re Sewerage System Operation and Maintenace Improvements
- 4 Review of MCGB's Actions to Implement the Sewerage System Operation and Maintenance Improvements

C FINANCIAL MATTERS AND FINANCIAL MANAGEMENT
- 1 Organization-Management-Staff-Systems for Financial Management and Accounting
- 2 Monitor Financial Management
- 3 Review Financial Performance
- 4 Monitor Timing and Review Prescribed Accounts and Audits thereon to Bank

D PROCUREMENT (re Bank "Guidelines" and re Technical Aspects).
- 1 Prior Review of Pre-qualification Documents
- 2 Prior Review of Bid Documents (Works and Goods)
- 3 Prior Review of Bid Evaluation Reports
- 4 Review of Conformed Contract Documents (Goods and Works)
- 5 Post Review (Mission) of Documents not subject to Prior Review

- 6 Prior Review of Consultant Recruitment Documents
- 7 Prior Review of Consultant Proposal Evaluations
- 8 Prior Review of Draft "as-negotiated" Contracts
- 9 Review of Conformed Consultant Contract Documents

E PROJECT PHYSICAL PROGRESS - EXPENDITURE - DISBURSEMENTS
- 1 Monitoring of Procurement Progress (Activites in D) against Schedules
- 2 Monitoring of Physical Progress on Goods/Works Contracts against Schedules
- 3 Monitoring of Borrower Inspection/Testing and Other Supervision re Quality
- 4 Monitoring of Implementation of Environmental Impact Mitigation Measures
- 5 Review Performance of Supervision Consultants
- 6 Review Performance of Consulants on Conveyance System Condition Surveys
- 7 Review Performance of Consultants on Upgrading of Operation and Maintenance Practices
- 8 Review of Project Expenditures (periodic and cumulative) against Targets
- 9 Review of Disbursement Claims (periodic and cumulative) against Targets

F SLUM SANITATION PROGRAM : INSTITUTIONAL - SOCIAL - TECHNICAL
- 1 Review of MCGB Organization - Management - Staff for Slum Sanitation
- 2 Review of MCGB Management of Technical-Social Consultants
- 3 Monitoring of Social Surveys
- 4 Monitoring of Implementation of Findings of Social Surveys
- 5 Review of Physical Measures Proposed
- 6 Review of Physical Implementation
- 7 Review of Independent Monitoring and Evaluation

G ENVIRONMENTAL
- 1 Advise re D4 above
- 2 Monitor the Review of Coastal Water Standards
- 3 Review the Output of Coastal Water Studies
- 4 Review Environmental ToRs and Outputs of Environmental Assessments in Second Stage Studies

H TECHNICAL - SECOND STAGE STUDIES
- 1 Assist with ToRs for Second Stage Geotechnical and Feasibility Studies
- 2 Review Performance of Consultants on Second Stage Geotechncial and Fesibility Studies
- 3 Review Outputs of Second Stage Geotechnical and Feasibility Studies

A PROVISIONAL BANK SUPERVISION PLAN

The actual timing and staffing of missions will, of course, be adjusted as appropriate to accommodate Project circumstances as these unfold.

Mission No	Timing	Bank FY	DESCRIPTION (Notes)	MISSION STAFFING (WEEKS) Mission Leader Engineer	Proc't Spec'st	Envir'l Spec'st	Slum Sanit'n Engin'r	Slum Sanit'n Sociol	Accounts and Finance	TOTAL STAFF WEEKS Miss	HQ	Total
1	Fall 1995	FY96	PROJECT LAUNCHING	2	1	1	2	2	1	9		
2	Spring 1996	FY96	FULL SUPERVISION	2	1	1	2	2	1	9		
									FY96	18	6	24
3	Fall 1996	FY97	(Compl'n Coastal WQuality Studies)	2	-	2	1	1	1	7		
4	Spring 1997	FY97	FULL SUPERVISION	2	1	1	2	2	1	9		
									FY97	16	6	22
5	Fall 1997	FY98	Supervision	1	-	-	1	1	1	4	-	-
6	Spring 1998	FY98	MID-TERM REIVEW	2	1	1	2	2	1	9	-	-
									FY98	13	6	19
7	Fall 1998	FY99	Supervision	1	-	-	1	1	1	4	-	-
8	Spring 1999	FY99	FULL SUPERVISION	2	-	-	1	1	1	5	-	-
									FY99	9	6	15
9	Fall 1999	FY00	(Subst Compl'n Physical Works)	1	-	-	1	1	-	3	-	-
10	Spring 2000	FY00	FULL SUPERVISION	2	-	-	-	-	1	3	-	-
									FY00	6	6	12
11	Fall 2000	FY01	Supervision	1	-	-	1	1	-	3	-	-
12	Spring 2001	FY01	FULL SUPERVISION	2	-	-	-	-	1	3	-	-
									FY01	6	5	11
13	Fall 2001	FY02	Supervision	1	-	-	1	1	-	3	-	-
14	Spring 2002	FY02	FULL SUPERVISION	2	-	-	-	-	1	3	-	-
									FY02	6	4	10
15	Fall 2002	FY03	ICR MISSION	2	1	1	2	2	1	9	6	15
			TOTALS	25	5	7	17	17	12	83	45	128
				30%	6%	8%	20%	20%	14%	100%		
			Average per Year (7.5 Yrs)							11.1	6.0	17.1

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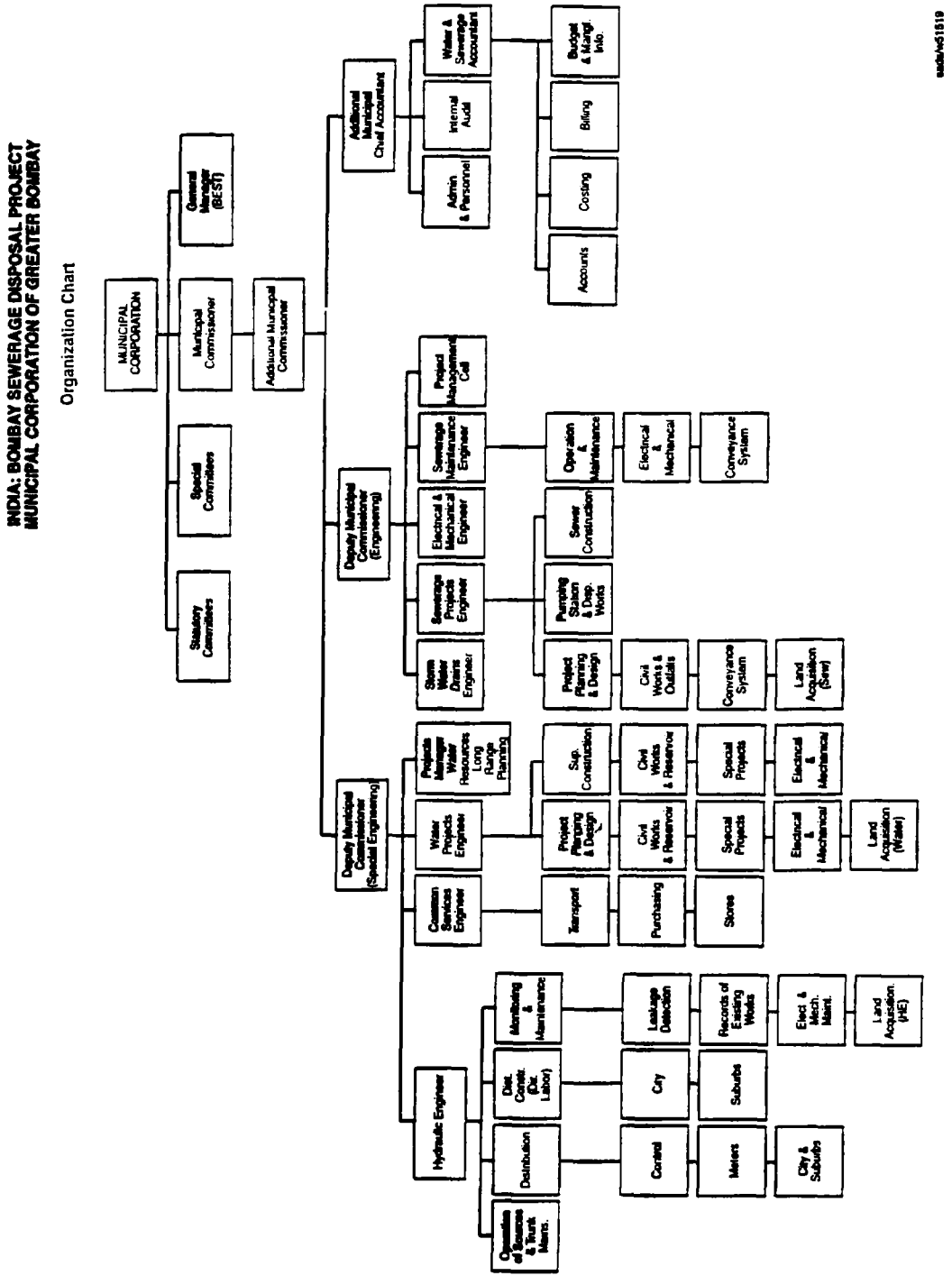
BOMBAY SEWAGE DISPOSAL PROJECT

MCGB ORGANIZATION CHART



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BOMBAY SEWAGE DISPOSAL PROJECT

FINANCIAL STATEMENTS AND MAJOR ASSUMPTIONS

1. MCGB's Water Supply and Sewerage Department's (WSSD) fiscal year runs from April 1 through March 31 of the following calendar year. The four years shown in the attached financial statements represent MCGB's recent operating history from April 1, 1991 to March 31, 1995 (budgeted). Projections thereafter are for fiscal years 1995/96 estimated to 1999/2000. Projections are made in November 27, 1994.

2. The Income and Expenditure statement (Table I), the Balance Sheet (Table II) and Sources and Application of Funds (Table III) were prepared by WSSD's Finance Department. These statements include actual (FY92-FY95) and projected (FY96-FY2000) figures.

3. Table IV and Table V provide detailed statements on revenues and costs.

4. Table VI depicts the water demand and supply patterns upon which revenue calculations have been based. It will be noted that transmission and distribution losses have been assumed to decline from 32% in FY95 to 26% in FY2002.

5. The projections include the capital costs, operation and maintenance costs and revenue implications from greater sales/coverage for the Third Bombay Water Supply and Sewerage Project. The project provides a total increment of 455 million liters of water per day (mld). 90 mld per day was provided in 1993/94 and the remaining 365 mld will be provided in 1996/97.

6. Capital Expenditures include a) Phase II (BSDP) from FY96 to FY2000; b) Phase III: Third Bombay Water Supply Sewerage Project from FY86 to FY97; c) Phase IV: Fourth Bombay Water Supply and Sewerage Project from FY97 onwards; and d) BRIM-STOWAD and Storm Water Drains are sourced from internally generated funds

7. The revenue projections are based on the present tariff levels which include the tariff increase of 1993/1994 and of 1994/95. An annual increase of 10% has been assumed for the rateable value basis.

8. The World Bank will fund 65% of project costs for the Second Water Supply Project. 35% will be sourced by internally generated funds from MCGB. Details of the cost sharing are given in Annex 4.

Revenues and Operating Costs

9. Revenues comprise of water revenues and sewerage revenues. These include:

a) revenues from metered consumers (charged mostly to industrial and larger domestic consumers);
b) revenues from unmetered consumers (tariffs mostly to domestic) charged on a flat rate basis;

c) a benefit tax based on the rental value (RV) of the property; and
d) a sewerage tax which is 50% of the water bill.

10. **Transmission and Distribution Losses.** Losses have been assumed at 20% throughout the projection period.

11. **Operating Expenses.** In making the projections, the number of employees are kept constant. On a yearly basis, wages are increased at 18%, chemicals at 16%, power at 16%, materials at 5%, transport at 10% and operational expenditures for Storm Water Drainage Project at 12%. With the exception of materials, each of the categories include an 8% inflation rate. The completion of the Third Bombay Water Supply and Sewerage Project will have a direct effect on operating costs from 1996/97 onwards.

12. **Interest and Depreciation.** Depreciation of fixed assets is based on the straight-line method, at 2.5% per annum.

Working Capital

18. **Cash.** Minimum cash requirement is assumed to be two months of operating and capital expenditures.

19. **Inventory** represents a three month supply of chemicals, and materials together with 10% of annual capital expenditures to cover stocks of cement, steel and other items.

20. **Accounts Receivables** other than those from customers are assumed to represent three months of advanced capital expenditures. Customer accounts receivable are predicted at collection efficiencies of 75% through FY2000.

21. **Accounts Payable** relate to the money due from WSSD to contractors and suppliers pending settlement of their bills (connected largely with capital works). It represents one month of capital expenditure, direct operating costs, and administrative expenses and is projected to increase in proportion to capital work-in-progress.

Internal Cash Generation

22. MCGB will need to increase water and sewerage tariffs in FY98, in FY99, and in FY2000 to ensure that internal funds are available to cover at least 35% of its capital expenditures in any year.

TABLE I

INCOME STATEMENT (WSSD) Rs. in million	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000
	ACTUALS/BUDGETED				PROJECTED				
Water Revenues									
Tariff revenue	1,384.20	1,425.60	2,336.00	2,734.60	2,807.36	3,156.07	3,281.52	3,419.51	3,571.30
Other revenue	127.80	106.80	111.46	167.00	168.44	189.36	196.89	205.17	214.28
Sewerage Revenue									
Tariff revenue	703.50	758.40	1,248.33	1,481.90	1,721.23	1,927.09	2,024.47	2,131.59	2,249.41
Other revenue	50.90	43.80	45.55	70.00	86.06	96.35	101.22	106.58	112.47
General revenue	267.00	254.10	190.09	300.50	139.76	156.04	90.75	29.31	30.74
TOTAL REVENUES:	2,533.40	2,588.70	3,931.43	4,754.00	4,922.85	5,524.91	5,694.85	5,892.16	6,178.20
Direct Costs:									
Water Supply	714.70	931.20	1,262.50	1,125.96	1,370.67	1,702.68	1,974.35	2,290.99	2,660.16
Sewerage	318.60	378.20	460.20	544.10	670.66	773.62	906.14	1,048.42	1,214.64
Storm Water Drains	148.30	212.20	234.20	309.07	346.16	387.70	434.22	486.33	544.69
TOTAL DIRECT COST:	1,181.60	1,521.60	1,956.90	1,979.13	2,387.49	2,864.00	3,314.71	3,825.74	4,419.49
Admin. & Gen. Expenses	112.60	132.30	88.40	99.01	110.89	124.20	139.10	155.79	174.49
TOTAL COST	1,294.20	1,653.90	2,045.30	2,078.14	2,498.38	2,988.20	3,453.81	3,981.53	4,593.98
Income before Intarest & Deprec.	1,239.20	934.80	1,886.13	2,675.86	2,424.48	2,536.73	2,241.03	1,910.63	1,584.23
Depreciation	225.00	235.10	258.50	349.77	349.77	424.77	424.77	449.77	449.77
Income before Interest	1,014.20	699.70	1,627.63	2,326.10	2,074.71	2,111.96	1,816.27	1,460.86	1,134.47
Interest Charged to Operation	9.90	6.90	11.21	10.36	10.36	10.36	10.36	6.80	5.00
Surplus/Deficit before Appropriations	1,004.30	692.80	1,616.42	2,315.74	2,064.35	2,101.60	1,805.91	1,454.06	1,129.47
Appropriations:									
Bad Debts	10.00	10.00	10.00	10.00	49.23	55.25	56.95	58.92	61.78
Non-Cash Expenses									
Fire & Accident Ins Fund	0.00	0.00	8.32	10.00	10.00	15.00	0.00	5.00	0.00
Third Party Ins Fund	0.00	0.00	0.04	0.04	0.04	0.04	0.04	0.04	0.04
NET SURPLUS/DEFICIT	994.30	682.80	1,598.06	2,295.70	2,005.08	2,031.31	1,748.92	1,390.10	1,067.65

TABLE II

ANNEX 10
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[illegible]	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-2000
	ACTUAL/BUDGETED				PROJECTED				
Assets:									
Fixed Assets in Operation	9,197.60	10,325.90	11,990.60	13,990.60	13,990.60	16,990.60	16,990.60	17,990.60	17,990.60
Less: Accumulated Deprn.	2,964.40	3,252.70	3,572.20	3,921.97	4,271.73	4,696.50	5,121.26	5,571.03	6,020.79
NET FIXED ASSETS	6,233.20	7,073.20	8,418.40	10,068.63	9,718.87	12,294.10	11,869.34	12,419.57	11,969.81
W.I.P. (Phase II)	4,322.10	3,431.50	2,611.96	611.96	2,569.68	4,983.86	7,825.39	11,119.91	14,103.61
W.I.P. (Phase III)	2,272.30	3,378.10	3,917.94	6,063.94	8,405.27	8,406.79	7,808.20	9,519.89	11,288.87
W.I.P. (Phase IV)	0.00	0.00	0.00	18.52	1,149.63	2,348.61	3,996.51	5,366.30	7,213.77
W.I.P. (BRIMSTOWAD/SWD)	111.70	160.40	145.80	599.80	1,313.79	2,070.62	2,872.85	2,723.23	4,136.37
Deferred Expenditure									
TOTAL:	12,939.30	14,041.20	15,094.10	17,362.85	23,157.24	28,103.98	34,372.29	41,148.70	48,712.23
Current Assets:									
Cash	2.98	1,951.70	2,029.90	1,440.42	1,393.28	1,691.15	1,867.95	2,101.21	750.00
Short Term Deposits	2,501.41			1,448.06	1,614.97	784.11	0.00	0.00	0.00
Cash & Short Term Deposits	2,504.40	1,951.70	2,029.90	2,888.48	3,008.25	2,475.26	1,867.95	2,101.21	750.00
Accounts Receivables	1,686.90	2,123.40	2,308.10	2,288.50	2,330.71	2,481.23	2,523.71	2,573.04	2,644.55
Contract Receivable	618.70	732.80	858.10	908.10	958.10	1,008.10	1,058.10	1,108.10	1,158.10
Inventories	246.20	248.30	400.90	757.46	661.66	770.28	786.60	828.38	375.00
Miscellaneous	776.00	788.00	1,021.50	1,071.50	1,121.50	1,171.50	1,221.50	1,271.50	1,321.50
TOTAL:	5,832.20	5,844.20	6,618.50	7,914.04	8,080.22	7,906.37	7,457.86	7,882.23	6,249.15
Less: Current Liabilities:									
Accounts Payable	959.50	1,036.90	926.10	1,082.78	1,740.42	1,693.28	1,991.15	2,167.95	2,401.21
Deposits Received	911.50	964.90	1,039.30	1,114.30	1,189.30	1,264.30	1,339.30	1,414.30	1,489.30
Interest Accrued	70.90	76.30	102.00	125.81	194.54	252.13	326.22	406.20	487.42
Misc. Accrued Liabilities	75.90	90.00	315.30	110.00	110.00	110.00	110.00	110.00	110.00
Current Maturities	171.30	167.20	168.80	162.24	181.97	249.68	298.55	285.16	250.00
TOTAL	2,189.10	2,335.30	2,549.50	2,595.13	3,416.23	3,569.39	4,065.22	4,383.61	4,737.93
NET CURRENT ASSETS	3,643.10	3,508.90	4,069.00	5,318.91	4,663.99	4,336.98	3,392.64	3,498.62	1,511.22
TOTAL ASSETS	16,582.40	17,550.10	19,163.10	22,681.76	27,821.23	32,440.96	37,764.93	44,647.32	50,223.45
Represented by:									
Equity Grant	1,137.50	1,186.50	1,207.50	1,207.50	1,207.50	1,207.50	1,243.71	1,280.79	1,280.79
Revaluation Surplus	798.40	798.40	798.40	798.40	798.40	798.40	798.40	798.40	798.40
Operational Surplus	10,326.00	11,076.20	12,235.70	14,530.39	16,534.46	18,465.78	20,312.68	21,702.45	22,770.10
Misc. Liabilities	187.00	212.70	241.00	261.04	320.31	390.60	447.59	511.55	573.37
TOTAL	12,448.90	13,273.80	14,482.60	16,797.33	18,860.67	20,862.26	22,802.38	24,273.19	25,432.66
Long Term Debt	4,133.50	4,276.30	4,743.50	5,884.44	8,960.57	11,479.70	14,715.65	18,255.87	21,966.06
Deficit/Further Funds Required	0.00	0.00	0.00	0.00	0.00	0.00	246.82	2,118.15	2,824.73
TOTAL LIABILITIES:	16,582.40	17,550.10	19,226.10	22,681.77	27,821.24	32,341.96	37,764.95	44,647.31	50,223.45

TABLE III

SOURCES AND APPLICATION OF FUNDS (WSSD) (Rs. in million)	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000
	ACTUALS/BUDGETED				PROJECTED				
Minimun Cash Balance required	2,298	3	1,952	2,021	1,440	1,393	1,691	1,868	2,101
Short Term deposit with budget A	0.00	2,501.41	0.00	0.00	1,448.06	1,614.97	784.11	0.00	0.00
Income before dep (cash profit)	1,239.20	934.80	1,886.13	2,675.86	2,424.48	2,536.73	2,241.03	1,910.63	1,584.23
Less: Debt Servicing									
(A) Principal Repayments (C.L.F.)	92.12	126.73	149.13	162.33	162.24	181.97	213.47	281.47	255.16
(B) Interest charged to Operation	9.90	6.90	11.21	10.36	10.36	10.36	10.36	6.80	5.00
(C) Amortization (Sinking Fund)	8.00	2.91	1.33	1.01	1.01	1.01	1.01	0.32	0.00
Total	110.02	136.54	161.67	173.70	173.61	193.34	224.84	288.59	260.16
(inc)/dec in assets	66.30	574.70	696.10	436.96	46.42	359.13	158.81	191.10	-281.87
inc/(dec) in Liabilities	139.30	150.30	214.60	50.19	801.38	85.44	446.95	331.79	389.48
Less: Min cash bal. required	3	1,952	2,021	1,440	1,393	1,691	1,868	2,101	750.00
Internal Generation before meeting Cap Expn.	3,497.59	936.56	1,164.76	2,704.87	4,501.02	3,386.81	2,911.65	1,529.47	3,346.62
Less: Annual Capital Expenditure									
Phase II (BSDP)	0.00	0.00	0.00	0.00	1,957.72	2,414.18	2,841.53	3,294.52	2,983.69
Phase III & IV (Bombay III and Bombay IV)	1,437.00	1,324.50	1,196.80	2,146.00	2,341.34	1,001.52	1,401.41	1,711.49	1,768.98
BRIM-STOWAD	0.00	0.00	0.00	18.52	1,131.11	1,198.98	1,647.90	1,369.79	1,847.48
Storm Water Drains (internal funds)	111.70	65.70	175.79	454.00	713.99	756.83	802.24	850.37	1,413.14
Total	1,548.70	1,390.20	1,372.59	2,618.52	6,144.16	5,371.51	6,693.08	7,226.17	8,013.29
Add: Further loans to be received									
(60% of PH II, III, & BRIM-STWD)	674.99	309.99	718.08	1,298.71	3,258.10	2,768.80	3,534.50	3,825.48	3,960.09
CASH SURPLUS/(DEFICIT)	2,623.88	-143.65	510.25	1,385.86	1,614.97	784.11	-246.92	-1,871.22	-706.58
(If Deficit increase in tariff required)									
Internal Generation req'd to meet Cap. Expn	873.71	1,080.21	654.51	1,319.81	2,886.05	2,602.70	3,158.57	3,400.69	4,053.20
% INCREASE IN TARIFF NEEDED:									
* If only Water & Sewerage Chgs are increased					0.00	0.00	8.68	65.77	24.84
* If Water, Sewerage Chgs & Taxes are increased					0.00	0.00	4.66	33.77	12.16

Note:

(A) MCGB covers in each of such years at least 33% of its capital expenditures (ie Phase-II, III & Brim-stwd 33%, full Amt for Storm Water Drains.)

(B) MCGB covers in 2 consecutive fin. yrs. at least 40% of the aggregate capital expenditure for such 2 years(ie Ph II, II & Brim-stwd 40%, full Amt for St. Wat. D)

(C) Bombay IV: Middle Vaitarana Project to start in 1996/97

TABLE IV

27-Nov-94 FINANCIAL MODEL : Municipal Corporation of Greater Bombay (MS&SD)

Table 1.1 : Statement of Revenues

	Refer to Table No.	Actual/Budgeted				Projected				(Rs. in millions)
		1991-92 Rs.	1992-93 Rs.	1993-94 Rs.	1994-95 Rs.	1995-96 Rs.	1996-97 Rs.	1997-98 Rs.	1998-99 Rs.	1999-2000 Rs.
(A) WATER SUPPLY										
TARRIFF REVENUE :										
WATER CHARGE BY MEASUREMENT	1.3	998.39	1,016.39	1,517.17	1,880.00	1,661.94	1,896.61	1,896.61	1,896.61	1,896.61
TAX ON RATEABLE VALUE	1.4	78.08	67.88	168.83	261.60	349.66	384.63	423.09	465.40	511.94
WATER BENEFIT TAX	1.4	387.87	331.88	648.22	670.00	798.76	869.84	956.82	1,052.50	1,157.75
RENT OF WATER METERS		2.11	1.71	1.78	3.00	5.00	5.00	5.00	5.00	5.00
TARIFF-WATER SUPPLY :		1,370.45	1,416.98	2,336.00	2,734.60	2,807.36	3,156.07	3,281.52	3,419.51	3,571.30
OTHER WATER REVENUE		133.40	115.57	111.46	167.00	168.44	189.36	196.89	205.17	214.20
T O T A L :		1,511.93	1,532.47	2,447.46	2,901.60	2,975.81	3,345.44	3,478.41	3,624.68	3,785.50
(B) SEWERAGE										
TARIFF REVENUE :										
SEWERAGE CHARGE BY MEASUREMENT	1.3	401.34	441.38	665.95	771.50	830.97	948.38	948.38	948.38	948.38
TAX ON RATEABLE VALUE	1.4	183.71	183.84	194.16	290.40	410.88	451.88	497.07	546.76	601.46
SEWERAGE BENEFIT TAX	1.4	192.38	286.29	387.84	420.00	474.46	521.90	574.09	631.50	694.65
SEWERAGE REVENUE FROM SP.SERV.		0.75	0.00	0.38	0.00	5.00	5.00	5.00	5.00	5.00
TARIFF-SEWERAGE :		698.18	758.63	1,248.33	1,481.90	1,721.23	1,927.09	2,024.47	2,131.59	2,249.41
OTHER SEWERAGE REVENUE		56.41	52.11	45.55	70.00	86.06	96.35	101.22	106.58	112.47
T O T A L :		754.51	802.74	1,293.88	1,551.90	1,807.29	2,023.44	2,125.69	2,238.16	2,361.86
C) GENERAL REVENUES										
INTEREST		264.96	247.76	185.61	294.00	115.84	129.28	62.73	0.00	0.00
OTHER GENERAL REVENUES		1.99	5.74	4.48	6.50	23.92	26.84	28.02	29.31	38.74
T O T A L :		266.95	253.50	190.09	300.50	139.76	156.04	90.75	29.31	38.74
G R A N D T O T A L :		2,533.39	2,588.71	3,931.43	4,754.00	4,922.86	5,524.92	5,694.85	5,892.16	6,178.20

TABLE V

27-Nov-94 FINANCIAL MODEL : Municipal Corporation of Greater Bombay (MS&SD)

Table 1.5 : Direct Costs

(Rs. in million)

	Actuals			Projected								
	1988-89 Rs.	1989-90 Rs.	1990-91 Rs.	1991-92 Rs.	1992-93 Rs.	1993-94 Rs.	1994-95 Rs.	1995-96 Rs.	1996-97 Rs.	1997-98 Rs.	1998-99 Rs.	1999-2000 Rs.
(A) WATER SUPPLY												
WAGES	205.40	224.30	267.70	299.30	351.60	427.30	458.71	541.28	638.71	753.68	889.34	1,049.42
CHEMICALS	8.00	11.00	17.20	18.50	16.50	26.00	25.00	37.65	49.04	57.82	67.07	77.80
POWER	174.30	216.90	289.00	314.00	437.60	512.30	497.20	653.97	865.72	1,004.23	1,164.91	1,351.30
MATERIAL (REP. & MAINT.)	40.60	37.70	33.70	40.00	55.30	60.20	66.40	69.72	73.21	76.87	80.71	84.75
TRANSPORT & COMMUNICATION	26.60	29.60	31.10	33.80	43.20	48.10	54.15	59.57	65.52	72.07	79.20	87.21
WATER CESS	8.90	5.30	5.10	8.30	27.00	100.60	24.50	8.49	9.69	9.69	9.69	9.69
DIRECT COST - WATER :	463.80	524.80	644.60	714.70	931.20	1,262.50	1,125.96	1,370.67	1,702.68	1,974.35	2,290.99	2,660.16
(B) SEWERAGE												
WAGES	129.00	129.00	165.40	197.40	227.00	274.90	320.00	377.60	445.57	525.77	620.41	732.00
POWER	31.00	33.50	67.20	53.50	75.30	90.60	112.40	174.79	202.76	247.52	287.19	333.14
MATERIAL (REP. & MAINT.)	44.40	51.02	41.00	57.00	63.00	91.00	97.60	102.40	107.60	112.90	118.65	124.57
TRANSPORT & OTHERS	9.10	8.40	10.40	9.90	12.10	13.70	14.10	15.79	17.69	19.81	22.19	24.85
DIRECT COST - SEWERAGE :	214.30	222.70	284.00	318.60	378.20	468.20	544.10	670.66	773.62	906.14	1,048.42	1,214.64
(C) STORM WATER DRAINS - * (DIRECT COST)	139.40	150.20	180.00	148.30	212.20	234.20	309.07	346.16	387.70	434.22	486.33	544.69
TOTAL DIRECT COST :	817.50	897.70	1,109.40	1,181.60	1,521.60	1,956.90	1,979.13	2,387.49	2,864.00	3,314.72	3,825.74	4,419.48

* NOTE : The operations of Storm Water Drains department are proposed to be merged with MS&SD with effect from 1991-92.

TABLE VI-

BOMBAY: PROJECTED FUTURE WATER SUPPLY (Mld)

	1996	1981	1982	1983	1984	1985	1986	1987	1988	1989	2000	2001	2002	2003	2004	2005
	Demand	Supply	Supply	Supply	Supply	Supply	Supply	Supply	Supply	Supply	Supply	Supply	Supply	Supply	Supply	Supply
Domestic Consumption	2608	1132	1132	1196	1196	1196	1454	1454	1454	1775	1775	1732	1732	2092	2092	2194
Non-Domestic Consumption	500	500	500	500	500	500	500	500	500	500	500	700	700	700	700	700
Other Consumption	62	33	33	34	34	34	39	39	39	46	46	49	49	56	56	58
TOTAL CONSUMPTION	**3170**	**1665**	**1665**	**1730**	**1730**	**1730**	**1993**	**1993**	**1993**	**2321**	**2321**	**2481**	**2481**	**2848**	**2848**	**2952**
Distribution Leakage	815	585	585	607	607	607	694	694	694	803	803	643	643	734	734	760
Subtotal	3985	2250	2250	2337	2337	2337	2687	2687	2687	3124	3124	3124	3124	3582	3582	3712
EnRoute Losses	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Plant Losses	170	98	98	101	101	101	116	116	116	134	134	134	134	153	153	159
Subtotal Supply Losses	260	188	188	191	191	191	206	206	206	224	224	224	224	243	243	249
TOTAL SUPPLY	**4245**	**2438**	**2438**	**2528**	**2528**	**2528**	**2893**	**2893**	**2893**	**3348**	**3348**	**3348**	**3348**	**3825**	**3825**	**3961**

Total losses Mld		773	773	798	798	798	900	900	900	1027	1027	867	867	977	977	1009
as of % of supply		32%	32%	32%	32%	32%	31%	31%	31%	31%	31%	26%	26%	26%	26%	25%

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

ENVIRONMENTAL ASSESSMENT SUMMARY

The Environmental Assessment Process

1. The environmental assessment (EA) for the project was undertaken by National Environmental Engineering Research Institute (NEERI) under contract to Municipal Corporation of Greater Bombay (MCGB), beginning in September 1991. Initially the EA was designed to meet the requirements of GOI Environment (Protection) Act of 1986 and the provisions of World Bank OD 4.00 Annex A, Environmental Assessment, applicable to Category A projects. Because the IEPS was issued prior to October 1, 1991, the project was not technically subject to OD 4.01 which superseded OD 4.00 Annex A; however, the workplan was modified to meet the changes in procedure as fully as possible without disrupting work in progress. The EA process was further modified to comply with BP 17.50, Disclosure of Operational Information, when it became effective for IBRD-financed projects on January 1, 1994.

2. The primary objectives of the EA were: (i) to ascertain if the facilities then being proposed as project components (described in Annexes 2 and 3) would be adequate to provide the desired environmental benefits; (ii) if inadequacies were identified, to examine alternatives that would achieve the desired benefits; and (iii) to develop a Mitigation Plan to address potential adverse impacts of construction and operation. Because of the extensive field investigations and hydrologic and water quality modeling required, the EA work was undertaken in three segments, each covering two of the six drainage areas the project was originally planned to cover (see drainage area description below). The Final Report on Marine Outfalls and the Final Report on the Aerated Lagoons at Bhandup and Ghatkopar were made available for public inspection and comment and officially submitted to the Bank in January 1995. The report on Aerated Lagoons at Malad and Versova was not officially submitted to the Bank, because MCGB decided to drop these lagoons from the project on the basis of the findings reported in the draft EA report (see paras. 47 - 49 for details), but a copy of the final report has been placed in the project files.

DRAINAGE AREAS IN GREATER BOMBAY

Name	Present Disposal Facilities	Proposed New Facilities
No. 1: Colaba	preliminary treatment and 1.2 km outfall to Bombay Harbor	none
No. 2: Worli	preliminary treatment and 0.5 km outfall to Arabian Sea	3 km outfall tunnel
No. 3: Bandra	discharge to Mahim Creek	prelim. treatment works; 3 km outfall
No. 4: Versova	3-stage aerated lagoons under construction	additional facilities in Second Stage Program
No. 5: Malad	discharge to Malad Creek	in Second Stage Program
No. 6: Ghatkopar	discharge to Thane Creek	single-stage aerated lagoons; upgrading to 3-stage in Second Stage Program
No. 7: Bhandup	discharge to Thane Creek	single-stage aerated lagoons; upgrading to 3-stage in Second Stage Program

Environmental Assessment Methodology

Marine Outfalls

3. As a baseline for assessment of potential improvement in coastal water quality, existing conditions were determined through extensive field surveys. The surveys were conducted during winter of 1991 (non-monsoon conditions) and summer of 1992 (monsoon conditions) and involved collection of 220 water and sediment samples along 24 kilometers of Bombay's coastline. Samples were analyzed for their relevant physical, chemical, bacteriological and biological characteristics. Ambient air quality, micrometeorology, noise levels, soil characteristics and land use patterns near the outfall construction sites were studied. Socioeconomic surveys and some interviews were also conducted in residential areas near the construction sites, in fishermens communities, and at recreational beaches to ascertain the identity and concerns of affected groups.

4. The water quality impacts of the outfalls as proposed were predicted in terms of three main parameters , dissolved oxygen (DO), biochemical oxygen demand (BOD_5) and total coliform bacteria (the basis of the GOI coastal marine water quality standard), using mathematical models to simulate initial dilution and advective-dispersive processes. These models were calibrated for local environmental conditions through in-situ and laboratory experiments. They were also applied in the analysis of alternative combinations of outfall lengths and levels of wastewater treatment. For environmental processes involving more complex interactions, such as nutrient enrichment, bioaccumulation of heavy metals, and ecological transformations of chemical compounds, the approach of observation at and inference from regions which have been receiving similar wastewater discharges over a long period was adopted for the prediction of impacts.

5. To assess the potential construction phase impacts, field investigations on sources of noise and air pollution during construction were conducted. Ground vibration data for blasting operations from previous construction in Bombay were also collected. A mathematical model was used to predict the impacts of blasting operations on structures and to establish charge limits. Ambient noise levels in surrounding communities were also predicted by a model.

Aerated Lagoons

6. The environmental status of Thane Creek, the receiving water for the proposed Bhandup and Ghatkopar lagoons, was determined through extensive physical, chemical, and biological surveys of winter and summer conditions. Hydrodynamic and bathymetric data were also collected as inputs to the mathematical models used to predict DO and BOD_5 concentrations in the creek after construction of the lagoons. These models were calibrated for local environmental conditions through in-situ and laboratory experiments. They were also applied in the analysis of alternatives. For processes involving highly complex interactions such as nutrient enrichment, bioaccumulation and ecological transformations, the approach of observation at and inference from regions that have been receiving similar wastewater discharges over a long period was adopted for the prediction of impacts.

7. For estimation of construction phase impacts, field investigations on ambient air quality, noise levels, creek and coastal water quality were conducted. Land-use patterns and soil characteristics near the construction sites were also studied. The area under mangrove cover was determined through use of satellite imagery.

8. The observations and model predictions were used to examine the efficacy of proposed single and three cell aerated lagoons in achieving the desired environmental benefits. Probable augmentations of the proposed treatment effort catering to increased flows by the year 2015 and after, in the forms of higher treatment and options for wastewater disposal at new locations in the creek, were evaluated. The scope for additional field observations and modeling work to finalize such options was also highlighted.

9. Similar methodology was followed in the assessment of the likely impacts of lagoons proposed to be constructed at Malad and Versova, on Malad Creek.

Baseline Environmental Conditions

Coastal Marine Waters, Beaches, and Bandra and Worli Outfall Sites

10. The primary impacts of the present wastewater discharges at the shoreline are manifested in terms of poor water quality in many regions along the western coast. Higher levels of pollution are observed during the ebb tide in comparison to the flood tide. Observations on bacterial quality along the coast show frequent occurrence of total coliform concentrations between 10^4 to 10^5 per 100 ml for about one third of the 24 kilometer long coastline. Only about 25 per cent of the total observations showed compliance with the present GOI bacterial standard, which is total coliform bacteria not to exceed 1,000 colonies per 100 ml (TC $\leq$ 1,000/100 ml) at any time at or within 1 km ("the reference line") of the shore. Bacterial quality of water at three of the four main recreational beaches of Bombay also reveals moderate to high levels of pollution (TC between 10,000 and 100,000/100 ml), indicating health risk to bathers.

11. Concentrations of BOD_5 at the 1 km "reference line" are generally low (less than 5 mg/l) indicating considerable dilution and decay of the organic matter from wastewater before the pollutants have traveled far from shore. Ammonia nitrogen (also often associated with wastewater discharges, even after treatment), is present in concentrations in the range of mildly polluted coastal waters whereas phosphorus concentrations are close to levels observed in clean sea. The nutrient levels (nitrogen and phosphorus) in sediments are observed to be higher during winter than summer. These levels, however, are similar in polluted and clean regions and therefore do not indicate accumulation of nutrients in sediments due to sewage discharges.

12. Amongst the phytoplankton, frequent occurrences of pollutant indicator groups like Cyanophyceae (blue-green algae) have been found in many of the regions which also show higher pollution in terms of physico-chemical and bacterial parameters. This observation signifies that the contamination of coastal waters due to organic pollutants is persistent enough to affect ecosystem characteristics.

13. The chemical analysis does not indicate any significant contamination of water or sediments by toxic metals or toxic organic compounds (e.g., pesticides). The possible explanation for these observations lies in the low levels of metals and toxic organics observed during sampling of the wastewater. The sediments and water samples, even from those regions which exhibits higher bacterial contamination and low DO, do not show significant variations in trace organic /inorganic concentrations when compared with levels from clean regions.

14. Interviews with users of the three most popular beaches indicate that though many people are frequent visitors to the beaches, they avoid bathing and swimming due to visibly poor water quality.

Among the three beaches, Juhu Beach is most scenic and is also relatively least polluted. Dadar and Girgaum beaches are highly polluted due to their proximity to wastewater discharges.

15. Water quality conditions near Malad Creek and Mahim Creek which discharge wastewater into the coastal area are extremely poor -- low DO, high BOD_5 and high TC levels. The anaerobic conditions in both creeks during low tide cause obnoxious odor in their immediate vicinity. The problem is particularly significant in Mahim Creek, since it cuts across some densely populated sections of the city.

16. Ambient air quality analysis at Worli and Bandra outfall sites was carried out for assessment of construction phase impacts. The results indicate that present air quality in terms of suspended particulate matter (SPM), nitrogen oxide (NO_2) and sulfur dioxide (SO_2) at both sites meet Indian standards for ambient air quality. The values for Worli, however, suggest that the capacity to assimilate additional quantities of air pollutants is lower there. Similarly, recorded on noise levels at Worli slightly exceed the upper threshold limit prescribed for urban residential/commercial areas.

Thane Creek and Bhandup and Ghatkopar Lagoon Sites

17. Thane Creek, in its inner regions, receives approximately 400 mld of untreated wastewater from Bhandup and Ghatkopar drainage areas, plus an undetermined volume of wastewater from municipal and industrial sources on the eastern shore (i.e., outside the administrative boundaries of MCGB). Due to shallow depths and narrow cross-section, the creek in this region does not have sufficient capacity to assimilate these discharges. As a result, about 10 km of the stream along the west bank of the creek exhibits poor water quality characterized by low DO and elevated levels of BOD_5 , suspended solids, and total coliform. Concentrations of BOD_5 as high as 7 mg/l and $TC > 10^4/100$ ml are common, and observations on biological indicators indicate that the aquatic biota is exposed to long-term stress. Creek sediments also show high concentration of nitrogen, denoting accumulation of nutrients due to large wastewater discharges. Heavy metals in sediments at about ten times the concentrations found along the Bombay seacoast are evidence of substantial industrial discharges to Thane Creek, but the concentrations are not generally high enough to exceed known tolerance limits of aquatic biota. Wastewater from the Bhandup and Ghatkopar service zones does not exhibit significantly higher metal concentrations than in wastewater from Bandra and Worli.

18. Ambient air quality analyses at Bhandup and Ghatkopar aerated lagoon sites indicate that the present air quality in terms of NO_2 and SO_2 at both sites meets Indian standards for ambient air quality. Observations on noise levels at the lagoon sites indicate that these are within the limit prescribed for urban residential areas.

19. The sites proposed for both lagoons are at the edge of tidal flats that are partially covered by mangroves in relatively good condition. There are no residential communities or other land uses in the immediate vicinity that would be incompatible with a wastewater treatment plant.

Environmental Impacts of the Proposed Project

Construction of the Outfalls

20. The major construction activities are blasting, tunneling, and material transfer at the sites of Worli and Bandra headworks. Additional tasks for the outfall construction will be the manufacture of precast concrete lining segments and the disposal of excavated material. The main potential adverse impacts of these activities are vibrations due to blasting, rise in ambient noise levels, impairment of air quality near the construction sites, and locally impaired water quality due to the trenching at the diffuser section.

21. No adverse impacts on nearby structures due to blasting are predicted to occur if charge sizes are restricted to 4.5 and 5 kg at Worli and Bandra respectively. Safe peak particle velocities of 20 mm/sec for concrete structures and 8 mm/sec for poor structures have been considered in reaching these conclusions.

22. Data on the noise characteristics of construction machinery and observations on an operating tunnel boring machine indicated that noise levels may reach 96 dBA near the most noisy machinery. Noise levels at about 100 meters from the construction sites will fall below 55 dBA and will, therefore, be within the acceptable levels for outdoor noise levels in an urban residential area. The sensitive receptors at both Bandra and Worli are more than 100 meters from the sites.

23. Hauling of construction materials to and from both construction sites and of excavated material from Worli to Bandra will cause traffic congestion on roads around the construction sites.

24. During the construction activities at outfall headworks, marginal increases in concentrations of air pollutants such as NO_x, and SO_2 are expected. The rise over the ambient levels, however, will be negligible as the additional emissions from the construction activities will constitute only small fractions of present emissions which are primarily from automobile exhausts. Also, due to their proximity to the coast, the sites experience strong diurnal land-sea breezes which disperse the pollutants effectively. A more significant rise in SPM levels, however, is expected during the construction activities.

25. The construction of tunnel outfalls will not have any significant impact on the coastal water quality, as tunneling will take place at about 50-70 meters below the seabed. For such construction the proper disposal of excavated material, generated at a rate of about 500 tons per day for about 15 months, will pose a challenge. This material will be composed of tuff and basalt and will be used for reclamation of additional land near the Bandra outfall headworks. In the already severely disturbed area, the reclamation itself will not have any significant ecological effect, but suspended solids concentrations in the nearby waters will increase if water draining from the excavated material is not properly managed.

26. No adverse impact on fishing interests in the region is expected to result from outfall construction, other than temporary constraints on navigation. Some localized, transient water quality impact due to the spillage of fuel and oils used for operation of construction machinery may occur. If improperly handled, human waste and solid waste from the construction crews will adversely affect surrounding neighborhoods. These impacts can be minimized with good housekeeping and vigilance.

Construction of the Lagoons

27. The major construction activities are site clearance, land filling, earth work, quarrying and material transfer. The single most important adverse impact of these activities is the loss of about 40 hectares of mangrove cover amounting to 5 percent of total area of mangrove forest in inner Thane Creek. This is an unavoidable impact and, considering the role of mangroves in the sustenance of coastal ecosystems, it requires compensation.

28. The other prominent impacts during the construction are rise in ambient noise levels and marginal increase in air borne pollutants like SPM at the construction site. The higher SPM levels are likely to be observed for short intervals only during peak periods of construction activities. There will be insignificant increase in the gaseous pollutants such as SO_2 and NOx.

29. Predictions of noise levels from construction machinery at sensitive locations, which are more than 1 km distant from the lagoon sites, indicate they will be attenuated to about 40 dBA -- i.e., the measured background levels now.

30. Construction of the aerated lagoons will not have any adverse impacts on creek water quality or fishing interests as all construction activities except for the effluent channel will be restricted to land. The construction is not expected to have significant impacts on drainage characteristics of the region. However, it will be important to avoid blocking any natural drainage channel in the vicinity of lagoons, so that local flooding does not occur.

Operation of the Outfalls

31. The impacts associated with operation of the marine outfalls are essentially beneficial; chief among them will be considerable improvement in the physico-chemical quality of the coastal waters. Moving the points of wastewater discharge 3 km offshore will fully eliminate the dissolved oxygen depletion which presently occurs during the low tide near the Mahim coast. Reduction in nutrient loading along with improvement in DO will considerably improve the ecological health of nearshore waters in the region. These improvements will contribute towards elimination of odor nuisance and enhancement of beach aesthetics and water use. It is important to note, however, that the full benefit of the outfall investment will not be realized until dry weather flows of sanitary sewage from storm drains are abated and solutions are found for the wastewater generated in slum communities not connected to the conveyance system.

32. The discharge of wastewater through marine outfalls will not cause environmentally adverse conditions -- e.g., low dissolved oxygen or high nutrient concentrations in the water column -- even in the vicinity of outfalls. The initial dilution is more than 50 times during most of the tidal cycle, and the DO and BOD_5 levels near the outfall diffuser section will therefore be more than 4 mg/l and less than 3 mg/l, respectively. However, if peak dry weather flow coincides with the tidal slack period, BOD_5 levels of up to 20 mg/l are probable in the immediate vicinity of outfalls. The probability of such an occurrence is less than 0.01, and because the concentration will fall below 5 mg/l soon after the tidal currents resume, there will not be a protracted negative influence on DO.

33. Observations in the immediate vicinity of Colaba outfall (a small outfall in operation since 1988) discharging sewage off the east coast of Bombay, indicate no significant accumulation of organic matter, nutrients or metals in the sediments. Since similar dilution and coastal currents are expected near the diffuser section of proposed outfalls, no significant adverse impacts on sediment

quality are expected. Due to low levels of metals and trace organics in the sewage, their concentrations in the water column or sediments in the vicinity of outfalls will also remain close to the ambient levels.

34. As the operation of outfalls does not result in impairment of water and sediment quality even near the diffuser section, no adverse effect is expected on marine biota or on the fish yield in the region. It is possible that increased fish yield may be obtained in coastal regions near Bandra and Worli due to improved water quality conditions. However, because it is likely that factors other than water quality deterioration have contributed to the decline in yields observed over the last ten years (e.g., overfishing, increase in the number of trawlers), water quality improvement alone may not reverse the trend.

35. The 3 km long outfalls are not expected to improve the bacterial quality of the coastal waters to the level specified in the GOI standard and the Notice of Consent to Discharge issued by the Maharasthra Pollution Control Board. (TC $\leq$ 1,000/100 ml at the 1 km reference line). Even after commissioning of the outfalls, about one-third of the length of the reference line will exhibit violations of the standard under adverse meteorological conditions. During the monsoon season, the bacterial counts are likely to exceed the standard by 100 times, and by about 50 times during the non-monsoon season. When compared to existing conditions, both the bacterial levels and the length of coastline in violation of the standard are expected to decrease by about 50%. To achieve further improvement, longer outfalls and perhaps a higher level of wastewater treatment will be necessary.

36. The EA points out, however, that the GOI bacterial standard is unnecessarily stringent, even in comparison to EEC and US standards. It should be reconsidered in four respects. First, the limit set for the chosen indicator organism, total coliform bacteria, is overly conservative. A limit of 10,000 is commonly thought to be sufficient to protect bathers from pathogens; it is the basis of the EEC standard, for example. Second, standards for bathing water normally allow for statistical variation. Thus the EEC requires that 95% of samples taken fall below the 10,000 limit, as compared to the 100% compliance specified by GOI. The US state of Florida applies a 1,000 TC/100 ml standard, but requires compliance in 80% of samples. Third, bathing water standards in many countries are either only in force during the bathing season or allow for unusual weather conditions. If that concept were embodied in GOI standards, requirements for the monsoon season (for which the model predicts larger and more frequent violations) would be less stringent than for non-monsoon. Finally, samples are usually required to be taken from the bathing waters themselves -- i.e., near the beach, rather than at a line 1 km offshore where recreational swimming does not occur. The EA includes a recommendation that the standard be revised before any decision is made regarding the next stage of sewage disposal works for Bombay. Adoption of the EEC standard, for example, could reduce the final length of outfall required while maintaining bathing water quality at internationally accepted levels. In recognition of these circumstances, in both the MPCB "consent to discharge" and the GOI environmental clearance, the construction of 3-km in this project is approved and the need for revised standards which would apply to the Second Stage Program is acknowledged. The designs for the 3-km outfalls have been modified to facilitate their eventual extension.

Operation of the Bhandup and Ghatkopar Lagoons

37. The EA also raises questions about the effluent standards applicable to the lagoons. The effluent standard for BOD_5 of 100 mg/l, which is incorporated in the MPCB Notice of Consent to Discharge, does not take into account the receiving waters' capacity to assimilate waste without dissolved oxygen depletion and resulting degradation of the aquatic ecosystem. A GOI receiving

water DO standard of 3 mg/l or 40% saturation, whichever is higher, applies to coastal creeks. If the effluent volume is large, discharge in compliance with the effluent standard will still lead to severe deterioration of receiving water quality. For the purposes of the EA, maintenance of DO levels of at least 2 mg/l was used as an objective in evaluating the proposed lagoons and alternatives.

38. It is important to note that the EA findings assume that other discharges to Thane Creek will be given similar levels of treatment. These are outside of the jurisdiction of MCGB, however, and the EA therefore recommends that GOM develop and implement a comprehensive water quality management plan for the entire creek. Otherwise, much of the potential benefit of MCGB's investments at Bhandup and Ghatkopar will not be realized.

39. The water quality model results for Thane Creek indicate that the proposed first-stage treatment works, single-cell aerated lagoons, will arrest the present trend of worsening water quality but will not lead to DO concentrations that are consistently at least 2 mg/l. The higher level of treatment planned for the second stage treatment works will be needed. (This is addressed further in the Analysis of Alternatives section below.) In addition, a revised estimate of the flows for the year 2005 from 180 Mld to 280 Mld caused the redesign of the Bhandup laggons to prevent overloading.

40. Hydrogen sulfide (H_2S) emissions in the event of aerator malfunctioning of the aerators could lead to significant odor nuisance within a 1 km radius of the lagoons on a typical stable winter day. However, impacts would not be significant in areas which are beyond 1.5 to 2 km distance from the lagoons.

Analysis of Alternatives

Marine Outfalls

41. Having concluded that the 3 km outfalls with preliminary treatment would not achieve the required receiving water standard for total coliform, NEERI investigated eight other combinations of outfall length and treatment level: 3 km with primary and secondary treatment and 4 and 5 km with preliminary, primary, and secondary treatment. They also evaluated the "no action" alternative.

42. Municipal wastewater discharges from the Bandra and Worli zones which are presently estimated at 800 mld are expected to double by year 2005, the design period of the project. If the proposed schemes are not implemented -- i.e., the no-action alternative is chosen, the wastewater will continue to reach the coastal regions through the present drainage routes. The existing conditions of gross bacterial pollution and near total DO depletion in regions near the main wastewater outlets and moderate pollution all along the coast will further deteriorate.

43. The analysis of other alternatives, although approximate in nature because of inadequate data on coastal currents, indicates that only the outfalls of 5 km with secondary treatment are likely to meet the existing bacterial standards at the reference line. Outfalls of 5 km with primary treatment are predicted to achieve substantial but partial compliance -- 50 percent during the daytime in monsoon season and 80 percent during non-monsoon, with poorer performance at night. These results suggested that longer outfalls should be investigated; they are a more practical alternative to the very difficult task of acquiring land and constructing secondary or even primary treatment facilities in the heavily developed areas around the Bandra and Worli sites. However, analysis of outfalls longer than 5 km, and more conclusive analysis of the shorter ones, was not possible with the limited current data available and the limitations of the mathematical model the data could support.

The EA therefore recommended that the outfall designs incorporate provisions for later extensions and that additional oceanographic surveys be conducted to support analysis of alternatives for the second stage works. Both recommendations were accepted, and the studies are in progress (see Annex 5).

Lagoons at Bhandup and Ghatkopar

44. The analysis of alternatives covered "no action", construction of three-cell aerated lagoons (the second-stage plan), secondary treatment by the activated sludge process, secondary treatment with nitrification, center-channel discharge, and flow reduction through industrial use of untreated wastewater (since there had been tentative expressions of interest for about 50 mld). Under the no action alternative, the creek water quality which is already impaired in terms of DO at low tide would seriously deteriorate, since the combined present flows of the two service zones, estimated at 400 mld, are projected to increase to 520 mld by 2005 and to reach 1,000 mld in 2015.

45. When augmented to three-cells and designed to achieve 35 mg/l or lower BOD_5 in the effluents, the aerated lagoons would provide an adequate level of pollution abatement in the affected creek region until wastewater flows exceed the volumes projected for 2005. Water quality scenarios developed to examine the benefits of further increases in the treatment level at Ghatkopar through use of the activated sludge process indicate that such augmentation for 2005 flows would give rise to only a marginal improvement of 0.3 mg/l in DO over the three-cell aerated lagoons option, and at substantially higher cost. Shifting the effluent discharge location to the center of the creek would not yield any significant improvement in creek DO.

46. When extended to 2015 flows, the water quality simulations indicated that Thane Creek cannot assimilate effluents beyond projected flows for the year 2005 at Bhandup and Ghatkopar, even after nitrification. To accommodate higher flows, it will thus be necessary to build additional wastewater treatment facilities and discharge the effluents at new locations in the creek. The analysis suggests that it would be possible to discharge up to 260 mld after secondary treatment near Vikhroli. To manage the entire increase projected from 2005 to 2015, however, would entail tertiary level treatment. Considering the high cost of tertiary treatment and also the need to plan even beyond the year 2015, the EA recommended that options for discharging the wastewater in other regions of the creek be explored. If that approach makes secondary treatment sufficient, the savings in treatment cost may more than offset the cost of conveying the wastewater to the more distant locations.

A Note on the Lagoons at Malad and Versova

47. Construction of two trains of three-cell lagoons is underway at Versova. Four trains were ultimately planned. At Malad, a two-stage approach similar to that for Bhandup and Ghatkopar would have resulted in construction of four trains of single-cell lagoons in the first stage, with upgrading to three cells to follow. Water quality studies and mathematical modeling similar to the work done on Thane Creek showed that while the first-stage works would comply with the MPCB Notice of Consent to Discharge, their operation would produce virtually no improvement in Malad Creek water quality. NEERI therefore analyzed a range of alternatives, 15 in all, including: the completion of the planned second-stage works, advanced secondary treatment at Malad (i.e., effluent BOD_5 of 10 mg/l), the conveyance of effluent from Malad to Versova for discharge nearer the creek mouth, the retention of Malad effluent for release during ebb tide only, dredging the creek, and diversion of all flow from the Malad service zone for treatment and disposal at a location where it would not be discharged to Malad Creek.

48. The analysis provided convincing evidence that due to limited assimilative capacity and incomplete tidal flushing of the upstream reach of the creek, there was no practical treatment option for wastewater to be discharged at the Malad site that would significantly change the present situation in which DO concentrations in upper Malad Creek fall to near zero during low tide. The Versova lagoons, close to the creek mouth where tidal flushing is more nearly complete, would provide some water quality benefit in the medium term. However, preliminary projections made in 1994 indicate that 2005 wastewater flows from both Malad and Versova service zones are likely to be 25% higher than the design flows. Aerated lagoon treatment at Versova would then be inadequate even with the planned expansion to four process trains.

49. Consequently, MCGB decided to eliminate the Malad Lagoons from this project. It intends to complete construction of the two process trains at Versova and to treat flows only up to design capacity. MCGB will use the Versova works to gain experience with aerated lagoon operation, conduct pilot testing of operating procedures, and train personnel prior to the commissioning of the larger lagoons at Bhandup and Ghatkopar. Final solutions for both the Malad and Versova service zones will be developed in the planning and feasibility studies and designs for the Second Stage Program (see Annex 5).

Environmental Impact Mitigation Plans

Marine Outfalls

50. Adverse impacts of outfall construction can be mitigated for the most part by adherence to good construction and housekeeping practices. The exception is increased turbidity near the diffuser sections during installation of risers, which is unavoidable but temporary and localized.

51. Findings of the EA indicate that operation of the 3 km outfalls will provide adequate environmental improvement for all water quality parameters except total coliform bacteria at the 1 km reference line. The mitigation plan therefore includes the recommendations cited below.

(a) As 3 km long outfalls at Worli and Bandra are expected to substantially improve the existing coastal water quality without causing any significant impairment at the discharge site, it is recommended to proceed with their construction as the initial phase of the project. Considering the need for further extension of outfalls for compliance of the bacterial standard, the outfall design should have provisions for such an extension.

(a) The hydrodynamic data on the region should be strengthened through further field studies to facilitate use of more powerful models that will be used in planning the Second Stage Program.

(b) Review of present bacterial standards will be necessary to allow a practical management option for the outfalls.

52. Mitigation measures during operation are synonymous with sound operating practices, supported by monitoring the condition of the outfalls. The objective is to avoid situations where bypassing is necessary to conduct repairs or sediment removal, because the release of untreated wastewater at the coastline will adversely affect water quality and thus marine life, aesthetic conditions, and public health at Worli and Bandra. Monitoring of heavy metal concentrations in the influent is also important; baseline data show that they are not present at levels that would have

adverse impacts on marine life, but it is essential to detect any change in that situation so that measures can be taken early to identify the source and eliminate it. A summary of all recommended mitigation measures is provided in Table 1 at the end of this annex, except for recommended tree plantations that are shown in Table 3.

Aerated Lagoons

53. Loss of about 40 ha of relatively good quality mangrove -- 5 percent of the total mangrove cover in inner Thane Creek -- is the most significant construction phase impact associated with the lagoons. It is an unavoidable impact, and the EA therefore recommends compensation, either by replanting an equal area of former mangrove habitat in the same reach of the creek or by designating a larger tract (e.g., 200 ha) as a protected area and taking measures against future reclamation or unauthorized cutting. (See main text para 6.17 for related condition of environmental clearance.

54. The other potential negative impacts of lagoon construction are comparatively minor and can be managed by adherence to good construction and house keeping practices. Recommended measures are summarized in Table 2 at the end of this annex and should be incorporated as fully as possible in construction contracts.

55. The operation of single cell lagoons will comply with MPCB effluent requirements and be a positive step towards the objective of overall water quality improvement in Thane Creek. It will arrest further deterioration in receiving water quality. In order to achieve acceptable environmental conditions in the vicinity of the creek, proper functioning of aerators is of prime importance. Adequate back up systems should be incorporated in the design stage itself to ensure their continuous and trouble-free operation. Table 2 also includes recommended mitigation measures for lagoon operation, with the exception of recommended tree plantations shown in Table 3.

56. Water quality in the affected region of the creek will not remain consistently above the minimum level necessary for a healthy ecosystem with single-cell treatment. An adequate mitigation measure, therefore, would be to construct three-cell aerated lagoons at this stage or to augment the lagoons to three-cell configuration as soon as possible. For significant improvement in creek water quality, the lagoons should be designed to produce effluents with BOD_5 below 35 mg/l. Considering that they would remain effective only for flows projected up to the year 2005, the recommended long-term management approach is to develop additional treatment units with facilities to discharge the effluent at new locations within the creek. One suitable discharge location has been identified near Vikhroli; it has the potential to assimilate about 260 mld of effluents after secondary treatment. Additional water quality modeling studies are recommended to assess assimilative capacity of the creek south of Tromby and identify other possible points for effluent discharge for the year 2015 and thereafter.

57. The full water quality benefits of the investments that MCGB plans to make on Thane Creek will not be realized unless all wastewater flowing to the creek is treated to levels comparable to those planned for Bhandup and Ghatkopar. It is imperative that a comprehensive management plan be developed for the creek and implemented by all dischargers. Because this involves multiple

jurisdictions, the plan should be developed by GOM, and compliance should be enforced by MPCB. This task should be undertaken immediately.

Environmental Monitoring Plans

Marine Outfalls

58. Recommended monitoring measures for the outfalls are included in Table 1at the end of this annex. Regular environmental monitoring should begin immediately and continue during the construction and post-commissioning phases. During the pre-commissioning phase, samples collected from important beaches and seafronts should be analyzed for bacterial contamination and dissolved oxygen. The critical period of the tidal cycle corresponding to elevated pollution levels at sampling locations should be identified first, by sampling at two hourly interval (only daytime hours) for a week. Year long sampling should then be undertaken at that period with the frequency of 10 samples per month.

59. Samples at selected locations at the reference line should be collected on alternate days for 15 days, once every year in winter and once in summer, to establish a database on existing coastal water quality. The samples should be collected at low tide slack and should be analyzed for relevant physicochemical, biological and bacteriological parameters. Sediment samples should also be collected and analyzed for benthos, nutrients and heavy metals.

60. During the construction phase additional samples, once every week, should be collected near the construction head and analyzed for physicochemical parameters. Visual inspection, once a day, should be conducted to detect any oil leaks from offshore construction machinery. Noise and air pollution levels should also be monitored at the construction sites and if required mitigation actions should be taken to ensure compliance with the standards. Additionally, daily visual inspection of roads and roadsides in the vicinity of the construction site should be undertaken to identify any nuisance that need attention with respect to dust, spill of construction materials or debris etc.

61. Post-commissioning monitoring similar to that for the pre-commissioning period should be undertaken. During this phase, water samples at the beaches and seafronts and locations on reference line situated at North of Worli should be collected during low and high tide slack and at South of Worli at low tide slack.

62. The effluents from grit removal facilities should be regularly analyzed for grit content and heavy metals.

Aerated Lagoons

63. A systematic water quality monitoring effort within Thane Creek should be initiated before and after commissioning the aerated lagoons, in the areas influenced by each lagoon. At the post-commissioning stage, the monitoring should be aimed at verifying the water quality projections and validating the water quality model used in the present study. This will help to ascertain the models usefulness in future wastewater management planning for Thane Creek. A regular effluent monitoring program to establish the performance characteristics for the treatment system should be undertaken immediately after commissioning the treatment systems and should be continued during the entire operation period of the treatment systems. Guidelines for such monitoring are included in Table 2 at the end of this annex.

64. Creek water quality monitoring along with observations on hydrodynamic parameters should be initiated by Government of Maharashtra to support the development of a comprehensive water

quality model for the entire Thane Creek. This is a prerequisite for preparing the recommended overall wastewater management plan (see para. 57). The objective should be the determination of location-specific effluent limits for the various industrial and municipal discharges to ensure that the pollution load to the creek does not exceed its assimilative capacity. The water quality monitoring should be supplemented by limited biological surveys to document improvements in the creek ecosystem as a result of wastewater treatment.

Assessment of Environmental Management Capacity and Needs for Strengthening

65. There is a need for substantial institutional development within the MCGB for effective operation of marine outfalls and aerated lagoons. Training programs should be conducted for staff at various levels, from managers to operators and maintenance technicians, to ensure that the capacity for routine operation and maintenance functions exists. For certain non-routine functions, such as the use of water quality models for effective water quality monitoring, the evaluation of long-term environmental impacts of the project, and the conduct of wastewater management planning for future discharges, MCGB should draw on specialized institutions in the metropolitan area to supplement its own capabilities.

66. For effective implementation of the recommended environmental monitoring, it will be necessary to develop adequate facilities for sampling and analysis. One alternative is for MCGB to create an environmental monitoring cell, with adequate training and instrumentation for coastal water quality monitoring and analysis related to the outfall project. Government and private laboratories with adequate facilities and expertise may also be identified to assist in these activities or to perform them under contract to MCGB.

Revisions to the Environmental Assessment as a Result of Appraisal

67. No revisions were made to the EA reports themselves as a result of appraisal. However, a number of additions and modifications to the mitigation and monitoring plans were determined to be necessary. The mission and MCGB discussed MCGB's present capacity for mitigation and monitoring plan implementation. Institutional arrangements for implementation were agreed on and elaborated. The results of these discussions are presented below. They should be treated as amendments and additions to the mitigation and monitoring plans presented in the EA reports and summarized in Tables 1 and 2 in this annex.

Modifications to Mitigation and Monitoring Plans

68. The mission reviewed arrangements for implementation of the Environmental Mitigation and Monitoring Plans contained in the Environmental Assessment and determined that they are adequate. With one exception (see para. 69), recommended measures to control construction-related impacts and protect worker safety that are the contractors' responsibility have been incorporated specifically into contract documents for the outfalls and are being included in documents for the lagoons. Their enforcement will be the responsibility of the Resident Engineer (RE) assigned to each site by Binnie & Partners (B&P, engineer on the contract), who will in turn train and supervise the MCGB construction supervisors. The RE will also be responsible for monitoring spoil disposal, site sanitation, dust, traffic, etc. A specialized subconsultant will be employed to monitor blasting operations, and MCGB's existing environmental unit, which has the appropriate staff and equipment, will monitor noise levels and water and air quality. The telephone number of each site's construction

office will be publicized in adjacent communities, and the RE will be responsible for responding to citizen questions or complaints.

69. The EA recommended maximum safe charge limits to ensure safety of nearby structures during blasting operations for the marine outfalls. The design engineers have modified this mitigation measure slightly, by requiring instead that the contractor conduct a trial blast to determine the permissible size of charges. The outfall contract documents also contain a number of other measures to manage the impacts of blasting that are not included in the EA.

70. Although the EA addressed potential impacts of operations at borrow areas or quarries from which the material for construction of the lagoons would be obtained, the Environmental Mitigation Plan did not inititally include corresponding mitigation measures. This has been remedied in Addendum 1 to the contract documents for the lagoons, which requires the contractor to prepare and present to B&P an environmental assessment and environmental management plan for location and operation of borrow areas and quarries and for transportation of excavated materials.

71. Contract documents for both the outfalls and the aerated lagoons contain provisions for the protection of worker health and safety that are considerably more extensive than those in the Environmental Mitigation Plan and are considered adequate.

72. Measures to mitigate impacts during operation are synonymous with good plant operating practice and process monitoring. The operations and maintenance (O&M) consultant being retained by MCGB will develop operating manuals, define staffing needs, design and conduct training, and develop specifications for laboratories and equipment. B&P intends to retain Sydney Water Board as advisors on outfall operation and monitoring during the 12-month commissioning period.

73. MCGB will contract with NEERI to carry out baseline chemical and biological water quality surveys before commissioning of the outfalls and lagoons and periodic monitoring of ambient conditions once they are in operation. During appraisal, it was agreed that the commencement of the baseline monitoring should be deferred until one year before the related facilities are commissioned. Given the present degraded conditions in the receiving waters, it is not likely that the baseline conditions will change significantly over the next few years from those documented in the EA, and annual sampling would therefore not add enough useful information to the database to justify the cost.

74. The matter of compensation for unavoidable loss of mangroves will be by means of replanting approximately 200 ha of suitable mangrove habitat along Thane Creek. It is intended that the actual location will be decided with GOM Forests Department, which will also be asked to oversee the implementation, with funding from MCGB.

75. A substantial amount of the public information and consultation activity for this project was conducted after the EA was completed and is therefore not documented in the EA reports. Indeed the consultation program was ongoing at the time of appraisal. All information and consultation activities during and after EA preparation are described in the next section of this annex.

Public Information and Consultation

Surveys of Communities Near Worli and Bandra

76. During EA preparation, NEERI conducted surveys in the neighborhoods adjacent to the planned outfall construction sites at Worli and Bandra, using questionnaires and personal interviews. The surveys encompassed on-site environmental conditions, general community structure and dominant occupations, environmental problems identified by residents, sensitive issues, and awareness of and opinion about the proposed project.

77. At Bandra, the settlement on Mahim Bay near the pumping station has approximately 35 pucca dwellings and 500 huts, with a population of 5,000, mostly fishermen. It is a community with few amenities. Residents complain of persistent odors causing discomfort and even nausea, and they attribute them to sewage. The fish catch at Mahim Bay has dwindled in the past 10 years, a trend that the fishermen also attribute to sewage. There was little awareness of MCGBs plans to construct an outfall, but fishermen recalled the earlier project and expressed concern about laying of pipeline. They felt that their opinion should be sought, as incorrect laying of the pipeline could interfere with fishing activities.

78. At Worli, there are two communities, one on each side of the drain that discharges sewage. One, MCGB Quarters, houses mostly municipal employees, and the other is a poor fishing village of kutcha houses called Worli Village. Residents of MCGB Quarters recalled inconvenience, discomfort and damage caused by noise, dust and vibrations from blasting for the previous outfall project, some of which was conducted at odd hours like 6:00 AM and midnight. They suggested that blasting be limited to the time between noon and 3:00 PM. They also complained of foul-smelling seawater backing up through drains into their homes at high tide. Worli Village dwellers complained of persistent odor, more predominant during the monsoon, which caused headaches and nausea. They were generally unaware of the proposed project.

Beach User Surveys

79. NEERI interviewed beach users at random at the three important beaches in Bombay, which are important open-space resources heavily used by city residents for walking, picnics, and other forms of recreation. At Juhu, a "suburban" beach, 80 percent of respondents were Bombay residents who stated that they visit the beach regularly. While 70 percent expressed their preference for this beach, 60 percent felt that it is degraded by litter, sewage, proliferation of hawkers, and accumulation of animal dung. Only 22 percent were aware of the proposed project, and they believed it would benefit the beach environment in general.

80. Dadar Beach is located in a densely populated residential section of the city, where it is the main open space area. Unlike Juhu, it experiences direct effects of wastewater from the Bandra service zone. Here, 92 percent of the respondents were Bombay citizens, and 60 percent felt the beach environment to be generally good as a recreation site. However, 75 percent thought the beach to be "dirty" as a result of sewage and litter. Awareness of the proposed project was much higher (50 percent), probably since the Bandra site is visible from Dadar. Only 20 percent were expecting a positive result for beach aesthetics and water quality; 70 percent had no opinion. It was a generally expressed view that MCGB should improve the beach quality for all taxpayers.

81. Chowpati Beach is in the heart of the city, near residential and commercial areas. It has a large number of food stalls and small shops, which have contributed to unsightly and unhygienic conditions. Sewage discharges at the waters edge at one end of the beach. Nearly all respondents described the beach as a "good environment", yet 70 percent also considered it dirty. Its popularity may be because of its location and traditionally heavy use.

Public Information Activities

82. MCGB has prepared an eight-page color brochure outlining the history of the Bombay Sewage Disposal Project and describing the salient features of the marine outfalls. It is published in two versions, English and Marathi. The brochures have been handed out at consultation meetings and, in June 1994, they were distributed in quantity to 23 local ward offices. Newspaper advertisements invited any interested citizen to obtain a copy from the ward office and to submit written comments to MCGB. The brochure was also directly mailed in June to about 30 citizens who have been actively involved with environmental concerns in Bombay, with an invitation to send comments in writing. At last count, more than 70 letters had been received in response to the brochure, and all were answered personally by the Additional Municipal Commissioner responsible for the project. Nearly all of the letters expressed strong support for the project, and many offered constructive suggestions. A second brochure is in preparation to inform the public about the aerated lagoons at Bhandup and Ghatkopar, the Low Cost Sanitation component, and MCGBs program to evaluate the condition of the collector system and repair dilapidated sewers.

83. MCGB officials have given interviews to reporters from *The Times of India*, *The Metropolis*, *Indian Express*, and several Marathi language papers. These interviews have prompted a number of articles about the project.

84. The full Environmental Assessment Reports and Executive Summaries for the outfalls and the Bhandup and Ghatkopar aerated lagoons have been made available for public inspection. Newspaper advertisements were published on February 6, 1995, informing the public of the three MCGB offices where the reports are located.

Public Consultation Activities

85. A meeting of representatives of environmental NGOs and eminent citizens interested in the future of Bombays environment (including several retired GOM and MCGB senior officials) was chaired by the Additional Municipal Commissioner on April 7, 1994. MCGB made a slide presentation of the project, which was followed by a question and answer session. Participants raised a number of significant points.

(a) They emphasized the need for solutions for sanitation and wastewater disposal in the slums, which are not served by sewers, both to improve conditions in those communities and reduce the amount of untreated wastewater that will still find its way to the nearshore waters after the outfalls are in operation.

(b) They pointed out that dry-weather discharges of sanitary sewage from storm drains cause local degradation of water quality at many locations in Bombay.

(c) They suggested that MCGB establish a committee of affected citizens to monitor the progress of the outfalls project and advise MCGB on problems, such as noise and vibration.

MCGB accepted all of these suggestions. A program to abate dry-weather storm drain flows has been initiated and MCGB has proposed including a Low Cost Sanitation component in the project that would provide facilities for approximately 1 million slum dwellers in 10 different areas. A Citizens Advisory Committee will be constituted before construction begins. It is worth noting that members of the MOEF Expert Panel assigned to review the environmental clearance application for the project attended this meeting. They recommended that implementation of programs to address points (a) and (b) above be made conditions of the clearance, and MOEF has written those requirements into the clearance letter.

86. A second meeting was held on April 29, 1994, chaired by the Mayor of Bombay and attended by leaders of various political parties and members of the press. The Additional Municipal Commissioner again presented the marine outfalls project, and a brief note entitled "Environmental Assessment for Proposed Marine Outfalls at Worli and Bandra" was distributed to the participants.

87. MCGB has begun holding meetings in communities most directly affected by the project. On November 13, 1994, MCGB officials and NEERI met with Carter Road Pali Hill Residents' Association and Bandra Reclamation HIG Residents' Association. Both groups were interested in getting a clear explanation of the proposed project and the nature and scale of problems likely to arise during the construction of the Bandra outfall. They were also concerned about the provisions for disposal of tunneling spoil, the amount of land that would be filled by it, and the plans for final grading of the disposal site. At the end of the meeting, participants expressed support for MCGB's efforts to improve the environment.

Planned Consultation Activities

88. MCGB will continue meeting with interested groups regarding the outfalls and will extend the consultations to cover the aerated lagoons. MCGB is also committed to establishing the Citizens Advisory Committee. In addition, more intensive consultations are planned to address the concerns of fishermen's communities and to develop the Low Cost Sanitation component.

89. MCGB has awarded a contract to Vasundhara Project, a wing of Nirmal Niketan (a well-known local NGO concerned with social issues) to carry out a socio-economic survey of the fishing communities and to obtain a more complete picture of their perceptions of and concerns about the project. During the work, Nirmal Niketan will fully inform the communities about the features of the outfalls and facilitate dialogue between community representatives and MCGB.

90. MCGB has selected a local environmental consultant teamed with local NGOs to conduct the survey of slum neighborhoods in the course of planning and design of the Low Cost Sanitation component. The approach to providing each community with sanitation facilities will be developed in concert with community representatives. Depending on their preferences for method of implementation, communities may assume responsibility for any or all of construction, operation, maintenance and ownership of the facilities.

TABLE 1
SUMMARY OF ENVIRONMENTAL MITIGATION AND MONITORING PLANS FOR CONSTRUCTION AND OPERATION OF MARINE OUTFALLS AT BANDRA AND WORLI

Potential Impact	Recommended Action	Responsibility
During Construction		
1. Dust contamination at site and on haul roads	(a) Construction sites and access roads will be watered twice each day	MCGB/ Contractor
2. Noise Pollution	(a) Operation of heavy machinery restricted to daytime hours (6:00am-8:00pm)	MCGB/ Contractor
	(b) Noise monitoring near blast/drilling site and in nearby sensitive locality (when machinery is under operation)	MCGB
	(c) Construction of sound barriers if monitoring reveals noise pollution in sensitive locality	MCGB
	(d) All transport activities causing noise pollution restricted to daytime hours	MCGB/ Contractor
	(e) Provision of ear muffs for all workers at site during blasting operations	Contractor
3. Vibration disturbance	(a) All blasting/drilling operations to be carried out under supervision	MCGB/ Contractor
	(b) Monitoring at site and in nearby areas 50-100 m away during blasting at the ground level	MCGB
4. Air pollution	(a) Monitoring at site and on access roads for SPM, NO_x and SO_2 twice each week	MCGB
5. Disposal of excavated material and construction debris	(a) To be used for land reclamation at Bandra construction site	MCGB/ Contractor
	(b) In case of semi-solid wastes, provision to be made for dewatering/drying prior to its use for reclamation	MCGB/ Contractor
	(c) Daily inspections at haul road and sites for construction debris, its collection and disposal to landfill site	MCGB
6. Traffic and transportation	(a) Properly planned transportation to be restricted to daytime hours	MCGB/Contractor
	(b) All hauling materials to be covered while being transported	Contractor
	(c) Routine check of vehicles used for transportation and their proper maintenance to minimize vehicular pollution	Contractor

TABLE 1 (continued)

Potential Impact	Recommended Action	Responsibility
7. Water pollution	(a) Offshore construction activities to be inspected daily for spillage of fuel/oils at the construction head	MCGB
8. Domestic sewage and rubbish	(a) Provision of human waste disposal facilities at construction workers' colony and job sites	Contractor
	(b) Provision at site and in workers' colony for jars/cans for solid waste collection	Contractor
	(c) Transportation for wastes from workers' colony to collection/dump site in the area	Contractor
9. Changes in Marine Water Quality	(a) Baseline monitoring at important beaches and seafronts like Dadar, Juhu, and Worli for bacterial and chemical parameters during critical period with respect to tidal cycle and season. Frequency 2 samples/week	MCGB/ NEERI
	(b) Monitoring at reference line during critical slack at selected stations on alternate days for two weeks per year per season. Water samples to be analyzed for relevant physico-chemical, bacterial and biological parameters. Sediment samples to be analyzed for benthos, nutrients, and heavy metals	MCGB/NEERI
During Operation		
10. Changes in Marine Water Quality	(a) Beaches and seafronts water samples to the collected during low tide slack at stations south of Worli and at low tide and high tide slack for stations north of Worli	MCGB/ NEERI
	(b) Reference line monitoring similar to that during construction phase	MCGB/ NEERI
	(c) Effluents from grit chambers to be monitored for grit and heavy metals	MCGB/ NEERI

TABLE 2
SUMMARY OF ENVIRONMENTAL MITIGATION AND MONITORING PLANS
FOR CONSTRUCTION AND OPERATION OF AERATED LAGOONS
AT BHANDUP AND GHATKOPAR

Potential Impact	Recommended Action	Responsibility
During Construction		
1. Dust at site and on haul roads	(a) Construction sites and access road will be watered twice each day	MCGB/Contractor
2. Noise pollution	(a) Operation of heavy construction machinery causing noise to restricted to daytime hours	MCGB/Contractor
	(b) Well-maintained vehicles to be used for material transport. The vehicle speed should be limited to 40 km/hr in residential areas.	
3. Air pollution	(a) Monitoring at site and on access roads for SPM, NO_x and SO_2 twice each week.	MCGB
4. Disposal of excavated material and construction debris	(a) In case of semi-solid waste, provision to be made for dewatering/drying prior to its use for reclamation	MCGB
	(b) Daily inspection at haul road and sites for construction debris, its collection and disposal to landfill sites.	MCGB
5. Traffic and transportation	(a) All materials to be covered while being transported	Contractor
	(b) Routine checks and proper maintenance of vehicles to minimize vehicular air pollution.	Contractor
6. Domestic sewage and rubbish	(a) Provision of human waste disposal facilities at construction workerś colony.	Contractor
	(b) Provision at site and in workerś colony for wastebins for solid waste collection	Contractor
	(c) Transportation for solid waste from workerś colony to transfer point or landfill	Contractor
7. Public participation	(a) Public awareness programs to be conducted	MCGB
8. Loss of about 40 hectares of mangroves for site clearance	(a) Mangrove replantation of equivalent area in inner Thane Creek.	MCGB

TABLE 2 (continued)

Potential Impacts	Recommended Action	Responsibility
During Operation		
9. Receiving water quality	(a) Weekly monitoring of lagoon effluent for BOD, suspended solids, NH_3-N, Org. -N and DO prior to discharge into Thane Creek	MCGB/NEERI
	(b) Monthly monitoring of metal concentrations in lagoon effluent	MCGB/NEERI
	(c) Seasonal monitoring in the creek for BOD, DO, and NH3-N levels and biological parameters during the neap tides. The observations should cover region of impacts during pre- and post-project period.	MCGB/NEERI
10. Maintenance	(a) Routine maintenance of all mechanical and electrical equipment like aerators and pumps for efficient operation	
11. Solid waste disposal	(a) Disposal of screenings and grit along with city refuse	MCGB
	(b) Environmentally suitable disposal of sludge from desludging operations of lagoons taking into account concentration of heavy metals in the sludge.	MCGB/NEERI

TABLE 3
DESIGN DETAILS FOR PLANTATION IN AREAS NEAR THE OUTFALL PUMPING STATIONS, PRELIMINARY TREATMENT WORKS AND AERATED LAGOONS

Site and Description	Total Length (m)	Name of Plant Species	Interval Between Plants (m)	Number of Plants Required
Worli:				
Two rows of plants along the inside boundary wall of the Lovegrove Sewage Treatment Works	2300	Cocos nucifera	10	460
		Drooping Asoka	10	460
Bandra:				
Two rows of plants inside the boundary of the proposed Sewage Treatment Works	2000	Royal Palm	10	400
		Drooping Asoka	10	400
Bhandup:	2000	Pride of India	10	200
Three rows of plants along the boundary of the aerated lagoon site		Cocos nucifera	10	200
		Pride of India	10	200
	1800	Pride of India	10	180
Ghatkopar:		Cocos nucifera	10	180
Three rows of plants along the boundary of the aerated lagoon site		Pride of India	10	180

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

MONITORING INDICATORS
(for Use in Quarterly Reports)

		Units	During (or Change) Previous Qtr	TOTAL to END Previous Qtr	During (or Change) this Qtr	TOTAL to END this Qtr
S:	STAFF & TRAINING					
S1	Total Staff - WSSD	No				
S2	Staff/100,000 People Served (water)	No				
S3	Staff/1,000 Connections (water)	No				
S4	No. of Staff Participating in Training	No				
S5	Total Staff Costs (salary benefits)	Rs mill				
S6	Amount Paid in Overtime	Rs mill				
S7	Pensions Sanctioned (< 3 mos of retirement)	No				
S8	No of New Staff Recruited	No				
F:	FINANCE					
F1	Revenue Billing (water)	Rs mill				
F2	Revenue Collection (water)	Rs mill				
F3	Revenue Billing (sewerage)	Rs mill				
F4	Revenue Collection (sewerage)	Rs mill				
F5	Total Collection/Total Billing	%				
F6	Consumer Receivables	Rs mill				
F7	F6*12/Previous 1 Yr Billing	months				
F8	Working Ratio	No				
F9	Operating Ratio	No				
F10	COVENANT	Rs mill				
F11	Current Ratio	No				
F12	Cost of Water Produced	Rs/m3				
F13	Cost of Water Sold	Rs/m3				
F14	Average Water Tariff - Domestic	Rs/m3				
F15	- Non-domestic	Rs/m3				

I:	INVESTMENT (WSSD)					
I1	Total investment - WSSD	Rs mill				
I2	- of which BSDP is	Rs mill				
I3	- I2 as Percent Rs 10,939 mill	%				
I4	No of Beneficiaries - Slum Sanitation	No				
I5	I4 as Percent of 1,000,000 Target	%				
OP	OPERATION					
OP1	Population Served ('000)	'000				
OP2	Water Produced	m3 mill				
OP3	Water Sold - domestic	m3 mill				
	- non-domestic	m3 mill				
OPN1	No. of Days Supply Given	Days				
OPN2	Avg. No of Supply Hours/Day Over that Period	Hrs.				
OP4	No of Public Standposts	No				
OP5	Total No of Connections	No				
OP6	- Of which domestic connections	No				
OP7	- Of which non-domestic connections	No				
OP8	- No of bulk supplies	No				
OP9	Domestic Conn's with Working Meters	%(DP6)				
OP10	Non-domestic Conn's with Working Meters	%(DP7)				
OP11	Bulk Supplies with Working Meters	%(DP8)				
OP12	Power Cost	Rs mill				
OP13	No of Pollution Cases	No				
OPN3	No of Water Samples Taken	No				
OP14	Interruptions of Major Supply Source	No				

Notes:

Note Pt	Item	Description
1	F7	This calculation gives the average number of months by which consumer payments lag consumer billings
2	F8	Working Ratio: Operating expenses * (before Depreciation)/Revenue
3	F9	Operating Ratio: Operating expenses * (including Depreciation)/Revenue
4	F10	Covenant: The amount by which Gross Revenue exceed operating expenses plus debt service requirements in excess of provision for depreciation
5	F11	Current Ratio: Current Assets/Current liabilities
6	F12	Cost-Water produced: Operating expenses (including Depreciation)/Quantity of Water Produced (OP2)
7	F13	Cost-Water sold: Operating expenses (including depreciation)/Quantity of Water Sold (OP3)
8	F14	Average Tariff: Operating Revenues/Quantity of Water Sold (OP3)
9		Investment: Water supply and Sewerage investment only (i.e. not including LCS and RRP)

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

LESSONS LEARNED AND THEIR APPLICATION

1. This Annex reviews the main lessons of experience and describes how these have been applied in the proposed Project. For convenience of reference, the full text of the Evaluation Summary (ES) from OED's PPAR [1/] for the Second Bombay Water Supply and Sewerage Project (BWSSP II - Cr 842-IN) is included here on pages 4 to 11 of this Annex. Numbers in parentheses refer to the paragraph numbers in the ES.

2. In particular, sewerage investments planned under BWSSP II were proposed but postponed from the First Project (Cr 390-IN)(10) which was the first Bank-supported project in India in the water supply sanitation sector. A BWSSP III is in implementation. The total value of these three projects is about US$1,180 million and the total value of Bank support is about US$436 million. Under BWSSP II the works comprised extending a collector network to virtually the entire Greater Bombay, rehabilitation of existing and construction of new pumping stations, two major and one minor sea outfalls and, in the inland areas, aerated lagoon treatment plants (11).

3. The Audit finds that:

(a) the final design should have been completed before appraisal (13);
(b) the Bank should have employed expert services to oversee the preparation of the outfalls (14);
(c) the implementation of the sewerage component was little short of a disaster" (16);
(d) costs exceeded appraisal estimates by a factor of about three (16);
(e) there were serious design errors and incompetence in procurement (16);
(f) Bank supervision of the sewerage components while intensive, lacked sufficient expertise and decisiveness (17);
(g) by far the most serious issue is the submarine outfalls; contracts were not awarded until one year after the original closing date; serious design problems were alleged; the contractor abandoned the work and took legal action against the Bombay Municipal Corporation (BMC) (18);
(h) the Consultant's on the sewerage component were eventually dismissed (23); they had only an advisory role in construction supervision (23);
(i) BMC appointed another consultant to report on remedial actions who recommended calling for bids for alternative outfall designs and redesign and remedial actions for the main pumping stations (19);
(j) the absence of the outfalls and the delays in the construction of the aerated lagoons (all included in the proposed BSDP) is creating unacceptable environmental pollution and health hazards (20);
(k) procurement problems and delays were a prominent feature of BWSSP I but they scaled new heights under BWSSP II (22); most of the procurement problems occurred on the sewerage components (22); the Bank would have been prudent to utilize a procurement expert (22);

[1/] From the Bank's Operation Evaluation Department's (OED's) Project Performance Audit Report (PPAR) No 9265 dated December 31, 1990.

(l) virtually all of the major components of the sewerage works, which were only partially complete, show a very low standard of workmanship; the lack of prequalification, inadequate supervision and the failure to apply of contractual remedies are identified as reasons (24);

(m) BMC lacked a capacity for decision-making at the highest levels (25) BUT the exceptionally candid Part II of the Project Completion Report, prepared by BMC, is a highly encouraging sign of the recognition of the problem by BMC (25);

(m) good financial performance partly accounted for by construction delays (28);

(n) future Bank assistance for completion of the delayed work and future development is still needed and expected, but, if granted, it must be on the basis of the utmost professionalism (particularly in the technical areas) without fear or favor (31);

(o) the size and technical complexity of the project demanded a higher level and more extensive supervisory input that the Bank, and BMC, had allocated; the results were disastrous for the sewerage works resulting in financial losses, delayed benefits and environmental damage (33).

4. In response to the above, in the proposed BSDP:

(i) Preparation - Procurement - Cost Estimation [3(a), (d), (e), (g), (j) and (l) above]. The completion of final designs, prepared by the consultants noted in (h) and bid documents using the Bank's standard bidding documents have been completed for the two outfalls, the two aerated lagoons and the Bandra pumping station; additionally bids have been received and evaluated for the outfalls (the bidding resulted in prices close to pre-bid cost estimates) and have been invited for the two aerated lagoons; in all these cases, the bid invitation of from pre-qualified contractors. These actions reflect conditions for negotiations.

(ii) Special Outfall Expertise [3(b) above]. Two individual experts in geology and tunnel construction and experts from the Water Board of Sydney, Australia (having recent related experience) were employed to review the preparation of the design and bid documents in the context of the results more detailed geological/geotechnical investigations and data.

(iii) Consultants and Supervision [3(c), (h), (k) above]. The consultants noted in 3(h) above have continued to provide survey, investigation, design, bid document preparation and evaluation services for the two outfalls for the two aerated lagoons, and for the Bandra pumping station. The same consultant, with the full authority of "the Engineer" is appointed to supervise all procurement and construction related to the two outfalls, the Bandra pumping station and the Ghatkopar influent tunnel; other (local) consultants will be appointed to supervise construction of the two aerated lagoons, the structural improvements to five pumping stations and the conveyance system improvements.

(iv) Bank Supervision [3(f) and (o)]. See Annex 8.

(v) MCGB's (was BMC) Organization - Management - Procedures [3(m) above]. MCGB and the sewerage part of its Water Supply and Sewerage Department (WSSD) is now under more able management. Relations between this staff and the current main consultant are good. MCGB has revised its procedures such that the Standing Committee approval of a staff/consultant recommendation on contract awards is deemed to be given in the absence of a contrary decision within 15 days.

(vi) MCGB's Financial Performance [3(m) above]. This has continued satisfactory through BWSSP III (see also Section V and Annex 10 of this SAR).

(vii) Future Bank Support and Supervision [3(i) and (n) above]. This proposed project; see also Annex 8 to this SAR.

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PROJECT PERFORMANCE AUDIT REPORT

INDIA

SECOND BOMBAY WATER SUPPLY AND SEWERAGE PROJECT (CREDIT 842-IN)

EVALUATION SUMMARY

Background

1. In India, the provision of water supply and waste disposal is the responsibility of the respective states which, normally, exercise these functions through various government departments and agencies. However, in the case of most large cities, the full responsibility is delegated to the municipal authority.

2. From independence to the late 1970s, competing demands for resources restricted sector investments to 1% to 2% of total public expenditures with the consequence that, according to the World Health Organization's (WHO) 1975 "Mid Decade Review," in India, only 31% of the population had access to safe water supply and only 20% had acceptable waste disposal facilities. These figures were lower than the average for all developing countries (PPAR, paras. 1 and 2).

3. The project under review was designed to serve the Greater Bombay area.. Bombay, the second largest city of India and the capital of the State of Maharastra, had an estimated 1977 population of 7.6 million. Lack of adequate investments and general neglect resulted in deplorable water and sewerage services in the city and not until the mid 1960s was there a serious attempt to develop comprehensive, long range, sector development plans for improving the situation at which time the Government of India (GOI) requested the Bank to assist Bombay in the financing of water supply improvements (PPAR, paras. 3, 4, and 5).

4. Following an extensive preparation period, the First Bombay Water Supply and Sewerage Project was appraised in 1972 and IDA Credit 390-IN, for US$55.0 million was approved on May 15, 1973. The project, forming the first stage of a long range water supply and sewerage development program, consisted of the provision of additional water supply source capacities, treatment for all water supplies for the city and transmission and distribution improvements and extensions. On the waste disposal side extensive additional sewer network and new pumping and treatment/disposal facilities were to be provided. The project also provided for institutional improvements for the municipality's Water Supply and Sewerage Department (WSSD).

5. The project encountered severe implementation problems. The consequent delays and the projected large cost overrun (140%) resulting from the re-estimation of costs on completion of the final designs, necessitated a restructuring, under which the majority of the proposed sewerage investments were postponed. The revised project was completed with a 2-1/2 years delay with the Credit being closed on June 30, 1981. Even with the postponement of the sewerage

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investments the revised, final, cost of the project was US$250.8 million, 58% over the appraisal estimate of US$158.2 million equivalent. This was largely due to: (i) low initial cost estimates; (ii) changes resulting from final design and (iii) cost escalation over the construction period. The most successful element of the project was the institutional improvement of WSSD and, in particular, its excellent financial performance. The project was subjected to a full evaluation by OED and Project Performance Audit report No. 5875 recorded the project experience (PPAR, paras. 5-7).

The Project and Its Objectives

6. The objectives of the Second Project were identical to the objectives of the Fist project and, indeed, the entire program namely the progressive improvement and extension of Bombay's water supply and sewerage services and to develop an efficient and financially self supporting water/sewerage entity.

7. The more specific objectives for the water supply services, however, did not include targets for the achieving of a continuous, 24-hour, supply. The immediate and long range targets only specified construction of incremental source, production, transmission and distribution facilities and limited improvements in the hours of supply were projected. Because of this "incremental" approach no detailed demand forecasts were made and the entire long range planning process lacked an ultimate target on which rational staging of the long range program could be based.

8. The Audit had extensive discussions with WSSD and the consultants and urged the development of specific plans for the provision of 24-hour water supply for the entire Bombay. The present system, in effect, does provide such service for those who can afford in-house storage but subjects low income consumers to an unsatisfactory service and the whole of Bombay to the danger of contaminated water supply due to the repeated de-pressurization of the pipe network. In the Audit's estimate, the provision of 24-hour supply is not out of reach, technically or financially (PPAR, paras. 10-13).

9. The water supply components of the project, as designed, consisted of the construction of intake, treatment and transmission facilities for an additional capacity of 450 mld, pumping, storage and distribution improvements, meter replacement and repair program and equipment for the control of Unaccounted for Water (UFW). The total estimated cost of the water supply components was US$114.5 million equivalent (PPAR, para. 14).

10. In terms of quality and coverage of service, the sewage collection and disposal was far below that of the water supply. Only about 44% of Greater Bombay was connected to sewers and there was no environmentally acceptable-disposal system. The housing densities and the soil conditions coupled with high water tables do not permit the use of alternative waste disposal methods (pit latrines etc.).

11. The sewerage works proposed but postponed under the First project were, with substantial additions, included in the Second Project. These comprised of extending the collector network to virtually the entire Greater Bombay, rehabilitation of existing and construction of new pumping stations, two major

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and one minor sea outfalls and, in the inland areas, aerated lagoon treatment plants. The estimated cost of these facilities was US$94.0 million equivalent.

12. The provision of stores, vehicles, engineering services and contingencies and training added another US$203.1 million, raising the total estimated cost of the project to US$411.6 million or, in local currency, Rs 3,540 million (PPAR, paras. 14-17).

Project Preparation

13. The appraisal of the project was based on preliminary design and final engineering design was to be carried out during implementation by consultants to be appointed as a condition of effectiveness. In the Audit's view, not having final design at appraisal was a serious omission in view of the size and complexity of the project. Procurement problems, familiar from the First project which were not expected to reoccur but did, delayed the appointment of consultants by 18 months, creating a corresponding delay in effectiveness and start up and 2-1/2 years after Board approval only 3% of the credit was disbursed. Furthermore serious design errors which subsequently delayed the sewerage works might have been uncovered early had the designs been available at appraisal.

14. Apart from the delay of final design, project preparation was generally efficient and appeared to augur well for future progress. Unfortunately this was to be a false hope. Bank resources for the preparation were generally adequate with the notable exception of not providing special expert services to oversee the preparation for the submarine sewer outfalls. The required expertise to handle these relatively rare and technically complex structures was clearly not available in the Bank (PPAR, paras. 17-20).

Implementation

15. Project implementation became a long and arduous process. The water supply facilities started production in 1986 but a number of major components, including a critical Master Balancing Reservoir will not be completed until mid/late 1990 with completion costs financed from WSSD resources. However, emergency solutions devised permit 90% utilization of the additional capacities. The completed components show good quality construction and efficient operations. The relatively trouble free implementation of the water supply components and the, apparently, consistently satisfactory financial performance of WSSD seem to have resulted in relatively perfunctory Bank supervision in these areas, however, without adverse effects (PPAR, paras. 21 and 23).

16. By contrast, the implementation of the sewerage components was little short of disaster and dealing with this, together with the exceptionally troublesome procurement process, dominated Bank supervision throughout the project's life (see also para. 22). Although the sewage collector network was essentially completed as planned, none of the major pumping stations (the largest ever built in Asia) or the treatment/disposal facilities have, as yet, been completed. Current estimates put the completion of these works at 1994-1995, at the earliest, and at a cost exceeding appraisal estimates by about the factor of three. This situation was brought about by a combination of factors, including

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incompetent management, serious design errors and incompetence in procurement, material shortages and appointment of unqualified contractors (PPAR, para. 22).

17. Bank supervision of the sewerage components while intensive, lacked sufficient expertise and decisiveness. Only a late 1989 supervision report revealed the disastrous situation in full. The Audit has confirmed the complete validity of this report, including the exceptionally poor construction workmanship, partially completed structures abandoned by contractors three years ago and expensive electrical and mechanical equipment which, stored on site without protection, deteriorated to the point of uselessness. It is essential that the findings of the 1989 supervision report and of the Audit be adequately considered in the Third Project which is funding the completion of these components (PPAR, para. 24 and 25).

18. Of the wide spread problems of the sewerage components by far the most serious is the issue of the two main submarine outfalls which were to discharge the major proportion (60%) of Bombay's sewage into the Bay of Bombay. The award of this large contract -- two outfalls, each 3,000 meters long and 3.5 m diameter -- took over two years (1982-84) and the first pipes were not laid until February 1986, one year after the original closing date of the credit. Subsequent discovery of serious design problems, followed by the inability/unwillingness of the contractor to proceed, resulted in the dismissal of the consultants, the eventual abandoning of the works by the contractor and the latter taking legal action against BMC for substantial damages.

19. WSSD appointed another consultant in January 1988 to report on the remedial actions required on the sewerage works. The consultant submitted his report in November 1989 recommending the calling of bids for alternative design solutions for the outfalls and redesign and remedial actions for the main pumping stations. WSSD is in the process of considering the report and has approached the Bank for financial assistance for the design and construction costs.

20. In the absence of the sea outfall disposal system and the delay in the construction of the aerated lagoons, the completed collector system discharges raw sewage at various points into inland waterways and the sea creating unacceptable environmental pollution and health hazards, essentially negating the projected health benefits of the project. An additional environmental issue arising is that the original design of the outfalls envisaged the construction of pretreatment and disinfection facilities at each outfall. Recent reviews confirmed that these facilities can not be built due to lack of available land and the potential nuisance effect of such plants in the heart of Bombay. As the shallow depth of the offshore waters will not permit adequate dilution of raw sewage at the 3,000 m distance from the shore, the probable solution is likely to be the extension of the outfalls to a length of some 8,000 meters (PPAR, paras. 25-27).

21. The necessary changes in the project which emerged at final design, together with the accumulated delays and high inflation escalated the project costs. Estimates in 1983 indicated a potential final cost of Rs 7,594 million compared to appraisal (1978) estimates of Rs 3,540 million. As no financing provisions could be made for the additional cost, the project was revised to a target cost of Rs 6,556 million and some components were postponed to a third

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project (already in preparation at the time) with an estimated cost of Rs 6,100 million. This project is now under way with Bank financing under Ln. 2769 of US$40.0 million and IDA Credit 1750 of US$145 million (PPAR, para. 28).

Procurement

22. Procurement problems and delays were a prominent feature of the First project but they scaled new heights under the second project. File references to poor bid documentation, design errors, alleged political interference and collusion, unfair evaluations, all were present.[1] These resulted in delays, frequent rebidding of contracts and persistent complaints by bidders. Dealing with these problems occupied an unreasonable proportion of the time of Bank supervisory staff as well as forming the bulk of the project correspondence. It is noteworthy that the majority of the procurement problems occurred on the sewerage components, a further indication of the poor management of this part of the project. While the Bank was diligent in pursuing the procurement problems it has never taken a strong stand to stem the tide and, considering the size and complexity of the project (some 92 major contracts were awarded) it would have been prudent to utilize a procurement expert which would have permitted the supervision staff to concentrate efforts on the technical problems of the project and would have also reduced the problem of imperfect bid documents (PPAR, paras. 29-32).

Performance of Consultants and Contractors

23. The consultants for the water supply components, an Indian and foreign, joint venture (under the First project the foreign consultant led, in the Second the roles were reversed) performed to full satisfaction. The Audit's only criticism is the lack of proposals to provide 24-hour supply for Bombay. The consultants, again a foreign/Indian joint venture, on the sewerage works did not perform well and were, eventually, dismissed. In fairness, the Audit notes that the foreign consultant encountered difficult and hostile relationship with some WSSD staff and had only advisory role in construction supervision. While this may limit his responsibility for the poor workmanship noted, in no way does it excuse the major design errors, considering its international reputation. Other consultants providing financial and management system assistance performed satisfactorily (PPAR, paras. 33-35).

24. The performance of construction contractors and equipment suppliers presents a very mixed record. Some of the water supply facilities were constructed to high standard and, apparently, efficiently while a few are still far from finished with no work in progress. On the sewerage side virtually all the major components, which are only partially complete, show very low standard of workmanship and some are essentially abandoned by the contractor. The Audit concluded that lack of pre-qualification, inadequate supervision and WSSD's inability or unwillingness to apply contractual remedies resulted in the massive

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[1] Government comments express reservations on these matters. The Audit considers that the magnitude of the problems warrant the highlighting of the issues recorded on the files.

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loss of resources in these works. On the incomplete sewer outfalls the foreign contractor, of good repute, started well but soon ran into major problems and, eventually, abandoned the works. The untenable relationship that has developed among the contractor, consultant and WSSD staff undoubtedly contributed to the problems (PPAR, paras. 36 and 37).

Institutional Development & Operations

25. Under both the First and the Second projects Bank reports gave high marks for the institutional development of WSSD. The availability of skilled manpower, sound training program and its relatively affluent status certainly raised WSSD well above the average Indian and, indeed, other developing country institutions of similar nature. However, the generally high level of technical competence (verified by the Audit) existing makes it all the more difficult to understand the utter failure to manage the sewerage investments. The often quoted "lack of familiarity with sewerage works" can not be accepted as an excuse, considering the vast amount of accumulated technical experience in the Corporation. In the Audit's view the principal problems were the lack of decision making at the highest levels and a peculiar, traditional, promotion system which, in most senior positions, often prevents the appointment of "the best man" for the job. The political sensitivity of senior staff and outside interference seems to account for the appalling procurement process. The exceptionally candid Part II of the PCR, produced by the borrower, is a highly encouraging sign of the recognition of the problems by BMC.

26. The operation and maintenance of the major water supply facilities visited by the Audit were satisfactory by any standard. Maintenance of the distribution facilities were more difficult to judge. The complex process of manipulating the intermittent supply system is, for the time being, satisfactory but likely to become unmanageable in the future because the increasing precision required to direct the flows into different parts of the city. Since most of the sewerage facilities are incomplete, the Audit had no means of forming a judgement on sewerage operations (PPAR, paras. 38-40).

Financial Aspects

27. With the current level and structure of the combined water/sewerage charges and water/sewerage taxes the revenue generation of WSSD is highly satisfactory. For the past several years, total revenues exceeded total direct expenditures 2-1/2 to 3 times. Actual contribution to investment from internally generated sources have, consistently, exceeded the 40% covenanted in the Credit Agreements and BMC has been able to cover the substantial cost overruns which characterized all its projects.

28. Nevertheless the WSSD has serious emerging problems, the principal among them is the steadily increasing accounts receivable which, in 1989, reached nearly 69%. Of the total, outstanding, arrears of Rs 1,356 million nearly one fifth is over three years old, mostly due from government and industrial organizations. At the same time, provisions for bad debts is a mere Rs 51 million and no debts have ever been written off. The Credit covenants require no more than 20% accounts receivable. The resulting reduced liquidity has been

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largely compensated by substantially reduced annual capital investment requirements due to the extensive delays in construction.

29. The 1988/89 audit report on WSSD's accounts, although only marginally qualified, severely criticized several aspects of the financial management, among them the particularly poor performance of the metering/meter repair process which has resulted in reduced water revenues despite substantially increased supplies. Another worrisome aspect is the limited information on UFW. Although the estimated 15-20% appears low, the lack of detailed information (due to the intermittent supplies) and the poor metering practices cast some doubt on the validity of these figures.

30. The generally sound financial performance of WSSD seem to have given rise to some complacency and a tightening of the management is required. Perceptions of excess cash generation and overcharging for the still inadequate services appear to be forming and increased levels of this may jeopardize WSSD's ability to continue to impose adequate tariff levels in the future (PPAR, paras. 42-44).

The Role of the Bank

31. The Bank's sustained and substantial (total lending US$336 million) support for Bombay's water/sewerage services is both commendable and justified. It is, therefore, surprising that this level of commitment to lend was not accompanied by the allocation of adequate resources, commensurate with the complexities of the project, particularly at the engineering level. The Bank never seemed to have recognized the exceptional scope and complexity of the projects (program) and did not accord any special attention to them. This lack of attention, and possibly Bank staff's preoccupation with the monumental procurement problems, undoubtedly contributed to the lack of early solutions to the project's implementation problems. It has also generated the only criticism of the Bank by the top management of BMC which evidently relies heavily on the Bank for early warning of problems. Future Bank assistance for the completion of the delayed work and future development is still needed and expected, but, if granted, it must be on the basis of utmost professionalism (particularly in the technical areas) without fear or favor (PPAR, paras. 45 and 46).

Economic Analysis

32. The elaborate economic analysis presented in the SAR could not be repeated either by the PCR or the Audit, due to the non-completion of the project (PPAR, para. 47).

Conclusions and Lessons

33. The conclusions and lessons emerging from this project are both simple and obvious. The size and technical complexity of the project demanded a higher level and more extensive technical supervisory input than the Bank, and WSSD, have allocated. Previously good performance on water supply works (which continued under the Second project) may have led to complacency but the results were disastrous for the sewerage works resulting in financial losses, delayed benefits, and environmental damage.

PROJECT PERFORMANCE AUDIT REPORT FOR BOMBAY WATER SUPPLY-SEWERAGE II
(Report No 9265 - December 31, 1990)

EVALUATION SUMMARY

33. Institutional and financial performance were, on the whole, highly encouraging and should serve (minus the shortcomings mentioned) as a good example for other agencies in India and elsewhere.

34. The Bank's contribution to the water supply and sewerage developments in Bombay are highly valued but, in this case, in the Audit's view, the Bank's performance was found wanting in the areas of technical expertise and the handling of the procurement issues (PPAR, paras. 48-55).

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

SLUM SANITATION SCHEMES

Table of Contents

CONCEPTUAL FRAMEWORK AND APPROACH

Aim and Scope

1. The aim of the Slum Sanitation Schemes is to provide sustainable improvements in sanitation (with particular reference to safe excreta disposal) for about 1.0 million of the slum dwellers located on municipally owned land. This will provide coverage for about 20 per cent of the estimated total of 5.5 million slum dwellers in Bombay.

Rationale

2. Concern about inadequacies of sanitation in the slum communities has been expressed by the MCGB itself, by the Government of India's Ministry of Environment and Forests (while granting its environmental clearance for the BSDP), and recently by NGOs and the general public during the public hearings on the Environmental Assessment of the Project. It was such concerns in the past that prompted the inclusion of "low-cost sanitation" components in Bank-supported Second (FY79) and Third (FY85) Bombay Water Supply and Sewerage Projects. However, these initiatives were largely unsuccessful, probably because of perverse incentives inherent in the approaches used. The BSDP's approach to Slum Sanitation Schemes is designed to address such inadequacies. The goal of the new approach is sustainability of installed facilities; and the strategy for achieving this goal is to create incentives to induce investment and operational efficiencies. Accordingly, the approach to be followed in the schemes will be demand-driven and participatory in nature. Its implementation will call for the use of multi-disciplinary teams (of NGOs and technical personnel) to provide intermediation and assistance to communities to make informed choices.

Slum and Technology Selection Criteria

3. All choices will therefore be based on community demands. For example, selection of participating communities will be based on: (a) community initiative and demand, and (b) satisfaction of the "Policy Guidelines for Implementing Slum Sanitation Schemes" (Annex 14, p5) in order to ensure that there is no involuntary resettlement. Communities will be offered a wider range of technological options besides large-scale centralized blocks of public toilets; MCGB will ensure that choice between such technologies and their locations reflect collective community views as a whole, and not just those of a minority in the leadership. In addition, communities will: (i) make financial contributions towards capital costs, (ii) participate in signing off on completed works, (iii) assume full responsibility for operation and maintenance of installed facilities, and (iv) have permanent right of use of such facilities.

Implementation

4. The implementation of the schemes will follow a four-step approach. Step I will be used to publicize information about the schemes, and to identify communities wishing to participate in the schemes. During Step II, communities will be assisted by multi-disciplinary project teams to choose the types and location of desired technological types. Following approval of these choices, the communities will be assisted to prepare plans for operation and maintenance (i.e. facilities maintenance plans), and to collect their upfront capital contributions. Step III is the step where approved choices and designs will be constructed; and Step IV is for operation, maintenance and use of the installed facilities by the communities.

5. A two-phase adaptive approach will be used in implementing the schemes as described in paragraph 4 above. Phase I (which will cover about 100,000 persons) will be a pilot phase for testing, strengthening, and refining the institutional, technical, and financing strategies being followed. Through concurrent monitoring and evaluation, the lessons from this phase will be used to finalize the design for the full-scale operation in Phase II.

Consultant and NGO Services

6. The following consultant/NGO services are included under the Slum Sanitation Schemes: (i) consultancy for publicity and information dissemination, (ii) consultancy for multi-disciplinary project teams, and (iii) consultancy for concurrent monitoring and evaluation of the implementation of the schemes.

7. The consultants for publicity services will help to inform communities about the schemes so that those interested in participating would step forward and apply for participation. Their functions will include: (i) creating awareness about the schemes in specified slum settlements; (ii) creating community-wide understanding of the conditions to be satisfied to qualify for participation in the schemes; (iii) assisting interested slum communities to make estimates of the level of upfront contributions they must make toward capital costs of improved sanitation facilities they desire; and (iv) helping interested communities to apply for participation.

8. The multi-disciplinary project teams will serve as intermediaries and facilitators to communities that are selected to participated in the schemes. Their functions will include the following: (i) helping communities to choose feasible technological options of toilets; (ii) helping communities to identify suitable locations for such toilets, having regard to the Policy Guidelines for Implementing Slum Sanitation Schemes" in order to avoid involuntary resettlement. The multi-disciplinary project teams will also help communities to organize themselves, help them to prepare facilities maintenance plans, train them to undertake technical tasks they wish to undertake by themselves, and provide them with hygiene and health education.

9. The consultancy for concurrent monitoring and evaluation is designed to find out what changes, if any, need to be made to improve the policy framework and implementation strategy for the slum sanitation schemes. The scope of work will include the development of a detailed program for such concurrent monitoring and evaluation, implementation of the agreed program for monitoring and evaluation, and feedback of the results to the MCGB for use in improving and adapting the ongoing schemes.

Withdrawal Certification

10. Withdrawal applications with respect to the slum sanitation schemes will be required to include certification of compliance with the "Policy Guidelines for Implementing Slum Sanitation Schemes" (Annex 14, p 5).

Institutional Framework

11. The Deputy City Engineer (Slums), assisted by a minimum of three full time experienced urban community development officers of the MCGB, will have direct responsibility for day-to-day activities. The Deputy City Engineer (Slums will report to the Deputy/Additional Municipal Engineer

in charge of the MCGB's Water Supply and Sewerage Department which will have overall responsibility for implementing the BSDP, including the slum sanitation schemes. MCGB's Community Development Officers will provide the link between the field and operations and the Deputy Engineer (Slums) for overall monitoring of the schemes.

INDIA: PROPOSED BOMBAY SEWAGE DISPOSAL PROJECT

POLICY GUIDELINES FOR IMPLEMENTING SLUM SANITATION SCHEMES

Objectives

1. These guidelines provide the principles and instructions which will ensure that all persons affected, regardless of their land tenure status, will be assisted to improve, or at least restore, their living standards, income earning or production capacity, and quality of life to pre-project levels.

2. A slum dweller is any one who owns or occupies a physical structure in a slum community and has lived there for at least one year. A slum dweller is said to be affected if: (i) his/her dwelling place is not moved, but however is affected by the physical facilities installed under a slum sanitation scheme of the Bombay Sewage Disposal Project or (ii) his/her dwelling place is moved as a result of such scheme.

3. All choices in such schemes will result from community demands: participation will be based on community selection; and choice of sanitation technologies and their location within slum communities will be made by beneficiary communities themselves, with technical guidance by multi-disciplinary project teams consisting of NGOs and engineers.

4. Criteria for the selection of sites eligible for Bank financing include:

(a) consensus of the community affected by the siting of the sanitation facilities, which consensus would be recorded in the minutes of the meetings;

(b) payment of full restitution to the affected slum dwellers by the beneficiary slum communities prior to implementation of the scheme for such site; and

(c) adjustments of structures and movement of households should be within the same slum community and within a radius of not more than 100 meters from the original location of the structure or household.

Restitution Principles

5. The MCGB shall, or shall ensure, that all restitution be related to actual loss sustained, and that any of the following means of restitution, or their combination, have been provided by beneficiary slum communities to affected persons:

(a) replacement location for structures within the slum community;

(b) materials and assistance to fully replace solid structures to be fully or partially demolished; and

(c) other acceptable in-kind restitution.

Consultation Process

6. The MCGB shall, or shall ensure, that the choice of technologies and their locations reflect the collective views of the community as a whole, and not those of a minority in a leadership position; that all occupants of land and owners of assets affected are consulted. There will be community meetings to inform slum dwellers of their rights and the options available in accordance with these guidelines. Minutes of these meetings shall be prepared promptly and shall reflect the discussions held, agreements reached, and include the following:

(a) for land/asset vacated against restitution, names of affected persons and details about the nature and level of restitution;

(b) type of structure or assets affected, with valuation at replacement cost;

(c) signature of office-bearers of the community association or society; and

(d) record of any complaints raised by affected persons

7. The multi-disciplinary project team assigned to the community shall provide a copy of the minutes to affected persons and confirm in discussions with each of them their requests for restitution, agreements reached, and any eventual complaints.

Approval of Community Choices

8. Prior to the commencement of detailed design and construction of selected technological options, the MCGB shall, or shall ensure, that:

(a) where choices require any movement of households, satisfactory restitution has been agreed between all the affected persons above the age of majority and the communities, as mentioned above; and

(b) any agreed restitution has been completed satisfactorily to the affected persons.

Complaints and Conflict Resolution

9. In order that conflicts be resolved, the following procedures shall be used:

(a) all complaints shall first be negotiated (with the mediation of the multi-disciplinary project teams) to reach agreement at the community level. If this fails, the case shall be referred for a decision to an officer appointed by MCGB for this purpose; and

(b) complaints and grievances about these guidelines, implementation of the agreements recorded in the community meeting minutes or any alleged irregularity in carrying out the slum sanitation schemes should be addressed by the affected persons or their representative to the independent Monitoring and Evaluation Teams (METs) appointed for the implementation of these schemes for information;

Verification

10. The community meeting minutes and evidence of restitution having been made shall be provided by the beneficiary communities to the MCGB and to the METs.

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OUTLINE TERMS OF REFERENCE FOR PROGRAM PUBLICITY

BACKGROUND

1. As a part of the proposed Bombay Sewage Disposal Project (BSDP), the MCGB wishes to implement a Slum Sanitation Program to improve the human excreta disposal for slum dwellers occupying the municipal land in Bombay.

2. Past approaches to the program of slum sanitation services have not been sustainable over long periods. It is estimated that only about 20 percent of the existing pubic toilets in slum areas are functioning satisfactorily. A rapid review has shown the underlying cause of poor functioning of such toilets to be rooted in the inappropriateness of the institutional arrangements used in providing and maintaining the toilets. For example, past approaches have been supply-driven, with little or no participation of beneficiaries in the choice and siting of facilities, their ownership or their operation and maintenance.

3. To address these problems, the MCGB wishes to introduce a number of innovative measures known to be conducive to the sustainability of such services. In particular, it wishes to follow a demand based approach in the selection of participating communities and in the choice and siting of toilet facilities.

4. The following are the four key steps in the implementation of this approach:

Step 1: program publicity and selection of communities who qualify to participate in the program;

Step 2: demand assessment and community level project preparation;

Step 3: design and construction of selected sanitation facilities; and

Step 4: operation, maintenance and use of installed facilities.

This consultancy is concerned only with Step 1 - program publicity.

OBJECTIVES

5. The objectives of this assignment are:

(a) to create awareness about the program in specified slum settlements;

(b) to create community-wide understanding of the conditions to be satisfied to qualify for participation in the program;

(c) to enable interested slum settlements to make an estimate of the level of upfront contribution they must make towards capital costs of improved sanitation facilities; and

(d) to enable interested communities to apply for participation.

(e) beneficiary familiarization with the "Policy Guidelines".

SCOPE OF ASSIGNMENT

6. The geographical scope of this assignment is as defined in the list of eligible slum communities in Attachment 1 (to be provided by MCGB) which have been identified for this assignment. Attachment 2 and 3 are respectively (i) the proposed Overall Policy Framework and (ii) the proposed Strategy and Approach. The scope of activities to be carried out by the consultants shall include, but shall not necessarily be limited to the activities described below.

General Awareness about Program

7. Using appropriate aids and materials, the consultants will help the identified settlement to understand the following:

- goals of the program;
- rules of program;
- criteria for participation by communities and slum settlements;
- phasing of implementation;
- key implementation steps;
- conditions to be met before moving from one step to the next;
- roles of communities;
- roles of MCGB;
- roles of intermediaries and project teams; and
- expected immediate and long-term benefits form the program.

Awareness about Qualification for Participation

8. Through appropriate consultation processes, the consultants shall create community-wide awareness about the screening criteria for slum communities to participate in the program.

Upfront Contribution towards Capital Costs

9. The consultants shall explain: (i) why it is considered necessary for communities to contribute to capital costs; (ii) the level of per household contributions; and (iii) how the total upfront contributions to capital costs are estimated, using the information on the estimated number of household in the settlement.

Applying for Participation in Program

10. The consultants shall explain the procedure for applying for participation in the program, including the level of application fees, and where to the submit application documents and pay application fees.

METHODOLOGY

11. The consultants shall prepare an Inception Report, indicating how the consultation process will be initiated in order to achieve the goals of the program. Further, the consultants should also spell out the various stages in the publicity process to be followed after the approval of Inception Report.

QUALIFICATIONS AND REQUIRED SKILLS

12. The task is to be carried out by NGOs with appropriate experience. The selected NGOs would be responsible for designing the campaign and disseminating the information about the program. The involvement NGOs is necessary because of their close association with communities, possession of social skills, and their use of participatory approaches. The community development group in the MCGB would provide the basic information and would assume the supervisory role.

OUTLINE TERMS OF REFERENCE FOR MULTI-DISCIPLINARY PROJECT TEAM

BACKGROUND

1. The MCGB proposes to implement a Slum sanitation Program which focuses primarily on improved facilities for human excreta disposal in selected slum localities situated on the municipal lands in Bombay. This program is a part of the Bombay Sewage Disposal Project. Its goal is to deliver direct sanitation benefits to about one million people living on municipally owned land. The program will follow a demand driven approach and other innovative strategies. It will be implemented in two phases in a flexible and adaptable way. The first phase will be extended to a few selected slum localities covering an estimated population of about 100,000. There will be intensive testing and monitoring of new strategies during this phase. The lessons learnt in this phase will be used to design and implement the full scale program in phase II.

2. The following are the four key steps in implementation of this approach:

Step 1: program publicity and selection of communities who qualify to participate in the program;

Step 2: demand assessment and community level project preparation;

Step 3: design and construction of selected sanitation facilities; and

Step 4: operation, maintenance and use of installed facilities.

3. The Program publicity will be undertaken to disseminate information about the project separately and this particular assignment will be carried out only in those communities who have come forward to participate in the program. The assignment will be carried out only from step 2 onwards as mentioned in para 2 above.

OBJECTIVES

4. The objectives of the proposed multi-disciplinary Project Team are:

(a) slum scheme implementation in accordance with the related "Policy Guidelines";
(b) to help the communities in choosing the feasible technical options of toilets;
(c) to assist the communities in identifying the suitable locations;
(d) to provide guidance to the communities in preparing a Facilities Maintenance Plan;
(e) to impart necessary skills in construction supervision, accounting, book-keeping, etc. to enable the community to assume full responsibility in implementing the program;
(f) to assist the communities in choosing the executive mechanism of the program;
(g) to undertake health education activities for improving the environmental conditions in the slums; and
(h) to provide back-up and necessary orientation to implement the Facilities maintenance Plan.

SCOPE OF ASSIGNMENT

5. This assignment is to be restricted to only those slum communities which are selected through a screening process. A list of selected slums is given in Attachment 1 (to be provided by MCGB). The scope of activities to be carried out by the Project Team shall include but shall not necessarily be limited to the activities described below.

Demand Assessment and Community level preparation

6. The Project Team shall undertake the following tasks to help the communities in program implementation:

(a) review feasible technical options and their costs in order to enable the community to choose options they want and are willing to pay for;
(b) assist the communities in identifying the suitable sites and helping them in readjusting some of the structures, if necessary in order to avoid involuntary resettlement;
(c) assist the communities in forming registered associations/Societies for collection of upfront contributions towards capital costs on a family basis;
(d) explain to the communities their responsibilities towards construction supervision, financial liabilities towards capital cost as well as operation/maintenance; and
(e) assist the communities to prepare a Facilities Maintenance Plan and helping them to get it approved by the MCGB.

Design and construction

7. Once the communities proposals are accepted, the Project Team will undertake following tasks during this stage:

(a) helping the community to determine and approve the layout or design of the proposed sites;
(b) imparting training to the selected members of the community for supervision of construction work;
(c) assist the community to choose the execution mechanism in construction;
(d) providing site supervision and receiving feed back from the community;
(e) reporting the results of supervision to the MCGB; and
(f) assisting the communities to sign off on installed facilities.

Operation, Maintenance and Use

8. During this stage the Project Team will provide back-up to the community for implementation of the Facilities Implementation Plan and assist in mobilizing operation and maintenance contributions from the users.

Health Education

9. One of the objectives of the program is to alleviate health risks and improve the environmental conditions in slums. In order to achieve this, the Project Team is expected to undertake health and hygiene education throughout the process of this assignment as a parallel activity. The health education should contain aspects related to proper disposal of solid wastes, handling and storage of potable drinking water, personal hygiene, etc. Appropriate methods for this

program are to be designed by the Project Team for inclusion in the consultation process following approval from MCGB.

Training

10. The purpose of this activity is to provide related training in the various tasks proposed by the beneficiaries in order to build their capacities to manage all the activities proposed by them. These include construction, supervision during construction, accounting, book-keeping, operation and maintenance, etc. The training activities should start from step 2 onward and continue throughout the implementation process.

METHODOLOGY

11. The Project Team is required to follow the process of beneficiary consultation and community involvement. The aim of this process is to promote beneficiary participation in technological choices and location and the construction, operation, and maintenance of the selected technologies in order to ensure that the proposed program delivers the expected benefits to communities on a sustainable basis. This process is necessary because the successful implementation of the program depends upon responsiveness to beneficiary preferences. The Project Team would design the appropriate procedures for conducting the consultation process.

12. The Project Team shall prepare an Inception Report indicating how the entire beneficiary consultation process will be initiated in order to achieve the aims of the program and also provide the composition of the team with an appropriate mix of skills. Further, the Project Team shall participate in the project launch workshop along with other teams to discuss and finalize the process of beneficiary consultation. The Project Team is required to maintain a close communication with the designated MCGB's officials to provide continuous feed-back to enable them to make timely adjustment to the program.

REPORTING

Record Keeping of consultations

13. The Project Team is expected to provide a brief report after completion of each task/consultation. This should include notification to the community, and record of follow-up action points agreed at the consultation meetings. The Project Team will also prepare a final report containing description of the entire process of consultations and lessons learnt and modifications and improvements needed for the Stage II.

Quarterly reports

14. Quarterly reports on the progress and the impact of activities will be submitted to the MCGB. In addition, a report will be submitted upon successful implementation of the activities under each step of the implementation process.

COMPOSITION OF MULTI-DISCIPLINARY PROJECT TEAM

15. The assignment is to be carried out by a Project Team consisting of engineers with skills in sanitation program and NGOs/Comminity-base Organizations (CBOs) with an experience in community development, social skills and health education. Each Project Team will be allotted a certain number of communities depending upon their capacity and goals for implementation of the program. The MCGB's Community Development Officers and the designated engineers will provide link to the Project Team.

OUTLINE TERMS OF REFERENCE FOR CONCURRENT MONITORING AND EVALUATION

BACKGROUND

1. A slum sanitation program focussed on excreta disposal is proposed to be implemented for about one million slum dwellers living on MCGB land. The program will be implemented in two phases. The first phase (for 100,000 people) will be used to test models of a beneficiary sense of "ownership" of facilities, choice of technologies, financing capital and recurrent costs, and operating and maintaining installed facilities.

2. The design of the program's implementation process is driven by an overall policy framework (available from the (MCGB). The framework has such innovative features as: (i) demand-based approach in the selection of communities to receive services under the program; (ii) widening of technological options used in providing sanitation services to slum dwellers; (iii) responsiveness to the technologies chosen by beneficiaries; (iv) community sense of "ownership" and maintenance of installed facilities; (v) community contribution to capital costs; and (vi) assignment of operation and maintenance responsibilities to the beneficiary communities.

3. The implementation process follows the four steps given below:

Step 1: program publicity and selection of communities who qualify to participate in the program;

Step 2: demand assessment and community level project preparation;

Step 3: design and construction of selected sanitation facilities; and

Step 4: operation, maintenance and use of installed facilities.

4. The implementation will be accompanied by concurrent monitoring and evaluation. It will also be sufficiently flexible and adaptive to permit adjustments to be made in the policy measures and strategies. The lessons learnt from the first phase will be used to design and implement the second phase of the program. It is anticipated that the experience of the two phases will provide MCGB with a strategy for expanding improved sanitation services to all slums in the city.

5. This consultancy is concerned with the development and implementation of a concurrent monitoring and evaluation program for the MCGB slum sanitation program. The work envisaged under this consultancy is to be carried out over a period of about three years, and it will be subject to possible extension.

OBJECTIVES

6. One primary objective of this consultancy is to find out what changes, if any, need to be made to improve the policy framework and implementation strategy for the slum sanitation program being undertaken by MCGB. This entails an assessment of compliance with the related "Policy Guidelines" and a determination of how implementation strategies are affecting overall performance as well as the

performance at each of the four steps in the implementation process [para. 3 above] in the development and provision of improved slum sanitation services.

7. The monitoring and evaluation program should also include an assessment of the impact on performance of consultants, the inter-disciplinary teams assisting communities, and other public officials and other institutional teams and personnel. In addition, it should include an assessment of the decision making processes at community level to ascertain the extent to which local decision making is truly participatory and inclusive.

SCOPE OF THE WORK

8. The scope of work covers the following:

(a) development of a detailed program for concurrent monitoring and evaluation;
(b) implementation of the agreed monitoring and evaluation program; and
(c) feedback to MCGB for improvement and adaptation of ongoing slum sanitation program.

Development of Detailed Monitoring and Evaluation Program

9. Using a participatory approach, the consultant shall develop a detailed program for the concurrent monitoring and evaluation of the slum sanitation program. This will entail, but will not necessarily be limited to, the following activities: (i) review of appropriate project documents, especially the overall policy framework, the proposed strategy and approach, and the Staff Appraisal Report of the World Bank; (ii) discussions with key officials and participants in the program, including: MCGB officials, NGOs and other consultants involved in the program, leaders of participating communities, community members, and World Bank officials; (iii) preliminary field visits to participating communities; and (iv) participation in a program launch workshop.

10. The detailed program for concurrent monitoring and evaluation will define (for each step in the implementation process and for the overall program) a set of indicators which describe: (a) the key outcomes to be monitored; (b) the likely determinants (or explanatory variables) of the outcomes; (c) the relevance of the parameters to be followed; and (d) the methodology for measuring or assessing the outcomes and their determinants. The consultant should ascertain which provisions of the policy framework are the determinants of the observed outcomes.

11. In the case of Step 1 (program publicity and selection of communities), for example, a key outcome would be the number of communities that step forward to apply for participation in the program. This number may be too high, too low or just what was anticipated. The determinants (or explanatory variables) for this outcome may include: effectiveness of the publicity campaign, agreement or disagreement of community with policy on financial contributions towards capital costs, the level of contribution towards capital costs, availability of alternative sanitation programs that are not so demanding on beneficiaries, or absence of preferred solutions in the range of technological options. Similarly, the outcomes and determinants from the other steps can be identified as parameters to be followed in the concurrent monitoring and evaluation.

12. The detailed program should also include a definition of the timing and locations of the observations and measurements or assessments to be made; it will also include information on the reporting intervals and what will be included in the reports.

13. The consultant will be expected to make a presentation on the detailed program for the concurrent monitoring and evaluation during the program launch workshop.

Implementation of Agreed Monitoring and Evaluation Program

14. Once approved, the consultant will apply the monitoring and evaluation program to the first two steps of in the implementation process. As it is with other components of the slum sanitation program, the monitoring and evaluation program will itself be subject to periodic review at intervals to be determined and agreed with the MCGB.

Feedback to MCGB

15. The consultant shall provide timely reports on the results of the monitoring and evaluation program to the MCGB. The contents of the reports shall include, but will not necessarily be limited to, where monitoring observations were made, what parameters were observed, findings of the observations, and recommended actions arising from the findings.

16. In addition to the periodic reports, the consultant will prepare a final report summarizing the entire monitoring and evaluation activities undertaken during the period of assignment, and the overall findings and recommendations.

QUALIFICATIONS AND REQUIRED SKILLS

17. The assignment is to be carried out by a social science institution, an NGO or a consultant with analytical skills, especially in the design of field surveys and in the various forms of statistical analysis.

INDIA

BOMBAY SEWAGE DISPOSAL PROJECT

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6. Report on Design for Independent Review by Sydney Water Board, Municipal Corporation of Greater Bombay/Binnie/Tata, May 1992.

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9. The Remedial Works Program Status Report, Municipal Corporation of Greater Bombay, October 14, 1994.

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11. Completion of Worli & Bandra Outfalls, Supplementary Report, Municipal Corporation of Greater Bombay, Binnie and Tata, January 1990.

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20. Report to MCGB upon Methods for Treatment & Disposal of Waste Waters from Greater Bombay, Metcalf, Eddy & Company, Vols 1-4, May 1979.

21. Review of "Binnie: Appraisal of Outfall Alternatives" (May 1990 for the World Bank), the Water Board, Sydney, Australia, May 1992.

22. Review of "Binnie: Design for Independent Review" (May 1992 for the World Bank), The Water Board, Sydney, Australia, June 1992.

23. Bombay Sewage Disposal Project - Marine Outfalls Final Report (Appendix), NEERI for the Municipal Corporation of Greater Bombay, January 1995.

24. Bombay Sewage Disposal Project - Marine Outfalls Final Report (Appendix), NEERI for the Municipal Corporation of Greater Bombay, January 1995.

25. Environmental Management Plan for Bombay Sewerage Project: Issues and Approach, NEERI for the Municipal Corporation of Greater Bombay, January 1992.

26. Aerated Lagoons: Bhandup and Gahtkopar, Municipal Corporation of Greater Bombay/NEERI, January 1995.

27. Aerated Lagoons: Maladan, Versova, Municipal Corporation of Greater Bombay/NEERI, January 1995.

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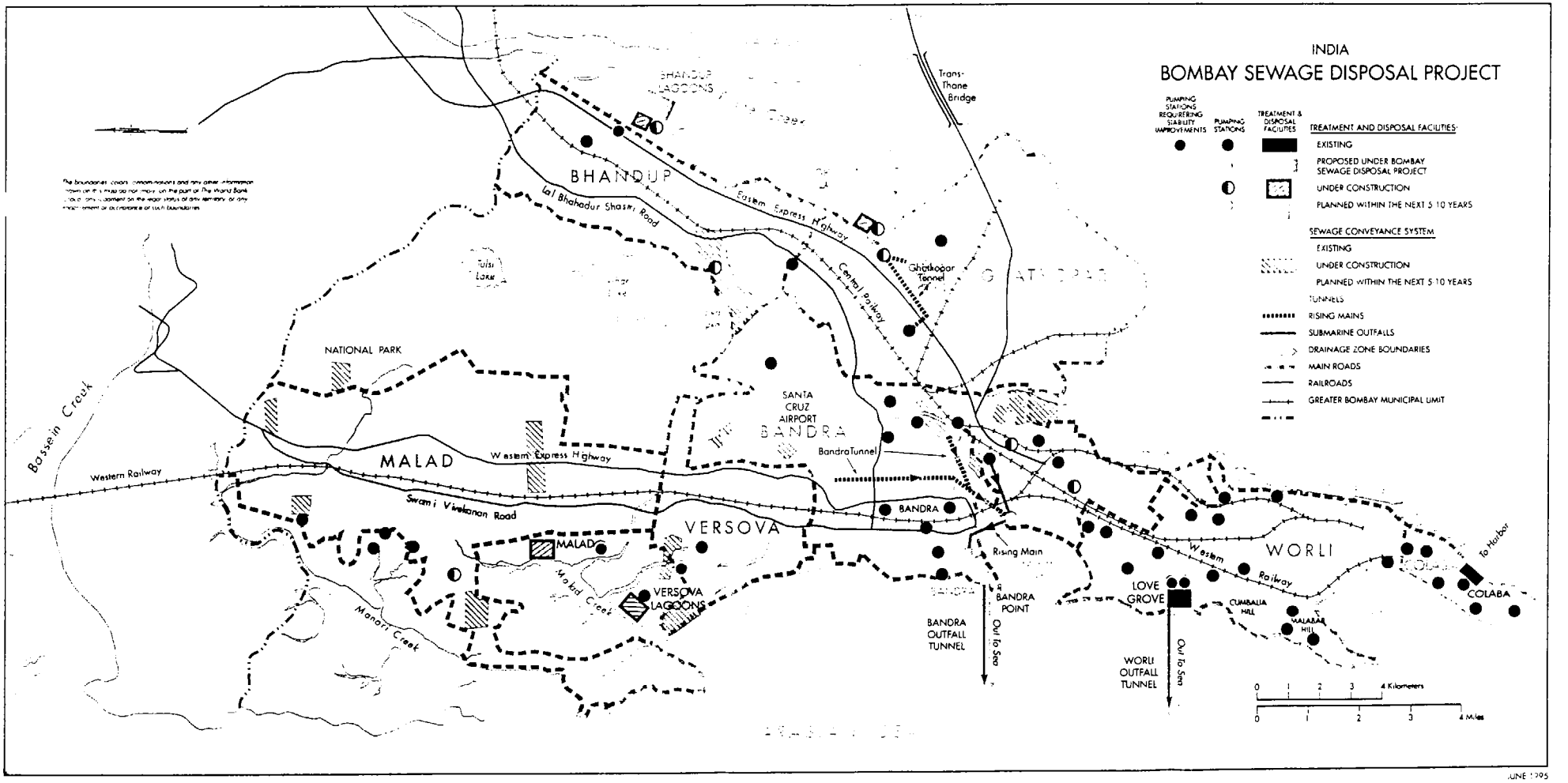
12-April-95

MAP SECTION

IBRD 26628



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IMAGING

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