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L N. 2799-CHA
CR. 1979-CHA

Report No. 6485-CHA

STAFF APPRAISAL REPORT

CHINA

SHANGHAI SEWERAGE PROJECT

March 20, 1987

Projects Department
East Asia and Pacific Regional Office

CURENCY EQUIVALENT

Currency Unit = Yuan (Y)

	Calendar 1986	March 1987
$ 1.00 =	Y 3.48	Y 3.71
Y 1.00 =	$ 0.28	$ 0.27

The staff appraisal report is based on the exchange rate (US$1.00 = Y 3.71) prevailing at appraisal in September 1986.

FISCAL YEAR

January 1 to December 31

WEIGHTS AND MEASURES

ADWF	average dry weather flow	lpcd	liters per capita per day
A$	Australia dollar	m	meter
BOD5	5-day biochemical oxygen demand	m3	cubic meter
dia	diameter	m3/day	cubic meters per day
DO	dissolved oxygen	mg/l	milligram per liter
km	kilometer	sq km	square kilometer

ABBREVIATIONS USED

ADAB	Australian Development Assistance Bureau
BOF	Bureau of Finance of Shanghai
BMEA	Bureau of Municipal Engineering Administration of Shanghai
BSA	Bureau of Sanitation Administration of Shanghai
BUP	Bureau of Urban Planning of Shanghai
CC	Construction Commission of Shanghai
EC	Economic Commission of Shanghai
EPA	Environmental Protection Agency
EPB	Environmental Protection Bureau of Shanghai
GOC	Government of the People's Republic of China
HLLG	High Level Leadership Group (Shanghai)
MDAD	Municipal Drainage Administration Division of BMEA
MEAD	Municipal Engineering Administration Division of BMEA
MOF	Ministry of Finance
MURCEP	Ministry of Urban and Rural Construction and Environmental Protection
PC	Planning Commission of Shanghai
SAA	State Audit Agency
SM	Shanghai Municipality
SMAB	Shanghai Municipality Audit Bureau
SMEDI	Shanghai Municipal Engineering Design Institute
SMR	Shanghai Metropolitan Region
SMWC	Shanghai Municipal Waterworks Company
SPC	State Planning Commission
SSC	Shanghai Sewerage Company
SSPCC	Shanghai Sewerage Project Construction Company
STDI	Shanghai Tunnel Design Institute .CW 10

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SHANGHAI SEWERAGE PROJECT

Loan/Credit and Project Summary

Borrower: People's Republic of China

Beneficiaries: Shanghai Municipality and Shanghai Sewerage Company

Amount:
IBRD Loan: $45 million
IDA Credit: SDR 78.9 million ($100 million equivalent)

Terms:
IBRD Loan: 20 years including 5 years of grace, at standard variable interest rate.
IDA Credit: Standard

Relending Terms: From the Government to Shanghai Municipality: 20 years including 5 years of grace at 4.5% p.a. interest.

From Shanghai Municipality to Shanghai Sewerage Company: 20 years including 5 years of grace at 4.5% p.a. interest.

Project Description: The objectives of the project are to improve the environment of Shanghai through building sewerage facilities for the removal and disposal of wastewater in the city, and to create and develop the institutions for providing sewerage services, managing water resources and protecting the environment. The project consists of the construction of a link and intercepting sewer system to collect and transport wastewater in the project area to the estuary of the Changjiang for disposal, conducting of four studies and training. Project elements consist of a 35 km long trunk intercepting sewer, 32 km of link sewers, two pump stations on the intercepting sewer and eight pump stations on the link sewers, a screening plant and 2.6 km of outfall tunnels. The studies include: (a) a management and organization study to determine organizational and staffing needs for the Shanghai Sewerage Company (SSC); (b) a sewerage tariff study ; (c) a river basin management study of the Huangpu River for the purpose of setting up the institutional framework for water resources allocation and waste discharge control; and (d) a study to examine economic ways of rehabilitating the existing combined sewer system in Shanghai. A comprehensive training program for SSC and Shanghai Sewerage Project Construction Company (SSPCC) staff would also be carried out. The main benefits of the project come from the improvement of the environment in Shanghai, and institutional development in management of liquid wastes and environmental pollution control. Project risks include: (a) possibility of environmental problems at

the Changjiang estuary due to stronger than expected effluents entering the system or overestimation of assimilative capacity of the estuary; and (b) failure to reduce point and non-point pollution sources upstream of the city resulting in inability to achieve water quality objectives. Monitors have been built into the project to detect problems early in order that appropriate remedies can be found and carried out.

Estimated Costs:

	Local	Foreign	Total
	($ million)		
Civil Works	120.7	75.2	195.9
M & E Equipment	9.6	26.7	36.3
Design, supervision, management, studies and training	12.5	8.1	20.6
Land acquisition	48.4	10.6	59.0
Base Cost (1987 prices)	191.2	120.6	311.8
Physical contingency	19.1	12.1	31.2
Price contingency	7.9	5.1	13.0
Total Project Cost /a	218.2	137.8	356.0
Interest during construction	0.0	16.6	16.6
Total Financing required	218.2	154.4	372.6

Financing Plan:

	Local	Foreign	Total	%
	($ million)			
Proposed IBRD loan/IDA credit	7.2	137.8	145.0	38.9
Shanghai Municipal Government	211.0	16.6	227.6	61.1
Total	218.2	154.4	372.6	100.0

Estimated Disbursements:

Bank Group FY	1988	1989	1990	1991	1992	1993
	($ million)					
Annual	12	21	38	33	27	14
Cumulative	12	33	71	104	131	145

/a Project-financed goods are exempt from import duties and taxes..CW 10

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SHANGHAI SEWERAGE PROJECT

STAFF APPRAISAL REPORT

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This report is based on the findings of an appraisal mission consisting of Messrs. John W. Huang, N. Noda (Engineers), C. Fernandez, P.C. Kapur (Financial Analysts), H.A. Garn (Economist) and M. Durosseau (Environmental Engineer), who visited China in September, 1986.

TABLES IN TEXT

ANNEXES 34

MAP

I. THE URBAN AND ENVIRONMENTAL SECTORS

Urbanization in China

1.01 About 37% of China's roughly one billion population lives in urban areas defined as cities and towns with populations over 5,000. This is comparable to the urbanization level of 35% for other countries at similar income levels. Rapid changes in urbanization have occurred in China in the past, most notably a 7% p.a. growth in 1949-58 and 1978-83, and 10% from 1984 to 1986. These were periods when major shifts in Government policies resulted in large-scale population migration. Within the 26 provinces and the three centrally-controlled provincial-level municipalities of Beijing, Tianjin, and Shanghai, there are 57 cities with populations exceeding one million, 267 cities with 50,000 to one million people, and 7,511 towns.

1.02 While the recently observed rate of urban growth may be somewhat overstated due to a recent definitional change of urban areas and urban population, it is at least seen to be in the 4 to 6% p.a. growth range, which is similar to those in other developing economies experiencing rapid economic growth. These trends are expected to continue in the next several years. The most important contributing factor is the existence of surplus farm workers who migrate to nearby market towns and cities seeking full-time or part-time work, often to supplement family earnings. While China plans to contain urban population growth within specific growth poles (townships and small towns), the viability of these plans is being challenged by a weakening of the traditional mechanisms for migration control, namely government job and housing allocation and food rationing. Rural migrants to cities can acquire food in the free market, and take jobs in the growing private and collective sectors. It is estimated that the urbanization level could reach 50% by the year 2000, and that, contrary to the Government's expectations, a large part of the increased urbanization could occur in the large and medium-sized cities, where job opportunities are better.

Environmental Situation in Urban Areas

1.03 Growing population and industrialization in urban areas have caused widespread water pollution, often contaminating sources for drinking water supplies. In most large cities, including Shanghai, the location of the proposed project, local watercourses are heavily polluted with chemical and biological impurities. A national environmental protection law (1979) and a water pollution control law (1984) were enacted with the aim of addressing these pollution issues, but implementation has been slow because high treatment costs threaten the financial viability of the large number of old industrial plants. Current policy is to relocate waste-producing industries away from populated areas, and to require industries to pay pollution charges for effluents exceeding prescribed standards. Funds collected are used to finance pollution abatement facilities. Because of the slow progress in reducing pollution through regulatory measures and the need to dispose of increasing amounts of domestic wastewater, most cities are now confronted with the need to construct sewerage systems with suitable wastewater disposal facilities, including treatment plants, to solve industrial and domestic pollution problems.

1.04 The bucket (night soil) system is still widely used in cities for human waste disposal. With rising standards of living, this system is no longer considered acceptable in crowded urban areas. In large cities, new housing estates are now planned to have flush toilets and sanitary sewerage systems equipped with treatment facilities. Urban upgrading in old city cores usually includes conversion to flush toilets, and as separate sewerage does not exist, individual septic tanks are required by city codes to provide some treatment prior to disposal into storm sewers or local watercourses.

Sector Organization

1.05 The Ministry of Urban and Rural Construction and Environmental Protection (MURCEP) is the central agency providing overall guidance to the provinces and the three centrally-controlled municipalities on matters concerning the planning and programming of investments for all works in the cities and towns, including sewerage. It also sets operating rules for carrying out national policies for environmental protection. Each province/municipality is responsible for works in cities and towns under its jurisdiction, executed through various provincial or municipality bureaus. In larger provinces and the centrally-controlled municipalities, commissions, another administrative level above the bureau, have been created, with each commission supervising several bureaus. Overseeing urban matters are the provincial bureaus of planning, design, capital construction, and municipal finance, which approve urban plans and major projects for cities and towns. The actual work of planning and design of projects is carried out by municipal departments except when the projects are too large, in which case, provincial assistance would be requested. Construction work has normally been carried out by municipal construction bureaus, but is now also being contracted out to construction enterprises. All urban projects are reported to MURCEP. Large projects (exceeding Y 200 million for Shanghai and other special cities) require approval by the State Planning Commission (SPC). Those involving foreign loans require approval by both the SPC and the State Council.

1.06 China now gives great importance to environmental protection. The central Environmental Protection Agency (EPA), while administratively part of MURCEP, reports directly to the State Council. The EPA sets national environmental standards and provides guidance and supervision to provincial/municipality environmental protection bureaus.

Sectoral Issues and Priorities

1.07 For the past three decades China has concentrated on industrialization, leaving urban services, especially those required to preserve environmental quality, seriously neglected. Main urban issues are shortage of housing, traffic congestion, inadequate water supply and sanitation facilities, and air and water pollution. Significantly higher investments in urban services are now required to remedy past inadequacies and to provide for future growth. Given the large investment needs and limited available resources, improved investment planning is needed in order to help selection among competing priorities. Increasingly urban investments would need to be funded from local resources, and, therefore, upgrading local government finance is another priority area of concern.

Cost recovery is also an issue in the sector, and past pricing policies have contributed to inefficient use and poor maintenance of most urban services. The Government recognizes this deficiency and is promoting a "users pay" policy. The full enforcement of this policy cannot, however, be carried out until the Government undertakes wage reforms, which may take some time to complete. In the area of wastewater disposal, management is weak and responsibilities are divided and often inappropriate. Institutional strengthening through better financial planning and management, tighter regulations to support operations, and more intensive staff training are urgently needed. Sector studies are being conducted by the Bank in cooperation with Chinese officials to address these issues (para. 1.09).

Past Experience under Previous Operation

1.08 The Bank Group has thus far been involved in only one project in China's urban and water supply sectors. This was the China Rural Water Supply Project (Credit 1578-CHA, SDR 82.1 million, 1985) to finance equipment and goods for the construction of water supply systems in about 4,650 villages, which previously did not have access to safe drinking water, in four provinces and one municipality. The project also supports training for and development of management and monitoring systems in rural water supply. Project implementation is on schedule, with about 30% of the materials and equipment required for the project already procured. Project officials have shown competence in carrying out the work. The project is scheduled for completion in 1990.

Bank Role in Sector

1.09 In addition to the above project, the Bank has carried out significant urban sector work. This includes: (a) the Shanghai Sector Memorandum (Urban), Report No. 4227-CHA, December 1982; (b) a Bank economic report, China -- Long-term Development Issues and Options, Report No. 5206-CHA, May 22, 1985, which includes a chapter on spatial and urban issues; (c) an urban sector survey in Liaoning province in 1985 in cooperation with UNDP and ADAB; and (d) an urban sector study in Zhejiang Province (now in progress) to study urbanization trends, urban development policies, needs for urban services and means for planning and financing such services. The Bank's role in the urban sector in China is meant to: (a) assist the Government to prioritize needs for urban services and prepare cost-effective projects; (b) provide project funding, as well as attract other sources of external financing; (c) help strengthen institutions responsible for preparing, constructing and operating urban services through support for organizational structure and staff training; (d) promote sound financial and cost recovery policies for the sector; (e) help develop sector policies, legislation and regulations conducive to efficient urban development and operation of urban services, and (f) promote environmental protection. In areas of urban planning, finance, and management, China looks to the Bank for transfer of experience gained in other countries. The Government is presently discussing with the Bank the possibility of assistance for a number of potential urban and water supply projects.

II. PROJECT BACKGROUND

Project Genesis

2.01 At the invitation of the Shanghai Municipal Government, a Bank sector mission visited Shanghai in April 1982 to review Shanghai's development priorities. This resulted in the Shanghai Sector Memorandum (para. 1.09) which identified priority areas of investment as: liquid waste management with an emphasis on improving the quality of water in the two major waterways, upgrading of old housing linked with a strategy for new housing construction, and improvement in traffic and public transport. Australian consultants were subsequently engaged under a technical assistance grant from the Australian Development Assistance Bureau (ADAB) to carry out with Chinese counterparts detailed strategic studies in each of these four areas. In August 1984, the Municipality requested the Bank to finance a project to deal with liquid waste management. A preparation mission in January 1985 and a preappraisal mission in May 1985 reviewed project preparation work. Project appraisal was delayed because of various domestic procedural matters, and some additional preparation work needed due to a change in the location of the proposed outfall. These issues were resolved in May 1986. The project, which was appraised in September 1986, involves the construction of an intercepting sewer and link sewers to transport wastewater in the existing combined sewer system of the northern half of the city to the Changjiang (Yangtze River) estuary for disposal. A number of significant institutional development measures are also included.

Shanghai Municipality

2.02 Shanghai Municipality (SM) is located in the Changjiang (Yangtze River) delta plain (see IBRD Map 20201). It has an area of 6,186 sq km, of which 300 sq km (increased recently from 141 sq km) are classified as urban, and referred to here as the Shanghai Metropolitan Region (SMR). SMR is made up of ten central districts collectively referred to as the City, two outlying urban districts (satellite towns), and areas recently annexed from adjacent counties. The remaining territory consists of ten rural counties. SMR is inhabited by about 7 million of the 12.1 million population (1984 statistics) of the municipality. About 6 million of the urban population live in the City. In addition there is a floating population of about one million, comprising mainly of persons who come to Shanghai to conduct business or engage in temporary jobs. SM has 1.2% of the country's population but contributes 10.6% of the country's gross industrial output. Shanghai City is the country's largest and most heavily industrialized urban agglomeration and a seat of higher education and technology. About half of the some 8,000 factories and enterprises of the municipality are located in SMR. Major industries include metallurgy, machinery, shipbuilding, automobile and bicycle manufacturing, chemicals, electronics, textiles, pharmaceuticals and printing, which produce a wide range of high-quality, precision and sophisticated products. China's Seventh Five-Year Plan (1986-1990) envisages continued expansion of both internal and external trade for Shanghai as well as the strengthening of Shanghai's advanced technology industries. The Central Government has approved the use of increased external assistance and borrowings for Shanghai. Indeed, Shanghai is viewed by Chinese planners as a "window" to the outside world through which various approaches to modernization can be introduced into China.

2.03 SM is aiming to become one of the major economic and trade centers in the Pacific region. To achieve this it would have to resolve the many urban problems mentioned in para. 2.01. Currently its urban development plan includes, in addition to the current project, major investments in housing construction, expansion of its airport, construction of vehicular tunnels and a new bridge across the Huangpu River and a rapid transit system. An amount of Y 1,300 million ($350 million) per year has been budgeted by SM for these works (para. 6.09).

Water Supply

2.04 The main watercourse of the municipality is the Huangpu River, a tributary of the Changjiang, with an average flow of 320 m3/sec at the City. The river skirts the southern and eastern borders of the City, and is the main recipient of storm and wastewater flows from the City. It also provides water for domestic, industrial and agricultural needs, and serves as a major waterway and harbor for local and international shipping. Numerous tributaries of the Huangpu River and canals linking to it traverse the municipality. The most important of these tributaries is Suzhou Creek (Wusong River), which passes through densely populated and heavily industrialized areas in the heart of the City, and is used extensively for river transport.

2.05 SMR is served by water treatment plants operated by the Shanghai Municipal Waterworks Company (SMWC) using water from the Huangpu River. The water plants have a combined capacity of 3.77 million m3/day, and are currently producing about 3.5 million m3/day (90% of capacity). About 62% of the water is sold to industry and the remainder to households. Another 94 waterworks independently serve the ten rural counties and outlying districts. In addition to water provided by SMWC, about 2.5 million m3/day of river water from the Huangpu River and 0.2 million m3/day of groundwater are drawn directly by industry. Water supplied by the SMWC is kept bacteriologically safe by heavy chlorination, but chemical impurities in the source water from industrial wastewater discharges impose serious health hazards. For this reason SM is embarking on a project, financed from its own funds, to construct a new water intake at the Huangpu River about 35 km upstream of the City with a 41 km pipeline to provide better quality water to the eight existing water plants. Construction of the project, which is estimated to cost about Y 900 million ($243 million), has already begun and completion is expected in 1988.

Domestic and Industrial Wastewater Disposal

2.06 A schematic flow diagram on domestic and industrial wastewater flows in the City is shown in Annex 1. Soil water (excreta and toilet water) and grey water (kitchen, bath and wash water) are normally disposed of separately from houses. Grey water from all houses is discharged into the City's stormwater drains which now function as combined sewers. For excreta disposal, about half of the 6 million inhabitants of the City still use the bucket system. Night soil from the buckets is emptied at night by the users into communal storage tanks, collected by small vacuum trucks and taken to barges to be transported to neighboring villages for agricultural purposes. The remaining 3 million people use flush toilets. Of these,

roughly 0.9 million people are connected to separate sanitary sewerage systems which provide biological treatment prior to disposal into the Huangpu River or its tributaries. There are eight sewage treatment plants serving mainly newer areas in the urban fringe. Another three are planned or under construction. The remaining 2.1 million people not connected to separate sanitary sewerage systems are required to have their toilet waste discharged into septic tanks with the effluent piped into the City's combined sewers. Septic tank sludge is collected by vacuum trucks operated by the Municipality, and disposed of with the night soil.

2.07 Most factories discharge their wastewaters untreated or partially treated either into the city's combined sewers (about 40%), or directly into the Huangpu River or its tributaries (about 60%). The present industrial waste load discharged from factories in the City is estimated to be equivalent to that from a population of about 8 million on a biological load basis, and about 11 million on a hydraulic load basis. Water pollution control in Shanghai is exercised by the Environmental Protection Bureau (EPB). The EPB requires industries to pay pollution charges on a graduated scale according to the extent their discharged effluents exceed permissible EPB standards. Part of the funds (80%) from these charges are then used to finance pollution abatement facilities. While the standards appear to be appropriately set, the charges are too low, and, even so, the EPB often finds it necessary to forgive industries which are already operating at marginal profitability. Thus, despite the soundness of the water pollution control policies, water pollution remains a serious problem. The EPB is aware of these issues, and have proposed measures to correct the situation (para. 4.19).

Status of Existing Sewerage System

2.08 The combined sewer system in the City was originally designed as a stormwater system, but is now also accepting household and industrial wastewater (paras. 2.06-2.07). Some parts of the pipe system are old (constructed prior to 1949), but the majority of pipes have been reconstructed. In a few districts where the soil is poor, pipes constructed using the pipe jacking method have settled, giving rise to excessive infiltration of groundwater often resulting in damage to road surfaces. The internal surface of many sewers running through industrial districts is often severely corroded by strong effluents discharged by industries, and the sewers are sometimes also heavily clogged with industrial wastes which have to be removed at high cost. As a large part of the system extends in the most crowded parts of the city, future replacement will be both difficult and expensive. A study would be carried out in the proposed project to examine economic ways of rehabilitating the pipe system in order to extend its life. Draft terms of reference for this study are shown in Annex 20. During negotiations assurances were obtained from SM that the study would be conducted on terms of reference and with assistance from consultants acceptable to the Bank/IDA, and that the study would be completed not later than December 31, 1989, and the results of the study would be reviewed with the Bank/IDA.

2.09 The combined sewer system drains to 160 pumping stations, which have now been upgraded to discharge rainfall without the occurrence of flooding more than once a year on average. The pumping stations have been

adequately maintained. Currently these pumping stations discharge their contents directly into the Huangpu River or its tributaries. Pump stations which serve areas included in the project will be modified to have the dry weather flow discharge into a proposed interceptor sewer, while storm flows would continue to be discharged into the Huangpu River or its tributaries.

2.10 Two intercepting sewers, the Western and the Southern Interceptors, were constructed in 1971 to relieve water pollution in the City. These are still in good structural condition. However, because of overloading and inadequate outfall design, serious local pollution conditions are found at the discharge points in the Changjiang estuary and Hangzhou Bay. Their operating conditions will improve when overloaded flows are diverted to the proposed intercepting sewer. Measures are already planned to expand the capacity of the Southern Interceptor, which would be used to serve the City areas east and south of the Huangpu River. Plans have also been proposed to reconstruct the outfalls to a more appropriate design. The separate sewerage systems and the eight sewage treatment plants (para. 2.06) serving urban fringe areas are relatively new and are operating satisfactorily.

Present Environmental Situation

2.11 The amount of pollution discharged into the Huangpu River now far exceeds the assimilative (self-purification) capacity of the river system, and serious deterioration in water quality has resulted. The bulk of this pollution is from industrial effluents. While efforts have been made by EPB to reduce industrial pollution (para. 2.07), the measures used have not been adequate to produce any noticeable improvement in river water quality. Samples taken from the Huangpu River in the vicinity of the City show that the river turns anaerobic in many stretches for 150 days a year (compared to 33 days a year in 1975). EPB's required standard for Shanghai waterways is a dissolved oxygen content of not less than 4.0 mg/l. Suzhou Creek and many other tributaries of the Huangpu River are black and malodorous during most parts of the year. As these creeks run through densely populated areas of the city, their condition seriously affects the living conditions and well-being of a large number of people. The situation is expected to worsen with planned industrial expansion in Shanghai, and the steady replacement of the bucket system with flush toilets. In addition about 80,000 new housing units a year would be equipped with flush toilets requiring expansion of the sewerage system. These problems would be addressed by the project.

III. POPULATION, WATER CONSUMPTION, AND WASTEWATER FLOW PROJECTIONS

Population Growth

3.01 Shanghai's natural population growth rate has fallen dramatically from 52.6 per thousand in 1954 to 11.8 per thousand in 1980. With a natural population growth trend expected to be less than 10 per thousand, and with the assumption that control of in-migration by administrative means could continue to be possible, SM has projected virtually no population increase, so that by 1990 its total population would increase to 13 million from 12.1 million in 1984 (para. 2.02), with 7 million living in the SMR. However,

with the possible increase of rural-to-urban migration brought about by the recent economic reform (para. 1.02), this projection is generally considered to be too low. Already about half of the one million floating population in Shanghai (para. 2.02) are believed to be living permanently in the city, but are not registered as residents. It would therefore be more reasonable to estimate urban population in Shanghai to grow at a rate of 1.3% p.a. on the 1984 population base, a figure which is still low compared to historical urban growth patterns in China (para. 1.01). This would result in an urban population of 8.5 million in the year 2000, and is considered to be the population consistent with an increase in the work force in line with Shanghai's economic expansion. It is, however, expected that the bulk of any population growth in Shanghai would take place in new City areas. For the old City area, where the proposed project is located, population growth would be relatively low, as the area is severely overcrowded (population density approaching 40,000 persons per sq km), and the Municipality is already taking steps to relieve the crowded conditions there. Any underestimate of population growth in Shanghai is therefore not likely to affect the project design. Details of the population projection in the project area are shown in Annex 3.

Regulations Affecting Water Use and Wastewater Discharge

3.02 Growth in water supply demand and sewage flows is expected to continue with the City's projected economic expansion. SM is, however, attempting to deal with the adverse effects of this development. Current legislation reflects SM's determination to protect public health and the environment, to eliminate pollution, and to make rational use of available resources. Plans to relocate polluting industries away from dense residential areas are also being pursued. The EPB is actively monitoring industrial waste discharges and imposing pollution charges in an effort to reduce pollution (para. 2.07). It also plans to review industrial effluent discharge standards and pollution charges (para. 4.19). The Municipality has imposed sewerage charges on industrial and commercial users commencing in December 1986, which would almost double the cost of water usage (water supply and wastewater disposal) (para. 6.04). Heavy industrial polluters connected to the sewerage systems will also be made to pretreat their effluents (paras. 3.09 and 4.19). Together, these measures are expected to moderate the potential growth in water and sewerage demands of the City.

Water Demand

3.03 Detailed projections of water demand in SMR were prepared by SM and reviewed by the mission for different categories of consumers. Domestic, commercial and industrial water consumption from the SMWC system were recorded respectively at 0.55, 0.47 and 1.59 million m3/day in 1983; 0.57, 0.50 and 1.65 million m3/day in 1984; and 0.60, 0.53 and 1.72 million m3/day in 1985. These levels constitute the total domestic and commercial supply and a major part of the industrial water supply of the City, as well as of the industries and some 500,000 people in the two outlying urban districts and recently annexed areas. A few industries extract water from private wells, but as SM has stringent restrictions on groundwater extraction due to ground subsidence problems, the amount from this source is negligible. Several large industries draw water directly from the Huangpu River for their own use. This amounts to about 2.5 million m3/day (about

71% of the amount supplied by SMWC). Wastewater from these industries is discharged directly back into the river.

3.04 Domestic per capita consumption in SMR was estimated to be 91 liters per capita per day (lpcd) in 1985. The low per capita figure reflects inadequate internal plumbing, sharing of bathroom facilities, and the common practice of using ablution facilities provided at the work places by industries and enterprises. As personal income improves and with the gradual replacement of the bucket with flush toilets, domestic per capita consumption is projected to increase to 123 lpcd in the year 2000. Commercial and industrial demands from the SMWC system are expected to decrease by 10% each year in 1987 and 1988 with sewerage charges introduced in December 1986 (para. 6.04), implying a price elasticity of demand of about -0.2, and to increase thereafter at a rate of 3 to 4% p.a. in response to economic growth. The volume of water that industries extract directly from the Huangpu River is expected to decrease (in relative terms) to about 51% of the amount supplied by SMWC in the year 2000. Details of water demand projections are shown in Annex 3.

3.05 Using the above assumptions the total water demand to be met by SMWC is projected to be 4.1 million m3/day in the year 2000. Assuming unaccounted-for water at 18%, the total required production capacity would be 5.0 million m3/day, or an expansion of 40% over the present production capacity of 3.5 million m3/day. This demand projection is considered reasonable. Expansion plans have already been formulated by SMWC and include, in addition to the construction of the new intake on the upper Huangpu River (para. 2.05), the construction of additional water treatment plants, and the eventual construction of a water intake on the Changjiang.

Wastewater Flow Projections

3.06 Total wastewater flow from SMR is presently estimated to be 6.1 million m3/day (average dry weather flow, ADWF). This is projected to increase to 7.5 million m3/day in the year 2000. The projected wastewater flows (ADWF) were estimated from water demand projections, less 10% for evaporation and other losses, and including groundwater infiltration (estimated from tests to be 5,000 m3/day/km2 in the old combined sewer system and 1,000 m3/day/km2 for new sewers). The wastewater flows are planned to be disposed of through the existing western and southern intercepting sewers (1.2 million m3/day), existing and future separate sewer systems (0.3 million m3/day), the proposed project works (1.4 million m3/day) and a future Stage 2 project (2.0 million m3/day). About 2.6 million m3/day would continue to be discharged directly into the Huangpu River. This would consist mainly of effluents from industries extracting water directly from the Huangpu River, with such effluents expected to meet EPB's standards by the year 2000 with the improved monitoring and control planned. Details are shown in Annex 3.

Sewer Design Criteria

3.07 Seasonal and diurnal flow variation factors measured by studies conducted by the municipality are 1.3 and 1.5, respectively, on a citywide basis, and a peak factor of 1.95 (1.3 x 1.5) has therefore been adopted. The project interceptor sewer will be designed to capture as much of the

wastewater from the combined sewers in the project area as is economically feasible and environmentally satisfactory. A comprehensive study was carried out to determine the appropriate intercepting ratio (ratio of capacity of intercepting sewer to the ADWF) to be used in the design (a larger ratio would mean the use of a larger sewer with resulting higher costs, but a greater percentage of the wastewater would be intercepted). The study recommended a ratio of 2.5 for the main intercepting sewer, and ratios of 3.0 to 4.0 for link sewers in the Suzhou Creek area. With these design criteria it is estimated that about 98% of the wastewater in the combined sewers of the project service area would be intercepted, with the remaining 2% escaping into the Huangpu River with stormwater flows.

Biological Loads and Toxic Matters

3.08 About 80% of the present wastewater pollution load is of industrial origin. While the total pollution load is projected to increase, this percentage is expected to decrease in the future with increased industrial pollution control balanced by higher domestic waste discharges from the gradual elimination of the bucket system. Projected wastewater pollution loads in terms of 5-day biochemical oxygen demand (BOD5) are shown in Annex 3.

3.09 The principal toxic substances appearing in Shanghai wastewater are arsenic, cyanide, phenol, chromium, copper, mercury, nickel, lead, and zinc. Projected amounts of these substances and other pollutants expected in wastewater from the project area are shown in Annex 4. EPB's required water quality standards at the Changjiang estuary for these pollutants are also shown. Under current ambient water quality conditions of the estuary, a reduction in the pollution level in the effluent would be necessary for six pollutants in order to meet water quality standards. This would be done by enforcement of pretreatment for industries discharging these pollutants into the system. The allowable effluent strengths for wastewater discharged by industries into the combined sewer system in order to permit the achievement of water quality objectives at the Changjiang estuary are shown in Annex 5. Industries whose effluents exceed these standards would be required to pretreat, and this requirement would be enforced through sewer regulations which are to be enacted by December 1987 (para. 4.19).

IV. THE PROPOSED PROJECT

Project Objectives

4.01 The project will be the first part of a comprehensive two-stage program of works required for improvement of the environment in Shanghai and involves the removal and disposal of wastewater in Shanghai City, which now suffers due to inappropriate wastewater disposal. The project would also set up the appropriate institutional framework, encompassing organizational, financial, technical and legislative matters, for management of liquid wastes and environmental protection. This would involve the establishment of a self-financing sewerage company, and creation of the mechanism to control and improve water quality in the Huangpu River and its tributaries.

Project Conceptual Design

4.02 The project would aim towards the achievement of specific environmental targets (para. 2.11) in the Huangpu River and its tributaries. Since the proposed project is only the first stage of a two-stage scheme, the final environmental target would only be achieved after the second stage is implemented. The various alternatives studied are presented in Annex 2, and the results form part of the master plan for wastewater management in Shanghai. The plan proposes continued use of the existing combined sewers and pumping stations for wastewater collection, and the construction of new intercepting sewers to transport the collected wastewater to the Changjiang estuary for disposal. In the newer city areas included after the extension of the city limits (para. 2.02), separate sanitary sewer systems with sewage treatment plants would be used.

Project Description

4.03 The project consists of: (a) the construction of a sewerage system which includes intercepting and link sewers, two main and eight smaller pumping stations, a treatment plant and other ancillary works; (b) the conducting of four project-related studies; and (c) staff training. The physical works of the project forms an integral system, and is independent of the work in the subsequent second stage, although the systems in the two stages may be linked eventually to facilitate operation. The project would serve the main commercial district of the City where intensive redevelopment is taking place, and the residential and industrial properties along Suzhou Creek. It is designed to serve about half the population of the City (3 million) up to the design year 2000 with a capacity to remove 1.4 million m3/day of wastewater. The project includes construction of a 35 km long trunk intercepting sewer (3m to 4m dia. and twin 4.25m x 3.5m box section), 32 km of link sewers (0.45m to 3m dia.), two pump stations on the intercepting sewer and eight pump stations on the link sewers, a treatment (screening) plant and 2.6 km of outfall tunnels (twin 3.5m dia.). The second stage project, planned to be started in 1991, would provide the remaining work for SM's wastewater disposal.

4.04 Wastewater in the combined sewer system presently discharging into the Huangpu River and Suzhou Creek would be diverted at riverside pump stations through new link sewers into the proposed intercepting sewer, which would run from the western end of the city eastwards, roughly parallel to Suzhou Creek. The intercepting sewer would cross the Huangpu River by a tunnel to a proposed treatment (screening) plant which removes coarse and stringy particles from the wastewater. The wastewater would then flow further eastward for a distance of about 10 km to the Changjiang estuary. Two pumping stations on the interceptor would provide the necessary head to maintain the flow. The discharge point for the wastewater is at Zhuyuan, about 6 km east of the city. Twin deep outfalls of tunnel construction, each 3.5 m in diameter and 1.3 km long, would be used. The wastewater would be released through ten vertical 1 m diameter diffuser pipes located along the last 400 m of each outfall tunnel. The main components of the project are listed in Annex 6.

4.05 The project would also further institutional development through the provision of consultant services to assist in the conducting of project-related studies (paras. 2.08, 4.21, 5.06 and 6.04), and a comprehensive training program (paras. 5.13, 5.14 and 5.15). This assistance would enable SM to: (a) develop an efficient, self-financing sewerage entity, the Shanghai Sewerage Company (SSC); (b) develop and strengthen industrial waste management policies, regulations and practices; (c) establish appropriate sewerage tariff policies to promote water conservation and pollution abatement, as well as to provide a basis for financial viability to the SSC; (d) develop sewer and other operating regulations to support the operations of the SSC; (e) strengthen environmental protection; (f) provide training for sector staff in project preparation and in the management and operation of sewerage services; and (g) set up an organization to be responsible for allocation of the Huangpu River's water resources and control of effluent discharges into the river.

Rationale for Bank Involvement

4.06 Environmental pollution control and large-scale sewerage development are new fields in China. The proposed project includes major construction work to relieve serious water pollution conditions in Shanghai. The project would establish a self-financing sewerage company, and develop the institution and measures required to manage the water resources in the city's waterways. It would also provide a model for liquid waste management which can be emulated by other cities in China. Bank experience and technical assistance can provide the necessary expertise to develop the appropriate legal and institutional framework required. The proposed project is large and has complex technical problems requiring external expertise the provision of which the Bank can assist in.

Project Cost Estimates

4.07 Project cost estimates are based on engineering designs prepared by SM officials with the assistance of consultants financed by ADAB. The cost estimates are based on prices from recent construction contracts in China, or quotations from foreign manufacturers for imported equipment, updated to February 1987 prices. The project is exempt from import duties. A physical contingency of 10% of the base cost has been added. Local price contingencies assume price increases of 6.5% p.a. until 1990 and 4.5% p.a. thereafter, and foreign price contingencies used are 3.0% p.a. in 1987, 1.0% p.a. from 1988 to 1990 and 3.5% p.a. thereafter.

4.08 The total estimated project cost is $356 million (Y 1,531 million), with a foreign exchange component of $138 million (39%). The total financing required, which includes $16.6 million of interest during construction is $373 million (Y 1,592 million). Table 4.1 shows a breakdown of the project costs by major project components. Detailed cost estimates are shown in Annex 7.

Table 4.1: PROJECT COST ESTIMATE

	Local	Foreign	Total	Local	Foreign	Total
	--- (Y million) ----			--- ($ million) ---		
Civil Works	455.1	283.7	738.8	120.7	75.2	195.9
M & E Equipment	36.4	100.7	137.1	9.6	26.7	36.3
Services	47.2	30.4	77.6	12.5	8.1	20.6
Land acquisition	182.7	40.1	222.8	48.4	10.6	59.0
Base Cost (1987 prices)	721.4	454.9	1,176.3	191.2	120.6	311.8
Physical contingency	72.1	45.5	117.6	19.1	12.1	31.2
Price contingency	143.6	93.0	236.6	7.9	5.1	13.0
Total Project Cost	937.1	593.4	1,530.5	218.2	137.8	356.0
Interest during construction	0.0	61.5	61.5	0.0	16.6	16.6
Total Financing Required	937.1	654.9	1,592.0	218.2	154.4	372.6

Project Financing Plan

4.09 The Bank Group would provide $145 million for the project ($45 million as a Bank loan and SDR 78.9 million ($100 million equivalent) as an IDA Credit), which is equivalent to 41% of the project cost and 39% of the total financing required. This would finance about $138 million of foreign exchange costs and $7 million of the local cost of civil works. SM would provide the remaining funds amounting to Y 970 million ($227.6 million) or 61% of the total financing required. The proposed project financing plan is shown in Table 4.2. Retroactive financing of up to $1 million for foreign consultant services required for detailed design and preparation of contract documents, commencing January 1, 1987 has been included.

Table 4.2: PROJECT FINANCING PLAN

	Local	Foreign	Total	%
	----- ($ million) -----			
Financing				
Proposed IBRD loan/IDA credit	7.2	137.8	145.0	38.9
Shanghai Municipal Government	211.0	16.6	227.6	61.1
Total	218.2	154.4	372.6	100.0

4.10 The loan and the credit would be made to the Government of the People's Republic of China (GOC). The loan would have the standard variable interest rate for a 20-year term including a 5-year grace period. The credit would be for a 50-year period including 10 years grace. The proceeds of the loan and the credit would be onlent to SM at an interest rate of 4.5%

for a 20-year period including five years grace according to the standard procedure for China. SM would bear the commitment charges on the Bank loan, as well as the foreign exchange risk. A Project Agreement was concluded between the Bank/IDA and SM. The Project Agreement defined the financial objectives of the SSC, and the financial arrangements for the transfer of assets and debts of the project from SM to SSC upon project completion. These financial arrangements would form the basis of a Transfer and Operation Agreement to be made between SM and SSC. During negotiations assurances were obtained from SM that it would send a copy of the draft Transfer and Operation Agreement to the Bank/IDA for review not later than December 31, 1990, and to have the Agreement concluded not later than December 31, 1991. Approval of the Loan and Development Credit Agreements by the State Council would be conditions of loan and credit effectiveness.

Status of Engineering

4.11 The project feasibility study was completed by SM with the assistance of Australian consultants financed by ADAB. Engineering design work is being carried out by three design institutes, the Shanghai Municipal Engineering Design Institute (SMEDI), the Shanghai Tunnel Design Institute (STDI) and the Design Institute of BMEA, supervised by the Shanghai Sewerage Project Construction Company (para. 4.12) assisted by consultants. All three design institutes are well staffed and have experience in the design of similar works. Their qualifications are satisfactory to the Bank/IDA. Design for all works to be constructed in 1987 have been completed, and tender documents are under preparation. The first tender will be invited by June 1987. Work completed to date includes design and drawings for tunnels and box culverts suitable for international bidding. Preliminary design of other project components has also been completed. Because of the size and complexity of the project, the Bank/IDA has asked SM to continue to engage expert foreign consultants to advise on project engineering and construction.

Project Management

4.12 SM is in the process of creating a high level leadership group (HLLG) headed by the Deputy Mayor to direct and coordinate project implementation. Membership of the HLLG would include senior officials from various concerned commissions and bureaus, including the Planning Commission, the Construction Commission, the Economic Commission, the Foreign Economic and Trade Commission, the Urban Planning Commission, the Bureau of Finance, the Bureau of Municipal Engineering Administration and the Environmental Protection Bureau. Day-to-day management of the project will be handled by the Shanghai Sewerage Project Construction Company (SSPCC) which has already been established. The SSPCC will come organizationally under the HLLG. SSPCC's Manager, a senior engineer appointed by BMEA, will be a member of the HLLG. One of the Deputy Managers of the SSPCC will be a senior official from SSC. Total SSPCC's staffing requirement is estimated to be about 1,400 man-years with a peak staff of about 300 persons in 1988 and 1989. SSPCC's organization is shown in Annex 11. Assurances were obtained during negotiations that the staff, functions and responsibilities of the SSPCC would be maintained throughout project implementation in a manner satisfactory to the Bank/IDA.

Consultant Services

4.13 Consultant services for project preparation were provided by ADAB to SM under a grant of about A$2 million covering detailed design and preparation of bid documents up to December 1986. After this, engineering consultant services would be financed under the project through retroactive financing for the period from January 1, 1987 to loan/credit effectiveness and directly from the project thereafter (para. 4.11). Consultant services would also be required for project-related studies. Foreign consultant services (excluding those provided by ADAB), estimated at a total cost of $2.4 million, including salary, costs, fees, international travel and subsistence, would be procured in accordance with the Bank's Guidelines for the use of consultants by World Bank borrowers and by the World Bank as executing agency. SM would provide engineering and project management services estimated at about 18,500 local man-months of which about 10% would be for local consultants. During negotiations assurances were obtained from SM that it would engage consultants satisfactory to the Bank/IDA on a continuous basis to advise on detailed design, preparation of contract documents, supervision of project construction and the conducting of project-related studies.

Procurement

4.14 All major contracts would be procured through international competitive bidding (ICB) in accordance with the Bank's procurement guidelines. Contracts of less than $3 million (approximately Y 11 million) for smaller civil works and works which are scattered throughout congested parts of the city, aggregating to not more than $30 million (approximately Y111 million), and less than $270,000 (approximately Y 1 million) for equipment aggregating to not more than $5 million (approximately Y 19 million), would be procured through local competitive bidding (LCB). Bid documents for civil works under ICB would adopt procedures which would ensure fair competition for both local and foreign bidders. Procedures now used for civil works contracts under ICB in Bank Group-financed projects in China ensure such fair competition by providing for a schedule of prices for local wage rates and local unit material costs to be specified by the procurement agency and used by both local and foreign bidders, and allow for actual payments to be adjusted or indexed with changes in these prices. The Bank has reviewed the LCB procedures to be followed and considers them to be satisfactory. For bid evaluation purposes under ICB, a 15% margin of preference or an amount equal to customs duties, whichever is lower, would be applied for locally produced equipment and materials. For civil works contracts under ICB, domestic contractors would be given a margin of preference of 7-1/2%. Prior review of procurement documents by the Bank will be required for all civil works contracts estimated to cost more than $6 million (approximately Y 22 million), and for all contracts for goods estimated to cost more than $2 million (approximately Y 7 million). The proposed project contracts are shown in Annex 8. Assistance for procurement would be provided by the Shanghai Corporation for Foreign and Technological Cooperation which comes under the Shanghai Foreign Economic Relations and Trade Commission, the Municipality counterpart of the Central Ministry of Foreign Economic Relations and Trade. Procurement arrangements are shown in Table 4.3.

Table 4.3: PROCUREMENT ARRANGEMENTS
($ million)

Project Element	Procurement Method			Total Cost
	ICB	LCB	Other	
Civil Works	128.8 (39.0)	18.3 (5.5)		147.1 (44.5)
Materials & Equipment	106.8 (94.0)	3.3 (1.7)		110.1 (95.7)
Technical Assistance			25.9 (4.8)	25.9 (4.8)
Land and Resettlement			72.8	72.8
Total	235.6 (133.0)	21.6 (7.2)	98.7 (4.8)	355.9 (145.0)

Note: Figures in parentheses are the respective amounts (including contingencies) to be financed by the Bank/IDA.

Disbursement

4.15 The proposed Bank loan of $45 million and IDA credit of SDR 78.9 million (equivalent to $100 million) would be disbursed over a period of six years as follows:

1. Civil Works	$44.5 million	40% of total expenditures
2. Materials and Equipment	$95.7 million	100% of foreign expenditures and 100% of local expenditures (ex-factory) and 75% of local expenditures for other items procured locally
3. Technical assistance	$ 4.8 million	100% of total expenditures

4.16 A Special Account with an authorized allocation of US dollar equivalent of SDR 7.5 million, based on four months average disbursement, would be established to facilitate disbursements for the above expenditures. Replenishment would be made on a quarterly basis or whenever the Special Account is drawn to 50% of its initial deposit value. Disbursements for overseas training, contracts of civil works, goods and services valued at less than $200,000 would be made on the basis of statement of expenditures (SOE) to be certified by the SSPCC. Documents supporting the SOEs would be retained by the SSPCC and made available for inspection by Bank/IDA supervision missions. All other disbursements will be made against fully documented expenditures. The disbursement schedule (Annex 10) is based on

and agrees with the standard disbursement schedule for China. Project completion is estimated to be December 31, 1992, and the loan/credit closing date would be June 30, 1993.

Land Acquisition and Resettlement

4.17 A comprehensive survey was carried out by SM on land required for the project. The survey identified the land to be acquired for pump stations and treatment plant, the land required for street widening to accommodate the large sewers, and the land to be rented during construction. The survey also identified the houses that have to be demolished and the people to be resettled. Demolition of existing housing has been kept to a minimum through a prudent choice of sewer routes. SM has land acquisition regulations (No. 119 of October 20, 1980) which outline the procedures and compensations required. Current policy requires the project to construct not less than three square meters of housing space for every square meter demolished. In addition relocated persons are paid moving expenses. These compensations are included in the project cost estimates. Housing for displaced persons would be purchased from housing enterprises or constructed under the project. The latter is necessary because of present housing shortages. It is estimated that a period of about 15 months would be required to provide housing for resettlement. SM anticipates no difficulty in carrying out the resettlement program, as SSPCC has a team responsible for land acquisition and resettlement, and preparation work in this area is now well advanced. The various steps to be undertaken for resettlement are outlined in Annex 13. Housing of about 60,000 square meters for about 5,000 persons to be resettled in the first year of project implementation would be purchased, and the required number of housing units has been assured by SM. The resettlement schedule prepared by SM (Annex 9) is satisfactory to the Bank. During negotiations assurances were obtained from SM that it would carry out resettlement of persons affected by the project in a manner and according to a schedule which is satisfactory to the Bank/IDA. An understanding on the various steps to be taken for resettlement was reached during negotiations.

Monitoring Criteria

4.18 The proposed project implementation schedule is shown in Annex 9. Financial monitoring indicators are in Table 5 of Annex 15. Reports on project implementation progress and on SSC's operations would be prepared by the SSPCC and sent to the Bank/IDA quarterly commencing September 1, 1987. A project completion report reviewing the planned objectives and the achievements of the project, including costs and benefits derived and performance and contribution of all parties associated with the project execution and system operation, would be prepared by SM and submitted to the Bank/IDA within six months following the closing date of the Loan/Credit.

Environmental Pollution Control

4.19 Shanghai is taking various physical measures to reduce water pollution in the city. The EPB is also formulating new pollution control regulations with more stringent industrial effluent standards to be enacted during 1987. These regulations would specify the standards for industrial effluents discharged into natural water bodies (e.g. Huangpu River and

Changjiang). Pollution charges on effluents exceeding the prescribed standards are already being collected by EPB. Sewer regulations also to be enacted in 1987 would prescribe pretreatment requirements for industrial effluents for discharge into separate sewers and the combined sewers in the service areas included in the project. These regulations would include mandatory threshold levels for toxic and non-biodegradable pollutants, and a framework for effluent strength charges for biodegradable matter. The drafts of both regulations were reviewed during appraisal. Industrial sewerage charges based on volume as well as effluent strength would be studied in the proposed tariff study (para. 6.04). To help industries install appropriate pretreatment facilities, SM would arrange financing of construction costs through local banks, provide funds collected from pollution charges and explore bilateral sources for imported equipment. SM is already implementing tax exemption measures which deduct from taxable income the capital and interest for expenditures incurred by industries to construct pretreatment facilities. During negotiations assurances were obtained from SM that the new pollution control regulations and the sewer regulations would both be enacted not later than December 31, 1988. An understanding was obtained that SM would arrange suitable sources of financing for industries to construct pretreatment facilities, and continue with tax exemption measures and such measures which are acceptable to the Bank/IDA.

4.20 It is envisaged that monitoring of the quality of industrial effluents within SSC's system would initially be carried out with the assistance of EPB staff who are familiar with the work. New equipment for environmental quality monitoring, estimated to cost about $750,000, is included in the project. EPB would continue to be responsible for monitoring of environmental quality in water bodies within the municipality and of industrial effluents outside of SSC's system.

4.21 Because of the presence of other point and non-point pollution discharges into the Huangpu River both upstream and downstream of the city, the project alone will not completely solve the environmental problems of the river. SM will therefore set up an organization with responsibilities to allocate water resources and to control waste discharges in the Huangpu River in order to preserve the quality of the water. A river basin management study of the Huangpu River is included in the project to set up the institutional framework for this organization and to develop a model to allocate and manage the Huangpu River's water resources, optimize water use and ensure the environmental integrity of the river. The proposed terms of reference of the study are in Annex 18. Assurances were obtained from SM during negotiations that the proposed study would be completed not later than December 31, 1988, under terms of reference and with the assistance of consultants satisfactory to the Bank/IDA, and the results of the study would be reviewed with the Bank/IDA.

V. THE BENEFICIARY

The Shanghai Sewerage Company

5.01 The Shanghai Sewerage Company (SSC), the project beneficiary, will be established as a self-accounting and self-funding enterprise responsible for sewerage in the SMR. SSC will maintain and operate existing as well as new facilities to be constructed under the proposed project.

Existing Institutional Arrangements

5.02 Urban matters in Shanghai Municipality (SM) are overseen by the Planning Commission (PC), the Economic Commission (EC) and the Capital Commission (CC), each of which supervises several bureaus. The bureaus carry out planning, design, capital construction and operation of all major projects. The PC, the EC and the Bureau of Finance (BOF) approve all physical and financial plans and budgets for submission to the People's Standing Committee of SM and to the State Council in Beijing. Sewerage works are the responsibility of the Bureau of Urban Planning (BUP) under the Urban Planning Commission for planning; and the Bureau of Municipal Engineering Administration (BMEA) for design, construction, operation and maintenance. BMEA is also responsible for urban road works. Given BMEA's increasing workload, design and construction work is now also being contracted out to other bureaus or enterprises. The Environmental Protection Bureau of Shanghai (EPB), while organizationally under the Urban Planning Commission, receives guidance directly from the EPA. EPB is responsible for monitoring environmental quality and pollutant discharges, and compliance with environmental standards within SM. It has the power to impose charges and fines on polluters. The Bureau of Sanitation Administration (BSA) handles night soil collection and its disposal. The SMWC (para. 2.05) provides piped water supply in the SMR.

5.03 BMEA has the main responsibility for sewerage services in Shanghai. It is headed by a Director General, and has inhouse staff facilities to design and construct municipal works as well as conduct research and training in this area. Operation and maintenance of the system is shared by two divisions: (a) the Municipal Drainage Administration Division (MDAD) responsible for sewage pumping stations and sewage treatment plants; and (b) the Municipal Engineering Administration Division (MEAD) responsible for sanitary and combined sewers. MEAD is also responsible for maintenance of urban roads and bridges. Physical planning, design and construction of sewerage works are carried out by a municipal engineering design office, a municipal engineering development company and two construction companies, all under BMEA. No user charges are presently levied and sewerage operations are totally dependent on municipal funds.

Organizational Improvements

5.04 The current division of responsibilities is not considered adequate for effective management of the vastly expanded system now proposed. The absence of a cost recovery system in the past has also been placing a heavy burden on the municipal finances, resulting in slow and tardy expansion of the services and consequent deterioration of the environment. SM has now recognized the need for consolidating the sewerage

services under one entity and making that entity financially viable by introducing in stages sewerage charges on industrial, commercial and domestic users. Several forms of organization for such an entity were considered, including a joint organization for water supply and sewerage. The latter arrangement, which would have been feasible in smaller cities, was not favored because it would have entailed major organizational changes and would have made the enterprise too unwieldy. SM decided, with the Bank's agreement, that the SSC would be established under BMEA to take over responsibility for all sewerage services including planning, operation, maintenance, staffing, accounting, financial management and training, etc., with a mandate to charge for its services in order to make it self-supporting.

5.05 SSC's charter, which was reviewed and agreed by the Bank/IDA, has been approved by SM and signed. An application to Shanghai Administration for Industry and Commerce for registration of SSC as a public enterprise in Shanghai has already been made, and the procedures for this are expected to be completed by July 1987. Registration of SSC is a condition of loan/credit effectiveness. In practice this is a formality since the staff now operating the sewerage system are de facto employees of the future SSC.

5.06 MDAD and its staff would form the base organization for SSC. SSC would also take over MEAD staff responsible for sewer maintenance work. As of May 1986, MDAD had 2,365 employees comprising 135 engineers, 133 technicians, 207 administrative personnel, 113 skilled workers, 1,495 semi-skilled workers and 202 unskilled laborers. MEAD employs about 7,000 people, including about 220 engineers. MEAD staff is assigned to general maintenance work on sewers, drains, roads and bridges. Those working exclusively on sewerage duties are not clearly identified, but it is estimated that SSC would take over about 2,000 of MEAD's employees. Both MDAD and MEAD are weak in the accounting and financial fields. SSC would recruit experienced staff to strengthen the handling of its accounting and financial activities. The development of SSC into a strong organization capable of coping with the challenging tasks of managing the expanded system and achieving the required financial goals would, however, need substantial work in the following areas: (a) improving the organization structure; (b) determining staffing needs and recruiting staff; (c) defining job responsibilities for various levels of staff; (d) developing appropriate management, financial and accounting systems; (e) establishing appropriate tariffs; and (f) training staff. Tentative organizational proposals (Annex 12) made by the SM project preparation team and ADAB-funded consultants recommend that SSC be governed by a Board with a General Manager as the chief executive officer, and seven divisional managers for operation and maintenance; materials management; planning and design; technical and scientific services; human services and training; finance and accounting and administration and legal services. An internal auditor reporting directly to the General Manager was also proposed. The total staff strength is estimated at 3,350. Since these proposals need to be reviewed and refined, a management and organization study is proposed to be carried out by a Chinese team assisted by consultants. The study will review SSC's

organizational structure, functions and staffing needs, and develop management information systems for planning, financial management and control. Draft terms of reference of the study are in Annex 19. During negotiations assurances were obtained that SM would complete not later than December 31, 1988 a management and organization study for SSC under terms of reference and with the assistance of consultants acceptable to the Bank Group, and would give the Bank Group the opportunity to comment on the recommendations of the study before their implementation.

Billing and Collection

5.07 Billing for sewerage services started in 1987 after the introduction of tariffs for industrial and commercial consumers in December 1986 (para. 6.04). BMEA had initially proposed that the billing and collection work would be entrusted to SMWC with appropriate fees. SMWC has an excellent record for billing and collection -- with recoveries from non-domestic consumers made through bank account transfers, the level of receivables is insignificant and there are no bad debts. Billing and collection of sewerage charges by SMWC would avoid unnecessary duplication of work. However SMWC does not wish to take on the additional work, given the constraint that its billing is done manually. SM therefore decided that SSC should handle its own billing and collection, with consumer water supply meter readings provided by SMWC. Collections for industrial consumers would be made through bank account transfers. The joint billing for water supply and sewerage services, including the setting up of a central billing agency, would be reviewed under a proposed tariff study (para. 6.04).

Accounting

5.08 The accounts of MDAD and MEAD are maintained on a cash basis and reflect expenditures incurred against budget allocations made by SM. Little distinction is made between capital expenditures (replacements of plant) and operating costs, and for most items they are merged with expenditures on other activities of BMEA.

5.09 SSC will be a self-accounting entity under the leadership of BMEA. National accounting regulations applicable to public enterprises, as prescribed by the Ministry of Finance (MOF), will be adopted by SSC supplemented by management information systems and reporting procedures recommended by the consultants (para. 5.06). SSC's accounts will be maintained on an accrual basis using a double entry system. The public enterprise accounting system requires the preparation of an income statement, balance sheet, cash flow and other supplementary statements on a monthly and annual basis. This system is acceptable to the Bank Group.

5.10 Project accounts will be maintained by the SSPCC (para. 4.12) in accordance with the Government State Construction Unit Accounting System This system sets out detailed accounting definitions for capital works, cash control, receivables, payables, and specific rules for capitalizing and expensing of various items. It also identifies a number of basic monthly and annual reporting formats including funds flow statements and balance sheets. The construction accounting system is comprehensive, and is adequate for the proposed project.

Audits

5.11 The Foreign Investment Audit Bureau of the State Audit Administration (SAA) will be responsible for auditing the accounts of SSC and of project expenditures. Actual audits will be conducted by the Shanghai Municipality Audit Bureau (SMAB), a subordinate organization of SAA. These arrangements are satisfactory to the Bank Group. At negotiations, assurances were obtained from SM that it would cause SSC to furnish SSC's annual financial statements, certified by SMAB or an independent auditor acceptable to the Bank Group, to the Bank/IDA within six months of the end of each financial year. Assurances were also obtained that the accounts of the SSPCC, and the Special Account, duly audited by SMAB or by an independent auditor, would similarly be submitted to the Bank/IDA within six months of the end of each financial year.

5.12 Officers of SSC and of SSPCC would conduct internal audits of their respective organizations. The SSPCC's internal auditor would report to the SSPCC's Manager and SSC's to the General Manager.

Staff Training and Development

5.13 Training of staff employed in the operation and maintenance of sewerage services is currently conducted in a fragmented and uncoordinated way by BMEA's training institute and the Municipal Engineering Research Institute. EPB and BUP also provide some training.

5.14 The project includes a comprehensive training program for SSPCC and SSC formulated by BMEA with the assistance of the ADAB-financed consultants. For SSPCC this program envisages training of managers, engineers, computer operators and programmers and accountants. Three management trainees and two engineers would receive training overseas for periods of one to three months. Training courses for eight management trainees, 60 computer operators/programmers and 60 financial staff will be arranged in China. In addition, a foreign training expert will be engaged for a three-month period who, with the assistance of Chinese engineers trained overseas, will conduct intensive training courses for engineers in Shanghai. The training program of SSC staff includes: (a) training of four Chinese trainers overseas for a total period of six months; (b) hiring of three foreign specialists - one each for technical, management and finance - to advise on training courses in Shanghai for a total period of 4-1/2 months; (c) management development program for ten senior managers and 15 managers at other levels for a total of 45 trainee-months; (d) attendance of 62 fresh recruits in 4-year professional and 3-year technical courses in Chinese educational institutions; (e) mechanical operator training courses for 200 employees for a total of 200 trainee-months; (f) intensive short courses for 136 technicians, administrative and accounting staff; and (g) procurement of training equipment.

5.15 The training programs for SSPCC and SSC are estimated to cost $0.2 million and $1.5 million respectively and are planned to be completed over four years. Training and laboratory equipment amounting to about $0.6 million would also be required. Details are shown in Annex 21. The management and organization study (para. 5.06) would review these proposals and, if necessary, prepare supplemental training proposals for SSC and SSPCC

staff. At negotiations assurances were obtained from SM that the training would be implemented by SSPCC and SSC after consultation and under a schedule agreed with the Bank/IDA, and completed not later than December 31, 1990.

Insurance

5.16 Like other Government bureaus, BMEA's sewerage facilities are self-insured. This has been justified because there have not been serious incidents involving loss or destruction of sewerage property. However, in view of the large investments now planned, SSC will take insurance with appropriate coverage on its assets to be underwritten by the People's Insurance Company.

Taxation

5.17 Under the current regulations, enterprises pay income tax at 55% of their taxable income. In addition an adjustment tax is levied. The latter tax varies for various enterprises with a maximum rate of about 35% of the taxable income. SM, with approval from the Central Government, has decided to exempt SSC from payment of these taxes. SSC would, however, be required to pay a sales tax at the rate of 3% of its operating revenues. To help SSC in its initial years of operation, the Central Government and SM have decided to give SSC a tax holiday on sales tax for 1987 (para. 6.05).

VI. FINANCES

Past and Present Financial Position

6.01 Drainage and sewerage services are presently provided and financed out of SM's budget. No user charges were levied before December 1986, accounting was kept on a cash basis, no financial statements were produced and the responsibility for sewerage services was divided between MDAD and MEAD. These factors make it difficult to compile accurate financial information for services to be taken over by SSC. For these reasons, the financial information shown in Table 6.1 should be taken as approximate. Financial data show that operating expenses increased 36% during the last two years (1984-86). A major factor in the increase was the end-1984 increase in salaries, partly paid in 1985. Although the sewerage network requires considerable improvements, capital expenditures during the last two years averaged only about 0.3% of fixed assets. However, repair and maintenance expenses (excluding labor) are high, reaching almost 2% of fixed assets. This is due to the age of the fixed assets and the inclusion of replacements of some assets in these expenses.

Table 6.1: PAST EXPENDITURES FOR SEWERAGE SERVICES
(Million Yuan)

	1983	1984	1985	1986
	---------	Actual	--------	Estimated
Operating Expenses				
Salaries and Wages	3.61	4.08	7.01	6.77
Power	5.46	5.43	6.12	6.13
Repairs and Maintenance	8.07	8.74	11.67	11.00
Materials	1.41	1.17	2.49	2.50
Administration	0.40	0.47	0.59	0.57
Total Operating Expend.	18.95	19.89	27.88	26.97
Capital Expenditures	6.50	2.35	2.30	2.00

Balance Sheet and Fixed Assets

6.02 SSPCC has prepared an estimated Balance Sheet for sewerage services (Annex 14). For this purpose MDAD estimated the replacement value of fixed assets as of end-1983, based on the records maintained by it and MEAD. SSPCC also computed the cumulative depreciation of the fixed assets. The identified sewerage network of 1,050 km (0.15 m per person) seems to be underestimated. However, any unreported pipelines have probably exceeded their useful lives and being fully depreciated would not affect the financial projections. By end-1985 fixed assets were 96% of the total assets of Y 652 million ($176 million). The accumulated depreciation, Y 394 million, is equivalent to 60% of the value of the fixed assets. The average depreciation rate is 2.5%. Fixed assets would increase 3.3 times and net fixed assets would be 6.5 times larger upon project completion. For the appraisal projections, the estimated replacement value of fixed assets is satisfactory. However, SSC would require detailed records of the fixed assets taken over from MDAD and MEAD, their location, value, useful lives and depreciation. Assurances were obtained from SM during negotiations that not later than December 31, 1988, SSC would complete and incorporate in its books an inventory and valuation of its fixed assets.

Financial Objectives

6.03 Sewerage services are part of the general expenditures of the city. During project preparation SM decided to establish the SSC, which would be a self-supporting, autonomous company. Sewerage tariffs were introduced in December 1986 for industrial and commercial consumers, and would be introduced in 1989 for domestic consumers (para. 6.04). These tariffs are now collected by BMEA, but would be collected by SSC once it is established (para. 5.05). Given the lack of any previous debt service, these tariffs would eliminate the need for operating subsidies and allow SSC to cover its operating expenses, pay interest during construction, finance normal capital investments and accumulate a cash surplus during the project implementation period (1987-1992). In 1993, when the project comes into operation, an increase in the average tariff would be required (para. 6.04). To maintain a satisfactory financial position, assurances were obtained

during negotiations that not later than 1993 SSC's revenues should be at least sufficient to cover its operating and maintenance expenses (including staff bonuses and welfare expenses) and the larger of either depreciation or total debt service (total interest and principal expenses). To protect SSC's capacity to pay debt service, assurances were obtained during negotiations that no additional debt would be undertaken by SSC without Bank Group agreement, unless a reasonable forecast shows that SSC would have a debt service coverage of at least 1.3.

Sewerage Tariffs

6.04 Although almost half of the City population still use the bucket system, grey water from most houses is discharged into the sewerage system (para. 2.06). To support and finance SSC, SM has approved the introduction of sewerage charges for both grey water and raw sewage. A sewerage charge of Y 0.12 ($0.03) per m3 has been implemented on December 1, 1986 for industrial and commercial consumers who contribute almost 80% of the City's wastewater flow. The charges would be based on 90% of the water sold by SMWC. SMWC is already collecting a water charge of Y0.12 per m3. A sewerage tariff study would be conducted under the project by SSC with the support of consultants to determine sewerage charges for SSC to achieve its financial objectives (para. 6.03) with due consideration given to consumer affordability, in particular with regard to domestic sewerage charges of Y0.03/m3 expected to be implemented in 1989, and tariff increases required after the proposed project comes into operation in 1993 (financial projections show that an increase in the average tariff from Y0.098/m3 to Y0.132/m3 would be required). The study would look into alternative methods of charging (surcharges on water tariffs, taxes, land use fees, etc.), and charges to provide incentives to reduce pollution (effluent strength and pollution load charges). Assurances were obtained during negotiations that (a) sewerage charges agreed with the Bank/IDA would continue to be implemented for commercial and industrial consumers; (b) a sewerage tariff study would be completed not later than December 31, 1988, under terms of reference and with the assistance of consultants satisfactory to the Bank/IDA; and (c) the recommendations of the study would be discussed with the Bank/IDA and implemented not later than June 30, 1989.

Future Financial Performance

6.05 BMEA will build the project works and, upon completion, will transfer them to SSC. For continuity, the financial projections (Annex 15) include project financing and investment. After project completion SSC would also assume the debt service in local currency on the equivalent amount of Bank loan and IDA credit. SSC repayment conditions to SM are 20 years, including five years grace, at 4.5% p.a. interest, which is in line with interest rates for similar projects in China. SSC will pay the interest during construction on the equivalent in local currency of the Bank/IDA disbursements. SSC will be exempted from income and adjustment taxes, and would receive a tax holiday for one year on its sales tax (para. 5.17) to enable it to cover debt service and expand sewerage services. These tax exemptions were confirmed during negotiations.

6.06 The critical variables for SSC's financial viability are water consumption, increase in operating efficiency, and capital and operating

expenditures of the project. The water sold by SMWC, the basis for sewerage charges, is expected to increase, on the average, by some 3% to 4% p.a. from population and industrialization growth, higher incomes, better housing, and increased use of flush toilets. However, the introduction of sewerage charges in 1987 for industrial and commercial consumers is expected to lower water consumption by about 20% between 1987 and 1988. Domestic sewerage charges (estimated at Y 0.03 per m3) in 1989 and further increases in 1993 will increase SSC's financial viability. In addition SSC's operating efficiency and cost control efforts are expected to increase with staff training under the project. The ongoing program for renewal and expansion of housing in Shanghai would increase the number of sewer connections to the system. This, together with limitations on staff increase, would reduce the number of staff per thousand sewer connections from 10.0 in 1986 to 7.7 in 1993. The possibility to install sewer connections which take both grey and soil water as a result of the project will increase the population with flush toilets from 51% to 65% in the same period. Operating expenses would, however, be increased by 43% between 1991 and 1993 with commissioning of the project.

6.07 SSC's financial projections are presented in Annex 15 and summarized in Table 6.2. Assumptions for these projections are in Annex 14. Under the proposed financial covenant (para. 6.03), SSC's financial performance would be satisfactory. SSC's revenues would increase from Y 85 million to Y 138 million between 1987 and 1993. This would involve a tariff increase of about 35% in 1993, which just about maintains in real terms the initial tariffs of about Y 0.12 per m3 for commercial and industrial consumers and about Y 0.03 per m3 for domestic consumers. These sewerage charges are easily affordable (para. 7.10). SSC's financing plan (Annex 15, Table 4) shows that the project represents 92% of total investments, and that cash would accumulate during this period. It includes: (a) onlending of the Bank/IDA proceeds, 36.5%; (b) SM's equity contributions 56.5%; (c) other loans (Stage 2 Project), 2.1%; and (d) internal cash contributions, 4.9%.

Table 6.2: KEY FINANCIAL INDICATORS

	1987	1989	1991	1993	1994
Domestic Sewage billed (Mln m3)	204.4	208.2	226.8	247.0	259.1
Comm. & Ind. Sewage billed (Mln m3)	704.2	666.1	722.3	770.5	800.6
Total Sewage billed (Mln m3)	908.7	874.3	949.1	1017.5	1059.7
Domestic Tariff (Y/m3)	0.000	0.030	0.030	0.040	0.043
Comm. & Ind. Tariff (Y/m3)	0.120	0.120	0.120	0.161	0.173
Average Tariff (Y/m3)	0.093	0.099	0.098	0.132	0.141
Operating Revenues (Mln Y)	84.51	88.59	96.43	137.70	154.23
Operating Expenses (Mln Y)	30.48	39.45	45.19	63.79	71.34
Net Income (Mln Y)	37.65	35.30	39.67	-0.47	8.30
Operating Ratio	55.4%	63.2%	64.1%	86.1%	81.8%
Rate of Return on Net Fixed Assets	15.9%	15.7%	19.2%	1.2%	1.8%
Debt Service Ratio				1.14	1.30
Total Debt to Equity	11.2%	22.7%	37.4%	57.6%	74.5%

6.08 The most critical year for SSC's financial performance is 1993, when the project comes into operation and debt payments begin. Even then, SSC's financial performance would be satisfactorily and comparable to other similar utilities. In 1993, SSC's operating ratio would be 86%, which is satisfactory but higher than the 64% averaged during 1987-92. After project completion the fixed asset base would be substantially increased, tripling the amount allowed for depreciation. This reduces SSC's rate of return on net fixed assets from an average of 10% during project construction to about 2%, which is low, but comparable to other sewerage utilities. By 1993, SSC's debt equity ratio would be 75%, and SSC would be able to finance internally about 15% of the cost of the second stage sewerage project. After SSC is established and is operating satisfactorily, plans should immediately be made to efficiently deploy the forecast surplus cash available. These plans could include the use of the funds to rehabilitate and expand the sewerage network and pump stations, or finance part of the project expenditures. As in other countries, SSC may also establish a revolving fund to finance and promote the installation of flush toilet facilities and sewer connections.

Shanghai Municipal Finances

6.09 SM has considerable revenues, amounting to Y 17,500 million in 1986. However, only 23.2% (Y 4,060 million) is retained by the Municipality. The remaining funds are remitted to the Central Government. After covering its administration and recurrent expenditures (Y 2,500 million), SM has been budgeting about Y 1,300 million ($350 million) per year for capital investments. Future investments would be higher due to the planned construction of the subway, bridges, urban transport and housing. The project investments will be financed by the IBRD loan and IDA credit, and SM's contributions. The latter are forecast at Y 1,062 million, and

peak in 1989 at Y 289 million, representing 22% of SM's budgeted investments in that year.

VII. ECONOMIC, SOCIAL AND ENVIRONMENTAL CONSIDERATIONS

Project Justification

7.01 Waterways in Shanghai are already extremely polluted (para. 2.11), and pollution loads are expected to increase further with projected growth in industrial output and personal incomes. It is estimated that, if adequate pollution abatement measures are not carried out urgently, by 1990 dissolved oxygen (a measure of river water quality) will be reduced to zero over a length of 28 km of the Huangpu River at Shanghai during low river flows occurring about 10% of the time (Annex 2). Pollution will be especially severe in Suzhou Creek, a major tributary of the Huangpu River, where dissolved oxygen levels are already reduced to zero along its entire length through the City area (20 km) for a large part of the year. Such conditions would pose serious hardship on Shanghai's residents, and the proposed project is required to alleviate these conditions. The project, the first of two stages, has been determined to be the least-cost approach for improving the water quality of the Huangpu River and its tributaries to achieve in part the specific water quality goals mentioned in para. 2.10. It will address in particular the very serious water pollution problems in Suzhou Creek. Because of the difficulty in quantifying benefits in sewerage projects, the premise that the project is the least-cost approach will be used to provide the principal basis for the justification of the project.

Least-Cost Considerations

7.02 A two-step process was used to arrive at the least-cost solution for the project. The first step involves obtaining the least-cost method of wastewater disposal among potential alternatives using different processes to achieve water quality objectives. The alternatives considered included:

(a) an intercepting sewer with the outfall in the Changjiang estuary;

(b) large treatment facilities with effluents discharging into the Huangpu River;

(c) full on-site treatment of industrial and domestic wastewater;

(d) full on-site treatment of industrial wastewater and minimum treatment of domestic wastewater using septic tanks for households currently on the night-soil system; and

(e) a non-construction alternative involving reduction of industrial wastewater by relocating a sufficiently large number of polluting industries outside of Shanghai.

It was concluded that Alternative (a), for the construction of an intercepting sewer, was by far the lowest-cost alternative (about half as

costly as the next best alternative), and it was adopted for the project (Annex 16).

7.03 The second step involves the optimum selection of design configuration for the chosen intercepting sewer solution. Major design considerations included the choice of outfall location, sewer routing (including considerations of space availability and traffic interruption), and appropriate construction methods. During the course of the work, the site for the best location for the sewer outfall (from cost and hydraulic dispersion points of view) was ruled out on the grounds that its outfall would interfere with shipping and related facilities. A second acceptable site was therefore adopted. Capital costs were minimized by using less-costly construction methods whenever possible (e.g. culverts in lieu of tunnels). Land acquisition and demolition of existing structures were kept to a minimum by prudent choice of sewer routings.

Project Benefits

7.04 The primary benefits of the project come from its contribution to improving environmental quality in Shanghai's waterways, in particular Suzhou Creek, through the removal of industrial and domestic wastewater which is currently discharged, largely untreated, directly into the waterways, and the potential additional economic values such improvement creates.

7.05 The project will also have substantial longer-term benefits by establishing an efficient institutional framework for managing liquid wastes in Shanghai. It will establish a financially self-supporting sewerage company, SSC (para. 5.01), provide staff training (para. 5.13), and strengthen SM's capability to monitor and control environmental pollution with the promulgation of tighter regulations for water pollution control and sewerage operations (para. 4.19). Appropriate sewerage tariffs for SSC to meet its financial objectives and to provide incentives for pollution abatement would also be determined and implemented under the project (para. 6.04). An organization responsible for management of the Huangpu River water resources, to include allocation and setting effluent discharge standards, would also be set up (para. 4.21). In addition the project would provide an effective model for liquid waste management which can be emulated in other Chinese cities.

7.06 An attempt has been made to estimate an economic rate of return to the proposed investment, but there are major difficulties in arriving at satisfactory proxies for benefits, and some benefits (e.g. to health) are only very partially captured in the quantification. Moreover, the full realization of certain benefits depends upon a series of governmental choices that would have to be made in the context of administered prices and the absence of market signals regarding changing input and output prices.

7.07 Improvement in water quality in the presently highly polluted Suzhou Creek has the potential to result in substantial, but difficult to quantify, increases in property values in the vicinity of the Creek. The magnitude of these increases, a measure of project benefit, is a function of both the size of the affected area and the degree to which the environmental improvement causes higher production (or utility) from more economic land

use. Order-of-magnitude estimates of these potential benefits, based upon current survey data of net profitability from property (annual income less annual costs) in various Shanghai districts, show a present value of about Y1,200 million, using conservative assumptions on the size of the improved areas and after taking into account development costs to achieve improved land use. As indicated above, the realization of these benefits will depend largely on whether or not SM chooses to facilitate redevelopment in the environmentally-improved area. Additional benefits, conservatively estimated to be about Y 200-300 million in present value, can also accrue from increased vegetable production on land currently affected by polluted water, reduction of treatment costs for use of water drawn directly from water courses, and water supply savings from use of more water drawn directly from Suzhou Creek and the Huangpu River due to the improved quality. Annex 16 gives additional information about the above estimates.

7.08 The sum total of all the various proxy benefits described above is about Y1,400 million at a discount rate of 10%, compared with an estimated present value of the project capital and operating costs of about Y 1,100 million. The economic rate of return (ERR) estimated using the above cost and benefit streams is on the order of 13%.

Average Incremental Cost and Affordability

7.09 The average incremental cost of the project is estimated to be Y 0.39/m3 at a discount rate of 10%. This value becomes Y 0.46/m3 after shadow pricing of inputs (Annex 16). The currently proposed sewerage tariff of Y 0.12/m3 (para. 6.04) on industrial and commercial users is below the average incremental cost of the project. However, as the project has substantial external benefits from environmental improvement (para 7.05), direct users of the system, who are not the only beneficiaries, need not be required to cover total project costs. The proposed tariff study (para. 6.04) will address, among other things, the issue of how the project's average incremental costs would be reflected in the sewerage charges.

7.10 Incomes in Shanghai have risen substantially in real terms in recent years. On average, per capita real income rose by 12.3% between 1984 and 1985. Survey data on household incomes in 1983 and 1984 are available, and these were extrapolated to obtain 1986 data. At sewerage charges equal to the average incremental cost, it is found that household expenditures for sewerage would represent only about 1.0% of household income at the 25th percentile of income distribution. At the charge of Y 0.03/m3, suggested to be levied in 1989, expected expenditure would be less than one-tenth of one percent of the income at the 25th percentile (Annex 16). Thus the project is clearly affordable to low-income households.

7.11 It is difficult to establish a precise estimate of the share of the project which serves households in poverty in the Shanghai context. The income distribution as reported in household surveys is very flat with little income differential between deciles. Moreover, neighborhoods tend not to be differentiated according to income. One possibly relevant indicator of service to the poor is that the project area contains about 1.5 million of the City's 2.7 million people who are on the nightsoil system, lacking indoor plumbing. Because domestic wastes may be fully discharged into the sewer once the project is implemented, the project will encourage

households lacking indoor plumbing to improve their dwellings and improve sanitary conditions.

Environmental Impact

7.12 The project will improve the environment in the City of Shanghai through the removal of wastewater discharges into its waterways. There will, however, be an adverse impact to city residents during construction in loss of time and inconvenience from traffic congestion and disruption due to the extent of the construction works to be carried out in overcrowded city areas, but careful construction management will minimize this impact. To examine if there could be any adverse environmental effect from the discharge of the intercepted wastewater into the Changjiang estuary, extensive model studies have been carried out by two research institutes in China. The results show quite conclusively that the quality of the river water, after receiving the discharged wastewater, would reach ambient conditions within about one km from the discharge point (para. 4 of Annex 2). Because the river channel is almost 10 km wide at this location, and the outfall point is about 1-1/2 km from the river bank, no adverse environmental effects on beach activities and fishlife are expected.

Project Risks

7.13 There is a remote possibility that environmental quality in the Changjiang estuary could be worse than is now predicted as a result of the project. This could result from unforeseen strong effluents entering the system or from an actual lower assimilative capacity in the Changjiang than is now expected. Monitors have, however, been built into the project to ensure that abnormal sewage effluents would be detected early and remedies found. Furthermore, model studies on the assimilative capacity of the estuary have shown a large margin of safety in the capacity of the Changjiang to assimilate the proposed wastewater discharges. Thus the likelihood of environmental problems occurring at the Changjiang is small. Should this happen, it would still be possible to supplement the minimal treatment currently planned by additional treatment prior to discharge to the Changjiang.

7.14 It is also possible that the water quality objectives (and hence the benefits associated with environmental improvement) in Suzhou Creek and the Huangpu will not be reached even though major sources of pollution in the City are intercepted. This can arise from increased point and non-point pollution upstream of the project area. This risk is reduced by the strong interest of SM to improve environmental quality, and the measures taken to manage the water resources of the Huangpu River (para. 4.21).

VIII. AGREEMENTS REACHED AND RECOMMENDATIONS

8.01 At negotiations assurances were obtained from SM on the following:

(a) a study to examine economic ways to rehabilitate the existing pipe system would be conducted on terms of reference and with assistance from consultants acceptable to the Bank/IDA, and that

the study would be completed not later than December 31, 1989, and the results reviewed with the Bank/IDA (para. 2.08);

(b) SM would send a copy of the draft Transfer and Operations Agreement to the Bank/IDA for review by December 31, 1990, and to have the agreement concluded with SSC not later than December 31, 1991 (para. 4.10);

(c) the staff, functions and responsibilities of the SSPCC would be maintained throughout project implementation in a manner satisfactory to the Bank/IDA (para. 4.12);

(d) consultants satisfactory to the Bank/IDA would be engaged on a continuous basis to advise on detailed design, preparation of contract documents, supervision of project construction and conducting of project-related studies (para. 4.13);

(e) resettlement of persons affected by the project would be carried out in a manner and according to a schedule satisfactory to the Bank/IDA (para. 4.17);

(f) new pollution control regulations and sewer regulations would be enacted not later than December 31, 1988 (para. 4.19);

(g) a river basin management study for the Huangpu River basin would be conducted under terms of reference and with the assistance of consultants satisfactory to the Bank/IDA, and completed not later than December 31, 1988, and the results reviewed with the Bank/IDA (para. 4.21);

(h) a management and organization study for SSC would be conducted on terms of reference and with the assistance of consultants acceptable to the Bank/IDA, and completed not later than December 31, 1988, and that comments of the Bank/IDA would be sought prior to implementation of the study's recommendations (para. 5.06);

(i) annual financial statements of the SSC, certified by SMAB or an independent auditor acceptable to the Bank Group, would be furnished to the Bank/IDA within six months of the end of each financial year, and the accounts of the SSPCC and the Special Account, duly audited by SMAB or by such independent auditor, would be submitted to the Bank/IDA within six months of the end of each financial year (para. 5.11);

(j) the proposed training program would be implemented by SSPCC and SSC after consultation and according to a schedule agreed with the Bank/IDA and completed not later than December 31, 1990 (para. 5.15);

(k) SSC would complete and incorporate in its books an inventory and valuation of its fixed assets not later than December 31, 1988 (para. 6.02);

(l) not later than January 1, 1993, SSC's revenues should be at least sufficient to cover its operating and maintenance expenses and the larger of either depreciation or total debt service, and that no additional debt would be undertaken by SSC without Bank/IDA agreement, unless a reasonable forecast shows that SSC would have a debt service coverage of at least 1.3 (para. 6.03);

(m) sewerage charges agreed with the Bank/IDA would continue to be implemented for commercial and industrial consumers, and that a sewerage tariff study, under terms of reference and with the assistance of consultants satisfactory to the Bank/IDA would be completed not later than December 31, 1988, and the recommendations of the study discussed with the Bank/IDA and implemented not later than June 30, 1989 (para. 6.04);

8.02 Understandings were reached and recorded in the minutes of negotiations on the following:

(a) The various steps to be taken for resettlement were agreed (para. 4.17);

(b) SM would arrange suitable sources of financing for industries to construct pretreatment facilities (para. 4.19);

(c) SSC would be exempted from income and adjustment taxes, and SSC would also receive a tax holiday on its sales tax in its initial year of operation (para. 6.05).

8.03 Conditions of loan and credit effectiveness are:

(a) Borrower's State Council approval of the Loan and Development Credit Agreements (para. 4.09).

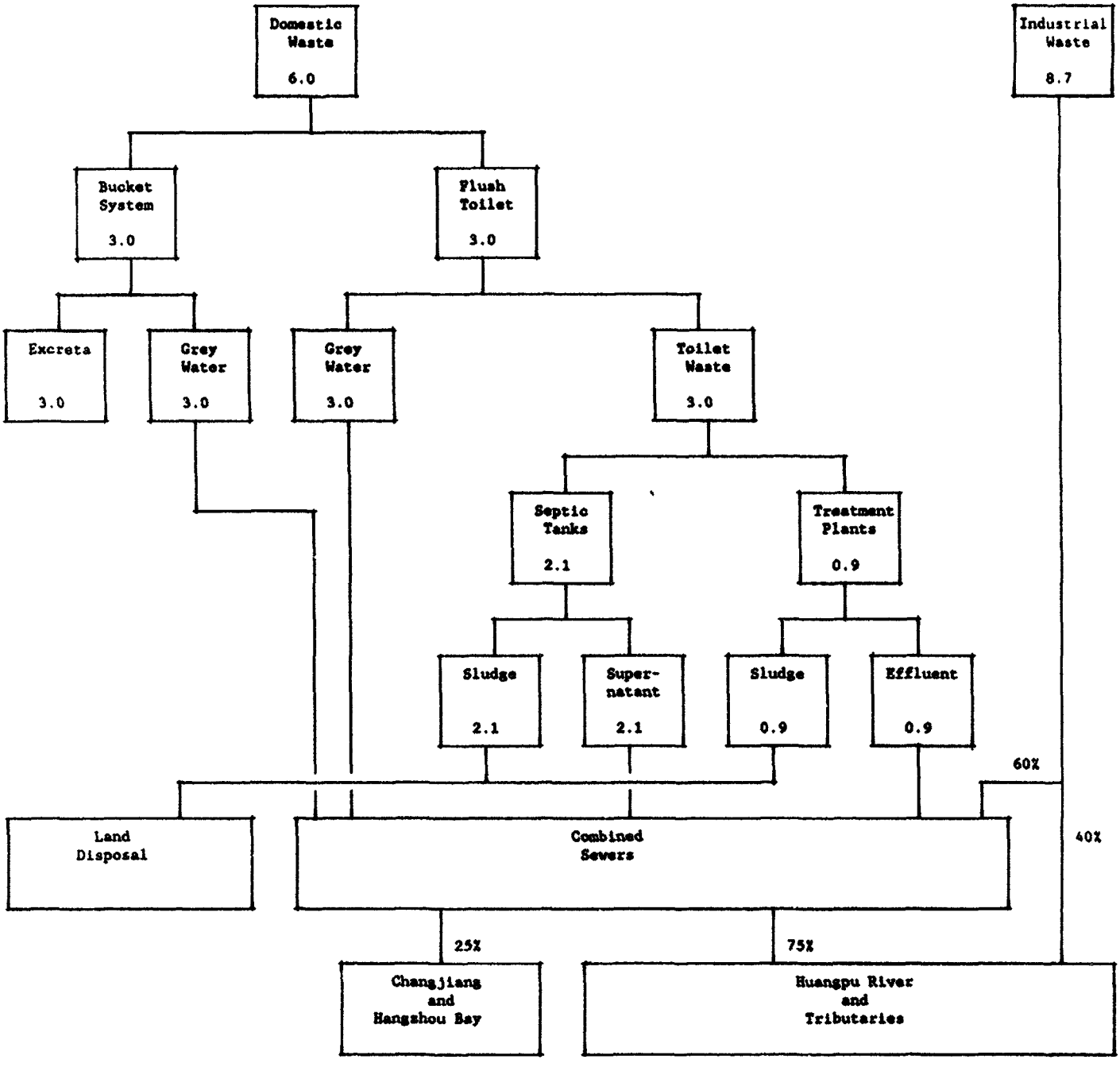
(b) registration of the Shanghai Sewerage Company, SSC (para. 5.05).

8.04 With the above assurances and understandings the project is suitable for a Bank loan of US$45 million at standard variable interest rate for a 20-year term including a 5-year grace period, and an IDA credit of SDR 78.9 million (US$100 million) on standard IDA terms. The Borrower would be the People's Republic of China.

CHINA

SHANGHAI SEWERAGE PROJECT

Flow Diagram of Existing Sewerage System



Note: Numbers in boxes refer to population or population equivalent in millions contributing to the waste.

CHINA

SHANGHAI SEWERAGE PROJECT

Wastewater Disposal Alternatives

1. Alternatives studied for collecting wastewater from houses and factories included: (a) using the existing combined sewer system with a new intercepting sewer, and (b) constructing a new separate sanitary sewer system. The cost of a new separate sanitary sewerage system, however, far outweighed the benefit from the slightly better environmental quality that could be achieved with the combined sewers. In addition, the crowded conditions of the city areas would pose serious construction problems. Continuing use of the combined sewers for wastewater collection was therefore adopted.

2. For final disposal of the collected wastewater the following alternatives were studied:

a. The use of a single sewage treatment plant located at the eastern edge of the City, with secondary treatment and effluent discharging into the Huangpu River.

b. The use of multiple (3) treatment plants located in the northern, southern and eastern edges of the City Proper with secondary treatment and effluents discharging into the Huangpu River or its tributaries.

c. The use of a smaller treatment plant for areas in the southern part of the City, and construction of an intercepting sewer to transport wastewater from the remaining City areas to the Changjiang estuary for disposal.

d. Transporting all wastewater from the City Proper via a large intercepting sewer to the Changjiang estuary for disposal. Four feasible outfall locations (Gaoqiao, Shi Dong Kou, Bai Long Gang and Zhuyuan) have been studied.

3. Alternative (d) was found to be the least-cost alternative. The most favorable location of the outfall for this alternative from a hydraulic dispersion point of view was for discharge of the wastewater into the South Channel of the South Branch of the Changjiang estuary at Gaoqiao. The river estuary is about 40 km wide at this point and is divided into three flow channels, the North Branch and the South Branch which is further subdivided into the North and South Channels. The South Channel itself is about 6 km in width, and is an important local as well as international shipping route. Further investigations revealed serious objections to the use of the Gaoqiao location by the Harbor Control Department of the Ministry of Transport, because of the necessity to locate the outfall diffusers in the main navigation channel to avoid polluting the shoreline (the navigation channel is only about 1 km from the shoreline). It was contended that delay or damage to busy shipping using the navigation channel could occur both during the construction period and when repair and maintenance work have to be carried out. The location at Zhuyuan, about 4 km downstream of Gaoqiao,

which was subsequently studied, ranked second for hydraulic dispersion, but would allow the navigation channel to be avoided by the outfall altogether. Although the construction cost in using the outfall at this location would be about $20 million more than at Gaoqiao, the potential cost of delay and damage to shipping by locating the outfall at Gaoqiao was estimated to be much higher. Locating the outfall at Zhuyuan was therefore selected.

4. An important aspect studied was the environmental impact of discharging partially treated wastewater into the Changjiang estuary (only preliminary treatment by screening was proposed). A higher degree of treatment would not have made the alternative as economically viable. Because of the earlier inclination towards the Gaoqiao location, physical model tests were conducted for this location at the Nanjing Hydraulic Academy and the Changjiang Scientific Hydraulic Research Institute to study the diffusion characteristics of the river and pollutant concentration profiles. Dye tests were also carried out to trace potential travel paths of pollutants in order to determine any adverse effects on downstream users of the river. The tests showed quite conclusively that with properly designed diffusers the mixing capability of the river at Gaoqiao was such that the quality of the water after receiving the wastewater discharge would almost reach the ambient river water quality level within 0.5 km of the discharge point in any direction. Model tests were not reconducted at the Zhuyuan location, but because of the similarity in river characteristics between this location and Gaoqiao, quite reliable conclusions could be inferred using data from the Gaoqiao tests. These conclusions indicated that because of the shallower river bed, the mixed fluids (wastewater and river water) would take longer (0.75 km instead of 0.5 km) to reach ambient quality. This condition is considered to be acceptable since any undesirable zone would be limited to an area of about 1.5 sq km in the middle of the river and any impact on fishlife or shore activities would be minimal.

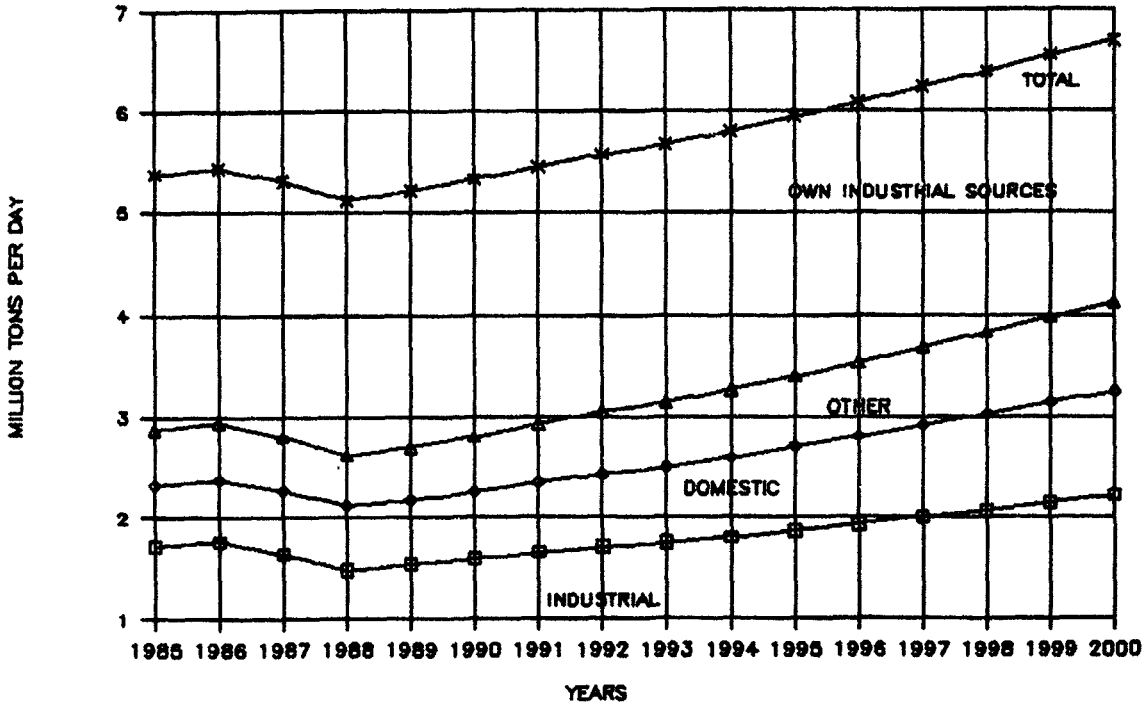
5. A computer model (the AUTOSS steady-state model adapted for use with an IBM PC-XT computer) was used to predict water quality conditions in the Huangpu River with no action taken and under the reduced pollution loads with the implementation of the alternatives considered. The pollution load discharged into the Huangpu River at present from the City alone is around 450 t/day in terms of biochemical oxygen demand (BOD), and is expected to grow to 770 t/day in 1990. In addition, pollution loads (point and non-point) are also being discharged into the river upstream and downstream of the City. The model study showed that the assimilative (self-purification) capacity of the river is about 100 t/day. It also showed that if nothing is done to relieve pollution, the present situation would rapidly deteriorate, and by 1990 dissolved oxygen (DO), a measure of river water quality, would be reduced to zero over a length of 28 km for an average of 10% of the time at low river flows, compared to a DO level of 0.44 mg/l over a length of 4 km. The study also showed that, with secondary treatment of all wastewater from the City, the DO level would be raised to a minimum level of 3.0 mg/l during low flow (EPB's target is 4.0 mg/l), with additional pollution control measures upstream of the City. This is because the treatment plant effluent that is discharged into the Huangpu River would still contain about 20% of the source pollution. With the removal of the City wastewater by an intercepting sewer to Changjiang for disposal, the minimum DO level can be raised to 4.5 mg/l during low flow.

SHANGHAI METROPOLITAN REGION (SMR) - WATER DEMAND AND SEWERAGE PROJECTIONS

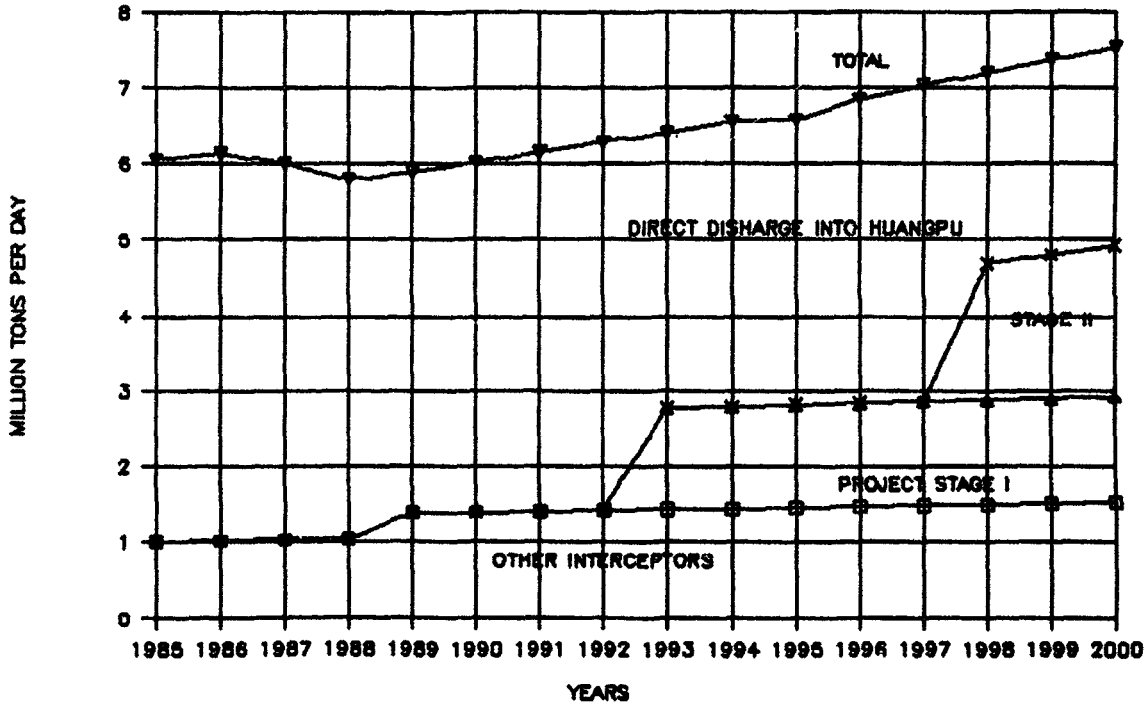
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Population Shanghai Metrop. Region-00	7000	7091	7183	7277	7371	7467	7564	7662	7762	7863	7965	8069	8174	8280	8387	8496
% Population Growth		1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%
A) WATER SUPPLY DEMAND:																
WATER DEMAND - MILLION TONS PER YEAR																
Domestic	220	222	227	233	231	240	252	265	274	288	302	317	331	346	361	377
Commercial Demand	182	184	189	197	177	187	199	211	219	230	242	254	266	279	291	304
Industrial Demand	626	643	600	544	569	589	604	625	637	660	669	707	732	757	784	812
Other (Social, Standpipes, etc)	12	12	12	12	12	12	13	13	13	13	14	14	14	15	15	15
TOTAL WATER SOLD BY SMWC	1060	1071	1022	956	989	1023	1067	1114	1144	1191	1249	1292	1343	1395	1450	1508
WATER PRODUCED BY SMWC	1280	1306	1246	1188	1199	1249	1301	1358	1395	1452	1438	1576	1638	1702	1768	1839
Industrial Own Water Production	913	914	916	918	920	922	924	925	927	929	931	933	935	937	938	940
TOTAL WATER DEMAND IN SMR	2193	2220	2162	2084	2119	2169	2225	2284	2322	2381	2387	2508	2572	2638	2707	2779
PER CAPITA WATER DEMAND (Liters per Capita per Day)																
Domestic	91	90	91	92	90	92	95	97	99	102	105	108	112	115	119	123
Commercial Demand	79	79	78	66	69	72	75	78	79	82	84	87	90	93	96	99
Industrial Demand	258	262	241	215	219	223	227	230	231	235	238	242	249	253	259	264
Other (Social, Standpipes, etc)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
TOTAL WATER SOLD BY SMWC	433	436	410	378	383	391	401	409	414	423	433	442	455	466	478	490
WATER PRODUCED BY SMWC	528	531	500	461	467	477	488	499	505	516	509	539	554	569	583	597
Industrial Own Water Production	376	372	368	363	358	352	347	340	336	330	325	319	316	313	310	305
TOTAL WATER DEMAND IN SMR	903	903	868	824	825	829	835	839	841	847	834	858	871	882	893	903
DISTRIBUTION OF WATER SOLD BY SMWC:																
Domestic	21.0%	20.7%	22.2%	24.4%	23.5%	23.5%	23.6%	23.8%	24.0%	24.2%	24.3%	24.5%	24.7%	24.8%	24.9%	25.0%
Commercial Demand	18.3%	18.1%	17.8%	17.4%	18.0%	18.3%	18.5%	18.8%	19.1%	19.3%	19.5%	19.6%	19.8%	19.9%	20.0%	20.2%
Industrial Demand	59.6%	60.0%	58.6%	56.9%	57.5%	57.0%	56.6%	56.1%	55.7%	55.4%	55.1%	54.7%	54.5%	54.3%	54.1%	53.8%
Other (Social, Standpipes, etc)	1.1%	1.1%	1.2%	1.3%	1.2%	1.2%	1.2%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%	1.0%	1.0%
TOTAL WATER SOLD BY SMWC	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
AVERAGE DAILY DEMAND (Thousand Tons/ Day)																
Domestic	603	608	622	637	634	658	690	724	752	789	827	867	907	947	988	1031
Commercial Demand	528	532	498	455	484	514	545	578	600	630	662	698	729	762	796	830
Industrial Demand	1715	1762	1645	1487	1549	1599	1654	1707	1746	1807	1871	1931	2004	2075	2148	2217
Other (Social, standpipes, etc)	33	33	33	34	33	34	34	35	36	37	37	38	38	40	41	41
TOTAL WATER SOLD BY SMWC	2877	2934	2799	2612	2694	2803	2924	3048	3139	3262	3397	3530	3679	3823	3972	4119
WATER PRODUCED BY SMWC	3508	3578	3414	3188	3286	3419	3565	3711	3821	3978	3960	4305	4497	4692	4845	5024
Industrial Own Water Production	2500	2505	2510	2508	2520	2525	2530	2528	2540	2545	2550	2549	2561	2566	2571	2589
TOTAL WATER DEMAND IN SMR	6008	6083	5924	5694	5806	5844	6095	6239	6361	6524	6540	6853	7048	7228	7415	7583
B) SEWERAGE AND WASTEWATER PROJECTIONS																
Pop. with Sewerage or Septic Tanks	54.0%	54.0%	54.0%	54.0%	58.0%	58.0%	60.0%	62.0%	64.0%	67.0%	70.0%	73.0%	76.0%	79.0%	82.0%	85.0%
End of Year Sewerage Connections-1000	439	444	450	461	499	519	549	581	614	658	709	761	800	851	904	959
Wastewater: (Assumed as 90% of Water Production)																
Sewage, Thousand Ton/Day	5407	5475	5331	5125	5225	5349	5486	5615	5725	5871	5988	6158	5343	6505	6674	6833
Infiltration- Thousand Ton/Day	660	663	665	668	670	673	676	678	681	684	686	689	692	694	697	700
Total Dry Weather Flow-Thous.Ton/Day	6067	6138	5997	5792	5896	6022	6162	6294	6406	6555	6673	6857	7035	7200	7371	7533
SEWAGE DISPOSAL (Thousand Ton per Day)																
Project Interceptor - Stage I									1334	1343	1353	1362	1371	1381	1390	1399
Project Interceptor - Stage II														1800	1900	2000
Separate Sewerage Systems	128	140	152	164	176	188	200	212	224	236	248	260	272	284	296	308
Southern and Western Interceptors	877	877	877	877	1215	1215	1215	1215	1215	1215	1215	1215	1215	1215	1215	1215
Direct Discharges into Huangpu River	5062	5121	4968	4751	4505	4619	4747	4867	3633	3761	3757	4020	4177	2520	2570	2611
Total Sewage	6067	6138	5997	5792	5896	6022	6162	6294	6406	6555	6573	6857	7035	7200	7371	7533
BOD Load (Excluding wastewater from industries which have their own water supply)																
Tons per Day	505.40	529.70	555.10	581.80	609.80	639.10	649.30	660.10	671.50	683.50	696.20	709.60	723.70	738.60	754.40	771.10

16-Oct-88

GRAPH 1 – WATER DEMAND IN SMR



GRAPH 2 – WASTEWATER DISPOSAL IN SMR



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SHANGHAI SEWERAGE PROJECT

Estimate of Wastewater Effluent Requirement at Sewer Outfall

Pollutant	Water Quality Class*	Water Quality Std. (mg/l) A	Ambient conc. pollutant in estu. (mg/l) B	Allow. conc. pollutant outfall (mg/l) C=100(A-B)	Allow. pollutant load (t/d) D=1.4E6xC	Estimated load in Stage I (t/d) E	Load reduction required F=E-D	Reduction % G
BOD5	II	3.0	1.10	190	266	272	6	2
OC	II	4.0	3.50	50	70	190	120	63
Phenols	II	0.01	0.0025	0.25	0.35	0.43	0.08	19
Cyanides	I	0.01	0.01	0.20	0.28	0.069		
As	I	0.01					0.005	
Hg	II	0.0005	0.0004	0.0005	0.0007	0.000024		
Cd	I	0.001	0.0001	0.09	0.126	0.007		
Cr(VI)	I	0.01	0.0004	0.96	0.134	0.084		
Pb	I	0.01	0.01	0.01	0.014	0.023	0.009	39
Cu	II	0.01	0.01	0.01	0.014	0.126	0.112	89
Ni	F	0.10					0.084	
Zn	F	0.10					0.33	
Oil	II	0.30	0.10	20	28	46	18	40
Sulphides	F	0.20					1.2	
Total P	II	0.10						
Total N	II	1.0					48**	

Note: * I or II is class in environmental quality standard for surface water. F is standard for fisheries.
** The load refers to ammonia nitrogen.

CHINA

SHANGHAI SEWERAGE PROJECT

Proposed Industrial Wastewater Standards for Discharge into Combined Sewer System

Pollutant	Standard (mg/l)
Temperature	< 40 deg. C
pH	6.5 - 9
SS	500
Oil	50
BOD5	600
OC	800
Sulphide	10
Phenol	5
CN	2
As	0.5
Hg	0.02
Cd	0.1
Cr(VI)	0.5
Pb	1
Cu	1
Zn	5
Ni	2
NH3-n	30
Organic P	0.5
Nitro-Benzene	5
Anilines	3
F	10

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SHANGHAI SEWERAGE PROJECT

Project Components

(a) About 11 km of trunk intercepting sewer of tunnel or pipe jacking construction ranging in diameter from 3 m to 4 m;

(b) about 24 km of trunk intercepting sewer of cut and cover construction with twin 4.25 m x 3.5 m rectangular culverts;

(c) about 32 km of link sewers of 0.45 m to 3 m in diameter of pipe-jacking construction;

(d) about 2.6 km of 3.5 m diameter outfall tunnels with diffusers;

(e) 2 pumping stations, with installed capacities of 40 and 45 m3/sec, respectively ;

(f) 1 screeening plant with a flow capacity of 1.4 million m3/day;

(g) 8 new pumping stations on link sewer system;

(h) alterations to about 44 existing pumping stations on link sewer system;

(i) vehicles and equipment for operation and environmental quality monitoring;

(j) detailed design and construction supervision;

(k) organization, tariff, river basin management and sewer renovation studies;

(l) staff training.

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SHANGHAI SEWERAGE PROJECT

Project Cost Estimate in RMB Yuan

	1987			1988			1989			1990		
	Local RMB mln	Foreign RMB mln	Total RMB mln	Local RMB mln	Foreign RMB mln	Total RMB mln	Local RMB mln	Foreign RMB mln	Total RMB mln	Local RMB mln	Foreign RMB mln	Total RMB mln
CIVIL WORKS												
Site Clearance	3.50	0.02	3.52	14.01	0.09	14.10	21.01	0.14	21.15	15.76	0.10	15.86
Tunnel Construction	1.85	1.65	3.51	16.66	14.89	31.55	28.29	25.11	53.40	21.07	17.64	38.71
Culvert Construction	8.85	6.59	15.44	43.40	30.73	74.12	69.09	48.27	117.37	43.21	30.23	73.44
Pumping Station Construction	0.00	0.00	0.00	3.90	2.68	6.58	10.85	7.43	18.28	12.16	8.31	20.47
Treatment Works Construction	0.00	0.00	0.00	0.65	0.64	1.29	1.95	1.91	3.87	2.61	2.55	5.16
Sewer Outfall Construction	0.00	0.00	0.00	3.00	2.55	5.55	8.26	7.00	15.26	10.51	8.91	19.42
Link Sewer System Constr.	1.36	0.81	2.17	9.54	5.60	15.14	16.36	9.58	25.93	16.49	9.82	26.30
MECHANICAL AND ELECTRICAL EQUIP												
Link Sewer System P/S	0.23	0.00	0.23	0.92	0.00	0.92	1.37	0.00	1.37	1.37	0.00	1.37
Main and Outfall P/S	0.00	0.00	0.00	2.44	10.55	12.99	4.36	17.71	22.07	5.00	21.29	26.30
Treatment Works	0.00	0.00	0.00	0.43	2.39	2.82	1.22	6.77	7.99	1.01	5.57	6.58
OTHERS												
Control & Communication Equip	0.00	0.00	0.00	0.73	1.05	1.78	1.83	2.64	4.46	2.19	3.16	5.35
Oper. & Envir. Monitor Equip.	0.04	0.00	0.04	0.28	0.00	0.28	0.44	0.00	0.44	1.38	0.98	2.36
Eng., Contract., Constr. Sup.	4.92	0.94	5.86	8.18	1.91	10.09	6.26	1.91	8.18	5.32	1.78	7.10
Studies	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.56	0.96	0.82	1.15	1.97
Training	0.00	0.25	0.25	0.00	0.48	0.48	0.69	0.82	1.51	1.37	1.03	2.41
Land Acquisition (incl. housing for resettlement)	9.14	2.01	11.14	36.54	8.02	44.56	54.81	12.03	66.84	41.11	9.02	50.13
Power Supply Conn. Charges	0.00	0.00	0.00	1.91	2.14	4.05	4.46	5.00	9.46	4.46	5.00	9.46
BASE COST (1987 prices)	29.90	12.27	42.17	142.60	83.73	226.32	231.66	146.88	378.54	185.82	126.57	312.38
Physical Contingency (10%)	2.99	1.23	4.22	14.26	8.37	22.63	23.17	14.69	37.85	18.58	12.66	31.24
BASE COST + PHYS. CONT.	32.89	13.50	46.39	156.86	92.10	248.96	254.83	161.57	416.39	204.40	139.22	343.62
Price Contingency	0.53	0.22	0.75	10.20	5.99	16.18	34.20	21.69	55.89	42.50	28.95	71.46
TOTAL PROJECT COST	33.42	13.72	47.14	167.05	98.08	265.14	289.03	183.25	472.28	246.90	168.17	415.08
Int. during Construction 4.5%		0.75	0.75		2.50	2.50		6.09	6.09		11.85	11.85
TOTAL FINANCING REQUIRED	33.42	14.47	47.89	167.05	100.59	267.64	289.03	189.35	478.38	246.90	180.03	426.93
Inflation Rate	6.5%	3.0%		6.5%	1.0%		6.5%	1.0%		6.5%	1.0%	
Escalation Factor	1.00	1.00		1.07	1.02		1.13	1.03		1.21	1.04	

CHINA

SHANGHAI SEWERAGE PROJECT

Annex 7
Table 1
page 2

Project Cost Estimate in RMB Yuan

	1991 Local RMB mln	1991 Foreign RMB mln	1991 Total RMB mln	1992 Local RMB mln	1992 Foreign RMB mln	1992 Total RMB mln	Total Local RMB mln	Total Foreign RMB mln	Total Total RMB mln
CIVIL WORKS									
Site Clearance	10.50	0.07	10.57	5.25	0.03	5.29	70.03	0.46	70.49
Tunnel Construction	11.61	9.24	20.85	4.03	3.47	7.50	83.51	72.01	155.52
Culvert Construction	8.66	6.10	14.76	0.00	0.00	0.00	173.21	121.91	295.13
Pumping Station Construction	6.52	4.44	10.96	1.31	0.88	2.19	34.74	23.75	58.49
Treatment Works Construction	1.30	1.28	2.58	0.00	0.00	0.00	6.52	6.38	12.90
Sewer Outfall Construction	6.75	5.73	12.48	1.50	1.27	2.77	30.02	25.46	55.48
Link Sewer System Constr.	10.82	6.50	17.32	2.51	1.47	3.98	57.08	33.77	90.85
MECHANICAL AND ELECTRICAL EQUIP									
Link Sewer System P/S	0.69	0.00	0.69	0.00	0.00	0.00	4.58	0.00	4.58
Main and Outfall P/S	3.79	17.46	21.25	0.70	3.32	4.02	16.29	70.34	86.63
Treatment Works	0.22	1.19	1.41	0.00	0.00	0.00	2.88	15.92	18.80
OTHERS									
Control & Communication Equip	1.83	2.64	4.46	0.73	1.05	1.78	7.30	10.54	17.84
Oper. & Envir. Monitor Equip.	2.17	1.96	4.12	0.98	0.98	1.96	5.30	3.91	9.21
Eng., Contract., Constr. Sup.	2.96	1.63	4.59	0.65	0.78	1.43	28.29	8.95	37.25
Studies	0.95	1.30	2.25	0.54	0.70	1.25	2.72	3.71	6.43
Training	1.03	0.64	1.67	0.34	0.20	0.54	3.43	3.44	6.87
Land Acquisition (incl. housing for resettlement)	27.41	6.02	33.42	13.70	3.01	16.71	182.71	40.11	222.82
Power Supply Conn. Charges	1.91	2.14	4.05	0.00	0.00	0.00	12.74	14.28	27.02
BASE COST (1987 prices)	99.11	68.32	167.44	32.26	17.18	49.44	721.35	454.95	1176.29
Physical Contingency (10%)	9.91	6.83	16.74	3.23	1.72	4.94	72.13	45.49	117.63
BASE COST + PHYS. CONT.	109.03	75.15	184.18	35.48	18.90	54.38	793.48	500.44	1293.92
Price Contingency	29.92	20.62	50.54	11.77	6.27	18.04	129.12	83.73	212.86
TOTAL PROJECT COST	138.94	95.77	234.72	47.25	25.17	72.42	922.61	584.18	1506.78
Int. during Construction 4.5%		17.45	17.45		22.87	22.87		61.52	61.52
TOTAL FINANCING REQUIRED	138.94	113.22	252.16	47.25	48.04	95.29	922.61	645.70	1568.30
Inflation Rate	4.5%	3.5%		4.5%	3.5%				
Escalation Factor	1.27	1.06		1.33	1.10				

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SHANGHAI SEWERAGE PROJECT

Project Cost Estimate in US Dollar

	1987 Local US$ mln	1987 Foreign US$ mln	1987 Total US$ mln	1988 Local US$ mln	1988 Foreign US$ mln	1988 Total US$ mln	1989 Local US$ mln	1989 Foreign US$ mln	1989 Total US$ mln	1990 Local US$ mln	1990 Foreign US$ mln	1990 Total US$ mln
CIVIL WORKS												
Site Clearance	0.93	0.01	0.93	3.71	0.02	3.74	5.57	0.04	5.61	4.18	0.03	4.20
Tunnel Construction	0.49	0.44	0.93	4.42	3.95	8.37	7.50	6.66	14.16	5.58	4.68	10.26
Culvert Construction	2.35	1.75	4.09	11.51	8.15	19.65	18.32	12.80	31.11	11.45	8.01	19.47
Pumping Station Construction	0.00	0.00	0.00	1.03	0.71	1.74	2.88	1.97	4.85	3.22	2.20	5.43
Treatment Works Construction	0.00	0.00	0.00	0.17	0.17	0.34	0.52	0.51	1.03	0.69	0.68	1.37
Sewer Outfall Construction	0.00	0.00	0.00	0.80	0.68	1.47	2.19	1.86	4.04	2.79	2.36	5.15
Link Sewer System Constr.	0.36	0.21	0.58	2.53	1.48	4.01	4.34	2.54	6.87	4.37	2.60	6.97
MECHANICAL AND ELECTRICAL EQUIP												
Link Sewer System P/S	0.06	0.00	0.06	0.24	0.00	0.24	0.36	0.00	0.36	0.36	0.00	0.36
Main and Outfall P/S	0.00	0.00	0.00	0.65	2.80	3.44	1.16	4.69	5.85	1.33	5.65	6.97
Treatment Works	0.00	0.00	0.00	0.11	0.63	0.75	0.32	1.79	2:12	0.27	1.48	1.74
OTHERS												
Control & Communication Equip	0.00	0.00	0.00	0.19	0.28	0.47	0.48	0.70	1.18	0.58	0.84	1.42
Oper. & Envir. Monitor Equip.	0.01	0.00	0.01	0.08	0.00	0.08	0.12	0.00	0.12	0.37	0.26	0.63
Eng., Contract., Constr. Sup.	1.31	0.25	1.55	2.17	0.50	2.67	1.66	0.50	2.17	1.41	0.47	1.88
Studies	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.15	0.26	0.22	0.31	0.53
Training	0.00	0.07	0.07	0.00	0.13	0.13	0.18	0.22	0.40	0.36	0.27	0.64
Land Acquisition (incl. housing for resettlement)	2.42	0.53	2.95	9.69	2.13	11.81	14.53	3.19	17.72	10.90	2.39	13.29
Power Supply Conn. Charges	0.00	0.00	0.00	0.51	0.57	1.07	1.18	1.32	2.51	1.18	1.32	2.51
BASE COST (1987 prices)	7.93	3.25	11.18	37.80	22.19	60.00	61.41	38.94	100.35	49.26	33.55	82.81
Physical Contingency (10%)	0.79	0.33	1.12	3.78	2.22	6.00	6.14	3.89	10.04	4.93	3.36	8.28
BASE COST + PHYS. CONT.	8.72	3.58	12.30	41.58	24.41	66.00	67.56	42.83	110.39	54.19	36.91	91.10
Price Contingency	0.07	0.03	0.09	0.83	0.49	1.32	2.04	1.29	3.33	2.19	1.49	3.69
TOTAL PROJECT COST	8.78	3.60	12.39	42.42	24.90	67.32	69.60	44.12	113.72	56.38	38.40	94.79
Int. during Construction 4.5%		0.20	0.20		0.68	0.68		1.64	1.64		3.20	3.20
TOTAL FINANCING REQUIRED	8.78	3.81	12.59	42.42	25.58	67.99	69.60	45.77	115.36	56.38	41.60	97.98
Inflation Rate	6.5%	3.0%		6.5%	1.0%		6.5%	1.0%		6.5%	1.0%	
Escalation Factor	1.00	1.00		1.07	1.02		1.13	1.03		1.21	1.04	

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SHANGHAI SEWERAGE PROJECT

Project Cost Estimate in US Dollars

	1991 Local US$ mln	1991 Foreign US$ mln	1991 Total US$ mln	1992 Local US$ mln	1992 Foreign US$ mln	1992 Total US$ mln	Total Local US$ mln	Total Foreign US$ mln	Total Total US$ mln
CIVIL WORKS									
Site Clearance	2.78	0.02	2.80	1.39	0.01	1.40	18.56	0.12	18.69
Tunnel Construction	3.08	2.45	5.53	1.07	0.92	1.99	22.14	19.09	41.23
Culvert Construction	2.30	1.62	3.91	0.00	0.00	0.00	45.92	32.32	78.24
Pumping Station Construction	1.73	1.18	2.91	0.35	0.23	0.58	9.21	6.30	15.50
Treatment Works Construction	0.35	0.34	0.68	0.00	0.00	0.00	1.73	1.69	3.42
Sewer Outfall Construction	1.79	1.52	3.31	0.40	0.34	0.74	7.96	6.75	14.71
Link Sewer System Constr.	2.87	1.72	4.59	0.67	0.39	1.06	15.13	8.95	24.08
MECHANICAL AND ELECTRICAL EQUIP									
Link Sewer System P/S	0.18	0.00	0.18	0.00	0.00	0.00	1.21	0.00	1.21
Main and Outfall P/S	1.00	4.63	5.63	0.19	0.88	1.07	4.32	18.65	22.96
Treatment Works	0.06	0.32	0.37	0.00	0.00	0.00	0.76	4.22	4.98
OTHERS									
Control & Communication Equip	0.48	0.70	1.18	0.19	0.28	0.47	1.94	2.79	4.73
Oper. & Envir. Monitor Equip.	0.57	0.52	1.09	0.26	0.26	0.52	1.40	1.04	2.44
Eng., Contract., Constr. Sup.	0.78	0.43	1.21	0.17	0.21	0.38	7.50	2.36	9.87
Studies	0.25	0.35	0.60	0.14	0.19	0.33	0.72	1.00	1.72
Training	0.27	0.17	0.44	0.09	0.05	0.14	0.91	0.90	1.81
Land Acquisition (incl. housing for resettlement)	7.27	1.59	8.86	3.63	0.80	4.43	48.44	10.63	59.07
Power Supply Conn. Charges	0.51	0.57	1.07	0.00	0.00	0.00	3.38	3.79	7.16
BASE COST (1987 prices)	26.28	18.11	44.39	8.55	4.56	13.11	191.23	120.61	311.84
Physical Contingency (10%)	2.63	1.81	4.44	0.86	0.46	1.31	19.12	12.06	31.18
BASE COST + PHYS. CONT.	28.90	19.93	48.83	9.41	5.01	14.42	210.35	132.67	343.02
Price Contingency	1.85	1.27	3.12	0.95	0.51	1.46	7.93	5.08	13.01
TOTAL PROJECT COST	30.75	21.20	51.95	10.36	5.52	15.88	218.28	137.75	356.04
Int. during Construction 4.5%		4.70	4.70		6.17	6.17	0.00	16.58	16.58
TOTAL FINANCING REQUIRED	30.75	25.90	56.65	10.36	11.68	22.04	218.28	154.33	372.62
Inflation Rate	4.5%	3.5%		4.5%	3.5%				
Escalation Factor	1.27	1.06		1.33	1.10				

CHINA

Shanghai Sewerage Project

Project Cost Estimate by Contracts

Contract Packages	Classification	Total US$ mln
Supply Contracts		
1. Cement Supply No.1	ICB	9.56
2. Cement Supply No.2	ICB	9.56
3. Steel Supply No.1	ICB	18.49
4. Steel Supply No.2	ICB	18.49
Civil Works Contacts		
5. Puxi Culvert No.1	ICB	19.36
6. Puxi Culvert No.2	ICB	19.72
7. Putong Culvert	ICB	26.05
8. Outfall Tunnel	ICB	11.27
9. Huangpu Tunnel	ICB	8.22
10. 4000 mm Tunnel	ICB	8.69
11. 3500 mm Tunnel	ICB	6.82
12. 3000 mm Tunnel	ICB	5.17
13. Peng Yue Pu P/S Construction	ICB	10.09
14. Outfall P/S Construction	ICB	11.27
15. Pretreatment Construction	ICB	2.58
16. Link Sewers (450-2460 mm dia.) (3 contracts at different locations)	LCB	7.06
17. Link Sewers (800-2400 mm dia.) (3 contracts at different locations)	LCB	6.58
18. Link Sewers (800-2400 mm dia.) (3 contracts at different locations)	LCB	6.58
19. Link Sewers (600-1400 mm dia.) (2 contracts at different locations)	LCB	3.31
20. New Link P/S (10 No.) Construc.	LCB	0.65
Mech. & Elect. Contracts		
21. Peng Yue Pu P/S M & E	ICB	16.82
22. Outfall P/S M & E	ICB	7.19
23. Pretreatment M & E	ICB	8.93
24. Central Control Equipment	ICB	5.61
25. Alternation to ex. P/S	LCB	1.46
26. New Link P/S (10 No.) M & E	LCB	1.73
Other Equipment Contracts		
27. Operation & Maintenance Equipment	ICB	0.64
28. Sewerage Monitoring Equipment	ICB	1.75
Other Works		
Eng., Contract., Constr. Sup.		12.68
Studies		2.21
Training		2.33
Land Acquisition (incl. housing for resettlement)		75.87
Power Supply Conn. Charges		9.20
TOTAL PROJECT COST		355.94

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SHANGHAI SEWERAGE PROJECT

Project Implementation Schedule

Contract	Classification	1986 SOND	1987 JFMAMJJASOND	1988 JFMAMJJASOND	1989 JFMAMJJASOND	1990 JFMAMJJASOND	1991 JFMAMJJASOND	1992 JFMAMJJASOND
1. Cement Supply No.1	ICB	D==	R==T==A==M=S	=====				
2. Cement Supply No.2	ICB			D=	=R==T==A==M=	S=====		
3. Steel Supply No.1	ICB	D==	R==T==A==M=S	=====				
4. Steel Supply No.2	ICB			D=	=R==T==A==M=	S=====		
5. Link Pipe Supply	ICB		D===R==T===A	====F===S===	==========	==========	==========	
6. Puxi Culvert No.1	ICB		D===	R==T===A====	M==C========	==========	=========	COM
7. Puxi Culvert No.2	ICB		D===	R==T===A====	M==C========	==========	=========	COM
8. Putong Culvert	ICB		D===	R==T===A====	M==C========	==========	=========	COM
9. Outfall Tunnel	ICB		D===R==T===A	===M==C=====	==========	==========	==========	== COM
10. Huangpu Tunnel	ICB		D===R==T===A	===M==C=====	==========	==========	==========	== COM
11. 4000 mm Tunnel	ICB	D==R	==T===A====M	==C=========	==========	==========	=====	COM
12. 3500 mm Tunnel	ICB		D===R==T==	=A====M==C==	==========	==========	==========	COM
13. 3000 mm Tunnel	ICB		D===R==T==	=A====M==C==	==========	==========	==========	= COM
14. Peng Yue Pu P/S Construction	ICB		D===R==T	===A====M==C	==========	==========	==========	== COM
15. Outfall P/S Construction	ICB		D===R==T	===A====M==C	==========	==========	=========	COM
16. Pretreatment Construction	ICB		D===R=	=T===A====M=	=C=========	==========	=========	COM
17. Link Sewers (450-2460 mm dia.)	LCB		D=	==R==T=A==M=	=C=========	==========	==========	= COM
18. Link Sewers (800-2400 mm dia.)	LCB		D=	==R==T=A==M=	=C=========	==========	==========	= COM
19. Link Sewers (800-2400 mm dia.)	LCB		D=	==R==T=A==M=	=C=========	==========	==========	= COM
20. Link Sewers (600-1400 mm dia.)	LCB		D=	==R==T=A==M=	=C=========	==========	==========	= COM
21. New Link P/S (10 No.) Construc.	LCB		D=	==R==T=A==M=	=C=========	==========	=========	COM
22. Peng Yue Pu P/S M & E	ICB		D===R==T	===A====P===	==F=========	=====S===I==	==========	== COM
23. Outfall P/S M & E	ICB		D===R==T	===A====P===	==F=========	========S===	I========	COM
24. Pretreatment M & E	ICB		D====R=	=T===A====P=	====F=======	======S==I==	=========	COM
25. Central Control Equipment	ICB		D===R==T==	=A====P=====	===F========	S==I========	== COM
26. Alternation to ex. P/S	LCB		D=	==R==T=A==P=	====F==I====	==========	==========	COM
27. New Link P/S (10 No.) M & E	LCB		D=	==R==T=A==P=	====F===I===	==========	==========	COM
28. Operation & Maintenance Equi.	ICB		D===R==T==	=A====P=====	===F========	S==I========	== COM
29. Sewerage Monitoring Equi.	ICB		D===R==T==	=A====S=====				

Resettlement Schedule (People to be resettled)	1987	1988	1989	1990	TOTAL
6. Puxi Culvert No.1		875	750	55	1680
7. Puxi Culvert No.2		775	1250	1188	3213
11. 4000 mm Tunnel		213			213
12. 3500 mm Tunnel		975			975
13. 3500 mm Tunnel		125	125		250
14. Peng Yue Pu P/S		938			938
17. Link Sewers (450-2460 mm dia.)		843	846		1689
18. Link Sewers (800-2400 mm dia.)			1013	1025	2038
19. Link Sewers (800-2400 mm dia.)			1320	2640	3960
20. Link Sewers (600-1400 mm dia.)			188		188
TOTAL		4744	5492	4908	15144

Note: D= Contract document R= Review by SM & Bank T= Tender A= Analysis and contract award M= Mobilisation S= Site delivery
P= Prepare drawings F= Factory manufacturing I= Installation C= Construction COM= Commission

CHINA

SHANGHAI SEWERAGE PROJECT

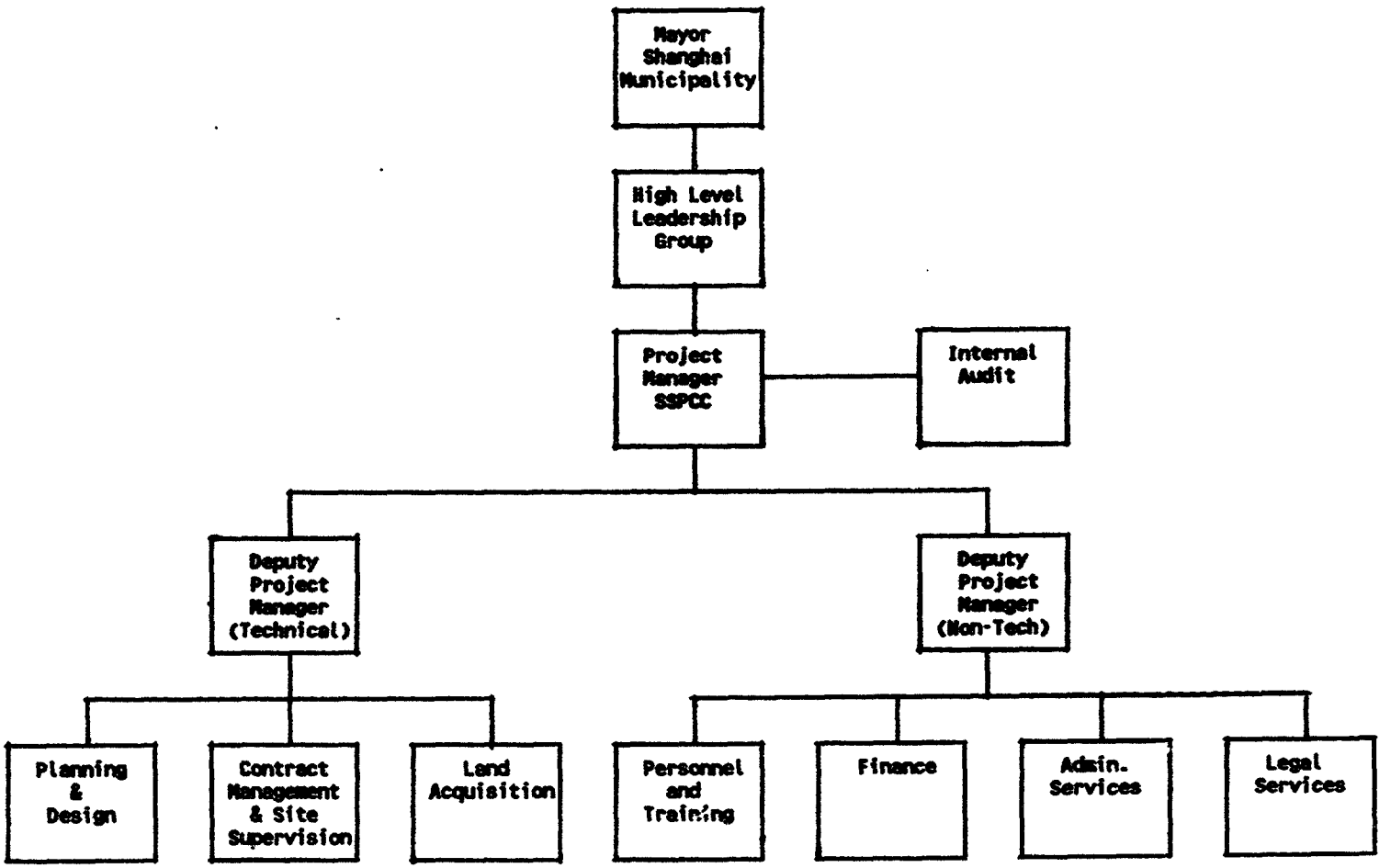
DISBURSEMENT SCHEDULE 1]
(US$ Million)

Bank Fiscal Year	Year and Semester Ending	-- DISBURSEMENTS -- Semester	Cumulative	DISBURSEMENT PROFILE China's (General)	Project's
1988 1]	31-Dec-87	9	9	0.0%	6.2%
	30-Jun-88	3	12	4.0%	8.3%
1988	31-Dec-88	9	21	12.0%	14.5%
	30-Jun-89	12	33	23.0%	22.8%
1990	31-Dec-89	19	52	37.0%	35.9%
	30-Jun-90	19	71	50.0%	49.0%
1991	31-Dec-90	19	90	63.0%	62.0%
	30-Jun-91	14	104	73.0%	71.7%
1992	31-Dec-91	15	119	82.0%	82.1%
	30-Jun-92	12	131	90.0%	90.3%
1993	31-Dec-92	8	139	96.0%	95.9%
	30-Jun-93	6	145	100.0%	100.0%

1] Includes the initial disbursement of $9 million for the Special Account.

CHINA
SHANGHAI SEWERAGE PROJECT

Project Management Organization



Annex 11

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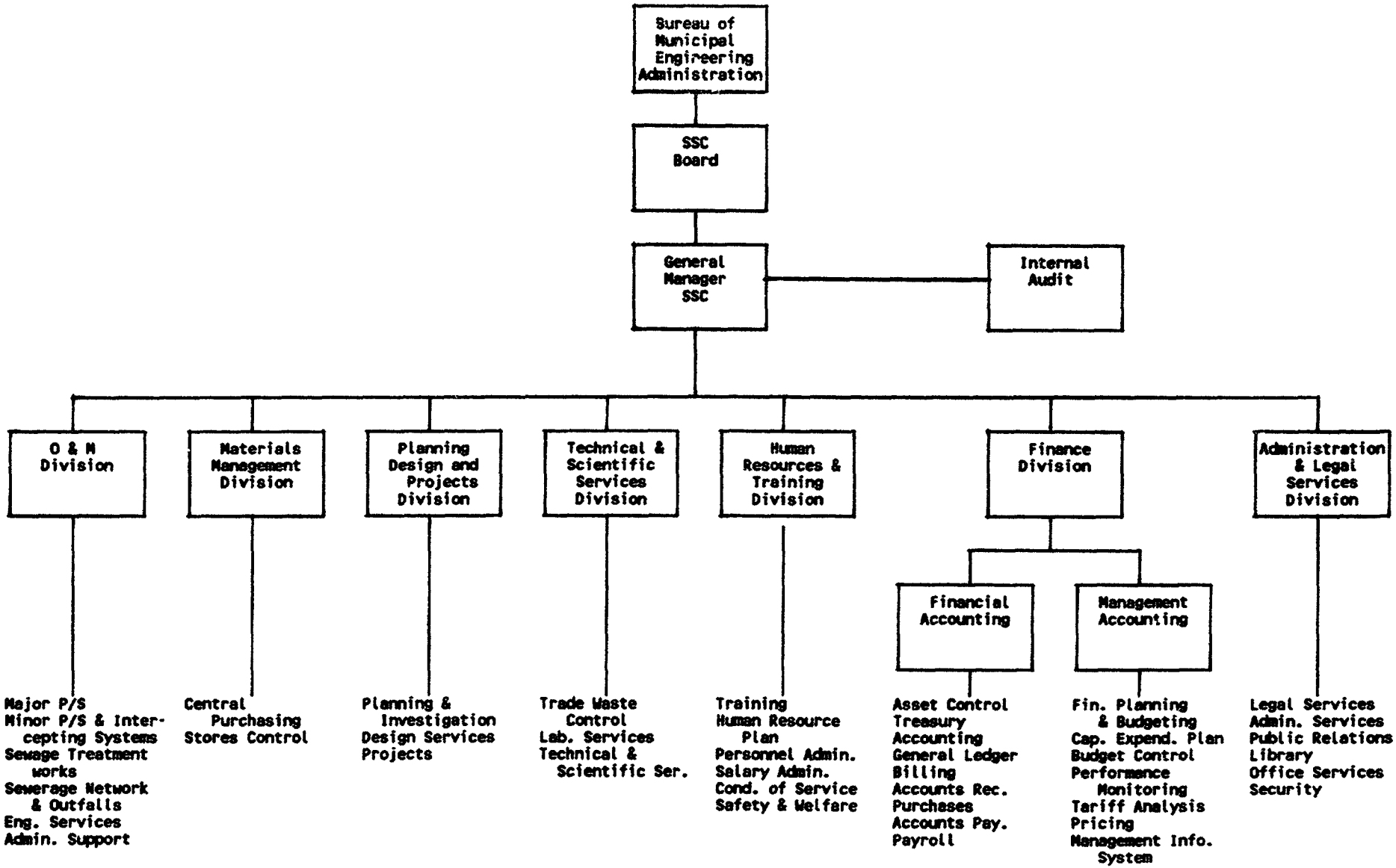
SHANGHAI SEWERAGE PROJECT

Organization of Shanghai Sewerage Company



CHINA

Shanghai Sewerage Project

Resettlement Plan

The Shanghai Sewerage Project Construction Company (SSPCC) has prepared the preliminary design for the project, which includes land acquisition and resettlement. This has been approved by the Shanghai Municipality (SM). The next step would be for SSPCC to conduct a full detailed survey of the exact area required by each contract and a head count of the population to be resettled. The time for this work will be about 2 months. The detailed survey will be submitted to SM for approval, after which the population in the affected areas will be frozen and put under police surveillance to avoid any further in-migration. A notice to this effect would be published.

About 18 months prior to the actual need to use the land, the SSPCC will prepare a detailed plan for resettlement of the population with information provided by relevant municipality bureaus on land available for housing construction and housing units that can be supplied from housing enterprises. The time required for this process will be about 1 month. The housing plan would estimate the number of housing units required. If all the necessary housing units can be provided by housing enterprises, they would be purchased. The time for arranging and delivery of the housing units will then be from 6 to 12 months, depending on the amount of housing units in stock. If all or some of the necessary housing units are not available, they should be designed and constructed under the project. The time required for this process is dependent upon the work scale, and estimated to be slightly longer than purchasing (about 15 months). Therefore this would be on the critical path for the resettlement plan.

With the housing and resettlement plan determined, the SSPCC will contact local district officials to discuss implementation details of the plan. The time required for this would be about 0.5-1 month. The actual work of arranging relocation of the residents would be done by the local district officials. They will negotiate with residents and decide when the relocation would take place. This process would usually run over a period of 8-9 months, before residents in an area are completely moved. The residents would be paid RMB 100-120 per person (the amount may diminish, if moving is not prompt) to encourage moving. When all the residents have moved out, the area will be demolished, a process which takes about one month. The total time required for resettling occupants in an area is thus estimated to be 13-15 months.

The first contract of the project is for a 2.1 km long tunnel with a diameter of 4 m. Since the construction is scheduled to start in March 1988, the detailed resettlement plan for this contract should be started in November 1986. The process has already commenced. Detailed resettlement plans for other contracts would be started according to the implementation schedule (see Annex 9).

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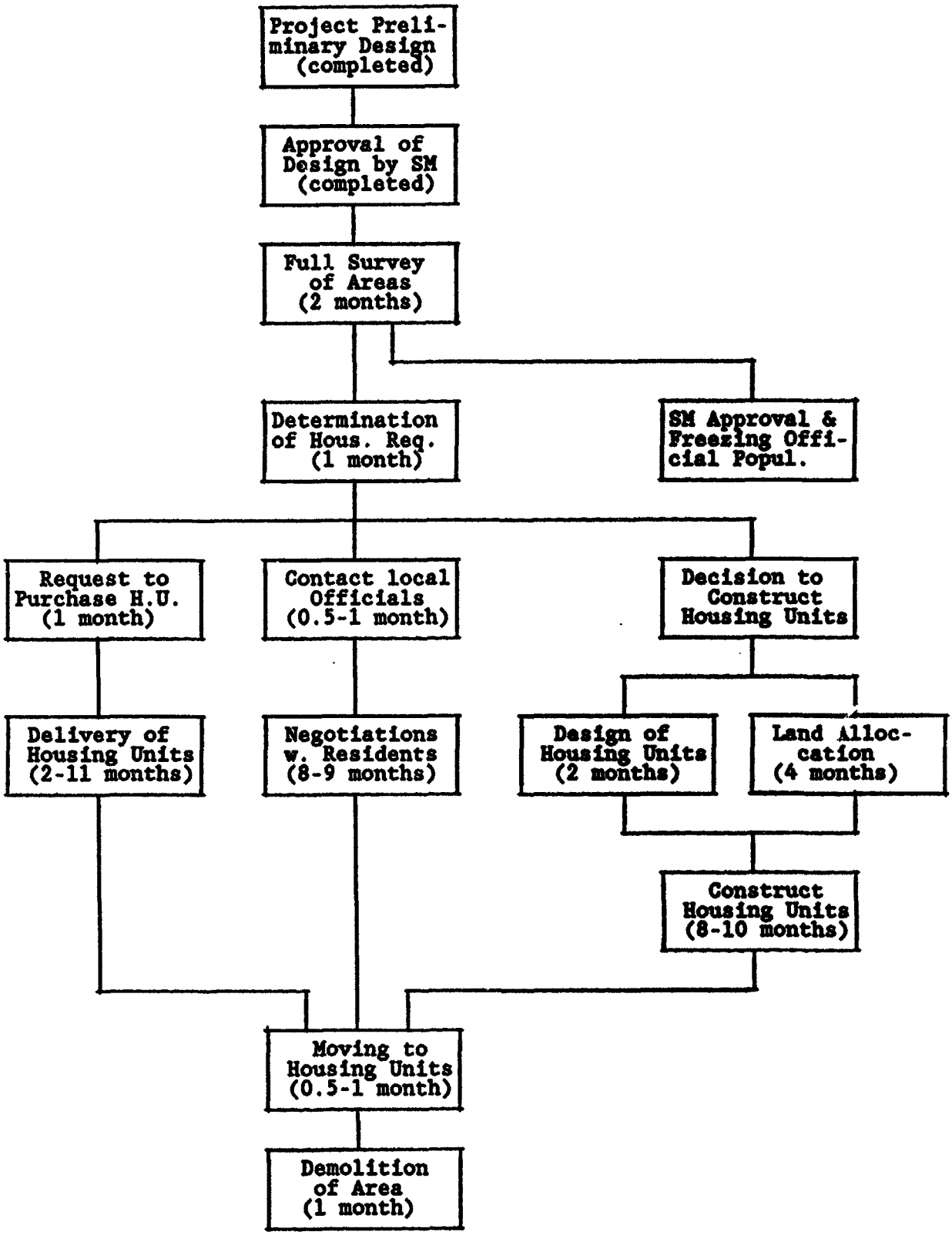
Shanghai Sewerage Project

Resettlement Plan



The path from Full Survey to Demolition is estimated to be 13-15 months.

CHINA

SHANGHAI SEWERAGE PROJECT

Assumptions for Financial Projections

Inflation

1. Project cost tables assume that foreign price increases would be 3% in 1987, 1% p.a. between 1988 and 1990, and 3% thereafter. Local inflation is assumed at about 6.5% p.a. between 1987 and 1990, and about 4.5% p.a. thereafter. The exchange rate is assumed to be adjusted to maintain "purchasing power parity." The exchange rate for end-1986 is assumed at Y 3.71 per US dollar.

Balance Statements for Present Sewerage Services

2. During project preparation, a balance statement was prepared for SM's sewerage services, which gives a basis for the initial balance for the SSC. This balance provides only a rough approximation, since present accounting is concerned primarily with cash budgetary results; there is no proper inventory, depreciation and valuation of fixed assets, and the data and responsibilities for sewerage services are shared between two different units (MDAD and MEAD). Fixed assets, which at present are 96% of the total assets would be revaluated during project implementation (para. 19), and would represent only about one third of the fixed assets after the project completion. There are no debts to be assumed by SSC. Cash represents budget savings on MDAD and MEAD allocations, which are normally kept by the Industrial and Commercial Bank of China's Shanghai branch.

Balance Statement for Shanghai's Sewerage Services

As of December 31,	1983	1984	1985
ASSETS			
Fixed Assets			
Fixed Assets in Operation	647.58	649.93	652.22
Less: Accumulated Depreciation	361.94	378.16	394.44
Net Fixed Assets	285.64	271.77	257.78
Current Assets			
Cash and Deposits	4.99	3.85	3.79
Inventories	1.21	1.82	3.80
Advance Payments for Materials	2.01	2.54	3.22
Total Current Assets	8.21	8.22	10.81
Total Assets	293.85	279.98	268.59
EQUITY AND LIABILITIES			
SM's Equity and Reserves	293.35	279.04	265.81
Payables	0.50	0.94	2.78
Total Equity and Liabilities	293.85	279.98	268.59

Financial Projections

3. SSC's investment programs and financial projections were developed by the appraisal team using computer programs tailored to SSC's programs and financial condition. The main financial statements (Table 1 - Income, Table 2 - Flow of Funds, Table 3 - Balance, Table 4 - Financial Plan, and Table 5 - Monitoring Indicators) are presented in Annex 14. Additional tables, available in the project file, provide details of all the assumptions and intermediate results regarding water demand and sewerage services, fixed assets, debt analysis, operational expenses, working capital and sewerage tariffs. Therefore only the main assumptions are explained below. Although present accounting is on a cash basis, proper accrual accounting, in accordance with Chinese standards for public enterprises, would be started after the establishment of SSC.

Water Demand

4. Detailed projections were prepared for water demand by categories (domestic, commercial, industrial and others). After the completion of the tariff study all water consumers are expected to pay sewerage charges. Historical demand data for 1985 and SMWC's forecasts were provided by SMWC and used by the appraisal mission to forecast the demand for water and the wastewater flow until the year 2000 (Annex 3). A major uncertainty is the population growth, which in the past was kept very low by administrative controls. However, migration rates are higher at present, and it is estimated that several hundred thousand persons are living in the city in a "transitory" status. Since no clear estimates are available, only an estimated half million of persons without resident status were included in the tables. The population of SMR includes Shanghai City and the surrounding urban districts, which receive water from SWSC and whose sewerage services would be under SSC responsibility. The estimated population of 7 million persons is projected to increase at about 1.3% p.a. Since about 95% of the population is reported served, the main reasons for increases in water demand of about 3-4% p.a. are the industrial growth, the increase in income of the population and the progressive increase in flush toilets brought about by housing renovation, new housing construction and the facilities for new sewerage connections resulting from the project. A price elasticity of 0.20 is assumed for the water demand, in particular for the introduction of the sewerage tariff and the expected tariff increase in 1993. The reduction of 20% in water demand following the doubling of water charges due to the introduction of the proposed sewerage tariff is expected to be distributed during two years (1987-88).

Income Statement

5. Sewerage Revenues. Sewerage charges would be based on 90% of the water demand. Industrial and commercial charges of Y 0.12 per ton are expected to start in 1987, and domestic charges of Y 0.03 per ton are assumed to start in 1989. Sewerage revenues would cover operating and maintenance expenses, and the higher of either depreciation or debt service. Debt service would include the principal payments and the total interest (capitalized or operational). The financial projections (Annex 14) show the financial position of SSC upon achieving these financial targets. Tariff increases of about 35% would be needed to cover the increase in operating expenses and debt service after project completion. These charges are

equivalent to maintaining the proposed 1987 tariffs in real prices. Although a system of gradual tariff increases would be preferable, at the moment there is no mechanism for frequent reviews of charges for public services. Moreover SSC is expected to have significant cash surpluses until 1993.

6. SSC would also be responsible for making the sewerage connections, which would be charged at cost to the beneficiaries, and therefore do not affect SSC's financial results.

7. Personnel. The number of staff to be transferred to SSC is assumed to be 4,365. Staff increases of about 4% would be required in 1987 to assume the management, financial and accounting responsibilities of the new company. Increases in efficiency are expected to reduce further increases in the number of staff to only 11% even after project completion. This should reduce the number of staff per thousand connections from 10.0 in 1987 to 7.7 by 1994. Unit salaries are low, averaging some Y 130 ($35) per month, but living expenses are also very low. Unit salaries are assumed to increase by about 2% p.a. in real terms. Enterprises now provide staff bonuses to promote efficiency, and incur welfare expenses (including housing and retirement benefits). Generally, these benefits are equivalent to about 6% of the net income. However, this is less applicable for public enterprises, where the net income may have wide fluctuations, and depend more on tariff rather than efficiency increases. Bonuses and welfare expenses are assumed at 20% of personnel expenses, including 11.5% for a pension fund which was recently established in Beijing and soon to be extended to other cities.

8. Power. Power expenses are based on the estimated flow of sewage to be pumped by SSC. Power tariffs are expected to increase 10% in 1987 and 1989, and with inflation after 1991. SSC is not expected to pay demand charges, but will instead pay the industrial rate for power (Y 0.10 per Kwh in 1986).

9. Materials and Maintenance. Materials and maintenance expenses, excluding labor, are high, reaching 51% of operating expenses in 1985 and 2.2% of the revalued fixed assets. This is because the existing system is old, and because some replacement costs are included in these expenses. Materials and maintenance expenses are assumed to increase with inflation until the new system enters into operation, when an increase of about 20% in real terms is assumed between 1993 and 1994. These expenses would represent 1% of the gross fixed assets in 1993.

10. Other Expenses. Administrative expenses are estimated as 8.5% of personnel expenses. Bad debts are very small, and are estimated at 0.2% of revenues.

11. Taxes. Starting in 1988, SSC would pay sales taxes at 3% of the sewerage revenues. Shanghai Municipality has decided to exempt SSC from income and adjustment taxes which may reach 90% of the net income after depreciation and interest (including the total interest paid, capitalized or operational).

12. Appropriation of Net Income: all net income, after the appropriations for bonuses and staff welfare (which are included in the

operating expenses), would be available for investments and payment of debt service. For simplicity this is presented as cash.

13. Depreciation expenses assume a straight-line depreciation on the average gross fixed assets in operation, averaging 2.5% p.a. for the projected period.

Sources and Applications of Funds

15. Borrowing. The proceeds of the proposed Bank loan and IDA credit would be onlent to SM, to be repaid in 20 years, including 5 year grace, at 4.5% interest. SM would bear the foreign exchange risk. The equivalent of Bank/IDA disbursements in local currency would be repaid by SSC to SM, in 15 years, after a 5 year grace period, and have an interest rate of 4.5%. Similar loans are assumed to finance about 40% of the second sewerage stage, starting in 1992.

16. SM Contributions. SCC would pay the interest during construction. The remaining part of the project cost not financed by IBRD/IDA would be contributed by SM, as well as any unlikely subsidies which may be needed for operation.

17. Investments. SSC's investments include the proposed project and some minor works (estimated at about Y 2.5 million per year). The second stage of the sewerage project is assumed to start in 1992. Cash surpluses between 1987 and 1992 are expected to be used to rehabilitate and expand the sewerage network and to promote sewerage connections. Cash deposits in banks are assumed to earn interest of about 3% p.a. A policy on the use of cash surpluses would be put in effect after SSC has been established and is functional.

Balance Statement

18. Accounts Receivable. Accounts receivable are assumed at about one month of revenues. Prompt payment by other government corporations is ensured by automatic transfers of funds between the respective bank accounts.

19. Fixed Assets. Fixed assets are based on a replacement cost estimated by SMEDI. Although the total amount seems underestimated, it does not affect the financial projections, since many assets are more than 30 years old. A detailed valuation and inventory of fixed assets would be undertaken under the project (para. 6.02). Given the low levels of inflation and lack of proper legislation for assets revaluation, fixed assets would not be revalued after they are included in the accounting records.

20. Inventories are assumed at the historical level of about 27% of annual expenses for materials and maintenance.

21. Advances are projected to continue at their current level.

22. Accounts Payable are projected at about their current level of 25% of expenses for materials and maintenance.

SHANGHAI SEWERAGE COMPANY
FINANCIAL PROJECTIONS

TABLE 1 INCOME STATEMENT 1] Y Million

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Population Shanghai Metrop. Region-000	7000	7091	7183	7277	7371	7467	7564	7662	7762	7863
% Population with Water Connections	95.0%	95.0%	95.0%	95.0%	95.5%	96.0%	96.5%	97.0%	97.5%	98.0%
Water Connections (End of Year)-1000	772	781	792	811	835	859	884	909	935	962
Volume Water Sold-Liters/Person/Day	433	436	410	378	383	391	401	409	414	423
Water Sold-Million Tons	1050	1071	1022	956	983	1023	1067	1114	1144	1191
% Population with Sewerage Connections	54%	54%	54%	54%	56%	58%	60%	62%	64%	67%
End of Year Sewerage Connections-1000	439	444	450	461	489	519	549	581	614	658
Domestic Sewage Billed-Million Ton			204.4	209.7	208.2	216.2	226.8	238.5	247.0	259.1
Commercial & Ind. Sewage Billed-Mill.Ton			704.2	639.8	666.1	693.6	722.3	752.3	770.5	800.6
Total Sewage Billed- Million Ton			908.7	849.5	874.3	909.8	949.1	990.8	1017.5	1059.7
Domestic Tariff per Volume Billed-Y/Ton			0.000	0.000	0.030	0.030	0.030	0.030	0.040	0.043
Industrial & Commercial Tariff -Y/Ton			0.120	0.120	0.120	0.120	0.120	0.120	0.161	0.173
Average Tariff per Volume Billed Y/Ton			0.093	0.090	0.099	0.099	0.098	0.098	0.132	0.141
OPERATIONAL REVENUES										
Sewerage Revenues - Y Million			84.51	76.77	86.18	89.72	93.48	97.43	134.21	149.35
Sewerage Connection Charges - Y Million			0.00	0.86	2.41	2.67	2.95	3.23	3.49	4.88
OPERATING REVENUES			84.51	77.63	88.59	92.39	96.43	100.66	137.70	154.23
Salaries & Wages	7.01	6.77	7.57	8.22	8.93	9.70	10.54	11.80	13.21	14.08
Power	6.12	6.13	6.43	6.02	6.81	7.09	7.80	8.50	16.26	17.44
Materials and Supplies	2.49	2.50	2.66	2.84	3.05	3.25	3.43	3.58	4.12	4.73
Maintenance	11.66	11.00	11.72	12.48	13.29	14.15	14.93	15.60	17.93	20.61
Administration	0.60	0.57	0.64	0.70	0.76	0.82	0.90	1.00	1.12	1.20
Sewerage Connections Expenses	0.00	0.00	0.00	0.86	2.41	2.67	2.95	3.23	3.49	4.88
Staff Bonus & Welfare Expenses	0.00	0.00	1.29	1.20	1.36	1.42	1.56	1.70	3.25	3.49
Bad Debts	0.00	0.00	0.17	0.16	0.18	0.18	0.19	0.20	0.27	0.29
Sales Tax	0.00	0.00	0.00	2.33	2.66	2.77	2.89	3.02	4.13	4.63
OPERATING EXPENSES	27.88	26.97	30.48	34.80	39.45	42.05	45.19	48.64	63.79	71.34
INCOME BEFORE DEPRECIATION	-27.88	-26.97	54.03	42.83	49.14	50.33	51.24	52.02	73.91	82.89
Depreciation	16.31	16.33	16.38	16.44	16.50	16.56	16.63	35.71	54.79	54.87
OPERATING INCOME	-44.19	-43.30	37.65	26.39	32.65	33.77	34.61	16.31	19.12	28.02
Other Non-Operational Income (net)	0.00	0.00	0.00	1.46	2.66	3.91	5.06	6.05	7.04	5.65
Operational Interest Expenses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.63	25.37
Amortization Deferred Charges	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Amortization Debt Revaluation Losses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NET INCOME	-44.19	-43.30	37.65	27.86	35.30	37.69	39.67	22.36	-0.47	8.30
Increase in Sewage Billed				-6.5%	2.9%	4.1%	4.3%	4.4%	2.7%	4.1%
Direct Expenses per Volume Billed (RMB/Ton)			0.03	0.04	0.05	0.05	0.05	0.05	0.06	0.07
Increase in Operating Revenues				-8.1%	14.1%	4.3%	4.4%	4.4%	36.8%	12.0%
Working Ratio			36.1%	44.8%	44.5%	45.5%	46.9%	48.3%	46.3%	46.3%
Operating Ratio			55.4%	66.0%	63.2%	63.4%	64.1%	83.8%	86.1%	81.8%
Net Income for Year on Equity			12.4%	5.1%	3.8%	3.1%	2.9%	1.6%	0.0%	0.6%
Average Asset's Rate Base			236	222	208	194	180	917	1635	1584
Rate of Return on Net Fixed Assets			15.9%	11.9%	15.7%	17.4%	19.2%	1.8%	1.2%	1.8%

1] Due to rounding, the last digit in totals may appear different than the sum of columns.

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SHANGHAI SEWERAGE COMPANY
FINANCIAL PROJECTIONS

TABLE 2 SOURCES AND APPLICATIONS OF FUNDS Y Million

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCES OF FUNDS:										
Income Before Depreciation	-27.88	-26.97	54.03	42.83	49.14	50.33	51.24	52.02	73.91	82.89
Other Non-Operational Income (net)	0.00	0.00	0.00	1.46	2.66	3.91	5.06	6.05	7.04	5.65
Contributions for Operation	27.88	28.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INTERNAL SOURCES OF FUNDS	0.00	1.23	54.03	44.29	51.80	54.25	56.30	58.07	80.95	88.54
EQUITY CONTRIBUTIONS FOR CONSTRUCTION	2.30	2.00	12.43	217.85	343.47	248.59	103.66	0.00	0.00	0.00
BORROWING:										
Onlending IBRD Loan & IDA Credit	0.00	0.00	33.96	47.29	128.81	166.49	131.06	91.26	27.64	0.00
Loans Stage II Project	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	175.00	280.00
TOTAL BORROWING	0.00	0.00	33.96	47.29	128.81	166.49	131.06	126.26	202.64	280.00
TOTAL SOURCES OF FUNDS	2.30	3.24	100.42	309.43	524.08	469.33	291.02	184.33	283.60	368.54
APPLICATIONS OF FUNDS:										
Shanghai Sewerage Project-Stage I	0.00	0.00	46.39	265.14	472.28	415.08	234.72	72.42	0.00	0.00
Interest Capitalized	0.00	0.00	0.38	2.59	6.55	13.20	19.89	25.68	5.51	15.75
Shanghai Sewerage Project-Stage II	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	250.00	400.00
Other Works	2.30	2.00	2.14	2.28	2.44	2.61	2.72	2.83	2.94	3.06
TOTAL CAPITAL EXPENDITURES	2.30	2.00	48.91	270.01	481.27	430.89	257.33	150.93	258.45	418.81
Amortization	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.77	41.77
Operational Interest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.63	25.37
TOTAL DEBT SERVICE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.40	67.14
WORKING CAPITAL NEEDS (+)	0.00	0.81	7.02	-0.51	0.98	0.39	0.40	0.41	3.24	1.59
OTHER ASSETS/LIABIL. CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL APPLICATIONS OF FUNDS	2.30	2.81	55.93	269.50	482.26	431.28	257.73	151.34	330.09	487.54
CASH INCREASE (+) OR DECREASE	0.00	0.42	44.49	39.93	41.83	38.05	33.28	32.99	-46.50	-119.00
Debt Service Ratio									1.1	1.3
Internal Contribution to Investment	0.0%	21.2%	96.1%	16.6%	10.6%	12.5%	21.7%	38.2%	3.6%	4.7%
% Capital expend. of Net Assets	0.9%	0.8%	21.3%	125.6%	239.4%	230.4%	148.6%	9.1%	16.1%	26.9%

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SHANGHAI SEWERAGE COMPANY
FINANCIAL PROJECTIONS

TABLE 3 — BALANCE STATEMENT — Y Million, Fy ends 12/31

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Fixed Assets in Operation	652.22	654.22	656.36	658.64	661.08	663.69	666.41	2190.29	2193.23	2196.29
Accumulated Depreciation	394.44	410.77	427.15	443.59	460.09	476.65	493.27	528.98	583.78	638.64
NET FIXED ASSETS	257.78	243.45	229.21	215.05	200.99	187.04	173.14	1661.31	1609.45	1557.65
WORK IN PROGRESS	0.00	0.00	46.77	314.50	793.34	1221.62	1476.23	103.28	358.80	774.55
Cash	3.79	4.22	48.71	88.64	130.46	168.51	201.79	234.78	188.29	69.29
Accounts Receivable	0.00	0.00	7.01	6.44	7.35	7.67	8.00	8.35	11.43	12.80
Other Account Receivable	3.22	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10
Inventories	3.80	3.73	3.88	4.13	4.41	4.70	4.96	5.18	5.95	6.84
Other Current Assets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL CURRENT ASSETS	10.81	12.05	63.70	103.31	146.33	184.98	218.85	252.42	209.77	93.03
DEFERRED CHARGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER ASSETS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL ASSETS	268.59	255.49	339.68	632.87	1140.66	1593.64	1868.22	2017.01	2178.02	2425.22
Accounts Payable	2.78	2.78	2.93	3.12	3.32	3.54	3.73	3.90	4.51	5.18
Other Current Liabilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Current Matur.Long-Term Debt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.77	41.77	41.77
TOTAL CURRENT LIABILITIES	2.78	2.78	2.93	3.12	3.32	3.54	3.73	45.67	46.28	46.95
Other Liabilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Long-Term Debt (net)	0.00	0.00	33.96	81.24	210.05	376.54	507.60	592.09	752.97	991.20
Gross Debt	0.00	0.00	33.96	81.24	210.05	376.54	507.60	633.86	794.73	1032.97
Minus: Current Maturities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.77	41.77	41.77
TOTAL LIABILITIES	2.78	2.78	36.89	84.36	213.38	380.08	511.33	637.76	799.24	1038.15
Operational Surplus	0.00	0.00	37.65	65.50	100.81	138.49	178.17	200.53	200.06	208.35
Capital	265.81	252.71	265.15	483.00	826.47	1075.06	1178.72	1178.72	1178.72	1178.72
TOTAL EQUITY	265.81	252.71	302.80	548.51	927.28	1213.56	1356.89	1379.25	1378.78	1387.08
TOTAL EQUITY AND LIABILITIES	268.59	255.49	339.68	632.87	1140.66	1593.64	1868.22	2017.01	2178.02	2425.22
Current Ratio	3.9	4.3	21.8	33.1	44.0	52.3	58.6	5.5	4.5	2.0
Total Debt on Equity	0.0%	0.0%	11.2%	14.8%	22.7%	31.0%	37.4%	46.0%	57.6%	74.5%
# Days Accounts Receivable (Net)			30	30	30	30	30	30	30	30

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TABLE 4 FINANCING PLAN Y Million

	TOTAL	% OF TOTAL	1987	1988	1989	1990	1991	1992
Income before depreciation	299.60	18.3%	54.03	42.83	49.14	50.33	51.24	52.02
Other Non-Operational Income (net)	19.14	1.2%	0.00	1.46	2.66	3.91	5.06	6.05
Contributions for Operation	0.00	0.0%	0.00	0.00	0.00	0.00	0.00	0.00
GROSS INTERNAL SOURCES OF FUNDS	318.74	19.4%	54.03	44.29	51.80	54.25	56.30	58.07
MINUS:								
Amortization	0.00	0.0%	0.00	0.00	0.00	0.00	0.00	0.00
Operational Interest	0.00	0.0%	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL DEBT SERVICE	0.00	0.0%	0.00	0.00	0.00	0.00	0.00	0.00
WORKING CAPITAL NEEDS (+)	8.68	0.5%	7.02	-0.51	0.98	0.39	0.40	0.41
OTHER ASSETS (+) OR LIAB.NEEDS	0.00	0.0%	0.00	0.00	0.00	0.00	0.00	0.00
CASH INCREASE (+) OR DECREASE	230.57	14.1%	44.49	39.93	41.83	38.05	33.28	32.99
NET INTERNAL SOURCES OF FUNDS	79.48	4.8%	2.52	4.87	8.99	15.81	22.61	24.68
CAPITAL EXPENDITURES								
Shanghai Sewerage Project-Stage I	1506.03	91.9%	46.39	265.14	472.28	415.08	234.72	72.42
Interest Capitalized	68.30	4.2%	0.38	2.59	6.55	13.20	19.89	25.68
Shanghai Sewerage Project-Stage II	50.00	3.0%	0.00	0.00	0.00	0.00	0.00	50.00
Other Works	15.02	0.9%	2.14	2.28	2.44	2.61	2.72	2.83
TOTAL CAPITAL EXPENDITURES	1639.35	100.0%	48.91	270.01	481.27	430.89	257.33	150.93
NET TO BE FINANCED:	1559.87	95.2%	46.39	265.14	472.28	415.08	234.72	126.26
FINANCED BY:								
Onlending IBRD Loan & IDA Credit	598.86	36.5%	33.96	47.29	128.81	166.49	131.06	91.26
Loans Stage II Project	35.00	2.1%	0.00	0.00	0.00	0.00	0.00	35.00
TOTAL BORROWING	633.86	38.7%	33.96	47.29	128.81	166.49	131.06	126.26
EQUITY CONTRIBUTIONS FOR CONSTRUCTION	926.01	56.5%	12.43	217.85	343.47	248.59	103.66	0.00
TOTAL FINANCED	1559.87	95.2%	46.39	265.14	472.28	415.08	234.72	126.26
CASH DEFICIT (IF ANY)	0.00	0.0%	0.00	0.00	0.00	0.00	0.00	0.00

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SHANGHAI SEWERAGE COMPANY
FINANCIAL PROJECTIONS

TABLE 5 MONITORING INDICATORS

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ACHIEVEMENT OF TARGETS:										
Population Shanghai Metrop. Region-000	7000	7091	7183	7277	7371	7467	7564	7662	7762	7863
% Population with Water Connections	95.0%	95.0%	95.0%	95.0%	95.5%	96.0%	96.5%	97.0%	97.5%	98.0%
Water Connections (End of Year)-1000	771.8	781.4	792.4	811.2	834.7	858.8	883.6	909.2	935.2	962.1
Water Sold-Million Tons	1050	1071	1022	956	983	1023	1067	1114	1144	1191
Volume Water Sold-Liters/Person/Day	433	436	410	378	383	391	401	409	414	423
% Population with Sewerage Connections			54%	54%	56%	58%	60%	62%	64%	67%
End of Year Sewerage Connections-1000	439	444	450	461	489	519	549	581	614	658
Total Sewage Billed- Million Ton	0	0	909	849	874	910	949	991	1018	1060
Average Tariff per Volume Billed Y/Ton	0.000	0.000	0.093	0.090	0.099	0.099	0.098	0.098	0.132	0.141
MANAGEMENT:										
Operating Expenses (Excluding Depreciation) per Ton of Sewage Billed			0.03	0.04	0.05	0.05	0.05	0.05	0.06	0.07
# Days Accounts Receivable			30	30	30	30	30	30	30	30
Number of Employees	4365	4365	4540	4540	4540	4540	4585	4814	5055	5055
Employees per 1000 Sewerage Connect.	9.9	9.8	10.1	9.8	9.3	8.7	8.3	8.3	8.2	7.7
FINANCIAL RATIOS:										
Sewerage Revenues - Y Million			84.51	76.77	86.18	89.72	93.48	97.43	134.21	149.35
Domestic Tariff per Volume Billed-Y/Ton			0.000	0.000	0.030	0.030	0.030	0.030	0.040	0.043
Industrial & Commercial Tariff -Y/Ton			0.120	0.120	0.120	0.120	0.120	0.120	0.161	0.173
Average Tariff per Volume Billed Y/Ton			0.093	0.090	0.099	0.099	0.098	0.098	0.132	0.141
Working Ratio			36.1%	44.8%	44.5%	45.5%	46.9%	48.3%	46.3%	46.3%
Operating Ratio			55.4%	66.0%	63.2%	63.4%	64.1%	83.8%	86.1%	81.8%
Rate of Return on Net Fixed Assets			15.9%	11.9%	15.7%	17.4%	19.2%	1.8%	1.2%	1.8%
Net Income per Year on Equity			12.4%	5.1%	3.8%	3.1%	2.9%	1.6%	0.0%	0.6%
Shanghai Sewerage Project-Stage I	0.00	0.00	46.39	265.14	472.28	415.08	234.72	72.42	0.00	0.00
Total Investment- Y Million	2	2	49	270	481	431	257	151	258	419
Internal Contribution to Investment	0.0%	21.2%	96.1%	16.6%	10.6%	12.5%	21.7%	38.2%	3.6%	4.7%
% of Investment Financed by Equity	100.0%	100.0%	25.4%	80.7%	71.4%	57.7%	40.3%	0.0%	0.0%	0.0%
Debt Service ratio									1.1	1.3
Total Debt/Equity Ratio	0.0%	0.0%	11.2%	14.8%	22.7%	31.0%	37.4%	46.0%	57.6%	74.5%
Current Ratio	3.9	4.3	21.8	33.1	44.0	52.3	58.6	5.5	4.5	2.0
ANALYSIS IN 1986 CONSTANT PRICES:										
Domestic Tariff per Volume Billed-Y/Ton			0.000	0.000	0.025	0.023	0.022	0.021	0.027	0.028
Industrial & Commercial Tariff -Y/Ton			0.113	0.106	0.099	0.093	0.088	0.085	0.109	0.111
Average Tariff per Volume Billed Y/Ton			0.087	0.080	0.082	0.077	0.073	0.069	0.089	0.091
Real Tariff Increase				-8.8%	2.4%	-6.1%	-5.3%	-4.5%	28.4%	2.3%
Operating Revenues			79.35	68.44	73.34	71.81	71.05	70.97	92.91	99.58

CRITICAL FINANCIAL INDICATORS BETWEEN 1986-1992

VARIABLE OR INDICATOR	MINIMU	AVERAG	MAXIMUM
Cash	69.29	154.54	234.78
Average Tariff per Volume Billed Y/Ton	0.07	0.08	0.09
Working ratio	44.5%	46.1%	48.3%
Rate of Return on Avg.Fixed Assets	1.2%	9.8%	19.2%

VARIABLE OR INDICATOR	MIN	AV	MAX
Debt Service Ratio	1.1	1.2	1.3
Days Accounts Receivable	30	30	30
Total Debt/Equity Ratio	14.8%	40.6%	74.5%

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CHINA

SHANGHAI SEWERAGE PROJECT

Economic Analysis

Results and Assumptions used in the Analysis

1 This annex provides additional information on the estimation of benefits and the economic rate of return, least-cost estimates of alternatives, the average incremental cost, and affordability of the project.

Benefits and Economic Rate of Return

2. The project is estimated to have an economic rate of return of about 13% using the assumptions described below, as shown in Table 16.1.

Assumptions for Benefits

3. The estimated benefits are for property value enhancement (a proxy to direct benefits in the project area) and three types of external benefit: (a) increased agricultural output, (b) reduced treatment cost for water withdrawn by industry from Shanghai's waterways and (c) cost saving in investment in water supply as more water is withdrawn from waterways for industrial use.

Property Value Enhancement

4. This estimate is based upon expected improvement in land use and property value in the ribbon development area along Suzhou Creek marked on Figure 16.1. The area is 2.7 km2 or 4.5 km long and 300 m in width on either side of Suzhou Csreek.

5. Current annual profitability (annual operating income minus annual operating cost) for various land uses and zones of Shanghai has been estimated by the Financial Research Institute of the Shanghai Finance Bureau. The benefit shown in Table 16.1 is estimated by assuming that 50 percent of the ribbon development area will be upgraded from Class 2 (profitability of Y 2273/m2/year)to Class 1 (profitability of Y 3033 /m2/year) for the portion east of Heng Feng Bridge, and from Class 4 (profitability of Y 1127/m2/year) to Class 2 on the west of the bridge. The estimate takes into account a development cost of Y 540 per m2 of plot area, derived from estimates by the Zhabei District Construction Division, for the land area estimated to be redevelopable.

Increased Agricultural Output

6. This estimate is based upon data compiled by the Environmental Protection Bureau from studies done by the Shanghai Academy of Agricultural Sciences on the impact of improved qquality of irrigation water on agricultural output (primarily vegetable production). The data shows that about 130 hectares of land had to be withdrawn from production due to

pollution and that about 5000 hectares (of a total of 13,300 hectares) had reduced output due to polluted irrigation water. The output loss is estimated at about Y 30 million (1987 prices). Estimated benefits shown in Table 16.1 assume that about half of this annual loss will be recovered by the tenth year after the project is operational.

Reduced Treatment Cost

7. Industry draws about 3 million m3 of water a day from the lower and middle reaches of the Huangpu River. The benefit is calculated on the basis of estimates by the Shanghai Association for Water Purification Technology that treatment costs now incurred can be reduced by Y 0.01/m3 as the quality of water is improved. As with enhanced agricultural production, this reduction is assumed to be reached by the tenth year after the project is operational.

Reduced Cost of Water Supply

8. Potable water is now used in industrial processes by factories adjacent to Suzhou Creek due to pollution in the Creek. As water quality improves in the Creek it is estimated that industries would extract about 125,000 m3/day directly from the Creek, based upon data from the Bureau of Public Utilities. This level of extraction would permit a reduction in the scale of new water supply expansion currently being planned with a possible deferment of investment by over a year. These cost savings are shown in Table 15-1 as a project benefit.

Least Cost Analysis

9. Table 16.2 shows a summary of the estimated costs of alternative approaches for wastewater disposal to achieve water quality objectives in Shanghai's waterways. The selected option on least cost grounds (outfall discharging to the Chang Jiang estuary) (para. 2.10) is about half the cost of other means of achieving a similar level of environmental improvement.

Average Incremental Cost

10. Table 16.3 shows the average incremental cost of the project at various discount rates. The table shows values for capital and incremental operating cost without and then with shadow prices reflecting differences between China's administered and estimated border prices.

Income Distribution and Affordability

11. Income distribution data for Shanghai was estimated from household surveys of income and expenditures conducted by the Shanghai Finance Bureau in 1983 and 1984. Table 16.4 shows the percentile distribution for these years and extrapolations from these for 1985-1987.

12. Families at the 25th percentile had about four persons per household in these surveys. On this basis, monthly household income at the 25th percentile would be about Y 400. It is estimated that water consumption will average about 106 l/c/d or 424 l/household/day. This amounts to about 12.7 m3/houshold/month. Sewerage will be billed at 90% of

water consumption. Monthly sewerage charges would amount to about Y 4.46 or about 1% of their 1987 monthly income if charges equal to the average incremental cost were to be charged. At the proposed tariff of Y 0.03/m3 which the Shanghai authorities plan to charge domestic consumers in 1989, the consumers would pay less than one-tenth of one percent of their monthly income.

CHINA

SHANGHAI SEWERAGE PROJECT

Table 16.1: Economic Rate of Return

YEAR	COSTS			BENEFITS					NET BENEFITS
	Capital Cost	O & M Cost	Total Cost	Property Value	Agric. Output	Treatment Cost	Water Supply	Total Benefits	
1987	46.39		46.39						-46.39
1988	248.96		248.96						-248.96
1989	416.39		416.39						-416.39
1990	343.62		343.62						-343.62
1991	184.18		184.18						-184.18
1992	54.36		54.36						-54.36
1993		25.00	25.00	-579.40	1.38	1.17	188.68	-388.17	-413.17
1994		25.17	25.17	-454.60	2.97	2.33	97.52	-351.78	-376.95
1995		25.36	25.36	-329.70	4.45	3.50	97.52	-224.23	-249.59
1996		25.52	25.52	-204.90	5.94	4.66	97.52	-96.78	-122.30
1997		25.69	25.69	501.00	7.42	5.83	97.52	611.77	586.08
1998		25.88	25.88	501.00	8.90	7.00	97.52	614.42	588.54
1999		26.05	26.05	501.00	10.39	8.16	97.52	617.07	591.02
2000		26.22	26.22	501.00	11.87	9.33	97.52	619.72	593.50
2001		26.22	26.22	501.00	13.36	10.49	97.52	622.37	596.15
2002		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2003		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2004		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2005		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2006		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2007		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2008		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2009		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2010		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2011		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2012		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2013		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2014		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2015		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2016		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2017		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2018		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2019		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2020		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2021		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2022		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2023		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2024		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2025		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2026		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2027		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2028		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2029		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2030		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2031		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80
2032		26.22	26.22	501.00	14.84	11.66	97.52	625.02	598.80

Economic Rate of Return 0.13

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SHANGHAI SEWERAGE PROJECT

Table 16.2: Least Cost Comparisons

	Option	Total Cost (Y million)
1.	Outfall Discharging to Chang Jiang Estuary	3,831
2.	Large Treatment Facility Discharging to Huangpu	7,176
3.	On-site treatment of Ind. Waste And Domestic Treatment	11,104
4.	On-site Treatment of Ind. Waste and Septic Tanks	8,009
5.	Non-construction measures relocating or closing ind.	9,920

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SHANGHAI SEWERAGE PROJECT

Table 16.3: Average Incremental Cost

Year	Capital Cost	O & M Cost	Total Cost	Total Cost(sp)	Total Flow million m3/year
1987	46.39		46.39	74.51	
1988	248.96		248.96	293.26	
1989	416.39		416.39	463.60	
1990	343.62		343.62	389.83	
1991	184.18		184.18	218.90	
1992	54.36		54.36	72.23	
1993		25.00	25.00	32.42	484.69
1994		25.17	25.17	32.64	487.97
1995		25.36	25.36	32.88	491.63
1996		25.52	25.52	33.10	495.37
1997		25.69	25.69	33.32	499.30
1998		25.88	25.88	33.56	503.31
1999		26.05	26.05	33.76	507.33
2000		26.22	26.22	34.00	511.00
2001		26.22	26.22	34.00	511.00
2002		26.22	26.22	34.00	511.00
2003		26.22	26.22	34.00	511.00
2004		26.22	26.22	34.00	511.00
2005		26.22	26.22	34.00	511.00
2006		26.22	26.22	34.00	511.00
2007		26.22	26.22	34.00	511.00
2008		26.22	26.22	34.00	511.00
2009		26.22	26.22	34.00	511.00
2010		26.22	26.22	34.00	511.00
2011		26.22	26.22	34.00	511.00
2012		26.22	26.22	34.00	511.00
2013		26.22	26.22	34.00	511.00
2014		26.22	26.22	34.00	511.00
2015		26.22	26.22	34.00	511.00
2016		26.22	26.22	34.00	511.00
2017		26.22	26.22	34.00	511.00
2018		26.22	26.22	34.00	511.00
2019		26.22	26.22	34.00	511.00
2020		26.22	26.22	34.00	511.00
2021		26.22	26.22	34.00	511.00
2022		26.22	26.22	34.00	511.00
2023		26.22	26.22	34.00	511.00
2024		26.22	26.22	34.00	511.00
2025		26.22	26.22	34.00	511.00
2026		26.22	26.22	34.00	511.00
2027		26.22	26.22	34.00	511.00
2028		26.22	26.22	34.00	511.00
2029		26.22	26.22	34.00	511.00
2030		26.22	26.22	34.00	511.00
2031		26.22	26.22	34.00	511.00
2032		26.22	26.22	34.00	511.00

Discoount Rate		10%	8%	9%	11%	12%
Net Present Value of Cost		1083.15	1193.69	1135.09	1036.58	994.41
Net Present Value of Flow		2774.63	3785.78	3227.75	2402.84	2094.82
Average Incremental Cost						
	Y/m3	0.39	0.32	0.35	0.43	0.47
	$/m3	0.11	0.08	0.09	0.12	0.13
NPV of Cost (sp)		1286.33	1421.77	1349.82	1229.64	1178.52
AIC (sp)	Y/m3	0.46	0.38	0.42	0.51	0.56
	$/m3	0.12	0.10	0.11	0.14	0.15

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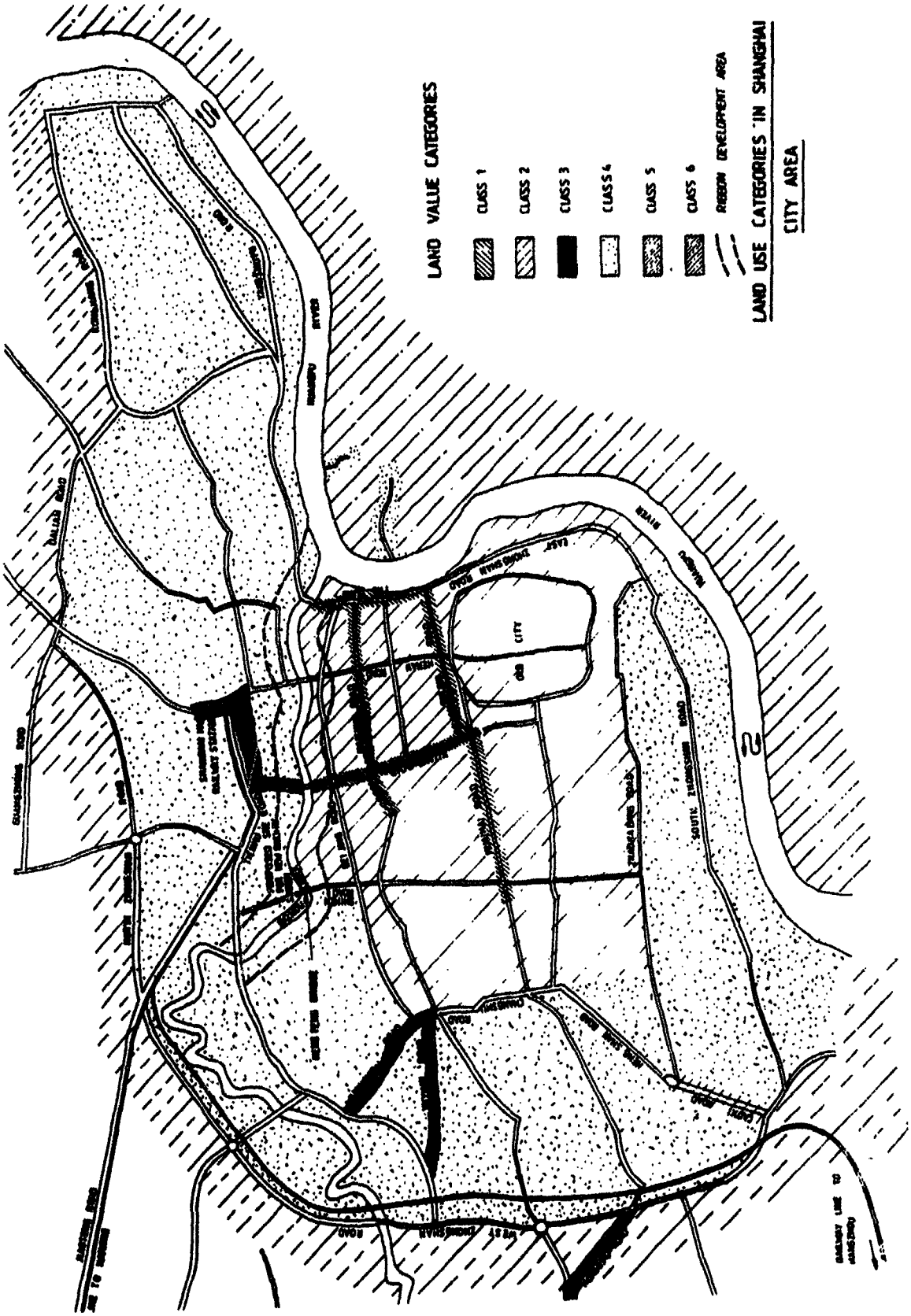
Table 16.4: Per Capita Income Distribution in Shanghai
(Y per month)

Year	Percentiles				
	25	37.2	50	71.2	Average
1983	43.50	48.00	52.70	60.00	53.40
1984	54.90	60.00	65.90	75.00	65.60
1985	69.30	75.00	82.40	93.80	80.50
1986	87.40	93.80	103.00	117.30	98.80
1987	100.30	107.30	117.30	134.20	112.30

FIGURE 16.1: LAND USE CATEGORIES IN SHANGHAI



CHINA

SHANGHAI SEWERAGE PROJECT

Tariff Study

Draft Terms of Reference

Background

1. The Shanghai Sewerage Company (SSC) of the Municipality of Shanghai is responsible for sewerage services in all areas within the city proper of the municipality. SSC is a self-accounting and self-funding enterprise established in _____ , and operating under Law ___ of ___ . It is managed along the lines of a public utility by a General Manager, supervised by a Board of Directors, and regulated under the Bureau of Municipal Engineering Administration (BMEA) of the Government of Shanghai Municipality (SM). The majority of SSC's present staff is recruited through a transfer of staff from the Municipal Engineering Administration Division (MDAD), and from a section of the Municipal Engineering Administration Division (MEAD), both divisions of BMEA. SSC's service area includes all ____ urban districts of SM.

2. SM has plans for major investments in wastewater collection and disposal to serve the approximately 7 million population and some 4,000 industries in the city area. For this purpose the Government of the People's Republic of China (GOC) is seeking financial assistance from the World Bank. Prior to the formation of SSC, no user sewerage charges were levied and sewerage services were funded entirely from SM budget allocations. SM has given approval for SSC to commence direct sewerage charges to industrial and commercial consumers commencing Januay 1988, and to domestic consumers commencing in 1989. The sewerage charges would apply to 90% of the water sold by SMWC. The present study is intended to examine more carefully charging methods, levels of sewerage charges and tariff structures, and to make appropriate proposals. It is also intended that the study would come up with a systematic method for computing such charges which can be replicated as and when required in the future.

Objectives of the Tariff Study

3. The objectives of the tariff study are to propose appropriate methods of charging and to design sewerage tariffs for SSC that would:

(a) allow SSC to achieve its financial objectives;

(b) reflect the economic cost of providing the services in order to encourage pollution abatement through water conservation, resource recovery, and better housekeeping practices among users; and

(c) take into consideration users' ability to pay.

Scope of Work

4. The main tasks of the study are expected to be, but not limited to, the following:

(a) gather and analyze all relevant data required for the study;

(b) review population estimates within the service area for the purpose of estimating demands;

(c) review water demand projections by the Shanghai Water Supply Company and other sources to arrive at reliable estimates for forecasting sewerage revenues, with such demand forecasts to be appropriately classified according to categories of consumers;

(d) review cost estimates and timing of SSC's capital investment program, and analyze operating costs according to main categories (personnel, power, materials, maintenance, others) to arrive at reliable forecasts;

(e) study different methods of charging for sewerage services, including direct charges, taxes, connection fees, surcharges, land use fees, etc., and propose appropriate method or methods of charging for SSC;

(f) Review potential benefits from increases in land values and agriculture production due to the project for cost recovery possibilities;

(g) prepare alternative feasible tariff proposals which should adequately reflect the economic (long-run incremental) cost of SSC's services;

(h) review financial projections (income statements, balance sheets, and cash flow statements) for SSC's operations using above tariff proposals up to 1995, showing the financial position of SSC under the various alternatives considered;

(i) fully document all assumptions and methodology used to facilitate future tariff reviews, and provide training to SSC Financial Department staff on how to carry out the work; and

(j) prepare draft submission to the Shanghai Municipal Government for approval to implement the proposed tariffs.

Important Points on Execution of the Study

5. The following background information is available:

(a) Shanghai Urban Studies Project - Liquid Waste Management Strategy Report; Management Report; Implementation Arrangement for Liquid Wastes Management Report; Engineering Design Report;

(b) Consultant advisory notes (CANs) produced by Australian consultants during the Shanghai Urban Studies financed by the Australian Development Assistance Bureau;

(c) Final Master Plan of Shanghai Sewerage Project;

(d) Work reports by the Project Preparation Team for the Shanghai Sewerage Project; and

(e) Staff Appraisal Report for the Shanghai Sewerage Project.

6. In reviewing projections for future demands in water supply and sewerage, account should be taken of the impact of urban and industrial development in Shanghai, the envisaged population growth, improvements in housing (both new construction and renewal), and rising standards of living. Projections of water demand, sewage flows, numbers of connections and population served should be made separately for each consumer category (industry, public services, commercial, domestic, etc.). These projections and the bases underlying the projections should be discussed and agreed with SM planning officials before proceeding with the study.

7. For estimating capital costs, use should be made of updated cost information on capital investments, including work under construction. Forecasts of operating costs should be made in consultation with SSC's management and operating staff.

8. Tariff proposals should adequately consider direct charges and levies to be borne by users, as well as charges to non-user beneficiaries. For industrial users, tariffs based both on volume and on effluent strength should be considered. In developing such tariffs, the trade-offs between what charges industries have to pay and the savings they can realize from a reduced degree of pretreatment should be thoroughly analyzed. Proposed tariffs should aim at providing satisfactory financial performance to SSC, and achieving good water pollution control results. In designing tariffs consideration should be given to ease of implementation, affordability of low-income families and cross-subsidy from other users with greater ability to pay. The study should also consider methods of charging users who obtain water from sources other than the Shanghai Water Supply Company.

9. The financial projections of SSC's operations to be produced using the proposed tariffs are the income and expenditure statement, balance sheet, and cash flow statement. The statements should show the funding required in each year to meet projected cash flow deficits, or the surplus available in each year to meet the investment needs of SSC as a whole. The documents should show clearly how the projections and estimates were arrived at, and the source and basis of all assumptions.

10. Tariff structure proposals should consider increasing block rates, with the lowest block consumption at a rate affordable by low-income users, and rates for higher consumption blocks set to encourage conservation.

Work Organization

11. The work would be carried out by a team of four Chinese professionals, working full-time, to be appointed by the BMEA Director General, and reporting to the Project Manager of the Project Implementation Unit (PIU). PIU would provide the necessary secretarial support. It is expected that the study would require about nine months to complete. Expertise in the team should include the following areas: (a) finance and accounting, (b) management specialist with tariff design experience, (c) water pollution control, and (d) economics. At least one member of the team should be a senior staff member of SSC.

12. The team will be assisted by one or two foreign consultants to be financed out of the proceeds of the World Bank loan/credit. Required qualifications of the consultants are:

(a) successful completion of a tariff study of similar scope and degree of complexity for a public utility;

(b) full familiarity with the economic and financial concepts underlying pricing of public services; and

(c) knowledge and familiarity with the administrative procedures of China and of SM would be useful. Previous work on China or knowledge of Chines would also be of value.

Study Reports

13. An inception report should be produced within two months after start of work. This report should include information on demand, capital and operating expenses, and other criteria to be used in the study. The report should be submitted to the SSC General Manager and the BMEA Director General for review with a copy to the World Bank. An interim report containing proposals for various tariff and charging alternatives together with a preliminary analysis of their financial, economic and environmental effects should be completed in three months after agreement is reached on the information contained in the inception report. This report should again be submitted to the SSC General Manager and the BMEA Director General with a copy to the World Bank for review. Remaining work on the study would be carried out taking into account suggestions from the review of the interim report, and a draft final report should be prepared within two months after receipt of the review suggestions. Sufficient copies of the draft final report should be submitted to the SSC General Manager to have the report circulated to the BMEA Director General, other relevant regulatory agencies of the Municipality and the World Bank for review. The SSC General Manager will be responsible for coordinating with the various agencies and the World Bank, and for preparing a summary of the views of all the parties concerned to be transmitted to the study team. The report should be finalized within two months after receipt of the summary of views.

14. The report should be completed by December 1, 1988 to enable SM and SSC to introduce the tariffs by June 30, 1989.

CHINA

SHANGHAI SEWERAGE PROJECT

Huangpu River Basin Management Study
Draft Terms of Reference

Background

1. The Huangpu River Basin is situated at the estuary delta of the Chang Jiang at the East China Sea. It is the downstream sub-basin of the Taihu Lake Drainage Design which encompasses 43 counties and cities with a total drainage area of about 36,500 sq km. The tributaries of the Huangpu River have headwaters in Jiangsu and Zhejiang provinces and drain about 70 to 80 percent of water from Taihu Lake to the East China Sea.

2. The Huangpu River Basin includes almost the whole of the administrative area of Shanghai. It is characterized by a network of waterways with more than 200 rivers, streams and lakes, all interconnected with each other. The total water surface covers (an area of about 600 sq km, 11.4 percent of the basin's total area. Water resources are supplemented with fresh water from rainfall, Taihu Lake and Chang Jiang, totaling 55,800 million m3 p.a. on average.

3. The topography of Huangpu River Basin is low and flat, and the river system is effected by the tide. The basin is often threatened by storm surge, tide, flooding, waterlogging, salinization and drought. The Municipal Government of Shanghai has constructed a primary system of water conservancy works to resolve the above mentioned problems and to meet irrigation needs.

Major Issues

4. While water demands in Shanghai can be met by the Huangpu River's water resources up to the turn of the century, the quality of the water is deteriorating rapidly with inappropriate wastewater disposal. Most of the major rivers in the basin are not suitable for potable purposes due to mercury and Phenol pollution. This situation is expected to worsen with growth in population and industrial and agricultural production, which require a increasing demand for water supply. The major issues identified are summarized below:

- Many institutions are involved in using water resources, but there is no central body with overall responsibility for resource management.
- No comprehensive master planning is carried out to provide the measures needed for efficient use and optimal management of water resources within the basin.
- Sufficient emphasis has not been made on water resource protection during the economic development.
- No proper consideration has been given to water resource protection in the planning of rural towns and industrial development.
- There is a lack of management and economic measures such as charging for use of water resources to encourage efficient utilization.

Study Objectives

5. The main objective of the study is to develop a strategy for the optimal management and efficient use of the Huangpu River's water resources within the framework of the entire Taihu drainage basin, by the application of administrative, economic and physical measures to be implemented through an appropriate institutional setup.

Study Approach and Main Tasks

6. The major emphasis of the study will be to improve management and institutional arrangements, and to identify administrative and economic measures to encourage the efficient use of water resources and avoidance of pollution. Detailed technical studies to prepare future physical measures identified during the proposed study can then follow. While the study will focus primarily on management strategy, a substantial technical component is required in order to prepare baseline studies of resources, uses, pollution and major hydraulic characteristics of the basin. The major tasks to be conducted in the study are as follows:

- definition of the study area, the natural environment, existing land use, population distribution and social and economic activities;
- identification of characteristics and functions of major rivers, quantitative and qualitative analysis of present water resources, evaluation of economic and environmental effects resulting from water resource utilization, defining the priority functions for major rivers and developing appropriate water quality standards and protection objectives;
- determination of point and non-point pollution loads from urban and rural areas, forecasting future spatial patterns of pollution loads, assessing existing practices in liquid waste control and water quality protection options;
- assessment of existing institutions directly and indirectly involved in water resource management;
- working out institutional arrangements for long-term water resource management, including establishing water resource management framework, co-ordinating body, responsibility and staffing requirements, financial sources etc.;
- analysis of current and potential laws, regulations, standards and plans which deal with water resource management; recommending strategic options and economic and administrative measures (pricing policies, penalties etc.) to optimize beneficial use of water resources;
- collection and assessment of local plans, suggestions, and assumptions dealing with water resource management of the basin;
- broad evaluation and comparison of developed options on the basis of social, economical and environmental-ecological effectiveness, and preparation of preferred strategy taking account of economic efficiency and environment protection;
- submission of proposed strategy and appropriate recommendations to Shanghai Municipality preparation of terms of reference and plan for further studies

Study Output

7. The main output of the study should be a strategy and action-option to make more efficient use of water resources, and to improve water quality up to appropriate standards to be approved by the State. The study output should include a series of reports for the major elements of the strategy such as;

- water quality protection and standards strategy
- water resource beneficial use strategy, and
- river basin institutional and management strategy

Technical Resources

8. A multi-disciplinary team with management and technical specialists would be needed to conduct the study. For this purpose, Shanghai Municipal Environmental Protection Bureau (EPB) has already carried out consultations with Shanghai Water Conservancy Bureau and other agencies concerned. It has been proposed to set up a study team through the Shanghai Municipality Government, but with all necessary liaison and consultations with relevant bodies in adjacent provinces. The preliminary assumption is that the study team would comprise technical personnel mainly from EPB, other bureaus and agencies concerned with water resource management, as well as from universities. The EPB would lead the study and provide overall co-ordination and would be responsible to a high level Municipal Government Steering Committee. Technical expert assistance by expatriate specialists on some specific aspects will also be necessary. A first estimate of the skills required for the study is given below;

Overseas specialists	Man/months	Visits
Water conservancy specialist- Water resource management (Designated as Project Manager)	4	2
Economist and organization specialist	4	2
Industrial/domestic waste specialist	4	2
Environmental/ecological specialist	4	2
Land use planner	1	1
Systems analyst	1	1
Total:	18	10

(The above total shows the expatriate specialists working in Shanghai, and does not include any overseas specialist support abroad. An additional 6 man/months will be required for inputs overseas giving a total of 24 man/months).

Local specialist	man/months
Project Manager	12
Water conservancy specialist (water resource management)	18
Economist and organization specialist	18
Urban planner	9
Industrial waste control specialist	18
Environmental/ecological specialist	18
Statistician	9
Laboratory analyst	12
Research assistants	18
Total:	132

Training

9. The study will also provide training to skilled personnel engaged in water resource planning and management through:

- on-the-job training
- lectures provided by local and overseas specialists, and
- overseas training for specific periods of time.

Equipment

10. The study will require the following equipment:

- One survey-minibus
- Survey equipment
- Computer hardware and software
- Photocopier
- Video-recorder and video-display equipment
- Books and technical information

Study Cost

11. Study costs based on man-months costs for expatriate consultants working in Shanghai and on costs of visits of Chinese overseas undertaken in 1985 have been estimated to be around 560,000 US Dollars, including fees, traveling expenses, accomodations, local and overseas training, equipment and contingencies. The cost breakdown is as follows:

	Amount US$
Lectures and seminars in Shanghai	10,000
Overseas training visits (allow 4 engineers/managers abroad for 4 weeks)	25,000
Equipment (see Sec. 8 above)	60,000
Local specialist fees	18,000
Office set up, administration, travel communications, support etc.	30,000
Expatriate fees and expenses	320,000
Contingencies @10%	47,000
Total:US$	560,000

CHINA

SHANGHAI SEWERAGE PROJECT

Management and Organization Study

Draft Terms of Reference

Background

1. The Shanghai Sewerage Company (SSC) of the Municipality of Shanghai is responsible for sewerage services in all areas within the city proper of the municipality. SSC is a self-accounting and self-funding enterprise established in _____ , and operating under Law ___ of ___ . It is managed along the lines of a public utility by a General Manager, supervised by a Board of Directors, and regulated under the Bureau of Municipal Engineering Administration (BMEA) of the Government of Shanghai Municipality (SM). The majority of SSC's present staff is recruited through a transfer of staff from the Municipal Engineering Administration Division (MDAD), and from a section of the Municipal Engineering Administration Division (MEAD), both divisions of BMEA. SSC's service area includes all ____ urban districts of SM.

2. Previously, wastewater from the city's urban districts was not subject to any treatment prior to disposal. This has resulted in severe pollution conditions in rivers running through and in the vicinity of the city, which are seriously affecting the living conditions of the people. SM is now taking appropriate measures to correct the situation. The plan for doing this includes the interception of wastewater from combined sewers in the City for disposal at the Changjiang estuary, and the construction of separate sewer systems with secondary treatment plants for new urban districts in fringe areas. SSC has been created for the purpose of managing the disposal of liquid wastes from the city's urban districts. It is foreseen that SSC's responsibilities will increase rapidly with mounting efforts of the city to clean up its environment. The objective of this study is to review the role, organization and staff of SSC, and to propose such changes as are necessary for SSC to carry out its work more effectively.

Scope of Work

3. The main tasks of this study are, but not necessarily limited to, the following:

A. Organization and Management

i. define SSC's present and future role in liquid waste management with due regard to the policies of SM, and determine expected growth in SSC's operations;

ii. define the main functions and geographical divisions and level of management talent required to head these functions, with due regard to the existing organizational structure;

iii. define the main procedures to be used for planning, decision making, project execution and flow of management information;

iv. design appropriate organization structure for SSC headquarters and for each SSC branch office and workshop, taking into account regulations and policies of SM concerning enterprise organization structures and staffing, and present arrangements, facilities and staff assignments;

v. prepare job descriptions and statement of objectives for all managerial positions down to Branch Office Manager level; and

vi. review existing regulations which govern the operations of SSC, identify areas which may affect the efficiency of SSC operations, and propose any necessary amendments.

B. Manpower, Staffing and Training

i. assess SSC's manpower requirements based on the proposed organizational structures and forecast of SSC's operational activities over the next ten years;

ii. assess gaps or excesses in staffing needs in terms of number, job classification, expertise and experience required (account should be taken of better utilization of existing staff together with associated training required);

iii. establish a recruitment plan in accordance with the build-up of SSC's operations;

iv. review existing staff recruiting practices and make proposals for improvement; and

v. assess training needs, review training proposals included in the project and prepare supplemental training proposals if necessary, such proposals to include possible in-house training, training at appropriate training institutions at home and abroad, and on-the-job training.

C. Personnel Policies and Procedures

i. review existing personnel policies, including salary structure, position classification, staff performance review procedures, bonus systems and other incentive methods and procedures, and propose appropriate improvements giving due regard to the laws and regulations governing employment in China; and

ii. review and propose improvements to procedures for maintaining personnel records;

D. Administrative Procedures

i. develop internal administrative procedures for liaison between SSC headquarters and operational units;

ii. develop administrative procedures for communications, transport, inventory control, procurement, security and other matters related to operations; and

iii. review arrangements with the Shanghai Water Supply Company for billing and collection of sewerage charges, and propose any necessary improvement measures.

E. Reporting Systems

i. develop management information systems to include reporting formats, type of reports, periodicity, timing and responsibility for preparation and report distribution.

Work Organization

4. The work would be carried out by a team of about six Chinese professionals (full-time) to be appointed by the Director of BMEA, and reporting to the Manager of the Shanghai Sewerage Project Construction Company (SSPCC). Expertise in the team should include the following areas: (a) management science, (b) organization design, and (c) institutional and labor law. At least two members of the team should be senior st ff members of SSC. Secretarial and other logistical support will be provided by the SSPCC under the project.

5. The team will be assisted by a foreign consultant or consultants to be financed out of the proceeds of the World Bank loan/credit. Required qualifications of the consultants are given below:

(a) past major participation in a management and organization study of similar scope and complexity for a public utility, with proposals successfully implemented;

(b) some familiarity with customs and practices in China;

(c) familiarity with Chinese labor and Government administrative regulations would be considered an additional asset.

Study Reports

6. A work plan for the study should be prepared by the team within one month of its formation, outlining details of the work to be carried out, and persons responsible for carrying out the work. The work plan is to be submitted to the BMEA Director General and the World Bank for review. Upon approval of the plan by the BMEA Director General, the work can commence. The time for conducting the study is estimated to be about 12 months, including time for review by various concerned parties. An interim report containing initial findings of the team, and any major issues which may require changes in the work plan or in the study objectives, should be

prepared three months after work commencement, and submitted to the BMEA Director General for review. A copy of this report should also be submitted to the Bank. Comments on the interim report and decisions on any major issues are expected to be communicated to the team in about three weeks. The draft final report of the study, which should address essentially all the matters contained in these terms of reference, allowing for any agreed changes proposed in the interim report, should be completed four months after approval of the interim report. Sufficient copies of this draft report should be made for submission to the BMEA Director General to be distributed for review by the various concerned departments of the Shanghai Municipal Government and the World Bank. BMEA would be responsible for coordination of the views of the various parties, and for the consolidation and transmittal of these views to the study team. The study report should be revised taking into account the official comments received from the BMEA Director General, and finalized within four weeks of receipt of such comments.

CHINA

SHANGHAI SEWERAGE PROJECT

Study on Rehabilitation of Existing Sewer System

Draft Terms of Reference

Background

1. The Shanghai Sewerage Company (SSC) of Shanghai Municipality (SM) is responsible for sewerage services in all urban areas of the municipality. SSC is a self-accounting and self-funding enterprise to be established in _____ , and operating under Law ____ of ____ . It is managed along the lines of a public utility by a General Manager, supervised by a board of Directors, and regulated under the Bureau of Municipal Engineering Administration (BMEA) of the Government of Shanghai Municipality (SM). Before the establishment of SSC, two divisions of BMEA were responsible for sewerage services in Shanghai: the Municipal Drainage Administration Division (MDAD) for operation and maintenance of pumping stations and treatment plants, and a section of the Municipal Engineering Administration Division (MEAD) for the city's sanitary and combined sewers, both under BMEA. The majority of SSC's present staff have been transferred from these divisions. SSC's service area includes all urban areas of SM.

2. Shanghai has both a combined sewer system and separate sewer systems with treatment plants. Some of the City's sewers in the area of the previous concession zones were constructed over 40 years ago, and are still in use. Many sections of these sewers have been reconstructed since 1949, and new sewers have been added. About 25% of population of the City are presently served by the Western and the Southern interceptors, and by separate sewer systems. Another 30% would be served by the project when it comes into service in 1993.

Objectives of the Study

3. The proposed study is intended to take inventory of the existing sewerage systems in the Shanghai Metropolitan Region (SMR), assess the physical condition of their components, and to make appropriate proposals for rehabilitation. The study would also provide cost estimates for needed repairs and replacements.

Scope of Work

4. The main tasks of this study are, but not limited to, the following:

(a) collect and analyze all relevant data required for the study, including the following:
   i. Sewers
      - Diameter
      - Length
      - Gradient

- Material
- Age
- Value (asset value or estimated)
- Condition (in good condition, poor condition but repairable, or unusable)

ii. Pumping stations
- Pumps (capacity, age, value, etc.)
- Motors (capacity, age, value, etc.)
- Other main facilities like buildings (age, value, etc.)

iii. Treatment plants
- Main facilities (capacity, age, value, etc.)
- Other main facilities like buildings (age, value, etc.)

(b) make reasonable estimates for the above, if data required are not available;

(c) prepare comprehensive maps and drawings for showing these data;

(d) make appropriate proposals for rehabilitating the existing system and estimate the costs required, in particular sewers constructed by pipe-jacking methods;

(e) propose measures to achieve integrated operation of the existing and new systems, and estimate the costs required for carrying out these measures;

(f) fully document all assumptions in the methodology used, to facilitate further reviews by SSC Planning Department staff and to develop the system in the future;

(g) prepare a draft submission of the proposed rehabilitation works for SSC's approval.

The study should be conducted for all catchments in urban areas of SM.

Work Organization

5. The work should be carried out by a team of 6 Chinese professionals, working full-time, to be appointed by the Director General of BMEA, and reporting to the Manager of the Shanghai Sewerage Project Construction Company (SSPCC). SSPCC would provide necessary support such as secretaries and technicians for preparing maps and drawings. Expertise in the team should include senior staffs of MDAD, MEAD and SSC.

6. The team will be assisted by a foreign consultant or consultants to be financed out of the proceeds of the World Bank loan/credit. Required qualifications of the consultants are the following:

(a) successful completion of a renovation study of similar scope and degree of complexity;

(b) full knowledge of sanitation and sewerage technology; and

(c) familiarity with the historical background and present administration of SM would be useful. Previous work on China would be desirable.

Study Reports

7. A work plan for the study should be prepared by the team within two months of its formation, outlining details of the work to be carried out, and persons responsible for carrying out the work. The work plan should be submitted to the Director General of BMEA and the World Bank for review. Upon approval of the work plan by the Director General of BMEA and the World Bank, the study can be started. The total time required for the study is estimated to be nine months. An interim report with maps and drawings containing an overview of the existing combined sewer system should be prepared within three months after start of work, and submitted to the Director General of BMEA and the World Bank for review. Remaining work on the study would be carried out taking into account suggestions from the review of the interim report, and a draft final report should be prepared within six months after receipt of the review suggestions. Sufficient copies of the draft final report should be submitted to the SSC Director General, who would arrange to have the report circulated to the BMEA Director General, other relevant agencies of the Municipality and the World Bank for review. The study report should be revised taking into account the official comments received from the BMEA Director General, and finalized within one month of receipt of such comments.

8. The report should be completed by March 1988.

CHINA

SHANGHAI SEWERAGE PROJECT

Proposed Training Program

Training and Management Development Strategy

1. The proposed training and management development strategy aims to utilise local training facilities and resources to the fullest, whilst recognising that some overseas training and involvement of foreign specialists will be required. Training will be for all staff levels from operators to senior management. Local training facilities in Shanghai and other cities in China will be utilised to the extent possible. Overseas training will mainly involve training Chinese trainers at overseas institutions. Upon their return to China, these trainers would become largely responsible for conducting the staff training program. Management development programs will be centered around improving the talents and capabilities of senior managers and will include project work, self-development activities, seminars, overseas visits and secondments.

2. The training strategy will concentrate heavily on increasing the awareness of Chinese trainers in modern training techniques. Primarily it will bring to the attention of experienced Chinese trainers, courses available overseas which, after modification, can be applied for the use of the new sewerage company. Another main feature of the strategy involves 'bringing' suitable courses and programs to China to be run by Chinese trainers. This approach would ensure that foreign training inputs would be minimised and be focused on introducing training techniques rather than actual job training. It will be necessary to allow for some time to be spent by foreign trainers in advising Chinese trainers and on establishing and setting into motion the chosen courses in Shanghai.

3. Foreign consultant advisory input would be to assist in.

(a) assessing training and management development needs;

(b) identifying all suitable sources of training; i.e. cost-effective and relevant sources;

(c) drafting of tender documents or terms of reference for the supply of training services; and

(d) evaluating proposals from training services institutes and agencies.

Local Training Facilities

4. Multi-level training facilities already exist in China. At the operator and trades level, two training schools already exist within the Bureau of Municipal Engineering Administration (BMEA). These are: (a) the Sewerage Administration Department (SAD) Training School which conducts short courses on the operation of sewage treatment works and pumping

stations, with approximately 200 employees of SAD attending each year; and (b) the BMEA Construction Training School which covers a full spectrum of construction activities carried out by the BMEA, including roads, sewerage and water supply.

5. The Tong Ji University is the principal technical university in Shanghai, and offers degree courses in civil and electrical engineering and environmental science. This University also runs specialised short courses relating to these fields. Accountancy courses are offered at the Li Xin Special Technical School whilst degree courses in economics and finance are provided at the Shanghai Finance College. A computer training school has recently been established at the Baoshan Steel Works, which, apart from serving the company, will also be offering courses to outside organisations. The China Management Training Center at Dalian (Liaoning Province), which was established approximately 4 years ago, provides intensive courses for senior managers.

6. The capabilities of these and other training institutions and the scope and contents of this training program will be reviewed in the managemment and organization study to be conducted under the project. The review will include an investigation into the content, standard and applicability of courses offered by these training institutions, as well as the resources and equipment available.

Training and Management Development Levels

7. The overall training plan envisages training activities at four basic staff levels:

(a) operator level for plant operators, assistants, and unskilled workers in the operation and maintenance of technical components of the sewerage system;

(b) sub-professional training for engineering and scientific technicians and other sub-professional staff, accounts clerks, personnel assistants;

(c) training of professionals - managers, engineers and accountants; and

(d) management development programme for senior management team.

Operator and Maintenance Personnel Training

8. This training will be provided in Shanghai at existing training facilities. Consideration will also be given to forming a new Training Center in the SSC. Existing equipment and resources presently available in the SAD Training School could be transferred to this new center. In addition to general operations and maintenance training, it is anticipated that training in the basic operation and maintenance of new plant and equipment will be provided by the manufacturers and/or contractors at the time of commissioning of the Stage 1 facilities. This requirement will be stipulated in the contract documents for those works. Consideration will also be given to involving maintenance personnel during the installation and

commissioning processes for plant and equipment of the Stage 1 Project.

9. The topics to be covered in operator training include, but are not necessarily limited to, the following:

(a) sewer maintenance to include: inspection procedures; entrance and safety procedures; cleaning techniques including flushing and grit removal; repairs and maintenance procedures including trench safety; operating procedures;

(b) sewage treatment to include: basic chemistry and microbiology of wastewater; basic laboratory and 'in-situ' testing procedures for wastewater; basic concepts of physical and chemical treatment; basic concepts of biological treatment; treatments works operation procedures covering general procedures, process control and specific mechanical equipment (e.g. drum screens, screenings dewatering equipment); basic concepts of planned maintenance; safety procedures; control and fault finding principles; administration and record keeping;

(c) pump stations to include: installation, operation, care and maintenance of pumps; pumping principles and basic hydraulics; ancillary equipment installation, maintenance and routine testing; operational procedures; safety at work; maintenance procedures; control and fault finding including emergency procedures; administration and record keeping.

10. While operator training courses are already offered in Shanghai, it is necessary to review the contents of these courses to see if they can fulfill the needs of SSC. It may be necessary to incorporate new training techniques and training materials used overseas and, possibly, the addition of overseas courses and training equipment.

Sub-Professional Training

11. Topics to be covered in this area comprise:

(a) training for engineering and scientific technicians on: general principles and objectives of sewage collection, treatment and disposal; special skills, e.g. laboratory techniques, use of specific computer models; report and letter writing techniques; programming and scheduling techniques (e.g. planned maintenance, routine monitoring);

(b) training for accounts clerks on: basic bookeeping principles; basic accounting concepts and office management procedures for control of source documents such as invoices and accounts payable; payroll management; use of computers for processing accounts;

(c) training on Materials Management for storekeepers and store clerks on: stock control procedures; stocktaking techniques; use of computers in stock control and management;

(d) training for administration personnel on: library maintenance

procedures; personnel record maintenance; security training for guards.

12. Courses are available for several of these topics at local training institutes and these courses can be augmented by the introduction of training techniques and topics not covered locally or requiring upgrading, using Chinese trainers.

Professional Training

13. Training of engineers, scientists (chemists, biologists, environmental scientists etc.), accountants, and other professionals will will include technical as well as managerial topics. Management training courses focusing on the specific management needs of SSC should be developed and established in Shanghai using models of such courses held abroad. Overseas visits to observe practices in other countries woould also be arranged for senior managers.

14. Training topics would include:

(a) management training on: decision making, accountability, and delegation power; organisational behaviour; organisational theory; motivation and development of staff; planning; financial management;

(b) specialist training on: use of computer techniques in specific professional fields; specific up-to-date techniques in engineering and scientific fields.

Management Development for Senior Management

15. The Senior Management Development Program is intended to prepare senior managers, identified as candidates for top positions in the SSC, for the expanded managerial roles required. Integration of technical and financial management responsibilities at the top level will be the focal point for training in this program. The program will include visits to other cities in China and abroad, attendance at seminars, project work and courses in Shanghai and at the China Management Training Centre at Dalian. Trainees will be given an exposure to performance-oriented management styles, up-to-date management planning and control techniques and performance monitoring systems. Project work will demonstrate how management techniques such as "performance budgeting", and "management by target control" can be applied within the trainee's environment.

Training for Shanghai Sewerage Project Construction Company (SSPCC) Staff

16. SSPCC training includes intensive local and overseas management courses for senior management personnel. Another main area of SSPCC training is in contract law which covers contract programming and administration, arbitration, and other related subjects. These skills have to be acquired overseas. It is envisaged that initially two persons (Contracts and Site Supervision Manager and Training Engineer) would undertake a specialised "live-in" course overseas on these subjects and that a foreign specialist would present courses in China with the assistance of

the Training Engineer at a later date. To increase the pool of staff with managerial capability, supernumerary personnel could be appointed in the early stages of the project to gain this skill by working alongside experienced managers.

Cost Estimates

17. The total cost of training and management development over the project period (1987 to 1992) is estimated to be Y 6.03 million (US$ 1.63 million) of which Y 0.62 million (US$ 0.17 million) is for the training of SSPCC personnel (Table 1), and Y 5.41 million (US$ 1.46 million) for SSC personnel (Table 2). Training and laboratory equipment amounting to Y 2.30 million (US$ 0.62 million) is listed in Table 3.

TABLE 1: ESTIMATED COST OF TRAINING FOR SHANGHAI SEWERAGE PROJECT CONSTRUCTION COMPANY STAFF

Item	Description of Training	Quantity	Unit	Rate RMB (Thous)	Amount (Thousands) Total Rmb	Total US$	Local Rmb	Local US$	Foreign Rmb	Foreign US$
1	Management Training at overseas management training institutions									
	. Return airfares and expenses	3	No.	12.4	37	10			37	10
	. Accommodation and per diem allowance	3	Months	16.1	48	13			48	13
	. Training programme	30	Days	2.8	85	23			85	23
2	Management Training at Chinese management training institutions									
	. Training program - 4 year course	8	Persons	11.5	92	25	92	25		
3	Training for Engineers and others involved in Contract preparation, negotiation, administration and site supervision including contractual law, arbitration, procedures, etc.									
	. Intensive overseas courses for Section Manager (Contract Management and Site Supervision) and 1 Training Engineer									
	- Return airfares and expenses	2	No.	13	26	7			26	7
	- Coursework ("live in") at recognised overseas institution	2	No.	31.5	63	17			63	17
	- per diem allowance	6	Months	3.7	22	6			22	6
	. Engagement of foreign Contract training specialist who will conduct (with the assistance of the Chinese Training Engineer above) intensive courses in Shanghai for Engineers and others who will be involved in Contracts									
	- Fees	3	Months	37.1	111	30			111	30
	- Return airfares and expenses	1	No.	11	11	3			11	3
	- Accommodation and per diem allowance	3	Months	9.9	30	8			30	8
	- Coursework material and aids		Lump Sum		11	3			11	3
4	Computer operation and programming training courses in China for approx. 60 persons 6 months duration									
	. Lectures and coursework material	60	Persons	0.7	42	11	42	11		
5	Financial Management & Accounting coursesin China for approx. 60 persons 6 months duration									
	. Lectures and coursework material	60	Persons	0.7	42	11	42	11		
	Total				620	167	176	47	444	120

Notes:

1. The costs given in this table are preliminary only and training needs are subject to further detailed investigation. The costs will be incurred over the period of project implementation (1987 - 1991).

2. The costs do not include the cost of supernumery employees to be attached to and to work alongside experienced managers to obtain experience (Paragraph 4.5).

3. Exchange rate : 3.71 Rmb Y = 1.00 US$.

TABLE 2: ESTIMATED COST OF TRAINING AND MANAGEMENT DEVELOPMENT FOR SHANGHAI SEWERAGE COMPANY

Item	Description of Training	Quantity	Unit	Rate RMB (Thous)	Amount (Thousands) Total RMB	Total US$	Local RMB	Local US$	Foreign RMB	Foreign US$
1	Professional/Sub-Professional cadetships at									
	. University (4 year course)	20	persons	26	520	140	520	140		
	. College (3 year course)	42	persons	7.5	315	85	315	85		
2	Intensive short-courses for Trades/ Administrative personnel at College or Tech School in China	136	persons	5.0	680	183	680	183		
3	Operator training courses in Shanghai	200	persons	1.0	200	54	200	54		
4	Training of Chinese Trainers at overseas training institutions									
	. Return airfares and expenses	4	No.	12	48	13			48	13
	. Accommodation and per diem allowance	6	Months	16.1	96	26			96	26
	. Training and development programme -technical, operations, maintenance	30	Days	1.9	56	15			56	15
	- Management training and development	30	Days	1.9	56	15			56	15
	- Finance and budgetary control	30	Days	1.9	56	15			56	15
	. Training aids, coursework material, references to be brought back to China	3	Sets	39.6	119	32			119	32
	. Administration and Co-ordination in overseas country where courses are being conducted	6	Months	6.2	37	10			37	10
5	Foreign Specialist advice on and assistance in the implementation of training and management development courses in Shanghai									
	. Fees - Technical specialist (1)	1.5	Months	37.1	56	15			56	15
	- Management specialist (1)	1.5	Months	37.1	56	15			56	15
	- Finance and budget specialist (1)	1.5	Months	37.1	56	15			56	15
	- Management development adviser	4	Months	37.1	148	40			148	40
	. Return airfares and expenses	5	No.	12.4	62	17			62	17
	. Accommodation and per diem allowance	5.7	Months	9.1	52	14			52	14
6	Training and laboratory equipment for Sewerage Authority (see Table 4.3)		Lump Sum		2302	620	1093	295	1209	326
7	Management Development Programme for 10 most senior managers including project work, self-development activities, seminars, overseas visits and secondments									
	. Return airfares and expenses for Chinese managers going overseas	10	No.	12.2	122	33			122	33
	. Accommodation and per diem allowance for Chinese managers whilst overseas	10	Months	16.0	160	43			160	43
	. Materials, references, miscellaneous expenses		Lump Sum		37	10			37	10
8	Management Training in China for managers at all levels									
	. Training programme	15	Persons	11.5	173	46	173	46		
	Total				5407	1456	2981	803	2426	654

Notes:

1. The costs given in this table are preliminary only and training and management development needs are subject fo further detailed investigation. The costs will be incurred over the period 1987 to 1991.

2. Exchange rate : 3.71 Rmb Y = 1.00 US$.

TABLE 3: ESTIMATED COST OF TRAINING AND LABORATORY EQUIPMENT FOR SHANGHAI SEWERAGE COMPANY

Item	Description	Quantity	Unit	Rate RMB (Thous)	Amount (Thousands) Total RMB	Total US$	Local RMB	Local US$	Foreign RMB	Foreign US$
1	Water and wastewater analysis equipment - general	2	Sets	106.5	213	57	213	57		
2	Electrical maintenance and testing training equipment	1	Set	58	58	16	58	16		
3	Mechanical maintenance and testing training equipment	2	Set	11	22	6	22	6		
4	Audio/visual training equipment	1	Set	200	200	54	200	54		
5	Computer PC including screen, keyboard, printer	10	No.	20	200	54	200	54		
6	Atomic absorption spectrophotometer	1	No.	371	371	100			371	100
7	Gas chromatograph	1	No.	371	371	100			371	100
8	Electronic balance and associated equipment	4	No.	3.7	15	4			15	4
9	Stereo microscope	4	No.	7.5	30	8			30	8
10	Infrared colorimeter	1	No.	45	45	12			45	12
11	Ultra-violet spectrophotometer	1	No.	7	7	2			7	2
12	Miscellaneous training and lab. equipment		Lump Sum		770	212	400	108	370	100
	Total				2302	621	1093	295	1209	326

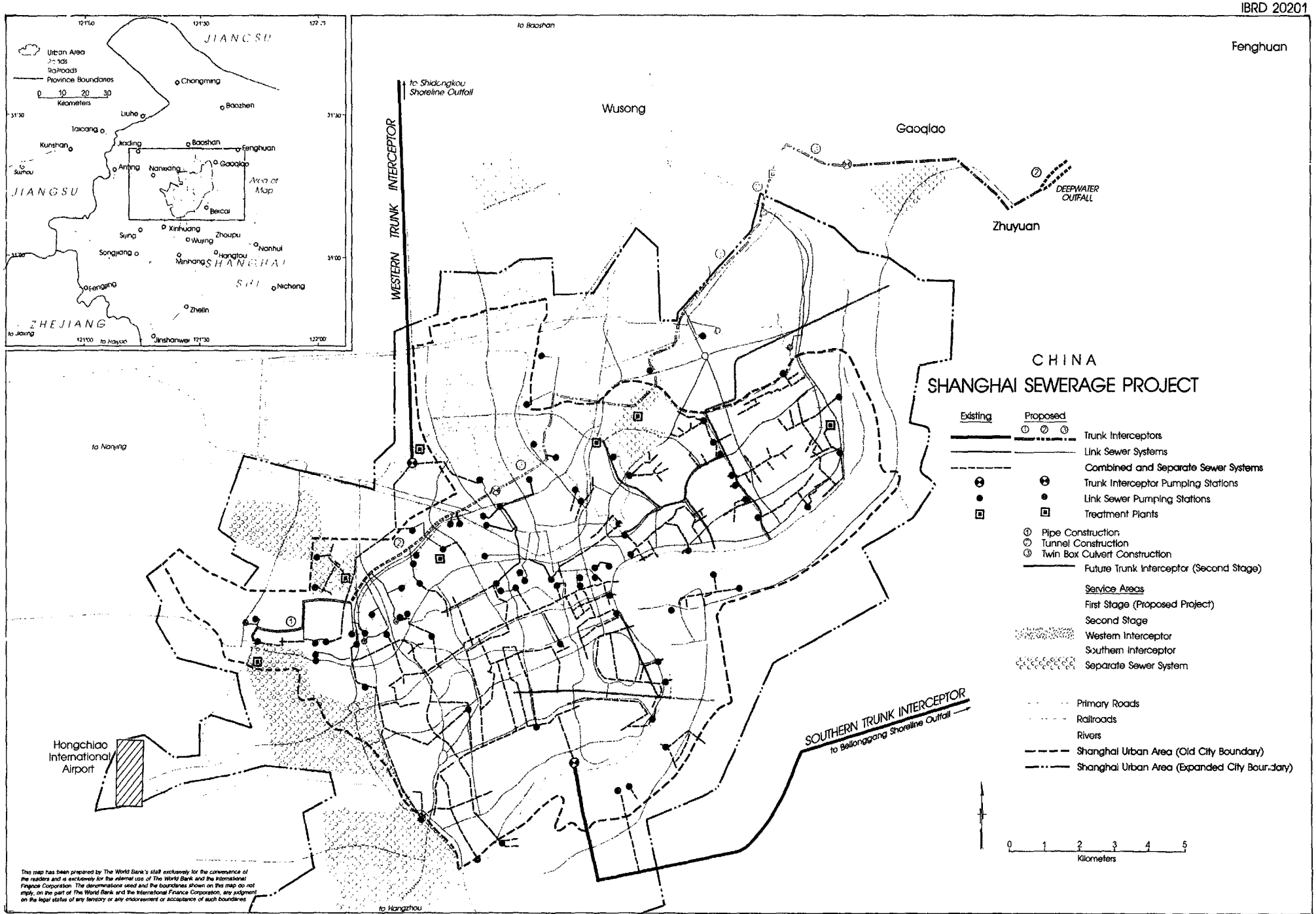
Note : Exchange rate : 3.71 Rmb Y = 1.00 US$.

CHINA

SHANGHAI SEWERAGE PROJECT

Selected Documents and Data available in Project File

Item No.	Description
1.	China: Long-Term Issues and Options; World Bank Report No. 5206-CHA, May 1985.
2.	Economic and Social Development in Shanghai by Municipal Statistical Bureau of Shanghai, 1985.
3.	Shanghai Sector Memorandum (Urban); World Bank Report No. 4227-CHA, December 1982.
4.	Shanghai Urban Studies Project - Liquid Waste Management Strategy Report by Maunsell & Partners Pty Ltd, Pak-Poy & Kneebone Pty Ltd, Binnie & Partners Pty Ltd, R.J. Nairn & Partners Pty Ltd, Coopers & Lybrand.
5.	Shanghai Combined Sewerage Implementation Project - Preliminary Design, Report and Drawings by Shanghai Municipal Engineering Design Institute, Shanghai Tunnel Engineering Design Institute and Design Institute of Shanghai Municipal Engineerring Bureau, August 1986.
6.	Shanghai Combined Sewerage Implementation Project - Management Report by Shanghai Municipal Engineering Adminstration Bureau and Binnie & Partners Pty Ltd, August 1986.
7.	Water Pollution Prevention and Treatment Law - People's Republic of China, May 11, 1984.
8.	Procedures for Pollution Charges and Fines - Shanghai Municipality, May 1984.
9.	Provisional Regulations on Registration and Control of Corporations - State Council, People's Republic of China, August 14, 1985.
10.	Guidelines for the Management of Land Acquisition for Capital Construction in Shanghai - Shanghai Government, October 20, 1980.


CHINA
SHANGHAI SEWERAGE PROJECT
Existing
Proposed
Trunk Interceptors
Link Sewer Systems
Combined and Separate Sewer Systems
Trunk Interceptor Pumping Stations
Link Sewer Pumping Stations
Treatment Plants
① Pipe Construction
② Tunnel Construction
③ Twin Box Culvert Construction
Future Trunk Interceptor (Second Stage)
Service Areas
First Stage (Proposed Project)
Second Stage
Western Interceptor
Southern Interceptor
Separate Sewer System
Primary Roads
Railroads
Rivers
Shanghai Urban Area (Old City Boundary)
Shanghai Urban Area (Expanded City Boundary)
0 1 2 3 4 5
Kilometers
Fenghuan
Wusong
Gaoqiao
Zhuyuan
DEEPWATER OUTFALL
WESTERN TRUNK INTERCEPTOR
to Shidongkou Shoreline Outfall
SOUTHERN TRUNK INTERCEPTOR
to Beilonggang Shoreline Outfall
Hongchiao International Airport
to Baoshan
to Nanjing
to Hangzhou
JIANGSU
ZHEJIANG
SHANGHAI
Urban Area
Rivers
Railroads
Province Boundaries
Kilometers
Changming
Baozhen
Liuhe
Taicang
Kunshan
Jiading
Baoshan
Fenghuan
Anting
Nanxiang
Gaoqiao
Area of Map
Bercai
Xinhuang
Sijing
Wujing
Zhoupu
Nanhui
Songjiang
Minhang
Hangtou
Fengjing
Nicheng
Zhelin
Jinshanwei
to Jiaxing
to Haiyan
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