Report No. 748

CONFIDENTIAL

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT PERFORMANCE AUDIT REPORT

on

SINGAPORE SECOND WATER SUPPLY PROJECT

(Loan 503-SI, Part II)

May 22, 1975

Operations Evaluation Department

Public Disclosure Authorized

PREFACE

This report covers a performance audit of Part II of the Bank's Loan 503-SI of July 1967 to the Public Utilities Board (PUB) of Singapore for expansion of island water supply facilities, on which disbursements terminated in June 1973. Part I of the same loan was devoted to expansion of the PUB's power distribution system and is covered, with another power distribution project, in a separate performance audit report.

The report is based principally on review of the Bank's relevant files and documents, including a Project Completion Report prepared by the East Asia and Pacific Regional Office in mid-1974, and a visit to Singapore in November 1974.

The assistance provided by the Singapore authorities, and particularly by the PUB, is gratefully acknowledged.

Measures and Equivalents

m^3 = cubic meter
m^3d = cubic meters per day
m^3dc = cubic meters per day per capita
Imgd = million Imperial gallons per day (1 Imgd = 4,546 m^3d)

Approximate Currency Equivalents (Singapore Dollar)

Original:	US$1.00 =	S$ 3.00
Final:	US$1.00 =	S$ 2.40

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PROJECT PERFORMANCE AUDIT

SINGAPORE SECOND WATER SUPPLY PROJECT

PROJECT BASIC DATA - LOAN 503-SI/PART II

Borrower:	Public Utilities Board, Singapore (PUB)
Loan Amount:	US$ 8 million 1/
Amount Disbursed:	US$ 8 million 1/
Date of Loan:	July 5, 1967
Effective Date:	July 26, 1967
Closing Date - Original:	March 31, 1972
- Final:	June 30, 1973
Terms of Loan:	20 years, 5 years grace period. Interest rate 6% p. a.
Fiscal Year:	January 1 to December 31.
Appraisal Report:	TO-588a; May 29, 1967.
Supervision Missions:	November 1968 August 1969 November 1969 December 1970 November 1971 May 1972 February 1973
Project Completion Report:	July 11, 1974
Project Completion Date:	
Forecast -	December 1970
Actual -	November 1973
Total Project Cost 2/:	
Forecast -	S$ 45.05 million
Actual -	S$ 54.15 million

1/ including US$ 1.1 million interest during construction.
2/ excluding US$ 1.1 million interest during construction.

SUMMARY

Loan 503-SI/Part II (Part I was for a Power project) of US$ 8 million was made in 1967, the 4th IBRD loan to Singapore's Public Utilities Board (PUB). It was to finance part of a water supply project of a total estimated cost of US$ 15 million comprising construction of the Seletar Reservoir, the expansion of the Woodleigh water treatment plant, and the expansion of Singapore's water distribution mains. The prime objective of Seletar Reservoir was to increase the island's water reserves by 20 million m^3, and a secondary objective was to add about 68,000 m^3d to Singapore's combined reliable dry weather yield. The Loan was signed and became effective in July 1967, and was closed more than one year behind schedule on June 30, 1973.

The project was completed some 3 years behind schedule, due mainly to substantial revisions and additions to the distribution expansion plans which followed the PUB's water distribution system review and study undertaken under a previous loan to PUB and completed in 1969. The Seletar Reservoir, completed on schedule, is 20% larger than expected. Its secondary objective has been achieved by two-thirds only, primarily because yields from eight supplementary streams made tributary and pumped to Seletar Reservoir have been half of those predicted by the project consultants. High silt content and pollution of the supplementary streams have made operations somewhat difficult, but the costs of these works were sufficiently low relative to actual useable water yield that the Investments still seem to have been worthwhile overall. Water treatment has been efficient, and quality of treated water continuously excellent. Installation of second stage pumps in Woodleigh treatment plant was required to bring the plant's peak capacity closer to forecasts. Expansion of the distribution mains system was 75% larger than appraisal estimates. Project total cost was 20% higher than forecast; a 37% increase in local costs was due to the larger distribution works. Average unit cost per km of mains laid was 17% lower than estimate.

Despite delay of project completion, all demand was met satisfactorily with supply coming principally from water sources located in Malaysia. Demand for water levelled off, after a dry year in 1971, due mainly to an efficient "Save Water" campaign. Distribution losses were reduced to commendably low levels, and technical operations have improved. The number of customers increased by 60% over 1967-1973. To further curb water demand growth, PUB introduced on its own in early 1973 new water tariffs with increasing block rates based on marginal capital costs. Financial performance of PUB overall and its Water Department has been outstanding, with rates of return averaging about 10% p.a. in 1967-1972 and reaching 16% in 1973. The Water Department was reorganized in 1972 and its shortage of technical staff overcome; it has been well run and efficient. PUB's management has continued to strengthen.

Aside from its significant financial contribution, the Bank's recommendation (made under an earlier Loan) for review and long-range planning of the distribution system and its advice on project content and operation were quite useful and beneficial to PUB Water Department development. As regards the supplementary streams it would have been helpful had the Bank advised the planning consultants to give more emphasis in their studies to outside factors, and other simultaneous developments, which could affect the quality of flow in the different streams.

PERFORMANCE AUDIT OF

SINGAPORE SECOND WATER PROJECT

Introduction

1.01 - The Public Utilities Board, Singapore (PUB) in an autonomous public corporation, established in May 1963, solely responsible for the water, electricity and gas utilities of Singapore. It is a single financial entity, but it is required to keep separate accounts for its Water, Electricity and Gas Departments.

1.02 - The PUB received five loans from the Bank totalling US$ 74.2 million, of which US$ 14.8 million financed water supply and distribution expansion, as shown below:

Loan No.	Date of Agreement	Amount[a/] (US$ mln)	Project Scope	Final Closing Date
337-SI	5/63	14.4	Generation (2x60MW)	12/67
405-MA	2/65	6.8	Johore River Water Project	6/69
473-SI	11/66	9.5	Generation (2x60MW)	6/68
503-SI Part 1	7/67	15.0	1967-68 Power Distribution	12/71
Part II	7/67	8.0	Seletar Reservoir, "	6/73
595-SI	4/69	20.5	1969-71 Power Distribution	4/73
Total		74.2		

a/ After cancellation of US$ 0.6 and 0.5 million in Loans 337-SI and 473-SI.

1.03 - PUB's Water Department supplies virtually all water used by Singapore and serves also part of the State of Johore, Malaysia. Six sources of supply are utilized. On Singapore island, three adjoining catchment areas with reservoirs supply water to two treatment plants (Bukit Timah and Woodleigh). Most of the water supply comes from the State of Johore where up to mid-1967 two small catchment areas and two river sources were supplying water to three treatment plants and then to the island; the Johore River Water Project (Loan 405-MA), fully completed in 1968 and including one treatment plant, increased the total combined reliable yield to Singapore by 123,000 m^3d to 523,000 m^3d. Following Government's policy of minimum reliance on outside water, PUB is completing the Kranji Pandan Reservoir scheme located on the northern part of the island and partly financed by an Asian Development Bank (ADB) loan of US$ 8.3 million made in 1971, and the Upper Pierce reservoir financed by a Commonwealth Development Corporation (CDC) loan of £ 4 million (S$ 29 million equivalent) made in 1972.

Project History and Objectives

2.01 - In continuation of its uninterrupted relationship with the Bank, the PUB applied in July/August 1966 for a loan to finance the Seletar Reservoir water project designed to increase the reliable yield of the island's own sources of water supply, and mainly to multiply the island's storage capacity by 3.8. The Seletar scheme, designed by PUB's engineering consultants (Binnie and Partners), was the most economical new source of water within the island, but was not the most economical means of increasing Singapore's water supply from the various sources available outside the island.1/ The Bank reacted positively, given the value and priority attached by the Government to domestic water supply and storage. The Bank asked PUB for further analysis and additional data to ascertain the project's expected benefits and clarify important issues, namely: i) hydrological and flow characteristics of 8 streams to be pumped into the reservoir in order to supplement the yield of the Seletar catchment area, particularly dry weather flows; ii) amounts of water which PUB would be allowed to withdraw from these streams under various conditions, taking account of other users' rights, and control of waste discharges into the streams; iii) proposed operating procedures for the reservoir, share of the reservoir capacity to be devoted to water reserves as opposed to yield increases, and effect on the island's total reliable yield; and iv) justification of the proposed construction schedule (which was based on 24 hours operations). On the basis of PUB's additional information, the Bank proposed, the PUB accepted, revisions of certain project components with resulting savings of S$ 230,000 on the project estimated cost for pumping equipment.

2.02 - Due to delays relating mainly to the Power Part I,2/ Loan 503-SI was made in July 1967. Part II of the Loan, of US$ 8 million (including US$ 1.1 million interest during construction), was to finance the foreign exchange component of a water project of a total estimated cost of US$ 14.9 million consisting of (a) the Seletar Dam and its 20 million m^3 reservoir, (b) water intake and pumping facilities on the 8 supplementary streams to be tapped and made tributary to the reservoir, (c) the expansion of Woodleigh Treatment Plant capacity to a water outflow of 181,800 m^3d on average and 245,500 m^3d on peak, (d) raw water pumping stations and mains from Seletar reservoir to Woodleigh Treatment Plant, and (e) extensions of about 62 km to the transmission and primary distribution mains and purchase of 77,000 water meters for the Water Department's 1967-1970 expansion program. The reservoir and other project components were to be operated so as to increase the combined reliable dry weather yield to Singapore by about 68,200 m^3d.3/

1/ A second stage Johore River project was estimated to be more economical.

2/ Cf. Project Performance Audit of 1st and 2nd Power Distribution Projects (Loans 503-SI/Part I and 595-SI).

3/ The actual effect of the project on reliable yield was estimated to range from a net 22,700 m^3d if most of the added storage is held in reserve for emergencies, to 81,800 or 90,900 m^3d if the storage is used only for increasing yield.

2.03 - PUB agreed to continue the covenants adopted in the previous loans regarding consultations with the Bank before appointment of PUB senior officers (namely General Manager, Chief Electrical Engineer, Chief Water Engineer, Chief Financial Officer), sound management of its sinking fund, short- and long-term debt limitations(in particular, short-term debt to be lower than S$ 12 million), improvement of organization, staffing and procedures, and maintaining tariffs sufficient to give PUB an overall return of at least 8% p.a. Moreover PUB agreed that revenues from each Department's services should cover the cost of such services and make an "adequate" contribution to the overall financial needs of the Board.

Project Implementation and Achievements

3.01 - The project, expected to be completed by December 31, 1970, was actually completed in November 1973, some 3 years behind schedule. However, the major component, the Seletar scheme, was completed, despite a slow start, by mid-1969, some 4 months ahead of Bank's expectations. The pumping facilities on the 8 supplementary streams were completed by March 1969. A first expansion of Woodleigh Treatment Plant was completed in February 1969; installation of 2nd stage high lift pumps was completed in April 1972, ten months behind schedule, due to late delivery of pumps. The main delays occurred in the transmission and distribution mains works. The major reason was the late completion in mid-1969 of a comprehensive study of PUB's water transmission and distribution system expansion financed under IBRD Loan 405-MA and expected by early 1968 from the consultants engaged (SIPEL); initial plans for distribution works were substantially modified and enlarged on the basis of that study. Some delays also occurred because roads were not ready for laying mains or because of similar coordination problems with other agencies and public services. Cement and labor shortages were other causes of delay. Another significant factor was the shortage of engineering staff; the Bank advised PUB to engage consultants to assist with design of distribution works, but PUB states it was never convinced this would have improved the situation. Finally, the construction of two service reservoirs, not included in the original project but added, following recommendation of the consultants' study to improve water pressure in some districts, postponed completion of the project to November 1973.

3.02 - Physical achievements of the project and variations from the original plans were as follows:

Project Achievements	Actual	Forecast
1. Seletar Reservoir Capacity	23.7 million m^3	20 million m^3
2. Woodleigh Treatment Plant:		
Final Capacity on sustained basis	204,600 m^3d	181,800 m^3d
Final Peak Capacity	231,800 m^3d	245,500 m^3d
3. Transmission and Distribution mains	109 km	62 km
4. No. of service meters purchased	68,000	77,000
5. Two Service reservoirs capacity	70,000 m^3	-

After removal of the jungle cover, the Seletar reservoir was found to have greater potential than expected, almost 20% additional storage capacity. The first-stage high-lift pumps installed at Woodleigh plant on the basis of PUB's plans showed during testing a peak capacity of only 190,000 m^3d and second stage pumps were required and installed to increase peak capacity which still remained below target. The PUB proposed, and the Bank agreed, to include in the project the enlargements to transmission and distribution program, as revised by the consultants, to be financed from savings on other parts of the project.

Project Costs

4.01 - The detailed project cost data given in Annex 1 are summarized as follows:

	S$ million		
	L.C.	F.X.	Total
Estimated Costs	24.12	20.93	45.05
Actual Costs	33.04	21.13	54.17
Percentage Increase	37%	0.9%	20.2%

Savings on the foreign currency expenditures for Seletar and Woodleigh components, and corresponding contingencies unused, financed the increased foreign exchange cost of the enlarged distribution program. One-third of the purchased service meters were supplied by a local manufacturer, resulting in further foreign exchange savings. The substantial increase in local costs was almost entirely due to the larger distribution program and the two service reservoirs. The project total cost includes S$ 684,000 paid by PUB as contribution to the S$ 2 million cost of anti-pollution works which were undertaken by Government agencies on the 8 supplementary streams (cf. para. 5.01). Actual unit costs were lower than estimates, namely S$ 201,000 per km of mains laid compared to S$ 242,000/km estimate, and S$ 21,000 per thousand m^3d of peak capacity at Woodleigh plant against S$ 27,000 estimate.

4.02 - Standard percentages were agreed upon for reimbursement to PUB from the loan proceeds of the foreign exchange components of the large civil works contracted for the Seletar dam and of the local purchase and laying of pipes and mains. All civil works contracts above US$ 100,000 and all contracts for equipment above US$ 50,000 were submitted to the Bank for approval. Three reallocations of the loan proceeds were necessary, and disbursements lagged behind schedule (Annex 2) due to project delays and to some delays in submission of disbursement applications by PUB.

Project Operations and Justification

5.01 - Less than one year after commissioning, significant operating difficulties appeared regarding the 8 supplementary streams made tributary to the Seletar reservoir. Water intake and pumping facilities were first protected from debris by improved screening, but the major problems remained the high silt content and pollution (by fishponds and pig farms) of the stream waters. Works to reduce gross pollution from unsewered farms and dwellings in the rural tributary areas were carried out in late 1969[1/] (para. 4.01). Nevertheless, the sanitary quality of the stream water has been unpredictable but generally poor[2/] and, due to large amounts of silt and the frequent need to stop stream pumping operations to remove settled silt from the relift basis[3/], the amounts of water pumped to Seletar have fallen short of the optimistic yield figures originally supplied by the project consultants (Annex 3); total yield from the 8 streams averaged 36,800 m^3d over 1969-1973 against 73,900 m^3d, reliable yield forecast by the project consultants. The secondary objective of the project to increase the reliable dry weather yield of Singapore's system by 68,200 m^3d was achieved by two-thirds only; during the dry years 1971 and 1972, less than 48,000 m^3d could be extracted from the Seletar scheme (Annex 3), and most of the water added by the streams and rainfall to the reservoir was held in reserve for emergency.

5.02 - Despite the unsatisfactory quality of the water pumped into the Seletar reservoir from the supplementary streams, the quality of the treated water of Woodleigh plant has been continuously excellent, as indicated by chemical and biological analyses (Annex 3). Treatment has been quite efficient in reducing turbidity, color, and the number of organisms and B-Coli per unit volume.

5.03 - The prime objective of the project to increase the island's water production and reserve storage capacities was realized inasmuch as the additions made to water treatment and storage facilities have exceeded forecasts. Water sales were forecast at appraisal to increase by about 6% p.a. on average over the period 1967-1972. Actual growth of water sales averaged 5.1% p.a. between 1967 and 1972 and 6.6% p.a. between 1967 and 1970 (Annex 4); water sales dropped by 2.6% in 1971, a record dry year, due to a strong public response to PUB's "Save Water" campaign launched to build up water reserves in its reservoir. PUB also reduced considerably the

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1/ These works consisted essentially of the supply and construction of cess pits and associated emptying or drainage facilities for human and animal wastes.

2/ Pumping was interrupted on one stream as of December 1971, due to badly polluted water.

3/ On average over 1970-1973, the 8 streams pumps were operating 270 days p.a., i.e. 74% of full time (Annex 3).

inevitable water wastage at public standpipes by reducing their numbers and providing new domestic connections instead; finally, "unaccounted for" water decreased from 9.3% to 8.3% of total water distributed, which is a very efficient performance. The actual combined reliable yield and total treatment capacity available to PUB's Water Department remained amply sufficient (Annex 4), as had been forecast by the appraisal report, due mainly to the 1965-1968 expansions in the Johore State facilities (Malaysia) financed by Loan 405-MA. Given Singapore's vulnerability in the matter of water supply and sensitivity to the issue, the whole project, including the 8 supplementary streams, appears justified, more by its prime objective than by its contribution to meeting demand.

Financial Performance

6.01 - Appraisal Forecasts of Water Department's accounts for the years 1967-1972 and actuals for 1967-1973 are compared in Annexes 5 and 6. Operating revenues for 1967-1972 were higher than appraisal forecasts by 3% to 5% each year except in 1971 when they were lower by 3% (para. 5.03). On the other hand, operating costs were lower than projected (by between 1.6% in 1969 and 11.5% in 1971) except in 1967 (higher by 3%) resulting in higher operating surpluses (by 3.6% in 1967 and 27.9% in 1970). The operating ratio (after depreciation) ranged between 56% and 61% against appraisal forecasts of 61-65%. Unit revenue per m^3 sold increased from S¢ 23.6 in 1967-1969 to S¢ 24.3 in 1972 due to larger sales at high prices for industrial/commercial purposes and jumped to S¢ 32.2 in 1973 due to the introduction of new tariffs (para. 7.01), and the unit operating cost ranging between S¢ 13.3 and 14.7 per m^3 sold was lower than forecast, due to more effective use of facilities and close control of costs. The rate of return on average net fixed assets in operation ranged between 9.1% and 10.6% against 6.8-9.2% forecast and increased to 16.3% in 1973. The debt-equity ratio improved from 41/59 in 1967 to 34/66 in 1973, and debt service coverage remained above 2.1.

6.02 - Total requirements of funds over 1967-71 were 3% lower than forecast, net internal cash generation contributed 61% to total requirements as compared to 53% forecast, and IBRD loans 27% (6% lower than forecast). Contributions of ADB's Loan for Kranji Pandan scheme and CDC's loan for the Upper Pierce Reservoir (para. 1.03) were important after 1971. Some 420 km of sub-mains[1/] not included in the IBRD project were installed over 1967-1971 at a total cost of S$ 9.75 million.

Water Tariffs

7.01 - Because of the need to finance the large investments for water foreseen over 1972-1976 and its own objective to achieve a 10% rate of return, PUB envisaged in 1972 a water tariff revision and postponed it by one year because sewer fees billed by PUB had been increased in 1970 and power tariffs in 1972. New water tariffs became effective February 1973. These tariffs,

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1/ Mains with diameter under 18".

worked out by PUB, have comprised for domestic consumers increasing block rates to deter wastage and curb water demand (Annex 8); block rates were computed essentially on the basis of existing (for the first block) and future (for other blocks) marginal capital costs of supply. Flat rates to commercial and industrial customers were based on cost of supply and comparisons with charges in other countries. PUB estimated that two-thirds of all domestic consumers (including 80% of Housing and Development Board low income tenants) would pay the first block rate only, that is 25% more than under the old tariffs, and that the higher income customers using more than 50 m^3 per month (10% in all) would pay 75% more than previously.

Institutional Development

8.01 - Distribution expansion programs had normally been planned and supervised by PUB's Water Department. However, the comprehensive overall review and expansion planning of PUB's water system made by SIPEL consultants in 1968/69 (para. 3.01) showed abnormal situations and deficiencies in the system. There was also room for improvement in the use of PUB's water sources; SIPEL developed a computer model to provide daily operating rules for minimizing operating costs, but the use of the model was hampered by the lack of meaningful hydrological data (in particular on the 8 supplementary streams). There had been a persistent shortage of technical staff and experienced engineers[1/] in the Water and in other PUB Departments.

8.02 - A reorganization of the Water Department made early in 1972 has consolidated and strengthened its technical wing at senior levels. At junior levels, all assistant engineers were upgraded and paid on higher scales; this enabled PUB to attract more engineers and retain those in service. Technical staff was relieved of administrative duties by strengthening administrative sections, and delegation of powers was increased throughout PUB, improving staff morale. The Bank recognized that the lack of a General Manager (see PPA on Power Loans 503-SI/Part I and 595-SI) had no adverse effects on Water Department's operations. Presently, the Water Department is functioning smoothly, its staffing is adequate, and SIPEL's model is being updated and improved for further increasing operational efficiency. A Pollution Survey Unit was established in 1971 to survey the Kranji Pandan catchment area (which covers the catchments of 3 of the 8 supplementary streams) and completed its survey in 1973. More than 80% of Singapore's total households were supplied at home with PUB water in 1973, compared to less than two-thirds in 1967.

Bank's Performance

9.01 - A major benefit of the Bank's involvement was the SIPEL study which reviewed PUB's water system and improved substantially the short- and long-term expansion planning and operations; this benefit however is attributable to

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1/ This was true of all public agencies in Singapore and was the result of rapid expansion in construction and industrial activity.

Loan 405-MA. Before appraisal of Loan 503-SI the Bank questioned the estimates of PUB's project consultants for yields expected from the Seletar scheme as well as the amount and quality of water expected from the 8 supplementary streams; however, yields were not the project's prime objective and the project could still be justified. After construction, the Bank wisely advised PUB to collect meaningful hydrological data as a basis for operational improvement and greater efficiency and suggested redesign of the relift basins (para. 5.01) to permit better and quicker removal of settled silt.1/ During project implementation, the Bank's agreements to include in the project the SIPEL-revised plans for distribution expansion and service reservoirs and to apply standard percentages of foreign exchange component to civil works contracts as a basis for disbursements increased the soundness of the project and efficiency in its implementation. Finally, the Bank recommended in 1967, and PUB agreed, to install a chemical/ bacteriological laboratory for water analysis in Woodleigh plant premises; in 1973, some 18,000 samples were analyzed therein, saving some S$ 250,000 analytical fees to PUB.

9.02 - Despite some minor shortcomings (silting, partly the result of subsequent construction activity in the area, was not foreseen, and the Bank could have advised the project consultants to take fuller account of its earlier recommendations and questions about the quality and pollution of the water from the streams), the Bank's performance regarding this water project has been good. Another possible important benefit is that, due to Bank's insistence on economic considerations and criteria in selecting and developing water resources, the Government and PUB may give in future more importance to such considerations after completion of Seletar, Kranji Pandan and Upper Pierce schemes which will provide the island with substantial water reserves2/ and thus lessen the special importance attached to development of local sources.

Conclusion

10.01 - Singapore's Water Project financed by Loan 503-SI/Part II has met its prime objective, to increase the island's reserve storage capacity, and has contributed also to meeting demand for water. The project was executed on the basis of original plans; substantial changes in the distribution expansion works and some difficulties in expansion of the treatment plant have delayed the project completion by about 3 years, without causing serious shortages in the total supply to the island's population. The project has helped PUB to maintain and further improve its good operational and financial performance beyond the Bank's expectations. The Bank's earlier action for the use of consultants for system review and long-range expansion planning and its suggestions during project implementation were useful, and its

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1/ Except for the installation of sand pumps, PUB has taken no correcting measures of the 8 stream pumping stations and associated relift basins. This will be necessary when higher demand for, and greater scarcity of, water require fullest and most efficient use of all the island's water resources.

2/ The Kranji Pandan reservoir will add some 7 million m^3 to the existing 31 million m^3 water reserve capacity of the island.

performance was satisfactory. While, as a whole, the supplementary streams part of the scheme still appear competitive in cost with the other sources of water, and therefore economically viable overall, they have shown substantial shortfalls from expectations in production, and it would appear that the Bank could have usefully advised the project consultants to take fuller account in their feasibility study of the external factors which have affected the quality of water in the different streams.

SINGAPORE

WATER SUPPLY PROJECT (Loan 503-SI - PART II)

Cost of the Project - Forecast/Actual

	Appraisal Estimate			Final Costs		
	Local	Foreign	Total	Local	Foreign	Total
	S $ millions					
Principal Elements						
Seletar Reservoir Project						
Site Investigation (Contract 1)	0.22	-	0.22	0.26	-	0.26
Pipelines (Contracts 2a and 2b)	1.29	1.41	2.70	1.56	1.50	3.06
Mechanical & Electrical Equipment (Contracts 3 & 4)	0.23	2.12	2.35	0.67	1.76	2.43
Dam and Ancillary Works (Contract 5)	5.44	2.33	7.77	5.62	2.41	8.03
Civil Works on Stream Intakes (Contract 6)	0.94	0.40	1.34	1.26	0.55 a/	1.81 a/
Road, Pipeline and Cable Relocations	1.47	0.00	1.47	1.21	-	1.21
Ancillary Buildings	0.30	0.06	0.36	-	-	-
Contingencies and Unallocated	1.87	0.96	2.83	1.86	-	1.86
Total Construction Costs	11.76	7.28	19.04	12.44	6.22	18.66
Engineering and Supervision	0.89	0.80	1.69	1.03	0.63	1.66
Total Seletar Project	12.65	8.08	20.73	13.47	6.85	20.32
Woodleigh Treatment Plant Extension						
Storage Facilities, Roads and Miscellaneous Site Work	0.40	0.10	0.50	0.31	0.19	0.50
Filter Construction	0.88	0.37	1.25	0.43	0.23	0.66
Supply and Installation of Treatment Equipment	0.58	1.14	1.72	1.03	0.75	1.78
Pumping Equipment (Stages 1 and 2)	0.09	0.72	0.81	0.60	0.24	0.84
Supply and Installation of Pipe, Valves, Meters and Air Vessel	0.33	0.93	1.26	0.51	0.59	1.10
Contingencies and Unallocated	0.47	0.42	0.89	-	-	-
Total Construction Costs	2.75	3.68	6.43	2.88	2.00	4.88
Engineering and Supervision	0.23	-	0.23	-	-	- b/
Total Woodleigh Project	2.98	3.68	6.66	2.88	2.00	4.88
Distribution Program						
18-inch and 24-inch Diameter Mains	1.90	1.50	3.40	3.09	2.05	5.14
30-inch Diameter and Larger Mains	5.05	4.50	9.55	9.18	7.28	16.46
Reservoirs	-	-	-	4.07	1.80	5.87
Contingencies	0.74	0.72	1.46	-	0.37	0.37
Total Construction Costs	7.69	6.72	14.41	16.34	11.50	27.84
Engineering and Supervision	0.60	-	0.60	-	-	- b/
Total Distribution Program	8.29	6.72	15.01	16.33	11.50	27.84
Water Service Meters	0.20	2.45	2.65	0.36	0.77	1.13
Total Cost Water Project	24.12	20.93	45.05	33.04	21.13	54.17

a/ Includes S$ 23,000 for purchase of sand pumps installed in 1973/74 in the 8 stream pumping stations to facilitate removal of silt and sand deposits.

b/ Engineering and supervision was done by PUB's regular staff whose salaries are charged to revenue expenditures.

SINGAPORE WATER SUPPLY PROJECT

Loan 503-SI - Part II

I. Disbursement Schedules: Forecast/Actual

CY	1967	1968	1969	1970	1971	1972	1973
Cumulative Disbursements (US$ million)[a/]							
Forecast	2.27	4.92	6.18	6.83	6.90	-	-
Actual	-	2.51	3.47	4.10	4.64	6.36	6.90
Actual/Forecast, %	0	51	56	60	67	92	100

II. Loan Allocation by items: Forecast/Actual

in US$ million equivalent Items	%	Appraisal (July 1967)	Revised (May 1970)	Revised (May 1971)	Revised (July 1972) Final	%
a- Seletar Dam and Reservoir, stream intakes and pumps, buildings and pipelines	31	2.11	2.01	2.03	2.03	29
b- Treatment Plant Expansion	14	1.00	0.80	.72	.69	10
c- Transmission/Distribution mains	29	2.00	3.64	3.69	3.72	54
d- Water Meters	12	0.82	.25	.25	.25	4
e- Consulting Services	4	0.27	.20	.21	.21	3
f- Unallocated	10	0.70	-	-	-	-
Total[a/]	100	6.90	6.90	6.90	6.90	100

a/ excluding US$ 1.1 million interest during construction.

Annex 2

SINGAPORE WATER SUPPLY PROJECT

Loan 503-SI - PART II

	1969	1970	1971	1972	1973	1969-73 Average	Targets IBRD	Targets Consults.
I. Seletar Reservoir Operation (million m^3)								
Water Reserves (End year)	22.97	20.03	22.58	22.26	22.23*			
Reservoir Annual Output:	n.a.	31.78	17.48	16.47	27.94			
Input: Rainfall Run-off	n.a.	16.51	7.23	7.08	14.18*			
8 stream-Supply	19.18	12.33	12.80	9.06	13.73			
Total Input to Reservoir	n.a.	28.84	20.03	16.14	27.91			
Drawdown (Addition) on Reserves	-	2.94	(2.55)	0.32	0.03*			
II. Yields (000 m^3d)								
1. Reservoir: Annual Average		87.1	47.9	45.1	76.5	64.2		136.4
"Dry Season" a/		99.0	3.0	72.3	73.8	62.0	68.2	81.8
2. 8 Supplementary Streams:								
Annual Average b/	52.6	33.8	35.1	24.8	37.6	36.8		
"Dry Season" a/	53.8	34.6	46.1	21.5	38.6	38.9	25.0	73.9

a/ July-October
b/ No. of days in operation (average on the 8 streams)

	365	296	298	250	235	289

II. Quality of Water Indicators (Annual Averages)						
1. Seletar Output						
Turbidity Index	n.a.	n.a.	n.a.	7.6	5.1	6.4
Color Index	n.a.	25	29	27	19	25
No. of organisms/unit	n.a.	473	541	485	423	481
% of samples with: 0 B-Coli/unit	n.a.	3.7	3.7	3.4	3.3	3.5
(M.P.N. Index) 1-9 " / "	n.a.	21.3	22.6	24.0	47.0	28.7
10-99 " / "	n.a.	40.5	36.7	39.9	29.1	36.6
2. Woodleigh Treatment Plant Output for Distribution						
Turbidity Index	n.a.	n.a.	0.5	0.6	0.7	0.6
Color Index	5	5	5	less than 5	less than 5	5- c/
No. of organisms/unit	182 a/	28	395 b/	10	10	111.
% of samples with: 0 B-Coli/unit	95.6	96.3	96.6	99.5	98.9	97.4
(M.P.N. Index) 1-9 " / "	4.4	3.7	3.4	0.5	1.1	2.6
10-99 " / "	0	0	0	0	0	0

a/ High number of organisms/unit throughout the year.
b/ High number in May and July only.
c/ Average over 1970-1973.

SINGAPORE WATER SUPPLY PROJECT

LOAN 503-SI - Part II

PUB's WATER DEPARTMENT OPERATIONS AND SALES - FORECAST/ACTUAL

	1967		1968		1969		1970		1971		1972		1973
	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Actual
I. Load and Capacity (000 m^3d)													
1. Dry Year Sustained Reliable Yield	400	400	564	523	650	650	650	650	650	650	650	650	650
2. Total Treatment Capacity	n.a.	745	n.a.	745	n.a.	895	n.a.	895	n.a.	895	n.a.	895	895
3. Demand: Annual Average	426	420	449	451	473	467	498	500	526	481	555	519	527
4. Daily Peak	n.a.	475	n.a.	500	n.a.	529	n.a.	554	n.a.	591	n.a.	581	571
5. Sustained Capacity Reserve (1 minus 3)	(26)	(20)	115	72	177	183	152	150	124	169	95	131	123
II. Production and Sales (million m^3)													
Total Water Processed	155.5	153.1	163.7	164.7	172.5	170.3	181.8	182.6	191.8	175.7	202.4	189.4	192.3
Total Water Distributed	149.6	n.a.	157.4	163.7	165.7	169.4	174.6	181.4	184.0	175.0	194.2	186.3	n.a.
Water Unaccounted for	12.8	n.a.	13.3	14.4	13.9	13.8	14.5	16.9	15.3	14.7	16.1	11.7	n.a.
(" " " , %)	8.6%	n.a.	8.4%	8.8%	8.4%	8.1%	8.3%	9.3%	8.3%	8.4%	8.3%	6.3%	
Water Sales													
Domestic	62.4)	35.6	69.2	62.7	76.3	66.1	83.8	71.0	89.4	71.5	95.4	79.0	76.7
Stand Pipes	9.1)		6.8	8.2	4.5	5.8	2.3	3.4	2.3	1.5	2.3	0.8	0.4
Commerce/Industry	26.7	33.4	28.1	30.8	29.6	33.7	31.2	38.0	32.8	41.0	34.5	49.1	53.9
Public Authorities	38.7	66.9	40.0	47.5	41.4	49.9	42.8	52.0	44.3	46.3	45.9	45.7	43.5
Total Sales	136.8	135.9	144.1	149.3	151.8	155.6	160.1	164.5	168.8	160.3	178.1	174.6	174.2
Island's Storage Capacity	7.3	7.3	7.3	7.3	27.3	31.0	27.3	31.0	27.3	31.0	27.3	31.0	31.0
III. Consumers													
Domestic (000)	n.a.		n.a.		197.9		218.4		236.9		254.8		277.3
Stand Pipes (No)	n.a.		n.a.		1134		570		247		154		20
Commercial/Industrial (000)	n.a.		n.a.		32.1		33.3		35.3		36.5		39.3
Public Authorities (000)					12.6		11.2		8.6		7.9		8.0
Total (000)	203.2		222.3		244.1		264.3		279.1		298.7		325.1
IV. Woodleigh Treatment Plant Operations													
Annual Output (million m^3)	16.5		10.1		21.5		38.2		17.2		22.8		33.5
Average Daily Output (000 m^3d)	45.1		27.6		58.9		104.8		47.1		62.5		91.8
V. Indicators													
No. of Employees	2273		2322		2539		2763		2801		2720		2771
No. of consumers/employee	89		96		96		96		100		110		117
Water Sales/employee (000 m^3)	60		64		61		60		57		64		63
Water Sales/capita (m^3)	68.7		74.2		76.2		79.3		76.0		81.3		79.7
Domestic Consumers as % of Households	n.a.		n.a.		66		69		72		76		79
Island's Storage capacity as % of water processed	4.8		4.4		18.2		17.0		17.6		16.4		16.1

Annex 4

SINGAPORE

PUBLIC UTILITIES BOARD SINGAPORE

WATER DEPARTMENT

INCOME STATEMENTS; FORECAST/ACTUAL

	1967		1968		1969		1970		1971		1972		1973
	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Appraisal Estimate	Actual	Actual
	S$ Million												
OPERATING REVENUES													
Revenue per Unit sold (S¢/m^3)	22.3	22.9	23.1	23.2	23.0	23.1	22.8	23.3	22.7	23.5	22.6	24.1	32.1
Revenue from Sales	30.52	31.07	33.30	34.66	34.84	35.92	36.48	38.37	38.34	37.74	40.31	42.10	55.86
Other Revenues	0.61	1.07	0.67	0.60	0.72	0.77	0.77	0.86	0.82	0.45	0.87	0.36	0.27
Total Revenues	31.13	32.14	33.97	35.26	35.56	36.69	37.25	39.23	39.16	38.19	41.18	42.46	56.13
OPERATING COSTS													
Operating costs excluding Depreciation	15.02	15.09	16.14	14.98	17.02	16.86	18.05	16.63	19.28	16.40	20.53	19.44	20.16
Depreciation	4.05	4.56	5.06	4.89	5.31	5.12	6.12	5.87	6.33	6.26	6.50	6.30	6.46
Total Operating Costs	19.07	19.65	21.20	19.87	22.33	21.98	24.17	22.50	25.61	22.66	27.03	25.74	26.62
Operating Cost per m^3 sold (S¢):	13.9	14.5	14.7	13.3	14.7	14.1	15.1	13.7	15.2	14.1	15.2	14.7	15.3
Operating Surplus	12.06	12.49	12.77	15.39	13.23	14.71	13.08	16.73	13.55	15.53	14.15	16.72	29.51
Interest & Other non-operating expenses (net)	4.09	3.69	4.71	5.37	5.45	5.98	5.54	6.03	6.57	5.87	6.13	6.19	7.08
Net Surplus	7.97	8.80	8.06	10.02	7.78	8.73	7.54	10.70	6.98	9.66	8.02	10.53	22.43
Operating Ratio, %	61	61	62	56	63	60	65	57	65	59	65	61	47
Actual Operating Revenues higher (lower) than appraisal forecasts %		3.2%		3.8%		3.2%		5.3%		(2.5%)		3.1%	
Actual Operating Costs higher (lower) than appraisal forecasts %		3.0%		(6.3%)		(1.6%)		(6.9%)		(11.5%)		4.8%	
Actual Operating Surplus higher (lower) than appraisal forecasts %		3.6%		20.5%		11.2%		27.9%		14.6%		18.2%	
Debt Service Coverage	2.7	2.8	2.6	2.5	2.2	2.1	2.2	2.3	2.0	2.2	2.0	2.3	3.1

Annex 5

SINGAPORE WATER SUPPLY PROJECT

Loan 503-SI - Part II

PUB's WATER DEPARTMENT BALANCE SHEETS - FORECAST/ACTUAL

	1967		1968		1969		1970		1971		1972		1973
	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Actual
	Million S $												
ASSETS													
Gross Fixed Assets Operating	199.6	191.4	210.0	195.6	253.0	226.4	263.6	232.0	270.7	237.3	281.7	249.8	263.4
Less: Depreciation	51.6	46.5	56.6	51.4	61.9	56.5	67.9	62.2	74.2	67.5	80.6	73.4	78.5
Net Fixed Assets Operating	148.0	144.9	153.4	144.2	191.1	169.9	195.7	169.8	196.5	169.8	201.1	176.4	184.9
Works in Progress	17.2	11.3	29.6	29.3	4.0	6.2	1.5	10.0	3.8	25.6	4.8	60.8	111.5
Total Net Fixed Assets	165.2	156.2	183.0	173.5	195.1	176.1	197.2	179.8	200.3	195.4	205.9	237.2	296.4
Current: Cash	1.2	9.0	0.9	9.0	1.0	16.3	4.3	23.2	5.4	15.8	4.1	(4.8)	(9.0)
Inventories	5.6	5.7	5.8	4.1	6.0	4.2	6.2	3.9	6.4	4.3	6.5	2.9	3.3
Total Current	7.2	14.8	7.0	13.1	7.2	20.5	10.6	27.1	11.8	20.2	10.6	(1.8)	(5.7)
TOTAL ASSETS	172.4	171.0	190.0	186.6	202.3	196.7	207.8	206.9	212.2	215.6	216.5	235.4	290.7
LIABILITIES													
Equity: Reserves/Surplus	84.0	90.4	94.2	102.4	104.3	113.3	114.3	126.8	123.9	139.1	134.6	152.2	180.7
Capital Contributions	8.1	7.8	8.5	8.2	8.9	8.8	9.3	9.4	9.7	10.3	10.2	11.3	12.0
Total Equity	92.1	98.2	102.7	110.6	113.2	122.1	123.6	136.2	133.6	149.4	144.8	163.5	192.8
Debt: Debenture Stocks	70.7	70.7	70.7	70.7	70.7	70.7	70.7	70.7	62.2	62.2	57.6	57.6	36.0
Less: Sinking Fund	41.9	41.6	45.1	45.2	48.4	48.9	51.8	53.2	46.9	48.9	45.9	47.8	29.2
Net Stocks	28.8	29.0	25.6	25.4	22.3	21.8	18.9	17.4	15.3	13.3	11.7	9.8	6.8
Loans: IBRD	25.4	18.5	34.6	26.8	38.7	31.4	41.1	33.1	40.4	33.7	38.6	37.4	35.5
Government	19.6	21.6	20.5	20.9	24.3	19.7	23.0	18.5	21.6	17.4	20.1	16.2	15.0
ADB	-	-	-		-		-		-	0.1	-	1.8	11.4
CDC	-	-	-		-		-		-	-	-	4.4	23.1
Suppliers Credits	-	0.4	-	0.4	-	0.3	-	0.2	-	1.8	-	2.2	6.1
Total Debt Outstanding	73.8	69.5	80.7	73.5	85.3	73.1	82.9	69.2	77.3	66.2	70.4	71.8	97.9
Refundable Deposits	5.3	2.1	5.3	0.3	2.5	-	-	-	-	-	-	-	-
Current: Clearing Accounts	1.3	1.2	1.3	2.2	1.3	1.4	1.3	1.4	1.3	-	1.3	-	-
TOTAL LIABILITIES	172.4	171.0	190.0	186.6	202.3	196.7	207.8	206.9	212.2	215.6	216.5	235.4	290.7
Return on Average Net Fixed Assets Operating (%)	9.2	9.6	8.5	10.6	7.7	9.4	6.8	9.8	6.9	9.1	7.1	9.7	16.3
Debt/Equity Ratio	46/54	41/59	46/54	40/60	44/56	37/63	40/60	34/66	37/63	31/69	33/67	31/69	34/66

Annex 6

SINGAPORE

PUBLIC UTILITIES BOARD - WATER DEPARTMENT

SINGAPORE WATER SUPPLY PROJECT (Loan 503-SI/PART II)

Financing Plan

	Appraisal Report 1967 - 71	Actual 1967-71	Actual 1967-73
SOURCES OF FUNDS	S$ million		
Funds generated from operations	91.56	101.62	160.71
Less Debt Service	39.56	43.04	64.59
Net	52.00	58.58	96.12
Capital Contributions	2.05	2.82	4.56
Other Receipts (net)	-	0.31	1.79
Decrease in Cash Balance	-	-	14.54
Borrowings			
IBRD Loan 405-MA	8.70	10.06	10.06
IBRD Loan for the project	24.00	15.85	22.23
Government Loan	12.00	5.60	5.60
ADB Loan	-	0.10	11.06
Commonwealth Development Corporation	-	-	25.66
Other Sources	-	2.13	7.55
Total Borrowings	44.70	33.74	82.16
TOTAL SOURCES OF FUNDS	98.75	95.45	199.17
APPLICATION OF FUNDS			
Capital Expenditures			
Project Cost	46.75	40.85	54.17
Johore River Project	12.38)	39.24 a/)	139.88 b/
Other Capital Expenditures	29.17)	)	
	88.30	80.09	194.05
Repayment of refundable deposits	5.27	5.12	5.12
Other Requirements	1.00	-	-
Increase in Cash Balance	4.18	10.24	-
TOTAL APPLICATION OF FUNDS	98.75	95.45	199.17

a/ includes S$ 9.75 million expenditure on laying 420 km of sub-mains (under 18") and S$ 3.16 million for purchase of water meters, over the period 1967-71.

b/ includes S$ 12.77 million on sub-main laying and S$ 4.23 million for water meters over the period 1967-1972.

Annex 8

PUBLIC UTILITIES BOARD, SINGAPORE

Water Tariff

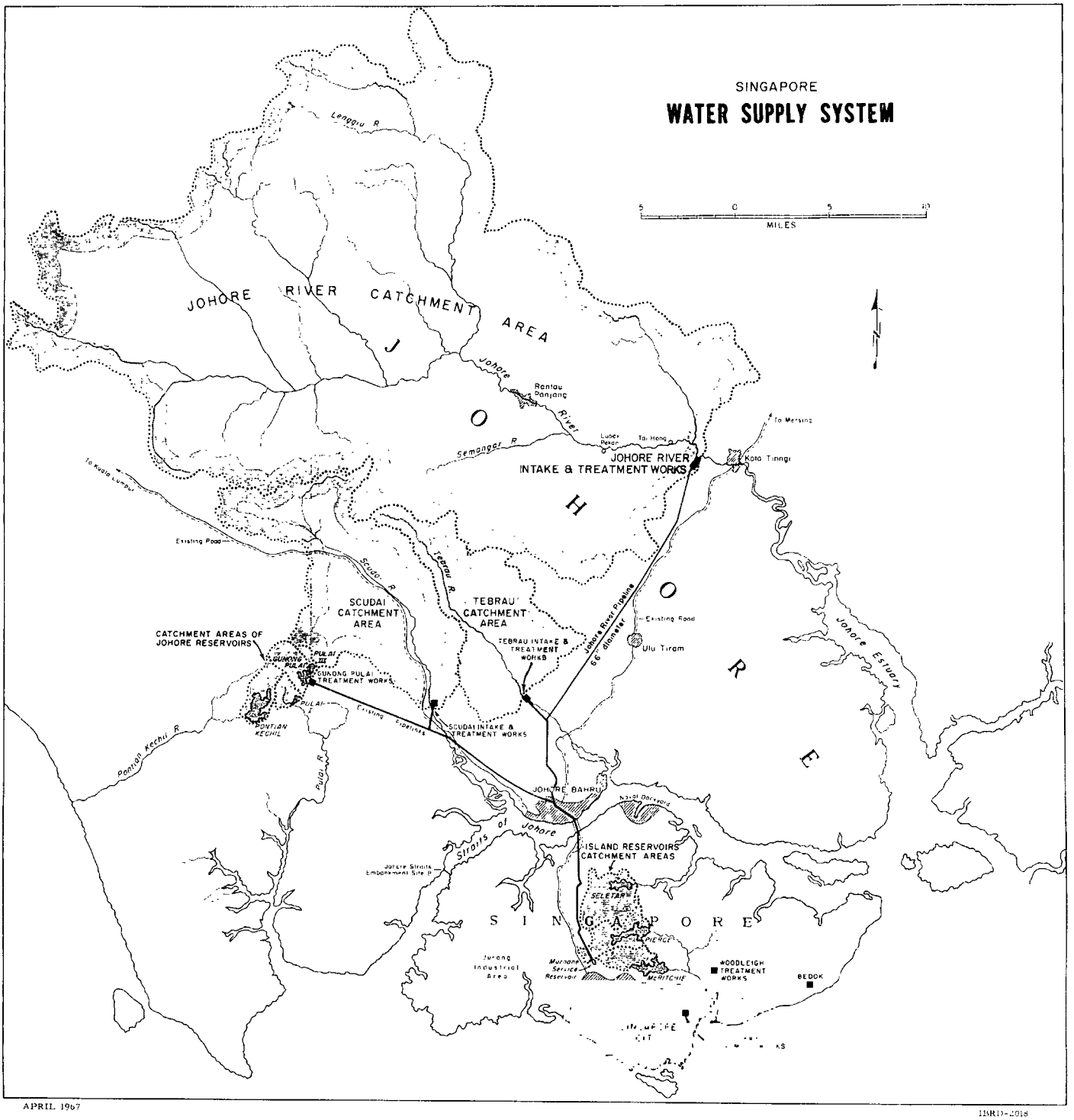
Effective March 1973 billing cycle, Public Utilities Board has revised water rates for different categories of consumers. The old rates, the new rates and the percentage increase for each category are shown below:

	Old Rate	New Rate	Percentage Increase
	---Singapore cents per m^3---		
Domestic - (Tariff A)[1/]			
For monthly consumption of 1-25 m^3	17.6	22.0	25%
Exceeding 25 m^3 but not exceeding 50 m^3	17.6	26.0	48%
Exceeding 50 m^3 but not exceeding 75 m^3	17.6	33.0	88%
Exceeding 75 m^3	17.6	44.0	150%
Non-Domestic			
Water processed for sale (Food Industries)	55.0	88.0	60%
Statutory Boards & Armed Forces	33.0	44.0	33%
Government	22.0	44.0	100%
Other Non-Domestic (Commercial/Industrial)	33.0	44.0	33%
Shipping	88.0	88.0	-
Johore Government and Tabrau Estate	11.0	11.0	-

1/ Any premises in which there are two or more households and the number of persons living therein is more than 10 but not more than 20, the consumer of such premises may make an application in writing to the Board and the Board may, at its discretion, grant the concession to such consumer and apply Tariff B shown below. If the number of persons living in such premises is more than 20 but not more than 30, the Board may apply Tariff C.

Tariff B	Singapore cents/m^3	Tariff C	Singapore cents/m^3
For monthly consumption of 1-50 m^3	22.0	For monthly consumption of 1-75 m^3	22.0
Exceeding 50 m^3 but not exceeding 75 m^3	26.0	Exceeding 75 m^3 but not exceeding 150 m^3	26.0
Exceeding 75 m^3 but not exceeding 150 m^3	33.0	Exceeding 150 m^3 but not exceeding 225 m^3	33.0
Exceeding 150 m^3	44.0	Exceeding 225 m^3	44.0

MAP 2



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