II. BIBLIOGRAPHY

Category Number	Data Number	Title	Collected from
1.		General	
	1.1	General Discription of Thailand and Bangkok	
	1.1.1	The Development of Bangkok	BDS
	1.1.2	Background Information of BMA	BDS
	1.1.3	Basic Planning Information, 1972	CPD
	1.1.4	Bangkok Metropolis' First Five-Year Plan (1977 - 1981)	FRS
	1.1.5	Map of BMA (Name of 24 Districts)	FRS
	1.1.6	Bulletin of Statistics Vol 25 - 26 No. 4 (1978)	NSO
	1.1.7	The Survey of Migration in Bangkok Metropolis, 1978	NSO
	1.1.8	Statistical Hand Book of Thailand, 1977	NSO
	1.1.9	Thailand Year Book 1975 - 1976	TPS
	1.1.10	Bangkok Metropolitan Administration	BDS
	1.1.11	Statistical Summary of Thailand (1978)	NSO
	1.1.12	Summary of the Third Five - Year Plan (1972 - 1976)	
	1.1.13	Government of Thailand The Fourth National Economic and Social Development Plan (1977 - 1981)	NESDB
	1.1.14	The Documents for Spredding Information of BMA (1978)	BDS
	1.2	Administrative Organization	
	1.2.1	Organzation Chart (BMA)	BDS
	1.2.2	BMA, Functions, Finances, and Facts	FRS
	1.2.3	Name of Governer, Deputy Governers, Secretaries, Director of Bureaus, and Chief of Districts	FRS
	1.2.4	Organization Chart (BDS)	BOS

1.3 Legal Data & Water Quality Standards

1.3.1	Rule for Building Control (prepared by BMA Board)	BPW
1.3.2	National Environmental Quality Act B.E. 2518 (1975)	BDS
1.3.3	" " B.E. 2522 (1979)	NEB
1.3.4	Standard for Dicharge to Deep-Well	MRD
1.3.5	Standard for Drinking Water	MRD
1.3.6	Deep-well Standard for Drinking Water	MRD
1.3.7	Standard of Industrial Wastewater (Announcement of Min. of Industry Bol. 2 1970)	MRD
1.3.8	Allowable Trade Effluent Standard	DOI
1.3.9	Controling Private Restaurant and Ice Processing (1975) (in Thai)	LD
1.3.10	Controling Public Market (in Thai)	LD
1.3.11	Controling Private Markey (in Thai)	LD
1.3.12	Controling Peddler (in Thai)	LD
1.3.13	Controling Disposing Aversion or Harmful Material (in Thai)	LD
1.3.14	Controling Stall (in Thai)	LD
1.3.15	Loan from Foreign Countries	LD

1.4 Maps

1.4.1	1:50,000	6 sheets	RSDT
1.4.2	1:20,000	12 sheets	RSDT

1.5 Meteorological Data

1.5.1	Temperature and Sun-shine Data (1974 - 1978)	MET
1.5.2	Meteorological Observation for Bangkok Metropolis (Jan - July, 1979)	MET
1.5.3	Rainfall Reconds (Copy of Record Sheets) (- 1978)	MET
1.5.4	The Biggest Rainfalls in mm	MET
1.5.5	Rainfall Intensity - Duration - Frequency Curves for Some Stantion in Thailand	MET

2. City Planning

2.1 Population

2.1.1	Population Data by District (1970 - 1978)	BDS
2.1.2	Population Data by District (1976)	CPD
2.1.3	Abstructs of "Report on Community Survey"	PPD
2.1.4	Projected Population by Five Year Interval in Bangkok - Thailand, 1970 - 2000	NESDB
2.1.5	Population for Thailand Whole Kingdom and Regions (1970 - 2010)	NESDB
2.1.6	The Population of Thailand (1974)	NESDB
2.1.7	Population Data by District (1973 - 1978)	NSO
2.1.8	Change in Population Growth in Each District (1972 - 1978)	BOS
2.1.9	Population Projection (1977 - 2000)	MWWA

2.2 Land Use

2.2.1	Future Land Use Map (copied by survey team)	BDS
2.2.2	Existing Land Use Map (copied by survey team)	CPD

2.3 Water Supply (Manicipal Water Supply, Ground Water Use)

2.3.1	Water Supply Master Plan (prepared by CDM, 1970) Vol. I " II " III " IV	MWWA
2.3.2	A Review of the Bangkok Water Supply Improvement ------ Phase 2 Project ------ (1977)	MWWA
2.3.3	Bangkok Water Supply, MWWA (Census on Sept. 30, 1978)	MWWA
2.3.4	Report on Water Supply Development in Thailand (Census on Sept. 30, 1978)	MWWA
2.3.5	Bangkok Water Supply Improvement, Stage I (Census on Sept. 30, 1978)	MWWA
2.3.6	Ground Water of Bandkok Metropolis, Thailand	BOS
2.3.7	Water Demand (1980 - 2000) (CDM)	MWWA

2.4 Infra Structures (Road, Electric Cable, Telephone,etc)

2.4.1	Outer Bangkok Ring Road (Ultimate Stage)	HWD
2,4,2	Telephone Cable Map	TOT
2.4.3	Drawing for Telephone Manhole	TOT

3. Drainage and Sewerage System

3.1 Data on Existing System (Drainage & Sewerage)

3.1.1	List of Drains taken over from District Offices to BDS in 1979	BDS
3.1.2	List of Existing Housing Estates in Bangkok	NHA
3.1.3	List of Housing Estate Plan (under construction)	NHA
3.1.4	List of Up Lift Pump Station	BDS
3.1.5	Example of Huay Kwang Sewage Treatment Plant	NHA
3.1.6	Map of Major Drains and Klongs	BDS
3.1.7	Major Drain Map (Pranakorn)	BDS
3.1.8	" (Sampantawong)	BDS
3.1.9	" (Pomprab)	BDS
3.1.10	Outline of Huay Kwang Sewage Treatment Plant	NHA
3.1.11	Construction Specifications	BPW
3.1.12	Drawings of dia. 1.20 m sewer	BPW
3.1.13	The Standard of R.F. Concrete Pavement (Drawings)	BPW
3.1.14	Standard Sewer (Drawings)	BPW
3.1.15	R.F. Concrete Pavement (Drawings)	BPW
3.1.16	Gate Valve (Drawings)	BPW

3.2 Strom Water

3.2.1	Monthly Rain Fall Data at Bangkok (1974-1978) This kind of data availble from 1956.	MET
3.2.2	Bangkok Runoff Hydrograph	AIT

3.3 Hydraulic Data

3.3.1	Predicted Tidal Curves at Bangkok Port	PAT
3.3.2	Tidal Data of the Chao Phya Estuary (1940 - 1969)	PAT

3.4 Geological Data

3.4.1	Report Seminar on Ground water Resource and Land Subsidence in the Bangkok Area (organized by NEB & AIT, 1979)	CU
3.4.2	Method of Making Vertical Bench Marks to BMA (in Thai)	BPW
3.4.3	Method of Making Vertical Bench Marks to BMA (translation of Data No. 3.4.2)	BPW
3.4.4	Soil Report, Subsurface Investigation in Bangkok Area for Bangkok Metropolis. at Luang Road, the End of New Pechaburi Road, Kruntep Bridge in Charanakorn Road, Vachila Hospital near Krungtol Bridge, and Klong Tan Bridge in Klong Tan Road.	BPW
3.4.5	Soil Report at Silom Road, 1	BPW
3.4.6	Subsoil Investigation Report at Rajadapisake Rd.	BPW
3.4.7	" at Wireless Road	BPW
3.4.8	" at Prapadang Samutprakan	BPW
3.4.9	" "	BPW
3.4.10	" at Nanglinchee	BPW
3.4.11	" at Yaowaraj Road	BPW
3.4.12	" at Sudjit Nives	BPW
3.4.13	" at Dao Kanong	BPW
3.4.14	" at Prakanong	BPW
3.4.15	" at Bang Chan	BPW
3.4.16	" at Lad Krabang District	BPW

3.5 Previous Plans & Studies on Drainage & Sewerage Systems

3.5.1	Master Plan : Sewerage, Drainage and Flood Protection for Bangkok Metropolis -------- Summary of Conclusion and Recommendations	BDS
3.5.2	Flood Protection Plan (1979) (in Thai)	BDS
3.5.3	Enbankment Plan (Map)	BDS

4. Wastewater Quantity and Quality

4.1 Domestic Wastewater

4.1.1	Technical Information and Data for Klong Lord Improvement in Bangkok (1980) (in thai.)	MU
4.1.2	" (Translation of Data No. 4.1.1, Abstracts)	BOS

4.2 Industrial Wastewater

4.2.1	Conclusion of Chao Phay River Side Activities in Dry Season (1978 - 1979)	DOI
4.2.2	Number of Factories Classified By Type of Industry by District	BPH
4.2.3	Location of High Loading Facteries along the Chao Phay River (Map)	DOI

5. Wastewater Treatment

5.1.1	Optimization of Sewage Treatment and Fish Propagation in Ponds (1978)	AIT
5.1.2	-	
5.1.3	Factors Affecting Algal Yields from High-rate Oxidation Ponds Treating Sewage (1970)	AIT
5.1.4	Effects of COD Loading and Detention Time on Anaerobic Pond Performance (1971)	AIT
5.1.5	Anaerobic and Faculative Ponds for Tropical Waste Treatment (1974)	AIT
5.1.6	Optimization of Sewage Treatment and Fish Propagation in Ponds (1976)	AIT
5.1.7	Effects of Some Operating Variables on Biological Filtration of Domestic Wastewater in the Tropics (1974)	AIT
5.1.8	Substrate and Nitrogen Conversion in Rotating Biological Filters (1974)	AIT
5.1.9	Principal Factors Affecting Suldge Drying on Sand Beds (1968)	AIT
5.1.10	Effects of the Bangkok Climate on Sludge Dewatering (1968)	AIT

5.1.11	A Study of High-Rate Aerobic Stabilization Ponds (1968)	AIT
5.1.12	Effect of Detention Time on Aerobic Stabilization Pond Performance in Southeast Asia (1968)	AIT
5.1.13	General Review of Oxidation Ponds and Oxidation Ditches (1974)	AIT
5.1.14	Perfomance of Rotating Drum Filter in Treatment of Wastewater in the Tropics (1975)	AIT
5.1.15	Performance of Oxidation Ditches in Thailand (1975)	AIT
5.1.16	Comparison of Activated Sludge, Trickling Filter and Anareobic Contact Processes (1976)	AIT
5.1.17	Aerobic Treatment of Liquid Wastes from the Fruit Processing Industry (1976)	AIT
5.1.18	Rapid Estimation of Waste Treatment (1978)	AIT

6. Water Pollution

6.1 Field Survey Data

6.1.1	Water Pollution Survey in Bangkok Metropolitan Area	CU
6.1.2	Distribution of Heavy Metals, DDT, PCB, and Certain Pollution Parameters in the Chao Phay River Estuary	CU
6.1.3	Findings of Major Klong Survey	BDS

6.2 Water System Analysis (Quality, Flow Rate)

6.2.1	Chao Phay Meklong Basin Study	RID
6.2.2	Multi-Purpose Reserviors of Operation Planning Study of the Year 1979	EGAT
6.2.3	Chao Phya Basin - Lower Rule Curve and Rationing Policy Initial Study (1978)	EGAT
6.2.4	Mathematical Optimization Model for Regional Water Quality Management : A Case Study of Chao Phya River (Phase I) (1978)	NEB

6.2.5	Water Discharge and Silt Transport - Port Phrachula - (1970 - 1076)	PAT
6.2.6	Water Discharge and Silt Transport - Bang Sai - (1970 - 1976)	PAT

6.3 Water Pollution Control

6.3.1	A Preliminary Study on Use of chao Phya River Fish as Pollution Bioassay Organisms (1978) (Abstracts)	NEB
6.3.2	Environment 1978 No. 1	NEB
6.3.3	Environment 1978 No. 2	NEB
6.3.4	Manual of NEB Guidelines for Preparation of Environmental Impact Evaluations (1979)	NEB
6.3.5	Environmental Guidelines for Coastal Zone Managemant in Thailand Inner Gulf Zone (Abstruct)	NEB

7. Sanitation & Hygienic Condition

7.1 Nightsoil Collection and Disposal

7.1.1	Standard Style of Toilet System (Drawings)	BDS
7.1.2	Data on Present Activities for Nightsoil Collection & Disposal	BDS

7.2 Water Borne Disease

7.2.1	Epidemiological Surveillance Report, Bangkok Metropolis for 1955 - 1978	BPH
7.2.2	Reported Communicable Diseases in Various Provinces, Thailand (1971)	MOH
7.2.3	------"------ (1972)	MOH
7.2.4	------"------ (1973)	MOH
7.2.5	------"------ (1974)	MOH
7.2.6	------"------ (1976)	MOH
7.2.7	------"------ (1977)	MOH

7.3 Solid Waste disposal

7.3.1	Price List of Fertilizer (Compost)	BOS

8. Price Data

8.1 Land Cost

8.1.1	Land Cost in Bangkok	DOL

8.2 Material, Energy and Construction

8.2.1	Price Data on Construction Cost of Pipes	BDS

9. Financial Data

9.1.1	BMA Income Comparison of 1977 and 1978	FRS
9.1.2	Annual Budget of 1979 Fiscal Year	BDS
9.1.3	Appraisal of the Second Bangkok Water	MWWA
9.1.4	Project in the Kingdom of Thailand Supply (1979)	FD
9.1.5	Expenditure Budget of Bureau of Public Works (1976 - 1980)	FD

10. Others

10.1	Research List of NEB (1979) (in Thai)	NEB
10.2	AIT Research Summary (1969 - 1972)	AIT
10.3	" (1973 - 1974)	AIT
10.4	" (1975 - 1977)	AIT
10.5	" (1977 - 1978)	AIT
10.6	Title of Research (1967 - 1979)	AIT
10.7	Research Topics of the Institute of Environmental Research (1975 - 1979)	CU
10.8	Thesis Abstructs 1977	CU
10.9	Statistical Bibliography 1975	NSO
10.10	Long Term Biochemical Oxygen Demand	AIT

ANNEX 3. NAME OF GOVERNMENT AGENCIES VISITED AND PERSONS MET

1. Building Control Division, BPW, BMA

   Mr. Tanoosuk, Engineer

2. Bureau of Public Health, BMA

   Dr. Prasongporn Jarumitintorn, Deputy Director - General

   Mrs. Nittaya Mahaplon

3. City Planning Division, Office of Under Secretary of State for BMA

   Mr. Charitparkorn Veraphalin, Director

4. Communicable Disease Division, Dept. of Health, Min. of Health

5. Construction Control Division, BPW, BMA

   Mr. Nikorm Pradnakorn, Deputy Director

6. Department of Sanitary Engineering, CU

   Prof. Sudchai Champa

   Dr. Thongchai Panswad

7. Development Division, Planning Dept., EGAT

   Mr. Payak Patnarathorn

8. Environmental Engineering Division, AIT

   Dr. Tanbo

   Dr. Watanabe

   Assist. Prof. Mrs. Samorn Muttamara

   Dr. Chongrak Polprasert

9. Environmental Health Division, BPH, BMA

   Dr. Voravit Leknark, Chief of Occupational Health Section

10. Estate Management Division, NHA

   Mr. Vivad Premprasert, Engineer

11. Groundwater Division, MRD, MOI

Dr. Vagee Rumanong

12. Industrial Environmental Division, DOI, MOI

Mr. Samarn Thungthongtavee, Chief

13. Institute of Environmental Research, CU

Dr. Surin Setamanit

Dr. Suthirak Sujarittanonta

14. Meteorological Department

15. National Environmental Board

Dr. Pakit Kiravanich, Deputy Secretary General

16. National Research Council

Dr. Sernpol Ratasuk

17. National Statistical Office, Office of Prime Minister

18. Planning and Control Division, MWWA

Mr. Bengapon, Engineer

19. Planning Department, EGAT

Mr. Srid Aphaiphuminart, Director

20. Physics and Engineering Division, Dept. of Science, MOI

Director

21. Route Division, PAT

Mr. Chit Swangsook, Director

22. Technical Division, BOS, BMA

Mr. Somchitt Trewichian, Head

23. Water Operation and Maintenance Division, RID, MOA

Mr. Lek Jindasangan

24. Department of Lands, Ministry of Interior

25. Department of Highways, Ministry of Communication

26. Faculty of Sanitary Engineering, Mahidol University

Assistant Professor Suvit

27. Financial Division, Office of Under Secretary of State for BMA

28. Legal Division, Office of Under Secretary of State for BMA

29. Metropolitan Electricity Authority, Ministry of Interior

30. Office of Town and Country Planning, Ministry of Interior

31. Telephone Organization of Thailand, Ministry of Communication

ANNEX 4. MINUTES OF THE MEETING (21 Nov. 1979)

The meeting was held between Bureau of Drainage and Sewerage, BMA, and Japanese Survey Team, as follow:

DATE : 21st November, 1979
TIME : 9:30 am - 3:00 pm
PLACE : BDS Conference Room in Bangkok

Attendents

Bureau of Drainage and Sewerage

Mr. Anuchit Sodsathit	Deputy Director
Mr. Somchitt Kattiyavara	Chief of Technical Division
Mr. Sumon Ratanataya	Chief of Wastewater Treatment Plant Div.
Dr. Kusak Komolrit	Senior Engineer of Technical Div.
Mr. Paitool Goolchai	Chief of Planning Section, Tech. Div.
Mr. Chungtong Opassiriwit	Counterpart
Mr. Chaiwat Angkitanonth	-"-
Miss Injira Porntaveewat	-"-

Japanese Survey Team

Dr. M. Kashiwaya	Member of Advisory Committee
Mr. A. Shinbuchi	-"-
Mr. T. Kasai	JICA
Mr. E. Takayanagi	Bangkok Resident Member
Mr. S. Nakatake	-"-
Mr. T. Mizutani	-"-

Subject

Report and discussion on the progress in the Preliminary Engineering Survey.

Minutes

1. Deputy Director of BDS declared opening of the meeting.

2. The chairman of Japanese advisory committee briefed the progress in the Preliminary Engineering Survey as follows;

After the submission of the Inception Report, our member in Bangkok started for data collection. During these two and half month they visited various municipal and central government agencies for collecting data. In parallel with that, field survey has also been carried out, namely for accumulating data of wastewater quality and quantity discharged from combined sewers under wet weather conditions. Unfortunately, during the rainy season of this year very scarce rains were experienced and the period of the season was unexpectedly short. Our members had only one chance of sampling so far. However, I think the progress of the Preliminary Engineering Survey is quite satisfactory in general. I would like to appreciate your cooperation for us. Today, I am glad to have a opportunity of reporting our achievements and discussing some major points each other.

3. The Survey Team gave Explanation of the present progress situation by the item, which was followed by discussions between both sides as follows;

i) Town Planning

It was reported by the Survey Team that data on existing and future population of entire BMA have already been collected.

The reliability of these data has been confirmed by both sides. However data needed for estimating population distribution at present and in the future are still inadequate. The cooperation for further follow-up of these lacking data were presented by BDS. Hereafter the data of population in each town (a district comprises some number of towns), will be pursuied.

The collected data on existing land use have been shown on the map and confirmed by BDS to be as only one available data. Therefore, it is agreed that as far as existing land use data is concerned the shown data can be used for the coming study.

As to the future land use plan, the Survey Team reported that the authorized one was not available. It was proposed by BDS to visit Department of City Planning, Ministry of Interior and ask for the future plan. The questionnaire will be prepared by the Survey Team and the appointment to the department will be made by BDS.

ii) Topography

It was confirmed by BDS that the available topographical maps are those with a scale of 1:50,000, 1:20,000 and 1:12,500. The street map of each district is also available at City Planning Division, BMA, and can be prepared by BDS if necessary at the time of the coming study. According to BDS there is no data of ground elevation which covers entire area of central Bangkok.

In case of necessity it is said to be allowable for the Survey Team to take back copies of the available topographical maps, however, these must be discussed further at the time when it would be requested.

iii) Domestic and Industrial Wastewater

Domestic wastewater flow for the future will be estimated on the basis of the Master Plan for Water Supply (MWWA).

Industrial wastewater flow data are now requested to Department of Industry, Ministry of Industry. If necessary further investigation will be carried out in the coming study.

Per capita flow and loadings data would be required in the coming study.

iv) Storm Water

The Survey Team Reported, the design criteria of storm water applied in the Master Plan by CDM can be adoppted for the study of the sewerage planning. However, the rainfall records required for the study of overflow rate of pollutant loads from combined system should further be collected by means of taking copies of rain guage's record papers for some ten years. It was pointed out by BDS that there were many rain guage stations in Bangkok and the station from which the records were collected should be properly decided. Considering the object of the expected study the Survey Team answered that data in the central portion of the city would be suitable one.

v) Existing Sewerage and Drainage Facilities

The Survey Team reported that they visited two of eight treatment plants belonging to NHA and collected data from them. Further field survey for the NHA's plants will be carried out during the latter half of this survey. It was confirmed by both sides that there are no existing communal treatment plants except those in NHA.

The necessity of survey for the sewerage charging system in NHA estate was proposed by the Survey Team and agreed by BDS.

It was agreed by BDS that there were no data which showed how many houses connected illegally their toilet effluents to public sewers or klongs nearby. It seems that the bulk of individual property throughout the city

must have connected their toilet outlets to nearest public sewers or receiving waters.

As to data on existing drainage facilities, the Survey Team stated that they would require further data and BDS answered they could cooperate for the need.

vi) Meteorological, Hydrological and Hydraulic Data

Most of data required has been collected.

vii) Geological Data

The data will be collected from now on. BDS informed the Survey Team that data of subsidence of ground would be available and they would try to seek it together with the Survey Team.

viii) Institutional Data

It was reported by the Survey Team that the data on administrative organization in BMA had already been collected but that of central government concerned project not adequate. BDS suggested that as to central government organization, "Thailand Year Book" might be helpful.

About the data collection on financials and laws concerning to drainage and sewerage management, the Survey Team asked an cooperation of BDS. BDS suggested if the questionnaires were prepared by the Survey Team they would properly assist the survey.

ix) Chronological Records on Flooding

BDS stated that the data on flooding could be easily prepared by them. The data could involve informations of areas flooded together with the frequency.

x) Sea and River Water Quality

Water quality data of the Chao Phya River was collected from National Environmental Board which is responsible for water pollusion control in Thailand. NEB presently put emphasis on a protection of the Chao Phya River in regard to water pollution.

Data on Klong water quality are still poor. The Survey Team suggested that further accumulation of klong water quality data would be desirable for the sewerage study in the coming year. It would also be suggested by the Survey Team, the data accumulation would be important as part of chronological monitaring of klongs's water quality which would be essencial for defining critical situations in the klongs.

BDS answered that they were aware of the important of the sampling and data accumulation of klong's water quality and they had set out to establish a laboratory in BDS. And the sampling of klong's water also had already been started. BDS declared that, although establishment of the laboratory was in short history, the intention of BDS to improve it and increase informations on water quality in klong was strong.

After the preliminary survey, it was understood that the sea water quality in around the river mouth of the Chao Phya River was effected by various pollution sources other than wastewater discharged from urbanized Bangkok area. Therefore, the Survey Team suggested that the sea water pollution control study required all sort of data concerning to pollutant loads together with their sources which were located throught the Chao Phya River basin, and it was clear that this sewerage study could not cover all those wider areas. It is also apparent the wider area comprise several municipal

government area which are beyond the reach of BMA authority. Although, BDS pointed out the importance of sea water pollution control, it was agreed on the basis of situations mentioned previously that it was impractical for BDS to do something for the sea water pollution control.

xi) Price Data

The land cost data will be asked to Department of land, which could estimate for tax purpose.

The other price data concerning to drainage and sewerage management will be asked to BDS.

xii) Data on Water Borne Disease

The data were collected although some check points are remained.

4. The Survey Team asked the members of BDS if they have some idea or comments on the project area to be covered by the Master Plan. BDS mentioned that it is expected for the Survey Team to propose the area by the end of this survey duration.

5. The Survey Team asked the target year of the Master plan. The member of BDS expected that the team would proposes the target year after collection of data and information.

6. The Survey Team reported that they picked up several points in the central area which were presently open spaces, as proposable treatment plant sites and asked whether those areas could be considered to be available as the plant sites.

Following places are proposable;

a) The mouth of Klong Bang Lam Poo

b) The Pond of Makkassan

c) The Ponds of Tobaccomonopory

d) The mouth of Klong Chong Nonsi

e) The space of Port Authority, Klong Toey

It was quite apparent that nobody could convince the possibility of certain open spaces' acquisition at this very beginning of the study. However, it was also apparent in the central area there is not open space except those mentioned above and if any point of them was considered to be absolutely not available due to specific local economic or social situations, the area should be eliminated at this critical time of sewerage study. Otherwise the validity of the coming study would significantly be reduced or in other words, inadequate informations might lead the study to a wrong truck.

BDS insisted that the study for justifing the request of proposable treatment sites should be firstly done as the prerequisite requirement for discussions or negociations for land acquisition. BDS also mentioned that there was not any point among those indicated by the Survey Team which was absolutely not available at this stage and agreed for the Survey Team to consider those areas to be as proposable sites, but BDS added it would be very difficult to acquire the lands if they were occupied for the other purposes by any municipal and central government agency. Private lands are rather easy in negotiation and have much more chance to be acquired.

7. The Survey Team mentioned that data collection is on schedule owing to cooperative efforts of Thai counterparts, that, however, storm water runoff survey is only one behind schedule because of very seldom rains caused by quite short rainy season of this year, and that data collection and follow up of inadequate data would be continued by the end of January. After that, the Preliminary Engineering Survey Report will be prepared and submitted to BDS by the end of February.

In the duration of preparation and submission of the

report, Japanese committee will arrive and discuss with member of BDS. It was approved.

8. BDS asked schedule of the coming studies, Master Plan and Feasibility Study. JICA answered that, provided the Government of Japan would approve to assist those studies, generally speaking it would take one year for Master plan and another year for Feasibility Study, therefore two years would be necessary. However, in the case that the Feasibility Study of certain part of the area are urgently needed it is not necessarily impossible to start the study from some time before the Master Plan will have been completed.

9. The Survey Team suggested that the topographical maps of 1:5,000 and 1:2,500, presently unavailable, would be required for further studies of sewerage which were expected as the next step. BDS answered that they have a plan to make maps in the unified form. The scale of the map under negotiation will be checked by a BDS member. In addition, it is informed that BDS has a plan to survey existing piping system and wastewater production as well as its characteristics in the most congested core portion of the city. BDS asked for the Survey Team to make suggestions or comments for the scope of work of the planned survey. The Survey Team promissed the assistance.

10. BDS stated that at the time of Master Plan study it should be considered whether the centralized system with one treatment plant be applied or not, if not how many treatment plants be constructed. And it should also be studied that individual home or property treatment system for wastewater disposal could be feasible or not from the view point of engineerings and economics. BDS also stated that for new housing area the sewerage system ought to be furnished as a part of infrastructure nevertheless there is not any engineering standard at the moment, thereupon, consideration and recommendation of the proper alternative were requested to be included in the coming study.

11. Deputy Director of BDS finally emphasized that BDS would continue to cooperate with the Survey Team for achieving the object of the preliminary engineering survey satisfactorily.

ANNEX 5. MINUTES OF THE MEETINGS (FEBRUARY, 1980)

MINUTES OF MEETING

FOR

THE BANGKOK SEWERAGE SYSTEM STUDY

Held on : 14 Feb. 1980
19 Feb. 1980

Agreed Between

BUREAU OF DRAINAGE AND SEWERAGE

And

JAPAN INTERNATIONAL COOPERATION AGENCY

Dated : Feb. 1980

P. Samalapa.

(Mr. Prasert Samalapa)

Director

Bureau of Drainage and Sewerage, BMA

E. Takayanagi

(Mr. Enao Takayanagi)

Site Leader of the Japanese Survey Team for the Bangkok Sewerage System Study

Minutes of Meeting (14 Feb. 1980)

The Meeting was held between Bureau of Drainage and Sewerage BMA, and Japanese Survey Team, as follow:

DATE : 14 February 1980
TIME : 9.30 A.M. - 12.00 A.M.
PLACE : BDS Conference Room in Bangkok.

Attendants

Bureau of Drainage and Sewerage

Mr. Prasert Samalapa	Director
Mr. Anuchit Sodsathit	Deputy Director
Mr. Somchit Kattiyavara	Chief of Technical Division
Mr. Sumon Ratanataya	Chief of Wastewater Treatment Plant Division
Dr. Kusak Komolrit	Senior Engineer of Technical Div.
Mr. Paitool Goolchai	Chief of Planning Section, Technical Division
Mr. Chungtong Opassiriwit	Counterpart
Mr. Chaiwat Angkitanonth	"
Mr. Chanchai Vitoonpunyakij	"

Japanese Survey Team

Dr. M. Kashiwaya	Member of Advisory Committee
Mr. E. Takayanagi	Bangkok Resident Member
Mr. S. Nakatake	"
Mr. T. Mizutani	"

Subject

Discussion on the Draft Preliminary Engineering Survey Report.

Minutes

1. Director of BDS welcomed the chairman of Japanese advisory committee and informed the members that the carrying out of sewerage project has officially been approved by the top executive administrators. Therefore the next step of work should be carried out smoothly and effectively.

2. The Director asked the Deputy Director to be the chairman of the meeting since he had other thing to be done.

3. The Deputy Director declared opening of the meeting.

4. The chairman of Japanese advisory committee together with Mr. S. Nakatake briefed the Draft in Preliminary Engineering Survey Report as follow:

The survey team has started for data collection since the arrival in August 1979. In November 21, 1979 there was a discussion between BDS staff and Japanese survey team about the progress report. After that the report was submitted to BDS, DTEC and Japan Embassy in Bangkok. Since then the team kept on carrying data collection and a draft final report has been prepared. Some parts of the report were the same as those in the progress report and some parts were going to be added.

5. The Survey Team described the contents of the draft final report item by item, which was followed by discussions between both sides as follows.

I) General

The Survey Team, with the cooperation of the counterparts had collected the available data which would be retained in both BDS and JICA. The data collected are enough for the further Master Plan Study. The results of the collecting data had shown that the Klong water pollution is serious as well as the Chao Phya River Pollution. Therefore, it would be

necessary to prepare a comprehensive Sewerage programme for further implementation.

The survey team also interviewed some academic experts at Chulalongkorn University, Mahidol University and AIT. Their opnion about the sewerage works in Bangkok were reported in the other part of the report.

II) Achievements and Findings

a) Town Planning

It was found that there was no comprehensive town planning for the Metropolis. The Team recommended that it is necessary to have town planning. The 10 years population collected from NSO were very useful for the study and were enough for the Team. There was also a working group consisted of the representatives from BMA, NESDB, NSO to work out the population projection. As for land use, the Team was informed from Office of Town and City planning, Ministry of Interior that there was no fix land use plan. For the other Infrastructure plans, the CDM plan for Drainage and Flood Protection, the map of planned route of highway and road, and the route of trunk underground telephone and electricity cables were collected. However, the underground power line map is not available.

b) Topography

The content of this item was the same as that in the progress report. There was no map which could be used for locating treatment plants and trunk sewers. Therefore, the 1:10,000 map would be needed for future study. The map of Bench Mark prepared by Chulalongkorn University and BPW, BMA was collected, however, the ground elevation survey for sewerage system planning would be needed and would be carried out by the Japanese side.

c) Domestic and Industrial Wastewater

The explanation on municipal water supply, groundwater

use and domestic wastewater were not change from those reported in the progress report. In addition, the dry weather wastewater survey at Huay Kwnag waste treatment plant was carried out and reported together with the wastewater survey in Klong Lord area done by Mahidol University. However, the data were not enough to estimate quantity and quality of domestic wastewater generated in Bangkok. For the commercial and institutional wastewater study, it was recommened that the field survey would be necessary for the later study. The Survey Team had tried to collect the data of industrial wastewater, but only the number of the industry was available. Therefore, it would be required to provide further information on location, quantity, quality, etc.

d) Storm Waters

The data reported in CDM plan could be used for future study. In addition to this, the survey team had collected the 10 years rainfall data which would be used in addition to the avaible CDM data.

e) Existing Sewerage and Drainage Facilities

The Survey Team reported that. There was no change in this item from that in the progress report. It was pointed out by BDS that there would be some more details on future facilities and for getting them the Survey Team could consult Mr. Paitool.

For nightsoil Collection and disposal, it was stated by the Survey Team that there were some illegal private firms collect sludge from septic tanks and dispose into some Klongs which causes water pollution. Unfortunately, no information had been obtained about exact disposal site. Therefore, it was required to collect further data of existing nightsoil disposal.

f) Meteorological, Hydrological and Hydraulic Data

It was informed by the Survey Team that most data had

been collected.

g) Geological Data

The data collected were sufficient enough for the later study. No boring test is required.

h) Institutional Data

The Survey Team reported that the basic information for the BMA administrative organization and central government concerned project had been collected. However, the BMA administrative structure would be changed in 1980. Therefore it would be necessary to study in more details in the later Master Plan study.

i) Chronological Records on Flooding

The Survey Team requested for the map of flood areas and their rainfall intensity. The BDS accepted it and the map would be given later.

j) Sea and River Water Quality

The Survey Team Reported that there was no long term monitoring of water quality. Although DOI was carried DO monitoring of Chao Phya River and water quality of selected Klongs in Bangkok had been monitored by BDS. The Survey Team requested for the data of Klong water quality. The BDS agreed and a copy of the data would be given.

k) Price Data

The Survey Team discussed that the land cost data was difficult to get from the Department of Land and it seems to be secret. However an official letter had been sent to ask for that data and the Survey Team hoped they could get it. The BDS suggested that the official

land cost might, in most cases, be lower than the market price. To get the actual land cost, the interview with the landlords were recommended by BDS.

l) Water Borne Disease

The data had been collected.

m) Survey for Existing Conditions of Sewerage, Drainage and Natural Water Course

In addition to those reported in the progress report, the Survey Team pointed out that according to the field survey it had been found that in some NHA Housing Estate effluent from Septic tanks are connected to central treatment plant. BDS discussed that probably the tanks had been constructed before the plant was furnished, Both sides agreed that for actual reason, the inteview with NHA staffs would be necessary.

The chairman of the Japanese Advisory Committee requested that if the sewerage charge system and its regulation in NHA were obtained it would be beneficial for the later Master Plan study. Both sides agreed that the Survey Team member together with BDS staff should see NHA staffs.

n) Survey for "Combined vs Separate System"

The Survey Team reported that to study the combined vs Separate System a study on wet weather wastewater Survey had been carried out at Klong Tan pumping station. It was obvious that the data collected was not enough, therefore, more survey would be needed in the Master Plan study.

The chairman of the Advisory Committee asked BDS to keep on carrying the Klong water quality monitoring and suggested that the program schedule attach to the Preliminary Engineering Survey Report.

The Survey Team reported that for finding per capita loading, a dry weather wastewater survey had been carried at Huay Kwang Treatment

plant. The results had been collected and reported. However, it was recommended to carry out more survey in the later Master Plan study.

o) Survey for Treatment Method of Wastewater and Sludge

The Survey Team informed that, in addition to those reported in the progress report, the interview to some experts in Thailand from Chulalongkorn University, Mahidol University and AIT had been made. This was to know their conceptual idea on water pollution control, wastewater treatment and sludge disposal and their idea was summaried in the report.

III. Transfer of Knowledge to counterparts

The Japanese Survey Team and Thai counterparts had been working together since August 1979. The improvement of analytical technic, field survey planning had been discussed. On top of this an example of klong water survey programme had been set and a dry weather wastewater survey had been carried out by BDS staffs.

IV. Recommendation for Statistical Data

For later studies the Survey Team requested that the data on water pollution, industrial wastewater and night soil collection and disposal should be provided. BDS accepted the principle and would try to collect the mentioned data.

5. The Chairman of the Advisory Committee Summarized the additional data to be provided as follow:

a) data on water Pollution
b) data on industrial wastewater (location, type and size)
c) data on existing nightsoil disposal
d) Survey for existing piping system
e) dry and wet weather wastewater quality sampling
f) Ground elevation survey

g) Map used for report (1:10,000)

h) Regulation of sewage charge system and charge collection system (NHA)

It was agreed that in the later study Japanese team would carry out for d) and f). The last item data could be collected in this survey.

6. Both BDS and Japanese Team agree to discuss the scope of work for the Master Plan study in the afternoon meeting.

Minutes of Meeting (14 Feb. 1980)

The Meeting was held between Bureau of Drainage and Sewerage, BMA, and Japanese Survey Team, as follow:

DATE : 14 February 1980
TIME : 14.00 - 16.00 PM.
PLACE : BDS. Conference Room in Bangkok

Attendants

Bureau of Drainage and Sewerage

Mr. Anuchit Sodsathit	Deputy Director
Mr. Somchit Kattiyavara	Chief of Technical Div.
Dr. Kusak Komolrit	Senior Engr. of Tech. Div.
Mr. Paitool Goolchai	Chief of Planning Sect. Tech. Div.
Mr. Chungtong Opassiriwit	Counterpart
Mr. Chaiwat Angkitanonth	"
Mr. Chanchai Vitoonpunyakij	"
Miss Injira Porntaveewat	"

Japanese Survey Team

Dr. M. Kashiwaya	Member of Advisory Committee
Mr. E. Takayanagi	Bangkok Resident Member
Mr. S. Nakatake	"
Mr. T. Mizutani	"

Subjects

Discussion on the scope of work for the Master Plan Study.

Minutes

1. The Deputy Director declared opening of the Meeting.

2. The Chairman of Japanese Advisory Committee Briefed the scope of Work (this is tentative and subject to official approval of both governments, Thai and Japan) for the Master Plan Study as follow:

It is tentatively scheduled that the Japanese Team of 9 - 10 members would come in June 1980. Two of them would work for both Master Plan and the Rattanakosin Project by staying longer than others. The Draft Final Report would be prepared in March 1981 and the Final one would be completed approximately in June 1981. From June 1981, provided the Government of Japan would approve to assist further studies, another Japanese Team would come and study on the Feaseability Study for the top priority area selected by BDS and Japanese Team. The Final Report of the latter study would be finished by September 1982.

3. The Japanese Survey Team described the scope of work for the Master Plan as follow:

1) Introduction

This part is only general condition of Bangkok and there was no special problem.

2) Study Area and Target Year for Planning

2.1 Target year for Planning.

The year of 2000 will be the Target year. This

idea came for MWWA Master Plan. And this target year would be considered later.

2.2 Study Area

Related to Master Plan for MWWA and CDM Master Plan, the study area would be approximately same as recommended by CDM, 370 km^2. BDS suggested that the whole Bangkok area should be studied, but not in details. After that the Master Plan Area of 370 km^2 would be considered. The feaseability study area would be chosen after the Master Plan Report would have finished.

The Survey Team would discuss about the Study Area later.

3) Survey of Existing conditions

3.1 Topography and geology

The ground elevation survey would be needed. The next mission might hire a local firm to do the work.

3.2 Population and Land use

This kind of Data is already enough.

3.3 Evaluation of Existing Wastewater Disposal Practices

This work would include survey of existing pipe size, slope and elevation. These Data would have been collected by BDS.

BDS reported that it was very difficult to collect these data. However, BDS. was going to hire Chulalongkorn University to carry out existing pipe survey. This would not cover the whole Bangkok area, but it could be used for Master Plan Study. For the details, the Survey Team could ask for Mr. Somchit and Dr. Kusak.

Existing toilet system would be investigated in order to make recommendation of its improvement.

3.4 Environmental Water Pollution

The area that has already been overloaded should be in Master Plan Area and klong water quality survey should be carried out further by BDS.

4) Future situation set for the study area

4.1 Population and Land Use

This should be designed and planned.

4.2 Drainage system to be expected in the future

BDS implied that new long range project would be planned on drainage and Flood Protection which would cover Patumtanee to Samutprakarn Provinces.

Basically CDM recommendation would be applied for the drainage project, however, reflecting gradual changing in the situations in Bangkok BDS would make slight modification to the recommended plan. The modification would not be large enough to change the fundmental portion of the proposed system, therefore, Japanese team could carry on their study in association with the Master Plan of CDM.

4.3 Water Supply

The MWWA Water Supply Plan was considered to be essential for the wastewater Management Planning.

4.4 Transportation, Electric Power and Telephone

It should be avoided competition for land spaces in the Master Plan. Therefore, the plans of the infrastructures were needed to be learnt.

5) Wastewäter Quantity and Characteristic

5.1 The Japanese Team should make field sampling and estimate flow rate of wastewater, domestic and industrial.

BDS suggested that Huay Kwang area cannot be used as a representative for typical area. Representative for Bangkok typical area should be Prakanong District, from Ploenchit area to Prakanong Bridge because Bangkok typical area is a combination of residential and commercial areas.

5.2 Industrial Wastewater

The quanity and quality of wastewater from factories would be needed to be checked.

5.3 Extraneous Waters

Flow rate of extraneous would be studied.

6) Estimation of Future Water Quality in the Chao Phya River due to Wastewater Disposal System.

This could be done by using the data of NEB and the computer of AIT.

7) Strategy for Wastewater Management

7.1 Longrange, Shortrange and Interim Measures.

It takes a long time to set up sewerage system to cover the whole area. Zoning should be required and the location of the treatment plants would be chosen together with trunk sewer routes. For the time being, only central of the area would have sewer system and treatment Plant. The interim measures for the unsewered area would be considered and alternatives would be recommended.

7.2 Combined vs Separate System

This study should be carried out taking account of various factors including engineering, economic and social aspects.

7.3 Study of treatment Methods for Wastewater and sludge.

7.3.1 Selection of recommendable sewage treatment processes

7.3.2 Selection of Recommendable Sludge, Grit and Screening Treatment Processes and Disposals.

Sludge problem should be considered.

7.4 Comparative Study of Alternative Sewerage Treatment and Disposal Systems.

The comparative study for alternatives would be carried out and the proper system should be proposed.

7.5 Design criteria and Design of Major Facilities of system Proposed.

The design criteria had to be studied and recommended. The proposed system would be designed and the drawing would be prepared.

8) Study on availability of Construction Materials, Machinery and Man Power for Constructions, Operation and Maintenance

The standard of the items concerned would be checked and considered.

9) Construction Method and Material

Applicable construction method and material would be studied and recommended. The Japanese Team would recommended for BDS to have new standard of materials of, such as, pipes or others. BDS agreed and reported that BDS had been considering this subject.

10) Rough Estimation of Cost of Construction, operation and Maintenance

These considerations would be executed.

11) Preparation of Implementation Programme.

The programme would be prepared in the form of staging.

12) Study of Sewerage and its related Regulations

The study would be conducted in the Master Plan.

13) Study on Organization for Sewerage work

14) Study of Charge System and Financial Plan

15) Rough Estimation of benefit

16) Evaluation of the Project

These studies would be carried out and reported in the final Master Plan Report.

Minutes of Meeting (19 Feb, 1980)

The meeting was held between Bureau of Drainage and Sewerage, BMA, and Japanese Survey Team, as follow:

Date : Feb. 19, 1980
Time : 9.30 AM. - 12.00 AM.
Place : BDS Conference Room in Bangkok

Attendants

Bureau of Drainage and Sewerage

Mr. Anuchit Sodsathit	Deputy Director
Mr. Somchit Kuttiyavara	Chief of Tech. Divison
Mr. Sumon Ratanataya	Chief of Wastewater Treatment Plant
Dr. Kusak Komolrit	Senior Engineer of Tech. Div.
Mr. Paitool Goolchai	Chief of Planning Section, Tech. Div.
Mr. Chungthong Opassirivit	Counterpart
Mr. Chaiwat Angkitanonth	"
Mr. Chanchai Vitoonpunyakij	"
Miss Injira Porntaveewat	"

Japanese Team

Mr. K. Kumagishi	Member of JICA
Mr. M. Kashiwaya	Member of Advisory Committee
Mr. E. Takayanagi	Leader of Japanese Survey Team
Mr. S. Nakatake	Member of Japanese Survey Team
Mr. T. Mizutani	"

Minutes

1. The Deputy Director of BDS declared opening of the meeting.

2. The Chairman of the Advisory Committee stated that on the Feb. 14, 1980 both sides discussed on the Draft Preliminary Engineering Report and the Scope of Work for the Master Plan Study. The meeting on Feb. 19, 1980 concerned about 2 major items details of ;

1) The scope of Work (draft) of the Study on the Bangkok Sewerage System Project in the Kingdom of Thailand (Revision of Master Plan).

This Scope of Work comprises not only the contents to be studied, which have already been discussed at the meeting held on 14 Feb., but also the name of the report to be submitted during the course of the study, and undertakings of both Governments, Thailand and Japan. This draft Scope of Work has been prepared with the objective to discuss and get agreement in principle on fundamental matters related to the Master Plan Study.

2) The Memo of Dr. M. Kashiwaya on February 19, 1980

This Memo has been prepared to explain required major works in the Master Plan Study for which the mutual cooperation is expected. The tentative work schedule together with estimated man-power are also included in the Memo. By this Memo Thai side can get idea of the study programme in perspective and could iniciate the preparations to receive the Japanese Study Team, including setting up of appropriate counterpart group, office space to accomodate expected man-power and other concerning affaires in the coming studies.

3. Both sides started the further discussion about the scope of work, BDS agreed for the study area of about 370 km^2 and the target year of 2000. However, BDS would like to know whether it means that the implementation of sewerage system would be finished by the year 2000.

The Chairman of the Advisory Committee explained that the study area of about 370 km^2 would be almost the same as that of CDM. Master Plan. However there would be some changes which would be depended on the study. In other words, the CDM Master Plan would be considered as the reference for the sewerage Master Plan Study.

As for the implementation programme, the central zone of the study area would be selected and divided tentatively into three phases, for example, as follow:

1st phase 1986 - 1990 for the first priority area

2nd phase 1991 - 1995 for the second priority area

3rd phase 1996 - 2000 for the third priority area

The first priority area would be studied in the stage of feasibility study in 1981 fiscal year and the implementation programme of the first priority area would be carried out in the year 1986 - 1990. Therefore, by the year of 2000 the implementation of sewerage system for the selected control zone would be finished.

For the other zones within in the Study Area wastewater treatment plant sites together with trunk sewer route would be recommended so as to reserve land space for the sewerage system to be required in the future. There would also be the design criteria or standard to be applied for the other zones in which the short-range measures including individual house treatment or communal treatment, would be applied at the time of development. The system as short-range measure would eventually be converted or connected to the public system when its implementation would become feasible. Since the implementation programme would take long time, it would be necessary to consider interim measures in the first three priority areas. Therefore, alternatives would be recommended.

4. BDS would like to add the objective to the scope of work as follow:

1) To develop the master plan for Bangkok to cover the area of 370 km^2 by June 1980 - March 1981. This plan should cover possible locating of treatment plant systems and its collection systems within the area.

2) Feasibility Study (Preliminary Engineering Design) by the time of March 1981 priority areas will be selected within the master plan area to be agreed upon by JICA and BMA. This study is to be completed by March 1982.

JT. described that the scope of work was only a formal form to get the approval from the Japanese Government. The details of the study and the range of time would be stated in the Inception Report which would be provided by Master Plan Study Team. It was also agreed by both sides that the details of scope of works and the Minutes of Meeting would be attached in the Preliminary Engineering Survey Report.

5. JT. reported the details of Scope of Work would be summaried as the Draft Scope of Work of the study on the Bangkok Sewerage System Project in the Kingdom of Thailand (Revision of Master Plan) which would be used as an agreement document signed by BMA and JICA. Both sides has considered the contents of the Draft scope of work and agreed that Design Criteria and Design of Major Facilities of System proposed should be added in the Draft scope of Work. JT. described the undertaking of the Government of Thailand. The Deputy Director of BDS commented Thai Government would undertake the additional appropriate required investigations recommended by the study team for the work. For the undertaking of the Government of Japan BDS would like to add as follow:

1) To dispatch the JICA study team.

2) To transfer the knowledge to Thai counterpart personnels during the study periods.

6. The Chairman of the Advisory Committee explained that the Japanese

Mission who come in June would read his memo. Any comments would be corrected by BDS. The Team would consist of not more than 10 persons. Two persons would stay in Bangkok until the end of December 1980. The rest would stay in Bangkok until Mid. August 1980, collecting additional data and bring back to Japan for making interim report which would be submitted to BDS in Mid December. Some persons would come by that time to discuss about the interim report and the feasibility area. The comments on the interim report would be given by Thai side in January, 1981. The Deputy Director of BDS suggested that the interim report should be submitted by English. However, summary of it should be in Thai in order that the submission of comments for the report should be achieved within one month. As for the transfer of knowledge and technology, two Thai counterparts would be sent to Tokyo from September to November 1980.

The Chairman of the Advisory Committee further explained that JICA would pay for the survey of wastewater flow and quality as well as for the feasibility study. However if BDS could allocate the budget partially for the latter, it would be helpful for carrying the study. Both sides ciscussed about the tentative schedule for the Master Plan Study and the Feasibility Study, the JT. explained that it would take 3 months to have the final Master Plan report printed therefore the report would be submitted to BDS in October. For the tentative schedule for Feasibility Study, BDS had no comment.

7. BDS asked for the Academic Training Program for one of BDS Engineer for Master Degree in Sanitary Engineer.

JT stated that there are only three universities in Japan which teach sanitary engineering. None of them instruct in English, therefore, it seems to be difficult for BDS engineer to attend the academic program in Japan. However, JICA would check the system for more details.

8. BDS would like to have one Japanese Sanitary Engineer in 1981 fiscal year to set the wastewater analysis laboratory and another expert as adviser for studying interim measures. JT. suggested BDS write the request to DTEC to show how many experts would be required as well as the job description and other details.

ANNEX 6

SCOPE OF WORK

ON

THE BANGKOK SEWERAGE AND SOLID WASTE DISPOSAL SYSTEM STUDY

IN THE KINGDOM OF THAILAND

(PRELIMINARY ENGINEERING SURVEY FOR SEWERAGE SYSTEM)

Agreed Between

BANGKOK METROPOLITAN ADMINISTRATION

And

JAPAN INTERNATIONAL COOPERATION AGENCY

Dated: August 22, 1979

(Maj.-Gen. Charan Sammatat)

Deputy Governor
Bangkok Metropolitan Administration

(Dr. Mamoru Kashiwaya)

Leader of the Japanese
Servey Team for the Bangkok
Sewerage and Solid Waste
Disposal System Study

(Mr.Xujati Pramoolpol)

Director - General
Department of Technical and Economic Cooperation

I. INTRODUCTION

In response to the request made by the Government of Thailand for technical cooperation in conducting the Master Plan Study on the Bangkok Sewerage and Solid Waste Disposal System, the Government of Japan agreed to offer the services of a team of Japanese experts to undertake the Study and transfer of knowledge to the counterpart personnel appointed by the Government of Thailand, in accordance with laws and regulations in force in Japan. The Japan International Cooperation Agency (hereinafter referred to as JICA) responsible for implementation of technical cooperation programmes of the Government of Japan, will carry out the Study in close cooperation with the Government of Thailand.

II. OBJECTIVE OF THE STUDY

The JICA dispatched a contact mission for the Bangkok Sewerage and Solid Waste Disposal System Study in March, 1979 to concrete the Study. Based on the Findings of this mission, the JICA will carry out the Preliminary Engineering Survey for the coming Study on Bangkok Sewerage System.

III. Contents of the Survey

1. Collection and Analyses of Data Available
   - (1) Town Planning
   - (2) Topography
   - (3) Data Related to Wastewater and Storm Water
   - (4) Data Related to Existing Facilities for Sanitation and Overland Flow
   - (5) Meteorological, Hydrological, and Hydraulic Data
   - (6) Geological Data
   - (7) Chronological Records on Flooding
   - (8) Institutional Data
   - (9) Price Data Including Material, Labour, and Land Costs
   - (10) Others

2. Survey for Existing Conditions of Sewerage, Drainage and Natural Water Course

3. Survey for "Combined vs Separated System" and "Zoning for Sewerage System".

   (1) Selection and investigation of typical Areas (Commercial, Civic and Residential)

   (2) Preview of Proposable Sites for Wastewater Treatment and Disposal

4. Survey for Treatment Methods of Wastewater and Sludge

5. Recommendation for Statistical Data to be improved for the Coming Studies

6. Recommendation for the Scope of Work for the Master Plan Study

IV. REPORTS

JICA will prepare and submit the following reports in English to the Government of Thailand.

1. Inception Report
   - 20 copies
   - within one month after arrival in Bangkok

2. Progress Report
   - 20 copies
   - in Mid-December

3. Preliminary Engineering Survey Report
   - 40 copies
   - at the end of the field work

V. UNDERTAKINGS OF THE GOVERNMENT OF THAILAND

1. To provide the Study Team with relevant data, information and mateirals necessary for the execution of the Study.

2. To exempt the Study Team from taxes and duties normally extended to Colombo Plan Experts for materials, equipment and personal.

effects brought into Thailand for the purpose of the Study.

3. To provide the Study Team with suitable office space, necessary office equipment and services for the Study.

4. To arrange necessary transporatation for the Study Team.

5. To appoint counterpart personnel (officials/engineers) to the Study Team during the Study period.

6. To make arrangements for the Study Team to bring data, maps and materials connected with the Study to Japan subject to the approval by the Government of Thailand.

VI. UNDERTAKING OF THE GOVERNMENT OF JAPAN

1. To transfer knowledge to the Thai counterpart personnel during the Study Period.

VII. SURVEY SCHEDULE

Items \ Year and Month	Aug. 79	Sep.	Oct.	Nov.	Dec.	Jan.80	Feb.
Collection and Analyses of Data Available	←	—	—	—	—	—	→
Survey for Existing Conditions of Sewerage, Drainage and Natural Water Course		←	—	—	→		
Survey for "Combined vs Separate System" and "Zoning of Sewerage System".			←	—	—	→	
Submission of Inception Report		o					
Submission of Progress Report					o		
Survey for Treatment Methods of Wastewater and Sludge				←	—	→	
Recommendation for Statistical Data to be inproved for the Coming Studies						←	→
Recommendation for the Scope of Work for the Master Plan Study						←	→
Submission of Preliminary Engineering Survey Report							o

ANNEX 7 MEMORANDUM FOR FIELD SURVEY PLANNING

I. WASTEWATER SURVEY

1. General

For the sewerage system designing, generally, wastewaters are considered on the base of following categories classified by various sources:

a) Domestic Wastewater
b) Commercial Wastewater
c) Industrial Wastewater
d) Extraneous Wastewater
e) Storm Water

Domestic wastewater includes all waters coming to sewer inlets from houses such as kitchen sink, bathing, washing, toilet flushing, etc.

Commercial wastewater is defined as water discharged from commercial area so that it includes domestic and trade wastes discharged from restaurant, hotel, shop, civic building, etc.

Industrial wastewater is usually determined by survey of each factory if it is considered to affect to a municipal sewer system.

Extraneous wastewater is consisted of groundwater infiltration through defective pipes, pipejoints, and manhole walls, and inflow of surface water from such sources as roof leaders, cooling water discharges, and storm drains.

Storm water is usually separated from dry-weather flow for economical treatment of wastewater, and discharged to receiving waters through the facilities designed well.

2. Estimation of Wastewater Quantity

1) Domestic and Commercial Flows

There are 3 ways, in principle, to estimate domestic and commercial flows as follows:

i) Gauging Flow

Where a wastewater system already exists, flow measurement is reliable. This survey is usually made by use of a weir on 24 hour-recording, and carried out during both dry and rainy seasons.

The results would be adjusted for increase of population and per capita flow to be expected.

ii) Totaling of Various Discharge Components

Where there is no existing sewer system, it is not feasible to measure flow, therefore, flow rate is estimated by summing up of various components of discharge such as kitchen sink, washing, bathing, toilet flushing, etc.

iii) Computation of Water Consumption Records

Water consumption record is a good basis for estimation of wastewater flow. However, the record is expressed by the avarage volume, in certain region, with respect only to the public water supply system. In usual, waters from private wells and other sources are not included. This point should be clarefully checked at the time of estimations of waste flow.

2) Industrial Wastewater Flow

Where industrial wastewater is not considered to affect to a municipal sewerage system it can be treated as a part of commercial wastes, or negrected.

3) Extraneous Water Flow

For economical wastewater treatment, extraneous waters should be shut out as much as possible.

Therefore, where existing pipes are used as a part of new sewerage system to be proposed, flow rate and causes of extraneous waters should be surveyed on the existing pipes.

4) Storm Water

As the base of hydraulic consideration for a combined sewer system, storm water is estimated for various runoff coefficients depending on each land use.

3. Wastewater Characteristics

1) Wastewater Parameters

For sewerage works, following wastewater parameters are usually used to describe general characteristics;

- Temperature
- pH
- Suspended Solids (SS) & Floatables
- Chemical Oxygen Demand (COD)
- Biochemical Oxygen Demand (BOD)
- Chloride Ion (Cl)

Other parameters such as toxics, color, etc. are also used for treatment of special industrial wastewaters.

2) Domestic and Commercial Wastewater

Where a sewerage system already exists, characteristics of domestic and commercial wastes are determined by field survey, which is usually carried out on 24 hours sampling (one or two hour interval) at the same time gauging flow. The samples are measured or analyzed on the parameters described above.

Appropriate correction on the results obtained are, if necessary, made for condition of the piping system such as deposition in the system, dilution by extraneous water, etc.

3) Industrial Wastewater

Where industrial wastes are considered to affect to sewerage system, their characteristics are estimated for each industry to be considered.

Adjustment is made for expected increase of future industrial wastewaters.

4) Extraneous Waters

Characteristics of extraneous waters are usually neglected for the sewerage works.

5) Storm Water (Wet Weather Wastewater)

Where a combined system exists, characteristics of wet weather wastewater are measured for initial runoff water flushing out deposts in the system to estimate the loadings to receiving waters.

4. Supplemental Survey

To obtain the data for correction and adjustment of results of field survey, following surveys are supplementally made:

1) Visiting survey for selected houses with questionnaire concerning with number of families and persons in each house, number of customers of shops if available, water bill per month, monthly income if available, etc.

2) Housing Survey on kinds and number of component houses in the survey area, such as shop, restaurant, processings and general residents.

5. Wastewater Survey Plan (Domestic and Extraneous)

1) Selection of Survey Area

The area to be surveyed should, at least, satisfy following conditions:

a) Population, households, and number of shops could be known or estimated in the area which be better as more typical on land use, residential or commercial.

b) Water Supply service should be completed.

c) Sewer system should be completely furnished in the area.

d) All wastewaters produced in the area are or could be made independent of the other areas' wastewaters, and be smoothly discharged before decomposition, if necessary,

by means of blocks and/or pumps.

2) Preliminary Preparation

a) Make discharge system to satisfy the above conditions putting blocks or pumps.

b) Sweep the sewer system.

c) Put a wier at the discharge point to measure flow rate.

3) Sampling and Measurement

a) Flow rate is continuously measured by means of a water level gauge set up at the weir during the survey duration.

b) Samples are collected one or two hours interval, at least, for 24 hours.

c) Temperature is measured at the same time each sampling.

d) The samples collected should be stored in a cooler with ice until analyzed.

4) Analysis

The samples taken are analyzed for items mentioned above at a laboratory.

5) Home Visiting Survey

To obtain supplemental background data, home visiting survey would be made by interview with questionnaire as mentioned above.

II. AN EXAMPLE OF KLONG WATER SURVEY PLAN

1. Purpose

General discription of existing state on water pollution would be one of the most important informations to make construction program for sewerage system to be proposed. Therefore, the klong water survey

should be made on systematic.

2. Sampling Points

Klongs to be surveyed and their sampling points are shown in Table 1.

3. Frequency of Sampling and its Ways

The sampling would be made once a month at each point. The sample would be taken as a surface spot sample i.e. at 30 - 50 cm. deep.

The samples would be required more than 2 liters in volume for chemical analysis.

4. Items to be Recorded

Following items would be recorded for each sample:

- Date
- Time
- Weather
- Direction of Flow
- Flow Rate if possible
- Water Temperature
- pH
- DO (Dissolved Oxygen)
- BOD (Biochemical Oxygen Demand)
- COD (Chemical Oxygen Demand)
- SS (Suspended Solids)
- Cl (Chloride Ion)
- H_2S (Hydrogen Sulphide)
- Coliforms

Note: Sampling Schedule

Depending on the capacity of the laboratory, the number of samples to be collected a day should be decided. As an example, sampling points are devided to 4 groups as shown in Table 1. The sampling would be made once a week for one of 4, i.e. each group would be selected once a month.

TABLE 1 LIST OF KLONGS TO BE SURVEYED

No.	Name of Klongs	No. of Points	Remarks
1.	K. Lord	3	*1
2.	K. Wattepthida	1	*1
3.	K. Rajabopit	1	*1
4.	K. Bang Lam Poo	2	*1
5.	K. Ong Ang	1	*1
6.	K. Phadung Krung Kasem	4	*1
7.	K. Mahanak	2	*1
8.	K. San Saep	3	*2 and *3
9.	K. Prem Prachakon	4	*2
10.	K. Sam Sen	3	*2
11.	K. Bang Sue	2	*2
12.	K. Huay Kwang	1	*2
13.	K. Lat Prao	2	*2
14.	K. Tan	1	*3
15.	K. Prakanong	2	*3
16.	K. Pai Sin Toe	1	*3
17.	K. Toey	1	*3
18.	K. Sathon	1	*3
19.	K. Chong Nonsi	1	*3
20.	a	1	*4
21.	K. Bangkok Noi	2	*4
22.	K. Mon	2	*4
23.	K. Bangkok Yai	2	*4
24.	K. San	1	*4
25.	b	1	*4
26.	c	1	*4
27.	K. Dao Kanong	1	*4
28.	K. Bang Na	1	*3
29.	K. Bang Khen	1	*2

Note: *1 - *4 show sampling groups.

ANNEX 8. ABBREVIATION

TECHNICAL TERMS

BOD	Biochemical Oxygen Demand
Cl^-	Cholride Ion
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
DWF	Dry Weather Flow
O&M	Operation and Maintenance
pH	pH Value
RT	Retention Time
SS	Suspended Solid
WT	Water Temperature

UNITS

cm	centimeter
g/c.d	gram per capita per day
ha	hectare
hr	hour
l/c.d	liter per capita per day
l/sec	liter per second
m	meter
m/sec	meter per second
mm	millimeter
m^2	squaremeter
m^3	cubicmeter
mg/l	milligram per liter
m^3/day	cubicmeter per day
m^3/min.	cubicmeter per minute
m^3/m^2.day	cubicmeter per squaremeter per day
kl/day	kiloliter per day
km	kilometer

GOVERNMENT AGENCIES

AIT	:	Asian Institute of Technology
BDS	:	Bureau of Drainage and Sewerage, BMA
BOS	:	Bureau of Sanitation, BMA
BMA	:	Bangkok Metropolitan Administration
BPH	:	Bureau of Public Health, BMA
BPW	:	Bureau of Public Works, BMA
CDM	:	Camp, Dresser & Mckee Consulting Engineers
CPD	:	City Planning Division, Office of Under Secretary of State for BMA
CU	:	Chulalongkorn University
DOI	:	Dept. of Industry, Ministry of Industry
DTEC	:	Dept. of Technical and Economic Cooperation
EGAT	:	Electricity, Generating Authority Thailand
FRS	:	Foreign Relations Section, Office of Under Secretary of State for BMA
HWD	:	High Way Department, Ministry of Communication
JICA	:	Japan International Cooperation Agency
LD	:	Legal Division. Office of Under Secretary of State for BMA
MET	:	Meteorological Dept.
MOA	:	Ministry of Agriculture
MOH	:	Ministry of Health
MOI	:	Ministry of Industry
MRD	:	Mineral Resources Dept., Ministry of Industry
MU	:	Mahidol University
MWWA	:	Metropolitan Water Works Authority
NEB	:	National Environment Board
NESDB	:	National Economic and Social Development Board
NHA	:	National Housing Authority
NSO	:	National Statistic Office, Office of the Prime Minister

PAT	:	Port Authority Thailand
PPD	:	Policy and Planning Division, Office of Under Secretary of State for BMA
RID	:	Royal Irrigation Dept., Ministry of Agriculture
RTSD	:	Royal Thai Survey Dept., Min, of Defence
TOT	:	Telephone Organization of Thailand
TPS	:	Temple Publicity Service
FD	:	Financial Division, Office of Under Secretary of State for BMA
MEA	:	Metropolitan Electrocity Anthority
MIN	:	Ministry of Interior
MOC	:	Ministry of Communication
OUSS	:	Office of Under Secretary of State for BMA

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PRELIMINARY ENGINEERING SURVEY REPORT

FOR

BANGKOK SEWERAGE SYSTEM PROJECT

IN

THE KINGDOM OF THAILAND

THE BANGKOK SEWERAGE & SOLID WASTE DISPOSAL STUDY

APPENDIX

FEBRUARY, 1980

JAPAN INTERNATIONAL COOPERATION AGENCY

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Remarks: ** ; filed in these Appendix.
* ; Abstract or a part of the data is filed in this Appendix.
- ; In BDS and JICA Office.

All data can be found in BDS and JICA Office.

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1.4 Maps

1.5 Meteorological Data

2. City Planning

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3.5 Previous Plans & Studies on Drainage & Sewerage Systems

4. Wastewater Quantity and Quality

4.1 Domestic Wastewater

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5. Wastewater Treatment