Appendix - 3

Content of Request and Present Conditions

Content of Requests and Present Conditions

(Phase 1)

(a) Modification to pipe work in Pumping Station No. 6

(b) New electrical switchgears and controls

- All electrical switchgears and controls in Pumping Station No. 1, 7, 8, 12 and 14 are necessary to be replaced.

- The equipment in Pumping Station No. 6 is operated properly and those in other pumping stations are under replacement or planned to be replaced. (refer to Appendix).

(c) Construction of new trunk sewers at western part in Zone J

- The area is out of existing sewered area and this Project is aimed to rehabilitate existing sewerage fucilities. Therefore this work is considered out of scope of this Project. (JICA)

- The area covers industrial area and many factories discharge industrial waste water. It is required to construct new tunk sewers, a pumping station and rising mains for this area in order to prevent pollution of the White Nile by industrial waste water. (NCK, Sudan)

(d) Modification of rising mains

- Existing rising mains made of asbestos cement pipes were installed about 30 years ago and some of them are heavyly damaged, so that some rising mains are necessary to be replaced by new strong pipe.

(e) Lifting and safety access ladders in pumping stations

- Lifting and safty access ladders in Pumping Stations No. 1, 7, 8, 12 and 14 are necessary to be replaced. However, other pumping stations are already under replacement or planned to be replaced.

(f) Sump pump

- Sump pumps are required to be installed in Pumping Stations No. 1, 7, 8, 12, and 14 as well as No. 6.

- Some portable submersible pumps are required to be prepared for emergency and temporary use.

(g) Rehabilitation of Goaze STP

- All mechanical and electrical equipment in the plant are deteriodated, and most of equipment are breakdown or not operating. Thus all mechanical and electrical equipment are necessary to be replaced.

- Sewage pipings in the plant are required small modification. However, all sludge pipings are necessary to be replaced because of damages and cloggings on it.

- Since grip chambers and bio filters have corrosions and damages on their concrete structures, it is necessary to repair them.

- In the view point of technical and economic conditions for the present operation and maintenance, they will face many problems in maintenance of facilities with present treatment method after completion of the Project.

  Therefore, it is necessary to study an alternative plan that is abolition of Goaze STP and integration to Soba STP with easy and less expense for operation and maintenance. The counterpart of Sudan agreed to study the alternative.

(h) Equipment, instruments and chemicals for Goaze STP's Laboratory

- Most of the existing equipment are out of oder or damaged. So that it is necessary to install new equipment and to supply some chemicals.

(i) Rehabilitation of Pumping Stations No. 1, 7, 8, 12 and 14

- All mechanical and electrical equipment in these pumping stations had been deteriorated or broken, and only one pump in each pumping station is operated barely. therefore, all mechanical, electrical and ventilation equipment are required replacement.

(j) Rising main of Pumping Station No. 15 to Goaze STP

- It is desirable to install new rising main from Pumping Station No. 15 to new pumping station (No. 20) because of abolition of Goaze STP.

(k) Rising main of Pumping Station No. 1 to No. 6

- This is the same as (d).

(Phase II)

(1) 4.5 km rising main to Soba STP

- There is an existing gravity main along the route. It is considered that the existing sewer without any specified damages has enough capability at present and will be able to send sewage from some adjacent area.

(m) Construction of a new pumping stqtion on rising main from Pumping Station NO. 6, which is located 4.5 km far from Soba STP

- Because of a reason mentioned in (1), a new pumping station of this location is not necessary. However, new pumping station is required on the route from Pumping Station No. 6 to Soba STP.

(n) Rehabilitation of Soba STP

- Necessary repair and improvement for existing plant are as follows:

  (1) Reinforcement, rearrangement of embankments around ponds.

  (2) Improvement of connection channels between ponds, effluent, drainage etc.

  (3) Improvement and construction of a flow meter and distribution pit.

  (4) Replacement of pipes, manholes etc. in the plant.

- Necessary expansion and construction for integration at Soba STP are as follows:

  (1) Construction of administration building (including office, laboratory, locker room, electric panel room etc.)

  (2) Construction of influent pumping station.

  (3) Construction of diesel engine generator house, workshop, warehouse etc.

  (4) Improvement and expansion of electrical facilities.

- Other strong requests in order to implement better maintenance of Soba STP are as follows:

  (1) Improvement of maintenance road in the plant.

  (2) Supply of equipment to remove vegetation on embankments and other places in the plant.

  (3) Supply of equipment, such as boat etc. to remove scums, vegetation, algae etc. in ponds.

  (4) Supply of equipment to remove sludge in ponds.

  (5) Supply of buses etc. for commuting of employees.

(Other Requested and Confirmed Items)

(a) Following items were strongly requested.

- Since regional electricity stoppage occures very often, it is required to prevent sewage flood caused by stoppage of pumps by introducing communication facilities among pumping stations. On the other hand, telephone system in Khartoum is not reliable enough. Therefore, new individual communication system will be requested.

- Type of pumps in pumping stations will be vertical contrifugal pumps which are installed in dry pit and motors are installed on ground floor, in order to provide easy inspection and maintenance.

(b) Following items were confirmed.

- The responsible terminal point for commercial electrical power supply system confirmed with fuse switch mounted on the Incoming Power Panel. The 11 kV/415 V Transformer/Facilities, 415 V/230 V Low Voltage Incoming Cable and TARIFF meter will be provided by National Electric Corporation (NEC).

- For the sake of re-using treated water from Soba STP in irrigation, some arrangement, if necessary, will be implemented by the National Capital Khartoum (NCK).

Appendix - 4

Other Rehabilitation Plan for Khartoum Sewerage System

(The Arab Development Fund etc.)

جمهورية السودان
العاصمة القومية
الادارة العامة للصرف الصحي والورش المركزية
ص.ب ٩٠٢٧
تلفون ٧١٤٠١

المسلسل : ..... نمرة الملف : .....

الموضوع : ..... التاريخ .....30/...1./1989.....

السيد/السادة/ : M/s. Nippon Jogesuido Sekkei Co.Ltd.,
9-15, Kaigan 1-Chome, Minao-ku,
TOKYO, Japan

DEar Sirs,

Re: REHABILITATION OF KHARTOUM SEWERAGE NETWORK

With reference to your enquiry in connection with rehabilitation program for the pumping stations not covered by The Japanese GRant Aid Project.

We would like to assure you that according to the projected program, the whole system should be rehabilitated and working by the time of commpletion of the project funded by The Japanese GRant Aid.

In the meantime, we are giving you hereunder some data covering stations not covered by The Japanese Grant Aid Project.

1. Stations No. 4, 5, 9 and 15.
   (a) Donor : The Arab Development Fund.
   (b) Date Of Agreement : July 1988
   (c) Amount : KD300,000.- (Kuwaiti Dinars)
   (d) Contractor : Complete works will be undertaken by SPP.
   (e) Date of Contract : Sept. 1988
   (f) Date of Delivery : Please see note.
   (g) Date of Completion of Installation : Please see note.
   (h) Date of Commissioning : Please see note.
   (i) Present progress : Please see note.
   (j) Expected date of Commissioning : Please see note.

   Note : SPP's offered programme for the works, commencing on receipt of confirmed L/C in U.K., is as follows:-
   Preperation of Station Drawings : 4/6 weeks
   Manufacture of Equipment : 30 weeks
   FReight to POrt Sudan : 6/8 weeks
   Delivery to site : 1/2 weeks
   Installation and set to work : 6 weeks

   (L/C was opened in October 1988 and thus expected to have been confirmed in U.K. in November 1988).

2. Stations No. 2 and 3.
   (a) Donor : The Sudanese Kuwaiti Builing & Const. Co.Ltd.
   (b) Date of Agreement : 1985
   (c) Amount : Stg.L895,000.-
   (d) Contractor : General Administration for sewerage & Central Workshops (i.e. by ourselves)
   (e) Date of Contract : 1988

...../2

جمهورية السودان
العاصمة القومية
الادارة العامة للصرف الصحي
والورش المركزية
ص.ب ٩٠٣٧
تلفون ٧٦٤٦١

السلسل : ..... نمرة الملف : .....

الموضوع : ..... التاريخ .....

السيد/السادة/ : .....

(f)Date of Delivery : No. 2 working / No.3 expected start operation 15/3/1989
(g)Date of Completion : - ditto -
(h)Date of Commission : - ditto -
(i)Present progress : - ditto -
(j)Expected date of Commissioning : - ditto -

3. Station No. 10
(a) Donor : The Arab Authority For Agricultural and Industrial Development (AAAID)
(b) Amount : Stg.L700,000.-
(c) Date of AGreement : 1985
(d) Contractor : General Administration for Sewerage & Central Workshops (ourselves)
(e) Date of Contract : 1988
(f) Date of delivery : Already received in Khartoum.
(g) Date of Completion of installation : Expected to operate 15/3/1989
(h) Date of Commissioning : - ditto -
(i) Prsent progress : works in progress.
(j) Expected date of commissioning : 15/3/1989.

We hope the foregoing will meet with your requirement.

Thanking you in advance for your concern, we remain,

Yours faithfully,

IBRAHIM ABD EL RAHMAN
GENERAL ADMINISTRATION FOR SEWERAGE
& CENTRAL W/SHOPS (SATT)

Appendix - 5

Soba STP Capacity Calculation

SOBA STP CAPACITY CALCULATION

1. Design Criteria

1.1 Design Flow

With the target year set for 1996, the design sewage flow was established 31,420 cu.m/day (daily average). The scale of the lagoon was determined by the daily average sewage flow, while the influent pumping station and plumbing were calculated by hourly maximum flow.

Daily average sewage flow : 31,420 cu.m/day (6.9MGD)

Hourly maximum sewage flow: 2,880 cu.m/hr

1.2 Influent Sewage Quality

Data in 1987 from the Goaze STP and the results of the analysis from this study are as follows:

(Unit: mg/l)

		BOD	SS
Data on influent sewage at Goaze STP	annual maximum	620	830
	annual minimum	60	70
	annual average	203	320
	monthly maximum	460	540
	monthly minimum	120	116
Result of the analysis	5 Dec '88 PS	400	---
	5 Dec '88 STP	288	366
	5 Dec '88 STP	280	438
	11 Dec '88 PS	663	74
	11 Dec '88 STP	400	66

The seasonal (annual average) are BOD 200 mg/l, SS 300 mg/l. Considering changes in seasons and the result of the analysis, BOD 300 mg/l and SS 350 mg/l are adopted as the design criteria.

1.3 Treatment Method

The stabilization pond method, which is the existing method in this plant, is adopted. This is because of the ease in maintaining the plant, the availability of the construction site and the effective land use.

Treatment Flow:

Influent--> Lift pump -> Screen, measuring chamber -> Anaerobic pond -> Facultative Lagoon ->A

A --> Maturation pond -> Green Belt

1.4 Design Water Quality

	Influent quality (mg/l)	Anaerobic Pond		Fac+Mat, Ponds		Total
		Removal rate (%)	Effluent quality (mg/l)	Removal rate (%)	Effluent quality (mg/l)	Removal rate (%)
BOD	300	50	150	70	45	85
S S	350	70	105	28	75	80

2. Capacity Calculation

Description	Items	Capacity Calculations
Lift pump station	Design flow	Hourly max. 2,880 cu.m/hr = 48.00 cu.m/min
	Number of pumps	5 units (existing 2 are for spare)
	Pumping capacity	16.0 cu.m/min ... 3 (units) new 26.8 cu.m/min ... 2 (units) existing
	Pumping Head	12.0 m
	Pump - New	Vertical mixed flow pump (installed at dry pit)
	Specification	Ø350 mm X 16.0 cu.m/min X 14.0 m X 75 kw X 3 units
	- Existing	Submergible pump (installed at wet pit) Ø600 mm X 26 cu.m/min X 20.0 m X 151 kw x 2 units
Screen	Type	Hand-raking fine screen
	Angle of inclination	60 degree
	Spacing	20 mm
	Structural dimension	(w) 1.0m X (h) 2.0m X 2 units
Anaerobic pond	Design flow	Daily average: 31,420 cu.m/day = 1,309 cu.m/hr
	Influent quality	BOD 300 mg/l, SS 350 mg/l
	Influent BOD load	$31,420 \times 300 \times 10^{-3}$ = 9,426 kg/day
	Monthly average lowest water temp.	20°C (22-23°C:monthly average lowest atmospheric temp.)
	BOD load	0.25 kg-BOD/cu.m/day
	Required capacity	9,426/0.25 = 37,700 cu.m
	Water depth	3.0 m

Description	Items	Capacity Calculations
	Required hydraulic surface	37,700 / 3.0 = 12,566 sq.m
	Structural dimensions	(l)174m X (w)100m X (h)3.0m X 4 (2 spares) units
	Effective capacity	= 174 X 100 X 3 X 2 = 104,400 cu.m > 37,700 cu.m
	Effective hydraulic surface	= 174 X 100 X 2 = 34,800 sq.m > 12,566 sq.m
	Retention time	104,000/31,420 = 3.30 days
	Removal rate of BOD	50 %
	Removal rate of SS	70 %
	Effluent quality	BOD : 150 mg/l SS : 105 mg/l
Facultative Lagoon	Design flow	Daily average: 31,420 cu.m/day
	Influent quality	BOD : 150 mg/l
	Influent BOD load	$31,420 \times 150 \times 10^{-3}$ = 4,713 kg/day
	Monthly average lowest water temp.	20 ℃
	Hydraulic surface load	$\lambda s = 20^{T} - 60 = 20 \times 20 - 60$ = 340 kg-BOD/ha/day
	Required hydraulic area	A = 10 X Li X Q X 1/λs = 10 X 150 X 31,420 X 1/340 = 138,600 sq.m
	Effective water depth	1.20 m
	Structural dimension	(W)240.0 m X(L)785.0 m X(H)1.20 m X 2 = 376,800 sq.m > 138,600 sq.m
	Effective capacity	376,800 X 1.20 = 452,160 cu.m

Description	Items	Capacity Calculations
	Retention time	452,160 / 31,420 = 14.40 ≒ 14.00 days
Maturation pond	Design flow	Daily average: 31,420 cu.m/day
	Number of coliform in influent	2 X 107/100 ml.
	Monthly average lowest atmospheric temperature	22 °C
	Number of coliform in treated water	$Be = \frac{Bi}{1 + KB_{(T)}\ t}$ $KB(T) = 2.6 \times 1.19^{(T-20)}$ $= 2.6 \times 1.19^{(22-20)}$ $= 3.68$
		$Be = \frac{Bi}{(1+KB_{(T)}\ tan) \times (1+KB_{(T)}\ tfac) \times (1+KB_{(T)}\ tmet)}$ $tan = 2.0^{d}$ $tfac = 12.0^{d}$ $tmet = 3.0$ days $Be = \frac{2 \times 107}{(1+3.68 \times 2.0) \times (1+3.68 \times 12.0) \times (1+3.68 \times 3.0)}$ $= \frac{2 \times 107}{8.36 \times 45.16 \times 12.04} = 4{,}400 FC/100ml$
	Structural dimension	Existing: W 240 m X L 220 m X H 1.2 m X 2 units
	Retention time	240X220X1.2X2/31,420 = 4.0days

Appendix - 6

Referential Data for Stabilization Pond and Irrigation Reuse

World Bank Technical Paper NO. 7

RECOMMENDED IRRIGATION AND DISCHARGE STANDARDS

Method of Reuse	BOD_5 mg/l	Fecal Coliforms No/100 ml /a
Irrigation of trees, cotton, and other non-edible crops	60	50,000
Irrigation of citrus fruit trees, fodder crops & nuts	45	10,000
Irrigation of deciduous fruit trees, /b sugar cane, cooked vegetables, and sports fields	35	1,000
Discharge to a receiving stream /c	25	5,000
Unrestricted crop irrigation including parks and lawns	25	100

/a These concentrations should not be exceeded in 80% of samples.

/b Irrigation should stop two weeks before picking and no fruit should be picked from the ground.

/c Depends on dilution available; effluent should contain less than 10^5 algal cells/ml (7).

Note: These figures represent rough guidelines. Effluent quality may have to satisfy other standards in different countries, or under particular circumstances or conditions. (1, 5, 6, 7, 8, 9)

Guide Line for Irrigation Use of Treated Sewage

	California	Israel	South Africa	West Germany	Peru
Orchard & Vineyard	Spray irrigation using treated water of primary treatment are forbidden. Fallen Fruits are forbidden to use.	Treated water of secondary treatment.	Treated water of tertiary treatment is adoptable. If possible, thick chlorination and spray irrigation should be avoided.	Spray irrigation is forbidden around the residential area.	Raw sewage can be used if there's more than 20 days between the final sprinkling and the harvest.
Fodder Crops, Textile-plants & Seed-plants	Surface and sparay irrigation using treated water of primary treatment are permitted.	Treated water of secondary treatment for edible units is permitted for irrigation.	Treated water of tertiary treatment.	Primary treatment must be done by screening and Sedimentation tank. Incase of spray irrigation, biological treatment and disinfection shall be adopted.	Industrial crops, such as cotton, corn sugercane, are same as orchard and vineyard. Treated water of secondary treatment can be used for fodder crops but the usage for pasturage.
Edible Crops Through Sterilization	Treated water of primary treatment is adoptable surface irrigation. Disinfected treated water treatment of secondary (coliform count is below 23/100 mℓ) is adoptable spray irrigation.	Vegitables irrigated with treated water must not be supplied for edibles without proper disinfections. (80% of samples must be less than 1000/100 mℓ of coliform count.)	Treeated water of tertiary treatment.	Irrigation can be done 4 weeks before the harvest.	Treated water of primary treatment can be adopted for irrigation 20 days before the harvest.
Raw Edible Crops	Colifrom count must be below 2.3/100mℓ case for surface irrigation Disinfected, coagulated and filtrated water with the furbidity below 10 is used for spray irrigation.	Fundamentaly forbidden. However, its adopted for the fruits which are peeled before eating.	——	Irrigation can be adopted only for potatoes and crops during blooming period.	Treated or non-treated sewage water cannot be used for the irrigation of funitsand vegitables which has short stem or creeping nature and eaten raw.

Empirical Design Criteria for Waste Stabilization Lagoons

Parameter	Unaerated Aerobic	Facultative	Aerated	
			Aerobic	Facultative
Flow regime	—	—	Completely mixed	Mixed surf. layer
Lagoon size (acres multiples)	10 acre multiples	2–10 multiples	2–10 multiples	2–10 multiples
Operation	Series or parallel	Series or parallel	Series or parallel	Series or paralle
Hydraulic retention time (days)	10–40	7–30	3–20	7–20
Depth (ft)	3–4	3–6	6–20	3–8
Hydraulic loading (in./day)	3–5	0.5–1.5	—	—
BOD_5 loading:				
(lb/day/acre)	60–120	15–50	20–400	—
(lb BOD/day/1,000 cu ft)	—	—	—	—
Optimum temperature (°C)	20	20	20	20
Temperature range (°C)	0–40	0–50	0–40	0–50
BOD_5 removal efficiency (%)	80–95	80–95	80–95	80–95
Algal concentration (mg/l)	80–200	40–160	—	—
Coliform removal, %	>99	>99	—	—
Effluent ss (mg/l)†:				
Algae	[0.4–1.2](BOD_5);	[0.2–0.8](BOD_5);	[0.02–0.1](BOD_5);	[0.02–0.1](BOD_5);
Microorganisms	[0.2–0.5](BOD_5);	[0.2–0.5](BOD_5);	[0.2–0.5](BOD_5);	[0.2–0.5](BOD_5);
Other	Low	[0.1–0.4](*SS*);	[1.1–1.4](*SS*);	[0.1–0.4](*SS*);
Effluent BOD_5 (mg/l):				
Soluble BOD_5	[0.02–0.1](BOD_5);	[0.02–0.1](BOD_5);	[0.02–0.1](BOD_5);	[0.02–0.1](BOD_5);
Insoluble BOD_5	[0.3–1.2](*SS*)$_e$	[0.3–1.0](*SS*)$_e$	[0.5–0.8](*SS*)$_e$	[0.3–0.8](*SS*)$_e$
Typical effluent quality, (mg/l):				
BOD_5	15–40	15–40	20–70	20–70
SS	25–50	25–50	—	—
pH	6.5–10.5	6.5–9.0	6.5–8.5	6.5–8.5
Oxygen source	Algae	Algae	Aerators	Aerators
Aerator design goals	—	—	Aeration plus mixing	Aeration

† i = influent, e = effluent.

Note: in. × 25.4 = mm; ft × 0.305 = m; lb/day/1,000 sq ft × 4.882 = kg/m²·d; lb/day/1,000 cu ft × 1.602 × 10^{-2} = kg/m³·d; acres × 4,050 = m².

ANTICIPATED BOD_5 AND FC CUMULATIVE PERCENTAGE REDUCTIONS FOR VARIOUS POND SYSTEMS AT 12°C, 20°, AND 25°C

	Cum. % BOD_5 Reduction			Cum. % FC Reduction		
	12°C	20°C	25°C	12°C	20°C	25°C
Anaerobic Pond	45	62	70	60	86	93
an. + fac.	80	88	90	96	99.50	99.2
an. + fac. + mat.	86	92	94	99.0	99.975	99.95
an. + fac. + 3 x mat.	94	95	95 +	99.95	99.9996	99.99999
Facultative Pond	75	80	84	91	97	98
fac. + mat.	86	90	93	98.2	99.94	99.98
fac. + 3 x mat.	93	95	95 +	99.90	99.998	99.99993
Aerated Lagoon	70	80	82	72	93	96
aer. + mat. (10 day)	84	92	93	95	99.50	99.9
aer. + 3 x mat.	93	95	95 +	99.90	99.996	99.999

Key: an. anaerobic pond; fac. facultative pond; mat. maturation pond; aer. aerated lagoon.

Assumptions:

1. Systems treating normal domestic sewage.
2. Anaerobic pond detention time of 2 days.
3. Facultative pond detention time 7 to 15 days depending on ambient temperature.
4. Maturation ponds detention time of 5 days, accept first maturation pond following aerated lagoons - 10 days.
5. Aerated lagoon detention time of 4 days.
6. First order removal of FC according to equations 4 and 5; BOD_5 removal according to a retarded exponential relationship using a variety of field data (30).

EFFECT ON FC CONTENT OF MATURATION PONDS OF 5-DAY DETENTION TIME AT 12°C, 20°, and 25°

	Temperature		
	12°C	20°C	25°C
Inflow to first maturation pond FC concentration/100 ml	1,000,000	1,000,000	1,000,000
Pond 1 Effluent	235,294	60,500	31,250
Pond 2 Effluent	55,363	3,770	976
Pond 3 Effluent	13,026	222	30

Note: Based on equations 4 and 5.

Recomended Criteria of WHO

	Irrigation			Recreation		Municipal Rouse		
	Crops not for direct human consumption	Crops esten cooked: fish culture	Crops eaten raw	No contact	Contact	Industrial reuse	Non potable	Potable
Health criteria (see below for esplanation of symbols)	A+F	D+F of D+F	A+F	B	D+G	C or D	C	E
Primary treatment	●●●	●●●	●●●	●●●	●●●	●●●	●●●	●●●
Secondary treatment		●●●	●●●	●●●	●●●	●●●	●●●	●●●
Sand filtration or equivalent polishing methods		●	●		●●●	●	●●●	●●
Nitrification						●		●●●
Denitrification								●●
Chemical clarification						●		●●
Carbon adsorption								●●
Ion exchange or other means of removing ions						●		●●
Disinfection		●	●●●	●	●●●	●	●●●	●●●

Health criteria :
A : Freedom from gross solids; significant removal of paresite eggs
B : As A, plus signiticant removal of bacteria.
C : As A, Plus more effective removal of bacteria, plus some removal of viruses.
D : Not more than 100 coliform organisms per 100 ml in 80% of samples.
E : No faecal coliform organisms in 100 ml, plus no virus particles in 1,000 ml plus no toxic effects on man, and other drinking-water criteria.
F : No chemicals that lead to undesirable residues in crops of fish.
G : No chemicals that tend to irritation of mucus mambranes and skin.

In order to meet the given health criteria, processes marked ●●● will be essential. In addition, one or more processes marked ●● will also be assential, and further processes marked ● may sometimes be required.

Source : WHO Technical Report No. 517

Appendix - 7

Water Supply and Sanitation Sector Review by UNDP/World Bank

WATER SUPPLY AND SANITATION SECTOR REVIEW

Prepared for the Government of Sudan by the Regional Water and Sanitation Group - Eastern Africa (UNDP/World Bank Project RAF/86/038)
August 1988.

IX. URBAN SANITATION

Organizational Structure and Staffing Levels

9.01 The Ministry of Health (MOH), in collaboration with the Department of Public Health Engineering of the Ministry of Housing and Public Utilities (MHPU), is responsible for non-piped sanitation (planning, design and inspection), health education and water quality control.

The Ministry of Housing and Public Utilities (MHPU) through its Department of Public Health Engineering, is responsible for urban sanitation (planning, design and construction). However, the Sanitary Engineering Department of the Khartoum Commissionerate has the overall responsibility for the sewerage and sewage disposal systems within Khartoum's metropolitan area (planning, design, construction and operation).

9.02 Four departments in the Ministry of Health deal with the sector:

- Department of Environmental Health (DEH). The DEH has activities in the following fields: food control, water supply, communicable diseases, water-borne and water-related diseases, town planning and solid waste. From provincial level downward, the Health staff (public health officers, sanitary overseers and primary health care workers) are detached from MOH to the local councils.

- Department of Health Education (DHE). The DHE is in charge of the training of medical and paramedical personnel, and community leaders in health education techniques. The Department's focus is mainly on training for trainers.

- Department of Primary Health Care (PHC). The responsibility for planning, implementation and follow-up is handled at regional level by the Director of Health and at provincial level by a deputy director of Health. At district level, there is a team consisting of a nurse, a medical assistant and a public health inspector.

- Central Laboratory. The Central Laboratory performs chemical and biological analysis of water, food and drugs. In addition to the Central Laboratory, located in Khartoum, there are regional laboratories for each of Sudan's regions.

9.03 The main responsibility of the Department of Public Health Engineering within the Ministry of Housing and Public Utilities is to design, construct, operate and maintain all water supply, sanitation and drainage systems that fall outside the responsibility of the municipalities.

9.04 The Sanitary Engineering Department within Khartoum Commissionerate is responsible for planning, design, construction, operation and maintenance of the sewerage system.

The Department is organized into the following sections:

- Project Section
- Operation Section
- Maintenance Section
- Administration Section
- Financial Section
- Purchasing Section

9.05 The staffing of the Sanitary Engineering Department of Khartoum is about 1,000 out of which 25 are engineers and 35 technicians, which is considered to be sufficient. The staffing of the Ministry of Health (para 8.01) directly related to urban sanitation can not be assessed.

Sanitation Coverage

9.06 No accurate data are available on urban sanitation and those stated below in Table 9.1 would be indicative only. Only Khartoum has a piped sanitation system covering part of its area.

TABLE 9.1 URBAN SANITATION

Type of Sanitation	Coverage %	Coverage population
Water borne sanitation, sewerage	5	300,000
Water borne sanitation, septic tanks or cess pits	30	1,500,000
Pit latrines	35	2,000,000
Dry privies or no facilities	30	1,500,000

Khartoum Sanitation System

9.07 Piped sanitation systems cover old Khartoum and the industrial area of Khartoum North including about 15% of the total population. The old Khartoum system was constructed at the end of 1950's and is in poor condition with insufficient capacity causing flooding which is further aggravated by frequent power cuts. The Gonze treatment works are reasonably well maintained but lack of necessary spares have caused partial shut downs. New treatment works have been constructed at Soba but its commissioning has been delayed because of delays in the completion of connecting trunk mains.

9.08 The piped sanitation system of Khartoum North covers the industrial area only, but related treatment works have never functioned satisfactorily, due to the toxic nature of the industrial effluent and is now completely out of order with sewage being discharged untreated into the Nile.

9.09 Septic tanks are common in the urban residential areas which are emptied frequently by private or municipal tankers. Any specific information cannot be provided on sanitary conditions for areas not covered by piped sanitation or septic tanks.

9.10 Urban sanitation facilities are fully financed by the house owners except for piped sanitation which is financed by the urban council - so far by the commissionerate of Khartoum - through the annual budget. The 1987/88 budget for Khartoum is LSD 2,500,000 for development works and LSD 500,000 for recurrent expenditures. The beneficiaries of piped sanitation are supposed to cover the operation and maintenance costs through charges, which in practice does not occur.

9.11 The present tariffs for piped sanitation are:

- connection fee for houses: LSD 30
- sewerage charge LSD 12/annum
- sewerage charge (Khartoum North) LSD 0.50 m^3 water used

Collection of charges cannot be realized due to problems encountered in billing and collection. There is also a lack of incentive since any charges to be collected are remitted to the commissionerate without a corresponding transfer back to the operational department.

Donor Involvement

9.12 At present only Japanese and Italian aids are provided for urban sanitation and limited to the Khartoum area. Through such assistance engineering works are being undertaken for rehabilitation and extension of the piped sanitation systems with contributions also expected to be provided for subsequent investments.

Rehabilitation and extension of Khartoum sewerage system have been envisaged, as follows:

- phase 1 Emergency. US$ 5M, funded by Italy.
- phase 2 Repair and rehabilitation of the sewerage system in Old Khartoum and in Khartoum North. US$ 80M, funded by Japan.
- phase 3 Master Plan and extension of the sewerage to the whole of Great Khartoum. US$ 900M (no funding found).

Appendix - 8

The Four Year Salvation, Recovery and Development Programme

REPUBLIC OF SUDAN

MINISTRY OF FINANCE & ECONOMIC PLANNING

(PLANNING)

THE FOUR YEAR SALVATION, RECOVERY AND DEVELOPMENT PROGRAMME 1988/89 - 1991/92

VOLUME I

JULY 1988

1. OBJECTIVES

2.01. This four-year Salvation, Recovery and Development program aims to address the immense inherited problems facing the present Government in a systematic and comprehensive way. The basic objectives of the Program will be:

(i) Inspiration and stimulation of the patriotic spirit and the sanctity of work.

(ii) A GDP average growth rate not less than 5% per annum.

(iii) Provision of basic needs in respect of food, water, clothing, shelter, security, health, education, and transport.

(iv) Food security for rural and urban populations.

(v) Social justice through reduction of disparities in income and wealth.

(vi) Progress to be made towards balanced regional development, with emphasis on less developed regions.

(vii) Formulation of post-war development programme for the Southern Region taking into full consideration the extra-ordinary conditions pertaining to that region.

2.02. The attainment of these objectives will require due emphasis being given to:

(a) Vertical development and full utilization of existing capacities.

(b) Maintenance and rehabilitation of existing projects.

(c) Development of the traditional sector.

(d) Infrastructure development and maintenance, particularly energy, transport and telecommunications.

(e) Sectoral balance which would realize the optimum utilization of resources.

(f) Prevention of further environmental degradation.

(g) Steady progress to realize economic stability by encouraging savings and investments.

(h) Revitalization of the production and investment activities of the private sector, so it can play an effective role in the development process.