Plan is shown in the table below. The project is proposed for implementation in five stages up to year 2018.

Table R.F.11 Summary of Cost for Sewage Development System in RCB

No	Component		Amount (Rs million)
1	Sewer Construction	・ West	159.77
		・ East	825.31
		・ Chaklala	21.72
2	Treatment Plant Construction	・ West	247.00
		・ East	558.00
		・ Chaklala	30.00
3	House Connections (175,000 Nos)		1225.00
4	Land Acquisition	・ West (6.5 ha)	25.60
		・ East (232 ha)	69.00
		・ Chaklala (1.6 ha)	8.00
5	Subtotal		3169.40
6	Contingency (5%)		158.47
7	Consultancy (3%)		95.08
8	Total		3422.96

1.4 River Water Quality

The river water in the study area is generally heavily polluted due to solid waste dumping and discharge of untreated sewage. The pollution level is very high especially in Rawalpindi area. Lai Nullah and its tributaries are accumulating the pollutions of a large volume of polluted sewage generated in the urbanized area and a huge amount of solid waste dumped, resulting in the highly deteriorated water quality in the rivers.

In Pakistan it is not common and regulated by law to take water samples in the systematic way to monitor the water quality of the rivers. So, no series of water quality analysis of Lai Nullah and its tributaries was available to the Study Team. A sample of the river water quality around the Study Area was analyzed in April 2000: the sampling points and their water quality data are as shown in Fig. F.14 and Table F.1, respectively. According to the data, the worst water quality was almost as polluted as raw sewage with BOD5 of 139 mg/l .

2. IMPROVEMENT OF DRAINAGE AND SEWERAGE SYSTEM

2.1 General

The Lai Nullah is currently used as the principal outlet for drainage of stormwater and sewerage in Islamabad and Rawalpindi. Islamabad is located on the gradual slope toward Lai Nullah. Due to the favorable geophysical condition as well as the rather adequate existing drainage network in the built-up area, Islamabad is likely to not have any significant drainage problem. On the other hand, the drainage conditions in Rawalpindi are deteriorated due to low-lying ground and the backwater effects of the high water level of Lai Nullah. Moreover, due to poor capacity of

the existing sewage treatment plants both in Islamabad and Rawalpindi, the river water of Lai Nullah is seriously polluted giving off a stench during a period of low flow discharge

In order to retrieve Lai Nullah from the current sewage problems, improvement of the existing sewage treatment plant for Islamabad has been launched out in 2003 through a financial assistance from the French Government. The sewerage and drainage master plan for the city center of Rawalpindi has been also formulated in 2002 and, in accordance with the master plan, the improvement works are now being implemented through a financial assistance from ADB funding.

The sewerage master plan and the drainage master plan for Rawalpindi are, however, projected to be completed in 2020, and 2014, respectively. Thus, it would still take some time more to be free from drainage and sewerage problems. Moreover, the drainage and sewage improvement work in Rawalpindi is limited to the jurisdiction area of TMA-R, and the Cantonment Area in Rawalpindi (i.e., the jurisdiction area of RCB) is left behind from any drainage and sewerage improvement. Taking these conditions into account, the following items would be given as the principal issues on the drainage and sewage:

2.2 Clarification of Phased Improvement Programs for On-going of Drainage and Sewage Improvement

The phased improvement programs are likely to have been already formulated in the on-going plan.

2.2.1 Improvement of Islamabad Sewage Treatment Project

Joint project by CDA and French government, consisting of newly completion of STP Phase IV, besides improvement and repair of the other STP Phase I, II and III, will start abound first of 2004 and construction period is about 30 month. After the completion, it is expected river water quality at down stream of the STP located at I-9 will be improved.

Improvement of the sewage collection system is required, that is maintenance of trunk sewer not to discharge / leak sewage on the way till the STP. And it is necessary to check house connection system with sewers.

Monitoring system on inflow, outflow at the STP is necessary and the monitoring system shall be regulated. River water quality monitoring system is also required.

2.2.2 Improvement of TMA-R Sewerage and Drainage System

After the “Urban Water Supply & Sanitation Project, Phase 1”, as a phase 2 “Rawalpindi Environmental Improvement Project” is now under preparation. The components are 1) water supply, 2) sewerage, 3) drainage, 4) solid waste management, 5) institutional strengthening.

From around September 2003 a feasibility study will start and the detailed components of the project (Phase II) will be decided in five (5) months, and the project commencement will start. The project will financed from ADB that has given indication of loan of US$ 50 million.

Rough components of the sewerage system is 1) construction of lateral sewers, 2) construction of trunk and outfall sewers, 3) construction of sewerage treatment plant, 4) purchase of equipment and machinery for operation and maintenance of the system. Rough components of the drainage is 1) Lai Nullah improvement works – phase 2, to include lining, deepening etc and construction of roads on both banks and 2) rehabilitation of Kassi East, Kassi West and other main drains.

2.3 Implementation of Drainage and Sewerage Improvement for Jurisdiction Area of RCB

The master plan for improvement of sewerage system in the jurisdiction area of RCB has been formulated by Engineers 10 Corps, Rawalpindi, while the drainage system in the area is left behind without any definitive improvement plan. The master plan for the sewage plan should be updated, as required. Effluent quality at STP is proposed as 40 mg/L in BOD and less than 1000 organisms / 100 ml in fecal coli-form, and the figure is relatively high, especially in fecal coli-form. Effluent quality with activated sludge sewage treatment process is regulated in Japan as BOD is less than 20mg/l, fecal coli-form is less than 3000 organisms / ml and SS is less than 70 mg/l. And the necessary budgetary arrangements as well as other relevant necessary works for implementation should be taken immediately. At the same time, the drainage master plan should be formulated in the earliest opportunity taking the on-going river improvement of Lai Nullah, the on-going drainage improvement works for the jurisdiction area of TMA and other relevant flood mitigation works into consideration.

3. RECOMMENDATION

3.1 Recommendations on Drainage System

The following are the recommendations on drainage improvement for the overall study area.

(1) Urgent development of drainage system at frequent flooding area

(2) Reconnection of household sewage sewers, connected to drainage, to sewage sewers

(3) Prohibition of solid waste disposal into drainages and rivers (see solid waste section in detail)

(4) Development of adequate drainage system considering back water from river

(5) Relocation of residents living at low area near rivers and keeping the space as water retention basin

(6) Installation of rainwater storage system using such as green belts, sports grounds and storage tank to reduce water run off and to reuse water

(7) Adequate planning and implementation of proper drainage on Phase II of WASA Project Implementation of Phase II Project for the jurisdiction area of WASA in Rawalpindi in particular.

(8) Establishment of drainage master plan and the implementation for Cantonment Board in particular.

3.2 Recommendations on Sewerage System

The following are the recommendations on drainage improvement for the overall study area.

(1) The following sewerage improvement works would be required to Islamabad:

  (a) Proper operation of existing sewage treatment plant on phase I & II with analyzing water quality

  (b) Connection of every outlets of sewage from households, institutes, industries and commerce with sewerage system

  (c) Relocation of slum area, or proper sewage management in slum area by such as construction of public toilet connected with sewers

  (d) Adequate design and implementation of STP new construction and rehabilitation at I-9 with French assistance

(2) The following sewerage improvement works would be required to the jurisdiction areas of WASA and RCB in Rawalpindi City:

  (a) Adequate planning and implementation of proper sewerage system, consists of sewage collection system and treatment plant on Phase II of WASA Project

  (b) Implementation of the sewerage master plan

  (c) Joint sewage management by WASA and RCB to achieve totally effective sewage management consisted of common main sewers and common STP.

3.3 Establishment of Environmental Guideline

Presently although environmental standard, such as target of river water quality, effluent of wastewater discharge into public water and sewerage system and monitoring system is prepared, the environmental standard is not well utilized for practical purpose. And the standard of the effluent quality from the factories is not appropriate to improve the water quality of Lai Nullah cleaner or at least to keep the present level, for the effluent qualities of BOD, COD and SS are 80 mg/L, 150 mg/L and 200 mg/L, respectively. These figures are too high in terms of environmental quality prevention, and shall be revised to achieve adequate water quality

environment. And the related laws and regulations shall be established to construct, operate and maintain drainage and sewerage system. Monitoring system of the river water quality and influent/effluent of WTP shall be also established in the laws and regulations.

3.4 Organization

Administration boundaries among CDA, Rawalpindi Municipality and RCB are overlapping at some rural areas. It is necessary to fix the boundaries to make properly public services of water, drainage and sewerage system respectively.