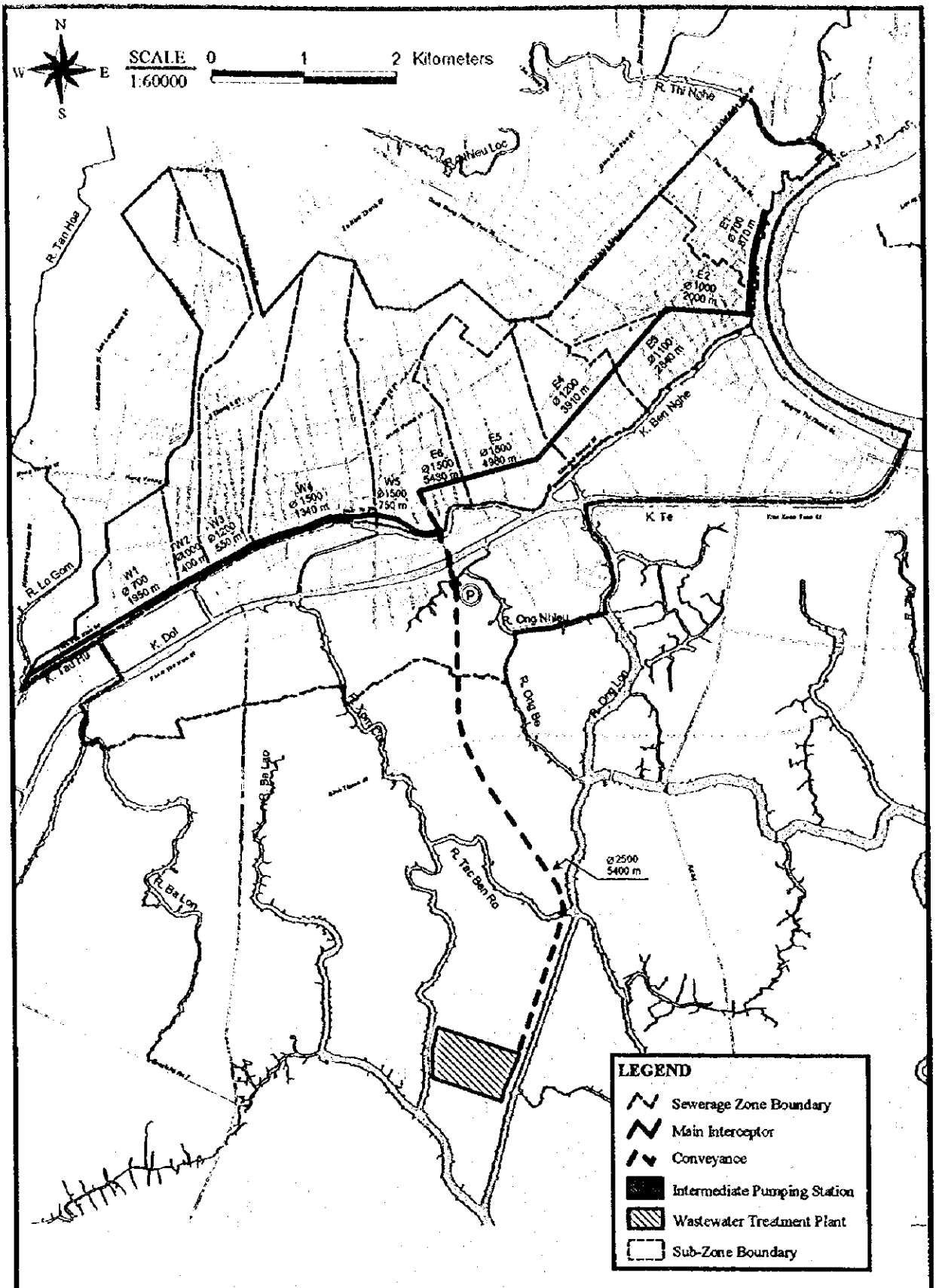


FIG. 8.31 PROPOSED ALIGNMENTS OF INTERCEPTOR AND CONVEYANCE SEWERS

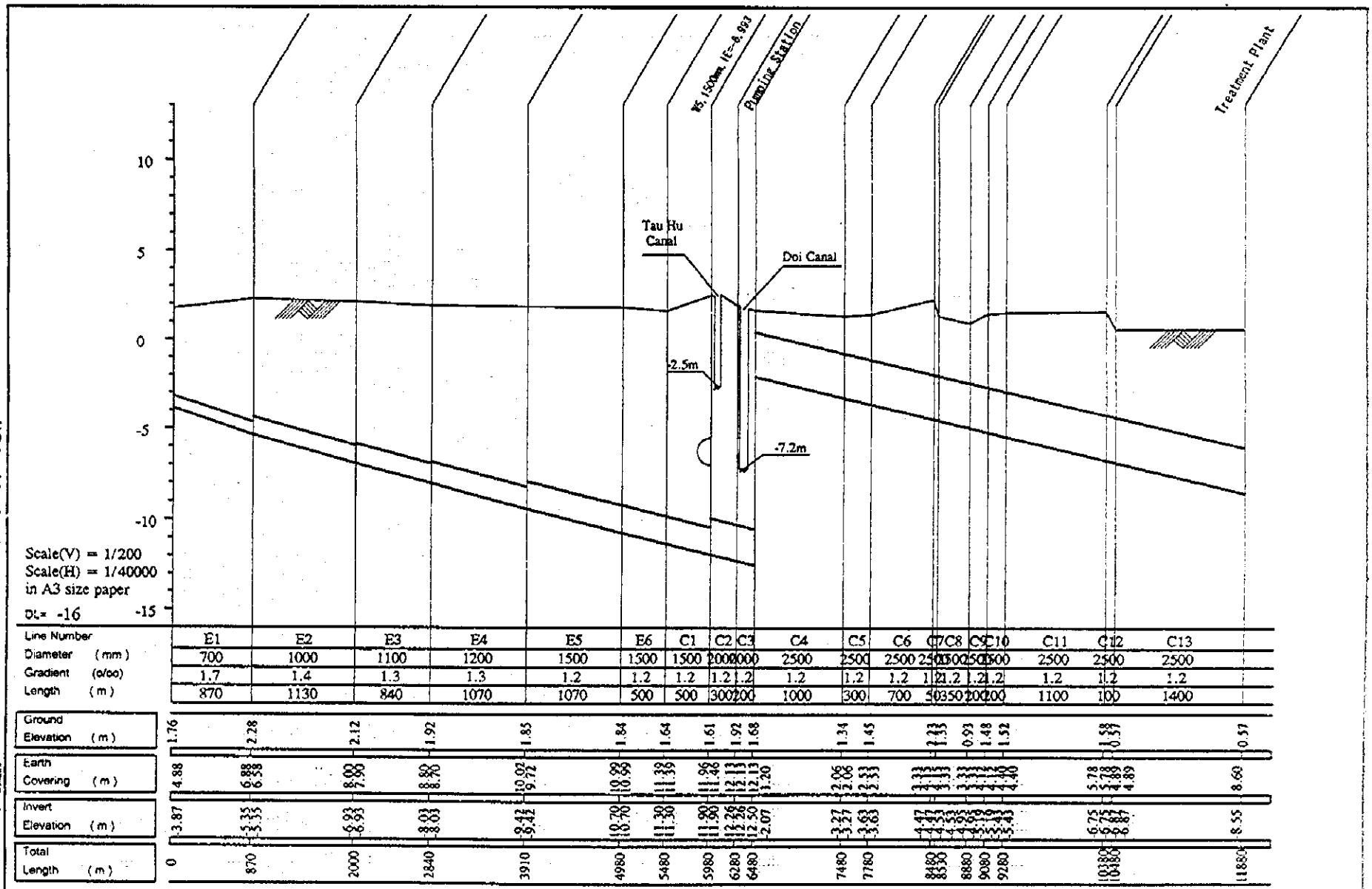


FIG. 8.32 LONGITUDINAL PROFILE OF PROPOSED INTERCEPTOR AND CONVEYANCE SEWERS

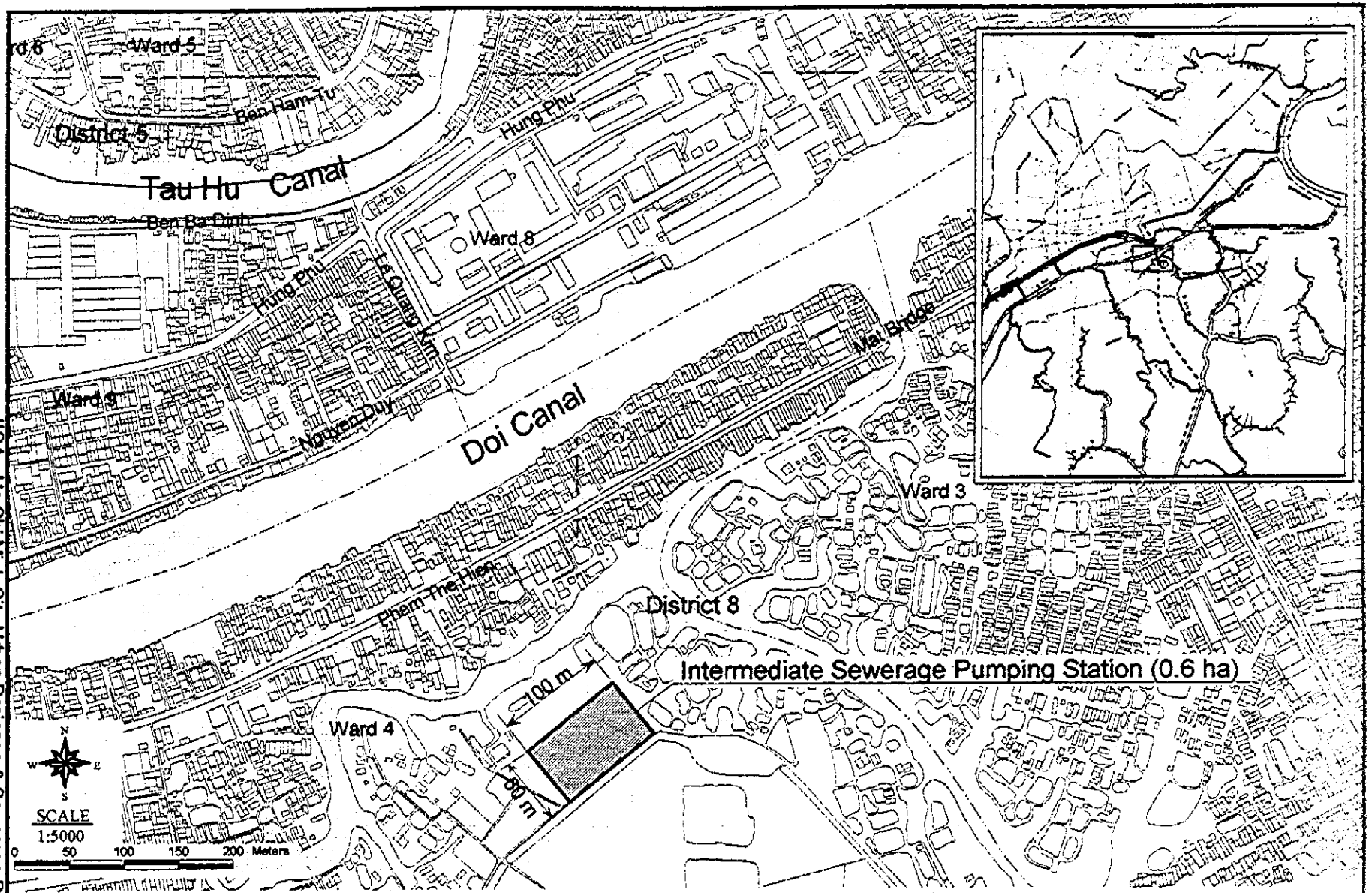


FIG. 8.33 PROPOSED LOCATION OF INTERMEDIATE SEWERAGE PUMPING STATION

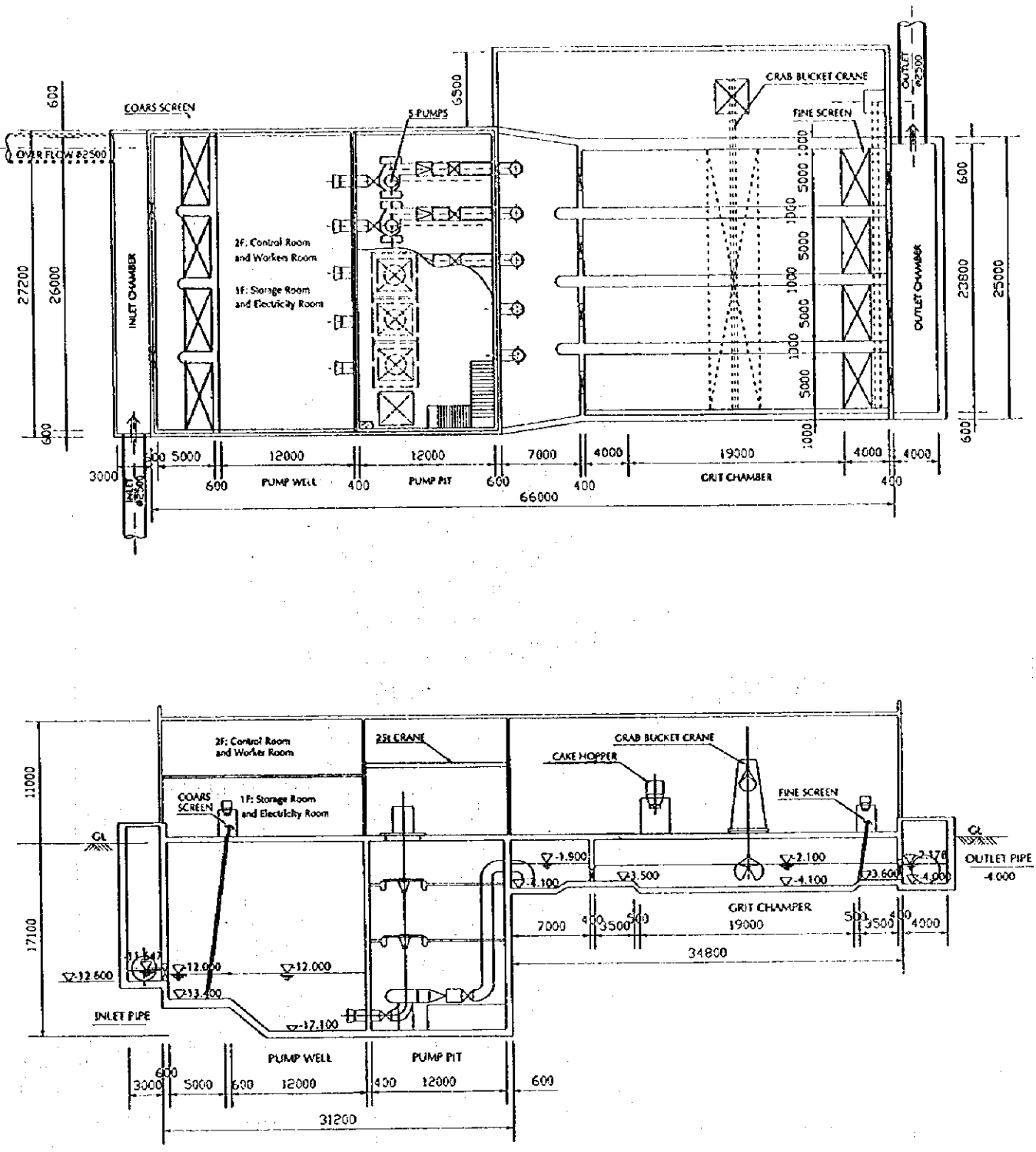


Fig. 8.34 LAYOUT OF INTERMEDIATE SEWERAGE PUMPING STATION

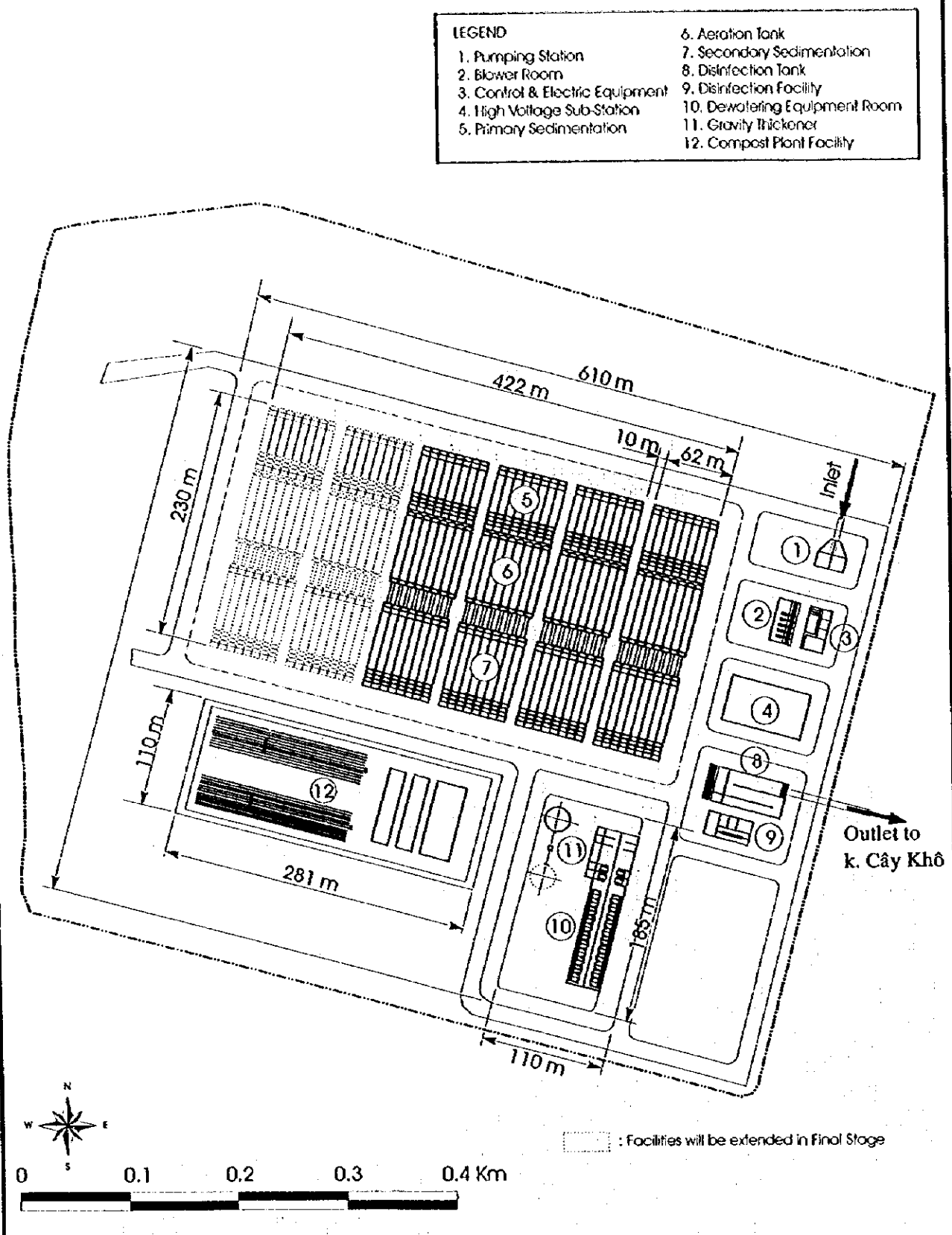


Fig. 8.35 PROPOSED LAYOUT OF WASTEWATER TREATMENT PLANT

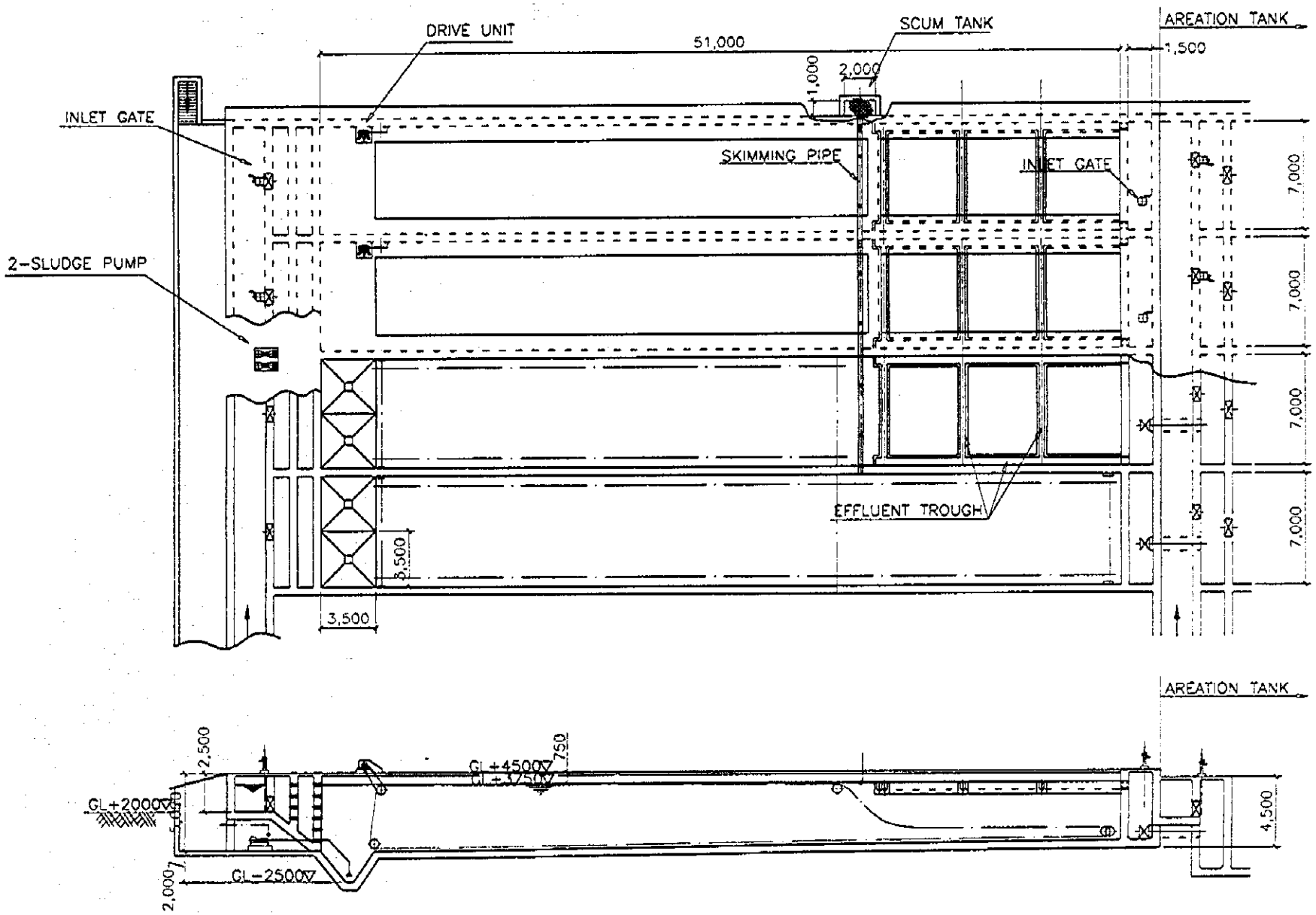


FIG. 8.36 PROPOSED LAYOUT OF PRIMARY SEDMENTATION BASIN

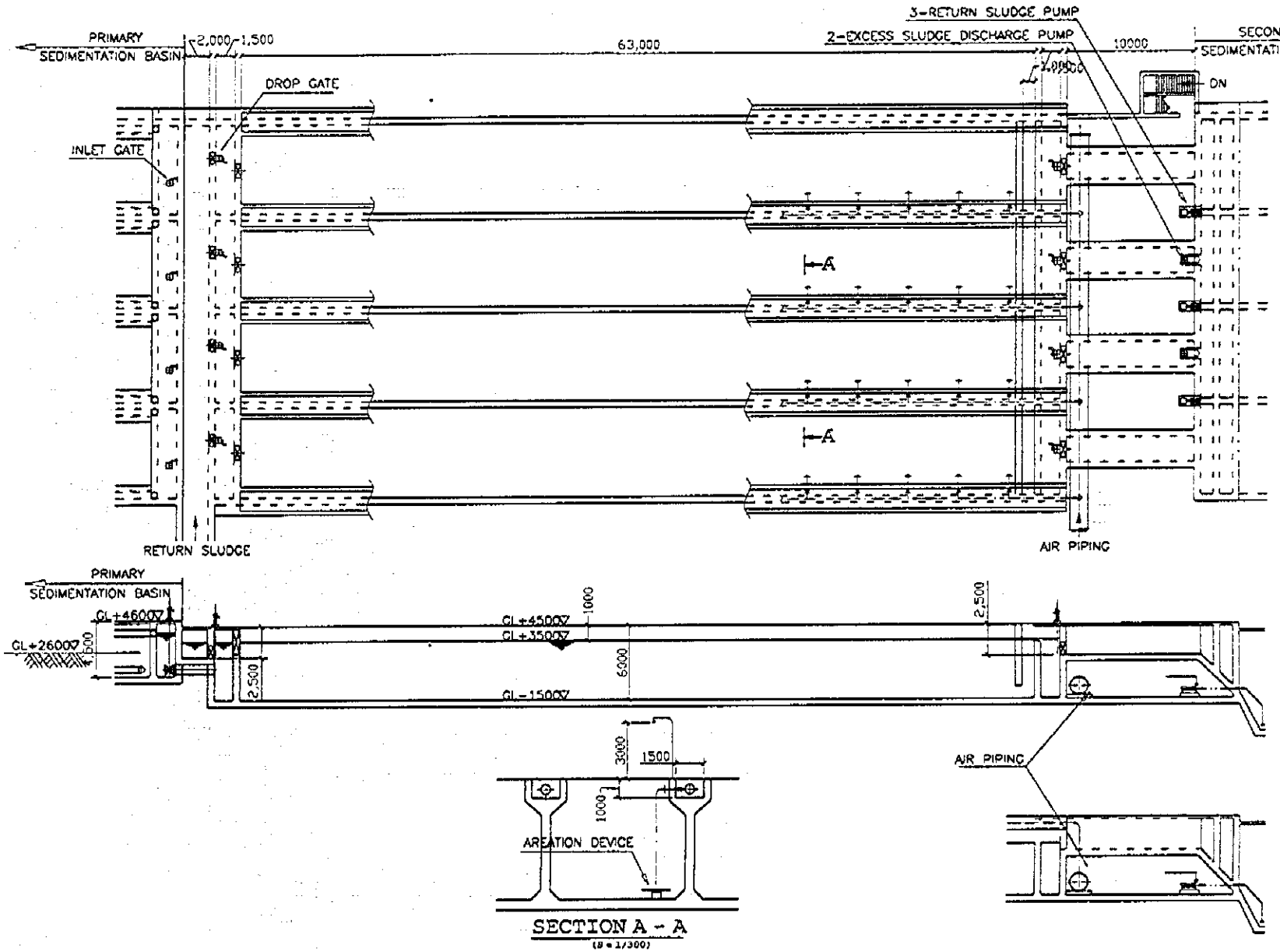


FIG. 8.37 PROPOSED LAYOUT OF AERATION TANK

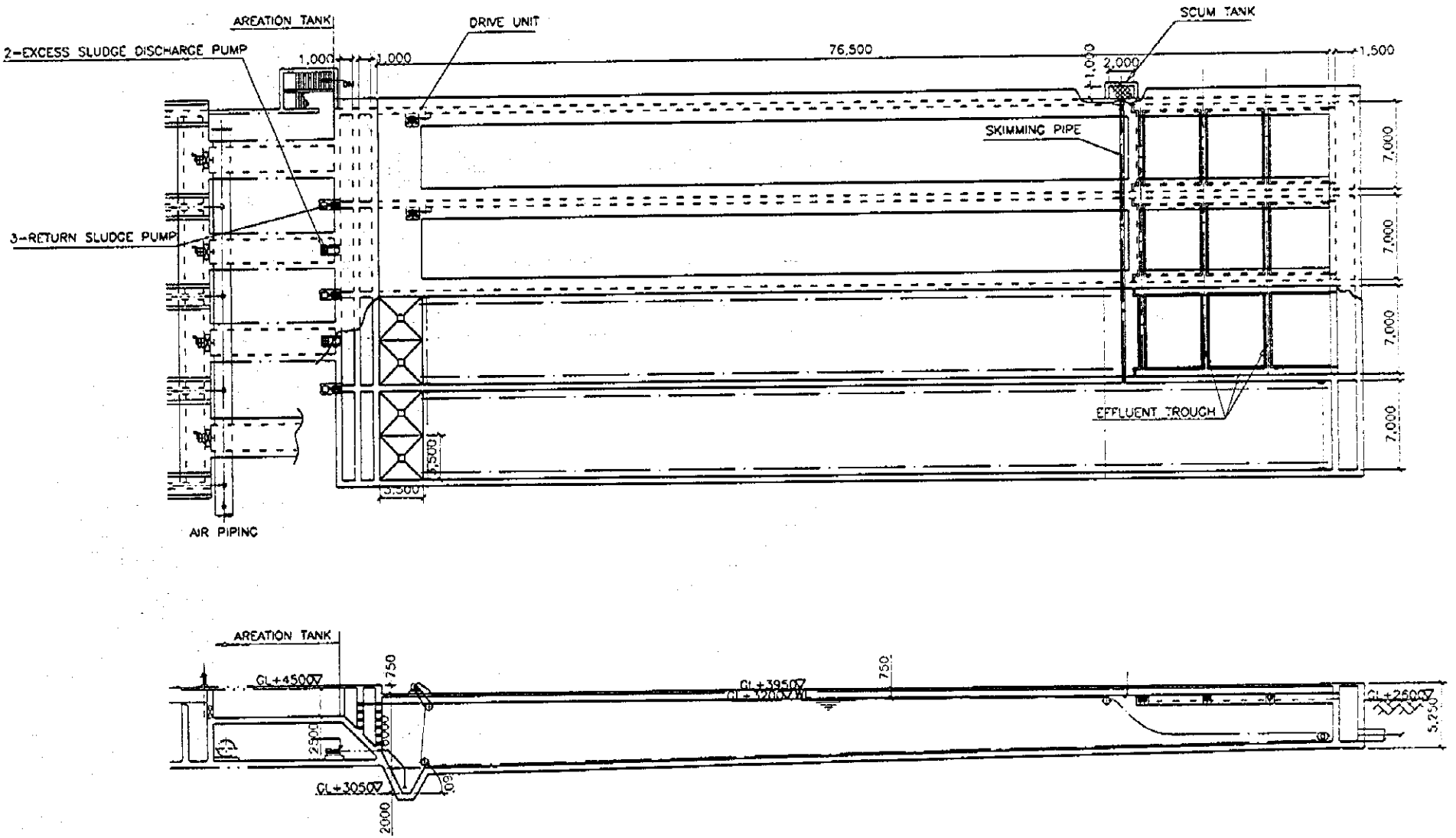


FIG. 8.38 PROPOSED LAYOUT OF SECONDARY SEDIMENTATION BASIN

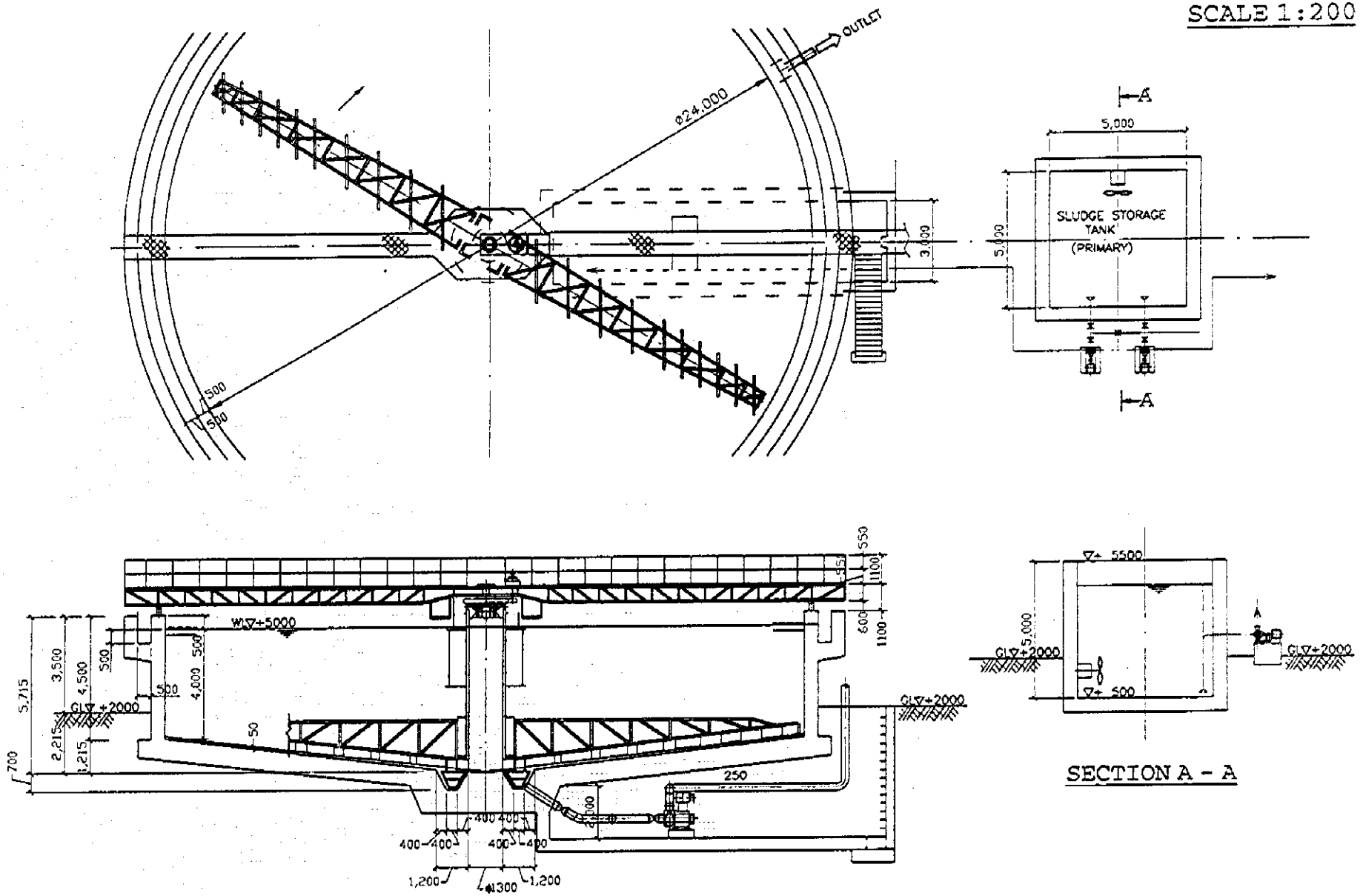


FIG. 8.39 PROPOSED LAYOUT OF GRAVITY THICKNER

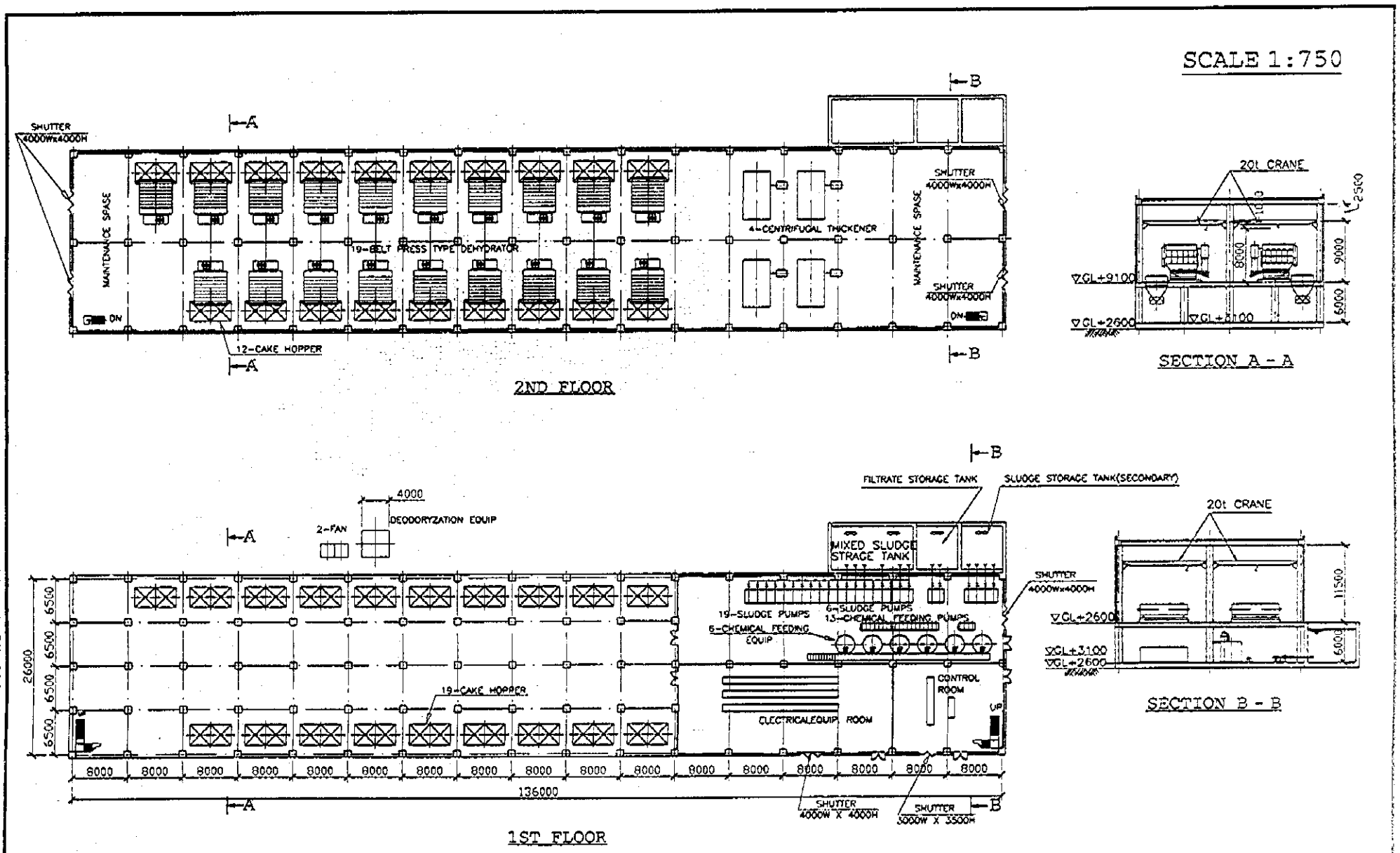


FIG. 8.40 PROPOSED LAYOUT OF CENTRIFUGAL THICKENER

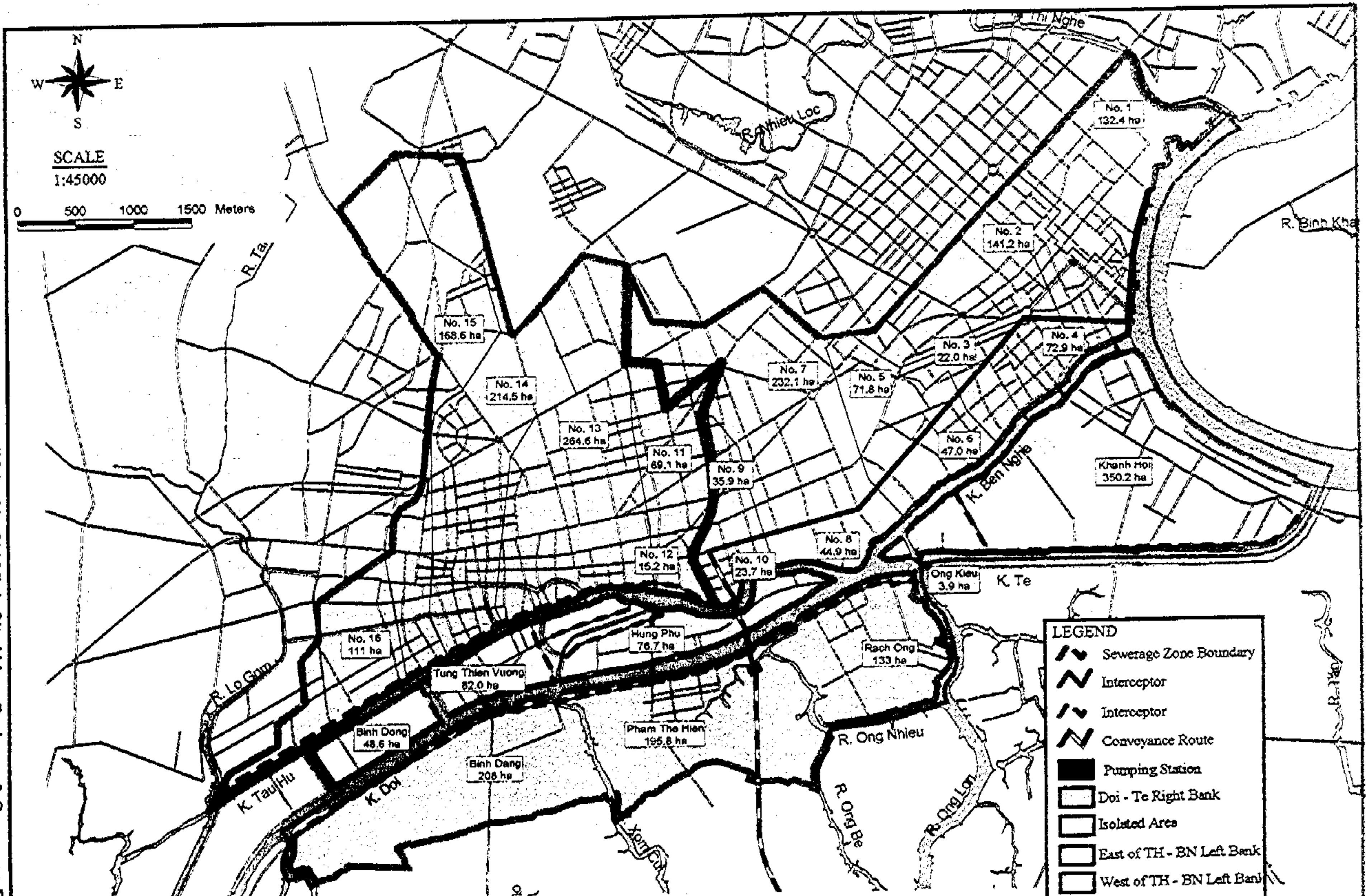


FIG. 8.41 PRIORITIZATION OF PRIORITY PROJECT AREA

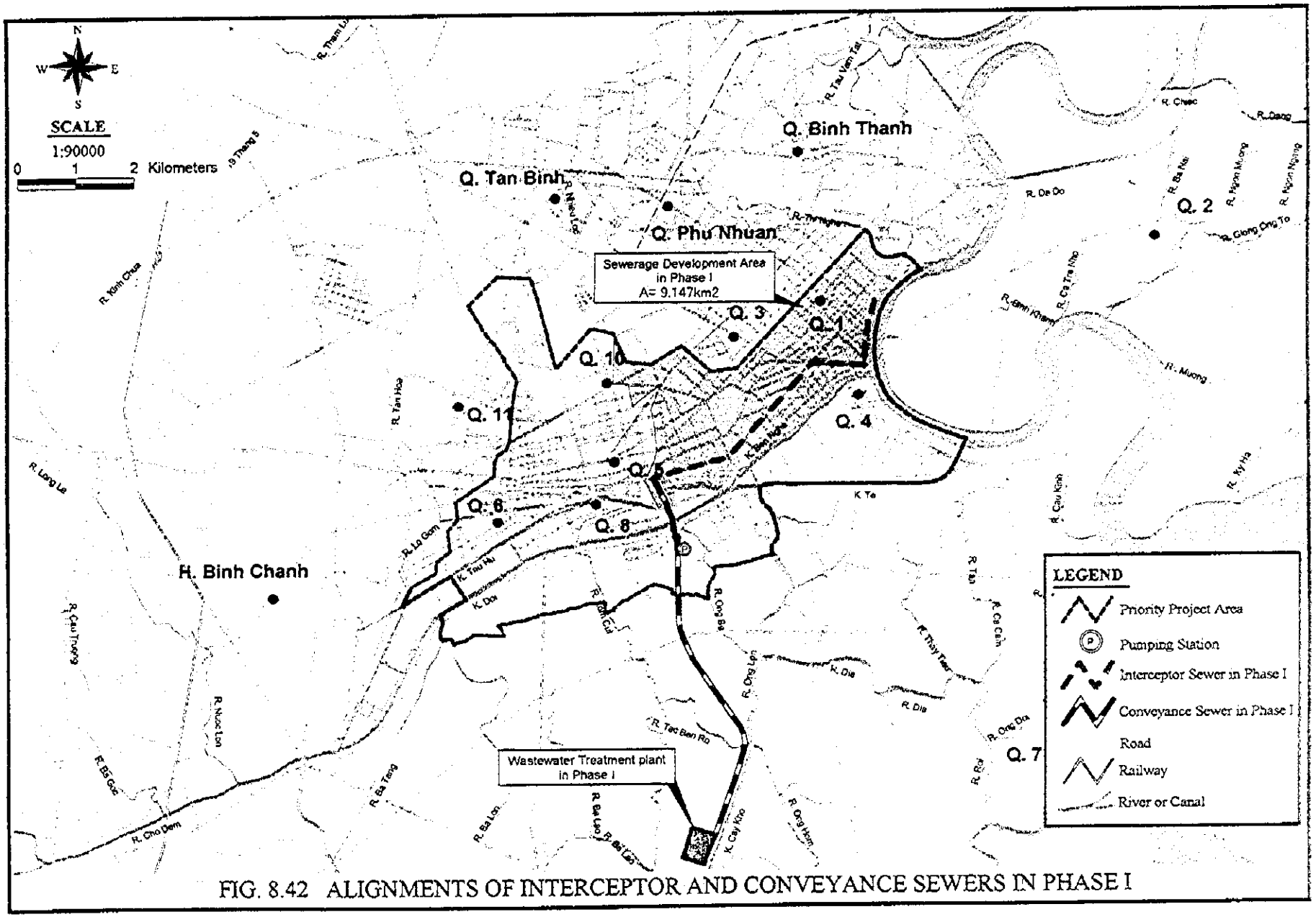


FIG. 8.42 ALIGNMENTS OF INTERCEPTOR AND CONVEYANCE SEWERS IN PHASE I

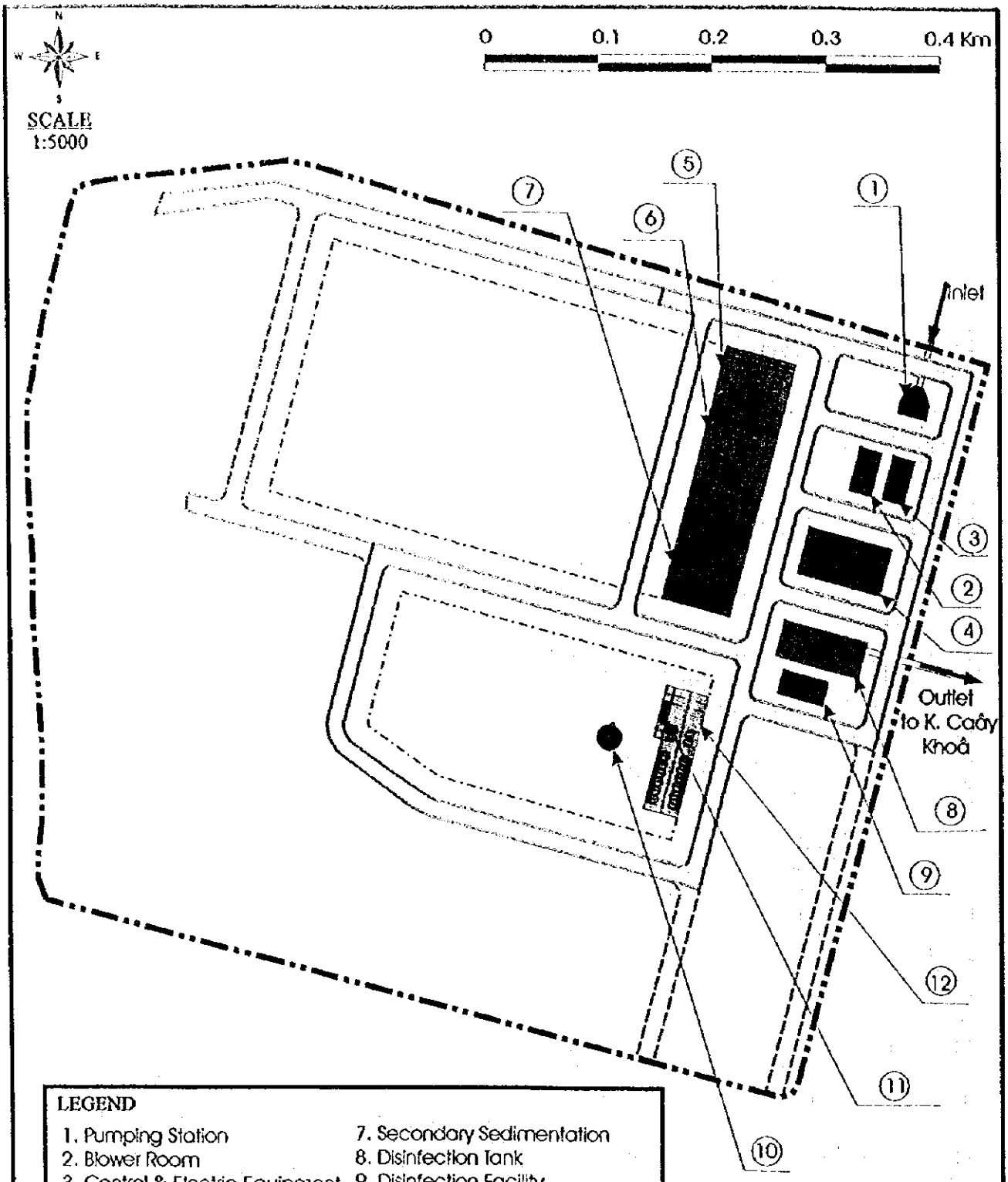


FIG. 8.43 PROPOSED TREATMENT PLANT FOR PHASE I

Q =141,000 m^3/day BOD_{in}: 180mg/l BOD_{out}: 50 mg/l

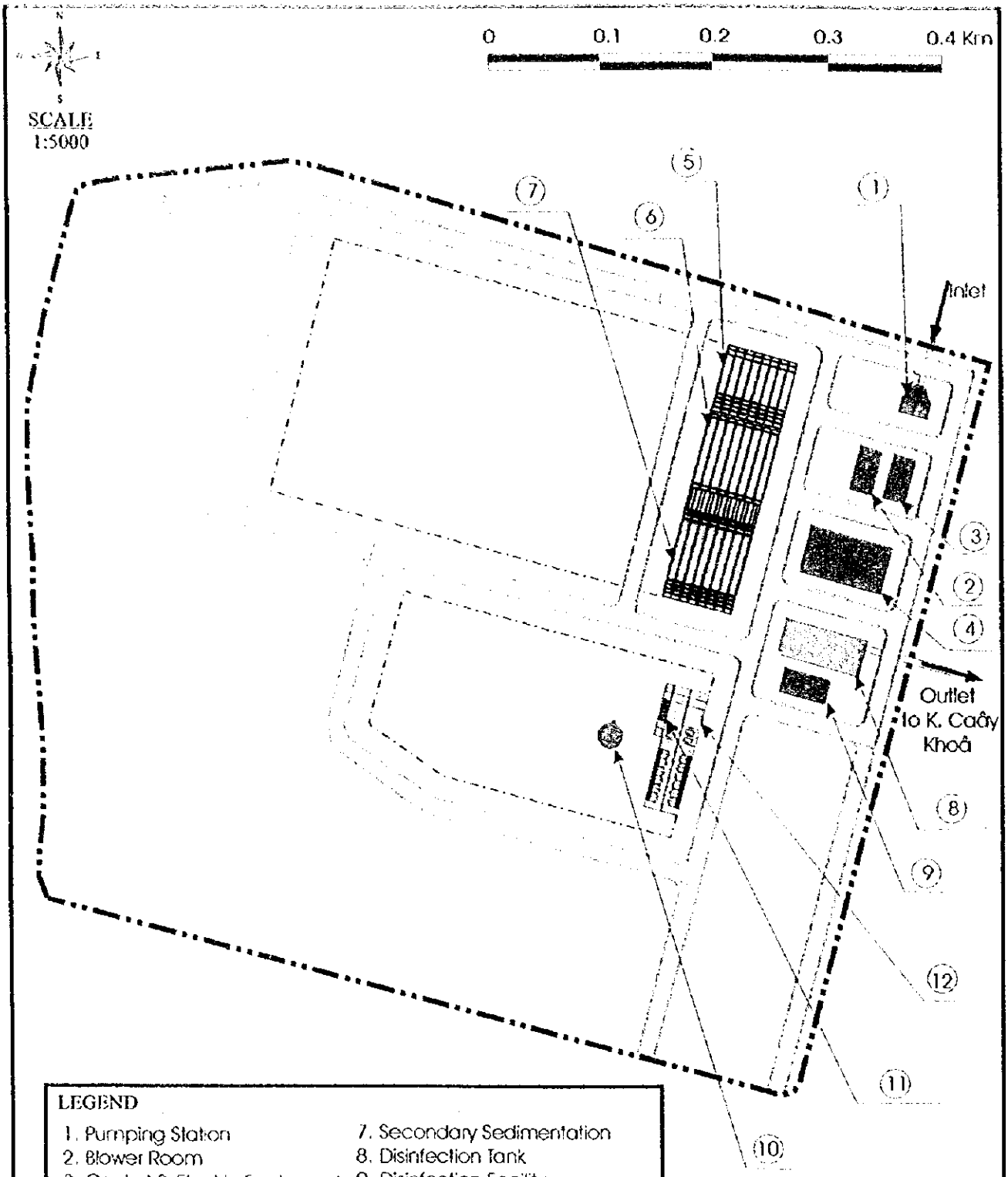


FIG. 8.43 PROPOSED TREATMENT PLANT FOR PHASE I

Q =141,000 m^3/day $BOD_{5,20}$: 180mg/l $BOD_{5,20}$: 50 mg/l

CHAPTER 9

OPERATION AND MAINTENANCE

CHAPTER 9 OPERATION AND MAINTENANCE

9. 1 Present Situation of Operation and Maintenance (O/M)

9.1.1 Urban Drainage

Administratively, the Office of Water Management (OWM) is in charge of the O/M for its assigned waterways, but mainly for navigation purposes with only minor concerns on drainage and environmental controls. On the other hand, the Urban Drainage Company (UDC) is the main organization in charge of O/M for the urban drainage sewer network in HCMC (Grades 1, 2, and 3). Meanwhile, the District Public Service Enterprises (DPSE) are in charge of O/M for the Grade 4 sewers within each district.

On the aspect of physical operation mechanism, the urban drainage is basically operated under the natural gravity system through an old sewer network constructed since the French era, which finally drains out the collected storm water and the domestic sewerage from the city into the canals/channels, particularly the Saigon River.

The cleaning of the drainage sewer network and the dredging of canals/channels, which are the major maintenance works for urban drainage facilities, mainly carried out by manual works through the responsible organizations with related budgets provided by the Government.

The sewer network is old with some places of insufficient drainage capacity or existing hard sedimentation deposits resulted from insufficient cleaning works, causing a bad drainage operation. For maintenance works, UDC has procured recently a little mechanical equipment through the foreign assistance projects.

There are no unified cleaning/dredging schedules and tariffs for properly providing O/M budgets to all responsible organizations, particularly for DPSE where the maintenance works are found very ununified. Moreover, there are no sufficient check system on their work efficiencies and no data filing on the whole situation of sewers and canals for an integrated control system at now.

9.1.2 Sewerage

According to the Decree No.388 of 1993 on the functions of UDC, apart from the O/M works for city drainage sewers, UDC is also administratively responsible for the sewage treatment works in HCMC. In fact, due to no existing facilities and operation means including budget allocations at present, this aspect has been neglected up to now.

Besides, based on city construction regulations, each housing construction in the city area should install a septic tank for collecting the toilet water as for a primary treatment

prior to make the connection of the domestic sewage to the city sewer system. This is under the control of Chief Architect Office.

The out-of-dated system of collecting the effluent from septic tanks and the storm water to drain out in large water bodies for natural cleansing applied since the French era has been continued up to now. The dredging works of these water bodies, however, have been neglected due to insufficient budgets.

At present, only about 50% of total households in HCMC are reportedly served by this septic tank system. And the remaining households have direct connections of their domestic sewerage to the city sewer system or to nearby local canals/channels.

Besides about half of the existing septic tanks are reportedly malconstructed, causing leakage of the inside liquid into the beneath soil and underground water. As most tanks have not been subjected to regular solids removals, an equivalent black water is flowing into the city sewer system up to now. This situation is considered dangerous to the public health because a lot of people in HCMC are presently using groundwater and some places in this city have been supplied with the city water from defected piping works at now. Moreover, various slump agglomerations with various hang-on toilets are presently observed around/on the water bodies in HCMC.

9.2 Actual Expenses for O/M Works

At present, the estimated annual expenses for O/M costs and budgeting systems for urban drainage and sewerage in HCMC are summarized as follows:

Section	Work Item	Organization in-charge	Annual O/M Expenses (Billion VND)	Budget Source	Annual Maintenance Volume/Distance
Drainage	Waterways	OWM	10.0	PC-HCMC	100km of 736km
	Grade 1	UDC	None	----	0 of 234km UDC
	Grade 2	UDC	30.0	----	50% of 100km
	Grade 3	UDC		----	50% of 416km
	Grade 4	District	30.0	----	90% of 415km
	Inner canals		None		0 of all canals
Sub-total		-	70.0	-	
Sewage	Government work	Citenco	1.0	Government Office	1 million m^3 for 150,000 units
	Tank treatment	Private Co	30.0	Individuals	
Sub-total		-	31.0	-	
Total		-	101.0	-	

Sources: OWM, UDC, District Public Service Enterprises and Aseptic Treatment Co.

The annual O/M expenses in HCMC for urban drainage and sewage are estimated at 101 billion VND, where 31 billion VND (or 30%) have been used for sewage (septic tanks) and 70 billion VND (or 70%) for urban drainage

On the calculation basis by coverage of sewer lengths, the actual expenses for urban drainage and sewerage development in the Priority Area are estimated as follows:

Section	Work Item	Carried out by	Annual OM Expenses (Billion VND)	Budget Source	Remarks
Drainage	Waterways	OWM	5.0	PC-HCMC	As 50 % *
	Grade 1	UDC	-	----	No works
	Grade 2 & 3	UDC	13.4	----	As 44.7 %*
	Grade 4	Districts	17.3	----	As 55.5 %*
Sub-total		-	35.7	PC-HCMC	
Sewage	Government Office	Citenco	0.3	Government	As 1/3 **
	Tank treat.	Priv.Co.	27.0	Individuals	As 1/3 **
Sub-total		-	27.3	Both sides	
T0tal		-	63.0	Both sides	

Notes : * of the total actual expenses for HCMC and
** of the actual expenses for the Study area

At present, the annual O/M expenses for urban drainage and sewage in the F/S Area are estimated at 63 billion VND where 27.3 billion VND (or 43%) have been used for sewage and 35.7 billion VND (or 57%) for urban drainage

9.3 Proposed O/M Framework for the Project

9.3.1 Proposed Institutional Organization

(1) Concerning the O/M aspect for the Project, there are two parts corresponding to the overall management of O/M (mentioned in the section of Project Organization) and the O/M works at field level for specific facilities envisaged in the Project.

(2) According to this proposed framework, the flowchart of O/M works for the Project is notified in Fig. 9.1.

(3) The present OWM, UDC and District Public Service Enterprises would be subjected to continue their routine dredging/cleaning works but under an integrated management on this aspect and a close collaboration among them along with the introduction of sophisticated equipment proposed in the Project. UDC representatives will be assigned to work at district level for properly conducting the maintenance schedule of the sewer network in each District for assuring its

smooth operation. On the basis of an integrated management system, O/M works will be proceeded with the same tariff system and same technical work specifications.

9.3.2 Introduction of Sophisticated Equipment for the Project

(1) For the maintenance (cleaning/dredging works) of the present sewer system, along with the rehabilitation works for all gates and damaged sewers, the introduction of sophisticated maintenance equipment at each district is proposed. The maintenance team at each district shall be equipped with a High Compressor Car, a Vacuum Car, a Bucket-type Sewer Cleaning Car, a Van, and a Set of Checking and Repairing Tools. The maintenance team is proposed to be set up with workers from the district under a team leader i.e. an UDC district representative.

(2) At present the sewer cleaning work is mainly done by a group of about 10 workers for manually cleaning about 100 m per day only, but the removal of hard sedimentation throughout the sewer system has been found in difficulties. Besides, the efficient checking and monitoring systems are also lacking. With the introduction of new maintenance equipment, a team of about 5 persons can effectively perform the cleaning of 500 m of sewers per day.

(3) On the aspect of Drainage Improvement, there are three (3) pumping stations, which are Ben Me Coc (1), Ben Me Coc (2) and Thanh Da. On the aspect of Sewerage Development, the installations of interceptors, conveyance systems, sewerage pumping stations and sewerage treatment plants are proposed accordingly. In the Priority Project, only one sewerage pumping station and one sewage treatment plant are proposed in the Project.

9.3.3 Allocation of Manpower for Proceeding O/M Works

(1) With the introduction of sophisticated equipment and facilities as mentioned above, a proper allocation of manpower is necessary for their operation. The basic principle for employing manpower for these facilities is firstly using the present competent manpower of related organizations with the application of further training. In case of unavailable proper manpower, the recruitment of new manpower will be done. Proper salaries along with strict regulations on working disciplines for these employees are basically recommended.

(2) As the drainage pumping stations are subjected to operation during the rainy seasons only, the administration section and the maintenance team for all three stations will be placed at Ben Me Coc (1) Station. Other two stations will have only the station manager and the operation team including guardian(s). During the

dry seasons, the pumps will have a short operation from times to times for maintenance purposes only.

(3) As for the aspect of Sewerage Development, the activities will be carried out all day long and throughout the year, three (3) shifts of working teams will be employed. The O/M personnel organizations of the related facilities are shown in Fig. 9.2 to 9.4.

9.4 Estimation of O/M Costs for Proposed O/M Frameworks

(1) Composition of O/M Costs for the Priority Project

Based on the proposed O/M frameworks, the composition of O/M costs for the Priority Project is made from the two (2) following parts:1) Cleaning and dredging costs of the existing sewer network and related canals/channels, and 2) O/M costs for the newly constructed facilities (for drainage improvement and sewerage development) proposed in the Priority Project.

(2) Total Annual O/M Costs for the Priority Project

(Unit : Billion VND)

Item	Phase I Total Annual O/M Costs			Phase II Total Annual O/M Costs		
	Drainage	Sewerage	Total	Drainage	Sewerage	Total
Cost	7.10	19.87	26.97	7.33	66.02	73.35

On the aspect of urban drainage improvement, the O/M costs will consist of (i) the cleaning costs for the existing sewer network and the O/M costs for the newly introduced equipment, and (ii) the O/M costs for the drainage pumping stations.

On the aspect of sewerage development, the O/M costs will consist of (i) the O/M costs for the new sewerage conveyance facilities (Sewage Pumping Station including the intereceptor and the conveyance), and (ii) the O/M costs for the Sewage Treatment Plant.

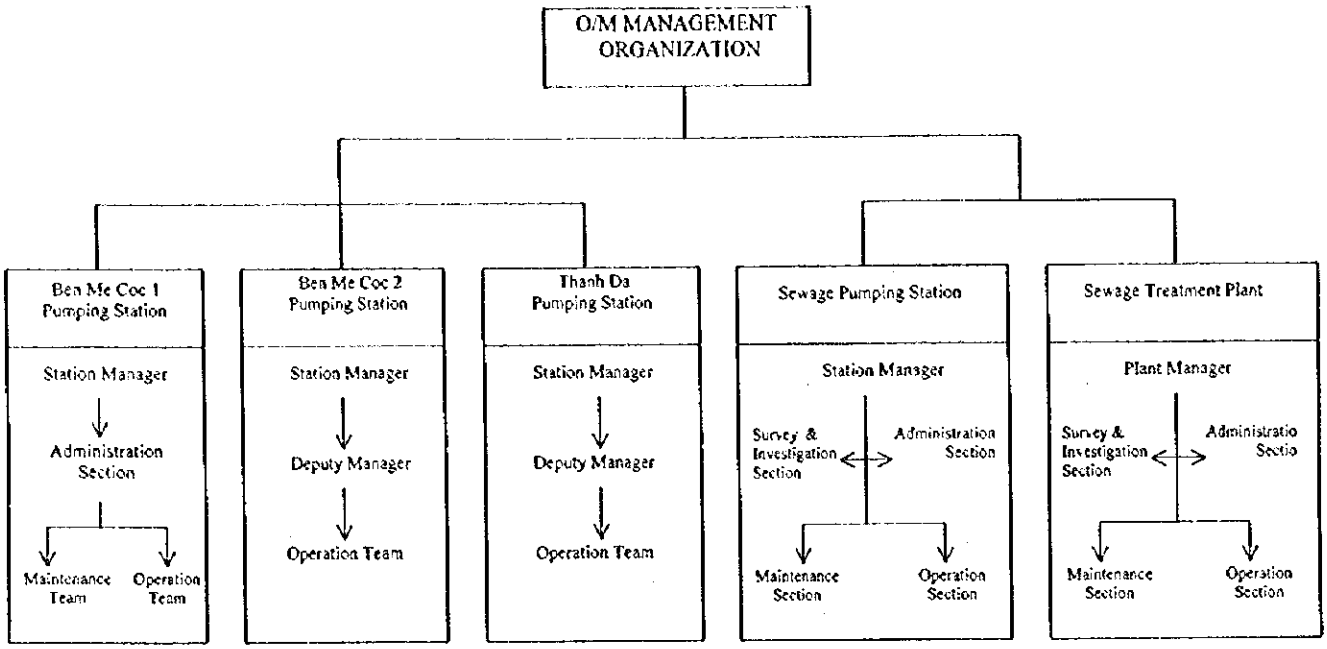


Fig. 9.1 Proposed O/M Organization for Priority Project

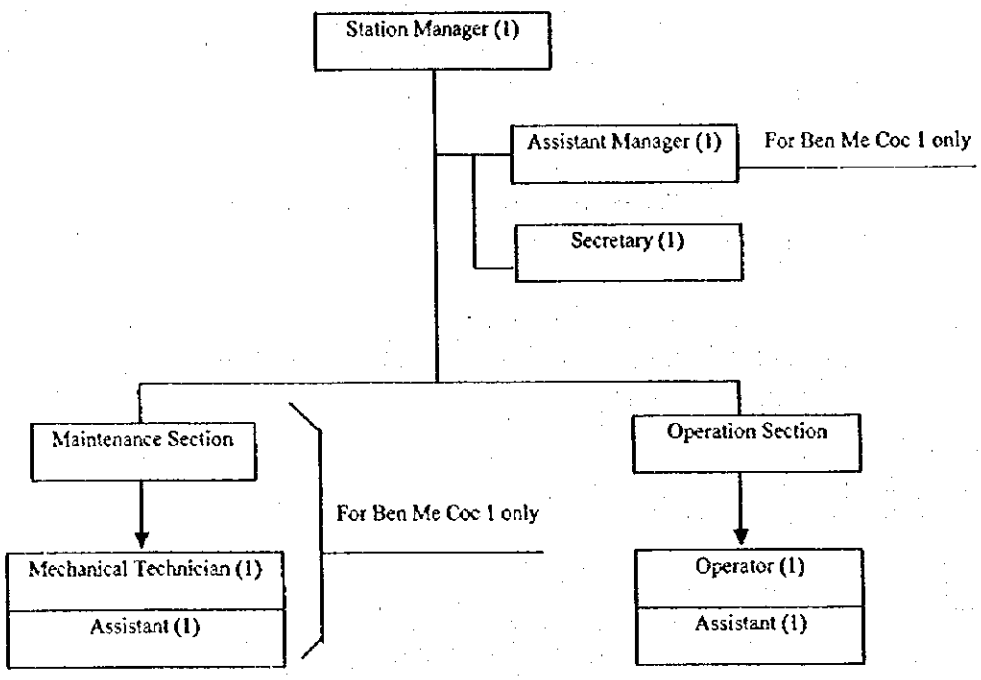


Fig.9.2 O/M Manpower Organization for Drainage Pumping Station

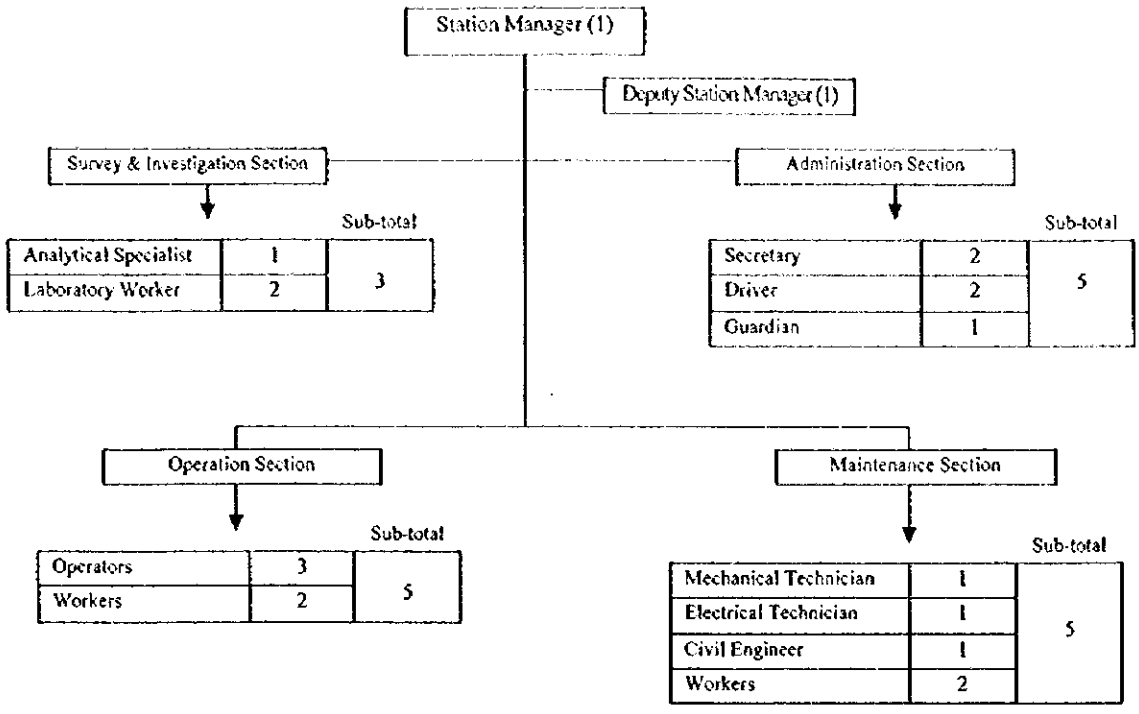
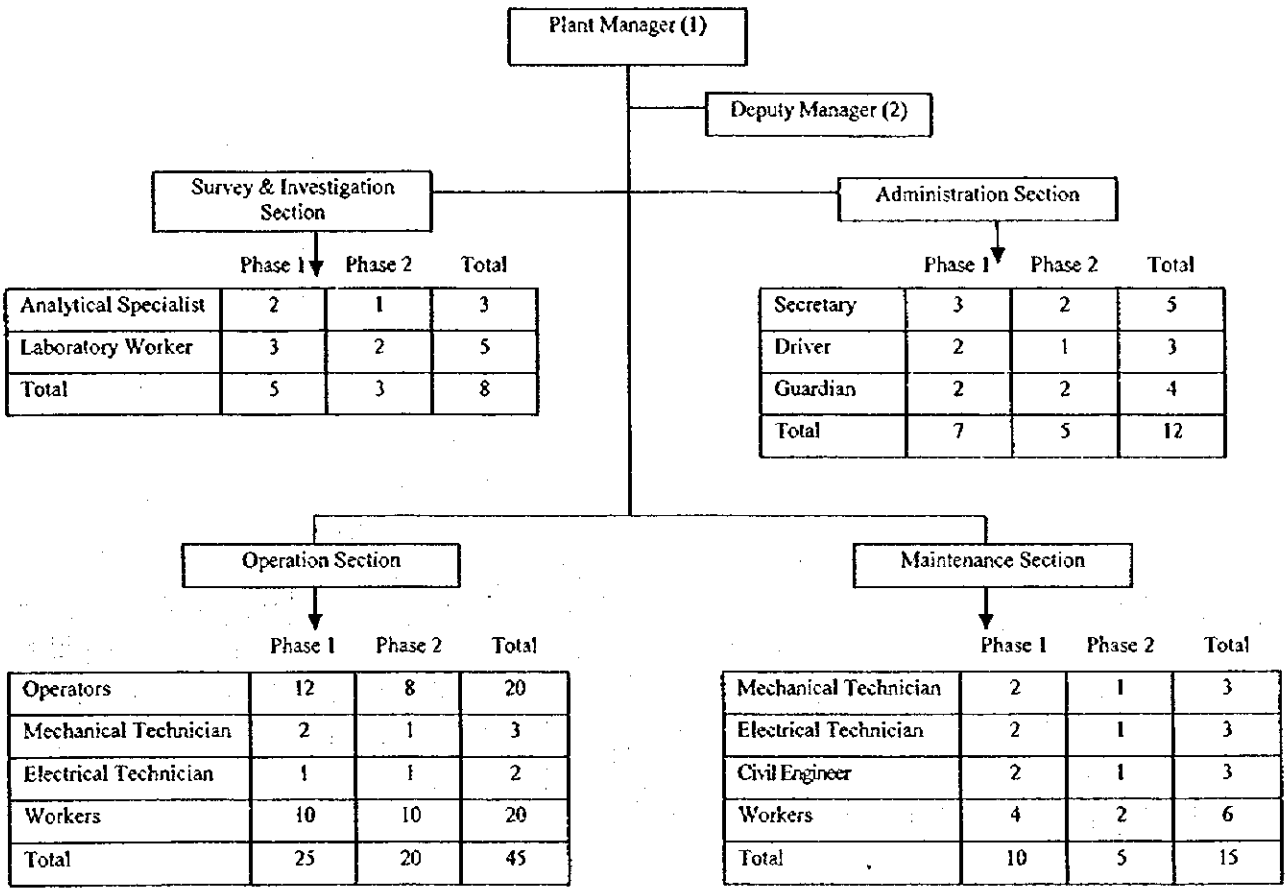


Fig. 9.3 O/M Manpower Organization for Sewerage Pumping Station



	Phase 1	Phase 2	Total
Analytical Specialist	2	1	3
Laboratory Worker	3	2	5
Total	5	3	8

	Phase 1	Phase 2	Total
Secretary	3	2	5
Driver	2	1	3
Guardian	2	2	4
Total	7	5	12

	Phase 1	Phase 2	Total
Operators	12	8	20
Mechanical Technician	2	1	3
Electrical Technician	1	1	2
Workers	10	10	20
Total	25	20	45

	Phase 1	Phase 2	Total
Mechanical Technician	2	1	3
Electrical Technician	2	1	3
Civil Engineer	2	1	3
Workers	4	2	6
Total	10	5	15

Fig. 9.4 O/M Manpower Organization for Wastewater Treatment

CHAPTER 10

ORGANIZATION AND LEGAL FRAMEWORK

CHAPTER 10 ORGANIZATION AND LEGAL FRAMEWORK

10.1 Administrative Organizations of Ho Chi Minh City

Local government system in HCMC is three-tiered. The City is administratively divided into 22 districts, of which 17 districts are urban, namely Inner City, and 5 are suburban. The districts are subdivided into wards in the Inner City and into communes in suburban districts. There are 281 wards and communes in the City. At each level of City, district and ward/commune, people's council that is legislature branch of elected members and people's committee that is executive branch are established. At the City and district levels, public administration is made through administrative divisions and public services through state-owned enterprises (SOE). Organization of HCMC is shown in Fig. 10.1.

HCMC Department of Transportation and Public Works (DTPW) is responsible for transportation, public lighting and other public services including water supply, urban drainage and sewerage, and undertaking such services through SOE's under its jurisdiction (see Fig. 10.2).

10.2 Maintenance of the Existing Sewerage

Urban Drainage Company (UDC), a SOE with approximately 700 personnel, is maintaining drainage canals (92 km) and sewer system (530 km). Sewers of smaller diameters (< dia 600 mm) are maintained by enterprises under district people's committees. Water Supply Company (WSC) is also a SOE with some 1,700 personnel. UDC acts as a service agent to DTPW for maintenance and minor construction of sewers, while WSC is a full-fledged water supply service provider owning title of production facilities as its asset. UDC's asset consists of only tools, vehicles and equipment. UDC's whole revenue is allocated from the PCHCMC's budget with the sum varying from 26 to 31 billion VND with which it cannot render the sufficient maintenance service. WSC's revenue in 1997 was 289 billion VND, all of which was collected from the beneficiaries. Thus, WSC has efficient tariff collection mechanism that UDC does not need.

10.3 Concept the Sector Service Organization

HCMC is currently planning a general upgrading of the sewerage and drainage service over the coming years. Due to the scale of investment and magnitude of the operation and maintenance cost, maintenance of the service may not be financed from the HCMC budget allocation alone as has been done for the existing service. Some measures for cost recovery from the service users should be instituted. Should the public service be provided for the fee from the beneficiary, a consensus that may be articulated in the following four principles should be sought for:

(a) **Single management** - One integrated and responsible entity shall operate and maintain all the sewerage and drainage facilities, and provide sewerage and drainage services in Ho Chi Minh City. There shall be a single central organization in charge of the sewerage and drainage services.

(b) **Efficient operation / least cost** - The service of acceptable quality should be provided with expense of the least operation cost. The provider needs to render the service very efficiently.

(c) **Transparent cost** - To ensure the least cost operation, detailed cost components that are verified by the audited financial reports shall be made available to the public and the beneficiaries.

(d) **Cost recovery as practicable** - It is desired to recover costs of the sewerage and drainage service from the beneficiaries as much as practicable or to the level of their affordability or willingness to pay. Share of the recoverable cost would be increased as the affordability-to-pay improves.

10.4 Proposed Service Charge and Collection Mechanisms

In view of the fact that the mass fee collecting system in the sector is available only with WSC and district PC's, UDC proposed the three-fee structure.

(a) **Wastewater fee** would be surcharge of percentage to water fee based on the metered consumption of water. This surcharge may be collected every monthly together with water fee by using tariff collection mechanism of WSC.

(b) **Storm water drainage fee** would be set as surcharge to the land tax. The land tax is collected annually by the district PC based on area-value of individual land. The proposed stormwater fee would be collected together with the land tax.

(c) **Network connection fee** would be one-time charge for new connection to the sewer system with rates based on the diameter of the connection.

This fee structure seems easier to implement, since the existing tariff collection mechanism can be utilized. Equitability concern, however, may be inherent in the surcharge on water bill, since only some 60 % households are connected to the WSC service. Total collection in the case of land tax surcharge will be limited, since total land tax is only 60 to 70 billion VND per year. Further study would be required to determine mode of tariff and collection mechanism.

10.5 Proposed Organization for the Sewerage and Drainage Service

Integration of WSC and UDC, and assign the management of the water supply, sewerage and drainage services to the integrated company. This institutional alignment seems theoretically ideal. In the actuality revealed in discussions with officials of the department level, however, the historical remoteness and very different organizational climates of two companies appeared as a hazard against the immediate integration. This alignment, therefore, would be a target to be achieved in the long term or by decisions by the higher authority. Given that such a higher authority is not in the reach, this program has to depict an accessible option.

Single management for the sewerage and drainage service, therefore, would be a practical option in the immediate future. The existing UDC should be reorganized and upgraded to build a Sewerage and Drainage Company (SDC) that should be the management center of the City's sector service. This new institution should provide with and consist of the following functional organizations:

Organization	Management	Division	Functional Unit
Sewerage and Drainage Corporation	Top Management	Technical Operation	Operation
			Maintenance and Repair
			Procurement and Storehouse
			Laboratory
			Design and Construction Management
		Planning	Planning
		Administration Support	Public and Customer Relations
			Human Resources Administration and Development
			Supply and Asset Administration
			General Administration
		Financial Control	Financial Administration & Cost Control
			Accounting
		Commercial Operation	Customer Registration
			Billing and Collection
			Marketing

Before the reorganized SDC come into service, cell of key personnel should be placed to prepare and implement the followings, which are essential in inuguration of SDC:

(a) training program for key staff,
(b) introduction of the management information system / cost control system, and
(c) establishment or creation of the connection / customer database.

This company is expected to run on extensive use of information system. Number of training on computer literacy and management information system shall be repeated. Customer registration or creation of connection / customer database will require extensive canvassing in the service area, in which WSC's experience or technique should hopefully be imported. Financial / accounting staff needs to undergo training on the international accounting practices and concept of cost control, whereas technical staff should be trained on modern technique of the quality control.

10.6 Project Implementing Organizations

Major activities in the project implementation period are preparation of land, detailed design, works, tenders and contracts with equipment suppliers and contractors, supervision of construction and installation works, initial operation of facilities and training of operation and maintenance personnel, and handing-over of constructed facilities from contractors to the service provider. Of all activities in the implementation phase, preparation of detailed designs, tender documents and tender evaluation reports, and supervision of construction and installation will be assigned to a consultant to be selected by the procedures stipulated in the lender's guidelines. Initial operation, training and handing-over will also be supervised by the consultant. The PMU's tasks will be to supervise and approve the consultant's activities. However, PC HCMC, the project implementing agency, should undertake the relocation and resettlement of residents from the project sites. In collaboration of the consultant, PMU has to prepare various reports required by the fund lender if the project will be financed by a foreign economic cooperation. Many of these activities require the important decisions that may influence quality of the services, lives of the project facilities, costs of the operation and so on.

With the completion of construction/installation works, the organization to be responsible for normal operation of the assigned services in urban drainage and sewrage treatment should direct the subjected activities as routine works. In the present conditions, such responsible organization should be aforementationed SDC, which is not yet reorganized or established. If SDC were already in existence, its planning unit and design and construction management unit should jointly establish the project implementing office and should direct throughout the implementation stage on behalf of SDC.

The present UDC is assumed to be a reorganized and upgraded in management and technical levels to take care of this SDC. The present UDC is considered not so delegated or capable that it may operate the envisaged sewerage and drainage services. It is, however, expected to do so after a total reorganization and upgrading with competent personal and sufficient trainings for the assigned staff. The PMU to be located in Project Implementation Office should be represented by a Project Director and other key staff on administration and technical aspects appointed by PC HCMC.

In principle, the PMU, should be made as an executing agency making closely to a steering committee, a consultant and a separately organized relocation office.

In Alternative 1 (Fig.10.3 (1)), a *project implementation office* would be organized under DTPW and associated with UDC, and would be provided with main professional staff from DTPW and UDC.

However, in order to reduce the consultation formalities with related departments of PC HCM, this PMU office is recommended to placed under the direct hierarchy of PC HCM via a Steering Committee consisting of DTPW and other related Departments (Fig10 3 (2)).

In this office, the PMU and the consultant should work closely in order to make the following functional units to complete the above tasks:

- Planning
- Engineering and design
- Public relations
- Legal officer
- Administration and accounting

Key personnel of these units shall be transferred to the future service provider for the purpose of smooth inauguration of SDC.
In the case that the detailed design service is provided by a donor as free donation, this organization setup for implementation phase does not apply. Project monitoring unit can be instituted for the place of implementation office.

10.7 Legal Considerations

For sustainable operation of the sewerage and drainage service in HCMC, the following items are desirable to be legalized:

- Obligation of Connection to Sewer

  Every house in areas where sewer network is developed must be connected. Disposal of wastewater to open channels other than sewers is prohibited. This obligation should be legalized.

- Enforceable Service Charge

  While direct beneficiaries of urban drainage facilities are difficult to be specified, those of water supply and sewerage services can be specified, and their volume of use can be defined by metering. Therefore, cost recovery from the direct users of water supply and sewerage is theoretically possible. While recovery of one hundred

percent of cost will be ultimate target, a practical tariff system must be applied in view of affordability to pay from household expenses. In the case of the sewerage services, costs for operation and maintenance, for the time being, shall be recovered through service charge from beneficiaries. Laws or decrees for this effect shall be enacted.

- Integrated Flood Control

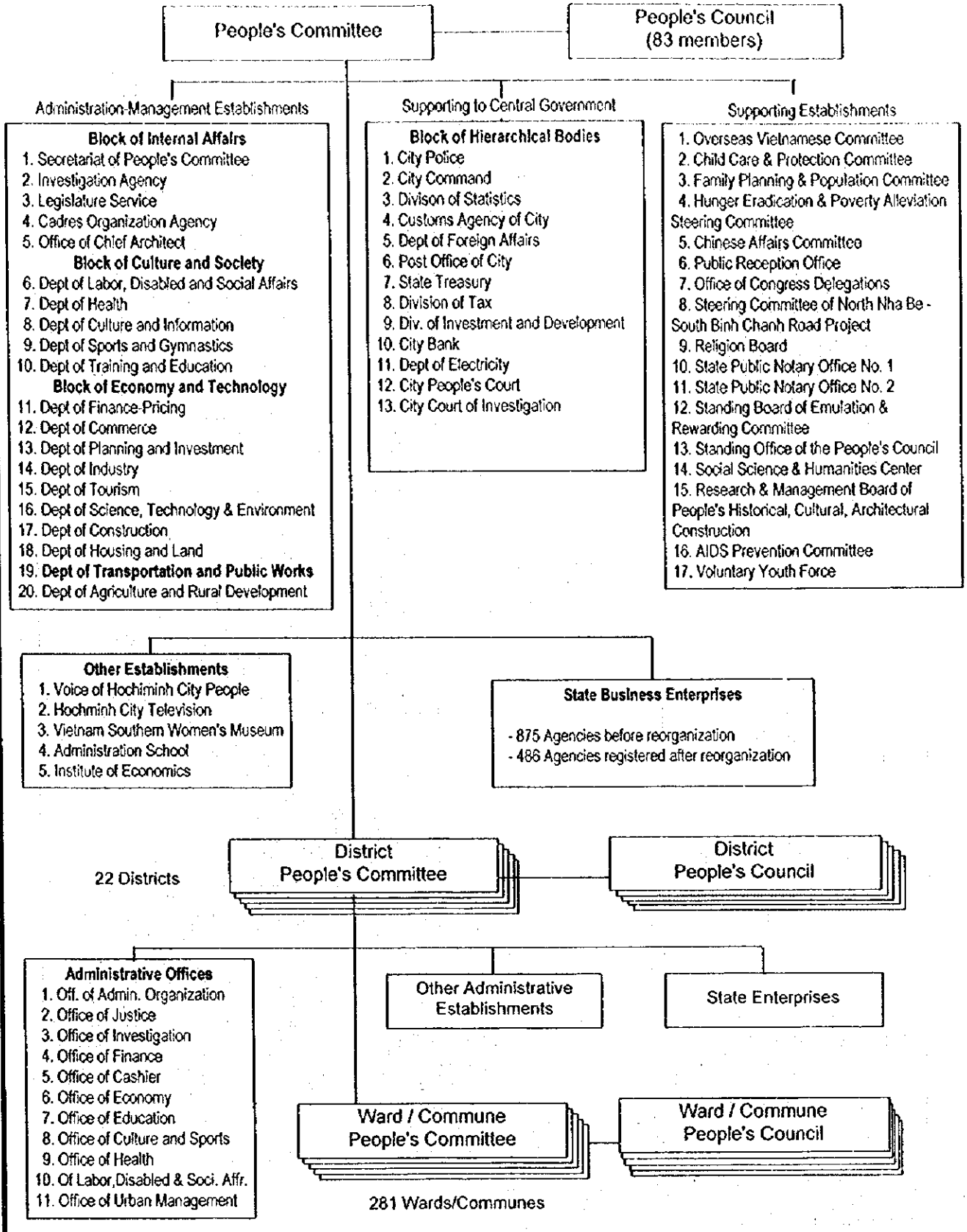
Rapid urbanization of peripheral Ho Chi Minh City is expected in the City Master Plan. Pattern of stormwater concentration will be diversely changed, as the urbanization and housing development will progress. It is anticipated that development of drainage facilities may not catch up the progress of encroaching urban area. Flood control measures may be integrated with non-structural ones such as catchment area development plan and land use plan, where developer's obligation to provide retention pond, utilization of low-laying agricultural land as natural flood plain, etc. are planned. Legal arrangement and organizational setup to enable such non-structural measures shall be sought for.

- Sewerage Law and Sewerage Facilities Law

Legal concept and definition of sewerage and drainage facilities shall be established. A basic law including ideal, objectives, definition, provider and provider's responsibility of the sewerage and drainage service will need to be enacted. A law to establish the service provider will also be needed.

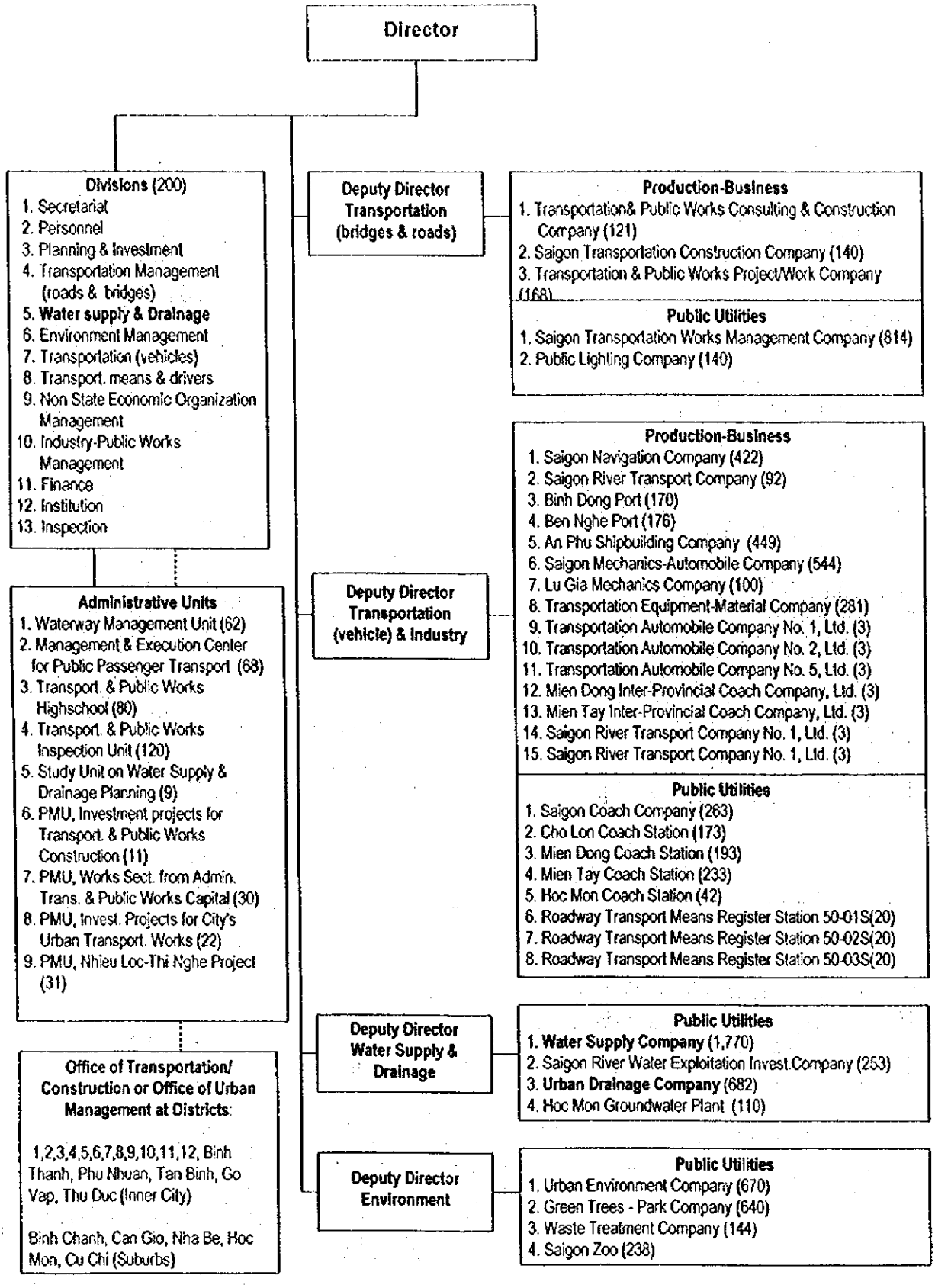
- Control of Groundwater Exploitation

There is no enforceable control over more than 100,000 groundwater wells, of which at least 200 are of the capacity over 1,000 m^3/day yield. The relate officials indicate concern on possible drawdown of aquifer table, salinity intrusion or even land subsidence. Mechanisms for effective control of groundwater exploitation should be instituted. Measures to quantify the groundwater yield and hence wastewater generation should be sought for.



Combination of People's Council (as elected legislature) and People's Committee (as executive organ) is three-tiered: city level, district level and ward/commune level. District and ward/commune people's committees are assumed as miniature versions of the City People's Committee. However, a district PC has more than 100 administrative personnel and a ward/commune PC has more than 10 officers.

Fig. 10.1 HO CHI MINH CITY



Note: Number of staff/employees in each unit/company is shown in parenthesis ( ).

Fig. 10.2 DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

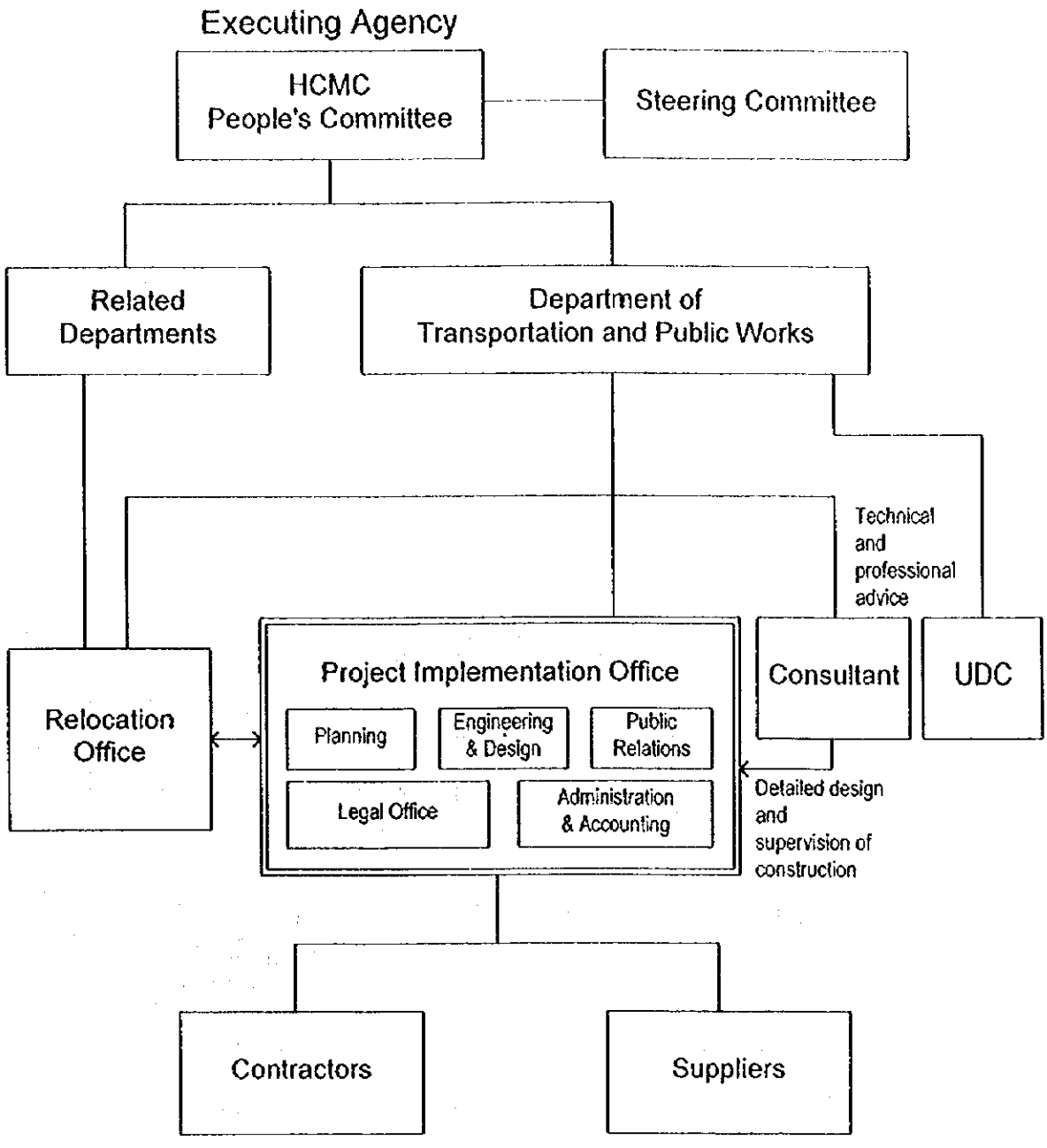


Fig. 10.3(1) Project Implementation Organization

Alternative 1

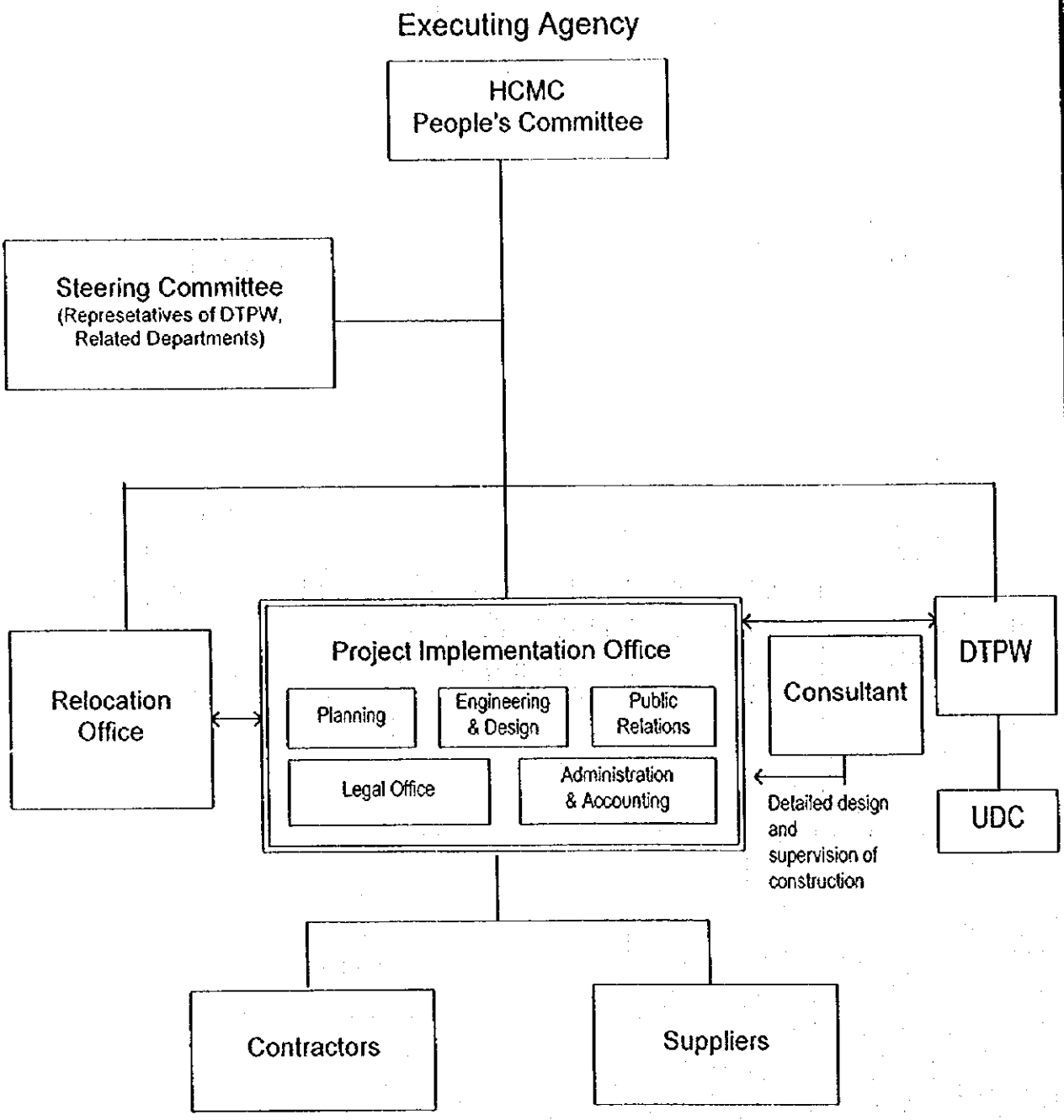


FIG. 10.3(2) Project Implementation Organization

Alternative 2

CHAPTER 11

RELOCATION AND RESETTLEMENT PROGRAM

CHAPTER 11 RELOCATION AND RESETTLEMENT

11.1 Project Components and Summary of Impacts

Relocation of inhabitants and their properties are inevitably brought about in the implementation of the priority project (hereinafter called as "the Project"), which is identified in the master plan. The relocation policy of HCMC is that all houses on and along the canals will be cleared (the houses located from the bank to the road or 20m from the bank in case of Nhieu Loc-Thi Nghe). Nevertheless, the primary objective of the policy on relocation in the Project is to avoid and minimize the relocated or negatively affected inhabitants and properties. Based on this policy, the routes and sites of all facilities have been selected. The target for relocation in Tau Hu-Ben Nghe Canal Improvement Site in the Project is designated as the structures located within distance of 5 m from the canal bank.

The Project will not cover the 4,650 houses (located mostly on the left bank of the Tau Hu-Ben Nghe Canal) to be relocated by the Transport Infrastructure Development Project in HCMC which plans to construct Ben Chuong Duong-Ben Ham Tu-Tran Van Kieu Road to National Highway No.1.

Total number of the houses to be relocated in case of implementation of the Project is estimated at 1,754. Impacts associated with each facility are expected as follows.

Summary of Impacts for Facilities

Impact	Drainage Pumping Station Site	Wastewater Pumping Station Site	Improvement of Tau Hu-Ben Nghe Canals	Wastewater Treatment Plant Site
Total Land Area (m^2)	3,687	792	41,909	15,000
Total Housing Area (m^2)	4,495	1,270	62,180	2,592
No. of Households to be Relocated	117	20	1,557	60

11.2 Compensation for Project-affected Populations and Properties

The table below shows the compensation costs to be residents that will be relocated by site.

Estimated Compensation Amount for the Relocation

Quantity	Location						Total
	Canal Improvement		Drainage Pumping Station Sites		Wastewater Treatment Plant Site	Wastewater Pumping Station Site	
	District 4	District 8	Thanh Da Area	Ben Me Coc 1 & 2	Nha Be District	Dong Dieu District 8	
No. of Houses to be Moved	755	802	96	21	60	20	1,754
Total Cost (1,000 VND)	49,038,760	29,365,230	6,808,320	436,758	2,651,160	771,440	79,767,315

11.3 Proposed Resettlement Sites

Based on the relocation survey and experience in HCMC, about 30% of the total households to be relocated want to find their houses by themselves after receiving compensation or subsidies/allowance. In which, 37% will plan to find land and buy houses with enough budget and 63% cannot afford to relocate because of insufficient budget to buy new houses. The rest 70% of the total households to be removed will move to the resettlement sites arranged by the local government.

There are 11 proposed housing construction projects consisting of town houses, apartment buildings and separate houses (villas). Among them, 5.8% of town houses (273 houses) and 15.4% of units of apartment buildings (3,261 units) are reserved for resettlement. In case of implementation of the Project, 70% of the total households to be relocated (1,228 households) need new housing in resettlement sites as shown in Fig. 11.1. Therefore, it is not difficult for HCMC to provide suitable dwellings for the inhabitants to be resettled.

11.4 Cost and Budget

The estimated costs for relocation and resettlement are shown in the following table.

Total Capital Needed for Relocation/Resettlement

(Unit: 1,000 VND)

Capital / Sources	Total	Compensation Cost	Construction Cost in Resettlement Site	
			Infrastructure	Housing
State Budget	127,362,516	79,767,316	47,595,200	-
Loan from State Budget	130,785,600	-	-	130,785,600
Self-investment by Inhabitants	107,190,400	-	-	107,190,400
Total	365,338,516	79,767,316	47,595,200	237,976,000
%	100	21.8	13.0	65.2

36.7% of the total capital are covered by State budget, 34.8% by loan from State budget and 28.5% by the inhabitants' self-build their houses. Compensation shares 22% of the total project budget. Total capital necessary for construction is 285.6 billion VND. Among the State budget, construction cost shares 67% of the total investment and the rest of 33% is for compensation. Based on the HCMC annual budget (850 billion VND in 1997, 830 billion in 1998, 840 billion in 1999), the financial capacity is feasible for covering the total investment needed for the state budget.

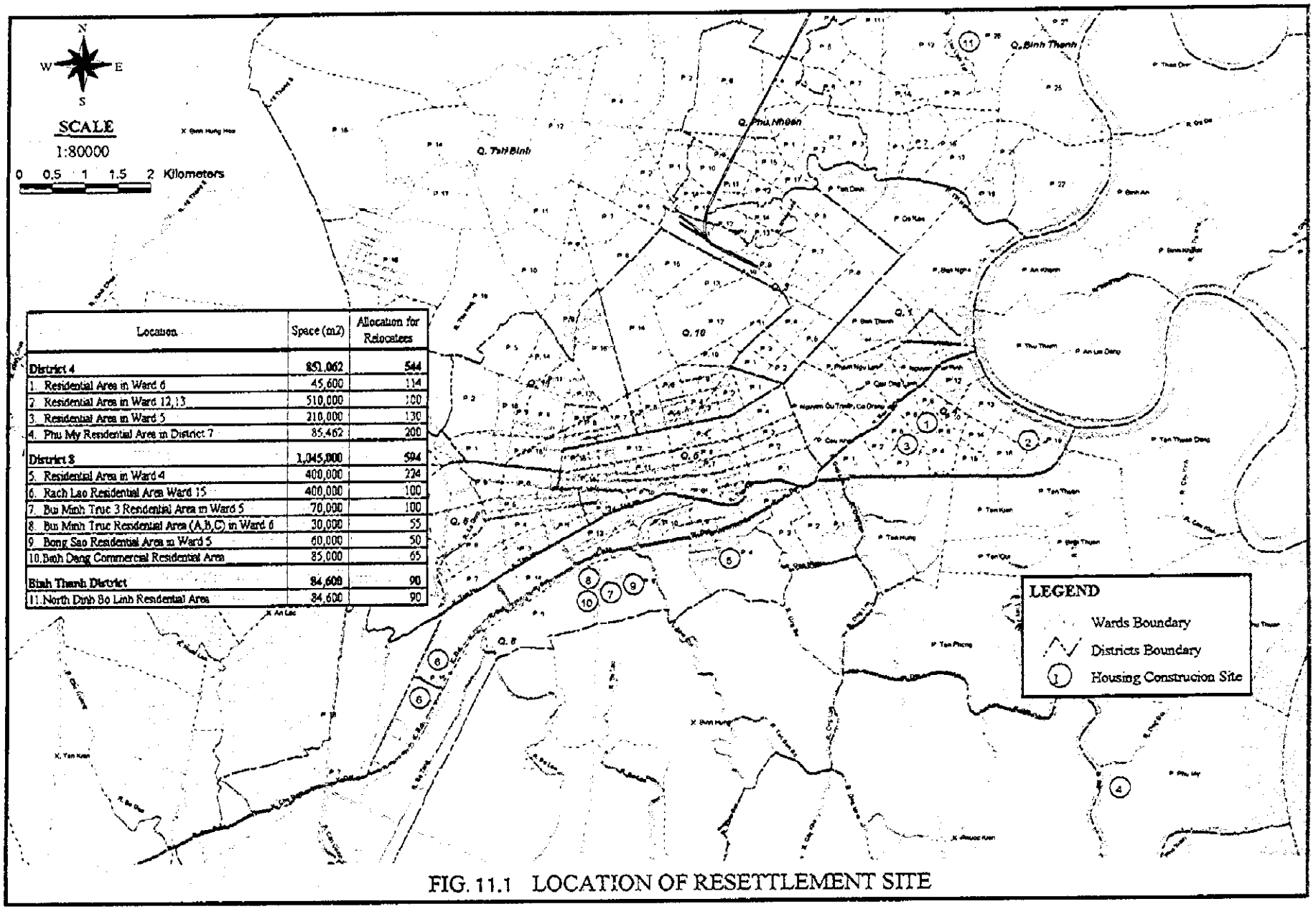
11.5 Organization of Relocation/Resettlement

The proposed organization to manage the project is based on the organization set up for Nhieu Loc-Thi Nghe project. The PMU (Project Management Unit) will be set up under the

PCHCMC shall be responsible for the day-to-day management and implementation of the Action Plan of Relocation and Resettlement. Department of Compensation and Resettlement in the PMU will work with Steering Committee at city level and district level.

There is not monitoring and evaluation system in HCMC. Therefore, the agency for monitoring and evaluation is necessary which will act as the ombudsman for the relocatees during resettlement, to resolve grievances as they occur, and will also conduct interview and surveys with all relocatees at intervals of 6 months and 12 months following the completion of resettlement activities. The monitoring and evaluation agency will also act as an impartial source of information for review of relocatees results.

Fig. 11.2 shows the proposed project management organization.



Location	Space (m2)	Allocation for Relocatees
District 4	851,062	544
1. Residential Area in Ward 6	45,600	114
2. Residential Area in Ward 12,13	510,000	100
3. Residential Area in Ward 5	210,000	130
4. Phu My Residential Area in District 7	85,462	200
District 8	1,045,000	594
5. Residential Area in Ward 4	400,000	224
6. Rach Lao Residential Area Ward 15	400,000	100
7. Bui Minh Truc 3 Residential Area in Ward 5	70,000	100
8. Bui Minh Truc Residential Area (A,B,C) in Ward 6	30,000	55
9. Bong Sao Residential Area in Ward 5	60,000	50
10.Binh Dang Commercial Residential Area	85,000	65
Binh Thanh District	84,600	90
11.North Dinh Bo Linh Residential Area	84,600	90

FIG. 11.1 LOCATION OF RESETTLEMENT SITE

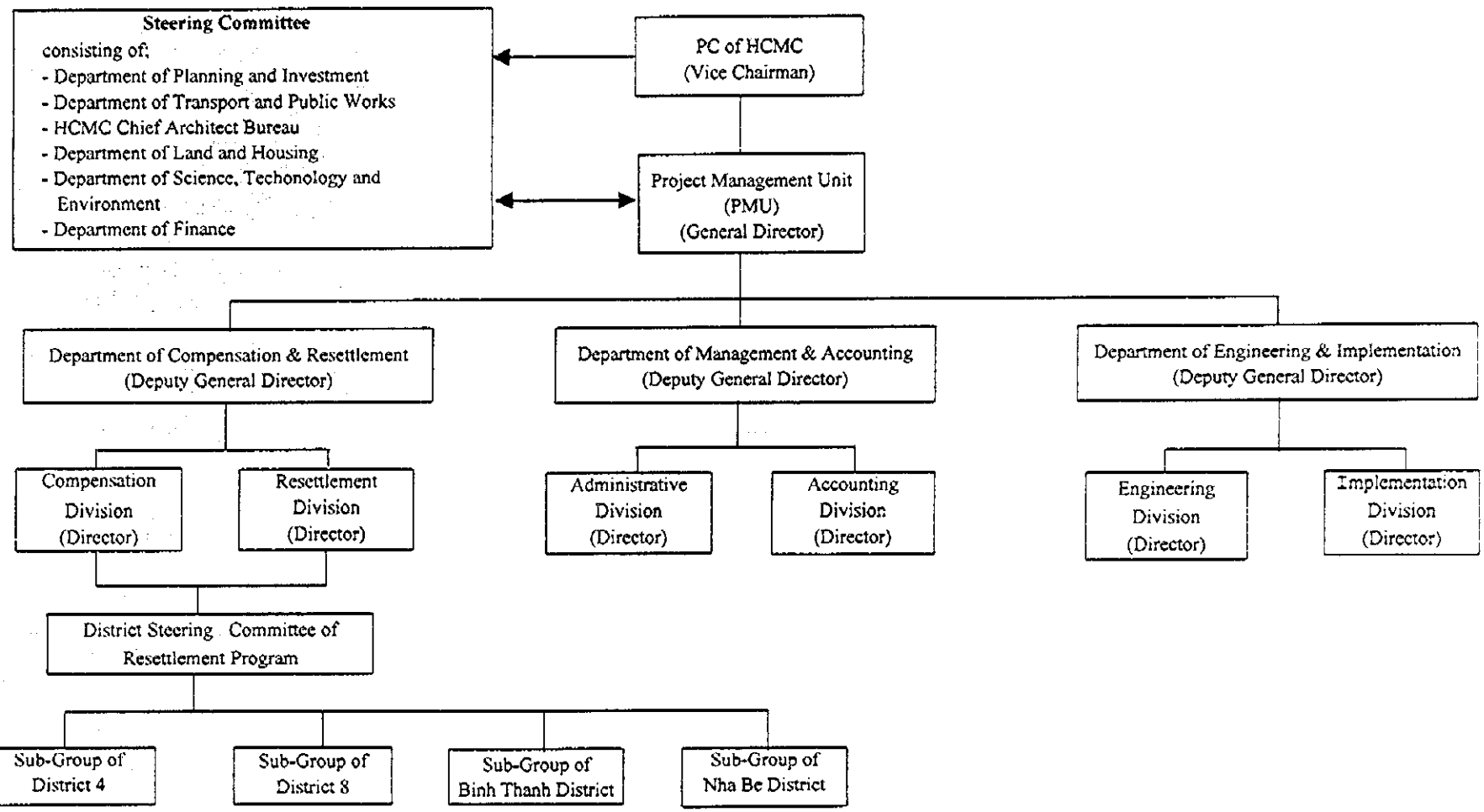


Fig. 11.2 Proposed Project Management Organization

CHAPTER 12

COST ESTIMATE AND IMPLEMENTATION SCHEDULE

CHAPTER 12 COST ESTIMATE AND IMPLEMENTATION SCHEDULE

12.1 Cost Estimate

12.1.1 General

Cost estimate of the priority project is carried out for the assessment of economic and financial viability and for the preparation of a fund allocation schedule by PCHCM. The costs are estimated based on the current economic conditions in HCMC, such as market price of construction materials, equipment labor wages, etc.

12.1.2 Basic Conditions for Cost Estimate

The project cost consists of (A) Construction Cost, (B) Administration Cost, (C) Engineering Cost, (D) Land Acquisition and Compensation Cost, (E) Physical Contingency, and (F) Price Contingency.

The project cost is estimated based on the following basic conditions.

(a) The estimates are made on the assumption that all construction works will be contracted to general contractors through the international bidding.
(b) All base costs are expressed under the economic conditions that are prevailing in July 1999.
(c) Construction cost consists of (i) direct construction cost, (ii) site preparation expense, and (iii) overhead, profit and tax. Direct construction cost is estimated by multiplying the quantity of work and its unit cost.
(d) Expenses of site preparation for urban drainage improvement and sewerage development are assumed respectively 15 % and 12 % of direct construction cost including equipment cost.
(e) Overhead, profit and tax for urban drainage improvement and sewerage development are assumed respectively at 10 % and 5 % of direct construction cost including equipment cost.
(f) Land acquisition cost is estimated based on the Vietnamese regulation called "Land use, Housing, and Land and Housing Tax".
(g) Compensation cost for relocation is also estimated by the Vietnamese regulations.
(h) Engineering service is assumed at 7.0 % of the construction cost.
(i) Administration cost is assumed at 3.0 % of the total cost of construction cost, land acquisition, and compensation cost.
(j) Physical contingency allowance at the rate of 10.0 % of the construction cost is assumed.
(k) Currency exchange rate of US$1 = 13,956 VND = ¥113.39 (July 1999) is applied.
(l) The cost is classified into Foreign Currency (F.C.) and Local Currency (L.C.).
F.C. portions include the cost of (i) imported equipment, materials and supplies, (ii) wages of expatriate personnel, and (iii) Overhead and profit of foreign firms. L.C. portions

contain (i) domestic materials and supplies, (ii) wages of local personnel, (iii) land acquisition and house compensation, (iv) overhead, profit of local firms, and (v) Taxes. The ratio of F.C. and L.C. portion of each cost is assumed as follows:

Item	F.C. (%)	L.C. (%)
Construction Cost for UDI	30	70
Construction Cost for SD	55	45
Engineering Cost	70	30
Land Acquisition Cost	0	100
Administration Cost	0	100

(m) Annual price escalation rate of F.C. and L.C. portion is assumed at 2% and 3% respectively.

12.1.3 Estimated Project Cost

Estimated cost of the priority project consisting of urban drainage improvement and sewerage development is at 7,157.2 billion VND under the economic condition in July 1999 as given below:

Priority Project Cost

(Unit: Billion VND)

Item	F.C.	L.C.	Total
A. Construction Cost			
1) Urban Drainage Improvement	296.3	691.3	987.6
2) Sewerage Development	2,023.8	1,655.8	3,679.6
Sub-Total	2,320.1	2,347.1	4,667.2
B. Administration Cost	0	154.5	154.5
C. Engineering Cost	228.7	98.0	326.7
D. Land Acquisition and Compensation Cost	0	483.6	483.6
E. Physical Contingency	213.6	253.1	466.7
Total	2,762.4	3,336.3	6,098.7
F. Price Escalation	398.2	660.3	1,058.5
Total	3,160.6	3,996.6	7,157.2

Note: Customs duties and Value Added Tax are excluded.

The breakdown of the estimated project cost is shown in Table 12.1.

12.2 Implementation Schedule

12.2.1 Construction Schedule

The priority project is proposed to implement in two (2) phases, taking into consideration of its target year of 2010 and its big amount of total project cost of about 7,157.2 billion VND.

considerations:

(a) Phase I and II will be executed in 2000 to 2006 and 2005 to 2010 respectively.
(b) Relocation/resettlement of Phase I and II shall be completed with in the middle of 2002 and the end of 2006 respectively.
(c) Financial and required administrative arrangements of Phase I and II shall be completed within the end of 1999 and 2004 respectively.
(d) Detailed design of Phase I and II shall be started in the begging of the year 2000 and 2005 respectively. Detailed design work will be taken about one year.
(e) Rehabilitation of existing combined sewers should be executed in Phase I resulting from its urgency for mitigation of the city inundation.
(f) New storm sewers in Binh Dang, Pham The Hien and Rach Ong areas shall be implemented in Phase II, taking into consideration of existing urbanization of these areas.
(g) Canal improvement is usually implemented from the downstream reaches. So, the canal improvement of Ben Nghe and downstream reaches of Tau Hu canal is proposed to implement in Phase I and remaining upstream reaches of Tau Hu canal is proposed to execute in Phase II.
(h) Pump drainage improvement of Thanh Da and eastern part of Ben Me Coc (1) shall be implemented in Phase I, considering the existing urbanization and flood conditions of these areas. Remaining western part of Ben Me Coc (1) and whole area of Ben Me Coc (2) shall be implemented in Phase II.
(i) The construction of interceptor sewer (east) and remaining (others) shall be implemented in Phase I and II respectively as mentioned in Chapter 8.
(j) Conveyance sewer construction shall be completed in Phase I.
(k) All civil works of intermediate sewerage pumping station shall be completed in Phase I. Mechanical and electrical works shall be implemented in Phase I and II to meet its requirement.
(l) Construction of wastewater treatment plant shall be executed in Phase I and II to meet its requirement.
(m) Sewerage collection system development in Binh Dang, Pham The Hien and Rach Ong areas shall be implemented in Phase II, taking into consideration of existing urbanization of these areas.

Fig. 12.1 shows the proposed construction schedule of the priority project.

12.2.2 Disbursement Schedule

Based on the estimated cost and proposed construction schedule for the priority project, its disbursement schedule is shown in Table 12.2.

12.3 Phase I Project

12.3.1 Implementation Program

The Phase I Project consisting of detailed design and construction of Phase I Project will be implemented within 70 months from March, 2000 to December 2005. The detailed design will be accomplished within 13 months between March, 2000 and March, 2001. The prequalification and tendering of contractor will be done within 6 months from April, 2001 to September, 2001. The construction works will be conducted within 51 months from October, 2001 to December, 2005.

The Phase I Project consists of:

- Existing combined sewer improvement
- Pump drainage improvement
- Canal improvement
- Interceptor sewer and conveyance sewer construction
- Intermediate sewage pumping station and
- Wastewater treatment plant construction

The salient features of Phase I Project are summarized as follows.

Project Area	914.7 ha (refer to Fig. 12.2)
Existing combined sewer improvement	**Additional** 10,272 m (ϕ 1,000 – □2,400 x 3,000 mm) **Replace** 1,320 m (ϕ 2,000 – ϕ 2,500 mm)
Pump drainage improvement	**Thanh Da area** 15.4 ha Pump capacity = 21 m^3/min. Concrete pile revetment = 74 m Drainage pipe = 655m (ϕ 800 – ϕ 1,200 mm) **Ben Me Coc (I) area** 70.9 ha Pump capacity = 42 m^3/min. Temporary earth dike = 3,950 m Drainage pipe = 4,607m (ϕ 900 – ϕ 1,650 mm) **Ben Me Coc (II) area** 46.0 ha Temporary earth dike = 3,290 m Drainage pipe = 4,206 m (ϕ 800 – ϕ 2,000 mm)
Canal improvement	**Ben Nghe canal** Type A : 3,140 m **Tau Hu canal** Type A : 2,490 m Type B : 1,205 m Type C : 525 m

Interceptor sewer	Interceptor sewer : Main : 870m (ϕ 700 mm) : 1,970m (ϕ 1,000 mm) : 1,070 m (ϕ 1,200 mm) : 1,570 m (ϕ 1,500mm) Secondary : 6,050 m (ϕ 300 – ϕ 700 mm) Diversion chamber Type I : 32 units
Intermediate sewage pumping station	Pump capacity : 133.3 m^3/min. x 1 unit (+1 unit as stand by)
Conveyance sewer	Conveyance sewer : 500m (ϕ 1,500mm) 500m (ϕ 2,000mm) 5,400m (ϕ 2,500mm)
Treatment plant	**Wastewater treatment** – Inflow pump : 133.3 m^3/min. x 20 m x 400 kw x 1 unit (+1 unit as stand by) – Primary sedimentation basin : 7 m(W) x 5 1m(L) x 4.5 m(D) x 8 units with flight chain type sludge collector – Aeration tank : 7 m(W) x 63 m(L) x 6 m(D) x 8 units with blower of 580 m^3/min. x 6.3 mAq x 800 kw x 1 units (+ 1 unit as stand by) – Secondary sedimentation basin : 7 m(W) x 76.5 m(L) x 5.25 m (D) x 8 units with flight chain type sludge collector – Disinfection tank : 25 m(W) x 56 m(L) x 4.5 m(D), dosing chlorine of 450kg/day **Sludge treatment** – Gravity thickener : 24 m x 4 m(H) x 1 unit – Dewatering : Belt filter press with a capacity of 157 m^3/day/unit x 6 units – Composting plant : Rotary kiln type dewatering, 1st fermentation tank of 18 m x 36 m and 2nd fermentation yard of 40 m x 75m

12.3.2 Cost Estimation of Phase I Project

The Phase I Project cost for Urban Drainage Improvement and Sewerage Development is estimated at 3,162 billion VND under the economic condition in July 1999. Its breakdown is shown below.

BREAKDOWN OF PHASE I PROJECT COST

Item		Cost (billion VND)		
		Foreign Portion	Local Portion	Total
A.	Construction Cost			
	1) Improvement of Combined Sewer	40.3	94.1	134.4
	2) Drainage Pumping Station	27.0	63.0	90.0
	3) Canal Improvement	89.2	208.2	297.4
	4) Cleaning/Dredging Equipment	11.1	25.8	36.9
	5) Interceptor Sewer	88.6	72.6	161.2
	6) Conveyance Sewer	225.2	184.2	409.4
	7) Diversion Chamber	2.3	1.8	4.1
	8) Sewage Pumping Station	58.1	47.5	105.6
	9) Sewage Treatment Plant	430.5	352.2	782.7
Sub-total of A		972.3	1,049.5	2,021.8
B.	Administration Cost	0	73.7	73.7
C.	Engineering Cost	99.1	42.5	141.6
D.	Land Acquisition & Compensation	0	433.9	433.9
E.	Physical Contingency	89.9	112.3	202.2
Sub-total of (B) to (E)		189.0	662.4	851.4
F.	Price Escalation	96.9	192.3	289.2
Grand Total		1,258.2	1,904.2	3,162.4

Note : Exchange rate : US$ 1 = VND 13,956 = ¥ 113.39 (¥ 1 = VND 123.08)
Physical contingency : 10% of construction cost
Engineering service : 7% of construction cost
Administration cost : 3% of construction cost
Price escalation : Foreign portion = 2 % per annum, Local portion = 3% per annum

Annual operation and maintenance cost in the year of 2005 is estimated about VND 27.0 billion consisting of VND 7.1 billion for urban drainage and VND 19.9 billion for sewerage management.

TABLE 12.1 BREAKDOWN OF PRIORITY PROJECT COST

(Unit: Million VND)

Item	F.C.	L.C.	Total
A. Construction Cost	2,320,037	2,347,106	4,667,143
A.1 Urban Drainage Improvement	296,270	691,296	987,566
(1) Canal Improvement	148,597	346,726	495,323
(i) Ben Nghe Canal	38,432	89,675	128,107
(ii) Tau Hu (Downstream) Canal	50,800	118,533	169,333
(iii) Tau Hu (Upstream) Canal incld. Ngang 1 -3	59,365	138,518	197,883
(2) Pump Drainage Improvement	43,121	100,615	143,736
(i) Thanh Da	6,061	14,142	20,203
(ii) Ben Me Coc (1)	19,850	46,316	66,166
(iii) Ben Me Coc (2)	17,210	40,157	57,367
(3) Drainage Pipe System Development	76,892	179,415	256,307
(i) Rehabilitation of Existing Combined Sewer	40,333	94,109	134,442
(ii) New Drainage Pipe Installation	36,560	85,306	121,865
(4) Procurement of Dredging Equipment	27,660	64,540	92,200
A.2 Sewerage Development	2,023,767	1,655,810	3,679,577
(1) Intercepter Sewer	293,954	240,507	534,461
(i) Interceptor Sewer (East)	90,932	74,399	165,330
(ii) Interceptor Sewer (West) and (Others)	203,022	166,109	369,131
(2) Conveyance Sewer	225,185	184,243	409,428
(3) Sewerage Pumping Station	113,442	92,817	206,259
(4) Wastewater Treatment Plant	1,339,388	1,095,863	2,435,251
(5) Sewerage Collection System Development	51,798	42,380	94,178
B. Administration Cost	0	154,522	154,522
C. Engineering Cost	228,691	98,009	326,700
D. Land Acquisition and Compenzation	0	483,603	483,603
D.1 Land Acquisition	0	94,411	94,411
D.2 Compenzation	0	103,621	103,621
D.3 Resettlement	0	285,571	285,571
E. Physical Contingency	213,607	253,108	466,715
Total of A, B, C, D, and E	2,762,335	3,336,348	6,098,683
F. Price Escalation	398,209	660,340	1,058,549
Total of A, B, C, D, E, and F	3,160,544	3,996,688	7,157,232

Table 12.2 Annual Disbursement of Construction Cost
(Urban Drainage and Sewerage Development)

1. Phase I

Cost Component	Project Cost (Mil. VND)	2000			2001			2002			2003			2004			2005		
	Total	FC	LC	Sb-total	FC	LC	Sb-total	FC	LC	Sb-total	FC	LC	Sb-total	FC	LC	Sb-total	FC	LC	Sb-total
1. Direct construction cost																			
(1) Drainage	558,836	0	0	0	25,148	58,678	83,825	41,913	97,796	139,709	41,913	97,796	139,709	41,913	97,796	139,709	16,765	39,119	55,884
(2) Sewerage	1,463,072	0	0	0	80,469	65,839	146,308	144,844	118,509	263,353	217,266	177,763	395,029	217,266	177,763	395,029	144,844	118,509	263,353
Sub total	2,021,908	0	0	0	105,617	124,517	230,133	186,757	216,305	403,062	259,179	275,559	534,738	259,179	275,559	534,738	161,609	157,628	319,237
2. Land acquisition & Comp.	433,907	0	217,241	217,241	0	54,167	54,167	0	54,167	54,167	0	54,167	54,167	0	54,167	54,167	0	0	0
3. Engineering cost	141,534	49,538	21,230	70,768	9,907	4,247	14,154	9,907	4,247	14,154	9,907	4,247	14,154	9,907	4,247	14,154	9,907	4,247	14,154
4. Administration cost	73,674	0	14,735	14,735	0	11,788	11,788	0	11,788	11,788	0	11,788	11,788	0	11,788	11,788	0	11,788	11,788
5. Physical contingency	202,191	0	0	0	17,146	20,499	37,644	18,822	24,411	43,232	18,822	24,411	43,232	18,822	24,411	43,232	16,307	18,543	34,849
Sub total	2,873,214	49,538	253,206	302,744	132,670	215,218	347,886	215,486	310,918	526,403	287,908	370,172	658,079	287,908	370,172	658,079	187,823	192,206	380,028
Price Contingency	289,185	991	7,596	8,587	5,360	13,107	18,467	13,189	28,830	42,020	23,733	46,460	70,193	29,966	58,959	88,924	23,696	37,298	60,994
Total	3,162,399	50,529	260,802	311,331	138,030	228,325	366,355	228,675	339,748	568,424	311,641	416,632	728,273	317,874	429,131	747,004	211,519	229,504	441,023

2. Phase II

Cost Component	Project Cost (Mil. VND)	2005			2006			2007			2008			2009			2010		
	Total	FC	LC	Sb-total	FC	LC	Sb-total	FC	LC	Sb-total	FC	LC	Sb-total	FC	LC	Sb-total	FC	LC	Sb-total
1. Direct construction cost																			
(1) Drainage	428,729	0	0	0	51,448	120,044	171,492	51,448	120,044	171,492	25,724	60,022	85,746	0	0	0	0	0	0
(2) Sewerage	2,216,505	0	0	0	182,862	149,614	332,476	304,769	249,357	554,126	304,769	249,357	554,126	304,769	249,357	554,126	121,908	99,743	221,651
Sub total	2,645,234	0	0	0	234,310	269,658	503,968	356,217	369,401	725,618	330,493	309,379	639,872	304,769	249,357	554,126	121,908	99,743	221,651
2. Land acquisition & Comp.	49,696	0	24,848	24,848	0	9,939	9,939	0	7,454	7,454	0	7,454	7,454	0	0	0	0	0	0
3. Engineering cost	185,166	64,809	27,775	92,584	15,062	6,456	21,518	14,012	6,006	20,018	14,012	6,006	20,018	10,861	4,655	15,516	10,861	4,655	15,516
4. Administration cost	80,848	0	16,887	16,887	0	14,227	14,227	0	14,227	14,227	0	14,227	14,227	0	10,639	10,639	0	10,639	10,639
5. Physical contingency	264,524	0	0	0	27,310	34,169	61,479	27,310	34,169	61,479	24,738	28,168	52,905	22,165	22,165	44,330	22,165	22,165	44,330
Sub total	3,225,468	64,809	69,510	134,319	276,682	334,449	611,131	397,539	431,257	828,796	369,243	365,234	734,476	337,795	286,816	624,611	154,934	137,202	292,136
Price contingency	769,363	8,176	13,489	21,665	41,139	76,881	118,020	68,241	115,046	183,288	72,037	111,314	183,350	73,975	98,641	172,616	37,707	52,718	90,425
Total	3,994,831	72,985	82,999	155,984	317,821	411,330	729,151	465,780	546,303	1,012,094	441,280	476,548	917,827	411,770	385,457	797,227	192,641	189,920	382,561

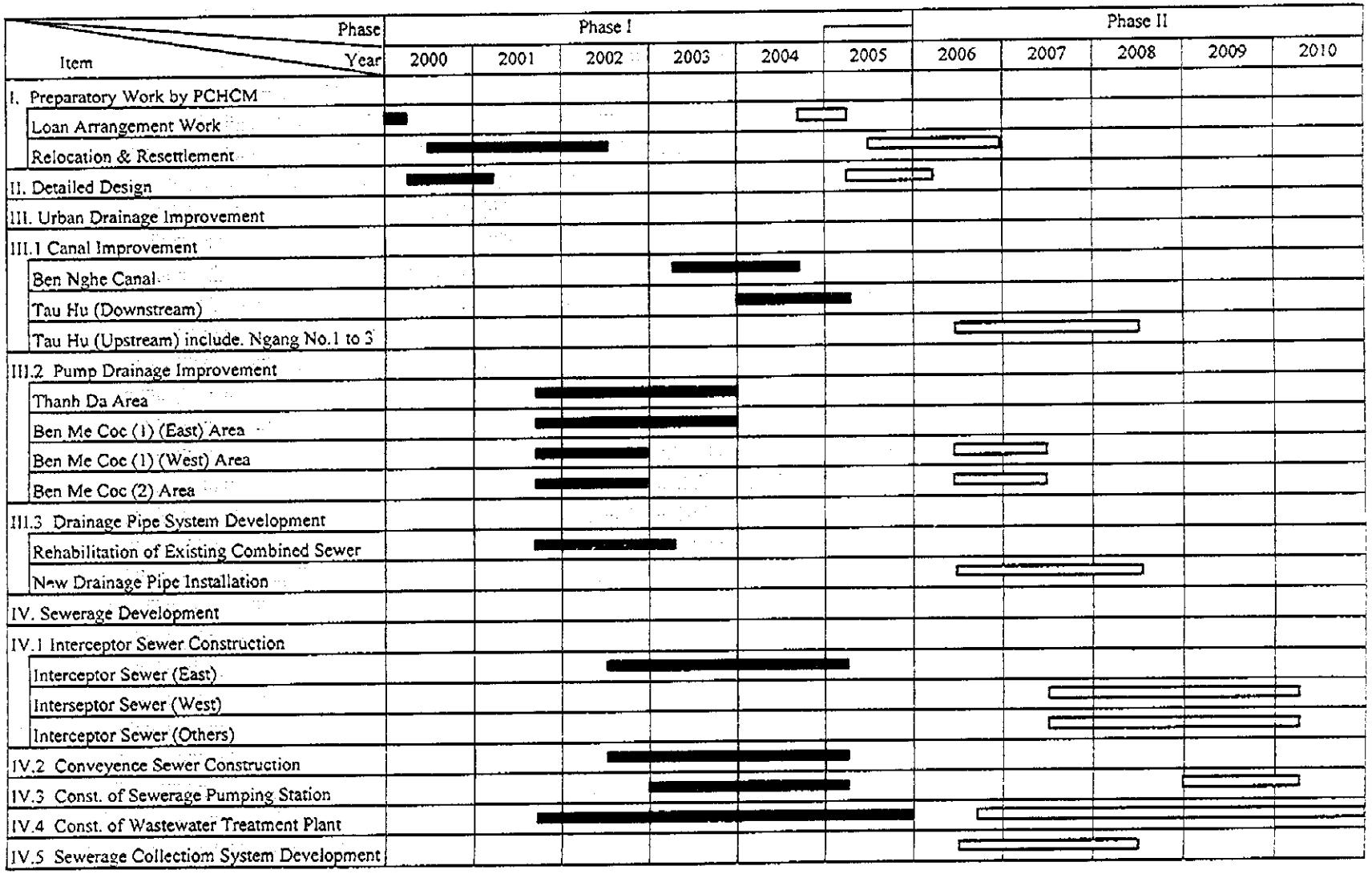


FIG. 12.1 PROPOSED CONSTRUCTION SCHEDULE OF THE PRIORITY PROJECT

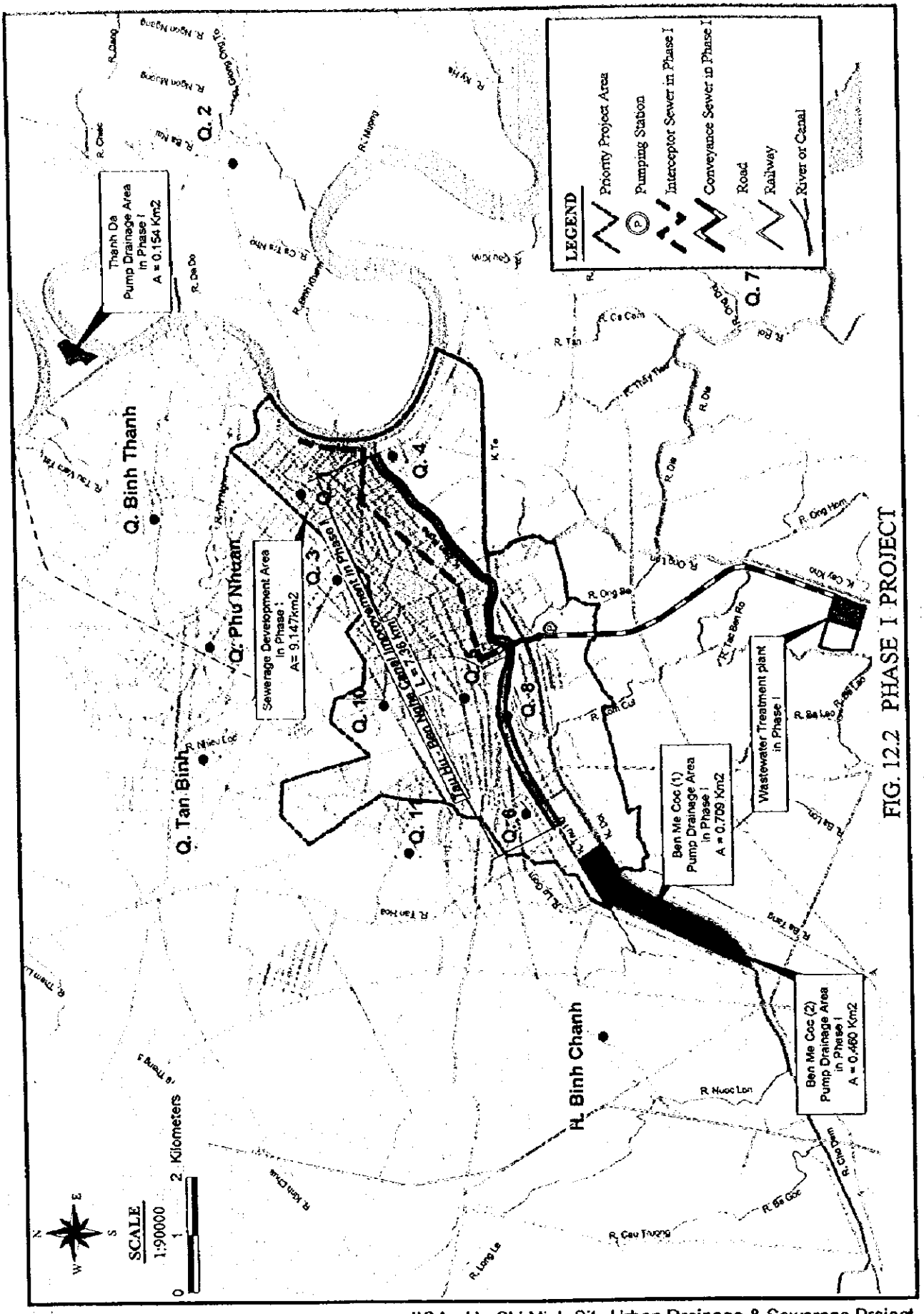


FIG. 12.2 PHASE I PROJECT

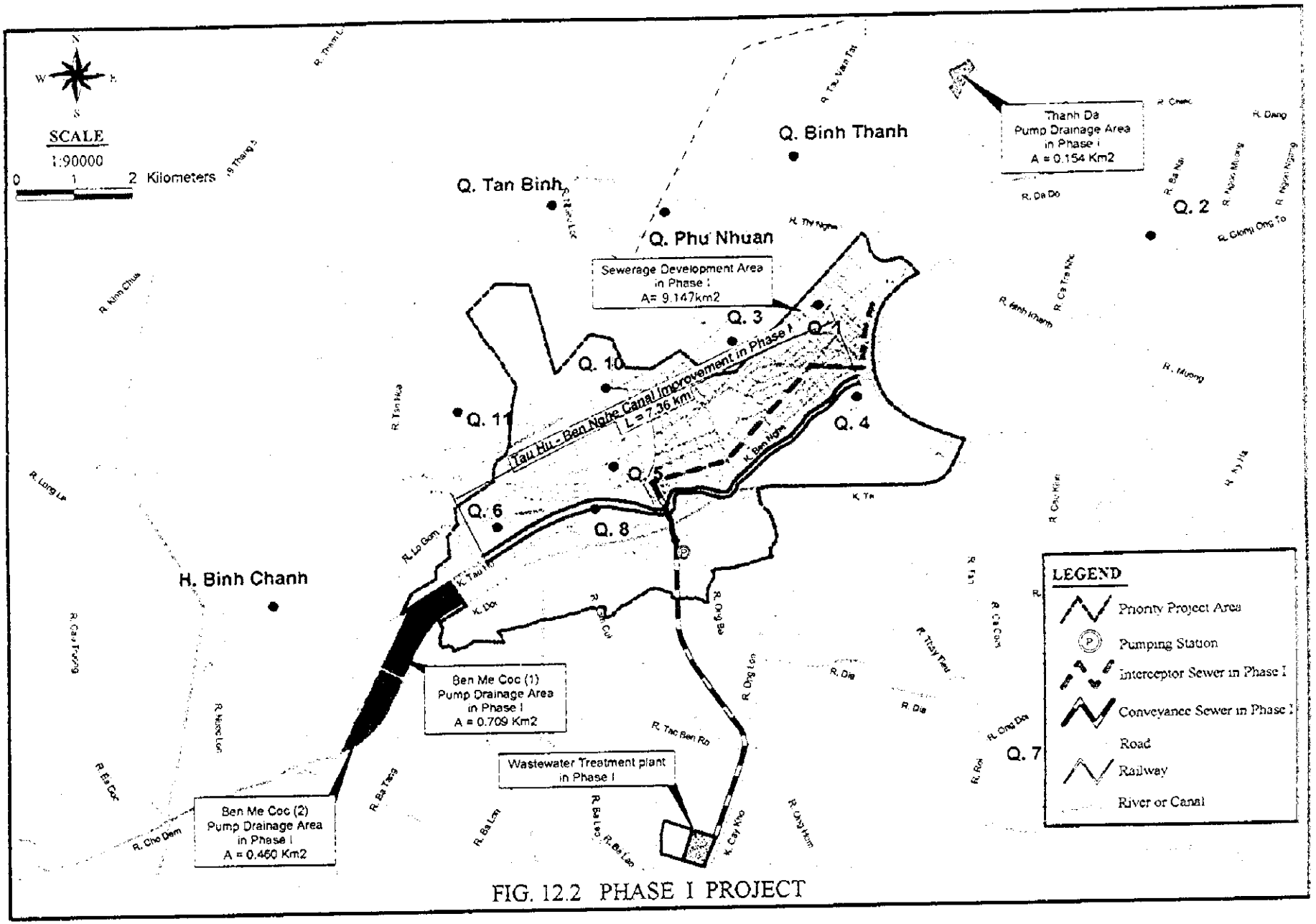


FIG. 12.2 PHASE I PROJECT

CHAPTER 13

ENVIRONMENTAL IMPACT ASSESSMENT

CHAPTER 13 ENVIRONMENTAL IMPACT ASSESSMENT

13.1 General

The environmental assessment is carried out in three steps as mentioned below:

Step 1 Initial Environmental Examination (IEE) and Preparation of Terms of Reference (TOR) for Environmental Impact Assessment Survey for the Priority Project,
Step 2 Execution of Environmental Surveys on the Priority Project, and
Step 3 Execution of Environmental Impact Assessment (EIA) on the Priority Project.

At Master Plan stage, Initial Environmental Examination (IEE) was conducted for the priority project to identify major environmental issues concerned. TOR for EIA was prepared to examine those issues in detail as per requirements of Vietnamese Laws. EIA was carried out by Center for Environmental Technology and Management (CENTEMA) under the management of JICA Study Team.

13.2 Environmental Legislation and Policies

13.2.1 Requirements for Environmental Impact Assessment

The EIA report for the priority projec is made based the following legal foundations:

- Government Decree 175/CP issued on Oct. 18, 1994 by the Government, in guidance on implementation of Environmental Protection Law (EPL);
- Introduction for guidelines on setting up and appraising the report of EIA to direct foreign investment projects (No. 1420/QD-Mtg);
- Decision of MOSTE minister on Promulgation of the regulation and organization of Appraisal Council on EIA and issuing environmental license (No. 1806/QD-Mtg);
- Regulation and organization of Appraisal Council on EIA report and issuing environmental license (No. 1807/QD-Mtg);
- Institution on guidance for preparation and appraisal of EIA report for investment projects (No. 1100/TT-Mtg) and, other related regulations and laws.
- Regulation of Foreign Investment Law (FIL) in Vietnam stipulated on Nov. 12, 1996 (modified from 1987, 1990, 1992 version);
- Decree No 12/CP issued on Feb. 18, 1997 by the Government, promulgating detailed regulations on implementation of FIL in Vietnam;

- EPL dated Dec. 27, 1993 by the Parliament of the Socialist Republic of Vietnam;
- Decision No 490/1998/TT-BKHCNMT issued on April 29,1998 by Ministry of Science, Technology and Environment in guidance on making and appraisal of EIA report for investment projects;
- Regulation on carrying out the EIA for the project;
- Regulation on the infrastructure execution for HCMC.

13.2.2 Approval Procedure for EIA

The approval of an EIA report shall constitute one of the bases for overseeing authorities to approve a project or authorize its implementation. In December 1994, MOSTE issued a decision to establish evaluation councils for EIA and environmental licensing. At the national level, the evaluation council is an advisory body to MOSTE, while at the local level the evaluation council advises the chair of the People Committee of provinces or cities, which assists in considering scientific and technical issues related to environmental protection identified in the EPL.

During the feasibility study of this project, it is required to submit the project documents, which presents brief potential environmental impacts from the project. The document must be submitted to the state management agency in charge of environmental protection for consideration, with onward submission to MOSTE for review and formal approval. Upon receiving the project EIA, MOSTE shall seek the opinion from DOSTE, HCMC for consideration and grant decision on approval or shall seek further environmental mitigation measures within 60 days.

13.2.3 Environmental Standards and Regulations

MOSTE has issued various environmental standards. MOSTE also allows a project proponent to propose equivalent standards from other countries for MOSTES's approval and for use where local and national standards are not available, inadequate, not regulated, not applicable, and finally not enforceable. For carrying out this project, the existing provincial and national policy and requirement on wastewater collection, treatment and safe disposal of effluent have been considered. The appropriateness of the set of Vietnamese standards has been evaluated and an affordable level of treatment is being proposed for approval by DOSTE and MOSTE to maximize the health benefit to the people.

13.3 Description of the Project

Major components of the project are Urban Drainage Improvement and Sewerage Development. As shown in the previous chapter, Urban Drainage Improvement involves the canal improvement of Tau Hu - Ben Nghe, pump drainage improvement at Thanh Da,

Ben Me Coc (1) and (2), and drainage pipe system improvement. Sewerage development involves sewerage collection system development, construction of intereceptor sewer, construction of conveyance sewer and lift pumping station, and construction of wastewater treatment plant.

13.4 Significant Environmental Impact and Mitigation Measures

The proposed project will result in improvement of living environment, public health benefits and abatement of pollution to rivers and groundwater. Improper planning and engineering design and the use of inappropriate construction techniques/methods and equipment can be counterproductive and lead to serious negative short term and long term impacts. Potential and significant environmental impacts, both positive and negative are identified and assesses for three (3) stages, (i) the pre-construction stage, (ii) the construction stage, and (iii) operation and maintenance stage.

Table 13.1 shows the impact matrix for significant impacts and Table 13.2 elaborates mitigation measures. Brief description of impacts and mitigation measures is given below.

13.4.1 Pre-construction Stage

(1) Impact

Project activity causing significant impact in this stage is Land Procurement for canal improvement, wastewater treatment plant (WWTP), pumping stations, etc.

Significant impact of this activity is in terms of relocating the people. More than 20,000 persons (about 3,125 households) are located along the banks of Tau Hu –Ben Nghe canal and at the site of treatment plant and pumping station. Environmental problems will appear in relocation/resettlement process as follow:

- Policy and compensation cost for 3,125 households;
- Relocation and resettlement to new residential areas;
- Clearing and transferring construction area;
- Culture, social safety and order of new residential areas;
- Relocation/resettlement of inhabitants from slum houses locating in and along Tau Hu - Ben Nghe and Doi – Te canals to other sites might create new slum houses;
- Changing career and creating new job for relocates;

If problem of relocation is not properly mitigated it may jeopardize the project. In addition, procurement of land will be essential for WWTP construction. Failure to

procure land will have serious impact, because alternative locations for WWTP site are limited.

(2) Mitigation Measure

For relocating people, new residential areas have to be planned with adequate job opportunity, so that resident can earn money by new jobs. It is also important to apply proper enforcement measures in order to avoid illegal relocating which can cause pollution in new areas. The compensation should be done only when people settle in new residential areas and sign agreement that they will not move to the other slums. Other management measures are listed below:

- Minimization of relocation
- Consideration of socio-economic condition
- Consideration of inhabitants' needs and community involvement.
- Sufficient planning and management of relocation/resettlement

13.4.2 Construction Stage

Project activities causing significant impacts in this stage are as follows:

- Construction of sewers, pumping station, wastewater treatment plant
- Improvement of Tau Hu - Ben Nghe canal

(1) Impact

(a) Water Environment

Process of dredging sediments from canals will result in mixing of settled pollutants with the water. Tau Hu - Ben Nghe is already seriously polluted and not much negative impact is expected but Saigon River could be seriously affected if proper precautions are not taken.

(b) Air Environment

During the dredging, anaerobic sediments mix up with water and gases coming from anaerobic degradation dissolve into water and can cause foul odor. The construction will increase the transportation activities, which may cause environmental pollution due to gas and dust emitted from vehicles and construction equipment. Minor short-term negative impact is expected which can be mitigated by proper planning construction activities.

(c) Soil Environment

During the construction, the following solid waste will be generated:

- About 5,000 m^3 of house wrecks and solid waste from dismantling, destroying houses and works for clearance plan;
- About 1.2 X 10^6 m^3 of sediment from the dredging of Tau Hu - Ben Nghe canal and its related tributary canals;
- About 685,000 m^3 (of which, 165,000 m^3 in phase 1 and 520,000 m^3 in phase 2) of surplus soil from construction of 42 km of interceptor route, 107 km of sewers, wastewater pumping station, 5.5 km of conveyance route;
- The amount of solid waste is discharged from workers working in construction sites (but the amount is not considerable).

The use of dredging sediments and the execution for land filling will give benefits not only from environmental aspect but also from economical point of view, such as:

- Reduction of transportation cost;
- Mitigation of environmental problems;
- Reduction of ancients on waterway;
- Prevention of landslides;
- Natural resource conservation.

Besides, reuse of sediments for agricultural purposes can also be considered. However strict monitoring of heavy metal content is necessary. Initial survey shows that concentration of heavy metals is below permissible standards of European countries and Japan.

(d) Human Living Quality

Negative impacts on the human living environment are short term as mentioned below:

- Impacts on the public health due to noise, vibration and air emission from construction
- Impacts due to traffic congestion due to increased transportation

Besides these negative impacts, prevention of flood, better employment opportunities for workers, improved environmental quality and better infrastructure for drainage and sewerage management are the positive impacts.

(2) Mitigation Measures

(a) Water Environment

During the dredging, water pollution from sediments can be prevented using the following measures:

- Use of suck pump instead of shovel scurf should be investigated. However solid wastes existing in the sediments may block the suck pump system and pipes.
- The dredging should start as tide start going down in order to avoid the spilling and settling of sediments on the upstream;

(b) Air Environment and Noise and Vibration

The major air pollutants emitted from construction activities are carbon monoxide (CO), gas, hydrocarbon and fugitive dust particles. These can be generated from construction equipment and transportation vehicles. CO is the only pollutant to be considered potentially hazardous to human health. Gaseous hydrocarbons and nitrogen oxides are not considered harmful at concentration found even in the most heavily trafficked urban area. Pollution can be mitigated by:

- Appropriate planning and scheduling of construction activities to minimize traffic diversion and congestion;
- Delivery of construction materials (raw materials, earth, spoils, concrete, etc.) should be done during off-peak hours to avoid traffic congestion.
- Low emission construction vehicles should be used whenever possible;
- Trucks carrying raw materials, earth, spoils that emit high fugitive dust should be covered while in motion;
- All the stationary equipment should be located as far away as practical from receptor locations to allow dispersion of emitted pollutants;
- Watering the area of execution to reduce the emission of dust.

Organic matters of sediment that are stagnant for a long time at canal bottom in anaerobic condition generates foul odor. The adverse impacts from this pollution source can be treated using 1 litter of effective microorganism (EM) per 1000 kg of sediments.

The following mitigation measures can be applied to mitigate noise and vibration pollution:

- Use special construction equipment that emit low level of noise and vibration;
- Schedule construction so that the unavoidable vibration occurs during hours when occupancy of building is low;
- Restrict the use of high vibration construction equipment to very short operation

hours;
- Minimize the use of many vibration and noise-causing pieces of equipment;
- Inform residents the expected duration of particular nose activities to minimize complaints.

(c) Soil Environment

The big amount of spoil can cause land pollution and water quality degradation if it is inappropriate disposal. The disposal sites should be properly selected to prevent from surface or groundwater pollution. If it is dumped in agricultural region, a big area of 45 ha will be lost. Therefore, the reuse of assess spoil as the ground level material will give many benefits such as saving the fee of sand exploration, resources and environmental conservation. However, in order to apply in ground level purpose at right place, the project authorities should cooperate with other judicial organizations before implementing.

(d) Living Environment

To avoid traffic congestion and discomfort from noise and vibration, the following measures can be applied:

- Using appropriate construction techniques that emit low level of vibration;
- Appropriate planning and scheduling of construction activities to minimize traffic diversions
- Plan construction period to minimize duration of high noise exposure;
- Use of quietest equipment that is economically suited for construction use;
- Try to meet guaranteed levels of maximum noise exposure levels;
- Phased utilization of vibration-cause equipment to reduce the magnitude of vibration.

13.4.3 Operation Stage

(1) Impact

(a) Water Environment

The wastewater treatment plant is proposed to build at Phuoc Loc Ward, Nha Be district. Treated wastewater will be discharged to Cay Kho canal with BOD 50 mg/l in Phase I and 20 mg/l in Final Phase. This will improve the water quality of Tau Hu - Ben Nghe and Doi - Te canals.

Effluent from wastewater treatment plant satisfies Vietnamese effluent standard TCXD 188-1996. Further to assess the impact of effluent discharge on water quality of receiving Cay Kho canal, flow measurement and water quality survey of Cay Kho canal

was conducted. Observed flow of Cay Kho canal in August 1999 is as high as 90.6 m^3 /sec, which is 55 times the discharge from treatment plant in Phase I, and 15 times in Final Phase. Flow measurement at Cay Kho canal, for 24 hrs, showed that Cay Kho canal is influenced by tide. After taking into account inward and outward movement of canal it has been found that about 1.5 million cum of water is flowing in one day. In dry season from December to April, water flow of Cay Kho canal is expected as about 70 % of that of rainy season. Thus no major impact is expected on the water quality of Cay Kho canal throughout the year.

If the wastewater treatment plant of the project is operated in proper way to meet the regulated standard of discharging water, there will be almost no impact on the botanic and zoological system of the receiving – Cay Kho canal.

(b) Air Environment

One of the air pollution sources in operation stage is air emission from the anaerobic degradation of organic matters. This volume of air emits from all of the drainage pipes. This impact can be treated by design of drainage pipes. Besides that, a considerate amount of air emission has been created from pumping stations and wastewater treatment plant, especially from the anaerobic process such as H_2S, NH_3. This impact becomes serious if the above sources are near the residential areas. However, if some proper treatment measures are applied the pollution can be controlled below the permitted standards.

(c) Soil Environment

An amount of solid waste collected from screen system of pumping stations is expected to be about 4 – 6 tons/day. The ingredients include leftover food, paper, wood, nylon, rubber, cloths, etc. About 67 m3/day of sludge in phase I and 241 m3/d in final phase will be generated. The sludge volume with quite high nutrient and organic concentration can be treated at landfill, but it is better to reuse it in agriculture at surrounding area.

(d) Human Living Quality

During the operation stage, impacts on the living environment are primarily positive. The provision of a wastewater collection system to convey wastewater away from the residential area will enhance the public health status especially in terms of waterborne diseases. Besides, the problem of flooding will be solved for the whole area. The impacts, which are primarily positive in nature, are listed below:

- Getting rid of flooding problem at hundreds of places of HCM city
- Loss of billions of VND due to damage from flood will be avoided

- Creating employment for thousands of labors;
- Making people pay environmental fees, will reduce Government's burden.

(1) Mitigation Measures

(a) Water Environment

No major negative impact is predicted during operation of the drainage and sewerage system. Proper operation and maintenance of treatment plant is necessary to avoid process failure.

(b) Air Environment

Exhaust gas generates from the periodical dredging of canals and from anaerobic degradation in sewer will be mitigated and treated as mentioned in the previous section. For mitigating foul smell from sewer, pumping station and treatment plant, the simplest measure is provision of good ventilation during installation. Foul odor can also be removed using effective microorganism.

Noise could be along term and persistent nuisance to the workers and the adjacent population if suitable mitigation is not incorporated into the preliminary and detailed design of the facility. A suitable buffer and noise barrier, use of quieter screens, and suitable enclosure should be considered. Monitoring of noise level at the boundary of any nearby sensitive receptors is recommended.

(c) Soil Environment

Solid waste from screening system of pumping station should be collected and disposed according to the local regulations on domestic solid waste disposal. Sludge generated from wastewater treatment plant will be properly treated by composting before disposal or reuse. Hence no negative impact is expected.

13.5 Monitoring Program

Monitoring Program is recommended during construction stage as well as during operation stage as mentioned below.

- Water Quality Monitoring
- Air quality, noise and vibration monitoring
- Solid waste disposal monitoring
- Labor safety and health care

13.6 Conclusions

This Project will improve urban drainage and sewerage system of Tau Hu - Ben Nghe - Doi - Te Basin and hence will protect both human health and water quality of the receiving water bodies. In the meantime, there are possibilities of some negative impacts unless adequate safeguards are taken during project implementation and operation. Relocation is the major impact, which is categorized as serious negative long-term impact. Proper relocation and compensation program with creation of new jobs is required. During project implementation, short term negative impacts are predicted. Dredging and disposal of sediments could have negative impact on water and soil environment. As mentioned in previous section by adopting proper dredging technique and effectively using dredged sediments as landfill material, these negative impacts can be mitigated. Other minor impacts are air pollution due to increased traffic activity and traffic congestion. Appropriate planning and scheduling of construction activities to minimize traffic diversion and congestion should be done. Monitoring program as mentioned in Supporting Report is strongly recommended during construction and operation stage. The operation of project will have many positive impacts, which are mentioned below:

- Pollution load reduction to Tau Hu Ben Hghe Canal of about 58,750 kg BOD/day
- Reduction of water-borne diseases in the basin
- Prevention of flood damage
- Creation of new employment opportunities

This EIA Study has been carried out during Feasibility Study of the project. More detailed EIA study is recommended during detailed design stage during which various construction technologies and methods of project implementation will be finalized.

Table 13.1 Significant Impact Matrix

Project Activity	Natural Environment							Social Environment			
	Aesthetic View	Surface water	Ground water	Air Environment	Soil Environment	Biological Resources & Ecosystem	Prevention of flood	Living Environment (Public health)	Infrastructure	Relocation	Employment opportunity
1 Pre Construction Stage											
Land procurement	-	-	-	-	-	CB	-	-	-	AA	-
2 Construction Stage											
2.1 Construction of sewers and rehabilitation of existing sewers											
Transportation of construction material	CB	CB	-	CB	-	-	-	CB	-	-	P
Excavation work	BB	CB	-	CB	-	-	CB	-	CB	-	P
Transportation and disposal of spoil	BB	BB	-	CB	BA	-	-	-	-	-	P
Transportation and disposal of sediment	BB	BB	-	CB	BA	-	-	-	-	-	P
2.2 Improvement of Tau Hu-Ben Nghe, Doi-Te canals											
Dredging of sediment from THBN canal	CB	AB	-	CB	-	CB	P	CB	CB	-	P
Construction of THBNDT canals	CB	BB	-	CB	-	CB	P	-	P	-	P
Transportation and disposal of sediments	CB	BB	-	CB	BA	CB	-	CB	-	-	P
3 Operation Stage											
3.1 Operation of sewerage system and Tau Hu –Ben Nghe canal											
Disposal of sewer sediment	CB	CB	-	CB	CA	-	-	CB	-	-	P
Disposal of sediment dredging	CB	CB	-	CB	CA	-	-	CB	-	-	P
Wastewater discharge	-	CA	P	CA	P	P	P	P	-	-	-
3.2 Operation of Wastewater treatment plant											
Treated wastewater discharge	-	P	P	P	P	P	-	P	-	-	P
Disposal of solid waste from pumping stations	CB	CB	-	CB	BA	-	-	CB	-	-	P
Disposal of sludge from wastewater treatment plant	CB	CB	-	CB	BA	-	-	CB	-	-	P

Note : P=> Positive Impact, AA => Serious Negative Long-term Impact, AB=> Serious Negative Short-term Impact
: BA=> Moderate Negative Long-term Impact, BB=> Moderate Negative Short-term Impact
: CA => Minor Negative Long-term Impact, CB=> Minor Negative Short-term Impact

Table 13.2 (1/2) Summary of Significant Environmental Impacts Mitigation/Compensation Measures

PROJECT ACTIVITY	IMPACT DESCRIPTION	CATEGORY	IMPACT	MITIGATION
1 Pre-construction Stage (immediate impact)				
Land procurement for interceptor and WTP	- Domestic life - Culture - Activity of factory in project area	Social	Serious	- Ensure procurement - Compensation - Relocation program - Creation of new jobs
2 Construction Stage (immediate or short-term impacts)				
- Dredging and excavation works	- Water pollution by sediment - Drilling of spoil and filling construction material	Physical	Moderate	- Proper procedure for dredging - Temporary storage - Proper operation and maintenance of vehicles and equipment
- Transportation of sediment, spoil, fill material	- Air pollution by CO_2, NO_x, SO_2 from construction vehicles and equipment - Traffic			- Proper operation and maintenance of vehicles and equipment and use of EM product to avoid smell from sediment - Proper levelling program
- Disposal of sediment and spoil	- Air pollution by CO_2, NO_x, SO_2, H_2S, CH_4 from construction vehicles and sediment - Spoil and sediment pollution			
- Construction activity	- Soil pollution - Noise, vibration and air pollution - Strain on infrastructure due to labour influx			- Take proper construction procedure to avoid wash away of material - Provide waste disposal facilities for temporary shelters for labour

Table 13.2 (2/2) Summary of Significant Environmental Impacts Mitigation/Compensation Measures

PROJECT ACTIVITY	IMPACT DESCRIPTION	CATEGORY	IMPACT	MITIGATION
3 Operation Stage (long-term impact)				
- Disposal of sewer sediment - Disposal of sludge - Operation of pumping station - Operation of WWTP	- Soil pollution by sediment - Soil pollution by solid waste from screen - Air pollution - Treated wastewater discharge - Excess combined waste and storm water discharge	Physical	Moderate	- Proper disposal (levelling) - Proper disposal (Landfilling) - Good ventilation - Dilution and flood out by tide regime - Proper diversion chamber for dilution

Note: Impacts are classified as Serious, Moderate and Monitor, of which only serious impact will endanger the Project implementation or its sustainability.