

Japan International Cooperation Agency (JICA)

**Haiphong People's Committee
Socialist Republic of Vietnam**

**The Study
on
Sanitation Improvement Plan for Haiphong City
in
The Socialist Republic of Vietnam**

FINAL REPORT

SUMMARY

July 2001

Nippon Koei Co., Ltd.

EX Corporation

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LIST OF REPORTS

SUMMARY

MAIN REPORT

Volume 1 Sanitation Master Plan

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SUPPORTING REPORT

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Note: All the figures shown in the tables of the reports were set or estimated by the JICA Study Team in case data sources are not written.

EXCHANGE RATE FOR COST ESTIMATION

Estimate of Base Cost : As of June 2000 Price Level

Currency Exchange Rate : USD1.0 = VND14,072

PREFACE

In response to a request from the Government of the Socialist Republic of Vietnam, the Government of Japan decided to conduct the master plan and feasibility study on Sanitation Improvement for Haiphong City and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Masatoshi Akagawa, Nippon Koei Co., Ltd., consisted of Nippon Koei Co., Ltd and EX Corporation to the Socialist Republic of Vietnam, three times between March 2000 and July 2001. In addition, JICA set up an advisory committee headed by Mr. Masami Mizuguchi, Environmental Administration Specialist of Institute for International Cooperation, between March 2000 and July 2001, which examined the study from technical point of view.

The team held discussions with the officials concerned of the Government of the Socialist Republic of Vietnam, and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Socialist Republic of Vietnam for their close cooperation extended to the Team.

July, 2001



Kunihiko Saito
President

Japan International Cooperation Agency

July, 2001

Mr. Kunihiko Saito
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Sir,

LETTER OF TRANSMITTAL

It is a great pleasure that we submit to you the Final Report of the Study on Sanitation Improvement Plan for Haiphong City completed by the Study Team with cooperative efforts of Haiphong People's Committee (HPPC) and other parties concerned. The report has been prepared for the Government of the Socialist Republic of Vietnam to contribute to the implementation of the effective sanitation improvement plan in the HPPC area.

The report consists of four volumes of the Summary, Main Report, Supporting Report and the Data Book. The Summary presents the outline of the study results and the Main Report gives all the study results regarding sanitation improvement. The Supporting Report describes the results of field surveys conducted during the study period, implementation of pilot projects, environmental impact assessment and detailed data for cost estimation. The Data Book presents the useful reference data relevant to the Study.

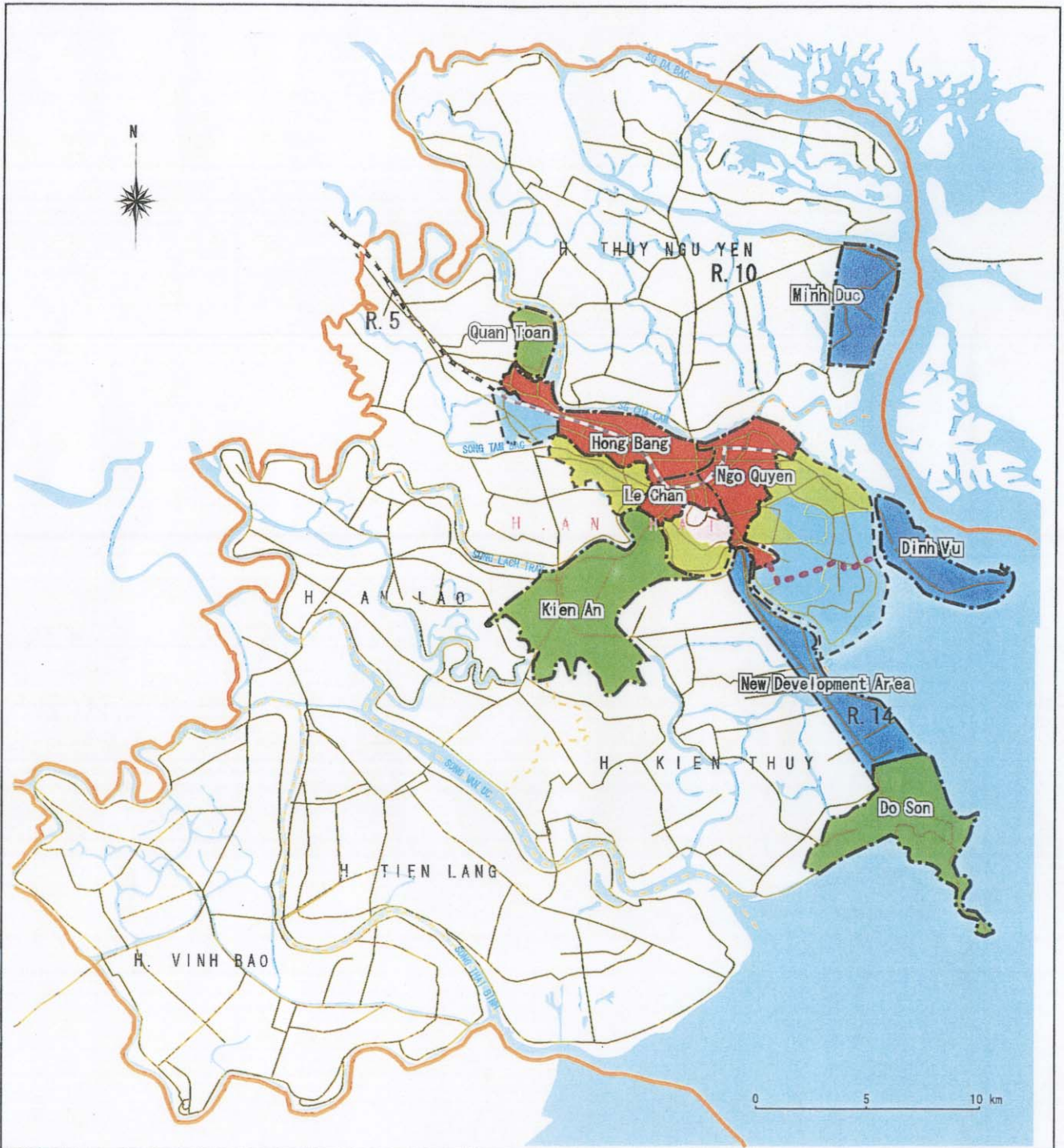
Taking this opportunity, on behalf of the Study Team, I would like to express my heartfelt gratitude to the personnel from JICA, Advisory Committee, Ministry of Foreign Affairs, Ministry of Environment, Ministry of Health, Labour and Welfare, Embassy of Japan in Vietnam and JICA Vietnam Office and Steering Committee / Project Management Unit and other Vietnamese officials concerned who extended the kind assistance and cooperation to the Study Team for the entire study period.

The Study Team hopes that the results of this study will contribute to the implementation of sanitation improvement project in Haiphong City, Vietnam.

Yours faithfully,



Masatoshi Akagawa
Team Leader
The Study on Sanitation Improvement Plan
for Haiphong City



Legend



Study Area



Effective Study Area



To the south of this boundary line
i.e., Trang Cat commune, only for
solid waste management study

Study Area Expanded Area

Zone A



Zone B



Zone C



Study Area and Effective Study Area

EXECUTIVE SUMMARY

I. INTRODUCTION

The Study on Sanitation Improvement Plan for Haiphong City in the Socialist Republic of Vietnam (herein referred to as the “Study”) was started in March, 2000 in compliance with an agreement between the Government of Vietnam and the Government of Japan. The study took the form of a technical cooperation program with the following objectives:

- To formulate a sanitation improvement plan for Haiphong City (Sanitation Master Plan: SMP), in particular the four urban districts and Do Son area and other relevant areas with the target year of 2020 and mid-term target year of 2010, encompassing the fields of water supply, drainage, sewerage and solid waste management
- To select priority projects for early implementation in the fields of drainage and sewerage and solid waste management and to conduct feasibility studies for them
- To transfer technology to the counterpart personnel in the course of the Study

It should be noted that a pilot project was implemented, comprising a) a small size contact purification facility and b) a small size activated sludge plant with a view to transferring an appropriate technology for water purification and raise environmental awareness among the citizens and people concerned with the environment in Haiphong City.

If the SMP, together with the priority projects identified, is materialized as proposed in the Study, current sanitation problems would be solved and future environmental degradation would be avoided. In order to bring the SMP into reality, however, it is noted that rigorous efforts of the Haiphong People’s Committee (HPPC) and the Government of Vietnam are essentially required to implement the study’s recommendations particular institutional and organizational reinforcement and financing of the required costs. The first step should be the quick action for the finalization of the sanitation master plan and its approval by the Government together with the necessary actions for the priority projects including the formulation of the resettlement action plan and detailed EIA.

II. SANITATION MASTER PLAN

2.1 Necessity, Macro-Frame and Scope of the Sanitation Master Plan

(1) Necessity

Haiphong City is one of the most important cities in Vietnam with the third largest population. With the increases of the population and economic growth, environmental quality has been degraded quickly. Due to the peculiarity of the city as a low lying and flat delta area, flooding occurs almost every year due to the inadequate drainage system. Receiving and disposal capacity of the solid waste out of the existin landfill will be exhausted soon, endangering the sanitary condition of the residents.

(2) Study Area

The Study Area comprises the 3 central urban districts of Hong Bang, Le Chan, and Ngo Quyen, and their surrounding areas of Kien An urban district and Do Son, with a total area of 209 km².

(3) Target Year and Macro-Frame

Target year used in the formulation of the Sanitation Master Plan was 2020 with a middle target year of 2010. The population of Haiphong City, according to the Haiphong City Master Plan is expected to increase to about 2.1 million in the year 2020 from the current 1.7 million a 1.12 % increase per year on average.

The population of the effective study area will increase from 659 thousand in 1999 to 892 thousand in 2020, accounting for about 42 % of the prihected population of the whole city.

The economic frame for the Study Area was developed from growth scenarios for Haiphong City envisaged by HPPC and from short-term GDP projections for Vietnam by the World Bank as shown below.

GRP Growth Rates for the Haiphong City and Study Area

Unit: %/year

	2001-2005	2006-2010	2011-2020
GRP Growth Rate Total Haiphong	6.8	9.3	5.0
GRP Growth Rate Study Area	7.7	10.9	5.0

The future land use plan presented was prepared using a zone classification Zones A, B, C, according to population density, expected urbanization, etc., based on information from the amended Haiphong City Master plan.

(4) Scope

The proposed Sanitation Master Plan (SMP) covers the fields of water supply, drainage, sewerage, water quality improvement for the lakes and channels and solid waste management with due consideration for the interrelationship and interdependence among the fields. In addition to facility and system plans, institutional and organizational recommendations are made for the effective materialization of the proposed systems. By the planning horizon of the year 2020, the majority of the population in the Study Area will direct, benefit from the SMP and the entire city will benefit from upgraded sanitation conditions.

Phased development plans have been worked out for individual sector improvement, placing priority orders on different areas considering the zoning as well as needs for improvement, physical characteristics, on-going and committed projects, etc. Top priority is placed on Class A areas for earliest implementation, being followed by Class B and Class C area.

2.2 Improvement Plan for Water Supply

Water supply improvement plan adopted for the SMP mainly comprises plans recommended in the World Bank/FINNIDA 1A and 2A Projects, which were a given condition of the Study. Some additional plans were worked out by this Study for areas not covered by World Bank/FINNIDA projects. The main features of the proposed water supply improvement plan are given below:

- Service area in 2020 195 km²
- Served population in 2020 794,000
- Total water supplied in 2020 197,400 m³/d
- Unit domestic consumption in 2020 130 lpcd
- Non-revenue water in 2020 20 %
- New intake and WTP Minh Duc, Hoa Binh
- New transmission mains and improvement of distribution network City center, other areas

- Implementation period Until 2020

2.3 Improvement Plan for Drainage

For Class C areas where development area occupies less than 40 % of the total, land area drainage facilities are deemed unnecessary.

The main features of the drainage improvement plan for Class A and Class B areas are given below.

Class A Area; short term up to year 2010

- Area 1,103 ha
- Beneficiaries 240,000 (in 2010)
- Construction and rehabilitation of sewers 177.6 km
- Rehabilitation of existing channel An Kim Hai Channel, 10 km
- Phoung Luu Lake construction 24 ha

Class A Area; long term during 2011 – 2020 period

- Area 5,241 ha
- Beneficiaries 575,000 (in 2020)
- Construction of storage lake 2 lakes., 51 ha
- Rehabilitation of channels 5.5 km
- New pipes 87 km
- Implementation Period 2011 to 2020

Kien An (Class B Area); 2011 - 2020

- Area 2,670 ha
- Beneficiaries 106,000 (in 2020)
- Construction and rehabilitation of sewers 27 km
- Construction of channel 5 km

2.4 Improvement Plan for Sewerage

The main features of the sewerage improvement plan is given below.

Class A Area, short term up to year 2010

- Area 1,103 ha
- Beneficiaries 240,000 (in 2010)
- Collection system Combined sewer system
- Estimated sewage 36,000 m³/day (in 2010)

- Sewer pipeline 20 km
- Treatment plant 36,000 m³/day (Aerated lagoon)
- Implementation period 2004 to 2010

Class A Area, long term during 2011 – 2020 period

- Area 5241 ha
- Beneficiaries 575,000 (in 2020)
- Collection System Combined and Separate Sewer System
- Estimated Sewage 71,000 m³/day (in 2020)
- Sewer pipeline 405 km
- Treatment Plant 72,000 m³/day (2 plants)

Kien An (Class B Area); 2004 - 2020

- Area 2670 ha
- Beneficiaries 106,000 (in 2020)
- Central treatment plant 1 plants (8,000 m³/day)
- Simplified treatment plant 3 plants
- Sewer pipe 160 km

Do Son (Class B Area); 2004 - 2020

- Area 3950 ha
- Beneficiaries 42,000 (in 2020)
- Simplified treatment plant 2 plants
- Sewer pipe 49 km

2.5 Water Quality Improvement for Lakes and Channels

The main components of the plan are based on the on-going World Bank 1B Project and rehabilitation plan by the Park Service of HPPC. Main features are given below.

Construction of Interceptor Sewers around Lakes; 2001 to 2004

- Interceptor Sewers 3 lakes, 2.6 km in total

Lake Rehabilitation Projects (Dredging) ; 2001 to 2004

- Target Lakes 5 lakes, 33 ha in total

2.6 Solid Waste Management

Main features of each aspect are given below.

Waste Collection and Transport

- Proposed system
 - Mechanical waste loading into vehicles,
 - Direct collection system using bins placed at fixed locations
- Beneficiaries 719, 000 in 2010, 859,400 in 2020
- Target collection

	<u>Generation</u>	<u>Target Collection</u>
- 2010	1,148 ton/day	1,086 ton/day (95 %)
- 2020	1,517 ton/day	1,441 ton/day (95 %)
- Equipment 134 compactors, 7,205 bins of 660 liter and 240 liter in 2020.

Waste Disposal

- Disposal method Sanitary landfill with leachate treatment plant and gas ventilation system
- Types of waste to be received
 - Solid waste excluding industrial waste
 - Incineration residue of medical waste and leachate treatment sludge
- Sanitary landfill site for 3 central urban districts

Phase 2 Landfill	11 ha	2001 – 2005
Phase 3 Landfill	32.7 ha	2005 – 2014
Phase 4 Landfill	20 ha	2015 – 2020
- For Kien An
 - 2001 – 2004 Trang Cat Phase 2 Landfill Site
 - 2005-2011 (7 years) Planned site is in An Lao District. 10 ha. Joint Use with An Lao District
 - 2012-2020 (9 years) A planned site of 9 ha is in An Hai District, inside the dyke of Van Uc River
- For Do Son Landfill site near the existing Do Son landfill for 2003 – 2020 period (13 ha)

Hospital Waste Management

- Target Hospitals 9 hospitals and 9 medical centers, located in the 4 urban districts and Do Son Town
- Proposed System
 - In-hospital storage room for infectious waste
 - Waste collection vehicles
 - Treatment (incineration)
 - Landfill for incineration residue

2.7 Institutional and Policy Measures

(1) Policy Measures

The following policies are recommended for the efficient provision of water supply and sanitation services in Haiphong:

- Freedom for organizations to recruit better qualified management and staff, including setting of salaries, while allowing more control over procurement decisions
- Development of private sector companies, including for collection and transport of septage
- For solid waste and sewerage sectors, user charges should be gradually increased, so that by the year 2010, 100 % of O and M costs are recovered in the form of user charges. The eventual target should be full cost recovery, including full amortization of investment costs, by 2020
- Price deregulation for industrial and hospital waste management services

(2) Organizational Measures

1) Implementation of JICA Sanitation Master Plan

A coordination council should be formed to:

- Coordinate the implementation of projects and activities of the SMP
- Ensure that the priority projects recommended in the SMP are included in socio-economic development plans and in spatial plans for Haiphong

Another alternative is to have a Technical Working Group for sanitation improvement under the existing Urban Management Coordination Council.

2) Trang Cat area Management

It is recommendable that a new company called Trang Cat Site Management Company (TCSMC) be established to foster the coordination and create efficiency in the various activities in the Trang Cat area. The other option is to set up a coordination committee comprising the people's committee and organizations/companies concerned.

3) Socio-economic Strategy and Planning

Technical assistance should be sought for the Department of Planning and Investment (DPI) to integrate sanitation improvement and environmental protection issues into socio-economic planning and to introduce methods for economic evaluation of sanitation and environmental improvement projects.

4) Spatial Planning

Technical assistance should be sought for the Urban Planning Institute (UPI) to integrate sanitation improvement and environmental protection issues into the spatial planning framework of the next amendment of Haiphong Master Plan to 2020.

5) Sanitary and Environmental Protection

It is proposed that specific funding commitments be made to enable the Department of Science, Technology and Environment (DOSTE) to conduct environmental monitoring, particularly water quality monitoring in both fresh and salt water.

6) Reinforcement of the Transport and Urban Public Works Service (TUPWS)

It is recommended that TUPWS be re-organized to formally create a Division of Public Works to be in charge of water supply, drainage, sewerage, and solid waste management and assume the tasks of sanitation planning and supervising project management units under the responsibility of a new Deputy Director.

2.8 Initial Environmental Examination

The social and environmental impacts of the proposed Master Plan were evaluated, encompassing (i) water supply component, (ii) drainage component, (iii) sewerage component and (iv) solid waste management component. If the appropriate counter-measures are taken, the adverse impacts are deemed to be alleviated within an acceptable range.

2.9 Financial Requirement and Affordability for the Sanitation Master Plan

(1) Implementation Schedule of Sanitation Master Plan

The Sanitation Master Plan will be progressively implemented starting from the year 2001 until the target year of 2020 for the sanitation improvement of the city.

(2) Financial Requirement

Financial requirements for the implementation and operation and maintenance (O&M) of the Sanitation Master Plan have been estimated in the constant price of 2000 including the costs for construction/procurement, land acquisition,

engineering service, administrative cost and physical contingency and O&M. For the whole study period from 2001 till 2020, it is estimated that US\$656.4 million will be required to cover capital costs. For O&M, US\$2.6 million of recurring cost will be needed in the year 2020 and US\$49.4 million for the whole study period. In total, US\$705.8 million would be required for the implementation of the recommended projects and measures for the SMP projects over the 20 years from 2001 through 2020. Of the total, US\$305.1 million will be required during the first 10 years and US\$400.7 million during the second 10 years. The sector-wise capital cost for the whole master plan period from 2001 till 2020 is shown below.

Sector-wise Capital Cost of Sanitation Master Plan (2001 – 2020)

Unit : US\$ million

		Total
1.	Water Supply	62.7
2.	Drainage	238.6
3.	Sewerage	280.2
4.	Lake Improvement	2.9
5.	Septage	19.4
6.	Solid Waste management	52.6
Total of Capital		656.4

(3) Affordability

Cost ratios of the SMP in relation to the key indicators are summarized below.

Affordability Analysis with regard to Key Indicators

Year	Cost as % of GRP in Study Area	Cost as % of HPPC Expenditure	Cost as % of Disp. Inc. Study Area
2010	3.1	23.0	6.1
2020	4.1	30.8	8.2

As shown in the table, the SMP costs as a percentage of the Study Area GRP remain below 5 % which is considered to be the maximum affordability level of the ratio in developing countries. Though the other two indicators show rather high figures, it should be noted that they are mutually exclusive. Namely the SMP cost will partly be met by HPPC expenditure while the remaining part will be covered by the disposable income in the form of tariff revenue. It is also noted that some projects may be carried out as Vietnamese Government undertaking and

some projects may be given Government subsidy. The figures are considered to indicate that the SMP is affordable for the Haiphong City.

2.10 Improvement of the Sanitation Conditions by the Sanitation Master Plan in 2020

(1) Improvement of the Access to Sanitary Water Supply

Through the implementation of the water supply improvement proposed in the SMP, 794,000 people will be provided with hygienic piped water, an additional 458,000 people than at present. Total water supply will be 197,400 m³/d or 86,200 m³/d increase. Unit water consumption will be about doubled, i.e., 130 l/d per capita.

In the central urban districts of Hong Bang, Le Chan and Ngo Quyen, eventually 100 % service coverage will be achieved by 2020. For Kien An district and Do Son, coverage will be more than doubled to 84 % and 90 %, respectively.

(2) Protection from Flooding

Through the implementation of the drainage improvement proposed in SMP, areas prone to flooding in Class A area will be reduced by 127 ha by the year 2020 under the condition of the storm water level of 5 year average recurrence interval and the tide level of 10 year recurrence interval. Combined with the effects of the World Bank project (170 ha) and FINNIDA project (23 ha), this means that flooding in Class A areas will be totally eliminated up to the storm water level of 5 year average interval under the tide level of 10 year interval.

(3) Improvement of Access to the Sewerage System

The Study proposes to construct a central sewerage system in the Class A area. The cover area of the sewerage improvement measures for Class A area is 5,241 ha with around 575,000 beneficiaries and will reach 100 % of the water supply coverage by the year 2020.

The cover area of the sewerage improvement measures for Kien An area is 2,670 ha with around 106,000 beneficiaries in 2020.

The cover area of the sewerage improvement measures for Do Son area is 3,950 ha with around 42,000 beneficiaries in 2020.

(4) Improvement of Solid Waste Management

Through the implementation of the SWM improvement plan in SMP, the service population will increase from 409,000 in 2000 to 719,000 in 2010, which is almost 100 % of the non-agricultural population in the Study Area. The service population in 2010 consists of 610,000 in URENCO service area, 78,000 in Kien An Company service area and 31,000 in Do Son Company service area. In 2020, the service population will reach 859,400.

(5) Improvement of Water Quality

The pollution loads discharged into lakes and channels in 2020 will be reduced to roughly 10 % of those projected to occur “without the Sanitation Master Plan” in terms of for BOD, T-N and T-P, and 20 % of SS.

Compared to the SMP not being implement, the pollution load inflow into the major rivers rives of Cam, Lach Tray, Da Do, Bach Dang and Bac Bo Bay, will be reduced to 72.3 % and 86.4 % for BOD and SS, respectively in 2010. The corresponding figures in 2020 will be 43.5 % and 71.5 %, respectively.

2.11 Selection of the Priority Projects

The criteria used to select the priority projects comprised the following 3 basic considerations:

- The project should be essential for solving the currently prevailing problem and should be implemented in the short-term
- The project should be in conformity with and an integral part of the Sanitation Master Plan
- There has been no previous detailed study nor F/S for the project and therefore a F/S needed to be carried out in this JICA Study (the Study)

III. FEASIBILITY STUDIES FOR THE PRIORITY PROJECTS

3.1 Outline of the Selected Priority Projects

From the Sanitation Master Plan, priority projects with urgent needs were selected following the criteria given in 2.11 above. An outline of these projects is as follows.

Outline of the Priority Projects

Priority Project	Principal Features	Capital cost (US\$million)	Construction Schedule
Drainage	* An Kim Hai channel: 10 km * Phuong Luu lake: 24 ha	49.1	2004-2009
Sewerage	* Sewer: 20 km * Treatment plant: 36,000 m ³	65.5	2004-2010
SWM	* Waste Collection: 761 t/day	4.6	2004
	* Sanitary landfill: 2.6 million tons	10.6	2004, 2005
	* Medical waste incinerator: 1.5 t/day	0.5	2004
Total		130.3	

As shown above, implementation of these projects of urgent needs will be started in 2004 to be completed by 2010 at the latest, depending on the priority project.

Financial requirements for the implementation and O&M of the priority projects will be US\$130.3 million for capital cost and US\$2.7 million for recurring cost in 2010. Out of the total capital cost, about 57 % is in terms of foreign currency and 43 % in local currency.

Evaluation of the priority projects were done considering 6 viewpoints, i.e., i) Objective achievement (Improvement of sanitation conditions), ii) Economic viability, iii) Financial feasibility, iv) Technical feasibility, v) Environmental impact, and vi) Organizational capability of the implementing and managing bodies. In economic and financial evaluation, benefits are estimated quantitatively and in monetary terms wherever possible. However, considering that the primary objective of the projects is the improvement of the sanitation conditions and that benefits obtained through the improvement of the sanitation conditions and public health are essentially very difficult to count in monetary terms and data required for estimation are also very limited, internal rate of return of the priority projects was not calculated.

In order to check the range of financial affordability of the projects, drainage project investment which is currently in progress in the Hanoi city was referred to. Namely, annual financial burden of the project on the Hanoi city budget is about

- A Project Management Unit (PMU) should be established for the two priority projects of drainage and sewerage development for the effective execution of the projects
- New technical units will be created within SADCO, namely, waste treatment plants, pumping stations and septage management
- There will be a requirement for 51 incremental staff, out of which 34 will be directly involved in O&M of the new facilities and 17 will provide logistic and administrative support. Adequate training should be provided for the personnel

(3) Project Evaluation

1) Objective Achievement

Thanks to the rehabilitation including dredging and widening of the channel, storage capacity of the An Kim Hai channel will be much enlarged from 192,000 m³ to 375,000 m³. Namely, the total storage capacity will be about 95 % greater than that before rehabilitation.

Hydraulic conveyance capacity of the An Kim Hai channel will also be enhanced because of the enlargement of the flow area in the channel and reduction of the roughness of the channel side slope. Namely, after rehabilitation composite (overall) hydraulic conveyance capacity will be 2013 compared with 641 before rehabilitation, i.e., 215 % greater.

Construction of the Phuong Luu new lake will increase the total effective storage capacity of the lakes in the priority project area from the current 500,000 m³ to 790,000 m³, i.e., 58 % increase.

The drainage priority project will reduce the flooding area by 46 ha in the the central city area which has the total area of 11km², under 5 year ARI storm water condition. Together with the drainage projects to be implemented by the assistance of WB and FINNIDA, flooding area will be reduced by 161 ha and no flooding will occur under 5 year ARI storm water condition. In total, 240,000 residents will be relieved from flooding up to 5 year ARI storm water.

2) Economic Evaluation

Among the formulated alternatives, the selected drainage priority project is the least-costly one for phase 1 development.

Under the GRP growth assumed in the macro-frame for the Study, percentage increases required to economically justify the drainage priority project, i.e., the switching value, is 1.8 % in terms of the property value, and 1.1 % in terms of GRP of the project area. It is judged that it is very probable that both the property value and GRP would increase by these percentages as a result of the project.

3) Financial Evaluation

Costs of the project were calculated on an amortized basis (amortized cost + recurring cost) using a loan condition of 25 years repayment period with 5 % annual interest rate. The calculated project cost corresponds to 1.5 % of the Study Area disposable income and 5.6 % of the HPPC expenditure in 2010. In 2020, the figures will be 2.3 % and 8.5 %. Assuming that 85 % of the construction/procurement is met by external concessionary loan while the remaining 15 % by HPPC/Government budget, the total financial requirement for HPPC will peak during the construction period, requiring 3.1 % of its annual expenditure. These figures are considered to be within the financially affordable range.

4) Technical Evaluation

Construction of the Drainage Priority Project will be by means of the traditional method and require no special or advanced technology. Neither will O&M of the project facilities themselves involve any advanced skills.

5) Environmental Impact Assessment

A detailed resettlement action program should be worked out before the land acquisition is commenced in order to find appropriate resettlement land and minimize the adverse impacts.

6) Organizational Capability of the Implementing and Managing Bodies

With the new PMU and organizational strengthening of SADCO together with adequate training, the Drainage Priority Project can be successfully executed and managed.

7) Overall Project Evaluation

The Drainage Priority Project passes all the examinations for project viability and feasibility and is considered to be feasible for implementation on the condition that all the recommended measures with regard to the

priority project implementation including organizational/institutional ones be carried out.

3.3 Sewerage Priority Project

(1) Project Outline

The main features of the sewerage priority project are given below:

- Location Central area of Class A Area
- Area 1103 ha
- Beneficiaries 240,000 (in 2010)
- Type of sewerage Combined sewers
- Estimated Sewage 36,000 m³/day (in 2010)
- Sewer pipeline 20 km
- Treatment Plant 36,000 m³/day (Aerated lagoon)
- Implementation Period 2004 to 2010

(2) Organization Plan

The recommended organizational plan is summarized below:

- A PMU should be established for the two priority projects of drainage and sewerage development for the effective execution of the projects
- SADCO should be strengthened to handle the new and enlarged sewerage and drainage systems as proposed previously

(3) Project Evaluation

1) Objective Achievement

In terms of the scale of development and size of influence, the Sewerage Priority Project will provide the central sewerage system to an area of about 11km² where 240 thousand residents will be living in the year 2010 and 286 thousand in the year 2020.

Through the project implementation, BOD load to be discharged into the water bodies will be reduced by 9,673 kg per day in the year 2010. Namely, about 72 % of the BOD load will be removed, which would otherwise be discharged if the Sewerage Priority Project were not implemented.

2) Economic Evaluation

Among the formulated alternatives that fully cover the urgent target area with fully proven technology, the selected sewerage priority project is the least-costly.

The percentage increases required to economically justify the sewerage priority project are 2.7 % in terms of the property value and 1.6 % in terms of GRP of the project area. It is judged that it is very probable that both the property value and GRP would increase by these percentages as a result of the project.

3) Financial Evaluation

The project cost corresponds to 1.5 % of the Study Area disposable income and 5.7 % of the HPPC expenditure in 2010. In 2020, the figures will be 2.7 % and 10.2 %, respectively. Assuming the same financing arrangement as for the Drainage Priority Project, the total financial requirement for HPPC will peak during the construction period, requiring 2.5 % of annual expenditure.

These figures are considered to be within financially affordable range.

4) Technical Evaluation

Assuming adequate training of the personnel of the managing organization, the Sewerage Priority Project is considered to be technically feasible.

5) Environmental Impact Assessment

Assuming appropriate measures be taken, the environmental impact is considered within an acceptable range.

6) Organizational Capability of the Implementing and Managing Bodies

With the new PMU and organizational strengthening of SADCO together with adequate training, the Sewerage Priority Project can be successfully executed and managed.

7) Overall Project Evaluation

The Drainage Priority Project passes all the examinations for project viability and feasibility and is considered to be feasible for implementation on the condition that all the recommended measures with regard to the priority project implementation including organizational/institutional ones be carried out.

3.4 Solid Waste Management Priority Project

(1) Project Outline

The solid waste management priority project comprises the 3 components, i.e. 1) waste collection and transport, 2) sanitary landfill, 3) hospital waste management system, each of which is an integral part of the solid waste management system. The main features of each component are given below.

A. Waste Collection and Transport System

- Location 4 urban districts and their neighboring areas to be urbanized, as well as Do Son Town
- Beneficiaries 608,000 (in 2005)
- Waste Collection Capacity 761 ton/day on average (in 2005)
- Equipment to be Procured
 - Waste collection vehicles (43 units)
 - Bins and handcarts (1,234 units)
 - Workshop equipment (3 sets)
- Procurement Year 2004
- Useful period of equipment 10 years from 2005 to 2014

B. Trang Cat Phase 3 Landfill Site

- Type of Landfill Sanitary landfill of semi-aerobic type
- Location A part of Trang Cat Site (60 ha in total) in Trang Cat Commune
- Area 32.7 ha
- Beneficiaries 528,000 (in 2005)
- Type of disposal Sanitary landfill
- Total waste receiving capacity 2.6 million ton
- Construction Period 2 years from 2004 to 2005
- Operation Period 10 years from 2005 – 2014

C. Hospital Waste Management System

- Location Existing Trang Cat Phase 1 Landfill Site, after its closure
- System Components
 - In-hospital storage room for infectious waste
 - Waste collection vehicles (1.5 ton/unit × 2 units)
 - Incinerator (1 unit, 1.5 ton/day)
- Beneficiaries 9 hospitals and 9 medical centers, located in the 4 urban districts and Do Son Town

- Construction/Procurement Year 2004
- Operation Period 8 years from 2005 - 2012

(2) Organization Plan

The recommended organizational plan is summarized below:

- A PMU should be established for the solid waste management priority project, in particular for the landfill and medical waste components
- New technical unit for hospital waste management will be created within URENCO and the existing landfill section will be reinforced
- Adequate training will be provided for the URENCO personnel and one chemical expert will be recruited for leachate treatment operation

(3) Project Evaluation

1) Objective Achievement

In 2005, a population of 608,000 will receive collection service in the target areas comprising four urban districts and Do Son. The service ratio will be 94 % in terms of population in 2005. In terms of collection amount, the waste collection ratio will be 85 % in 2005.

All the non-hazardous wastes collected in the 3 central urban districts will be received and disposed of in a sanitary manner. In total, 2.6 million tons can be received.

The infectious hospital waste generated at the 9 hospitals and 9 medical centers in the four urban districts and Do Son will be collected, transported and disposed of in a sanitary manner. These hospitals/medical centers account for 74 % of the total of Haiphong city in terms of the number of beds and will contribute much to reducing the risks of spreading infectious diseases either directly or indirectly.

2) Economic Evaluation

The proposed single handling collection system will reduce the per ton unit collection cost by 28 % compared to the current unit cost of the single collection system. Among the sanitary disposal options that include incineration, the proposed option is least-costly. Among the options which can verify the completion of disinfection, incineration is least-costly.

3) Financial Evaluation

The project cost corresponds to 0.92 % of the disposable income of the beneficiaries, and 4.0 % of the HPPC expenditure in 2010. In 2020, the figures will be 0.93 % and 4.35 %, respectively. Assuming the same financing arrangement as for the other priority projects, the total financial requirement for HPPC for the project will be 3.3 % of its annual expenditure at its peak if all the recurrent expenditure of the priority project is included. The estimated ratio is considered to be in the acceptable range. By increasing the cost-recovery of SWM service through collection charge, the above ratio will be lower.

4) Technical Evaluation

Construction and O&M of the project facility of the SWM Priority Project will require no special or advanced technology. Assuming adequate training of the personnel of the managing organization, SWM Priority Project is considered to be technically feasible.

5) Environmental Impact Assessment

The proposed landfill project will not require any resettlement of residents. With the proposed facility including a leachate treatment plant, the environmental impact is expected to be within an acceptable range. Emissions from the incinerator will be within permissible levels.

6) Organizational Capability of the Implementing and Managing Bodies

With the new PMU and organizational strengthening of URENCO together with adequate training, the Solid Waste Management Priority Project can be successfully executed and managed.

7) Overall Project Evaluation

The Drainage Priority Project passes all the examinations for project viability and feasibility and is considered to be feasible for implementation on the condition that all the recommended measures with regard to the priority project implementation including organizational/institutional ones be carried out.

3.5 Feasibility of the Priority Project Packages

(1) Drainage/Sewerage Priority Project Package

1) General

The combined project package passes all the evaluation examinations except economic and financial ones which are checked hereunder.

2) Economic Evaluation

The project package is the combination of the least-costly projects for drainage and sewerage and satisfies the required least-cost condition.

Under the GRP growth assumed in the macro-frame for the Study, the percentage increases required to economically justify the priority project package is 4.5 % in terms of property value, and 2.7 % in terms of GRP of the project area. It is judged that it is very probable that both the property value and GRP would increase by these percentages as a result of the project package.

The drainage/sewerage project package is, therefore, evaluated as economically feasible for implementation.

3) Financial Evaluation

As shown in the table below, the drainage/sewerage project cost corresponds to 3.0 % of the Study Area disposable income and 11.3 % of the HPPC expenditure in 2010. In 2020, the figures will be 5.0 % and 18.7 %, respectively. Assuming that 85 % of the project package cost be financed by concessionary loan with 1.3 % annual interest and 30 year repayment period, and 15 % by HPPC's own fund, the financial burden will peak during the construction period requiring 5.6 % of HPPC's expenditure. The figures become bigger relative to the individual priority projects but are considered within the financial capacity of HPPC and residents.

Affordability for the Priority Projects and Packages

Unit: %

	D+S
a) SA economy	
i) GRP (2010)	1.50
ii) Disposable income (2010)	3.00
b) HPPC expenditure	
i) 5 % interest/25 year repayment (2010)	11.32
ii) Soft loan + 15 % HPPC's own fund at peak year	5.6 (2004)

Note; D: Drainage, S: Sewerage

4) Overall Project Evaluation

The Drainage/Sewerage Priority Project Package passes all the examinations for project viability and feasibility and is considered to be feasible for implementation on the condition that all the recommended measures with regard to the priority project implementation including organizational /institutional ones be carried out.

(2) Three Priority Project Package

1) General

The total project package comprising the 3 priority projects, is considered feasible in all aspects except financial affordability because of the increased financial burden. Feasibility of the project package is, therefore, checked from a financial viewpoint.

2) Financial Evaluation

As shown in the table below, the project cost corresponds to 4.0 % of the Study Area disposable income and 15.3 % of the HPPC expenditure in 2010. In 2020, the figures will be 6.1 % and 23.0 %, respectively. Assuming the same financial arrangements as for each priority project (interest rate of 1.3 %, payment period of 30 years, of which the first 10 years is grace period) financial burden peaks during the construction period requiring 7.2 % of HPPC’s expenditure in 2004. Though the figures are not small, they are considered within the financial capacity of HPPC and the city’s residents.

Affordability for the Priority Projects and Packages

Unit: %

	D+S+ SWM
a) SA economy	
i) GRP (2010)	2.03
ii) Disposable income (2010)	4.01
b) HPPC expenditure	
i) 5 % interest/25 year repayment (2010)	15.32
ii) Soft loan + 15 % HPPC’s own fund at peak year	7.2 (2004)

Note; SWM: Solid waste management, D: Drainage, S: Sewerage

3) Overall Project Evaluation

The Three Priority Project Package passes all the examinations for project viability and feasibility and is considered to be feasible for implementation on the condition that all the recommended measures with regard to the priority project implementation including organizational/institutional ones be carried out.

**THE STUDY
ON
SANITATION IMPROVEMENT PLAN FOR HAIPHONG CITY
IN
THE SOCIALIST REPUBLIC OF VIETNAM**

**FINAL REPORT
SUMMARY**

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Abbreviations

Government of Vietnam/Public Institutions

DI	:	Department of Industry
DARD	:	Department of Agriculture and Rural Development
DOC	:	Department of Construction
DOF	:	Department of Finance
DOH	:	Department of Health
DOSTE	:	Department of Science, Technology and Environment
EMD	:	Environmental Management Division
GOV	:	Government of Vietnam
HP	:	Haiphong
HPPC	:	Haiphong People's Committee
MOC	:	Ministry of Construction
MOF	:	Ministry of Finance
MOI	:	Ministry of Industry
MOSTE	:	Ministry of Science, Technology and Environment
MPI	:	Ministry of Planning and Investment
NEA	:	National Environmental Agency
NIED	:	National Institute for Educational Development
NIURP	:	National Institute for Urban and Rural Planning
PMU	:	Project Management Unit
SADCO	:	Sewerage And Drainage Company
SC	:	Steering Committee
SCPE	:	Scientific Center for Population and Environment
TEDI	:	Transportation Engineering Design Institute
TUPWS	:	Transport and Urban Public Works Service
URENCO	:	Urban Environment Company
VIWASE	:	Vietnam Institute for Water and Sanitation Engineering
WSCO	:	Water Supply Company

International / Foreign Organizations

ADB	:	Asian Development Bank
AIT	:	Asian Institute of Technology

ASEAN	:	Association of Southeast Asian Nations
AusAID	:	Australian Agency for International Development
CIDA	:	Canadian International Development Agency
DIDC	:	Department for International Development Cooperation of the Ministry for Foreign Affairs of Finland
EU	:	European Union
FINNIDA	:	Finnish International Development Agency
IBRD (WB)	:	International Bank for Reconstruction and Development (World Bank)
IFC	:	International Finance Agency
JBIC	:	Japan Bank for International Cooperation
JICA	:	Japan International Cooperation Agency
NGO	:	Non-Government Organization
OECD	:	Organization for Economic Cooperation and Development
SIDA	:	Swedish International Development Agency
UNDP	:	United Nations Development Program
UNICEF	:	United Nations Children’s Fund
UNIDO	:	United Nations Industrial Development Organization
WB	:	World Bank
WHO	:	World Health Organization

Peculiar Abbreviations for this Study

City MP	:	Haiphong City Master Plan
DVEZ	:	Dinh Vu Economic zone
NDA	:	New Development Area
NUA	:	New Urban Area
OCC	:	Old City Center
SA	:	Study Area
SMP	:	Sanitation Master Plan
The Study	:	The Study on Sanitation Improvement Plan for Haiphong City
The JICA Study Team	:	The JICA Team for the Study on Sanitation Improvement Plan for Haiphong City

Others

ADWF	:	Average Dry Weather Flow
AIDS	:	Acquired Immuno- Deficiency Syndrome

AJ	:	Aerated Jokaso
AL	:	Aerated Lagoon
AnA	:	Anaerobic Aerobic Process
ARI	:	Average Recurrence Interval
AS	:	Activated Sludge
ASP	:	Activated Sludge Process
BOD	:	Biochemical Oxygen Demand
BOT	:	Built, Operate, Transfer
C	:	Carbon
CAS	:	Conventional Activated Sludge
CCTV	:	Closed Circuit Television
CECS	:	Center for Environmental Chemistry Studies
CEST	:	Center for Environmental Science and Technology
CH ₄	:	Methane
Cl	:	Chlorine
CNMS	:	Customer Network Management System
CO ₂	:	Carbon dioxide
COD	:	Chemical Oxygen Demand
CPP	:	Contact Purification Process
CRES	:	Center for Regional and Environmental Studies
CSO	:	Combined Sewer Overflow
CW	:	Constructed Wetlands
DID	:	Densely Inhabited District
DO	:	Dissolved Oxygen
EAR	:	Environmental Awareness-Raising
EARET	:	Environmental Awareness-Raising, Education and Training
EE	:	Environmental Education
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Master Plan
ES	:	Executive Seminars
F/S	:	Feasibility Study
FC	:	Fecal Coliform
GDP	:	Gross Domestic Product
GRP	:	Gross Regional Product
H	:	Hydrogen
HCMC	:	Ho Chi Minh City

HDPE	:	High Density Poly-Ethylene
HIV	:	Human Immunodeficiency Virus
HPWSSP	:	Haiphong Water Supply & Sanitation Program
IDF	:	Intensity-Duration-Frequency
IEE	:	Initial Environmental Examinations
IUPM	:	Industrial and Urban Pollution Management
LEP	:	Law on Environmental Protection
LM	:	Laboratory and Monitoring
M/P	:	Master Plan
MEIP	:	Metropolitan Environmental Improvement Program
MT	:	Membrane Technology
MWSP	:	Modified Waste Stabilization Pond
N	:	Nitrogen
NE	:	North East
NH ₄	:	Ammonium
NRW	:	Non-Revenue Water
O	:	Oxygen
O&M	:	Operation & Maintenance
OD	:	Oxidation Ditch
ODA	:	Official Development Assistance
P	:	Phosphorous
PDWF	:	Peak Dry Weather Flow
PP	:	Poly Propylene
PS	:	Pumping Station
PVC	:	Poly Vinyl Chloride
RBC	:	Rotating Biological Contactor
SEDS	:	National Socio-Economic Development Strategy
SOE	:	State Owned Enterprises
SOP	:	Standard Operation Procedure
SP	:	Stabilization Pond
SPP	:	Sewerage Priority Project
SS	:	Suspended Solids
STW	:	Sewage Treatment Works
SW	:	South West
SWM	:	Solid Waste Management
SWS	:	Solid Waste Services

SWTC	:	Solid Waste Treatment Complex
TC	:	Total Coliform
TCVN	:	Vietnam Standard
TEQ	:	Toxic Equivalents
TMS	:	Time and Motion Survey
T-N	:	Total Nitrogen
T-P	:	Total Phosphorous
TSP	:	Total Suspended Particulate
TWAP	:	Treated water from Aeration Pond
TWPP	:	Treated water from Precipitation Pond
UASB	:	Up-flow Anaerobic Sludge Bed (Reactor)
UFW	:	Unaccounted For Water
VAT	:	Vietnam-Australia Training Project
VCEP	:	Vietnam Canada Environment Project
VIP	:	Ventilated Improved Pit (Latrine)
WSP	:	Waste Stabilization Pond
WTP	:	Water Treatment Plant
WWTP	:	Waste Water Treatment Plant
1A	:	Vietnam Three Cities Sanitation Program: Haiphong Component (Water Supply Phase 1)
2A	:	Vietnam Three Cities Sanitation Program: Haiphong Component (Water Supply Phase 2)
1B	:	Vietnam Three Cities Sanitation Program: Haiphong Component (Drainage & Sewerage)

Units of Measurement

T/Y	:	tonnes per year
°C	:	degrees Celsius
g/d	:	grams per day
Gm	:	Gram
ha	:	Hectare
kg	:	kilo gram
km	:	kilo meter
km ²	:	Square kilo meter
lpcd	:	liter per capita per day
m	:	Meter
m ²	:	square meter
m ³	:	cubic meter
m ³ /d	:	cubic meter per day
mg/l	:	milligram per liter
Nm ³	:	Normal cubic meter
pg	:	Picogram
t/m ³	:	tonnes per cubic meter
US\$:	United States Dollar
VND	:	Vietnamese Dong
wt%	:	weight percent

PART 1 INTRODUCTION

I. BACKGROUND AND OBJECTIVES OF THE STUDY

1.1 Background of the Study

To improve the environmental condition in Haiphong City, the Government of Vietnam requested to Government of Japan to make the sanitation improvement plan for Haiphong in September 1997. In response, project finding mission and preparatory study mission were sent. Discussions were made between the two Governments and the Scope of Work (S/W) for the Study on Sanitation Improvement Plan for Haiphong City in the Socialist Republic of Vietnam was agreed and signed on December 2, 1999 in Haiphong, Vietnam. Field work of the Study was started on March, 2000.

1.2 Objectives of the Study

The objectives of the “Study on Sanitation Improvement Plan for Haiphong City in the Socialist Republic of Vietnam” (herein referred to as the “Study”) comprises the following three main components:

- To formulate a sanitation improvement plan for Haiphong City (Sanitation Master Plan: SMP) which includes the fields of water supply, drainage, sewerage and solid waste management system
- To conduct feasibility study on priority projects that are identified in the fields of drainage and sewerage and/or solid waste management
- To transfer technology to the counterpart personnel in the course of the Study

It should be noted that a pilot project would be carried out comprising a) small size contact purification facility and b) small size activated sludge plant with a view to transferring an appropriate technology for water purification and raise environmental awareness among the citizens and people concerned with the environment in the Haiphong City.

1.3 The Effective Study Area

In addition to the Study Area agreed by S/W, the Vietnamese side requested that certain areas in its vicinity should be included for study works. After discussion, the both sides agreed for the inclusion of some areas considering:

- Secure continuity of sanitation improvement plan worked out for SA

- Take into account the demand generated in the area whose facility plan should be an integral part of the overall plan for SA

Accordingly, the following areas are agreed to be included:

- South of Hong Bang
Nam Son Com., An Dong Com.
- South of Le Chan
Du Hang Kenh Com., Vinh Niem Com.
- Southeast of Ngo Quyen
Dong Hai Com., Dang Lam Com., Dang Hai Com., Nam Hai Com.

It is noted that the Trang Cat commune in An Hai district is considered for solid waste management planning from the view point of solid waste generation volume which should be considered in determining the capacity of the Trang Cat landfill located in the same commune.

The added areas are shown in the following figure together with SA. The added areas are called as Augmented Study Area (ASA) and SA added with ASA as Effective Study Area (ESA). The total area of Effective Study Area (ESA) is 209.21 km². For convenience, hereafter Effective Study Area (ESA) is called as Study Area (SA).

1.4 Target Year

Considering the coordination with the relevant plans and programs, in particular the Haiphong City Master Plan for the year 2020, and practical time range for the future projection, the target year for the Study is set at 2020. As mid-term target year, 2010 is selected. For working out short-term plans, year 2005 is referred to.

1.5 Cooperation Extended by the Vietnamese Government

As agreed in the Scope of Works, counterpart personnel and office space as well as office assistants are duly provided through the Project Management Unit (PMU). Data and information requested during the first work in Vietnam were also provided.

1.6 Preparation of Donor Map

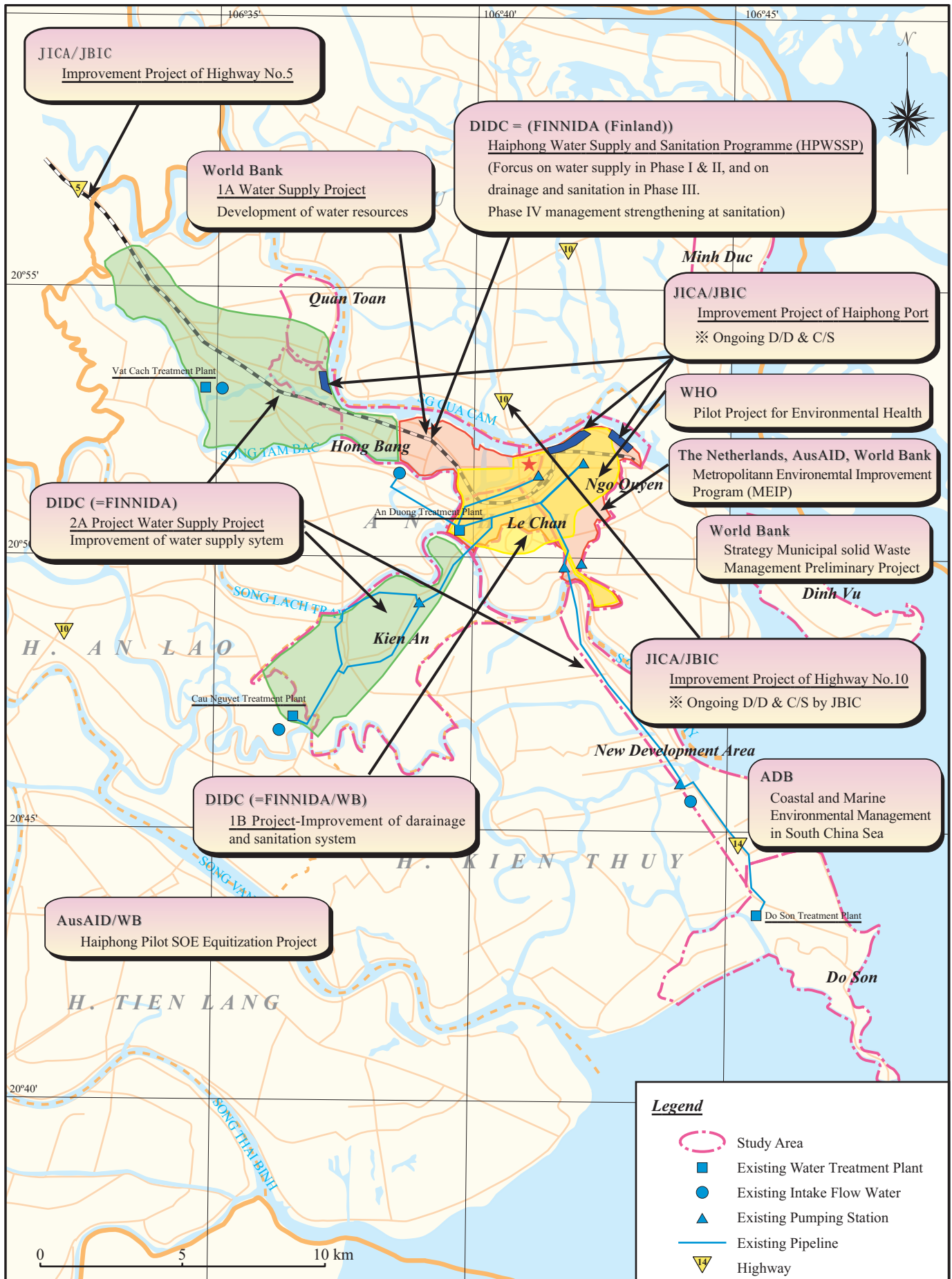
Several projects and studies related to water supply, sanitation and solid waste as well as the environment and institutional improvement have been carried

out in Haiphong under the assistance of the international and bilateral donors such as the World Bank, WHO, UNDP, IFC, DIDC (formerly called FINNIDA; hereafter the name of FINNIDA is used in the Study reports for convenience), CIDA and AusAID as shown in Figure 1.6.1. Activities of these donors are explained hereunder.

Besides the international projects mentioned above, DOSTE conducted environmental surveys, e.g. pollution source investigation and air and water quality monitoring.

Projects Conducted by International Donors

Sector	Donor	Activities	Imp. Period
Water supply, sanitation and solid waste	DIDC (= FINNIDA)	Haiphong Water Supply and Sanitation Programme (HPWSSP) (Phase I – III, IV)	1990 – 2000, 2001 – 2004
	DIDC / WB	Haiphong Water Supply and Environment Project Feasibility Study	1994 – 1995
	DIDC / WB	Haiphong Water Supply and Environment Project (1A Water Supply Project) Detailed Design	1996 – 1998
	WB	Haiphong Water Supply and Environment Project (1A Water Supply Project) Construction	1999 – 2002
	DIDC	Haiphong 2A Water Supply Project Feasibility Study	1999 – 2000
	DIDC / WB	Vietnam Three Cities Sanitation Project – Haiphong Component (1B Project) Feasibility Study	1997 – 1998
	DIDC / WB	Vietnam Three Cities Sanitation Project – Haiphong Component (1B Project) Detailed Design	1998 - 2000
	WB	Vietnam Three Cities Sanitation Project – Haiphong Component (1B Project) Construction	2001 – 2005
	WB	Strategic Municipal Solid Waste Management Planning Project	1999 – 2000
Environment	CIDA	Vietnam – Canada Environment Project (VCEP)	1996 – 2005
	ADB	Coastal and Marine Environmental Management in the South China Sea	1998 –
	Netherlands / AusAID/ WB	Metropolitan Environmental Improvement Program (MEIP)	2000 – 2001
	WHO	Pilot Project for Environmental Health in Ngo Quyen District	1998 – 2000
Institutional management	UNDB	Pilot Public Administrative Reform Project in Haiphong	1999 –
	AusAID / IFC	Haiphong Pilot SOE Equalization Project	1999 – 2001
Others	JICA/JBIC	Improvement Project of Haiphong Port	1993 –
	JICA/JBIC	Improvement Project of National Road No.5	1994 – 1999
	JICA/JBIC	Improvement Project of National Road No.10	1997 –



The Study on Sanitation Improvement Plan for Haiphong City in The Socialist Republic of Vietnam

Figure 1.6.1

Donor Map

II. SURVEY WORKS CARRIED OUT IN VIETNAM

2.1 Surveys for the Sanitation Master Plan

2.1.1 Surveys for Environmental Conditions

The surveys concerning evaluation of environmental condition are the following four surveys.

Surveys for Environmental Conditions

Title of the Surveys	Phase	Works
(1) Interview Survey of 500 Households	1st	Assistant
(2) Interview Survey of 100 Factories	1st	Assistant
(3) Survey for the Current Environmental Conditions	1st	Contract out
(4) Source-wise Unit Pollution Load Study	1st	Contract out

2.1.2 Surveys for Drainage and Sewerage

The survey was conducted to collect current information of sewer line and drainage.

Surveys for Drainage and Sewerage

Title of the Surveys	Phase	Works
(1) Sewer Line and Drainage Channel Profile Study	1st	Assistant

2.1.3 Surveys for Solid Waste Management

The surveys concerning waste generation, recycling and disposal were conducted.

Surveys for Solid Waste Management

Title of the Surveys	Phase	Works
(1) Study of Leachate from Solid Waste Disposal Site	1st	Contract out
(2) Household Waste Generation Survey	1st	Assistant
(3) Solid Waste Collection Quantity Survey	1st	Assistant
(4) Solid Waste Composition Analysis	1st	Contract out
(5) Recycling Materials Market Survey	2nd	Assistant
(6) Hazardous Industrial Waste Survey	2nd	Assistant

2.2 Surveys for Feasibility Study

2.2.1 Drainage Feasibility Study

The following surveys were conducted for the F/S of Drainage planning.

Title of the Surveys	Phase	Works
(1) Topographic Survey	2nd	Contract out
(2) Environmental Impact Assessment	2nd	Contract out

2.2.2 Sewerage Feasibility Study

The following surveys were conducted for the F/S of sewerage planning.

	Title of the Surveys	Phase	Works
(1)	Topographic Survey	2nd	Contract out
(2)	Geological Survey	2nd	Contract out
(3)	Environmental Impact Assessment	2nd	Contract out

2.2.3 Solid Waste Management

The following surveys were conducted for the F/S of solid waste management planning.

	Title of the Surveys	Phase	Works
(1)	Topographic Survey	2nd	Contract out
(2)	Geological Survey	2nd	Contract out
(3)	Environmental Impact Assessment	2nd	Contract out

III. Implementation of Pilot Project

3.1 Objectives and Outline of Pilot Project

The objectives of the Pilot Project are the followings:

- to transfer technology of operation and maintenance of wastewater treatment
- to demonstrate treatment technologies and thereby raise the environmental awareness of the citizens
- to investigate appropriate technologies for water purification and treatment

There are two components of the pilot project. The first is to treat polluted ambient water by contact purification process (CPP). The other is to treat wastewater by activated sludge process (ASP).

CPP: As an example of appropriate technologies to treat polluted ambient water, such as water from channel and lakes, CPP was selected based on the fact that this process requires little or no energy to operate, low investment cost, little maintenance, locally available materials, and low land requirement. The plant was designed to treat the polluted water from Southeast channel at the design capacity of 12 m³ per day. The plant is installed near Vinh Niem Tidal Gate. Oyster shell, which was collected from Bac Dang River in Ha Nam Island, is used for the contact media.



Contact Purification Process Component

ASP: As an example of biological wastewater treatment, ASP was selected based on appropriateness as pilot project and meeting the objectives to demonstrate a typical secondary treatment process. The plant is designed to

treat sewage from the residential area at the design capacity of 6 m³/day. The plant is installed at Dong Quoc Binh Pumping Station in Ngo Quyen District.



Activated Sludge Process Component

3.2 Implementation and Demonstration of Pilot Project

Installation of both plants was completed in June 2000 and the test operations were made in July 2000. In the 2nd phase during October 2000 to January 2001, regular operation and assessment of performance was carried out along with on-the-job technology transfer. In this stage, eleven water parameters were monitored regularly.

Table below summarizes the results from the operation of CPP. About 40 % removals of BOD, SS and T-N were achieved.

Average Performance of Contact Purification Unit

	Unit	BOD ₅	COD	SS	T-N	T-P
Influent	mg/L	5.46	40.43	75.63	13.72	1.29
Effluent	mg/L	3.07	34.45	41.63	6.69	1.05
Reduction	%	44 %	13 %	36 %	47 %	5 %
Standard*	mg/L	25	35	80	15**	-

* : Environmental Standard TCVN5942-1995 (column B)

** : as NO₃-N

Table below summarizes the results from the measurements in ASP. The effluent from the unit satisfied the Discharge Standard (TCVN 5945-1995) for BOD, COD and SS.

Average Performance of Activated Sludge Unit

	Unit	BOD ₅	COD	SS	T-N	T-P
Influent	mg/L	173.3	405.4	83.8	111.4	10.7
Effluent	mg/L	22.4	91.6	45.0	76.0	9.6
Reduction	%	86 %	77 %	40 %	30 %	10 %
Standard*	mg/L	50	100	100	60	6

* : Discharge Standard TCVN5945-1995 (column B)

3.3 Technology Transfer

Under the supervision of the JICA Study Team, SADCO participated in the operation of the contact purification unit and the activated sludge plant. This provided SADCO with unique and invaluable opportunities to learn how to:

- operate and maintain water purification systems
- optimize system performance
- trouble-shoot real problems

After successful demonstration, both the Pilot Plant is handed over to Project management Unit (PMU) with the approval of JICA Head Office. PMU decided to donate the plants to Haiphong Private University's Department of Environmental Engineering. This will give the students a valuable opportunity to learn the system mechanism and operation technique. This will also provide access to such process by all relevant agencies in Haiphong, namely, SADCO and DOSTE. Moreover, it will promote environmental awareness among the general public of Haiphong.

An operation manual is also prepared by the Study Team and handed over to PMU. This include process description, operation procedure, trouble shooting and suggested remedial methods. This will ensure smooth operation of the plants in future.