Chapter 8 Evaluation of the Future Environment with the Proposed Counter-measures

8.1 Assumed Changes for Reducing the Pollution Loads in the Future

During the coming two decades till the year 2020, a lot of changes are expected in Vietnam and Hanoi. Aged facility for manufacturing and transport will be replaced. Production of goods and services will substantially be increased. Style of life of the people will be changed and the living standards will sharply be upgraded.

Looking into the international society, specially the advanced countries, innovations of technologies are expected and new products will be produced. Resource and energy saving production as well as cleaner production technology will increasingly be in use. Electrically-powered car with much less or no exhaust gas may be used. All these are expected to be introduced soon after it took place, into Vietnam. At present, already efforts are being made for disseminating the knowledge and benefit of cleaner production in Hanoi.

Awareness to the environmental preservation will be raised in Vietnam. Cleaner production will partly be realized specially among the enterprises/industries with foreign equity participation discharging much less waste to outside. Products will be manufactured, taking into the reuse of the products when their lives are finished. Considering the above, it can be expected that the volume of waste per value-added of manufacturing sector would be reduced. Similarly the same level of consumption may generate less volume of waste.

However, to predict the degree of the materialization and timing of waste reduction in each sector or specific activities are extremely difficult to predict. In this JICA Study, therefore, the future reduction of unit generation and discharge of waste is assumed and expressed by adopting the slower growth of economy in the future. Namely, among the two growth cases adopted in this JICA Study, low growth case is adopted which would generate less products and less consumption, resulting in less generation of wastes, i.e., about 7.4% per annum on the average till the year 2020.

8.2 Evaluation of Water-related Sanitation Environment in the Future

8.2.1 Water-related Sanitary Situation

The inadequatel natural conditions and existing drainage system are the largest environmental and health risks in the urban area of Hanoi. The urban area is affected seriously every year by flood, which causes various kinds of damage to the socioeconomic life of the residents.

The management of sanitary water-related environment, therefore, is required in order to protect flood and mitigate the environmental and health risks. By executing the adequate management including structural measures, the index of flood probability, what assesses the water-related sanitation situation in the urban area, is improved as follows:

Comparison of Flood Probabilities

Drainage Systems	Flood Probabilities	
	Without measures	With measures
To Lich River	3-year to 5-yearr	10-year
Lu River	1.2-year	10-year
Kim Nguu River	1.6-year	10-year
Set River	1.1-yearr	10-year
Overall To Lich River System	1.2-yearr	10-year
Nhue River System	Less than 5-year	10-year
Red River System	More than 100-year	More than 100-year
Other Main Rivers	5-year to 10 year	10-year
Channels	0.5-year to 5-year	10-year
Sewers	Less than 1-year	5-year

Effectiveness of measures for flood control and drainage improvement is to be free at least from floods with a return period of 10-year or less in the whole area of the city and to reduce the indirect damages such as disease contraction, traffic obstruction, and loss of economic activities.

8.2.2 Degree of Achieving the Set Environmental Target

According to implementation of measures for flood control and drainage improvement, the set environmental targets will be achieved at each environmental zone below:

Environmental Zone	2005	2010	2020
Old City Center	- 10-year - Combined sewer - Mechanical drainage - Conservation of city lakes	- 10-year - Combined sewer - Mechanical drainage - Conservation of city lakes	- 10-year - Combined sewer - Mechanical drainage
Red River Right Bank-North West	- 5-year - Separate sewer - Mechanical drainage	- 10-year at northern area - 5-year at southern area - Separate sewer - Mechanical drainage	- 10-year - Separate sewer - Mechanical drainage
Red River Right Bank-South	- 10-year - Partially separate sewer - Mechanical drainage - Conservation of city lakes	- 10-year - Partially separate sewer - Mechanical drainage - Conservation of city lakes	- 10-year - Partially separate sewer - Mechanical drainage
Dong Anh Urban Area	- 5-year - Combined sewer - Natural drainage	- 10-year partially - Separate sewer - Natural drainage	- 10-year partially - Separate sewer - Natural drainage
Gia Lam Urban Area	- 5-year - Combined sewer - Natural drainage	- 10-year partially - Partially separate sewer - Natural drainage	- 10-year - Separate sewer - Natural drainage
Sub-urban Area	- Natural drainage	- Natural drainage	- Natural drainage
Ho Tay Area	- 10-year - Combined sewer - Natural drainage	- 10-year - Partially separate sewer - Natural drainage	- 10-year - Partially separate sewer - Natural drainage
Red River Quasi Zone	Less than 10-year at flood plain	Less than 25-year at flood plain	Less than 25-year at flood plain

8.3 Evaluation of Water Quality in the Future

This section presents estimates of future water pollution for 2010 and 2020 assuming that the countermeasures proposed in the Study are carried out.

8.3.1 Proposed Countermeasures

The proposed countermeasures for water pollution are described in section 6.3. In estimating future water quality, the effectiveness of each countermeasures are assumed to be as shown below.

Effectiveness of each Countermeasure

Countermeasure	Assumption of Effectiveness
Sewerage System Development	BOD pollution load generated in sewerage service area is to be reduced by 95%. 95% includes treatment reduction and runoff reduction.
Improvement of On-site Treatment System	BOD pollution load generated in urban area but outside of sewerage service area is to be reduced by 20%. 20% does not include runoff reduction.
Industrial Effluent Control	BOD concentration in Industrial Zones is improved from 400 mg/L to 20 mg/L.

8.3.2 Evaluation of the Receiving Water Quality

(1) Major Rivers

Even if no countermeasures are carried out, water quality in the Cau River, Red River and Duong River will still be in the category of "Un-polluted" as shown in section 3.2.2. If the proposed countermeasures are taken, the situation must be more optimistic. Predictions for Ca Lo River and Nhue River are shown below. The method of predicting water quality in the major rivers is described in section 1.2.4.

1) Ca Lo River

According to the sewerage development plan proposed in the Study, the public sewerage system in the basin of Ca Lo River will not be completed until 2020. The countermeasures carried out prior to 2020 are only "Industrial Effluent Control" and "On-site Treatment Development". If the proposed countermeasures are taken, predicted pollution indicators are as shown below.

Calculation of Incremental BOD Concentration in Ca Lo River

		1997	2010	2020
BOD Pollution Load	kg/d	19,359	38,569	65,233
Wastewater Generation	m^3/d	35,965	131,167	260,393
River Flow	m^3/d	829,440	829,440	829,440
Incremental BOD concentration from 1997	mg/L	0	+4.0	+8.4
Expected BOD Concentration	mg/L	2.8 – 4.8*	6.8 – 8.8	11.2 – 13.2
Evaluation		U	U	S

*) It is BOD values measured under the Study in 1999.

Even if the proposed countermeasures are carried out properly, water quality of Ca Lo River will deteriorate gradually and no longer be "Unpolluted" in 2020.

2) Nhue River (Upstream)

Out of 9,976 ha of the upper basin of Nhue River, about 4303 ha is planned to be accessible to a sewerage system. Due to the countermeasures proposed, water quality in the Nhue River will be kept at the present level.

Incremental BOD Concentration of Nhue River Upstream

		1997	2010	2020
BOD Pollution Load	kg/d	19,290	29,086	12,412
				25,061
Discharge BOD Load		3,858	5,817	3,735
Wastewater Generation	m^3/d	100,846	200,077	256,411
River Flow	m^3/d	691,200	691,200	691,200
Incremental BOD concentration	mg/L	0	+2.2	-0.1
Expected BOD concentration	mg/L	3.2 – 5.8	5.4 – 8.0	3.1 – 5.7
Evaluation	mg/L	U	U	U

(2) Water Bodies in Red River Right Bank

1) To Lich River System

According to the sewerage development plan, about 6820 ha of sewerage systems are to be established in To Lich River System. Sewerage service rates are show below.

Plan for Sewerage System Development in To Lich River System

(BOD Pollution Load: kg/day)

		1997	2010	2020
Up Stream				
1) To Lich River	1690 ha	-	90 %	100 %
2) Lu River	500 ha	-	100 %	100 %
3) Set River	-	-	100 %	100 %
4) Kim Nguu River	1033 ha	-	100 %	100 %
Middle Stream				
1) To Lich River	770 ha	-	-	100 %
2) Kim River	1817 ha	-	-	72 %
Downstream				
1) To Lich River	1010 ha	-	-	86 %

Assuming the effectiveness of the proposed countermeasures, BOD concentrations in the To Lich River System are calculated as shown below.

BOD Concentrations in To Lich River System

(BOD mg/L)

	1997	2010	2020
Up Stream			
1) To Lich River	44	12	7
2) Lu River	49	7	7
3) Set River	48	6	6
4) Kim Nguu River	48	6	6
Middle Stream			
1) To Lich River	43	17	13
2) Kim Nguu River	40	21	9
Downstream			
1) To Lich River	40	24	11
Overall Evaluation	P	U - S	U

Due to the countermeasures, the environmental conditions of To Lich River System will be improved significantly. Water bodies in Environmental Zone 1 which is almost the same as upstream of To Lich River System is evaluated as almost "Unpolluted". Only upstream of To Lich River can hardly achieve "Unpolluted" in Environmental Zone 1, because the sewerage system will not cover all of To Lich River basin. Sewerage systems in Zone 1 are highly appreciated for the water improvement in this area.

2) Nhue River

At the junction between Nhue River and To Lich River, water of the two rivers are mixed. BOD Concentration in the Nhue River after mixture with To Lich River is calculated as shown below.

BOD Concentration in Nhue River after Junction with To Lich River

		1997	2010	2020
To Lich River*				
BOD Concentration	mg/L	40	24	14
River Flow	m^3/d	310,356	313,163	303,283
Nhue River Upper*				
BOD Concentration	mg/L	3.2 – 5.8	5.4 – 8.0	3.1 – 5.7
River Flow	m^3/d	1,290,000	1,290,000	1,290,000
Nhue River Lower				
Expected BOD concentration	mg/L	10.9 – 13.6	10.1 – 12.7	5.6 – 8.2
Evaluation		S	S	U

*1) They are calculated above.

3) Suburban area

Countermeasures for suburban areas are not considered. The water quality in suburban areas will not be improved. However, the water bodies in suburban areas in 2020 are expected to be "Slightly Polluted"

(3) Water Bodies in Red River / Duong River Left Bank

The area covers "Environmental Zone 4: Dong Anh Urban Area". According to the Master Plan, Industrial Zones are expected to expand from 70.0 ha in 1997 to 895.5 ha in 2020. Industrial effluent control is definitely important. Predicted water quality is as shown below.

Calculation of Average BOD Values in Red River/Duong River Left Bank Area

	unit	1997	2010	2020
BOD Load	kg/day	19,090	39,480	66,828
Wastewater Generation	m^3/day	36,588	126,391	253,471
Natural River Flow	m^3/day	496,900	496,900	496,900
Expected BOD Concentration	m^3/day	10	13	16
Evaluation	m^3/day	U	S	S

Water quality in the area can be kept at the present level.

(4) Water Bodies in Duong River Right Bank

The area covers "Environmental Zone 5: Gia Lam Urban Area". According to the Master Plan, Industrial Zones are expected to expand from 42.0 ha in 1997 to 510 ha in 2020. Industrial effluent control is definitely important also in this area. Predicted water quality is as shown below.

Calculation of Average BOD Values in Duong River Right Bank Area

	unit	1997	2010	2020
BOD Load	kg/day	11,145	15,527	28,089
Wastewater Generation	m^3/day	25,587	60,538	115,050
Natural River Flow	m^3/day	193,340	193,340	193,340
Expected BOD Concentration	m^3/day	13	12	16
Evaluation	m^3/day	S	S	S

Water quality in the area can be kept at the present level.

(5) Water Bodies in Soc Son and other Sub-urban Area

No countermeasures have been considered in Soc Song or other suburban areas. Even if no countermeasures are carried out, water bodies in Soc Son District are expected to remain "Unpolluted" and other suburban areas are expected to remain "Slightly Polluted".

(6) West Lake

West Lake Environmental Improvement Project is to be completed before 2010 with the assistance of Government of Austria. Water quality in West Lake is expected to be "Unpolluted" after 2010.

(7) Overall Evaluation

The results of the predictions are summarized as follows.

Future Prediction with Countermeasures

		1997	2010	2020
Zone 1 Old City Center	To Lich River	P	S	U
	Lu River		U	U
	Set River		U	U
	Kim NguuRiver		U	U
Zone 2 Red River Righ Bank - North West	Nhue River (upper)	S	U	U
		S	S	U
Zone 3 Red River Right Bank - South	To Lich River	P	S	S
	Kim NguuRiver		S	S
Zone 4 Dong Anh Urban Area	Van Tri Lake	U	S	S
	Others			
Zone 5 Gia Lam Urban Area	Bac Hong River	S	S	S
	Others			
Zone 6 Suburban Area				
-Soc Song		U	U	U
-Dong Anh		U	S	S
-Gia Lam		S	S	S
-Tu Liem		S	S	S
-Thanh Tri		S	S	S
Zone 7 Ho Tay Area		S	U	U
Major River	Cau River	U	U	U
	Ca Lo River	U	S	S
	Red River	U	U	U
	Duong River	U	U	U
	Nhue River (Low)	S	S	U

Note:U: Unpolluted, S: Slightly Polluted, P: Polluted

Figure 8.3.1 and 8.3.2 present Future Water Pollution Maps showing the prediction of BOD pollution condition of major rivers and urban rivers in 2010 and 2020, respectively. Figure 8.3.3 and 8.3.4 present Future Water Pollution Maps showing the prediction of water pollution condition in each area in 2020 and 2020, respectively. The main points of the conclusion is as below.

- Basically, Zone 1, Zone 2, and major rivers are expected to achieve the level of "Unpolluted".
- None of the water bodies are expected to be "polluted". Sewerage system development in Zone 3 and Zone 4 will be required immediately after 2020 if

actual population growth rate will be as predicted.

- According to the plan proposed in the Study, any countermeasures in the suburban area (Zone 6) will not taken until 2020.

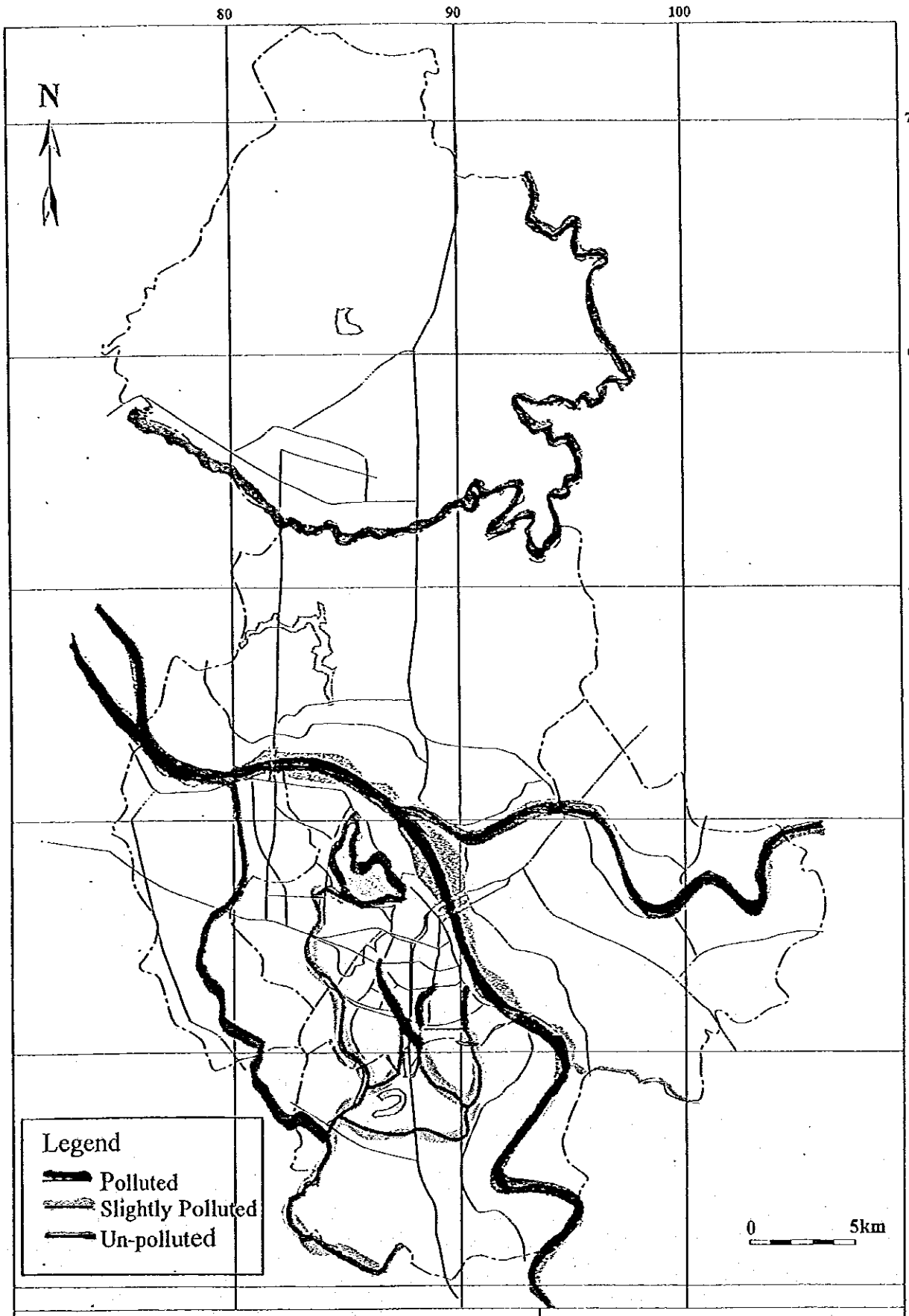

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Figure 8.2.1
Water Pollution Map(Major River) with Countermeasure, 2010

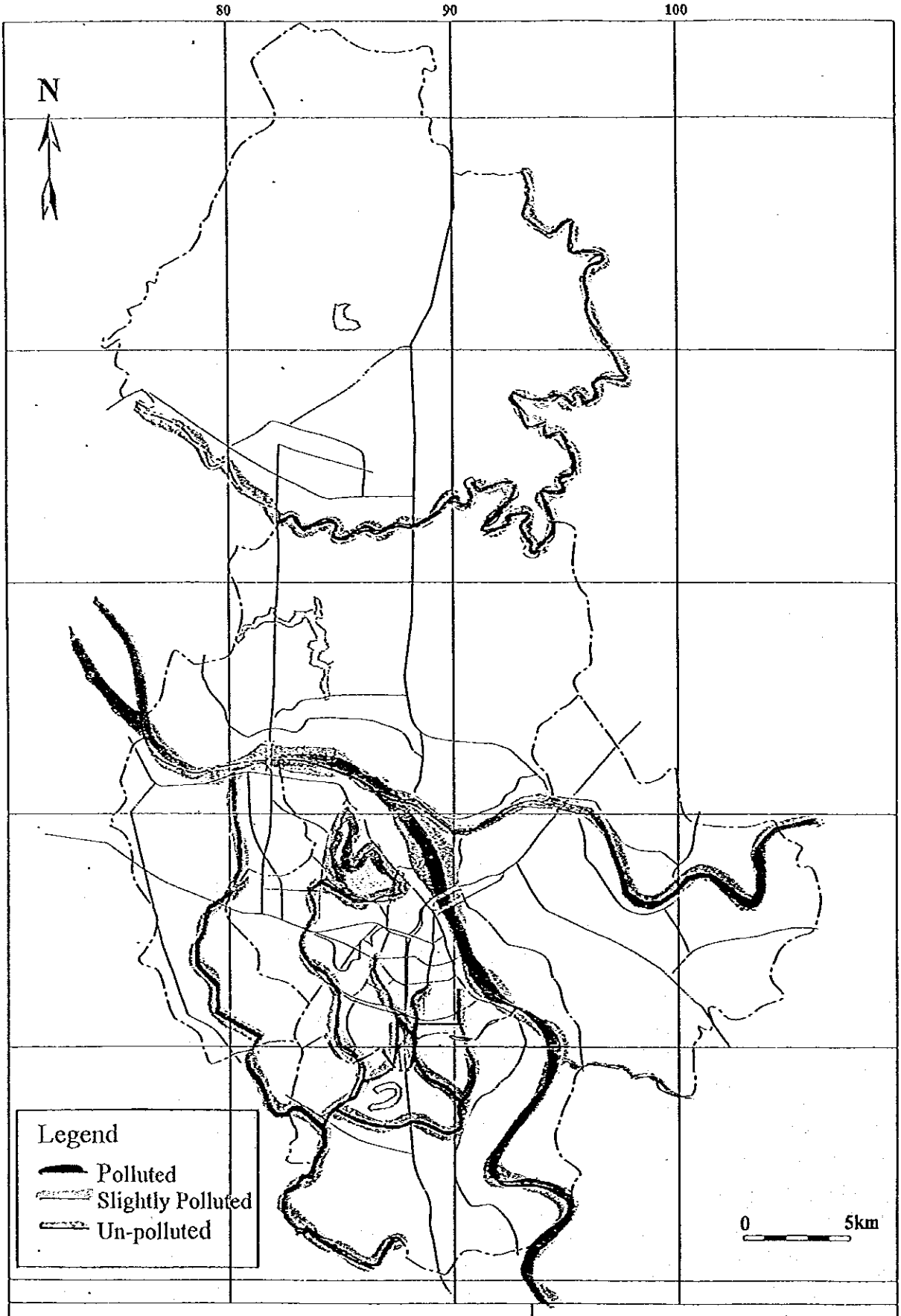

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Figure 8.2.2
Water Pollution Map(Major River) with Countermeasure, 2020

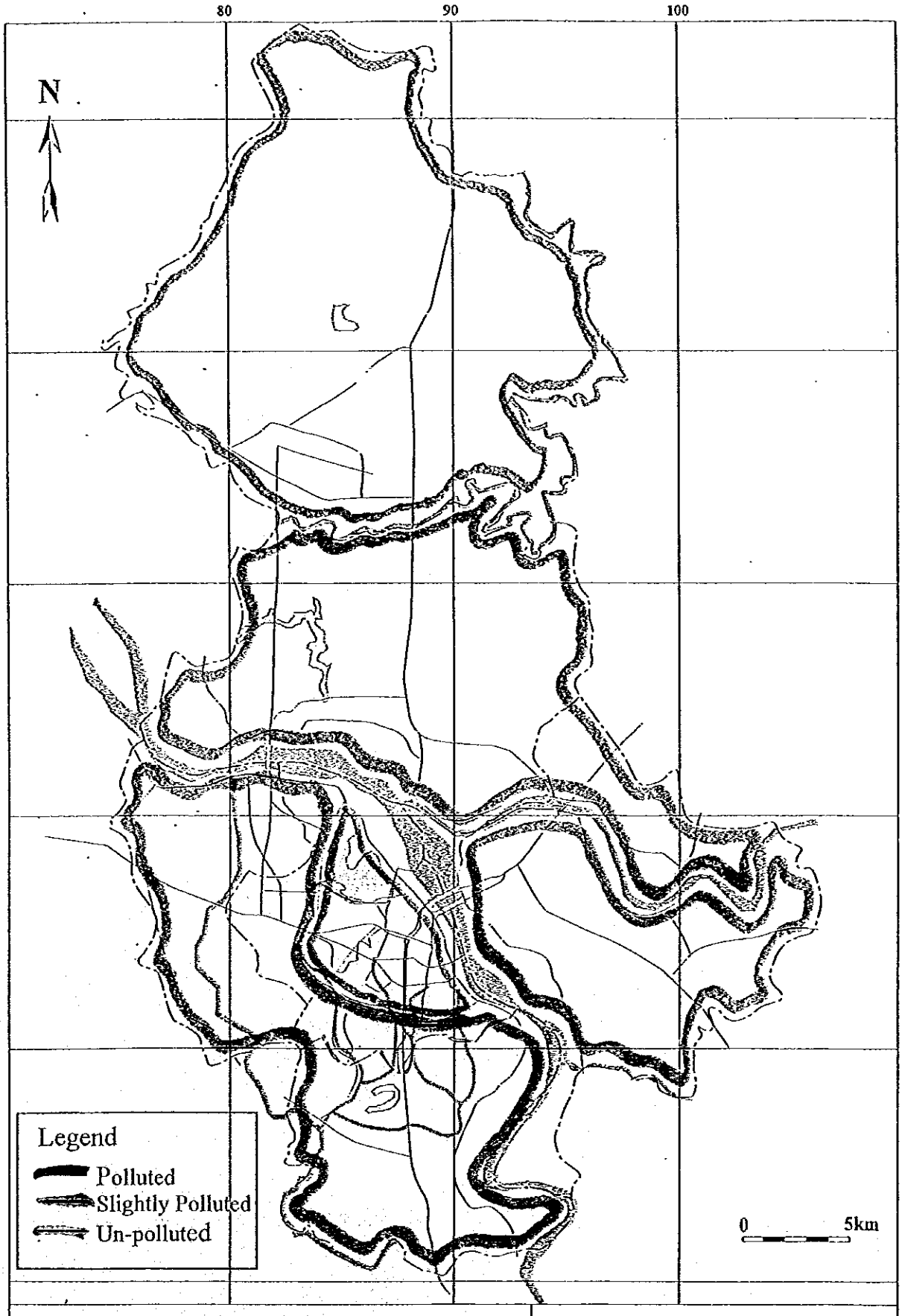

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Figure 8.2.3
Water Pollution Map(Area) with Countermeasure, 2010

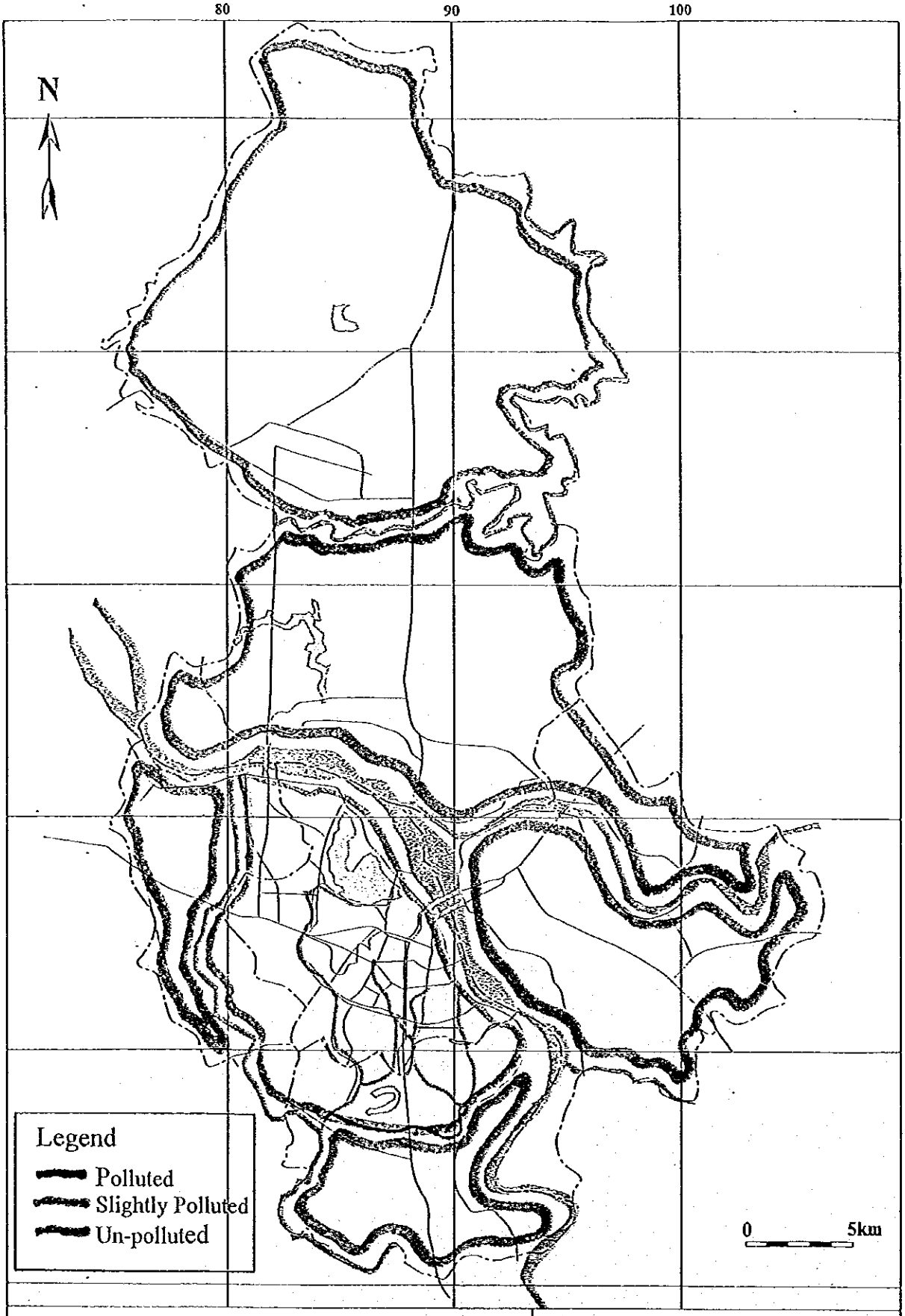

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Figure 8.2.4
Water Pollution Map(Area) with Countermeasure, 2020

8.4 Evaluation of Air Quality in the Future

Based on the results from the evaluation of the present air quality and future air quality for 2010 and 2020, and in order to achieve attainment of the selected air quality targets, several countermeasures will have to be implemented for each type of emission sources. Transportation and industrial emissions are the major sources of pollution in Hanoi and their importance will increase in the future. This section presents some countermeasures for domestic, industrial and transportation sources of air pollutants and presents the evaluation of air quality for 2010 and 2020 if all of these countermeasures are implemented before 2010. Intermediate reduction scenarios, such as selection of the optimal set of countermeasures to achieve the objectives (unpolluted everywhere) is not evaluated. Variations in the time frame for the implementation of the countermeasures are not considered either.

Also, evaluation of present and future air quality with and without countermeasures is based on typical emissions factors for various type of sources. No specific Hanoi data for transportation emissions per type of vehicle were used in the evaluation of air quality, neither for industrial emissions nor for road dust resuspension. Before implementing any of the proposed countermeasures and to establish priorities in the countermeasures, several studies should be conducted such as: comprehensive industrial air pollution inventory, specific emission factors for Hanoi vehicles, studies on road dust resuspension and adequate monitoring program. The most important would be the implementation of an air monitoring program designed for the following objectives, which are not met by the current very low frequency air quality surveys: establish current contaminant pollution levels and permit trend analysis or yearly variations in pollution levels.

(1) Countermeasures and Estimation of the Pollution Load Generation and Emission

1) Domestic emissions

Domestic emissions do not contribute a lot to the total atmospheric pollution. In a do nothing case and with further industrial development and increase in traffic, the relative contribution of domestics to atmospheric load will decrease. The main countermeasure will be to promote the use of cleaner fuels or electricity in household

Table 8.4.1 presents some objectives for use of various domestic fuel. The main objectives are to reduce by a large proportion the use of coal from about 50% to 5% of households and eliminate the use of wood in the Old City Center. In the rural areas, the reduction would be much less. Table

8.4.2 presents the change in various fuel consumption and air emissions and Table 8.4.3 presents the air emissions by environmental zones. Overall, this would reduce emissions by about 50-70% for CO, TSP (and PM10) and SO_2 and no change for NOx emissions. In the Old City Center environmental zone, the reductions would be maximum, with reductions between 50%-95% depending on the pollutant,

2) Industrial emissions

Globally, industrial emissions from fuel combustion could increase by a factor of 5 to 6 between 1997 and 2020 if no reduction measures are implemented. This increase estimate is based on the assumption that new industries emit the same amount of pollutants per unit production that the old ones and that none of the existing plants will reduce its emissions.

A large number of existing facilities who have submitted EIA reports have identified some measures to be implemented to reduce air emissions. The challenge will be to implement them.

Table 8.4.4 presents the reductions in fuel combustion emission factors for industrial zones that were considered in the evaluation of future air quality with countermeasures. Globally, they represent a 50% emission reduction of CO, NOx and SO_2 and a 90% emission reduction of TSP and PM10 when compared to the case without countermeasures. These means that on the average, new industrial zones will emit 50% less toxic gases and 90% less particulate matter per unit surface than the exiting ones. To obtain these estimates, the following measures and assumed reductions were applied to the present emission factors. These assumed reductions do not apply to each present and future facility individually, but to the ensemble of facilities:

- cleaner production, energy conservation and better combustion controls: 20% reduction. This reduction is applied equally to all contaminants, even if better combustion controls would have a greater impact on TSP, PM10, CO and NOx emissions than on SO_2 emissions.
- more frequent use of gas, electricity for small facilities, better quality heavy fuel oil in large industries, modern combustion devices (such as low-NOx burners) and more efficient air regulations enforcement: 35% reduction. For the purpose of estimating emission reduction, it was supposed that 40% of the energy demand in facilities will be supplied by gas and that 60% will continue be supplied by coal or heavy oil. Emission reduction were then applied to the present industrial zone surface emission factors (t/y/ha) by applied the ratio of emission factors

(g of contaminant / J of energy) of gas over coal and/or heavy oil to 40% of the emissions factors for the present situation.

- for facilities using coal: particulate emissions reduced by 80% and even more for major facilities. The 80% reduction is applied to the remaining sources (60% of energy demand) still using coal after considering switching from coal/oil to gas. Since dusts controls are more efficient for TSP than for PM10, a smaller reduction factor (75%) was applied to PM10 emissions for coal combustion.

Table 8.4.5 presents the estimated air pollution loads for 2010 and 2020 with application of the new global emissions factor for industrial zones and table 6 present the emission loads for each IZ. Instead of increasing by a factor of 5 to 6 in 2020 without any countermeasures in comparison with 1997, total loads of SO_2, NOx and CO would increase by a factor of 3 while TSP and PM10 would decrease by 41% and 27%.

3) Motor vehicles emissions

For motor vehicles, the major contributor for all contaminants in the urban area, emission reduction will be required for CO, NOx, SO_2 and lead in the future.

Air emission estimates with countermeasures for mobile sources were estimated with the following assumptions:

- unleaded gasoline: 100% reduction of lead emissions from gasoline vehicles
- reduction in CO and NOx emissions by implementing the following measures:
- catalytic converters for motor vehicle (car and motorcycles)
- inspection program for motorcycles
- reduction in emissions for diesel engine
- public transport trip share increased for 5.6% in 1997 to 16% in 2020.
- low sulfur gasoline (100 ppm) and diesel fuel (500 ppm): SO_2 emissions reduced by 60% and 90% respectively for gasoline and diesel vehicle.
- very efficient measures to eliminate dust loading on street and street cleaning: road dust resuspension reduced by 75%
- improvement in infrastructures so that traffic flow (in terms of average traveling speed and frequency of traffic congestion) remains the same as today.
- two-wheeler policy suggested in the JICA Urban Transport Master Plan is implemented to assure that personnel vehicles are still mainly composed of small motorcycles.

Table 8.4.7 presents the increase in traveled kilometers by transport mode with the introduction of a better public transport system and Table 8.4.8 presents the estimated pollution load for transport with countermeasures for 2010 and 2020.

4) Summary of air emissions loads with countermeasures

Table 8.4.9 presents the summary of atmospheric emissions in 2010 and 2020 if all countermeasures all implemented before 2010, and not further than 2005 for new emission regulations for new vehicles. Again, variation in the age of the vehicle fleet are not considered in the estimation of traffic emissions. With the countermeasures, SO_2 and NOx emissions will continue to increase respectively by a 2 and 3 factor from 1997 to 2020. CO would decrease between now and 2010 before increasing again between 2010 and 2020. The same goes for TSP and PM10, but as for CO, loads could be smaller than at present.

(2) Assessment of the Ambient Environment Conditions

As for the assessment of present conditions, results are representative of general air quality in an area. Concentrations near industrial zones or isolated industrial sources, major roadways or high density residential areas using coal should be higher than presented here. Also, the limitations of the modeling techniques and air emission loads than for evaluation of present air quality still apply.

Also, for industrial emissions, an effective release height of 40 meters was used in the simulations of future air quality, compared to 25 meters used in the evaluations for present and future air quality without countermeasures.

Table 8.4.10 presents the maximum calculated concentrations for each pollutant for each relevant averaging period for 2010 and 2020. Even with the proposed countermeasures, the calculated annual average concentrations of TSP exceed the standard for 2010 and 2020 in the central urban area. Hourly and daily NO_2 concentrations could also exceed the standards in the central area, especially in 2020. For order contaminants and other areas, all calculated concentrations for 2010 and 2020 are below standard.

The following tables present the air quality classification for 2010 and 2020 of each Environmental Zone for each pollutant.

Evaluation of Air Quality by Environmental Zone in 2010

Environmental Zone	CO	NO_2	SO_2	TSP	PM10	Lead	All
1 Old City Center	U	U	U	P-U	U	U	P-U
2 Red River Right Bank Northwest	U	U	U	U	U	U	U
3 Red River Right Bank South	U	U	U	U	U	U	U
4 Dong Anh urban area	U	U	U	U	U	U	U
5 Gia Lam urban area	U	U	U	U	U	U	U
6 Rural Areas							
Tu Liem	U	U	U	U	U	U	U
Soc Son	U	U	U	U-P	U	U	U-P
Dong Anh	U	U	U	U	U	U	U
Thanh Tri	U	U	U	U	U	U	U
Gia Lam	U	U	U	U	U	U	U
7 Ho Tay area	U	U	U	U	U	U	U

Note: U: unpolluted, SP: slighlty polluted, P: polluted
When several classes are indicated for the same environmental zone, the first one covers the largest area in the zone.

Evaluation of Air Quality by Environmental Zone in 2020

Environmental Zone	CO	NO_2	SO_2	TSP	PM10	Lead	All
1 Old City Center	U	SP	U	P	U	U	P
2 Red River Right Bank Northwest	U	U	U	U	U	U	U
3 Red River Right Bank South	U	U	U	U	U	U	U
4 Dong Anh urban area	U	U	U	U	U	U	U
5 Gia Lam urban area	U	U	U	U	U	U	U
6 Rural Areas							
Tu Liem	U	U	U	U	U	U	U
Soc Son	U	U	U	U-P	U	U	U-P
Dong Anh	U	U	U	U	U	U	U
Thanh Tri	U	U	U	U	U	U	U
Gia Lam	U	U	U	U	U	U	U
7 Ho Tay area	U	U	U	U	U	U	U

Note: U: unpolluted, SP: slighlty polluted, P: polluted
When several classes are indicated for the same environmental zone, the first one covers the largest area in the zone.

The following table presents the evolution of air quality from 1997 to 2010 and 2020 with the proposed countermeasures.

Air Quality by Environmental Zone for 1997, 2010 and 2020 with countermeasures

Environmental Zone	1997	2010	2020
1 Old City Center	P	P-U	P
2 Red River Right Bank North-West	U-P-SP	U	U
3 Red River Right Bank South	P-U-SP	U	U
4 Dong Anh urban area	U	U	U
5 Gia Lam urban area	U-SP	U	U
6 Rural Area			
Tu Liem	U	U	U
Soc Son	U-SP-P	U-P	U-P
Dong Anh	U-SP	U	U
Thanh Tri	U-P	U	U
Gia Lam	U	U	U
7 Ho Tay area	U-P	U	U

Note: U: unpolluted, SP: slightly polluted, P: polluted
When several classes are indicated for the same environmental zone, the first one covers the largest area in the zone.

The resulting air pollution maps for 2010 and 2020 with countermeasures are presented in Figure 1, with the pollution for the present situation. The proposed countermeasures would reduce considerably the area of the polluted zones from 1997 to 2010 and 2020, but the central urban area could still be polluted primarily by TSP and secondly by NO_2.

For 2010 and 2020, all Environmental zones can be qualified as unpolluted, except the Old City which remains polluted by TSP (annual criteria) and slightly polluted by NO_2 (hourly criteria). A very small part of Soc Son, near Donh Anh industrial zone, is also considered polluted by TSP (annual criteria). In the central area, even if TSP annual concentrations are above the criteria for 2010 and 2020, they are still about 3 time smaller than the calculated values without countermeasures.

Evaluation of present and future air quality with and without countermeasures is based on typical emissions factors for various type of sources. No specific Hanoi data for transportation emissions per type of vehicle were used in the evaluation of air quality, neither for industrial emissions nor for road dust resuspension. Before implementing any of the proposed countermeasures and to establish priorities, several studies should be conducted such as: comprehensive industrial air pollution inventories, specific emission factors for Hanoi vehicles, studies on road dust resuspension and adequate monitoring program. The most important would be

the implementation of the air monitoring program designed for the following objectives, which are not met by the current very low frequency air quality surveys: establish current contaminant pollution levels and permit trend analysis or yearly variations in pollution levels.

From these proposed studies, a better evaluation of current air pollution sources and ambient concentrations would be possible and more specific countermeasures could be proposed. Based on the results from this study, the biggest challenge will be to control dust emissions in order to achieve attainment of TSP air quality standards in the central urban area.

Table 8.4.1 Frequency of Households Fuel Used for Cooking by Environmental zone

Units: %

Present situation

Environmental Zone	Coal	Kerosene	Wood	Gas/electricity
1 Old City Center	51.4	26.4	11.3	11.0
2 Red River Right Bank - NW	71.5	10.5	13.5	4.5
3 Red River Right Bank - South	71.5	10.5	13.5	4.5
4 Dong Anh	71.5	10.5	13.5	4.5
5 Gia Lam	71.5	10.5	13.5	4.5
6 Rural Area	71.5	10.5	13.5	4.5
7 Ho Tay	41.0	29.5	5.5	24.0
Total for Hanoi	**63.7**	**16.6**	**12.6**	**7.1**

Objectives for 2010 and 2020

Environmental Zone	Coal	Kerosene	Wood	Gas/electricity
1 Old City Center	5.0	5.0	0.0	90.0
2 Red River Right Bank - NW	15.0	15.0	0.0	70.0
3 Red River Right Bank - South	15.0	15.0	0.0	70.0
4 Dong Anh	15.0	15.0	0.0	70.0
5 Gia Lam	15.0	15.0	0.0	70.0
6 Rural Area	15.0	15.0	0.0	70.0
7 Ho Tay	5.0	5.0	0.0	90.0
Total for Hanoi	**23.0**	**12.3**	**1.5**	**63.2**

Table 8.4.2 Estimated domestic fuel consumption and atmospheric emissions for 2010 and 2020

	1997	2010	2020
Fuel	**Estimated Fuel Consumption (t/y)**		
Coal	125,000	52,741	63,201
Wood	38,430	5,800	6,226
Kerosene	19,371	16,225	20,960
Gas	7,639	76,578	96,748
Pollutant	**Estimated Pollutant Emission Load (t/y)**		
SO2	1,335	594	718
NOX	315	254	315
CO	8,908	2,902	3,419
TSP	1,483	486	573

Table 8.4.3 Estimated domestic atmospheric emissions for 2010 and 2020 by Environmental Zone

(Unit: t/y)

Environmental Zone	1997				2010				2020			
	SO_2	NOx	CO	TSP	SO_2	NOx	CO	TSP	SO_2	NOx	CO	TSP
1- Old City Center	425	115	2,792	466	41	62	159	27	40	60	154	26
2- Red River Right Bank - NW	156	34	1,049	174	49	28	183	31	57	33	211	36
3- Red River Right Bank - South	152	33	1,025	170	37	21	136	23	42	24	157	27
4- Dong Anh	67	15	453	75	46	27	173	29	99	57	370	63
5- Gia Lam	76	17	515	86	23	13	85	14	48	28	181	31
6- Rural Area	451	99	3,032	504	388	99	2,109	352	430	110	2,340	391
7- Ho Tay	8	2	42	7	11	3	57	10	2	2	6	1
Total Hanoi	**1 335**	**315**	**8 908**	**1 483**	**594**	**254**	**2 902**	**486**	**718**	**315**	**3 419**	**573**

Note: TSP emissions for domestic coal combustion are considered be composed at 100% of PM10.

Table 8.4.4 Reduction of Emission factors for IZ fuel combustion

(Unit: t/y/ha)

	SO_2	NOx	CO	TSP	PM10
Present Emission Factor (t/y/ha) Without Countermeasures	6.33	4.29	1.11	18.38	13.78
Cleaner production and energy conservation (%)	20	20	20	20	20
Fuel switching from coal/oil to gas (energy supply: 60% coal/oil, 40% gas)	40	30	32	39.2	39.2
Dust control for coal combustion (Efficiency: 80% for TSP, 75% for PM10) (energy supply: 60% coal/oil, 40% gas)	--	--	--	78.9	72.9
Overall reduction (%/ha)	52	44	46	89.8	87.4
Future Emission Factor (t/y/ha) With Countermeasures	3.04	2.40	0.60	1.88	1.74

Example for TSP: 18.38 t/y/ha * (1-0.2)*(1-0.392)*(1-78.9) = 1.88 t/y/ha

Table 8.4.5 Estimated atmospheric emissions from industrial fuel combustion for 2010 and 2020 with countermeasures

(units: tons/year)

Year	Area of industrial zones (ha)	SO_2	NOX	CO	TSP	PM10
1997	441.3	2 794	1 893	489	8 111	6 083
2010	1642.7	4 999	3 946	990	3 092	2 862
2020	2537.7	7 722	6 096	1 530	4 776	4 422

Table 8.4.6 Estimated Atmospheric Emissions by Industrial Zone for 2010 and 2020 (fuel only)

Unit: tons/year1997

Industrial Zone	Area (ha)	SO_2	NOX	CO	TSP	PM10
Thuong Dinh	94.3	597	405	104	1,733	1,300
Minh Khai - Vinh Tuy	81	513	347	90	1,489	1,117
Truong Dinh - Hoang Mai	32	203	137	35	588	441
Van Dien - Phap Van	40	253	172	44	735	551
Cau Dien - Mai Dich	27	171	116	30	496	372
Chem	15	95	64	17	276	207
Cau Buou	40	253	172	44	735	551
Duc Giang - Gia Lam -Yen Vien	18	114	77	20	331	248
North Thang Long						
South Thang Long						
Sai Dong A	24	152	103	27	441	331
Sai Dong B						
Dong Anh	70	443	300	78	1,287	965
Soc Son						
Total	**441**	**2,794**	**1,893**	**489**	**8,111**	**6,083**

2010

Industrial Zone	Area (ha)	SO_2	NOX	CO	TSP	PM10
Thuong Dinh	98.2	299	236	59	185	171
Minh Khai - Vinh Tuy	101.5	309	244	61	191	177
Truong Dinh - Hoang Mai	32	97	77	19	60	56
Van Dien - Phap Van	50	152	120	30	94	87
Cau Dien - Mai Dich	77	234	185	46	145	134
Chem	20	61	48	12	38	35
Cau Buou	54	164	130	33	102	94
Duc Giang - Gia Lam -Yen Vien	80	243	192	48	151	139
North Thang Long	220	669	528	133	414	383
South Thang Long	160	487	384	96	301	279
Sai Dong A	80	243	192	48	151	139
Sai Dong B	220	669	528	133	414	383
Dong Anh	280	852	673	169	527	488
Soc Son	210	639	504	127	395	366
Total	**1,683**	**5,121**	**4,042**	**1,014**	**3,167**	**2,932**

2020

Industrial Zone	Area (ha)	SO_2	NOX	CO	TSP	PM10
Thuong Dinh	98.2	299	236	59	185	171
Minh Khai - Vinh Tuy	101.5	309	244	61	191	177
Truong Dinh - Hoang Mai	32	97	77	19	60	56
Van Dien - Phap Van	50	152	120	30	94	87
Cau Dien - Mai Dich	77	234	185	46	145	134
Chem	20	61	48	12	38	35
Cau Buou	54	164	130	33	102	94
Duc Giang - Gia Lam -Yen Vien	80	243	192	48	151	139
North Thang Long	350	1065	841	211	659	610
South Thang Long	270	822	649	163	508	470
Sai Dong A	80	243	192	48	151	139
Sai Dong B	350	1065	841	211	659	610
Dong Anh	545	1658	1,309	329	1,026	950
Soc Son	430	1309	1,033	259	809	749
Total	**2,538**	**7,722**	**6,096**	**1,530**	**4,776**	**4,422**

Table 8.4.7 Summary of running kilometers and fuel consumption estimates

	1997	2010	2020
Population in Hanoi (millions)	**2.48**	**2.82**	**3.51**
Number of trips (10^6/y)	**3,408**	**5,500**	**6,699**
Average trip length by mode (km)			
All modes	**5.47**	**5.78**	**6.34**
Bicycle	2.5	2.0	2.0
Motorcycle	8.0	6.7	6.7
Car	11.0	10.0	10.0
Bus	18.0	11.0	10.0
Truck	15.0	15.0	15.0
Trip share by mode (%)			
Bicycle	57.9	35.0	25.0
Motorcycle	35.0	49.3	53.7
Car	0.8	2.0	3.0
Bus	5.6	12.0	16.0
Truck	0.8	1.7	2.3
Running Kilometers per year (10^6 km/y)	**12,102**	**18,514**	**23,504**
Bicycle	4,698	3,667	3,190
Motorcycle	6,816	12,976	17,216
Car	103	379	693
Bus	144	303	447
Truck	340	1,189	1,959
Total motor vehicles	**7,403**	**14,847**	**20,314**
Estimated fuel consumption (l/y)			
Gasoline	111,591	231,348	326,591
Diesel	123,413	380,220	613,328

Basic fuel consumption (l/100 km)	Motorcycle	2
	Car	14
	Bus	30
	Truck	30

Table 8.4.8 Estimated Running kilometers and Air Emissions from transport sector

Base case - 1997

Transport Mode	Running km (10^6 km/y)	SO2 g/km	SO2 t/y	NOx g/km	NOx t/y	CO g/km	CO t/y	TSP g/km	TSP t/y	PM10 g/km	PM10 t/y
Gasoline vehicles											
Moto	6,816	0.0074	50	0.3	2,045	20	136,320	0.14	954	0.09	611
Car	103	0.052	5	3	310	50.2	5,191	0.30	31	0.19	20
Total gasoline vehicles	6,919		56		2,355		141,511		985		631
Diesel vehicles											
Bus	144	2.5	360	15.7	2,258	7.4	1,064	2.9	417	2.9	417
Truck	340	2.5	850	15.7	5,340	7.4	2,517	2.9	986	2.9	986
Total diesel vehicles	484		1,210		7,598		3,581		1,404		1,404
Total all vehicles	7,403		1,266		9,953		145,093		2,389		2,034
							Road resuspension	2.94	21,766	0.56	4,173
							Total		24,155		6,207

2010 with countermeasures

Transport Mode	Running km (10^6 km/y)	SO2 g/km	SO2 t/y	NOx g/km	NOx t/y	CO g/km	CO t/y	TSP g/km	TSP t/y	PM10 g/km	PM10 t/y
Gasoline vehicles											
Moto	12,976	0.005	65	0.3	3,893	6	77,859	0.05	649	0.03	415
Car	379	0.002	1	3	1,138	5	1,897	0.05	19	0.03	12
Total gasoline vehicles	13,356		65		5,031		79,755		668		427
Diesel vehicles											
Bus	303	0.25	76	10	3,025	5	1,513	1	303	1.0	303
Truck	1,189	0.25	297	10	11,886	5	5,943	1	1,189	1.0	1,189
Total diesel vehicles	1,491		373		14,911		7,455		1,491		1,491
Total all vehicles	14,847		438		19,941		87,211		2,159		1,918
							Road resuspension	0.74	10,987	0.14	2,106
							Total		13,146		4,025

2020 with countermeasures

Transport Mode	Running km (10^6 km/y)	SO2 g/km	SO2 t/y	NOx g/km	NOx t/y	CO g/km	CO t/y	TSP g/km	TSP t/y	PM10 g/km	PM10 t/y
Gasoline vehicles											
Moto	17,216	0.005	86	0.3	5,165	6	103,296	0.05	861	0.03	551
Car	693	0.002	1	3	2,079	5	3,465	0.05	35	0.03	22
Total gasoline vehicles	17,909		87		7,244		106,761		895		573
Diesel vehicles											
Bus	447	0.25	112	10	4,466	5	2,233	1	447	1.0	447
Truck	1,959	0.25	490	10	19,586	5	9,793	1	1,959	1.0	1,959
Total diesel vehicles	2,405		601		24,052		12,026		2,405		2,405
Total all vehicles	20,314		688		31,296		118,787		3,301		2,978
							Road resuspension	0.74	15,032	0.14	2,882
							Total		18,333		5,860

Table 8.4.9 Estimated air pollutant emissions (t/y) by sector of activity in Hanoi for 2010 and 2020

Units: tons/year

Base case : 1997

Sector of Activity	SO_2	NOx	CO	TSP	PM10
Industry(fuel combustion only)	2 794	1 893	489	8 111	6 083
Industry(process)*	--	--	--	82 000	16 400
Transport	1 266	9 953	145 093	2 389	2 034
Road dust resuspension	--	--	--	21 766	4 173
Domestic (fuel combustion)	1 335	315	8 908	1 483	1 483
Total	5 395	12 162	154 490	115 749	30 173

With countermeasures: 2010

Sector of Activity	SO_2	NOx	CO	TSP	PM10
Industry(fuel combustion only)	4,999	3,946	990	3,092	2,862
Industry(process)*	--	--	--	16,400	13,120
Transport	438	19,941	87,211	2,159	1,918
Road dust resuspension	--	--	--	10,987	2,106
Domestic (fuel combustion)	585	253	2851	478	478
Total	6,022	24,140	91,052	33,115	20,484

With countermeasures: 2020

Sector of Activity	SO_2	NOx	CO	TSP	PM10
Industry(fuel combustion only)	7,722	6,096	1,530	4,776	4,422
Industry(process)*	--	--	--	16,400	13120
Transport	688	31,296	118,787	3,301	2,978
Road dust resuspension	--	--	--	15,032	2,882
Domestic (fuel combustion)	718	315	3,419	573	573
Total	9,129	37,707	123,736	40,083	23,975

Note : * from the estimated TSP emssions for 1995 for tile and brick manufacturing cited in "Report on the Current Condition of Air Environment in Hanoi City" (in Vietnamese), Center for Environmental Technology Consultancy, July 1998.

Table 8.4.10 Maximum calculated air pollutant concentrations in ambient air

2010 with countermeasures Units: mg/m³

Air Contaminant	Averaging Period			
	1 hour	8 hours	24 hours	1 year
CO	3.8	1.4	--	--
	below standard	below standard	--	--
NO_2	0.348	--	0.092	--
	below standard	--	below standard	--
SO_2	0.264	--	0.061	0.021
	below standard	--	below standard	below standard
TSP	--	--	0.152	0.100 - Central
	--	--	below standard	above standard
PM10	--	--	0.050	0.023
	--	--	below standard	below standard
Lead	--	--	--	0
	--	--	--	below standard

2020 with countermeasures Units: mg/m³

Air Contaminant	Averaging Period			
	1 hour	8 hours	24 hours	1 year
CO	4.2	1.6	--	--
	below standard	below standard	--	--
NO_2	0.447 - Central	--	0.116 - Central	--
	above standard	--	above standard	--
SO_2	0.365	--	0.089	0.032
	below standard	--	below standard	below standard
TSP	--	--	0.170	0.106 - Central
	--		below standard	above standard
PM10	--	--	0.060	0.030
	--	--	below standard	below standard
Lead	--	--	--	0
	--	--	--	below standard

Notes: (1) IZ: in or near industrial zone in urban area; Central: in urban area

(2) These results are the maximum calculated values over the whole study area for a one year period. All these maximums occurs in the urban area of Hanoi or in the proximity of a IZ.

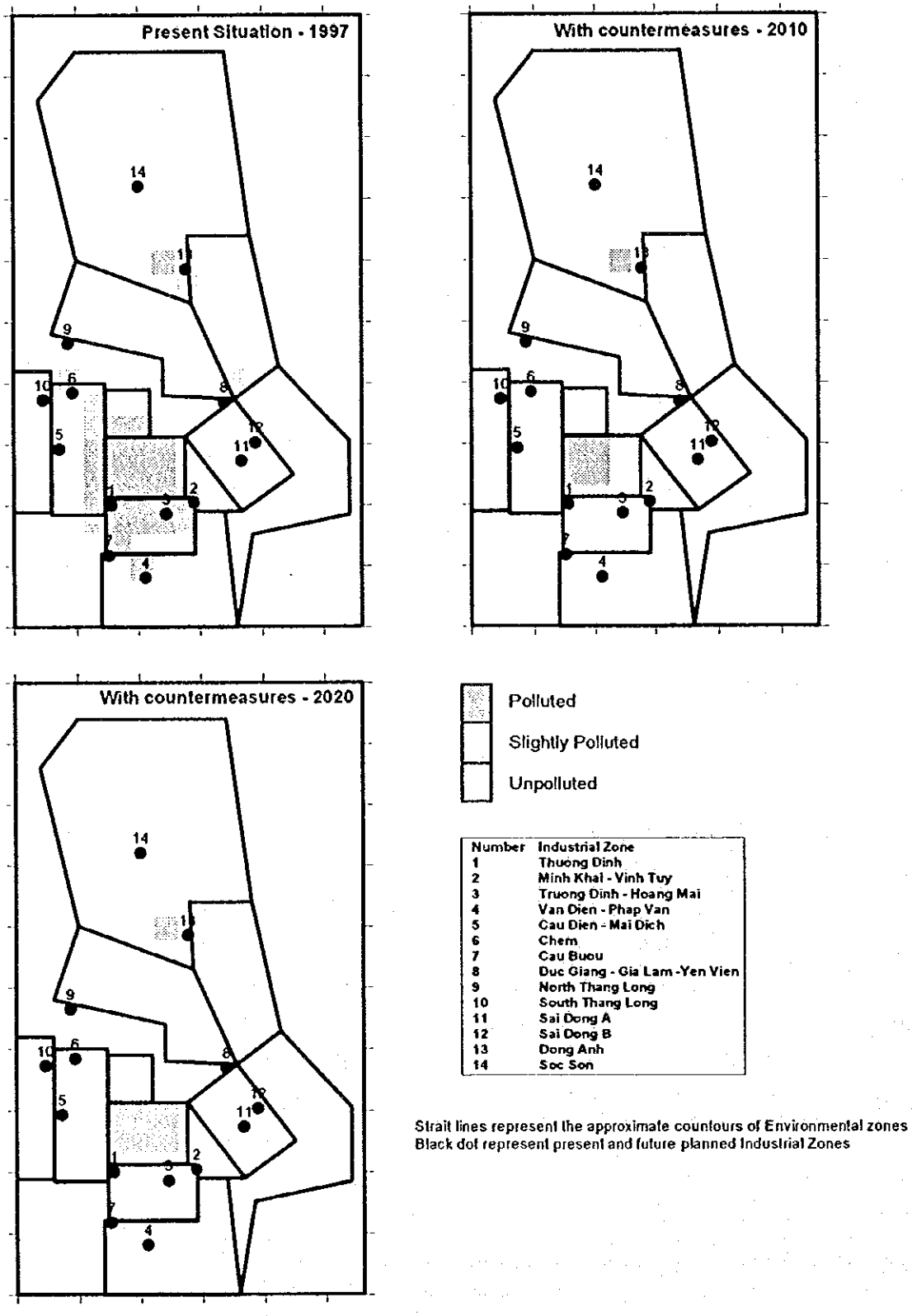

Figure 8.4.1 Air Pollution Maps (TSP) - Present, 2010 and 2020 with Counter-measures

8.5 Expected Cleanliness of the City in the Future

The main measures proposed by Study Team are

- Increases in capacity and efficiency of waste collection and transport by a) development of waste transfer system, b) replacement of old equipment and construction of garages, and c) changing to direct collection with trucks,
- application of sanitary landfill at disposal site

Situation Anticipated without the Measures for the Increases in Capacity and Efficiency of Waste Collection and Transport

- If HPC implements the proposed measures a) and b) above,
- HPC will have a capacity to collect and transport solid waste of planned amount to Nam Son landfill site.
- With the introduction of a transfer station in Dong Ngac, the overall cost of transport from collection areas to Nam Son landfill site will be halved than the case without the transfer system.
- With the implementation of renewal of equipment and construction of garages, HPC will be able to provide more reliable services of waste collection and transport, and long term costs of operation and maintenance will reduce.
- If HPC implement the above measure c) (a shift from the existing double handling system to a single handling system),
- unit cost of waste collection and transport from the city center to future Dong Ngac transfer station will be reduced by about one third.
- The above cost saving or reduction will enable HPC to strengthen waste collection capacity in terms of both quantity and quality.
- As result of the above situation, solid waste collection service coverage within the urban districts will increase to 95 % by the year 2007 from the current 77% in 1999.

Situation Expected with Application of the Proposed Sanitary Landfill

HPC and citizens will enjoy the following benefits:

- Environmental pollution in connection with operation of landfill will be minimized. The existing open dumping practice leads to generating fire, smoke, bad odor, scattered waste and leachate that would contaminate both surface and ground water. Application of the proposed sanitary landfill will substantially reduce such pollution. As result, risks of contaminating drinking water sources of Hanoi will reduce.
- HPC's landfill sites will become more acceptable to local residents living nearby the landfill sites, which will then make it smoother and easier for HPC to acquire land for future landfill sites.

8.6 Evaluation of Noise and Vibration Levels in the Future

As a result of the estimated noise and vibration levels for 2010 and 2020 in the absence of any counter-measures conducted by the JICA Study Team, it is clear that currently noise and vibration pollution is rather serious in the urban area of Hanoi City. To attain a quiet environment in the near future, counter-measures such as the establishment of an improved traffic control system and the improvement of infrastructure are required immediately in Hanoi City.

Education of drivers to have less selfish manners are a most important means of reducing noise and vibration pollution on the roads. Some of the drivers and owners of factories and commercial facilities may not think it is a form of environmental pollution to generate much noise and vibration.

It is key to let the citizens of Hanoi City be aware of the current noise and vibration problems as well as the actual introduction of the regulations and infrastructure. By conducting the many kinds of counter-measures proposed by the JICA Study Team, including enlightening of the people, acomplete achievement of a quiet environment can be obtained in all environmental zones by the year of 2010.

8.7 Evaluation of Co-existing with Nature and Amenity in the Future

With many kinds of countermeasures proposed by the JICA Study Team, level of coexisting with nature and amenity can be improved by the year of 2020 as shown in the table below, while remarkable changes will not be seen in the areas of Red River Right Bank Northwest, Red River Right Bank South and Gia Lam urban area.

Old City Center will be the town with rich natural environment and amenity facilities that are prepared well according to the master plan on condition that appropriate countermeasures are taken. In Ho Tay Area and Dong Anh urban area, there is much space for improving natural environment and expected to reach the level of satisfaction.

Level of Co-existing with Nature and Amenity at Present, 2010 and 2020 with Counter-measures

Environmental Zones	Present	2010	2020
1. Old City Center	B	A	A
2. Red River Right Bank Northwest	B	B	B
3. Red River Right Bank South	B	B	B
4. Dong Anh urban area	B	B	A
5. Gia Lam urban area	B	B	B
6. Suburban Area	A	A	A
7. Ho Tay Area	B	A	A

Note: A: Fully satisfied, B: Partially satisfied, C: Not satisfied

8.8 Evaluation of Preserving Cultural and Historical Assets in the Future

The level of the preservation of cultural and historical assets are considered to be rather good before 2010 as shown in the table by taking countermeasures proposed by the JICA Study Team together with the regulations and projects, which are operated by HPC side for preserving assets.

HPC has set the regulation to preserve the Ancient Quarter, which are in the zone of Old City Center, and Steering Committee for Thang Long 1000 Project, which consists of 36 projects aiming at the charity donation, restoration and reformation of cultural and historical vestiges in the area of Hanoi City including the construction of the museums.

The attitude of HPC toward the preservation of the assets is pretty active and agreeable. It will be still more preferable if the reuse of the buildings of French colony era are taken into consideration in the regulation and Thang Long 1000 Project.

Level of Preserving Cultural and Historical Assetsat Present, 2010 and 2020 with Counter-measures

Environmental Zones	Present	2010	2020
1, Old City Center	B	A	A
2, Red River Right Bank North- West	-	-	-
3, Red River Right Bank South	-	-	-
4, Dong Anh urban area	-	-	-
5, Gia Lam urban area	-	-	-
6, Suburban Area	-	-	-
7, Ho Tay Area	B	A	A

Note: A: Fully satisfied, B: Partially satisfied, C: Not satisfied

Chapter 9 Financial Requirement and Affordability of EMP

9.1 Implementation and Financial Requirement of EMP

(1) Overall Requirement

The overall financial requirement for the implementation of EMP for environmental management and environment-related services, is shown in Table 9.1.2 and summarized below.

Capital and Recurrent Costs for EMP

Unit: US$ 1,000

	2000 - 2010	2011 – 2020	Total
Projects for Sanitary Water			
- Capital Cost	335,626	59,411	395,037
- Recurrent	2,913	14,091	17,004
Projects for Clean Water			
- Capital Cost	275,577	396,921	672,498
- Recurrent	17,403	45146	62,589
Projects for Sanitary Water & Sanitary Water (Reform of HSDC)			
- Capital Cost	4,415	1,310	5,725
- Recurrent	5,816	9,355	15,171
Projects for Clean City			
- Capital Cost	85,020	49,105	134,125
- Recurrent	38,158	97,283	135,441
Sub-Total			
- Capital Cost	700,638	506,747	1,207,385
- Recurrent	64,290	165,915	230,205
Projects for Institutional	9,172	7,682	16,855
Grand Total	774,100	680,345	1,454,445

As shown above, US$1,454 million would be required in total for the implementation of the recommended projects and measures for EMP for the period of 21 years from 2000 through 2020, which comprises the capital cost of about US$1,207 million and about US$247 million for institutional project and incremental recurrent costs including O&M and personnel costs.

(2) Implementation Schedule and Financial Requirement for the Urgent and Priority Projects

Among the recommended projects, preparatory works should be started as soon as possible for the urgent project and construction should be commenced in 2002 to be completed around the beginning of 2004, aiming at receiving the solid wastes after the finish of the preceding landfill capacity. Construction schedules of the structural type priority projects are set considering;

a) Urgency of the projects
b) Continuation of the on-going previous stages/phases
c) Time required for pre-construction works including financing and design works

Accordingly, all the recommended priority projects of structural type will be started before 2005 and completed in 2010 at the latest.

Implementation schedule of the urgent and priority projects of structural type is shown in Figure 7.2.1 of Chapter 7. Total initial investment cost will amount to about US$514 million as summarized below.

Initial Investment Cost

(US$1,000)

Urgent/Priority Projects	Period	Investment Cost
Nam Son Landfill/Transfer System	2002-2005	45,848
To Lich River Drainage Project, Stage 2	2002-2006	153,941
Public Sewerage for Old City Center	2002-2010	219,039
West Lake Water Quality Improvement	2000-2003	36,421
Main City Lakes Improvement	2002-2005	10,258
Primary Waste Collection	2000-2010	32,980
Septage Collection & Disposal	2000-2010	16,000
Total		514,487

Considering the urgent need, reinforcement of the Hanoi DOSTE should be started from 2000, in particular the upgrading of the Environmental Management Division of Hanoi DOSTE to and agency under DOSTE. In order to upgrade the current activities as well as to prepare for the development of the new facility recommended in EMP, institutional and organizational type priority projects are recommended to be started in 2000.

9.2 Affordability of Implementation

In the reality, capital costs will be financed through various fund sources including general revenue of HPC and the Government, international financial organizations, bilateral official development aid, etc. Financing costs varies according to the sources. Specific fund sources and their conditions are yet to be known at this moment. Considering the characteristics of the EMP projects as well as the fund sources in the past and possible international finance assistance in the future, in this JICA Study, the total cost is capitalized, assuming 25 year repayment period with 5 % interest rate.

Affordability of EMP costs or its implementability was checked by the capitalized cost of EMP added with all the recurrent costs including the current as shown in Table 9.1.2, against the total revenue of HPC and GRP of the city. It is assumed that HPC revenue grows at the same rate as that for GRP.

Two cases of economic growth are assumed, i.e, high assuming 15% of annual growth and low case assuming 7.5%.

Range of Ratios of EMP Costs to Total Public Revenue and GRP

	2010	2020
Environmental Cost		
- Amortized capital cost + Recurrent cost (US$ million)	76.5	118.4
High Case		
- HPC revenue (US$ million)	1,089	4,406
- GRP (US$ million)	8,025	32,481
- Ratio to HPC revenue (%)	7.0	2.7
- Ratio to GRP (%)	1.0	0.4
Low Case		
- HPC revenue (US$ million)	453	935
- GRP (US$ million)	3,341	6,887
- Ratio to HPC revenue (%)	16.9	12.7
- Ratio to GRP (%)	2.3	1.7

In the case of High Case, the ratios are considered in the reasonable range. In the Low Case, the ratios become much higher but are considered to be within the acceptable range. By these analysis, EMP is judged to be affordable and therefore financially implementable.

9.3 Fund Raising for the Implementation of EMP

Though all the projects and measures recommended for EMP should serve for the common purpose of the preservation and improvement of the environment, their characteristic varies according to the project. Namely, some would serve for the city population as a whole, others serve for particular population. Some projects would necessitate large outlay of capital while some need small budget for implementation. Some projects need big capital cost but small O&M cost while some need relatively small outlay but big annual O&M. Though EMP should serve for the city of Hanoi, Hanoi being the capital of the country and its environmental improvement might serve for the State's interest by upgrading the image and impression of the country.

Characteristics of the recommended projects are shown below.

Purpose/Sector Whole City Particular Beneficiaries

Purpose/Sector	Whole City	Particular Beneficiaries
Sanitary Water		
- Drainage	B	B
Clean Water		
- Public sewerage	B	A
- Lake conservation	B	A
Clean City		
- Solid waste management	B	A
Institutional & Organizational		
- Environmental management	A	C
- Service providers	C	A

Remarks: A Strong relevance, B Limited relevance, C Not relevant

Funding facility conceivable comprise the following.

a) Hanoi City budget
b) Government budget
c) Own fund of the companies or service providers
d) Concessionary term loans by Official Development Aids (ODA) or international financing organizations
e) Grants by ODA

Considering the project characteristics, the following application of funding can be conceivable.

Fund Sources

Fund Sources	Drainage	Sewerage	Lake	SWM	EM
Hanoi City budget	A	A	A	A	A
Government budget	B	C	C	C	C
Own funds	C	B	C	A	C
Concessionary loans	A	A	A	A	C
Grants by ODA	C	C	C	A	C

Remarks: A Strong relevance/possibility, B Limited relevance/possibility, C No relevance/possibility

It should be noted that concessionary loans are extended through the Government or Hanoi City and are components of the budgets.

Table 9.1.1 Summary of Annual Investment and Operating Costs of EMP (Unit: US$ 1,000)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	subtotal	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	subtotal	Total
Sanitary Water																								
1) To Lech Kwei Basin Drainage Project																								
2nd stage project												155,941												155,941
Capital cost			11,452	23,856	54,908	44,658	19,067					153,941												153,941
Recurring costs								578	578	578	578	2,312	578	578	578	578	578	578	578	578	578	578	5,780	8,092
2) Nhue Kwe Basin Drainage Project																								
Capital cost	-	-	-	6,857	5,953	22,126	32,790	29,463	27,952	22,049	20,692	166,821	18,066	5,685	6,222	6,395	5,475	-	-	-	-	-	41,860	208,681
Recurring costs	-	-	-	-	-	-	-	-	-	273	273	546	273	612	612	612	612	792	792	792	792	792	6,564	6,912
3) Cay Lake Conservation																								
Capital cost	-	-	627	3,205	3,447	2,900	-	-	300	710	3,515	14,864	5,715	2,965	2,965	2,965	2,961	-	-	-	-	-	17,571	32,435
Recurring costs	-	-	-	-	-	-	11	11	11	11	11	55	11	11	11	11	11	378	378	378	378	378	1,945	2,000
Subtotal capital cost	-	-	12,079	33,998	64,308	69,684	51,797	29,463	28,552	22,759	24,207	335,626	23,781	8,650	9,187	9,357	8,436	-	-	-	-	-	59,431	395,057
Subtotal recurring costs	-	-	-	-	-	-	11	589	589	862	862	2,913	862	1,201	1,201	1,201	1,201	1,685	1,685	1,685	1,685	1,685	14,091	17,004
Clean Water																								
1) Lake Conservation																								
West Lake ph2												36,421												36,421
Capital cost	2,529	13,198	15,847	4,847								1,862	266	266	266	266	266	266	266	266	266	266	2,660	4,522
Recurring costs					266	266	266	266	266	266	266													
2) Public Sewerage																								
Capital cost	-	-	3,667	22,471	27,029	28,126	32,391	53,502	35,454	11,439	8,979	223,156	3504	26,568	31,953	27,151	32,046	34,791	46,460	55,894	74,847	62,445	395,675	618,829
Recurring costs	-	-	-	-	-	-	1,024	1,024	1,024	1,700	1,700	6,472	2994	2,994	2,994	2,994	2,994	4,082	4,082	4,082	4,994	5,145	37,305	43,777
3) Septage Collection and Disposal																								
Capital cost	5,529	1,181	4,635	1,041		324		162	2,966		162	16,000		400	349		162	162				175	1,248	17,248
Recurring costs	517	651	791	868	868	911	949	981	968	819	786	9,069	854	781	748	706	621	524	410	323	224	48	5,221	14,290
Subtotal capital cost	8,058	14,379	26,149	28,359	27,029	28,449	32,391	53,664	38,420	11,439	9,041	275,577	3,504	26,968	32,302	27,151	32,246	34,953	46,460	55,894	74,847	62,620	396,923	672,498
Subtotal recurring costs	517	651	791	868	1,134	1,177	2,239	2,271	2,238	2,785	2,752	17,603	4,084	4,033	3,996	3,956	3,871	4,872	4,758	4,671	5,484	5,459	48,186	62,889
Sanitary Water & Clean Water																								
1) Reform HSDC																								
Capital cost	1,050	-	-	-	-	890	580	80	330	0	1485	4,415	0	230	500	0	100	0	0	430	0	50	1,310	5,725
Recurring costs	378	378	378	378	378	478	614	620	710	710	794	5,816	809	809	809	880	968	973	973	1033	1033	1068	9,355	15,171
Subtotal capital cost	1,050	-	-	-	-	890	580	80	330	-	1,485	4,415	0	230	500	0	100	0	0	430	0	50	1,310	5,725
Subtotal recurring costs	378	378	378	378	378	478	614	620	710	710	794	5,816	809	809	809	880	968	973	973	1,033	1,033	1,068	9,355	15,171
Clean City																								
1) Experimental O&M Cost	0	30	103	641	1,222	1,850	2,528	3,067	3,492	3,963	4,477	21,372	4,861	5,258	5,692	6,161	6,607	7,090	7,591	8,110	8,648	9,205	69,204	90,576
2) Urgent Project																								
Capital Cost	-	-	4,706	30,266	4,706	7,147	681	1,947	590	250	1,947	52,040	200	200	4,027	5,336	501	2,996	992	601	801	300	15,955	67,995
Recurring Cost	-	-	-	-	1,952	2,069	2,342	2,461	2,551	2,650	2,762	16,784	2,799	2,880	2,965	3,050	3,171	3,226	3,222	2,237	2,375	2,627	28,079	44,865
3) Poverty Project																								
Capital Cost	3,420	4,802	4,809	2,960	4,819	2,570	1,520	1,520	1,230	880	4,470	32,980	4,100	4,120	3,770	3,700	3,410	2,500	2,420	2,350	1,790	5,590	33,760	66,740
Subtotal capital cost	3,420	4,802	9,515	33,226	9,525	9,717	2,201	3,467	1,820	1,130	6,417	85,020	4,300	4,320	7,797	9,036	3,911	4,896	3,412	2,951	2,591	5,890	49,105	134,125
Subtotal recurring cost	0	30	103	641	3,174	3,919	4,869	5,528	6,042	6,613	7,239	38,158	7,660	8,138	8,657	9,221	9,778	10,316	10,815	10,347	10,822	11,432	97,285	135,443
Total capital cost	12,528	19,261	45,743	95,483	101,042	108,759	86,969	85,674	68,902	35,327	41,050	700,638	31,585	40,144	49,786	45,544	44,693	39,851	49,872	59,275	77,438	68,560	506,747	1,207,385
Total recurring costs	895	1,059	1,272	1,887	4,686	5,594	7,755	9,068	9,579	10,970	11,647	64,290	13,415	14,181	14,665	15,258	15,818	17,866	18,329	17,736	19,024	19,444	165,918	230,205

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	subtotal	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	subtotal	Total
1. DOSTE																								
Cost	113	113	113	113	113	113	120	120	120	120	120	1,275	170	170	170	170	170	170	170	170	170	170	1,698	2,973
2. District Level																								
Cost	70	70	70	70	70	70	110	110	110	110	110	970	103	103	103	103	103	103	103	103	103	103	1,028	1,997
3. ECC																								
Cost	107	107	107	107	107	107	107	107	107	107	107	1,175	107	107	107	107	107	107	107	107	107	107	1,068	2,243
4. Env. Monitoring																								
Cost	94	94	94	94	94	94	482	482	482	482	482	2,978	323	323	323	323	323	323	323	323	323	323	3,227	6,205
5. Environmental Fund																								
Cost	47	2,047	47	47	47	47	47	47	47	47	47	2,513	47	47	47	47	47	47	47	47	47	47	466	2,979
6. HAPI																								
Cost	10	10	10	10	10	10	9	9	9	9	9	107	10	10	10	10	10	10	10	10	10	10	99	205
7. HCAO																								
Cost	18	18	18	18	18	18	10	10	10	10	10	157	10	10	10	10	10	10	10	10	10	10	100	257
TOTAL CONT	458	2,458	458	458	458	458	885	885	885	885	885	9,172	768	768	768	768	768	768	768	768	768	768	7,682	16,854
Grand Total	13,881	22,778	47,452	97,827	106,206	114,791	95,588	94,468	79,366	47,182	53,585	774,100	45,768	55,094	65,219	61,570	61,279	58,663	68,969	77,779	97,230	88,973	680,545	1,454,645

Table 9.1.2 Overall Annual Investment and Operating Costs of EMP (1/2)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	sub-total	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	sub-total	Total
Sanitary Condition																								
1) To Lich River Basin Drainage Project																								
1st stage project																								
Capital cost	47,851	27,178	4,442									79,471											-	79,471
Recurring costs				859	859	859	859	859	859	859	859	6,872	859	859	859	859	859	859	859	859	859	859	8,590	15,462
2nd stage project																								
Capital cost			11,452	23,856	54,908	44,658	19,067					153,941												153,941
Recurring costs								578	578	578	578	2,312	578	578	578	578	578	578	578	578	578	578	5,780	8,092
Sub-total capital cost	47,851	27,178	15,894	23,856	54,908	44,658	19,067	-	-	-	-	233,412	-	-	-	-	-	-	-	-	-	-	-	233,412
Sub-total recurring costs	-	-	-	859	859	859	859	1,437	1,437	1,437	1,437	9,184	1,437	1,437	1,437	1,437	1,437	1,437	1,437	1,437	1,437	1,437	14,370	23,554
2) Nhue River Basin Drainage Project																								
Co Nhue Basin																								
Capital cost				6,857	5,953	22,126	23,623	21,057	7,424			87,040												87,040
Recurring costs										273	273	546	273	273	273	273	273	273	273	273	273	273	2,730	3,276
My Dinh Basin																								
Capital cost							3,665	2,523	8,848	9,578	8,870	33,485	7,864										7,864	41,349
Recurring costs														159	159	159	159	159	159	159	159	159	1,431	1,431
Me Tri Basin																								
Capital cost							5,441	4,893	11,680	12,470	10,430	44,904	9,147										9,147	54,051
Recurring costs														180	180	180	180	180	180	180	180	180	1,620	1,620
Ba Xa Basin																								
Capital cost											1,392	1,392	1,055	5,685	6,222	6,392	5,475						24,829	26,221
Recurring costs																		117	117	117	117	117	585	585
Sub-total capital cost	-	-	-	6,857	5,953	22,126	32,730	28,363	27,952	22,048	20,692	166,821	18,066	5,685	6,222	6,392	5,475	-	-	-	-	-	41,840	208,661
Sub-total recurring costs	-	-	-	-	-	-	-	-	-	273	273	546	273	612	612	612	612	729	729	729	729	729	6,366	6,912
3) City Lake Conservation																								
Main City lakes																								
Capital cost			627	3,285	3,447	2,900						10,259												10,259
Recurring costs							11	11	11	11	11	55	11	11	11	11	11	11	11	11	11	11	110	165
Other City lakes																								
Capital cost									380	710	3,515	4,605	5,715	2965	2,965	2965	2,961						17,571	22,176
Recurring costs																		367	367	367	367	367	1,835	1,835
Sub-total capital cost	-	-	627	3,285	3,447	2,900	-	-	380	710	3,515	14,864	5,715	2,965	2,965	2,965	2,961	-	-	-	-	-	17,571	32,435
Sub-total recurring costs	-	-	-	-	-	-	11	11	11	11	11	55	11	11	11	11	11	378	378	378	378	378	1,945	2,000
Sub-total capital cost	47,851	27,178	16,521	33,998	64,308	69,684	51,797	28,463	28,332	22,758	24,207	415,097	23,781	8,650	9,187	9,357	8,436	-	-	-	-	-	59,411	474,508
Sub-total recurring costs	-	-	-	859	859	859	870	1,448	1,448	1,721	1,721	9,785	1,721	2,060	2,060	2,060	2,060	2,544	2,544	2,544	2,544	2,544	22,681	32,466
Clean Water																								
1) Lake Conservation																								
West Lake ph2																								
Capital cost	2,529	13,198	15,847	4,847								36,421												36,421
Recurring costs					266	266	266	266	266	266	266	1,862	266	266	266	266	266	266	266	266	266	266	2,660	4,522
2) Public Sewerage																								
Zone 2-1																								
Capital cost			3,667	22,471	25,742	17,448						69,328												69,328
Recurring costs							1,024	1,024	1,024	1,024	1,024	5,120	1024	1,024	1,024	1,024	1,024	1,024	1,024	1,024	1,024	1,024	10,240	15,360
Zone 4																								
Capital cost					1,487	7,767	21,122	16,714	2,683			49,773												49,773
Recurring costs										676	676	1,352	676	676	676	676	676	676	676	676	676	676	6,760	8,112
Zone 3																								
Capital cost						2,909	11,269	36,788	32,771	10,272	5,929	99,938												99,938
Recurring costs													1284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	1,284	13,840	13,840
Zone 2-2																								
Capital cost											1,783	1,783	2472	13,413	16,795	12,874	5,044						50,598	52,381
Recurring costs																		580	580	580	580	580	2,900	2,900
Zone 6-1																								
Capital cost										1,167	1,167	2,334	1,032	10,572	12,599	9,091	3,059						36,353	38,687
Recurring costs																		518	518	518	518	518	2,590	2,590
Zone 5																								
Capital cost														2,559	2,559	2,901	21,696	27,034	21,169	8,239			86,157	86,157
Recurring costs																					912	912	1,824	1,824
Zone 6-2																								
Capital cost																2,285	2,285	1,803	18,403	24,084	19,092	7,484	75,346	75,346
Recurring costs																								
Zone GT 1																								
Capital cost																		5,023	6,260	15,599	52,911	52,455	132,248	132,248
Recurring costs																								
Zone GT 2																								
Capital cost																		931	628	2,972	2,934		12,465	12,465
Recurring costs																						151	151	151
Zone DT 1																								
Capital cost																								
Recurring costs																						1,199	1,199	1,199
Zone DT 2																								
Capital cost																								
Recurring costs																						1,307	1,307	1,307
Sub-total capital cost	-	-	3,667	22,471	27,229	28,124	32,391	53,502	35,454	11,439	8,879	223,156	3504	26,544	31,953	27,151	32,084	34,791	46,460	55,894	74,847	62,445	395,673	618,829
Sub-total recurring costs	-	-	-	-	-	-	1,024	1,024	1,024	1,700	1,700	6,472	2984	2,984	2,984	2,984	2,984	4,082	4,082	4,082	4,994	5,145	37,305	43,777
3) Septage Collection and Disposal																								
Capital cost	5,529	1,181	4,635	1,041		324		162	2,966		162	16,000		400	349		162	162				175	1,248	17,248
Recurring costs	517	651	751	868	868	931	949	981	948	819	786	9,069	834	783	748	705	621	524	410	323	224	48	5,221	14,290
Sub-total capital cost	8,058	14,379	24,149	28,359	27,229	28,448	32,391	53,664	38,420	11,439	9,041	273,577	3,504	26,944	32,302	27,151	32,246	34,953	46,460	55,894	74,847	62,620	396,921	672,498
Sub-total recurring costs	517	651	751	868	1,134	1,197	2,239	2,271	2,238	2,785	2,752	17,403	4,084	4,033	3,998	3,955	3,871	4,872	4,758	4,671	5,484	5,459	45,186	62,589
Sanitary Water & Clean Water																								
1) Base Line Recurring Cost	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	11,550	1,050.0	1,050.0	1,050.0	1,050.0	1,050.0	1,050.0	1,050.0	1,050.0	1,050.0	1,050.0	10,500	22,050
2) Reform HSDC																								
Drainage																								
Capital cost	750					250	150	80	80		755	2,065		150	350		50			300			650	2,715
Recurring costs	277	277	277	277	277	277	287	293	299	299	299	3,139	299	299	299	296	300	300	300	300	300	300	2,993	6,131
Sewerage																								
Capital cost	300					640	430		250		730	2,350		80	350		50			130		50	660	3,010
Recurring costs	101	101	101	101	101	201	327	327	411	411	495	2,677	510	510	510	584	668	673	673	733	733	768	6,362	9,039
Sub-total capital cost	1,050	-	-	-	-	890	580	80	330	-	-	1,485	4,415	0	230	500	0	100	0	0	430	0	50	1,310	5,725
Sub-total recurring costs	1,428	1,428	1,428	1,428	1,428	1,528	1,664	1,670	1,760	1,760	1,844	17,366	1,859	1,859	1,859	1,930	2,018	2,023	2,023	2,083	2,083	2,118	19,855	37,221
Clean City																								
1) Exporsated O&M Cost	6,625	6,655	6,728	7,266	7,847	8,475	9,153	9,692	10,117	10,588	11,102	94,247	11,486	11,883	12,317	12,766	13,232	13,715	14,216	14,735	15,273	15,830	135,454	229,701
2) Urgent Project																								
Capital Cost	-	-	4,706	30,266	4,706	7,147	681	1,847	590	250	1,847	52,040	209	200	4,027	5,336	501	2,398	982	601	801	300	15,345	67,385
Recurrent Cost	-	-	-	-	1,952	2,069	2,342	2,461	2,551	2,650	2,762	16,786	2,799	2,880	2,965	3,080	3,178	3,224	3,322	2,237	2,175	2,227	28,079	44,865
3) Priority Project																								
Capital Cost	3,420	4,882	4,809	2,860	4,819	2,570	1,520	1,520	1,230	880	4,470	32,980	4,100	4,120	3,770	3,700	3,410	2,500	2,430	2,350	1,799	5,590	33,760	66,740
Sub-total capital cost	3,420	4,882	9,515	33,126	9,525	9,717	2,201	3,367	1,820	1,130	6,317	85,020	4,309	4,320	7,797	9,036	3,911	4,898	3,412	2,951	2,591	5,890	49,105	134,125
Sub-total recurring costs	6,625	6,655	6,728	7,266	9,799	10,544	11,494	12,153	12,667	13,238	13,864	111,033	14,285	14,763	15,282	15,846	16,409	16,939	17,538	16,972	17,447	18,057	163,533	274,566
Total capital cost	60,379	46,439	50,185	95,483	101,062	108,739	86,969	85,574	68,902	35,327	41,050	780,109	31,585	40,144	49,786	45,544	44,693	39,851	49,872	59,275	77,438	68,560	506,747	1,286,856
Total recurring costs	8,570	8,734	8,907	10,431	13,220	14,128	16,267	17,541	18,133	19,504	20,181	155,587	21,949	22,715	23,199	23,792	24,552	26,378	26,863	26,270	27,558	28,178	251,255	406,842

Table 9.1.2 Overall Annual Investment and Operating Costs of EMP (2/2)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	sub-total	Total
1. DOSTE												-												
1.1 Capital	8	8	8	8	8	8	4	4	4	4	4	70	6	6	6	6	6	6	6	6	6	6	60	130
1.2 Recurrent												-												
Existing Budget	10	10	10	10	10	10	10	10	10	10	10	110	10	10	10	10	10	10	10	10	10	10	100	210
New Recurrent	104	104	104	104	104	104	115	116	116	116	116	1,205	164	164	164	164	164	164	164	164	164	164	1,638	2,843
Total Recurrent	114	114	114	114	114	114	126	126	126	126	126	1,315	174	174	174	174	174	174	174	174	174	174	1,738	3,053
2. District Level												-												
2.1 Capital	7	7	7	7	7	7	10	10	10	10	10	90	6	6	6	6	6	6	6	6	6	6	60	150
2.2 Recurrent	63	63	63	63	63	63	100	100	100	100	100	880	97	97	97	97	97	97	97	97	97	97	968	1,847
3. ECC												-												
3.1 Capital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3.2 Recurrent	107	107	107	107	107	107	107	107	107	107	107	1,175	107	107	107	107	107	107	107	107	107	107	1,068	2,243
4. Env. Monitoring												-												
4.1 Capital	38	38	38	38	38	38	384	384	384	384	384	2,348	224	224	224	224	224	224	224	224	224	224	2,241	4,589
4.2 Recurrent	56	56	55	56	56	56	99	99	99	99	99	827	99	99	99	99	99	99	99	99	99	99	986	1,813
5. Environmental Fund												-												
5.1 Capital	-	2,000	-	-	-	-	-	-	-	-	-	2,000	-	-	-	-	-	-	-	-	-	-	-	2,000
5.2 Recurrent	47	47	47	47	47	47	47	47	47	47	47	513	47	47	47	47	47	47	47	47	47	47	466	979
6. HAPI												-												
6.1 Capital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6.2 Recurrent	10	10	10	10	10	10	9	9	9	9	9	107	10	10	10	10	10	10	10	10	10	10	96	203
7. HCAO												-												
7.1 Capital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7.2 Recurrent	18	18	18	18	18	18	10	10	10	10	10	157	10	10	10	10	10	10	10	10	10	10	100	257
TOTAL CAPITAL	53	2,053	53	53	53	53	398	398	398	398	398	4,508	236	236	236	236	236	236	236	236	236	236	2,361	6,869
TOTAL RECURRENT	404	414	414	414	414	414	498	498	498	498	498	4,954	542	542	542	542	542	542	542	542	542	542	5,421	10,586

TOTAL CAPITAL	60,432	48,492	50,238	95,536	101,115	108,793	87,367	85,972	69,299	35,725	41,448	784,417	31,821	30,380	50,022	45,780	44,929	40,087	50,108	59,511	77,674	68,795	509,108	1,293,525
TOTAL RECURRENT	8,975	9,149	9,321	10,835	13,634	14,542	16,765	18,049	18,611	20,001	20,679	160,551	23,491	23,257	23,741	24,334	24,894	25,920	27,405	26,813	28,101	28,720	256,677	417,228
GRAND TOTAL	69,407	57,641	59,559	106,371	114,750	123,335	104,132	104,021	87,910	55,726	62,127	944,968	55,312	53,638	73,763	70,114	69,823	66,007	77,513	86,323	105,774	97,517	765,785	1,710,753

Chapter 10 Recommendations Actions for Materializing the Environmental Master Plan

10.1 Finalization of the Environmental Master Plan and Approval Procedure

Hanoi City has two new plans to guide development during the early part of the 21st Century:

a) the General Urban Plan to 2020 (as known as Hanoi Master Plan to 2020); and
b) the Socioeconomic Development Strategy to 2020.

The General Urban Plan is a plan of the future physical infrastructure and settlement patterns for Hanoi; the Socioeconomic Development Strategy sets the basic orientation and direction for social and economic development and investment. It is generally agreed that these plans were developed with little or no consideration of the environment or the potential adverse environmental impacts of development. Most Vietnamese GOV officials agree that an environmental master plan is needed to balance the needs of socioeconomic development with the goals of environmental protection. This is necessary to achieve sustainable development for Hanoi.

(1) Hanoi City Environmental Master Plan to 2020

It is proposed that the preliminary Environmental Master Plan prepared by the JICA Study form the basis of the Hanoi City Environmental Master Plan to 2020. A step by step process is needed to transform the preliminary EMP is the Master Plan to 2020. The following steps should be undertaken:

a) A Review and Appraisal Committee should be created.
b) This Committee will review the existing EMP, the General Urban Plan to 2020, and the Socioeconomic Development Strategy to 2020.
c) Based it review, the Committee will make recommendations for improvements and specify the procedure for finalizing the EMP.
d) Based on the Committee's recommendation, necessary revisions to the EMP will be made. The Committee will review the final version.
e) Once the revisions to the EMP are completed and the final version has been reviewed, the EMP should be submitted for approval. As the EMP should be approved at the same level as the General Urban Plan 2020 and the Socio-economic Development Strategy it will be necessary to submit the plan to both the Hanoi People's Committee and to the Central Government Level.

(2) Review and Appraisal Committee

The members of the Review and Appraisal Committee should drawn from the Project Steering Committee and the Project Management Board for the JICA

Study on Environmental Improvement in Hanoi City. Additional technical experts should be added to the committee as necessary.

It is anticipated that Review and Appraisal Committee will be the first step towards creating the Environmental Coordination Committee (ECC). The ECC will have ultimate responsibility for implementation of the EMP and for continued revision of the plan every five years. Careful consideration should be given to inclusion of the appropriate Central Government agencies and Hanoi City agencies in selecting members for the Review and Appraisal Committee.

(3) Review of Preliminary EMP, Urban General Plan, and Socioeconomic Development Strategy

Many Vietnamese and Foreign experts suggested that the EMP should have been completed first prior to the development Urban General Plan (UGP), and Socioeconomic Development Strategy (SDS). However, as this was not the case, it is necessary to review in detail all three (EMP, UGP, and the SDS). This review is necessary to identify the basic interrelationships between the plans. It will also identify any potential conflicting objectives and proposals. This information will be useful during the amendment process (around the year 2003) of the UGP and the SDS.

The EMP, itself, should come under critical examination by Vietnamese experts, to determine its strengths and weaknesses – as well as to identify any gaps in scope and coverage of the EMP. This analysis will provide the recommendations for need improvements.

(4) Preparation of the Final EMP

Based on the review and recommendation, the Review and Appraisal Committee should prepare a work plan and schedule for finalization of the EMP. If a significant amount of additional work will be required, terms of reference for staff and consultants should be prepared.

(5) Approval of the EMP

The EMP should be approved at the same level as the Urban General Plan and Socioeconomic Development Strategy. This means approval by the Prime Minister. The approval of the EMP should also specify the implementation arrangements and designate the responsible agencies. It has been proposed that the official decision or directive that approves and authorize the EMP should also provide for the creation of an Environmental Coordination Committee (ECC). The ECC will be chaired by the Hanoi People's Committee and have broad representative from

both Central Government Ministries and Hanoi City Departments. This ECC must be given enough authority to:

- ensure the EMP's priority projects and activities are included in socioeconomic development plans;
- ensure the environmental objectives of the EMP are incorporated in Hanoi General Urban Plan;
- coordinate the implementation of projects and activities of the EMP; and
- coordinate the amendment of the EMP every five years.

(6) Overcoming Barriers and Constraints

The EMP proposes both structural and non-structural projects. The structural projects are designed to make substantial improvements in the environmental quality in Hanoi City. The non-structural projects are an essential complement to the structural projects. Specific reforms in the HSDC and URENCO are directed at ensuring the structural improvements will be successfully and efficiently implemented. Without these non-structural reforms there is serious doubt that the structural projects can be implemented to provide long term sustainable benefit.

Other non-structural improvements (e.g. upgrading the DOSTE, establishing environmental management, improving the environmental monitoring system) are directed at strategic implementation of effective environmental management in Hanoi. The proposed measures are urgently needed overcome the existing inadequacies and to prevent serious environmental deterioration from future socioeconomic development. These meausres are designed to create and build strong organizations for environmental protection and management.

The JICA Study is well aware of the practical difficulties in requesting organizational changes that involve increased staff, higher level of skilled workers, and much larger budgets. Some of the recommendation may seem to go against current GOV policy to reduce the size of the civil service. However, the recommendations are highly consistent with other government policy and directives to hasten the implementation of the Environmental Protection Law. The complete set of recommendations in the EMP should be seen the minimum necessary for Hanoi to achieve its goals of sustainable development.